NCFRP

REPORT 5

NATIONAL COOPERATIVE FREIGHT RESEARCH PROGRAM

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North American Marine Highways

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NATIONAL COOPERATIVE FREIGHT RESEARCH PROGRAM

NCFRP REPORT 5

North American Marine Highways

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2010
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NATIONAL COOPERATIVE FREIGHT RESEARCH PROGRAM

America's freight transportation system makes critical contributions to the nation's economy, security, and quality of life. The freight transportation system in the United States is a complex, decentralized, and dynamic network of private and public entities, involving all modes of transportation—trucking, rail, waterways, air, and pipelines. In recent years, the demand for freight transportation service has been increasing fueled by growth in international trade; however, bottlenecks or congestion points in the system are exposing the inadequacies of current infrastructure and operations to meet the growing demand for freight. Strategic operational and investment decisions by governments at all levels will be necessary to maintain freight system performance, and will in turn require sound technical guidance based on research.

The National Cooperative Freight Research Program (NCFRP) is a cooperative research program sponsored by the Research and Innovative Technology Administration (RITA) under Grant No. DTOS59-06-G-00039 and administered by the Transportation Research Board (TRB). The program was authorized in 2005 with the passage of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). On September 6, 2006, a contract to begin work was executed between RITA and The National Academies. The NCFRP will carry out applied research on problems facing the freight industry that are not being adequately addressed by existing research programs.

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NCFRP REPORT 5

Project NCFRP-17
ISSN 1947-5659
ISBN 978-0-309-15489-5
Library of Congress Control Number 2010931770

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Published reports of the

NATIONAL COOPERATIVE FREIGHT RESEARCH PROGRAM

are available from:

Transportation Research Board
Business Office
500 Fifth Street, NW
Washington, DC 20001

and can be ordered through the Internet at:

http://www.national-academies.org/trb/bookstore

Printed in the United States of America

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AUTHOR ACKNOWLEDGMENTS

The research reported herein was performed under NCFRP Project 17 by the Center for Ports and Waterways, Texas Transportation Institute (TTI), The Texas A&M University System. C. James Kruse, the Director of TTI's Center for Ports and Waterways, was the Project Director and Principal Investigator. Nathan Hutson of the University of Texas' Center for Transportation Research contributed to this report.

FOREWORD

By William C. Rogers
Staff Officer
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NCFRP Report 5: North American Marine Highways presents an evaluation of the potential for moving intermodal containers on chassis, non-containerized trailers, or rail cars on marine highways in North America. The report is especially valuable for its assessment of the conditions for feasibility; its analysis of the economic, technical, regulatory, and logistical barriers inhibiting greater use of the marine highway system; and proposed solutions for barrier elimination. This report will enable public and private stakeholders to better understand the underlying reasons for the current underutilization of the marine highway system.

The United States has an abundance of navigable rivers, lakes, canals, seaways, and coastal waterways. This marine highway system (often referred to as short sea shipping) is used to move billions of tons of freight each year; however, less than 4 percent of the Nation's domestic freight (by volume) moves by water, compared to 1957, when over 31 percent moved by water (*National Transportation Statistics*, Bureau of Transportation Statistics). Greater use of the marine highway system capacity could reduce major choke points on highways and railroads, reduce fuel consumption, and reduce air pollution and greenhouse gas emissions.

Under NCFRP Project 17, the Texas Transportation Institute was asked to (1) identify and analyze the successes and failures of past and existing North American marine highway operations; (2) identify and assess the impact of current barriers and constraints, as well as propose strategies to overcome them; (3) identify the necessary conditions for success and evaluate the feasibility of expanded North American marine operations; and (5) discuss public policy implications for marine highway shipping that could be used as a resource for the development of a national freight transportation policy, emphasizing existing multimodal comparative analyses from a public and private capital investment perspective.

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Note: Many of the photographs, figures, and tables in this report have been converted from color to grayscale for printing. The electronic version of the report (posted on the Web at www.trb.org) retains the color versions.

SUMMARY

North American Marine Highways

Introduction

As the economic and geographic character of the United States changes, so too must the transportation system. The important factors driving increased interest in waterborne shipments in Europe and other parts of the world—congested roads, high fuel prices, tolls, road taxes, hours of service limitations on truck drivers, driver shortages, safety concerns, and environmental concerns—can all be found in the United States.

It is with this basic understanding that the U.S. Maritime Administration (MARAD) launched its Short Sea Shipping (SSS) Initiative, which has now evolved into the North American Marine Highways (NAMH) Initiative. The enthusiasm for NAMH, however, has been tempered in recent years by the failure of some start-up initiatives and the fact that, despite record energy prices, the promise of NAMH does not appear to have been fully embraced by the freight community.

One of the first tasks in assessing NAMH or SSS is to establish a reasonable definition for "North American marine highways." This research uses the definition for "short sea shipping" adopted by the Society of Naval Architects and Marine Engineers Panel O-36 also to define North American marine highways as follows:

> Freight service operations carrying either containerized or trailerized cargoes (or empties) via the coastal waters and river systems . . . and in particular those services where there is a true "intermodal choice" to be made by the shipper between moving units by water and using one or more land-based alternatives (i.e., highway and/or rail).[1]

In order to understand NAMH and what can be done to support their development, the authors have divided the subject matter into the following seven topics:

- Ventures (both successful and unsuccessful) since 1990,
- Shipper requirements,
- Vessel considerations,
- Legislation aimed at encouraging NAMH,
- The European experience,
- Obstacles to further development of NAMH, and
- Miscellaneous important considerations.

Findings

One of the more interesting findings from this research effort is that marine highway ventures of varying distances have the potential for viability. Thus, the conventional wisdom

that marine highway operations are viable only at distances equal to, or greater than, those that are viable for intermodal rail is not correct. On the contrary, successful operations have been carried out on routes as short as "across the bay" and as long as more than 1,000 mi. More importantly, the researchers concluded that there is no critical distance for determining whether a particular venture will be successful. The specific geographic features of each service must be considered, including the alternative landside distances and connections.

There seem to be several themes that run through the successful attempts and those that characterize the unsuccessful ventures. Ventures that have been successful exhibit the following characteristics:

- They operate in a limited market in terms of geography and cargo mix. They deliberately do not try to be "all things to all people," but also do not depend exclusively on a single shipper.
- The vessels (ship or barge) are adequately sized for the cargo that is being targeted. Most of the successful operators work with relatively small lot sizes, enabling them to use equipment that requires a lower upfront capital budget. Smaller vessels such as barges also are easier to replace or substitute.
- The frequency meets the needs of the customers, and there are often set, reliable schedules.
- Successful ventures promote an integrated door-to-door service. Working with truckers (or controlling their own truck fleets) and becoming intermodal providers were key elements of success.
- They are able to provide cost-effective terminal services.
- There is limited competition from potential marine service providers.

Unsuccessful ventures also had several common characteristics:

- The door-to-door cost was not competitive with trucking and/or rail services.
- An attempt was made to develop a market based on the characteristics of a preexisting vessel or vessels, as opposed to the market characteristics dictating the type of vessel to be utilized.
- In order to reduce capital requirements, certain ventures time-chartered their vessels. When the charters expired they were unable to negotiate new charters for their vessels, or find suitable replacements.
- There was heavy reliance on a single vessel. When mechanical or weather problems arose, there was no ability to work around them, causing shippers to lose confidence in the service.
- Although the success rate of all ventures was low, services that were designed to cater to international cargoes have a higher failure rate than do domestic services.

The literature review and interviews revealed several shipper requirements that are important for a marine highway operator to address. To succeed, a NAMH service must possess two major characteristics: (1) it must provide a time/cost tradeoff that is competitive with that of other modes, and (2) it must be reliable and as seamless as possible.

The most important attributes in a shipper's choice of mode are (not necessarily in order): general preference for retaining the existing service structure, travel time, reliability, and cost.

Various vessel types are, or could be, employed in NAMH operations. They can be classified as the following:

- Tug and pull-barges (ocean going),
- Tug and barges (river type),
- Integrated tug/barge and articulated tug/barge (ITB/ATB),
- Small ships,
- Rail ferry, and
- High-speed ferry.

The literature suggests that in the case of vessel selection, smaller may be better. Optimal ship size is obtained by trading off economies of size in the hauling operations with diseconomies of size in the handling operations. The larger the vessels are, the lower the optimal frequency is to handle the same volume. This creates a barrier to entry into shipping routes, as the volume of cargo must be sufficient to enter the market with an economically sized vessel. In port, handling costs per ton often increase with ship size, but hauling costs per ton at sea decline with size.

Typically, shipping lines will enter a new market with the smallest vessels that meet their economic requirements and then grow the service by substituting larger vessels for the smaller ones. Intraregional container ships seem to fall within the range of 1,000 to 3,500 TEU. (TEU stands for 20-ft equivalent unit. A 20-ft ocean container is 1 TEU; a 40-ft container is 2 TEU. This is the standard unit of measure for container capacity.) The most appropriate roll-on/roll-off (Ro/Ro) vessels appear to be in the small- to mid-size range of 600–650 ft length overall, 21-ft draft, and the capacity to transport 140–150 48-ft or 53-ft trailers).

Focusing on a relatively high number of small vessels spreads the risk and mitigates the impact of taking a single vessel out of service, while allowing trucking and rail to serve as a safety net in the event of high demand or reduced vessel capacity (as in the case of a drydocking). Alternatively, the disadvantage of committing to smaller vessels in a high-volume market is that the service may never achieve the operating economy that could be realized by using larger ships and, thereby, might be more vulnerable to competitors.

Legislative activity to date can be separated into two main categories (1) attempts to modify or eliminate the Harbor Maintenance Tax (HMT), and (2) designation or promotion of routes for the development of marine highways or SSS through infrastructure grants or other mechanisms, along with attempts to actually fund these programs. Efforts to eliminate HMT for domestic shipping have been unsuccessful to date. In the last four congressional sessions, a number of lawmakers have sponsored bills providing HMT relief, either on a regional or national basis. Despite bipartisan support for the idea, none of those bills has made it out of committee. Such efforts are still underway in the current session of Congress. Bills that encourage the development of marine transportation alternatives have met with more success, but they have not been accompanied by levels of funding that would be necessary to jump-start the industry.

The literature is replete with obstacles encountered by prospective marine highway shippers and operators. For the most part, they all can be reduced to one issue: **these services are not cost-competitive with the alternatives that exist.** The economic model is complicated by the fact that NAMH services must not only meet the prices offered by alternative modes but, in many cases, must actually offer a significant discount over trucking alternatives to compel shippers to switch. (Studies indicate that discounts of 20% to 30% off trucking costs may be required to compensate for a transit time increase of one day for longer short sea transits, assuming that the NAMH service is reliable.) The question then becomes one of determining what factors prevent such services from competing effectively.

In the analysis of potential obstacles to NAMH, it is important to distinguish between obstacles common to all start-up business enterprises and those that uniquely disadvantage marine transportation in comparison to rail and truck transportation. For example, the lack of statistical data regarding trade flows is a real obstacle for the development of NAMH to marine operators. Although all transportation providers rely on data to a certain extent, providers in other modes also make business decisions based upon what their competitors are doing. For marine highway operators who may be the first service to serve a particular corridor, there are no direct competitors to examine; thus, they are far more reliant on third-party data. Another often-cited obstacle is lack of familiarity on the part of the shippers. Many of the interviewees felt that this is a problem that all new businesses must overcome. Any operator that is attempting to sell a service must explain how the service is different from other alternatives and what the benefits will be to the shipper. Another such obstacle is the flow-imbalance issue (significant differences in the volume of cargo moving in one direction as opposed to the opposite direction); all modes must deal with this problem.

Obstacles fall within the following categories:

- Service/marketing,
- Operating cost,
- Infrastructure and shoreside equipment,
- Government/regulatory,
- Operational constraints,
- Vessel-related, and
- Other.

One remarkable finding is that **port infrastructure issues—defined as docks, warehouses, storage areas, and cargo handling equipment—were rarely mentioned by interviewees as a serious impediment** to the development of marine highway services.

Conclusions

To develop a potential path to success, it is helpful to determine which of the hurdles standing in the way would have the greatest positive impact if removed. The primary issue at hand is that the NAMH industry has not been cost-competitive to date. Therefore, it would make sense to address the basic economic issues (such as capital and total shipment cost) first—directly or indirectly. Only once this has been accomplished can the other identified or perceived hurdles be cleared.

The conclusions flowing from the research can be divided into the following two broad categories:

1. Improving the underlying economic framework, and
2. Enhancing planning and operational activities.

These categories can be further divided into the following three broad subcategories:

1. Potential actions for industry and planning organizations,
2. Potential actions for the public sector (non legislative), and
3. Potential legislative actions.

Economic framework conclusions tend to fall into the category of potential legislative actions because they often revolve around issues of taxation and regulation, while planning

and operations issues tend to fall within the realm of non-legislative agency actions. The major conclusions included in this research are discussed in the following sections.

Economic Framework

Industry and Planning

Crewing requirements for NAMH vessels are a major issue that can jeopardize the viability of marine highway operations in the future if not properly addressed. In addition to the oft-cited distinctions in crew size for small self-propelled cargo ships versus equivalently sized barges, the researchers identified other labor/manning issues that may become more important as NAMH is developed. For instance, a greater role for domestic marine activity will require an expanded workforce of more qualified mariners than is currently available.

Several interviewees indicated that some degree of standardization on the vessel side would be necessary for the industry to emerge as a true competitor to truck and rail. There was marked disagreement over how extensive the standardization in design and construction could become; additional research into vessel design and construction strategies is needed.

Public Sector (Non Legislative)

There are multiple opportunities to incorporate externalities in taxing and funding by more fully assessing and considering the comparative impacts of marine highway transportation on air quality, carbon dioxide (CO_2) reduction, roadway maintenance costs, and safety. Providing incentives directly to shippers who choose marine alternatives is a method that could prove effective.

Due to high upfront capital costs, targeted assistance for the U.S. shipbuilding industry could be made under certain circumstances. With the tightened capital markets that have emerged since the global financial crisis, the provision of alternative channels for access to capital may be a consideration.

Legislative

On a broader scale, consideration could be given to establishing a program similar to the Transportation Infrastructure Finance and Innovation Act of 1998 (TIFIA) that would focus on marine or multimodal initiatives.

At the federal level, issues that could usefully be considered early in the process of NAMH implementation include the potential elimination of the HMT for all North American non-bulk shipments and a full review and assessment of the Title XI Program to make it more conducive to NAMH.

Planning and Operations

For planning entities, the most consistent observation is that that preexisting market analysis should drive vessel selection and not the other way around. This strategy has sometimes been difficult due to the limited supply of available vessels at a given time. It is critical that all parties involved—from shipowners to governmental authorities—work under the assumption that new services will become permanent. Most shippers have little interest in participating in experiments and will consider shifting modes only if they perceive it to be a long-term arrangement that will not require shifting again in the foreseeable future.

Although it is tempting to use large vessels in order to accentuate the natural advantages of marine transportation, planners would be wise to consider starting small and ramping up

capacity as demand increases. Small ships mean low operating costs and fast turn time—both of which are essential in the early implementation of services. It is also important to understand the specific policies of all affiliated terminals and preexisting trucking companies and freight forwarders.

There are several other public sector (non-legislative) actions that generally could encourage the development of marine highway activities. These include efforts to preserve working waterfronts and prevent marine encroachment that would undermine future NAMH origins, destinations, or corridors. Corridors that can safely transport hazardous cargo should be given a particular focus.

At some point in the future, it would be logical to incorporate NAMH into homeland security and infrastructure protection plans and coordinate this plan with a NAMH planning guide developed by MARAD. Future planning guides should be sufficiently flexible to accommodate new transportation statistics, even when the methodology for statistical collection changes.

Although it is unlikely that there will be significant change to the Jones Act in the near future, it may be possible to harmonize regulations and cabotage legislation among North American Free Trade Agreement (NAFTA) partners to better accommodate cabotage restrictions for shipments between partners. An adjustment to the requirement that U.S. Customs be notified of an inbound international shipment 24 h in advance would improve the prospects for U.S.-Canada marine trade. Additional standardization of customs processes at ports in the United States, Mexico, and Canada for marine highway traffic would also significantly reduce uncertainty for NAMH services.

CHAPTER 1

Background

As the economic and geographic character of the United States changes, so too must the transportation system. Yet, while changes in land utilization and economic production have been rapidly unfolding over the last two decades, the pace of transportation evolution has been slow and often reactive. In some cases, hesitation to embrace radical shifts in direction based upon existing trends has been prudent. For example, it does not appear that expansions to the intermodal system can be predicated on sustained and uninterrupted growth, or on exceptionally high energy costs.

The most essential driver of freight activity in a consumer-oriented economy is population growth, which will continue at a relatively constant rate. The inherent logic behind making better use of marine highways derives from where the growth is occurring. Coastal counties possess some of the most economically productive and strategically vital industries in the country. The counties of the coastal United States have a population density that is four times that of the country as a whole, yet they are served by a freight transportation system that was developed for a far less densely populated country. Although significant regional distinctions are seen around the United States in passenger transportation based on population density, no such distinction currently exists for freight. The United States does have a multimodal system; however, until now, distance—not density—has been the principal determinant of modal choice.

The case for a "mass freight transportation system" as well as a "mass transit system" is made even more compelling when the population is experiencing rapid growth. The National Oceanic and Atmospheric Administration (NOAA) estimates that in 2003, approximately 153 million people (53% of the nation's population) lived in the 673 coastal counties, an increase of 33 million people since 1980. This is expected to increase by more than 12 million people by 2015. Coastal counties average 300 persons per square mile with a density that grew by 28% between 1980 and 2003 (*2*). This surge in population has been reflected by sharply increased use of coastal highway infrastructure.

The important factors behind an increased interest in waterborne shipments in Europe and other parts of the world are also found in the United States—congested roads, high fuel prices, tolls, road taxes, hours-of-service limitations on truck drivers, driver shortages, safety concerns, and environmental concerns. Available land near the coasts and other navigable waterways is expensive, environmentally sensitive, and in short supply—factors that have significantly stymied the ability of the transportation network in these areas to expand to meet growing demand. Yet, proximity to water may turn out to be an important transportation asset serving coastal populations in the future because of the overwhelming efficiency advantages that can be gained utilizing marine transport. In fact, the process of removing trucks from the road cannot be viewed only as a transportation issue—it must also include industrial location, market incentives, and long-term urban planning strategies.

It is with this basic understanding that the U.S. Maritime Administration (MARAD) launched its Short Sea Shipping (SSS) Initiative, which has now evolved into the North American Marine Highways (NAMH) Initiative. The basic premise of this initiative is that with sufficient modernization of marine infrastructure, new freight corridors could be established that would serve the needs of populations near the coasts or other navigable bodies of water. These marine highways could theoretically provide a low-cost and energy-efficient alternative for moving cargo and would greatly expand the total transportation capacity of the United States. The enthusiasm for NAMH, however, has been tempered in recent years by the failure of some start-up initiatives and the fact that, despite record energy prices, the promise of NAMH does not appear to have been fully embraced by the freight community.

The development of a marine highway system as a major component of the freight transport profile in the United States would clearly mark a dramatic and deliberate shift. Extensive research on international and domestic SSS by the Texas Transportation Institute (TTI) has shown that the potential long-term economic benefits of SSS are significant, yet so are

the transition costs. The findings from TTI's research are presented in this report; they include (but are not limited to) issues such as the development of adequate market data, upgrading of dockside equipment for certain types of cargoes, the need to educate logistics managers and overcome their resistance to change, the need to set aside adequate waterfront land and protect it from encroachment, and the need to view freight transportation as a system rather than developing plans on a mode-by-mode basis.

The general consensus of the freight community is that without active federal-level involvement, NAMH will likely penetrate only in certain niche markets driven by geography and energy costs. However, for NAMH to truly make an impact in lowering congestion and improving the total energy and environmental performance of the freight sector, a national or North American strategy is clearly needed.

In a 2002 report, (*3*) FHWA made the following observation:

> Global market logistics rely heavily on the performance of infrastructure owned and operated by the public sector. Understanding the motivation of logistics decisions and their local implications is a critical point of departure for a national or multinational effort on fostering trade. Identifying freight bottlenecks, "solving them," and establishing market conditions that provide "free access" should be an important focus of regional, state, national, and international planning/policy efforts. . . . Public investment targeted at freight movement should adopt a framework in which the private sector is provided incentives to choose what is best for their business within the context of achieving public goals.

There are at least three types of congestion that the use of marine highways could potentially ease, and each has a different solution. First, there is congestion in and around container terminals, stemming from the growth in world trade and consisting primarily of international 20-ft and 40-ft shipping containers. Second, there is congestion on highway corridors, where the shipping containers are primarily 48-ft and 53-ft domestic containers or trailers moving between points that have a marine highway alternative. Finally, there is border congestion with Canada and Mexico, the United States' North American Free Trade Agreement (NAFTA) partners, that is driven not only by the absolute volumes of traffic but also by border security processes.

There are two broad markets for NAMH services: international feeder cargo and domestic cargo. International feeder cargo consists of shipments that arrive at a North American port from overseas and then are ultimately delivered by a smaller vessel to another North American port. Domestic cargo originates and terminates within North America. These two markets tend to be handled separately and with different technology. Lift-on/lift-off (Lo/Lo) serves as the dominant technology for international cargo and roll-on/roll-off (Ro/Ro) serves as the dominant technology for domestic cargoes. It is important to distinguish between the requirements for handling international freight and those for domestic freight. Table 1 illustrates those differences.

A primary difference in the two types of services is that feeders tend to operate from a "hub port" and their service patterns must be based on the needs of the transoceanic liner service, whereas domestic (or regional) NAMH operators tend to work on a port-to-port basis with the service patterns determined by the needs of the shipping customers.

International feeder operations have tended to favor the Lo/Lo model (containerized freight) because cargo is being transferred from ocean-going vessels and therefore sufficient volumes can be generated. For domestic containerized operations, Ro/Ro (tractor-trailers) has been preferred due to the lower required density to justify the service and lower start-up capital costs. It is also important to recognize that only a very small portion of current domestic waterborne cargo is of a type and form that would be consistent with freight moving over the nation's highways. Presently, manufactured goods make up only 6.7% of the total by weight and typically consist of heavy and bulky items that would not otherwise be suitable to move over the road (*4*). There is no technical rea-

Table 1. International and domestic NAMH characteristics.

Characteristic	International Market	Domestic Market
Market Served	Feeder cargo (from international liner service)	Regional or inter-company cargo
Basis of Service	Liner calls at hub port	Fixed schedule
Operations	Primarily Lo/Lo (containers)	Primarily Ro/Ro (may also include container and break-bulk)
Equipment	Ocean containers (typically 40 x 8 x 8.5 ft)	Domestic (53-ft) containers or truck trailers
Service Area	Major deepwater port to secondary port (or vice versa)	Any port pair capable of handling barge traffic (preferably door to door)
Customer Base	Mainly international	Mainly domestic
Infrastructure Requirements	Shoreside cranes and container yards	Minimal, particularly if vessel has self-sustaining ramp

son why marine highways cannot serve light manufacturers and producers of consumer-oriented goods, provided they can serve the needs of shippers, yet the market for these services is as yet unproven.

This report assumes that the development of NAMH is desirable in terms of the social and environmental benefits it would bring. There is a significant amount of literature that supports this premise. Therefore, this analysis focuses on obstacles, attempts to overcome those obstacles, and provides suggestions for further action. As shown in the following chapters, there are a number of challenges that the marine transportation system must overcome in order to achieve a significant expansion. Some of these issues can be addressed at the local or state level, whereas others must be resolved by the federal government or private industry.

This report contains appendices that provide detailed information related to research activities. Appendix A provides a table of interviewee characteristics, Appendix B gives a table of North American marine highway ventures, Appendix C lists shipper requirements, Appendix D compiles potential obstacles, Appendix E outlines marine highway legislation, Appendix F describes the Quebec Province greenhouse gas program, Appendix G contains an annotated bibliography, and Appendix H defines acronyms used in this report.

CHAPTER 2

Research Approach

The primary objectives of this study can be defined as follows:

- Understand the constraints on the development of NAMH and their severity,
- Investigate alternative measures to address constraints,
- "Ground truth" both the constraints and potential mitigation measures, and
- Identify realistic courses of action that can be implemented.

One of the first tasks in assessing NAMH or SSS is to establish a reasonable definition for "North American Marine Highways." This research uses the following definition for "short sea shipping" adopted by the Society of Naval Architects and Marine Engineers (SNAME) Panel O-36:

> Freight service operations carrying either containerized or trailerized cargoes (or empties) via the coastal waters and river systems . . . and in particular those services where there is a true "intermodal choice" to be made by the shipper between moving units by water and using one or more land-based alternatives (i.e. highway and/or rail). (*1*)

Coastwise movements and inland waterway movements are included in SNAME and most other definitions currently in use. Since the primary desired outcome of this study is to determine what, if anything, can be done to develop NAMH to a greater degree, it is prudent to exclude the following from the scope of the analysis:

- Operations between the lower 48 states and other U.S. states and territories (e.g., Alaska, Hawaii, Guam, and Puerto Rico). With the exception of air, there is no alternative to marine transport in these trade routes; therefore, there is no opportunity to divert cargo from another mode. (According to FHWA's Freight Analysis Framework for 2002, 12.6% of the freight that crossed Alaska's state borders was carried by truck or rail, but this includes international shipments as well as domestic, and is heavily weighted in the outbound direction. (*5*) This presents minimal market opportunities.)
- Bulk commodities that are not commonly containerized or carried in highway trailers but would (and already do) move by water in large bulk ships or barges. This would exclude such commodities as ores, coal, crude oil, and minerals.
- Movements that are part of a rotation that crosses the ocean (e.g., pendulum services). In some cases, these rotations call at several Canadian and U.S. ports and are competition to the development of a healthy NAMH option, especially in the current environment where the major carriers are practically desperate to attract cargo of any kind.
- Movements of freight by a company-owned vessel fleet that is not for hire to the general public. These shipments use privately owned facilities at either the origin or destination (typically the origin) and do not offer their services to third parties. Therefore, the development of these services is strictly tied to the needs and financial condition of one given company.

In order to understand NAMH and what can be done to support their development, the authors have divided the subject matter into the following seven topics:

- Ventures (both successful and unsuccessful) since 1990,
- Shipper requirements,
- Vessel considerations,
- Legislation aimed at encouraging NAMH,
- The European experience,
- Obstacles to further development of NAMH, and
- Miscellaneous important considerations.

The geographic characteristics of a given service region affect the issues with which current and potential NAMH

operators must grapple. Therefore, this analysis establishes the following service regions:

- Canadian domestic,
- West Coast (including United States-Canada),
- Gulf of Mexico,
- Great Lakes,
- East Coast (including United States-Canada), and
- Inland waterways.

The research effort involved several distinct activities. These activities were designed to cover a broad spectrum of issues and then analyze them in the light of the opinions expressed by individuals intimately familiar with the issues involved. These activities included the following:

- Extensive literature review,
- Interviews with stakeholders with diverse interests and geographical locations (see Appendix A for interviewee characteristics),
- Review of legislative activity and discussions with congressional committee staffers, and
- Project panel review.

CHAPTER 3

Findings and Applications

Although there are examples of successful marine highway services that are currently in operation or have operated in the recent past, the researchers found no extant service that could serve as a true model for marine highway development. Given the scale of services that would be necessary to divert a significant percentage of current and future volume onto the water, all existing models would have limited utility. Therefore, the researchers' approach was to isolate the factors within each of these services that would be potentially transferable to a future system of marine highways. An important issue, thus, in this type of study is the lack of successful NAMH models upon which to build substantive recommendations.

One of the more interesting findings from this research effort is that the conventional wisdom regarding the necessary distance for NAMH options (i.e., that marine highway operations are only viable at distances equal to or greater than those that are viable for intermodal rail) is not correct. On the contrary, successful operations have functioned on routes as short as "across the bay" and as long as more than 1,000 mi. More importantly, the researchers concluded that there is no critical distance for determining whether a particular venture will be successful. The specific geographic features of each service must be considered, including the alternative landside distances and connections.

Ventures

As with any other type of enterprise, there has been a wide variety of methods, equipment, geographic locations, and cargo mixes involved in marine highway ventures. These ventures have not had a high success rate. In an effort to determine what has already been attempted, what has failed, and what has succeeded, the researchers compiled a table of ventures that can be found in Appendix B.

There seem to be several themes that run through the successful attempts and those that characterize the unsuccessful ventures. Ventures that have been *successful* exhibit the following characteristics:

- They operate in a limited market in terms of geography and cargo mix. They deliberately do not try to be "all things to all people," but also do not depend exclusively on a single shipper.
- The vessels (ship or barge) are adequately sized for the cargo that is being targeted. Most of the successful operators work with relatively small lot sizes, enabling them to use equipment that requires a low up-front capital budget. Small vessels such as barges are also easier to replace or substitute.
- The frequency meets the needs of the customers, and there are often set, reliable schedules.
- Successful ventures promote an integrated door-to-door service. Working with truckers (or controlling their own truck fleets) and becoming intermodal providers were key elements of success.
- They are able to provide cost-effective terminal services.
- There is limited competition from potential marine service providers.

Unsuccessful ventures also had several of the following common characteristics:

- The door-to-door cost was not competitive with trucking and/or rail services.
- An attempt was made to develop a market based on the characteristics of a preexisting vessel or vessels, as opposed to the market characteristics dictating the type of vessel to be utilized.
- In order to reduce capital requirements, certain ventures time-chartered their vessels. When the charters expired, they were unable to negotiate new charters for their vessels or find suitable replacements.
- There was heavy reliance on a single vessel. When mechanical or weather problems arose, there was no ability to work

around these problems, causing shippers to lose confidence in the service.
- Although the success rate of all ventures was low, services that were designed to cater to international services exhibit a higher failure rate than do domestic services.

Of course, with the current economic recession being experienced across the globe, the ability to offer new services at a rate that will provide a proper return is severely impaired. As the crisis fades, rates and demand will improve, and those services that are properly positioned and structured will be in an advantageous position for capturing new marine highway markets.

Shipper Requirements

The literature review and interviews revealed several shipper requirements that are important for a marine highway operator to address. To succeed, a NAMH service must possess the following two major characteristics (1) it must provide a time/cost tradeoff that is competitive with that of other modes, and (2) it must be reliable and as seamless as possible.

The most important attributes in a shipper's choice of mode are (not necessarily in order) general preference for retaining the existing service structure, travel time, reliability, and cost.

The first category is probably least discussed yet quite salient due to the transaction costs involved in switching transportation providers. Although shippers are sometimes in a position of seeking to switch service providers, they certainly do not want to go through this process often. Therefore, the shipper must be convinced not only that the NAMH service is viable in the short term, but also in the long term. These shipper considerations were emphasized in a consultant study commissioned by a Canadian carrier to examine the economics of a feeder service on the East Coast that would use a fully amortized vessel. According to a representative of the carrier, the study determined that even with the limited capital expenditures on the front end, the service was not justified due to unacceptably high time of transport and high port charges. The economics would be even less favorable with fuel costs lower than those used in the study.

The shipper requirements documented in the literature are listed in Appendix C with references. The most important consideration to note is that shipper priorities will vary by type of business and the commodity transported. Given that caveat, there are certain requirements that seem to surface with great regularity, as follow:

- The service must be cost-competitive with alternatives.
- The service must provide door-to-door arrangements. The service that is offered must be an integrated service. It must be as "simple" from the shipper's perspective as arranging a truck-only shipment.
- Frequency is important. To attract a significant number of previously unaffiliated shippers, services must be once per week at a minimum. For certain commodities, multiple sailings per week are a requirement. NAMH cannot compete with same-day services.
- The service must be scheduled so a shipper can plan shipments. Timeliness and reliability are extremely important. Being "fast" is not as critical as being reliable. The more reliable the service, the more likely it will be chosen.
- Total delivery times are important. This is not the same as transit time. Although a barge's transit time may be longer, its total delivery time may be quicker if the transit can occur on the weekend and during late-hour operations, and avoid congestion as well.
- Marine highway operators need to be able to handle 48-ft and 53-ft containers as well as standard 20-ft and 40-ft ocean containers.
- Motor carriers interested in using marine highway services typically want to use their own equipment, which implies that Ro/Ro services will have an easier time partnering with motor carriers.
- Time-sensitive shippers, as well as shippers of high-value or hazardous goods, need a good system to track and manage their shipments. Real-time tracking services may partially compensate for slower delivery times.

Although these requirements are frequently cited, it must be noted that generalizations can be dangerous. Many operators are quick to point out that there is no substitute for understanding the shipper needs for a certain commodity or service in a certain geographic area.

Vessel Issues

According to MARAD, as of December 31, 2008, the U.S.-flag, privately owned ocean and Great Lakes merchant marine fleet consisted of 675 active and inactive vessels. Of those, 238 vessels were available for operation in U.S. foreign and domestic trades and within those, 145 were Jones Act vessels with unrestricted coastwise trading privileges. Of the 238 vessels, 116 (49%) were built before 1984. Of the 145 Jones Act Vessels, 103 (71%) were built before 1984. There are only 15 Ro/Ro and 27 container vessels available for the Jones Act trades, and most of them are approaching the end of their useful life. Table 2 shows the composition and age of the fleet.

Vessel Types

Types of vessels that are, or could be, employed on NAMH can be classified as the following:

- Tug and pull-barges (ocean-going),
- Tug and barges (river type),

Table 2. Age profile of U.S.-flag, privately owned ocean and Great Lakes fleets, 2008.

Fleet	Before 1984	1984–1988	1989–1993	1994–1998	1999–2003	After 2003
U.S. Flag	**116**	**38**	**6**	**34**	**19**	**25**
Tanker	19	4	0	13	7	13
Double Hull	9	1	0	11	7	13
Dry Bulk	53	4	0	0	2	1
Lakers	47	0	0	0	0	0
Container	19	21	3	16	7	9
Ro/Ro	17	8	2	7	3	4
General	5	1	1	0	0	0
Jones Act	**103**	**9**	**1**	**9**	**8**	**15**
Tanker	22	4	1	9	5	11
DH	9	1	0	9	5	11
Dry Bulk	51	0	0	0	0	0
Lakers	47	0	0	0	0	0
Container	19	3	1	0	1	3
Ro/Ro	10	2	0	0	2	1
General	1	0	0	0	0	0

Source: *U.S. Water Transportation Statistical Snapshot,* MARAD, July 2009. (*6*)

- Integrated tug/barge and articulated tug/barge (ITB/ATB),
- Small self-propelled container vessels: lift-on/lift-off (Lo/Lo),
- Small ships: Ro/Ro,
- Rail ferry, and
- High-speed ferry.

The literature and the interviewees expressed a wide range of opinion on the importance of the speed of the vessel. The actual speed of current operators ranges anywhere from 5 to 6 knots for inland operators up to 20 knots for coastal operators. One shipbuilder pointed out that high-speed vessels are "light-weight" vessels—their speed and fuel consumption are greatly affected by the load they carry. Some of the literature focused on time-sensitive cargoes where speed might be a factor, but most analysts seem to agree that highly time-sensitive cargoes are not a good market for marine highway operators. Furthermore, increased vessel speed is a key contributor to increased fuel consumption and vessel operating costs.

The draft requirements of an NAMH vessel are not likely to be the limiting factor in most cases. Of the regularly considered ship types, the deepest draft has been approximately 20 ft. Given average container weights, it is very likely that the cargo for ships will be volume-limited rather than draft-limited.

Tug and Pull-Barges (Ocean-Going)

The pull-barge is the most commonly used vessel for NAMH coastal operations in the United States. Barges are preferred in NAMH shipping operations due, in part, to federal regulations specifying small crew sizes. Both U.S. and Canadian crew size regulations stipulate minimum crew size based largely on the vessel's registered tonnage, which in the case of a pull-barge is the tug vessel, not the barge itself. The crew of the tug, typically about eight, is much smaller than that of a self-propelled vessel similar in size to the pulled barge. A self-propelled vessel of 700-TEU capacity would require a crew of 20. (TEU stands for 20-ft equivalent unit. A 20-ft ocean container is 1 TEU; a 40-ft container is 2 TEU. This is the standard unit of measure for container capacity.) Figure 1 is a photograph of an ocean-going pull-barge arrangement.

Figure 1. Ocean-going tug and barge.

Tug and Barges (River Type)

The inland tug and barge services attempted to date or currently in use utilize conventional deck or box barges to move containers. Container-carrying tug and barge services can be combined with barges carrying "traditional" cargoes such as agricultural commodities. Alternatively, river barge services in which there is a cargo imbalance for a traditional cargo in one direction can sometimes handle container barges on what would be the empty repositioning leg. Figure 2 is an example of a large container shipment on river barges.

Integrated Tug/Barge (ITB)/ Articulated Tug/Barge (ATB)

Tug and barge systems offer numerous advantages over self-propelled vessels. They require one-third the crew of self-

Figure 2. Containers on river barge.
Source: Marine Log.

propelled vessels and are able to consume significantly less fuel when slow speeds are acceptable. Tugs typically have crews of 6 to 8 versus a crew of 20 to 23 on self-propelled vessels. Additionally, tug crewmembers generally have a more favorable wage scale relative to crewmembers on self-propelled vessels, in large part because certified mariners for self-propelled vessels are a very small population. They also feature lower construction costs, maintenance costs, and drydocking fees, and are more conducive to moving larger freight. Ocean-going tugs/barges move at 9 knots, half the speed of self-propelled vessels, but this slower speed results in much less fuel consumed per mile. In addition, both new construction and maintenance costs on barges are well below similar size self-propelled vessels.

Integrated tug/barge units are used widely in the U.S. Gulf of Mexico and East Coast offshore trade. The stern is notched to accept a special tug that can be rigidly connected to the barge, forming a single vessel. The barge is built in the molded form of a normal ship's hull. Directional stability and control underway is far superior to that of a towed barge, although this configuration does not do well in high seas. No particular changes in the size or shape of the tug are required except for a higher pilothouse, needed for improved visibility.

The ITB is usually semi-permanently connected. The tug is not disconnected from the barge when loading or unloading. With an ATB, the tug is generally allowed to "float free" in the notch while loading or unloading. This is an important feature in that it allows the tugs to be utilized for a higher percentage of time as opposed to being tied to the barge while loading. Given that terminals handling NAMH traffic will often load containers at a slower rate than terminals serving ocean-going vessels, it is often attractive to separate the tug engine since it is the most costly element of the system.

Over time, the cost to build ITB units has risen to values in excess of an equivalent ship. Furthermore, with the issue of Navigation and Inspection Circular 2-81 (NVIC-2-81), the U.S. Coast Guard closed many loopholes in the regulations that the ITB was designed to take advantage. Thus, no ITB has been built since the early 1980s. (*7*)

An articulated tug/barge unit is a newer type of integrated barge. The cost of an ATB is about 20% less than the cost of an analogous self-propelled ship. Unlike the older integrated tug/barge style, the ATB has a hinged connection system between the tug and barge. In an ATB configuration, the tug and barge roll as one, but they pitch independently. The ATB system "couples" the tug and barge together. The ATB unit's barge has a notch in the stern where its tug bow fits. An ATB tug can be separated from the barge and used alone.

There are a few inherent drawbacks to the ATB system in terms of accomplishing broader utilization. The notches on most ATBs are designed such that a tug from one company can not be used with a barge from another. This has the effect of limiting the aftermarket and raising the cost of production and purchase. This lack of standardization is another obstacle to vessel procurement for marine highway service. Furthermore, ATBs have been used almost exclusively for liquid cargoes to date. Figure 3 is a photo of an ITB. Figure 4 is a photo of an ATB.

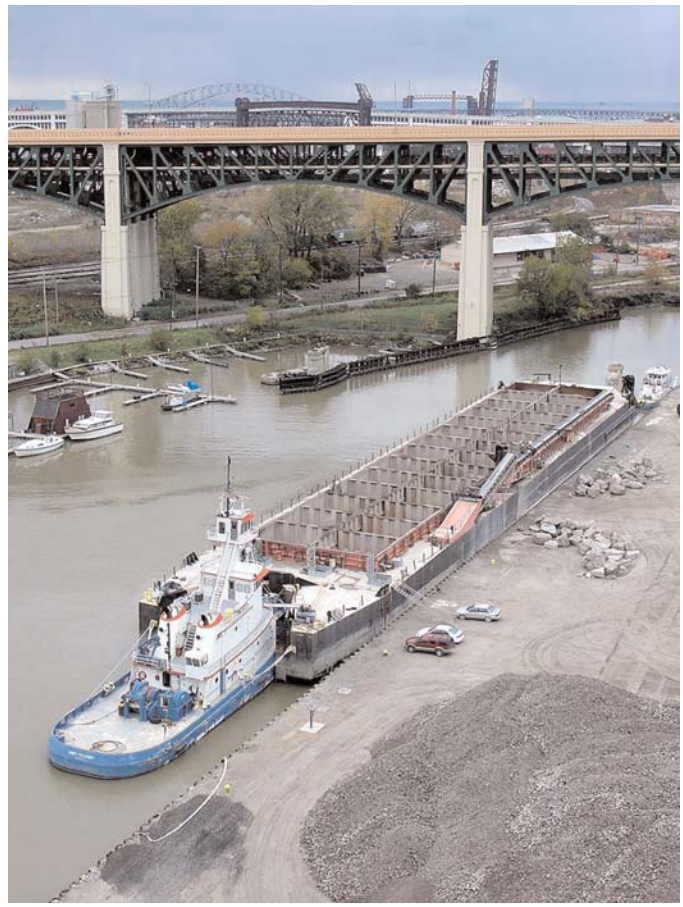

Figure 3. Integrated tug/barge.

Figure 4. Articulated tug/barge.

Small Self-Propelled Container Vessels: Lift-on/Lift-off (Lo/Lo)

The literature indicates that a time-chartered roll-on/roll-off vessel is probably more suitable to the domestic market and a geared container (Lo/Lo) vessel is more appropriate to the feeder market, depending upon the port choice. (*4, 8–11*) Ro/Ro cargoes typically compete on near-sea and short-sea distances with local truck transport, while Lo/Lo typically competes over longer distances with rail and long-haul trucking transport. A feeder ship will typically carry less than 1500 TEU. The capacity of Ro/Ro vessels can be less than one-half that of a Lo/Lo vessel of similar size. Furthermore, since cargo can not be stacked (due to wheels) and significant space is needed for load and offload ramps, the use of the Ro/Ro model also has implications for terminal efficiency. For this reason, space-constrained terminals may be less willing to accept a Ro/Ro operation if it interferes with more productive Lo/Lo services. However, even in the case of Lo/Lo operations, the operator is not guaranteed priority access for berthing slots. Because ports and terminals tend to give priority to ocean-going containerships, coastal Lo/Lo ships typically have to allocate 24 h per port call, although only 8–12 h are required to load and offload cargo.

New developments in the design of container feeder vessels, which operate in support of mainline vessels and in short sea trades, focus on speed and size. Whereas a service speed of 12–14 knots was acceptable 15 years ago, in order to maintain schedules, speeds of 15–17 knots are not uncommon. Feeder ships now range from 250 TEU to over 2,000 TEU in the Far East and Southeast Asia. SPM's new feeder, *Shamrock,* is considered a state-of-the art design. It is 376 TEU, with some Ro/Ro capacity on the upper deck. Its top speed is 16 knots, allowing it to call at four ports weekly. The vessel was new in January 2001. Figure 5 is an illustration of a small container vessel.

Figure 5. Small container (Lo/Lo) vessel.

Small Ships: Ro/Ro

Lower storage density and, in the case of larger vessels, the need for decking to accommodate multiple levels, makes Ro/Ro ships about three times more expensive than a conventional container feeder vessel of equivalent container or trailer capacity, which explains why Ro/Ro vessels require an intensive commercial operation to be economically viable. Examples of markets that have seen the successful adoption of Ro/Ro designs are the Baltic and the English Channel.

Vessels from 150-trailer to 700-trailer capacity have been proposed for a variety of markets. Smaller vessels of approximately 200-trailer capacity may have the broadest market potential while easing phase-in of a marine highways service. (*4, 8, 12–13*)

A container vessel can carry much more cargo per deadweight ton at a cheaper cost than a comparable Ro/Ro vessel, but container vessels take longer to load and offload—Lo/Lo operations are logistically more complicated.

Generally speaking, Ro/Ro vessels provide the most effective NAMH service platform, because they enable truckers to use containers or trailers on chassis for the entire movement. Several studies indicate that the cost savings from reduced port cargo-handling costs as well as service advantages in faster vessel and trailer turn-times more than offset the more effective vessel utilization provided by containerships versus Ro/Ro vessels. The literature does not definitively state the conditions under which this advantage holds and at what point the balance might shift. The majority of previous studies suggest that a Ro/Ro operation with 53-ft domestic tractor-trailers is the most viable coastal shipping option. The best vessel option from a cost perspective would appear to be a relatively new time-chartered Ro/Ro vessel capable of carrying highway trailers. Alternatively, an existing offshore service ship design could be modified to a single-deck ferry for 53-ft trailers.

The size of the vessels likely to be involved in such services (*4, 12–13*) would have the following general characteristics:

- Length overall: 190–200 meters (623–656 ft),
- Beam: 24 meters (79 ft),
- Draft: 6.4 meters (21 ft),
- Deadweight: 12,000 deadweight tons (DWT, a measure of how much weight a ship can safely carry),
- Road trailers: 140–150 (primarily 48-ft and 53-ft), and
- Stern ramp or quarter ramp.

Local street access to the highway system is required that is able to accommodate a flow of up to 140 trailers into the terminal and out of the terminal (each direction) within a 3- to 4-h period

MARAD shows 15 Jones Act Ro/Ro vessels as of the end of 2008. This number did not change for the period 2003–2008. (*14*)

According to Infomare, "the niches where the general Ro/Ro concept is likely to remain and be developed are definitely short sea trade routes with an increasing need for fast tonnage and deep sea trade with rolling cargoes only." (*15*) New Ro/Ro vessels built by Stena and DFDS point the way in terms of future development. Stena's 4Runner class vessels are 12,300 DWT, 195m length overall, with 3,000 lane-meters (lm) or 858 TEU capacity, and a service speed of 22.5 knots. An additional freight deck can be added above the upper deck, giving another 1,000 lm capacity to a total of 4,000 lm, similar to DFDS' Tor Line and Finnlines, which have ordered similar vessels with 4,000 lm capacity. Many of Stena's previous generation of Ro/Ro vessels, the Searunner class, were converted to roll-on/roll-off/passenger (Ro/Pax) vessels. Another new innovation was introduced by Cobelfret for the StoraEnso project, which combines full-width double-level ramps and straight driving lanes on-board vessels. It has since been introduced by TT-Line and DFDS as well.

Analysis of the economics of NAMH suggests that a Ro/Ro vessel of around 150-trailer capacity can be effectively employed on voyages of 800 to 1,000 nautical miles such as along the Atlantic Seaboard. Larger vessels (up to 300 trailers) may be deployed on the gulf routes where potential volumes are greater. (*4*) Figure 6 is an example of a small Ro/Ro vessel.

Ro/Pax. Ro/Pax is a ferry concept that is a mixture of trailers, trucks, cars, and passengers. These vessels are usually of 5,000–10,000 DWT, and operate at speeds of 22–28 knots. Typical vessels of this design are Stena's Seapacer class (400 passengers, 170 trailers, and 22 knots); TT-Line, which operates between Germany and Sweden, with a vessel of 1,000 passengers and 200 trailers at 22 knots; Superfast (the newest vessels have a passenger capacity of 626, vehicle capacity of 900, and sail at 30.4 knots.); and Irish Ferries (2,000 passengers and 270 trailers). In Europe, these vessels are designed for cargo plus utilitarian passenger travel. Unfortunately, the additional cost associated with Ro/Pax service as compared to straight Ro/Ro appears to be high enough to make such a service impractical in North America. (*16*)

Incat. Incat has developed a new variation of its successful Incat 98 vessel, the *Evolution 112,* which offers 25% more capacity than the previous generation. It is designed for passenger and freight applications, with a total freight capacity of 1,500 tons at reduced speed or 1,000 passengers at full speed. Total lane meter capacity for trucks is 345, while the ship can carry 198 cars (or 321 cars if no trucks are loaded) using the mezzanine decks. The ideal freight run would be 500 nautical miles.

Rail Ferry

There are two marine highway ventures in existence today that operate as rail ferries. The first is CG Railway, a subsidiary of International Shipholding Corporation. The service operates between Mobile, Alabama, and Coatzacoalcos in southern Mexico. CG Railway is actually a railway (as opposed to a marine operator) although its service is essentially a NAMH service. Figure 7 is a photo of a CG Railway vessel in operation.

The second operation is New York New Jersey Rail (NYNJR). The ferry is the only freight crossing of the Hudson River south of the Alfred H. Smith Memorial Bridge, 140 mi to the north of New York City. NYNJR leases approximately 27 acres of land at Conrail's Greenville Yard in Greenville, Jersey City, where it connects with two Class I railroads—CSX Transportation and Norfolk Southern Railway. On the Bay Ridge, Brooklyn, end, the 6-acre Bush Terminal Yard connects to the New York and Atlantic Railway's Bay Ridge Branch and the South Brooklyn Railway. The 2.5-mi barge trip across the harbor takes approximately 45 minutes. The equivalent truck trip would be 35 to 50 mi. Figure 8 is a photo of the NYNJR ferry in operation.

Figure 6. Ro/Ro vessel.
Photographer: Kurt Brandt.

Figure 7. CG Railway rail ferry.

Figure 8. NYNJR rail ferry.

These applications of marine highway operations have very limited applicability across North America. It seems to work in the case of CG Railway because of border congestion and the inefficiencies of rail operations that run from the southeastern United States to the Yucatan Peninsula and in the case of NYNJR because of extreme congestion. These conditions do not exist elsewhere.

High-Speed Ferry

High-speed ferries, advocated by some analysts, have much higher costs of construction and operation (fuel) than standard ferries. In fact, the time savings achieved with faster vessels often does not justify the additional fuel cost. Moreover, the commercial use for shorter routes, which constitutes most of the traffic, is limited. The high-speed vessels are simply not cost competitive with trucks. Figure 9 is a photo of a high-speed ferry operating overseas.

Vessels Used in Marine Highway Operations

The following sections summarize the key features of vessels used in current and defunct NAMH operations. Tables 3 and 4 list relevant NAMH ventures and their key characteristics.

Figure 9. High-speed ferry.

The literature suggests that in the case of vessel selection, smaller may be better. (*4, 9, 17–19*) Optimal ship size is obtained by trading off economies of size in the hauling operations with diseconomies of size in the handling operations. The larger the vessels are, the lower the optimal frequency is to handle the same volume. This creates a barrier to entry into shipping routes, as the volume of cargo must be sufficient to enter the market with an economically sized vessel. In port, handling costs per ton increase with ship size, while hauling costs per ton at sea, on the other hand, decline with size. Typically, shipping lines will enter a new market with the smallest vessels that meet their economic requirements and then grow the service by increasing ship size. Intra-regional container ships seem to fall within the range of 1,000–3,500 TEU. The most appropriate Ro/Ro vessels appear to be in the small- to mid-size range: 600–650 ft length overall, 21-ft draft, and the capacity to transport 140–150 48-ft or 53-ft trailers.

Deploying a relatively higher number of small vessels mitigates the impact of taking a single vessel out of service for overhaul, while allowing trucking and rail to serve as a safety net in the event of high demand or reduced vessel capacity (as in the case of a drydocking). Alternatively, the disadvantage of using smaller vessels is that it may not be possible to capitalize on the economy of scale offered by a larger ship—a factor that may be important in high-volume markets.

Relatively high-speed vessels (e.g., 25 knots) can not operate on most of the length of the inland waterway system. Vessel transit times are slowed by delays in negotiating the system's series of locks and dams. As a result, creating a truck-competitive NAMH service on the inland waterways (with the exception of across the Great Lakes) is not likely.

The general view of ocean carriers is that self-propelled vessels rather than traditional tug-barge combinations would be required to make domestic shipping services operationally feasible, primarily due to the considerably faster speed of a vessel (21 to 25 knots for conventional propulsion and much faster for advanced high-speed designs that may provide speeds in excess of 40 knots). The equipment that ocean carriers use and the labor force they employ are built around the management of self-propelled vessels. Furthermore, there is a greater probability of delays with international shipping due to weather, customs, and equipment availability; therefore, ocean carriers value speed and the ability to "make up time." This would apply mainly to feeder services as opposed to purely domestic shipments, where volumes would not be as great and more flexibility would be possible.

Vessel Financing

New marine highway services—both Ro/Ro and container vessel-based long-haul services—would be expected to use publicly owned existing terminal facilities or new facilities financed by state and federal authorities. The vessels have

Table 3. Defunct NAMH operations.

Venture	Service Area	Period	Vessel
Albany Express	NY/NJ–Albany	2003–2006	River barges
America's Marine Express	Memphis–Santo Tomas, Guatemala–Puerto Cortez Honduras	1994	Container vessel; DWT: 3,700; TEU: 256; speed: 16 kn
Crowley Liner Services	Lake Charles–Progreso	1999	Three Ro/Ro vessels
Gulf Bridge Ro/Ro	Mobile–Tuxpan	1998–1999	*Dolores*, Ro/Ro ship; DWT: 13,480; Cars: 1,158; TEU: 872; speed: 17.75 kn
Gulf Caribbean Transport	Tampa–Tampico	2001–2002	*Rita del Mar*, vehicle carrier; DWT: 10,890; Cars: 2,780; speed: 18 kn
Gulf of Mexico Express	Mobile–Veracruz	1999–2000	Ro/Ro vessel
Hale Container Line	NY–Philadelphia–Baltimore–Norfolk NY–Boston St. John–Boston–NY	1985–1987	Ocean barge with 420 TEU capacity and *Lanette*, container ship; DWT: 14,033; TEU: 827; speed: 16.5 kn
Matson (Company still active in other trades)	Los Angeles–Seattle–Vancouver	1994–2000	*Ewa*, container ship; DWT: 39.276; TEU: 2,128; speed: 21.25 kn
McAllister Brothers, Inc.	Boston–NY/NJ	1976–1988	Ocean barges (no description available)
Mexus Ro/Ro Ltd.	Houston–Tuxpan	1994–1995	Chartered Ro/Ro vessel
Protexa Burlington International	Galveston–Coatzacoalcos-Altamira–Veracruz	1993-1994	4 rail barges, each with capacity of 54 rail cars
Sause Brothers	Long Beach–Ensenada	1998–N/A	Ocean barges
Sea Lion Ocean Freight	Tampa–Veracruz	1997	*Mint Dart*, general cargo ship; DWT: 3,194; TEU: 256; speed: 12.5 kn
SPM Container Line	St. Pierre et Miquelon–Halifax–Portland–Boston	1994–July 2004	Carried autos and containers; DWT: 4,850; TEU: 396; speed: 16 kn
Yucatan Express	Tampa–Puerto Morelos Tampa–Cancun	2002	*Scotia Prince*, Ro/Pax vessel; DWT: 1,321; trucks: 21; cars: 75; speed: 21.5 kn

been, and are likely to be, owned by private interests. Although there is some divergence of opinion, stakeholders considering self-propelled vessel services indicate that vessel costs are such that new vessels for established operators will generally require federal financing assistance, and new operators will almost certainly require federal financing assistance.

For barge-based short- or intermediate-range services (mostly for 20-ft and 40-ft international container boxes and some for 53-ft domestic trailers), in the absence of Title XI, engine manufacture financing may be the practical financing solution. For container and Ro/Ro-vessel-based long-haul services (where vessels could cost $100 million or more, or where several $100 million vessels may be needed to establish a viable service), federal assistance such as that provided by MARAD's Title XI program may be required.

There are several points of view on the issue of Title XI funding. Some are opposed to it and feel that it only props up otherwise unprofitable businesses. They make the case that such programs encourage enterprises that do not have a sound business reason for existence. Their basic premise is that cargo/demand is the issue, not ship availability.

Others (especially shipyards) see it as a valuable tool to achieve a critical mass of shipbuilding activity. According to a recent study conducted by General Dynamics NASSCO (*19*), the present value benefit to a prospective shipowner of a Title XI loan over a traditional loan would be $23 million per $100 million of shipyard cost. If it is indeed preserved, the application and compliance processes could be simplified and the debt/equity ratio requirements may need to be relaxed.

The Title XI program currently has $45 million available. Due to recent failures, it may be difficult to get more funding in the short term. However, because of the way the leveraging works, this could assist in building vessels worth $900 million. (In the event of default, Title XI is only "on the hook" for about 5%.)

The age of the vessel affects the financing arrangements. New vessels can usually be mortgaged for 12–15 years, whereas older tonnage can be financed over 7–10 years.

Economic analyses have shown that the capital cost of a ship does not factor significantly into the price of transportation. That cost is spread over thousands of units per year for a 25-year projected life of the ship. A NAMH carrier could buy a comparable ship for half the price overseas, and it still would not make a strong difference in the economics for a given service. (*17*, *20–21*)

Vessel Construction

The Jones Act (Section 27 of the Merchant Marine Act of 1920 [46 USC 883]) requires that all waterborne shipping

Table 4. Current NAMH operations.

Venture	Service Area	Period	Vessel
64 Express	Norfolk to Richmond	2008–present	Conventional river box barges
CG Railway	Mobile–Coatzacoalcos	2000–present	
Columbia Coastal Transport	East Coast Ports	1990–present	5 deep draft barges with capacity of 450–912 TEU; approx. 8 kn speed
Detroit–Windsor Truck Ferry	Detroit–Windsor	1990–present	Flat deck barge; trucks: up to 30 speed: approx. 9 kn
Eco Transport	Oakland–Stockton	2009 (proposed)	Tug-barge, up to 350 containers (700 TEU) per barge; plans include 3 barges
Great Lakes Feeder Lines	Halifax–St. Pierre et Miquelon[1]	2008–present	*Dutch Runner*, general cargo ship with Ro/Ro capability; DWT: 3,056 trailers: 16; TEU: 219; speed: 13.5 kn
Horizon Lines	Tacoma–Oakland (extension of Hawaii String)	1999–present	5 container ships, DWT: 20,668–39,420; TEU: 1,172–2,824; speed: 20–23 kn.
Ingram Barge	Paducah–New Orleans	2006–present	Conventional river box barges
Linea Peninsular	Panama City–Progreso	1984–present	5 general cargo ships, DWT: 3,036–3,145; TEU: 154 each; speed: 11.0–11.6 kn
Maybank Industries	Port of Charleston to Nucor steel plant	2003–present	Shallow draft barges of 2,000–3,000 tons capacity
McKeil Marine	Sept-Îles–Trois-Rivières Hamilton–Montreal[2]	2005–present 2009–present	*Alouette Spirit*, capacity: 11,500 MT; operates as ATB with tug *Wilf Seymour*; retractable roof and bow ramp *Niagara Spirit,* capacity: 250 TEU, 8,500 short tons; operates as ITB
New York New Jersey Rail	New York Harbor	1983–present	2-290' x 40' carfloats and 1-360' x 41' carfloat, capacity: 10–15 cars each
Oceanex	Montreal–St. John's[3]	1997–present (current operational model started in 2005)	*Oceanex Avalon*, container ship with moveable cell guides; DWT: 14,747; TEU: 1,229; speed: 20 kn
Osprey Line	Houston–New Orleans New Orleans–Memphis	2000–present 2004–2009	Conventional river box barges (currently operating on inducement basis—no scheduled service)
Red Hook Container Barge	New York Harbor	1991–present	Container platform barges, capacity: 320–400 TEU each
Sause Brothers	PNW–Southern California	1950s–present	Ocean barges, capacity from 4,300–11,900 tons
Seabridge Freight	Port Manatee–Brownsville	2008–present	Ocean barge with 620 TEU capacity
Seaspan	British Columbia	1970–present	4 rail/vehicle carriers, DWT: 2,000–3,429; rail cars: 0–5 trailers: 2–8; speed: 12–18 kn
Various	Columbia/Snake River	1932–present	River barge, typically 120-ft deck barge; TEU: typically 80–100, largest is 160

[1] Because this is a mainland-island service, it does not meet the definition used for this study. However, the *Dutch Runner* was specifically retrofitted for service as a Canadian-flag vessel and therefore provides a relevant case study regarding vessel requirements.

[2] This service is actually offered by Sea3, Inc., a wholly-owned subsidiary of Hamilton Port Authority. McKeil provides the tug and barge service.

[3] Because this is a mainland-island service, it does not meet the definition used for this study. However, the *Oceanex Avalon* is a new build designed to carry containers (including 53-ft containers) relatively short distances and therefore is included as an example of a useful vessel design.

between points within the United States be carried by vessels built in the United States. Existing U.S. shipyards are serviceable but will require technological upgrades. Additional drydocks may also be needed, especially for larger vessels. The Title XI program could potentially provide seed money to finance new ships, and shipyard and terminal upgrades.

Any program targeting shipyards should probably focus on the mid-tier operations. The "big six" shipyards do primarily naval construction. A mid-tier shipyard with new construction and repair capability could build any vessel type other than large container ships. It is important to keep in mind that if things go smoothly, it takes 18–20 months to build the first ship following the placement of an order. Follow-ups take 14–18 months.

There *may* be an opportunity to realize economies of scale if multiple vessels of one type can be produced in series by a shipyard; however the gains from this form of standardization suffer diminishing returns to scale at a certain volume production. In the short-to-medium term, volume production is only viable for barges (e.g., ATBs and the like). Self-

propelled domestic container vessels are likely to continue to be "one off" designs (i.e., each one will be unique).

Some have recommended the idea of building in militarily useful features in new ship construction such as roll-on/roll-off ramps and heavy weight-bearing decks that could be paid for by the U.S. Department of Defense as part of a military sealift contingency program such as the current Maritime Security Program. However, there is little incentive for a potential NAMH operator to incorporate militarily useful features into vessels. In addition, the potential disruption associated with diverting NAMH vessels to support large-scale military deployments would not be easily absorbed. If such a program is established, a contingency plan for continuing to serve shippers in the event of a mass deployment would need to be taken into account.

The American Recovery and Reinvestment Act of 2009 (ARRA) made $98 million available for grants on a 75%/25% basis. The Omnibus Appropriations Act of 2009 provided an additional $17,150,000 for grants. The application periods for both of these programs have expired. No more than 25% of the funds available will be awarded to shipyard facilities that have more than 600 production employees. No recipient may have more than 1,200 production employees.

Freight ferries have been a major source of marine highway traffic in overseas markets. The Ferry Boat Discretionary Program (FBD) provides a special funding category for the construction of ferry boats and ferry terminal facilities. It was created by Section 1064 of ISTEA (1991, Public Law 102-240). It has been reauthorized and continued through the Surface Transportation Extension Acts. Section 1801 of SAFETEA-LU (Public Law 109-59) further continued the program and added the program to 23 U.S.C. as Section 147, Construction of Ferry Boats and Ferry Terminal Facilities. Additional funding was provided by the ARRA (Recovery Act, Public Law 111-5).

There is a set of circumstances/requirements that eligible projects must meet. The federal share of the costs for any project eligible under the FBD program is 80%.

Europe has created a program called CREATE3S that brings together some of the lead companies in SSS and ship design with the aim of developing a new generation of short sea vessels utilizing advanced design and manufacturing techniques. The program is intended to be equally applicable to container, dry bulk, and liquid cargoes. This approach will combine the ability for a "standard ship design" to be tuned to very different trades and commodities while using advanced construction techniques such as the "industrial" fabrication of large series of standardized basic modules. This is expected to reduce both operational and manufacturing costs. Production lead-times should also be trimmed by about 10%. According to press reports, the total funding for this project is €4.2 million with the European Union (EU) funding about €2.5 million of the total. The duration of the project, which started on November 1, 2006, is 36 months.

Legislation

The policy challenge for government is to bridge the gap between present circumstances and future aspirations. Businesses are not going to sacrifice potential profits purely for "greening" their operations. Political entities must ultimately either tax what they wish to discourage or incentivize what they wish to encourage.

Legislative activity to date at the federal level can be separated into two main categories: (1) attempts to modify or eliminate HMT, and (2) designation or promotion of routes for the development of marine highways or SSS through infrastructure grants or other mechanisms, along with attempts to actually fund these programs. Efforts to eliminate HMT for domestic shipping have been unsuccessful to date. In the last four congressional sessions, a number of lawmakers have sponsored bills providing HMT relief. Despite bipartisan support for the idea, none of those bills have made it out of committee. Such efforts are still underway. Bills that encourage the development of marine transportation alternatives have met with more success, but there has been little funding attached to them.

Appendix E provides a summary of legislative activity directly related to these two categories mentioned. It includes both successful and unsuccessful legislative proposals.

The HMT proposals may have been unsuccessful simply because they did not receive priority consideration, but it may also be because of trade-related issues. Congressional sources point out that a taxation scheme that differentiates between international trade and domestic trade through-ports could violate existing trade agreements and could result in an unfavorable ruling from the World Trade Organization if challenged.

Most interviewees believe that if incentives are deemed to be necessary, the best approach is to incentivize shippers, not operators. In this manner, the decision makers will be directly affected. With increased demand, capacity will follow. If incentives go to operators, there is no guarantee that the shipper will directly benefit and the effect of the incentive will be diminished. Furthermore, some analysts hold the view that for an incentive program to be effective, the recipient needs to have a significant financial stake (e.g., a one-to-one matching grant); otherwise, there is not a strong incentive to "do things right" from the outset.

There is strong disagreement over demonstration projects. Some believe that these projects often fail, and every failure makes it that much harder to convince a shipper that the marine option will work. Others say that it is necessary to at least try these projects in highly congested areas in order to acquaint shippers with the concept and verify their technical effectiveness. The reality is that when public money is used to subsidize a service and it fails (as in the case of the Albany Express service), it tends to create a negative reaction from

the public. Great care must be taken to ensure that any subsidized program has the necessary business foundation to have a reasonable chance of being successful.

The Congestion Mitigation and Air Quality Improvement Program (CMAQ) is often mentioned as a potential mechanism for funding NAMH projects. CMAQ is a federal program that provides funds to state departments of transportation, metropolitan planning organizations, and transit agencies to invest in projects that reduce criteria air pollutants regulated from transportation-related sources. Funding is available for areas that do not meet the National Ambient Air Quality Standards (nonattainment areas) as well as former nonattainment areas that are now in compliance (maintenance areas). Several ports have used this source for surface transportation improvements in their areas. The Albany Express service (now defunct), the Red Hook container barge service in New York/New Jersey, and the 64 Express container-on-barge service on the James River have received CMAQ funding.

Although its overall utility in creating viable corridors may be limited, CMAQ has the potential to become a good source of assistance, primarily for intra-state moves (such as the Albany Express and the 64 Express). The problem is that for movements between nonattainment areas or between one area that is in attainment and one that is not, the total benefit is reduced since only the benefits that occur within the boundaries of a nonattainment zone may be considered. Furthermore, it becomes extremely difficult to decide what the benefits are, who receives the benefits, and who should pay the costs.

Finally, there is a growing debate over the feasibility of using surface transportation funds for marine highway projects—specifically, those that mitigate or solve a surface transportation issue. This debate is in its early stages, but it seems to be gaining attention.

The European Experience

It is well known that European development of marine highway options has a longer history than those in the United States. The use of inland barging for container operations has long constituted a significant share of the total modal split for the extended hinterland of Rotterdam and Antwerp. The hub-and-spoke network for intra-European deliveries is more advanced, with small container vessels delivering containerized cargo from major port hubs to secondary ports. Finally, there is a system of hybrid passenger and freight ferry networks that moves trailer freight between different coastal locations throughout the continent.

In general, the geography of Western Europe is ideally suited for maritime activity given that the vast majority of the population lives near navigable waterways. Europe's unique coastline creates many port pairs in which the shortest distance between two points is by sea. Nevertheless, the area where Europeans have been least successful is in shifting domestic freight (defined as between two EU member countries) between two points over the open ocean. The dominance of trucking for intra-European domestic cargoes is still relatively fixed, despite an environment in which there are high road costs, high levels of congestion, and a freight rail system that is, in many instances, not competitive. The average speed of freight transport moving within Europe over rail was recently estimated at 17 km/h. (*22*) These conditions should make the European marketplace generally more favorable to marine highway development than is the United States.

As of 2006, the share of EU inland freight transport handled by road stood at 73%, an increase of 3% from 2000 to 2006. (*23*) By 2006, the share of inland waterway transport had fallen to 5% of total EU ton-miles. Germany and the Netherlands accounted for 77% of inland waterway ton-miles. Rail stood at 17% of ton-miles. Lost in these aggregate statistics is the segregation of containerized versus non-containerized cargoes; nevertheless, it is clear that when the total freight picture is examined, trucks play a dominant role.

Within the EU, several large countries are even less diversified. For example, in Spain alternative modes make up less than 10% of total inland freight shipments. In Italy, the percentage is also approximately 10%. At the same time, some EU countries have a higher percentage of rail transport than does the United States. In Poland, for example, one-third of total ton-km is by rail. Other former Eastern Bloc countries within the EU show a high percentage of rail shipment, partially a legacy of the rail-centric Soviet planning model that steered these nations for decades.

The European definition of "short sea shipping" or "marine highways" includes feedering of international cargo. Within Europe, there has been a debate as to whether the definition should be narrowed to include only "domestic" intra-European services, yet for many of the feeder services that currently utilize water a land-based alternative would be possible (though not desirable). Therefore, it is logical for purposes of comparison to classify the European feedering strings as legitimate "short sea" operations. While the total modal share for inland transport has been relatively fixed in recent years, impressive growth rates for SSS of containers have been realized in many EU member states. Between 2002 and 2007, Belgium recorded the highest growth rate in SSS of containers with a 23.8% average annual rate of growth, almost all of which is tied to the Port of Antwerp. Denmark also saw impressive double-digit annual growth in containerized traffic during this period. France, which has historically made less use of the marine highway network than the nations of Northern Europe, has nevertheless seen robust annual growth of 7.6%, and in 2007 moved 1.4 million TEU by short sea—a volume roughly equivalent to that of the Port of Houston. France's self-reported short

sea volume in 2007 was higher than Belgium's in 2002. (*24*) Growth in barge traffic from the Port of Rotterdam has slowed in recent years. For this reason, the port is taking steps to ensure that users of its future terminal expansion, Maasvlatke 2, meet a higher target for non-road alternatives.

Thus, the European situation can be described as successful in achieving a somewhat diverse modal balance, yet far from the goal of dislodging the dominance of trucking for internal movements. In the last decade, the EU made the strategic decision to invest in Motorways of the Sea (MoS), a series of start-up grants for new water corridors that would be a part of the Trans-European Transport Network (TEN-T) and interline with established rail and inland waterway networks. The goal is to achieve the same level of success for cargo that currently moves overland by truck in coastal corridors that has been realized from inland barging and international short sea feedering. The concept is in its early stages and has not yet been sufficient to create a paradigm shift in modal choice. The difficulties in switching cargo to rail are exacerbated by the fact that the freight rail network, dedicated mostly to passenger transport, has in general not served as a realistic option for a large enough pool of shippers. Most origin-destination distances for rail shipments are too short to be attractive minus outside subsidies.

The Marco Polo program is another EU effort to stimulate modal shifts for freight transportation. By subsidizing the cost of initiating certain actions that will lead to a modal shift, the EU is hoping to encourage more rail and waterborne freight transportation. Another program with potential applicability to the North American marketplace is Italy's Ecobonus program. This program subsidizes truckers who shift freight from a heavily congested highway corridor to a marine corridor.

Figure 10 summarizes the three major EU efforts to achieve a modal shift for freight transportation.

The MoS program has been slow in developing. Despite the fact that the initiative was announced several years ago, the

Profile of European Transport Programs

Marco Polo and Marco Polo II

Marco Polo is the European Union's funding program for projects that shift freight transport from the road to sea, rail, and inland waterways. This means fewer trucks on the road and thus less congestion, less pollution, and more reliable and efficient transport of goods. The current, second Marco Polo Program runs from 2007–2013 and is a continuation of the first Marco Polo Program, which ran from 2003–2006.

Source: Marco Polo: New Ways to a Green Program
http://ec.europa.eu/transport/marcopolo/calls/docs/faq/faq_programme.pdf

Ecobonus Program

The Ecobonus Program is an Italian initiative that provides a direct subsidy to truck companies that elect to use marine alternatives for heavily congested corridors. The program has recently been suggested as a European best practice that could be implemented in other markets. The formal ecobonus program was launched by Italy in 2007. There are 28 eligible routes within Italy and an additional 11 international routes that have been proposed.

Sources: "Italian Ecobonus Is Working"
http://www.shortseashipping.no/?nid=14358&lcid=1033, Lloyd's List, Accessed: October 30, 2009.

"Ecobonus Extension Critical to Motorways of the Sea Success," Lloyd's List, October 27, 2009.

Motorways of the Sea

The trans-European network of motorways of the sea is intended to concentrate flows of freight on sea-based logistical routes in such a way as to improve existing maritime links or to establish new viable, regular, and frequent maritime links for the transport of goods between member states so as to reduce road congestion and/or improve access to peripheral and island regions and states. Motorways of the sea should not exclude the combined transport of persons and goods, provided that freight is predominant.

Source: "Notification of an Open Call for Tender for Motorways of the Sea Projects in the North Sea Region.
2009–2013 ANNEX 1: Article 12a of the TEN-T guidelines"
Publication date: November 9, 2009.

http://ec.europa.eu/transport/maritime/motorways_sea/doc/2009_11_09_open_call_for_tender_ns_mos_2009_2013.pdf

Figure 10. European modal shift incentive programs.

first grants were issued in 2009. Development of the program has been complicated by the fact that in order to be eligible for funding, projects have to involve more than one member state (e.g., the connection between the northern coast of Spain and France). Because the planning behind these projects has taken so long, enthusiasm for launching them in the midst of the recession is tepid. Due to the reduction in economic activity within Europe, and an associated drop in congestion, it is unlikely that the new MoS Program will achieve the modal shift goals, at least initially, that were envisioned when these corridors were first proposed earlier in the decade. (*25*) Adding to the difficulty in predicting modal shift within Europe has been the willingness of the trucking industry to accept less favorable working conditions in order to secure employment. Therefore, assumptions that truckers would effectively cede marginally profitable routes to short sea operators will need to be reexamined.

In certain established markets, SSS functions quite well. Shipments between Baltic countries, such as Lithuania, Estonia, Latvia, and the northwestern corner of Russia, are generally seen as a success story. It is interesting to note that the situation for shipping between the Port of Riga, for example, and the Scandinavian countries is not fundamentally different from shipping between the northern coast of Spain and France. Yet, while the former has been a great success, there has been very little modal shift to water for proposed routes connecting secondary ports in northern Spain with their equivalents in France. (*26*) Lowering trans-Pyrenean traffic has been a major priority for Spain and France. Each has agreed to invest €30 million for the establishment of two new MoS lines, the first between the French port of Nantes-Saint Nazaire and the Spanish port of Gijon, and the second linking Nantes-Saint Nazaire in France with Le Havre and the Spanish port of Vigo. (*27*) Two models are used for this service, one in which the driver parks the trailer and a second in which the tractor and the driver ride along. Ship capacity will vary from 300–520 TEU. Payback provisions to the participating governments, should either of the lines become profitable, have been incorporated. Also, at the time of this report, Spain and Italy were in the final negotiation stages for a designation of MoS routes. The target mode shift from the Italian/Spanish initiative is to remove 400,000 trucks over the next two years. (*28*)

Each region within the European Union is currently developing its own MoS Program consistent with the overall TEN-T plan. As an example, the East Mediterranean MoS coalition was formed in 2007 in order to establish guidelines for investment. One of the first goals was to establish the patterns of freight movements and future trends to identify divertible flows.

MoS is seen as a component, not only of integrated transport policy, but also of an integrated EU maritime policy that would balance the demands and impacts of freight, passenger marine transport, fisheries, and tourism. Like MoS, the integrated policy is regionalized within each sea basin (i.e., the North Sea or the Mediterranean). The European Committee of the Regions (CoR) recently made a series of recommendations regarding European community (EC) maritime policy, including freight investment policy. With regard to the MoS program, the committee stated it would "like to see a more ambitious, comprehensive assessment of the type of operations and investment eligible for European subsidies, given that the measures taken in recent years have not achieved the expected results, especially with regard to the short-term viability of services." (*29*, p. 65)

More specifically, France has recently recommended to the European Commission a modification of the rules governing investment in MoS in order to allow national governments to take a more direct role in purchasing and controlling vessels for use in the motorways. The government of France argues that the current EU-directed pattern of incentives is not robust enough, and direct state support would be more effective in creating and directing a fleet of short sea vessels. The French approach would allow national governments to finance and fully or partially own vessels. (*30*) This would clearly change the level of state involvement in MoS policy, as compared with the current framework. Given the different characteristics of marine highway utilization around the EU, there is definitely an argument to be made for differentiating the strategy of investment based upon national need, particularly for the larger states. Conversely, direct state aid and ownership by one member has the possibility of upsetting the balance if other member states abstain from direct funding. In addition to vessels, the French proposal also recommends a modification of the Marco Polo Program to allow states to provide "eco-bonuses" directly to shippers or transportation providers who elect to use marine alternatives. The eco-bonus proposal is similar to an Italian initiative that has been viewed as a model.

None of the initiatives that subsidize freight modal shift has been completely without controversy. One of the key challenges within Europe is that there are so many preexisting services that already resemble MoS yet do not receive subsidies. With the collapse of shipping volumes that occurred during the 2008–2009 economic crisis, several of these preexisting services expressed the opinion that EC aid to the Marco Polo grant program and the MoS further weakened their business model and threatened to push existing services out of business. If this were to occur, it could ironically divert cargo to trucking. As an example, the Grandi Navi Veloci freight ferry service has launched a complaint against the European Commission for funding a Barcelona–Livorno service that serves essentially the same market as its preexisting Barcelona–Genoa service. (*31*)

If the economic crisis in Europe persists, it is possible that future funding schemes will endeavor not only to shift truck

cargo onto new marine alternatives but also to ensure that preexisting truck alternative routes stay in operation. For 2009, the Marco Polo Program has been allocated an additional €62 million in order to fund new mode-shift projects. Under current guidelines, Marco Polo can fund up to 50% of project costs. (*31*) In past rounds of Marco Polo, a flood of applications has meant that the vast majority of applicants were not able to take advantage of the subsidy. For future rounds, therefore, it has been recommended that funding levels be increased to a level that ensures all worthy applicants can take part. One of the more innovative aspects of the new Marco Polo Program is the decision to expand eligibility to "Wider Europe" (i.e., trading partners outside the EU 25). The rationale behind this expansion in eligibility is that truck traffic flows to and from major freight generators such as Russia could have a substantial impact on traffic within the European Union. Therefore, freight shipments that originate from Russia could be eligible for Marco Polo funding if they terminate within the EU 25. In order to fully participate in Marco Polo funding, Russia would need to sign a specific agreement with the EU specifying Russia's contribution to the general fund. (*32*)

Application

The willingness of the EU to expand funding for its Marco Polo and MoS programs to eligible parties outside of the EU 25 shows a general awareness that the freight flow issues that impact Europe go beyond Europe and that merely ensuring that all member nations are on the same page is not sufficient to solve the problem. The example set by the new orientation of Marco Polo could be seen as instructive for NAMH in that future programs may need to include other trading partners in the region even if they are not full participants. There is no direct equivalent of the Marco Polo program in North America in which multimodalism is universally incentivized. In comparing the MoS program with the NAMH initiative, both are closer to the inception, than to the full implementation, phase. Despite the fact that the MoS has already funded several implementation projects, its full potential has yet to be realized. It is likely that MoS will have an earlier impact than an analogous program started under the banner of NAMH because, in comparison to the United States, Europe has had several years of additional planning, as well as a greater preexisting pool of short sea operators and associated capital.

The challenges in making MoS and NAMH succeed diverge most sharply in the operating environments. Within Europe, policy makers are attempting to carve out new routes and services in the context of a very well developed container feeder and freight ferry network that would be recognized in the United States as a form of NAMH shipping. The biggest challenge for Europe is to continue to push forward new water services that take congestion off the roadway without disrupting the balance of a preexisting advanced water freight transport system. In the United States, with the exception of a few small-scale services, there is less of an established base on which to build. Freight or Ro/Pax ferries in the United States, which in Europe have served as a type of cottage industry for building up demand for water alternatives, are not a significant element of the transportation network. In addition, in the United States cabotage restrictions have, at times, constrained the establishment of domestic feeder services of international cargo. By contrast, in Europe, a robust international feeder market has contributed to the development of intra-European MoS services.

The Marco Polo Program, which covers rail as well as water mode shift, has certain common features with U.S. programs, but also some key differences. At its broadest level, the Marco Polo Program seeks to improve the energy efficiency and sustainability of freight transportation. In this sense, it can be seen as comparable to the EPA's SmartWay Program. Since being established in 2004, the SmartWay Program has generally sought to improve the efficiency of U.S. freight transportation through identification of best practices and limited grants. With the passage of the American Recovery and Reinvestment Act of 2009 (ARRA), the role of SmartWay has become more robust with grants such as the SmartWay Clean Diesel Finance Program. At present, the role of SmartWay 2.0 can be distinguished from Marco Polo in that Marco Polo has the specific function of improving efficiency through modal shift while SmartWay seeks to improve efficiency within each mode. Although in its early stages the program concentrated overwhelmingly on trucking, SmartWay 2.0 expands the program's scope to include all modes of land, sea, and air freight transport. Thus, as it evolves, SmartWay is looking more like Marco Polo. The two programs could never fully converge; however, the evolution of both programs shows a trend to greater breadth in systemwide transport planning.

In tracking the European experience, it is important to examine not only initiatives taken by the EU as a whole, but also actions taken at the national or sub-national level. The Port of Rotterdam' s master plan for the Maasvlatke 2 project to boost the non-truck modal split of the Port's additional traffic is a portcentric solution. Italy's Ecobonus program, which pays direct incentives to shippers, is being seen as a model that could be adopted in other areas of Europe.

Obstacles

The literature is replete with obstacles encountered by prospective marine highway shippers and operators. For the most part, they can all be reduced to one issue: *these services are not cost-competitive with the alternatives that exist.* Studies indicate that discounts of 20% to 30% off trucking costs may be required to compensate for a transit time increase of one

day for longer short sea transits, assuming that the NAMH service is reliable. Two examples can be found in references (*12*) and (*33*). The question then becomes one of determining what factors prevent such services from competing effectively.

In the analysis of potential obstacles to NAMH, it is important to distinguish between obstacles common to all start-up business enterprises and those that uniquely disadvantage marine transportation in comparison to rail and truck transportation. For example, the lack of statistical data regarding trade flows is a real obstacle for the development of NAMH to marine operators. Another often-cited obstacle is lack of familiarity on the part of the shippers. Many of the interviewees felt that this is a problem that all new businesses must overcome. Any operator that is attempting to sell his service must explain how his service is different from other alternatives and what the benefits will be to the shipper. Another such obstacle is the flow-imbalance issue (significant differences in the volume of cargo moving in one direction as opposed to the opposite direction); all modes must deal with this problem.

This analysis specifically focuses on factors that create a disadvantage for marine operations compared to truck or rail operations. The researchers established certain categories into which these obstacles fall, as follows:

- Service/marketing,
- Operating cost,
- Infrastructure and shoreside equipment,
- Government/regulatory,
- Operational constraints,
- Vessel-related, and
- Other.

These obstacles are listed by category in Appendix D, with references to the literature where these items are discussed. A brief summary is provided in the following sections. Within each category, there are certain issues that are essentially universal in nature, while others are specific to a region or certain class of stakeholder. These distinctions are important when crafting potential actions and responses to market conditions.

One remarkable finding is that *port infrastructure issues—defined as docks, warehouses, storage areas, and cargo handling equipment—are rarely mentioned as a serious impediment* to the development of marine highway services.

Service/Marketing Issues

Universal Concerns

All of the alternatives must be considered on a door-to-door basis. This is true for both delivery times and cost. It can be very difficult for a marine transportation provider to compete on a door-to-door basis. Inexperienced operators do not always identify the subtle cost elements in the supply chain that can weaken the competitiveness of NAMH initiatives vis-à-vis traditional modes. The operator must understand the total cost of the shipment (including demurrage, detention, container management, the need to send export cargo to terminals early, terminal costs, associated trucking costs, etc.).

NAMH interests are quite often seen as competitors to trucking interests. However, there is almost always a truck component to a shipment that moves by water. Experience with cargo shifts to intermodal rail indicates that many truckers are attracted to the prospect of reliable short-haul deliveries that allow them to stay close to their place of residence. Therefore, it is possible that the establishment of a new NAMH service could be seen as a positive development for the trucking community.

One of the recurring themes in the literature and interviews is that much of the success of NAMH services will be determined by the willingness of trucking interests to retail the service and partner with the potential operator. NAMH operators need to build a system that "a trucker can use," especially long-haul truckload operators. This has been done successfully in the case of truck-rail intermodal services. Facing a shortage of drivers, trucking companies have already expressed their interest in cooperating with ship owners. However, less than truckload (LTL) operators generally are not likely users due to NAMH's longer transit times and multiple steps in the intermodal process.

Marine highway service is more viable for large trucking companies with broad geographic scope who have tractors in both origin and discharge ports. NAMH operators should include an owner-operator network to coordinate owner-operator hand-offs at load and discharge ports.

Freight forwarders, by controlling the cargo flows, can easily provide alternative transport routes through which cargoes travel at the lowest transit time and cost. However, they are under strong cost pressures themselves.

The reliance of many NAMH start-up ventures on a single vessel (or a very limited number) has proven to be problematic. Although this approach is understandable due to the high capital cost associated with marine vessels, it has led to many instances where the failure of a vessel is the death-knell of an otherwise promising venture. (The Matson service on the West Coast connecting Seattle to Oakland in the 1990s was one example.) This approach has made long-term schedule reliability a very difficult task. Having only one vessel reduces the operator's flexibility and magnifies the impact of any obstacles encountered. Gulf/Atlantic corridor vessel strings may require up to six vessels, with three required for pure Atlantic strings. (*12*)

The reputation of the NAMH industry has not benefitted from the fact that many services employ older retrofitted vessels that are approaching the end of their service lives and are employed in a type of service different from that for which

they were originally designed. Furthermore, each start-up that fails due to equipment failure damages the overall reputation of the industry. Conversations with shipbuilding experts confirmed that the retrofitting of ships for alternative uses does not tend to yield a good result except in cases where there is no alternative.

The acceptance of frequency of service can be evaluated only in terms of a certain commodity type. Generally speaking, the frequency of departures has a significant positive effect on the allocation of cargo shipments toward the option providing the greatest frequency. However, for low-value commodities it is not a strong factor. The higher the cargo ranks on the value scale, the more of a factor it becomes. Distance also influences the need for frequency. Shippers are willing to accept less frequent service at greater distances. Additionally, although the economies of scale continue to work in NAMH's favor, the general agreement from interviewees was that the optimal size of NAMH shipments should be closer to that of an intermodal train as opposed to a container ship. The closer an operator can get to a low-volume/high-frequency paradigm that roughly duplicates the service characteristics of intermodal rail, the higher the chances of success will be over the long term.

Some start-up ventures have taken the approach of first acquiring a vessel and then attempting to develop a market. However, a number of interviewees indicated that this is the reverse of what should be done. Ideally, a start-up venture will identify the needs and the customers, and then configure the service accordingly. Securing vessels after the fact is easier when the NAMH service can use traditional barge technology with slow operating speeds and loading processes, as opposed to services that require higher speeds and rapid turnaround.

It is possible that there has been too much of an emphasis on the differences in air emissions or CO_2 production across the transportation modes. Although it remains a legitimate point of comparison, trucks and locomotives are required to employ ever-cleaner technologies and the fleet age for these modes is, in general, much lower than that of barges and inland vessels. Therefore, these differences are diminishing. However, the potential energy savings from maritime transportation in markets where intermodal rail is unavailable or uneconomic is still quite substantial.

Prospective services should keep in mind that domestic shipments have fewer customs requirements and often do not have to be concentrated at major load center ports, which may allow for the use of underutilized ports in the region. Most importantly, though, is the sheer volume of domestic freight flows, which outnumber international volumes by almost a 2:1 ratio. The challenge of handling the growing volume of international cargo is important, but it pales in comparison to the challenge presented by the movement of domestic freight by highway. Domestic shipments not only offer more volume, they also consist of a more diverse commodity mix and move between a larger number of origins and destinations.

Regional Concerns

United States. Focusing on a container-on-barge (COB) paradigm competing for international shipments is probably not advisable. Northbound international shipments need faster transit times than southbound shipments, but northbound (upbound) river traffic is slower. COB forces an international focus when domestic shipments might be more productive.

Stakeholder Class Concerns

Operators who have tried to acquire business from ocean carriers have differing opinions based on their business models. Generally, businesses attempting to serve as coastwise feeder services are finding that a feeder service provides a very low profit margin. Ocean carriers want the lowest price possible and use their market power to get it. Additionally, some ocean carriers need the business to supplement current volumes, and one existing operator fears that if he gets such a service started, the ocean carrier will simply "steal" it from him. The interviewees that move cargo inland or move overweight/oversize cargo find that it is a good business. They may find the business even more attractive if ocean carriers continue the current trend of withdrawing from the inland logistics business.

Operating Cost Issues

Universal Concerns

Start-up (initial capital) costs make it difficult for marine operators to compete with a truck service. Trucking services can lease their equipment and "right-size" their operations rapidly. A comparative assessment of short sea operations in Europe versus North America (*34*) determined that one of the key advantages of the European model is the prevalence of short-term chartering, which allows marine highway operators to right-size their fleets and respond to changing economic conditions. In terms of creating an even playing field for the modes, marine alternatives must become less capital intensive. Railroads can compete with trucking on cost, despite the capital-intensive nature of rail service, due to the accumulation of capital assets over decades—there are few, if any, start-up railroads in the United States.

In the current economic environment, truckers are desperate for business and can easily undercut a start-up marine service provider. Most likely, this will change as the economy improves, yet even after a recovery has taken place, the trucker shortage that occurred in the earlier part of this decade is unlikely to reemerge for quite some time.

In many instances, the origin or ultimate destination of the shipment is too far from the docking facility to be cost-effective for marine operations. Drayage becomes too expensive for the marine alternative to work.

In a recent study of potential West Coast operations, the financial analysis determined that the largest contributors to the total cost are the fuel, drayage, and stevedoring components, accounting for approximately 80% of the total per trailer cost for a Ro/Ro operation. (*21*) The vessel used in the study was a Ro/Ro vessel with a capacity of between 450 and 550 trailers and a cruising speed of 27 knots. In this analysis, the capital cost of the vessel is a minor contributor to the overall operating cost of moving cargoes.

Regional Concerns

Canada. It is difficult to compete against rail service in certain corridors, especially against the railroads in Eastern Canada.

In Canada, many fees are charged to marine transportation service providers that are not charged to land-based transportation service providers (customs services, pilots, icebreaking, etc.). For the smaller shipments, these fees tend to make it uneconomical to ship by water. Also, with lower population density than the United States, Canada experiences less intense general clamor to remove trucks from congested corridors.

Canada and U.S. West Coast. The cost of labor is an important issue to many existing and potential operators, especially in Canada and on the U.S. West Coast. To overcome costly labor, an operator would have to have a much larger volume than would be expected for a marine highway operation. The International Longshoremen's Association (ILA) appears to be more willing to establish special pricing and working conditions for new SSS operators than other unions. Certain special agreements have already been reached at some terminals serviced by the ILA, such as reducing gang size requirements, reducing the minimum hours requirement, allowing a gang working on a deep sea vessel that finishes early to "fill in" time with NAMH work, and even offering a reduced wage rate. The severity of labor issues varies around the country based upon the preferred vessel type, with barge or Ro/Ro services being comparatively less severely impacted.

West Coast. On the West Coast, the cost of waterfront property is a big issue. Ocean carriers typically receive priority scheduling and service because of the volume they transport. Port authorities do not want to set aside high-cost property for NAMH because of the low volume of cargo moved. The overwhelming flood of Asian imports has until recently strained existing capacity and made port and labor officials cautious in signing on to new untested services, particularly when the volumes they promise pale in comparison with the promise of new international growth.

Stakeholder Class Concerns

Operators. Port fees can become an issue in some cases. For example, NAMH operators have to pay dockage and wharfage fees twice—once when the cargo is discharged from a deep sea vessel and once for the cargo to go on the barge (or vice versa). Truckers and railroads do not have this double cost. Some operators took exception to having to pay security fees when they do not handle international cargoes.

One cost element that is also a regulatory matter is the manning requirements established by the U.S. Coast Guard. Operators make the case that different vessel types with equal capacity should have similar manning requirements and that manning requirements should be different for vessels crossing the ocean than they are for vessels employed in the coastal trades. Crew expenses are a significant cost component, and operators do not want to have any more crew than is absolutely necessary.

However, a recent study of the feasibility of a marine highway service on the West Coast indicated that (at least on larger vessels) manpower represents only 4% to 5% of annual vessel costs, and vessel costs represent 31% to 59% of the total costs per load. In this analysis, the authors selected a nominal Ro/Ro vessel with a capacity of 700 trailers and a cruising speed ranging between 20 and 27 knots. The lower percentage of vessel cost applied to shipments from northern California to southern California at a speed of 27 knots. The higher percentage applied to shipments from northern California to the Pacific Northwest at a speed of 24 knots. In this economic analysis, vessel manpower represents 1% to 3% of the total costs per load of a NAMH Ro/Ro operation. Crew reductions as high as 60% would represent only a reduction in the cost per load of less than 1% to 2%. (*35*)

In the past, Coast Guard procedures have allowed for operators to submit an application to reduce manning levels based upon a number of criteria. Manning requirements are set in accordance with vessel technology. (*36*) If the application is approved, the service is allowed to operate for a trial period. However, this can be a burdensome process.

Infrastructure and Shoreside Equipment Issues

Universal Concerns

Port infrastructure does not appear to be the chief limiting factor for most routes under consideration. Equipment seems to be an issue only with regard to larger vessels, especially

Lo/Lo vessels. In fact, the experience of inland waterway operators has shown that stick cranes are sufficient and, after some experience, operators of such equipment have shown that they can match the throughput of "sophisticated" container terminals (28 lifts/h).

Right-sizing capacity, whether it is for rail or water, is significantly more difficult than it is for trucking. Marine and rail operators have to pay for infrastructure capacity expansion, but truckers have to pay only for trucks. This makes long-term planning particularly important for crafting effective water transport policies.

Regional Concerns

Canada. There may be some need for Ro/Ro adaptations in smaller Canadian ports. (*16*)

Government/Regulatory Issues

Universal Concerns

The HMT is widely viewed as an impediment. It was instituted by the Water Resources Development Act of 1986 (P.L. 99-662). The tax is 0.125% of cargo value and is assessed to the shippers receiving inbound cargo at most ports. The tax on exports was declared unconstitutional by the Supreme Court in 1998 and was discontinued at that time. The HMT was intended to recover 100% of maintenance dredging expenses incurred by the federal government. Some believe HMT is an impediment because of the cost, others because of the paperwork involved, and yet others for both reasons. Some interviewees called it a "deal killer" (especially in the Great Lakes region) while others said it was just an irritant. (The sensitivity to the issue in the Great Lakes region could be due to the fact that when traffic is international, there is much stricter enforcement of HMT collections than with strictly domestic moves.) The degree to which it impacts a service seems to depend primarily on the type of cargo handled. The greatest impact is on LTL and less than container load (LCL) shipments. Some interviewees claimed that many shippers simply do not pay it, and almost no one pays it twice. Still, if enforcement is stepped up, this will become more of an issue. In the Detroit area, many shippers elect to take a 165-mi detour rather than have to pay the HMT when using the truck ferry. Thousands of trucks each day opt to wait at the border rather than deal with HMT. This happens even though they incur the cost of waiting and a much higher degree of uncertainty of crossing times. (The trucks that take the ferry southbound tend to be empty.) The ports of Nanticoke and Erie also claim that a NAMH operation they are attempting to start up is being stymied by HMT. There are efforts underway to resolve this issue.

The amount of HMT charged per unit of freight varies by the commodity and trade corridor, but several estimates are available that provide an idea of the magnitude of the effect. In 2004, the vice-president of operations for Apex Marine (who was the chairman of the Short Sea Shipping Cooperative at the time) was quoted as stating "HMT is an identified cost of anywhere from USD 75 to USD 120 on a 20-ft box moving by water." (*37*) In 2005, the average value of goods in a 40-ft container (2 TEU) was estimated to be $47,788. With double collection for international containers, the amount of HMT comes to $120 per box, half of which is for the domestic move. For local trailers (2.5 TEU) the average HMT would be $75 per load. Without taking social benefits into account, in many cases these amounts substantially reduce or simply eliminate the financial savings generated by marine highway services. (*38*) Other studies estimated the amount to be around 2.5% of the total cost of an SSS movement along the Atlantic Coast (*4*) and 6-10% of the total cost per trailer load on the West Coast. (*39*)

The effect goes beyond the actual amount of the tax. One example is that of a LTL carrier who wishes to use a marine highway service for part of the move. To do so, the highway carrier must contact every shipper with freight in the trailer to seek permission to subject each shipment to the HMT at the expense of the shipper or importer. The domestic shipper/importer will then need to make a business decision whether the time and money saved on the congestion avoidance route (NAMH) is worth the added tax and document filing obligation. If it agrees to incur the added costs associated with HMT, the domestic shipper/importer will need to declare accurately the shipment contents and value of the merchandise shipped. (*40*)

It is important to note that HMT is also a source of friction internationally. The EU views it as a discriminatory import tariff that violates the General Agreement on Tariffs and Trade (GATT). EU's reasoning is that the current HMT regime allows tax-free port use to products originating in the United States but imposes a tax on imported products, a direct violation of GATT. The possibility exists that exempting certain types of shipments (especially if they are domestic versus foreign) could create some conflicts with other trade agreements as well.

According to congressional staff sources, a recent congressional analysis showed that if HMT were eliminated for NAMH shipments, it would cost the federal government approximately $12 million over the next 10 years. In total, the domestic movement of containers contributed only about $1.7–1.9 million of the $880 million of HMT collected in 2004, or 0.2% of total. Yet this tax creates an uneven playing field for new NAMH service providers as truck and rail freight carriers do not have to pay HMT. (*41*) (Some would make the argument that trucks contribute to the cost of their infrastructure by paying fuel and other taxes into the Highway Trust Fund

and railroads build their own infrastructure; however, marine services also pay fuel taxes and a host of other fees related to their use of ports and waterways.)

Several interviewees felt that trucks have an unfair advantage because of the funding that highway infrastructure receives and the lack of any requirement to pay for externalities. The lack of a systematic accounting for comparative greenhouse gas (GHG) emissions for freight that could reward reductions in carbon emissions regardless of where fuel is combusted is a constraint on the development of marine highways. Additionally, the use of roads is considered free for truckers, but maritime operators must pay a host of fees to use the water (e.g., piloting, wharfage, dockage, longshoremen, icebreaking, etc.).

Part of the success of marine highway development in Europe has been tied to surcharges on trucking that have accompanied investments in water. Taxing and revenue policies need to positively impact water vis-à-vis other modes. Peak-period tolling for trucks is not judged to be as effective in incentivizing water transportation as an across-the-board increase in fuel tax. The literature indicates that increases in fuel surcharges would result in a greater likelihood of considering NAMH services as an alternative to trucks. (*42*) Alternatively, carbon taxes could have a similar effect in raising the average per mile cost of trucking. If peak-period pricing is used, truckers of non-time-sensitive products (the type of which would be eligible for water shipment) will simply avoid the peak period, and there will be no net gain for using an alternative mode.

Some of the interviewees suggested that there should be more flexibility in the use of highway funds. Some went so far as to suggest that the Highway Trust Fund should be opened up to marine infrastructure investments. The argument is that when a marine project is identified that will solve or mitigate a congestion or safety issue on roadways, transportation authorities should be allowed to use highway money to help implement such projects. However, the reality is that this may not be a politically effective policy. Highways are seen and used by almost the entire population, whereas waterways are typically "out of sight, out of mind." It is to be expected that politicians will choose options that are most visible to the greatest number of people. With the current condition of the Highway Trust Fund, gaining political buy-in for any program that is seen as diverting highway funds away from traditional surface transportation projects will be difficult even if the projected benefit-cost ratios are positive.

One interviewee pointed out that there may be some governmental resistance, at least in some states, to taking cargo off highways. In California, marine fuel is not taxed by the state but highway diesel is taxed. Taking cargo off the highways will reduce the immediate cash flow to the state, but it should be offset by reduced maintenance and congestion costs.

Local communities are beginning to push back against port expansions. They are enacting regulations and policies that limit the ability of marine operations to expand and continue to be efficient.

There seems to be general sentiment among the interviewees that there is insufficient leadership in both Canada and the United States in terms of an overarching freight movement program or strategy. This results in investments being made that may hinder efficiencies or ignore large systemic issues.

Regional Concerns

Canada. The Canadian policy of total cost recovery for new or expanded customs services is viewed as a serious impediment. Proponents of change point out that this policy restricts the ability of start-up businesses to be viable. It was blamed by one operator for the failure of the Rochester ferry. Some contend that the federal government should promote trade and encourage business development by providing the level of service needed in each location. The Canadian government can issue exceptions, but then that puts the government in the position of picking winners and losers. Additionally, Canadian interviewees also believe that customs capability is not always adequate at the smaller ports.

Canada/Great Lakes. The 24-h advance notice rule imposed by U.S. Customs is an issue in the Great Lakes Region. The actual trip time is less than 24 h. Trucks are required to report only 1 h in advance; therefore, this places a serious handicap on marine services. The 24-h rule has been blamed for causing the failure of a potential Oswego–Hamilton service. One operator has installed a computerized advance notification system and worked out a special arrangement with customs.

United States. U.S. interviewees mentioned that there is unequal customs service at different ports, limiting the options for international cargo.

Many state departments of transportation do not have any in-house marine expertise. This almost guarantees that they will not consider marine alternatives when dealing with surface transportation problems.

Stakeholder Class Concerns

Operators. As noted in the section on cost issues, the manning requirements required by the Coast Guard can seriously affect the economic model for a marine operator.

Agency/Government. One planner noted that the inability of government to plan and fund multi-jurisdictional projects is a serious impediment. The planner questioned whether the 64 Express project would have been viable had it crossed

state lines ("New York doesn't care about traffic jams on I-95 in Connecticut"). Rail projects often face this issue. Marine transportation planners need to borrow best practices from rail and regional highway planners. Furthermore, local efforts are not as likely to result in an efficient freight transportation *system* as are regional or national approaches.

Shipyards. Although it relates to a vessel issue, interviewees believe that the current Title XI program administered by MARAD is too cumbersome and complex and that if the program is to continue, it should be simplified. One of the biggest drawbacks to the current Title XI program is that it requires a 1:1 debt-equity ratio.

Operational Constraints

Universal Concerns

Marine operations need a higher volume per shipment than truckers do to be profitable. This reduces the flexibility of a marine service in handling sporadic and/or small shipments. (Railroads also face this difficulty.)

Because of high equipment costs and uncertainty in demand, marine operators must maintain a fairly high level of working capital. Unlike railroads, they do not have an existing capital base from which to work.

To be able to obtain competitive financing, operators need to have long-term commitments and fairly stable volumes. This has been very difficult for marine operators to achieve to date.

Ocean terminals tend to favor ocean carriers, given the high volume they represent. Terminal layout, equipment, and scheduling practices tend to be geared toward large ocean-going vessels moving between continents.

Marine operations tend to require too many "touches." Given the number of handoffs involved, especially in relation to a truck move, many shippers believe there is too much potential for delays. For example, a trucker simply loads a truck at the origin and unloads it at the destination. When a marine service is involved, the truck must be loaded at the origin, the cargo must be taken off the truck and placed on a barge or vessel, then at the destination the cargo must be taken off the barge or vessel and placed on a truck, and then the truck must be unloaded at the final destination. In addition to the potential for delays, this extra handling results in more costs and opportunities for damages.

Traditionally, there has been too much variability in demand in the markets that marine highway operators have pursued. High variability in demand can make it difficult for an operator to be successful. It does not work to try to consolidate cargoes by bouncing around a harbor area and then transporting the load—there must be adequate dock-to-dock volume. This is one of the reasons that the Ensenada, Mexico to Los Angeles/Long Beach, California attempts have not been successful.

Regional Concerns

Canada/Great Lakes. In areas that require a winter shutdown, it will be very difficult to develop a true NAMH service, especially in dealing with high-value cargoes where buyers and sellers do not want to maintain high inventories.

Vessel-Related Issues

Universal Concerns

There is quite a divergence of opinion on the availability of capital for vessel acquisitions. Some claim the lack of capital is a serious impediment, while others state that with a good business plan capital is readily available, at least in comparison to availability in other industries. All agree that long-term shipper commitments will enable an operator to acquire capital on more favorable terms. In today's economic environment, long-term fixed-rate financing is difficult to obtain. Vessels are assets that are difficult to redeploy in the event of a business failure, and this has an effect on the cost of capital.

Many parties have called for standardization of vessel designs as a means to reduce the cost of production. The general rule is that the first vessel is most expensive, the second vessel is less expensive, and the third and fourth vessels are where production becomes optimized. So for total construction costs, an order of four or more ships is best. However, operators point out, and others agree, that this level of standardization may not be possible. Operators want vessels that are unique to their services and offer a competitive advantage. Additionally, there is a very wide range of cargoes and operating environments that are involved in NAMH operations. Not even in the shipbuilding industry, where vessel standardization could have significant benefits, is this approach universally supported. Furthermore, there simply are not enough procurements on the horizon to justify standardization.

Interviewees in both the United States and Canada emphasized that the lack of qualified vessels and barges is a serious impediment to the development of NAMH. Although there may be plenty of water and shoreside infrastructure to accommodate the development of this industry, a lack of vessels becomes a capacity issue. Canadian interests seem to be the most concerned. There are only two container ships in the Canadian fleet that are appropriate for feeder services and the fleet for domestic service is limited and aging. It is interesting to note that in Europe, most short sea feeder operators charter their vessels rather than owning them because it provides maximum flexibility in responding to changes in market conditions and demand. With a very limited number of vessels available that meet cabotage restrictions, such arrangements are not feasible in North America.

Several studies indicate that the cost of vessels is not as important to the overall economic structure as might be

supposed. Specifically, when examining Ro/Ro opportunities, studies show that the most significant costs for NAMH on a per trailer basis remain the landside costs including truck drayage to and from the terminals, port costs, and fuel costs. The cost of the vessel falls within the range of 10% to 14% of the total cost per trailer. Reducing the cost of the vessel will help the economics, but will not determine definitively whether the operation can be profitable.

Regional Concerns

Canada. Although there is no direct equivalent of the Jones Act (described in the following subsection) in Canada, there is currently a 25% duty on the value of imported vessels. Canadian interests state that it is not possible to get vessels built in Canada that would be suitable for a marine highway operation. This situation, in conjunction with the 25% import duty, is resulting in a lack of suitable vessels. Furthermore, the import duty and the vessel modifications required to meet Canadian cabotage restrictions are sunk costs that cannot be recovered if the service is unsuccessful.

Ro/Ro and barge seem to be the vessels of choice. However, in Canada, there are very few Ro/Ro vessels available and several smaller ports do not have Ro/Ro ramps that would even allow such vessels to call. (*16*)

United States. Some interviewees say that the cost of vessels is holding the industry back. Almost all agree that U.S.-made vessels are more expensive than foreign-made vessels, but there is disagreement as to whether this really affects the viability of the industry. Since vessels are financed over long periods, the effect on annual operating expenses should not be dramatic.

There is much talk about the negative effect of the Jones Act on NAMH. The Jones Act is Section 27 of the Merchant Marine Act of 1920 (46 USC 883). It requires that all waterborne shipping between points within the United States be carried by vessels built in the United States, owned by U.S. citizens (at least 75%), and manned with U.S. citizens. In discussing the Jones Act, one prominent shipper even went so far as to state that the cost of drayage is not a big problem—it is the long-haul costs that are inflated because of Jones Act protections. The shipper's experience has shown that the cost to ship to Antwerp is one-fourth of the cost to ship to Puerto Rico, and they blame this on the Jones Act.

Contrary to expectations, the cost of labor in the United States is not a prohibitive factor in the overall cost of a U.S.-built vessel. Compared to other key shipbuilding nations, the United States ranks third or fourth in the hourly cost of labor. When compared to world-class shipyards, the key differential in shipbuilding cost is volume. The best way to reduce the cost of a Jones Act ship is to establish the requirements of the marketplace, identify or design a vessel to meet those requirements, and then—once the design is complete—produce those vessels in quantities that drive down the "learning curve" toward more affordable unit prices.

The Jones Act was originally—and should still be viewed as—a military strategy to protect U.S. shipyards that can build vessels that will be under the control of the U.S. government during times of military conflict. Congress will not consider weakening national security by abolishing the Jones Act.

It is highly unlikely that the Jones Act will see any significant amendments any time soon. One interviewee pointed out that even abolishing it might not make the difference everyone thinks it will. When similar laws were repealed in some other countries, the impact was far less than projected. Besides, capital costs are not the tipping point. (Several interviewees made this last point.) If the Jones Act were to be amended, it would be necessary to consider the effect it would have on current operators who have built their business model around Jones Act requirements. One shipyard pointed out that there are more shipyard employees than there are U.S. Merchant Marine employees.

Stakeholder Class Concerns

Shipyard. There is a wide range of opinions on Title XI financing. Because of recent failures, several interviewees felt that the program was ineffective. Others believe that it is difficult to qualify and stay in compliance with Title XI requirements, but if a shipyard can qualify, the program helps financially. Another related issue is that existing operators often oppose such applications vigorously, seeing it as government favoring one operator over another.

Other Issues

Universal Concerns

Externalities are not included in freight rates or the cost of doing business. Because of this, marine operators are not able to capitalize on their reduced impacts on the environment.

There are competing uses for the waterfront. As more cities consider building hotels, condos, parks, and the like along the waterfront, it will be more difficult to acquire space at ports.

In much of the discussion on NAMH, little has been made of the fact that such operations are going to be profitable only in limited circumstances. Some analysts make the claim that it is a better strategy to invest in a few priority corridors rather than offering nominal assistance to all parties.

The possibility exists that if NAMH becomes a serious transportation competitor, the railroads would "fight back." There would definitely be an attempt on the part of rail companies to hold on to market share. Can marine operators weather that kind of challenge?

Regional Concerns

United States. There are differences in the liability a carrier has to the shipper. For example, marine carriers are statutorily limited to $500 liability per "package" (unit), while truckers are fully responsible for the cargo they carry but typically carry insurance for $100,000 per shipment. Especially for coastal shipping, this difference in the liability assumed by the carrier can be an issue in modal choice.

Stakeholder Class Concerns

Operators. Many operators suggest that dealing with intermodal marketing companies or third-party logistics (3PL) providers is a good marketing strategy. However, both types of providers will often try to force the carrier's price down to maintain their own margins.

Many operators try to operate on what amounts to a "shoestring." Because of variability in demand and high fixed costs, any unforeseen difficulties cause them to fail. They are unprepared for situations—such as a rail line lowering rates to keep its business.

Miscellaneous Considerations

Land Requirements

One of the concerns often expressed by port planners and smaller ports is whether there is sufficient acreage available at a given port to accommodate new marine highway activities.

Some of the literature indicates that at least 10 acres is the minimum required size for container operations. (*43*, *44*) It is likely that smaller sites will start to constrict the required traffic circulation for an efficient marine terminal.

Land requirements for a conceptual NAMH terminal with rail intermodal facilities and supporting business operations tend to fall within the following ranges:

- Terminal operations and storage: 10 to 20 acres,
- Rail intermodal yard: 8 to 10 acres,
- Supporting container industry business operations: 10 to 40 acres plus, and
- Total approximate land area requirements: 28 to 70 acres plus.

These totals are for an integrated container operations center containing a variety of facilities and operations. For prospective node sites with adjacent or nearby distribution center facilities and/or intermodal facilities, an effective NAMH terminal could be established on as little as 10 to 15 acres of land.

Given the model of a Ro/Ro vessel system, the primary requirement is for a paved trailer parking area of at least 5.5 acres to support a 150-trailer vessel operation and ramps either on the vessel or fixed to the shore that enable the fast loading and discharge of trailers by stevedores using yard tractors. A rule of thumb that is often used is that there must be parking for two times the maximum number of trailers expected on a given voyage. A parking area of 5.5 to 6.5 acres would provide parking for 240 to 280 trailers.

It is difficult to comment on the available port and terminal capacity to handle NAMH operations without considering the specific commodities and markets to be served. The bigger problem is the need for waterfront land for facilities that would bring shippers closer to the services. This type of industrial expansion could be prohibitive in most existing port locations and would face considerable community opposition in many cases.

Columbia/Snake River Lessons

Three major factors contributed to the start-up and continued success of container barging on the Columbia/Snake River System: cooperation, commodity mix, and geography.

The ports, barge lines, shippers, and steamship lines all saw container-on-barge shipping as the best alternative. Steamship lines agreed to quote through rates to and from the inland ports, and they were willing to position containers at those inland ports. In the past, the trans-Pacific trade was large enough to offer a sufficient mix of ocean carriers that some steamship lines chose to cater to markets such as the agricultural and forest products that make up the majority of the container barge movements. However, the Asian trade out of Portland has dropped as a result of the global economic crisis, causing some shippers to look more to Tacoma and Seattle. Perhaps the most important factor was that the container barges could be easily added to existing tows of grain or petroleum barges without adding significantly to the cost of the move.

Shippers of low-value, non-time-sensitive cargo can afford the extra couple days of transit time in exchange for the lower transportation cost. Further, the cargo is concentrated in very close proximity to the river system. Forest products in Lewiston, Idaho; potato products in Boardman, Oregon; and hay cubes in Pasco, Washington are all produced less than a mile from the barge docks.

The cargo is concentrated, moving from a few inland locations to one major hub for steamship service in Portland and on to the Far East and Europe. Having one common-user ocean terminal in Portland is a great advantage. If the container-on-barge cargo needed to be split among two or more terminals, it would be much more difficult to aggregate the volumes needed to make economical use of ocean container terminal labor and equipment.

The inland move is of intermediate distance (200–400 mi), which balances the cost and time factors to the shippers' advantage.

Infrastructure Requirements

Infrastructure and other requirements potentially include Ro/Ro ramps and facilities, additional drivers, cross docks, chassis pools, rubber tired gantry cranes for Lo/Lo, and yard hustlers. One study indicated that a typical Atlantic port can be prepared to handle Ro/Ro traffic with a $5 million investment. (*8*)

Redundancy

The I-95, I-5, and I-10 coastal interstates have 6,600 bridges collectively among them. Of these, 1,370 bridges have spans greater than 300 ft that cross significant features. If destroyed, at a minimum, these bridges would take months to replace and, for the longest bridges over major rivers, years to restore service. (*8*) This presents a significant vulnerability for the U.S. economy. A bridge that is out of commission is more than a frustration to commuters; it can cause serious disruptions that ripple through regional trade corridors with consequences across a wide sector of the economy.

NAMH provide significant and invaluable additional redundancy to the transport network when considered as a system. Instead of a single line of communication vulnerable to being severed by a determined attack, the network could be developed as a web that cannot be disrupted even if individual lines are severed.

CHAPTER 4

Conclusions and Suggested Research

In order to develop a potential path to success, it is helpful to determine which of the hurdles standing in the way would have the greatest positive impact if removed. The primary issue at hand is that the NAMH industry has not been cost-competitive to date. Therefore, it would make sense to address the basic economic issues (such as capital and total shipment cost) first—directly or indirectly. Only once this has been accomplished can the other identified or perceived hurdles be solved.

Accelerating the development of NAMH will require a new business model and new policies. The following conclusions provide the building blocks for the new paradigm. Success will require the best technology available; innovative business models; and favorable government policies.

The conclusions flowing from the research can be divided into two broad categories:

1. Economic framework and
2. Planning and operations.

These categories can be further divided into three broad subcategories:

1. Potential actions for industry and planning organizations,
2. Potential actions for the public sector (non legislative), and
3. Potential legislative actions.

Some of these subcategories can be further classified into regional issues. Where an action is specific to a region, such distinction is noted. Although the success or failure of actions in one category could affect the implementation of actions in another category, they are treated as independent actions for the purpose of this analysis.

Economic Framework

Industry and Planning

The potential industry and planning activities related to the economic framework are shown in Figure 11 and Table 5. These figures associate the potential actions with the obstacles they address.

Address Labor/Manning Issues

Labor cost and restrictive labor policies were seen as burdensome to the development of NAMH at several levels. A viable labor model needs to be developed that will avoid burdening marine highway operations with costs that disadvantage the industry vis-à-vis other modes. Buy-in from organized labor is critical to creating a cost-competitive NAMH service in terms of both vessel and marine terminal operations. In order to accomplish this goal, labor interests on the dockside would need to be of the opinion that the opportunities from new cargo are sufficient to merit special consideration, even if the per unit profitability from serving NAMH services is lower than that of existing services.

Reducing required manning levels for self-propelled blue-water vessels is important for NAMH to have a competitive cost structure. Talks would need to be undertaken with authorities in both Canada and the United States to develop manning requirements that reflect the differences in coastal shipping and cross-ocean shipping. One of the goals could be to eliminate the discrepancy in manning levels between barge configurations and small vessels. Furthermore, NAMH SHORT SEA operators in the past who have attempted to retrofit or reconfigure vessels have been burdened by the ad hoc process of modifying crewing requirements. One benefit of establishing standards for NAMH vessel fleets would be that the manning requirements could be set at the onset of the new service.

Vessel capital and crew costs as well as marine terminal expenses would need to be set at "best in class" levels for U.S. operations for NAMH to be price-competitive with ground transport alternatives on a door-to-door basis.

The best way to control costs and scheduling is to use terminals that are under the control of the operator. In a similar vein, an operator could employ its own draymen exclusively to pick up/deliver as a means to control drayage costs and make them more predictable.

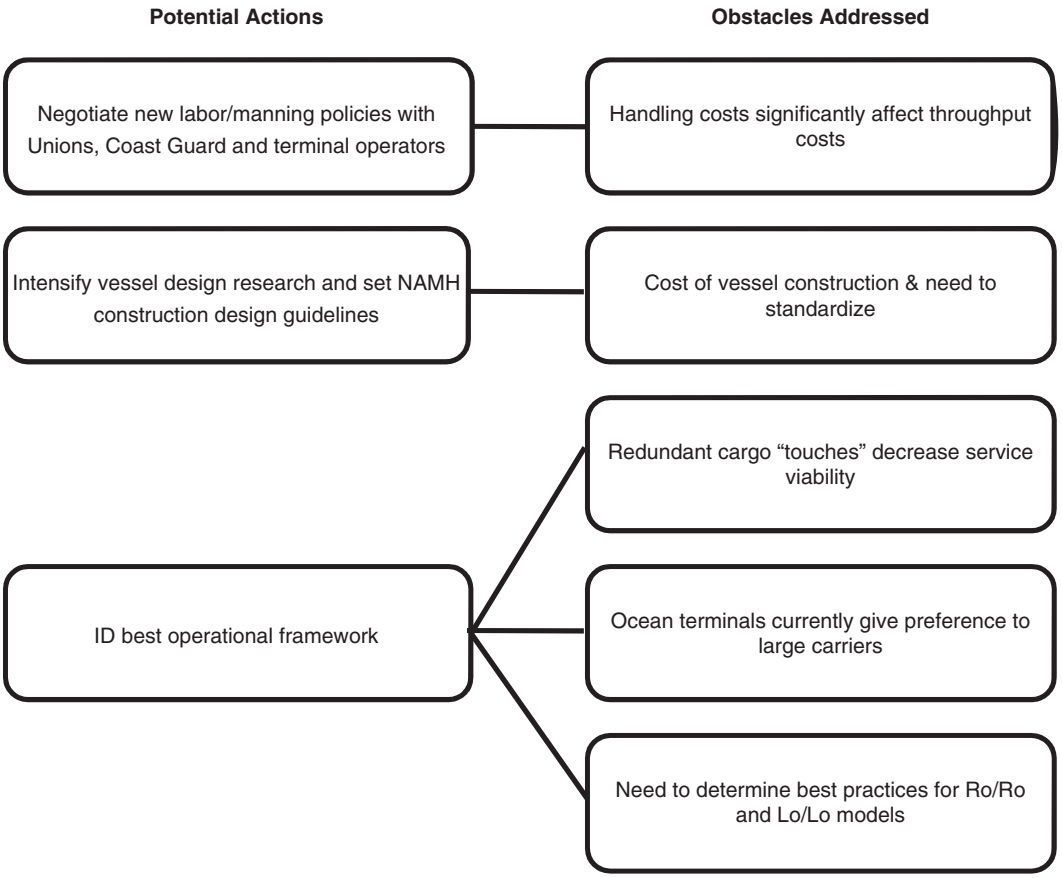

Figure 11. Economic framework potential actions—universal: industry and planning.

Miscellaneous Operational Strategies

Most interviewees who had examined the concept of NAMH from a national focus suggested an initial focus on Ro/Ro for most corridors. Lo/Lo can be considered if crane infrastructure is already in place and lift costs can be discounted for NAMH operators. Less landside infrastructure and equipment are required for Ro/Ro, and operations are simpler. Furthermore, the predominance of 53-ft containers and trailers in the United States clearly favors the deployment of vessels with these capabilities.

Intensify Research into Vessel Design and Construction Strategies

Several interviewees indicated that some degree of standardization on the vessel side would be necessary for the industry to emerge as a true competitor to truck and rail. There was marked disagreement, however, over how extensive the standardization could become and what its primary drivers would be. Standardization has been viewed as an advantage for shipbuilders; however, it could also benefit ports that are considering different options for terminal construction or modification. More research is required into what features could be standardized across a range of NAMH vessels. Stakeholder workshops on this subject would also be of value in attempting to form areas of consensus.

New Lo/Lo vessels should not be geared (have shipboard cranes). All indications are that there is no real market for such vessels in the NAMH future. Although the per unit cost of using landside container cranes is high, the fully amortized cost of shipboard cranes is even higher since they generally are idle for most of the time. Not only do shipboard cranes add to

Table 5. Economic framework potential actions—regional: industry and planning.

Potential Actions	Obstacles Addressed
Address labor cost issue	Canada & US West Coast: high cost of labor
Vessel design research	Canada: need vessels for NAMH
Identify best operational framework	US: container on barge not high probability of success

initial capital costs, they also increase ongoing maintenance expense considerably.

Public Sector (Non Legislative)

The potential public sector (non-legislative) actions related to the economic framework are shown in Figure 12 and Tables 6 and 7. These figures associate the potential actions with the obstacles they address.

Include Externalities in Taxing and Funding System

As truck and rail engines become cleaner, CO_2 emissions will emerge as one of the most compelling policy drivers for

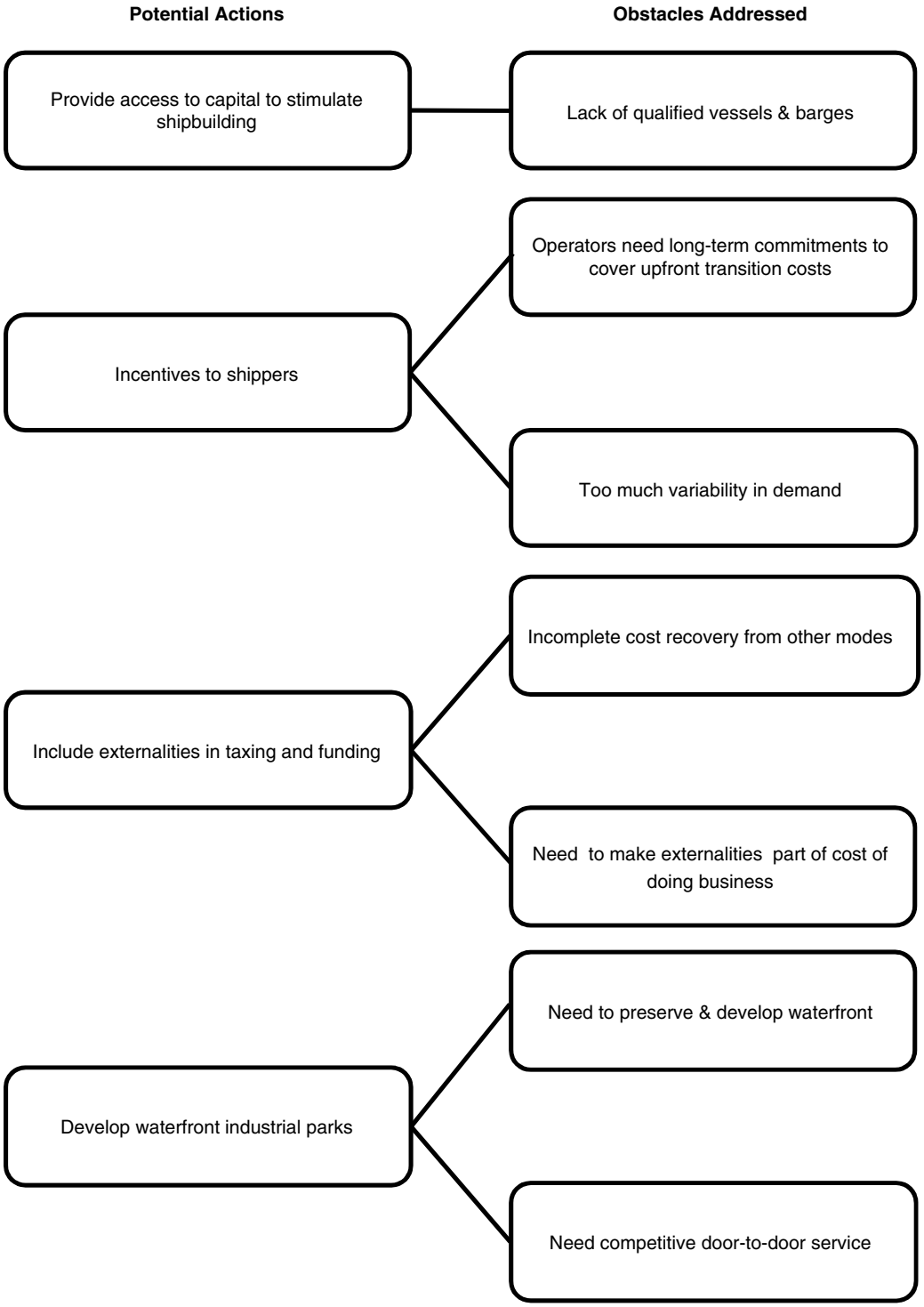

Figure 12. Economic framework potential actions—universal: government (non legislative).

Table 6. Economic framework potential actions—regional: government (non legislative).

Potential Actions	Obstacles Addressed
Incentives to shippers	Canada: difficult to compete against rail

Table 7. Economic framework potential actions specific to stakeholders: government (non legislative).

Potential Actions	Obstacles Addressed
Revisit manning requirements	Operators: manning requirements burdensome for certain vessel types
Improve Title XI to stimulate shipbuilding	Shipyards: Title XI cumbersome and restrictive

making greater use of marine highways. The Quebec provincial government has established a GHG reduction incentive program that might serve as a model. (See Appendix F for a description of this program.) It might be possible to use this approach as a foundation for compensating shippers for using marine highways and thereby reducing negative externalities.

Taxing and revenue policies need to positively impact water vis-à-vis other modes. Increases in fuel surcharges appear to have the greatest likelihood of causing shippers to consider NAMH services as an alternative to trucks. Alternatively, carbon taxes could have a similar effect in raising the average per mile cost of trucking.

Another possible approach is to tax trucks that use highways (as in Germany), especially during peak congestion hours. The Eurovignette directive, for example, has been in place since 1999 and has been repeatedly modified to capture more externalities. The origins of this European policy go back to the early 1990s. A process of trial and error would likely be required in order to properly design a taxing scheme that would account for externalities in the U.S. modal split.

In some cases, tolling might be used when fuel taxes are deemed insufficient to fully capture externalities. Externalities would include not only emissions but also the traffic burden placed by trucks on the general public. One approach would be to set up a tolling system that would vary the charge by the route taken.

Revisit Manning Requirements

It is important to ensure that government regulations concerning U.S. vessel safety and manning levels, as well as U.S. shipyard work processes, are consistent with similar measures maintained by leading maritime nations such as Japan, Germany, and Denmark. (See the discussion under "Address Labor/Manning Issues" earlier in this chapter.)

Encourage the U.S. Shipbuilding Industry

The U.S. shipbuilding industry could reinvent itself by building a new fleet of environmentally friendly coastal ships. This type of redirection, however, would require a major new concerted effort at the federal level. It has been suggested that the full-scale replacement of the Military Sealift Command would be an initiative of the scale required to create a fleet. If the fleet were designed principally for civilian freight needs but with requirements necessary for military needs in mind, it could create a viable fleet.

More research is needed into vessel design characteristics that will be desirable for maintaining the viability of marine highway operations into the future under a variety of fuel costs, congestion, and economic scenarios.

Provide Incentives to Shippers and/or Receivers

The federal government could provide some form of stimulus to make it attractive for shippers and/or receivers to explore the use of a new and (at least in terms of perception) more complex transportation option. It is important to keep in mind that the carriers are not the decision makers—the shippers and receivers are.

A wide range of incentives is available. Incentives used for industrial development purposes include items such as property tax rebates, income tax credits for qualified investments, financial assistance in developing site infrastructure, and income tax credits based on actual shipping volume. The government of Quebec adopted a program to pay an amount per ton of GHG reduced as a result of a modal shift. Further information on Quebec's program is found in Appendix F.

In Canada, Change Policy of Full-Cost Recovery for Customs Services

Under the current policy, the entity requesting new or expanded customs services must cover the full cost of that

expansion or new service. The government could consider a policy of fully funding customs services as an economic development tool.

Have Ports Consider Volume Guarantees

Ports could consider strategies for guaranteeing volumes for a fixed period of time to get operations up and running.

Legislative

Potential legislative actions relating to the economic framework are shown in Figure 13, Figure 14, and Table 8. These figures associate the potential actions with the obstacles they address.

Federal Government—United States and Canada

Institute Effective Subsidies and Grants. Some interviewees expressed support for government to help smaller terminals and port entities acquire new capital equipment related to marine highway services and suggested that MARAD was the entity best suited to administer such a program. Although smaller ports are often capable of handling short sea intermodal cargo at low volume levels, the efficiency of the crane infrastructure is often not up to a standard where the level of service could be maintained under higher volumes.

Interviewees pointed out that government, either at the national or state level, could look at strategies for making terminal land costs more affordable for marine highway operations on the West Coast, either by providing subsidies that would offset the cost of procuring the required land or by offsetting the opportunity cost of displacing other cargoes already utilizing the area. This might involve simply buying and transferring land or it could involve some type of subsidy or favorable tax structure for the port or terminal operator that would make them more amenable to working with NAMH interests. One interviewee mentioned that—while certainly extreme—state governments could even use their power of eminent domain to set up marine highway terminals.

Interviewees also pointed out that government could take steps to attract private capital and reduce the excessive risk, similar to the approach the federal government took for the railroads in the mid-19th century. This could be done by providing loans with competitive terms—the Alameda Corridor received a $400 million loan that was leveraged to finance the $2.4 billion project. It could also be accomplished via 100% loan guarantees. Federal government entities could do what businesses, states, and local governments do today to raise capital for infrastructure projects—sell bonds and leverage the proceeds.

Mode switching can be induced by price incentives, such as an "ecotax" on truck fuel (a tax proportional to the amount of pollution associated with transport), or by changes to the total cost structure for a mode. Interviewees repeatedly stated that it would be a better solution to lessen the existing subsidies for trucking as opposed to creating new subsidies for water transport.

Provide Tax Incentives. More consideration could be given to tax incentives for intermodal supply chains that include water. For example, federal tax credits might be restricted to designated marine highways projects (most likely to be designated by MARAD). Qualified expenditures could include design, construction, or modification of vessels; development or improvement of shoreside infrastructure; cargo handling equipment; intermodal connectors; or any expenditure that reduces emissions. (The solar energy investment tax credit might be a good model to emulate.) Accelerated depreciation for participants in designated marine highways projects could focus on the first three years of operation. This might better align tax obligations with expected cash flows.

Establish "TIFIA for Ports." A program could be established for marine activities similar to the program established under the Transportation Infrastructure Finance and Innovation Act of 1998 (TIFIA), but with a lower minimum amount to make it more accessible to small ports and terminals. The TIFIA program is a federal credit program for eligible transportation projects of national or regional significance under which U.S.DOT may provide three forms of credit assistance—secured (direct) loans, loan guarantees, and standby lines of credit. The program's fundamental goal is to leverage federal funds by attracting substantial private and other non-federal co-investment in critical improvements to the nation's surface transportation system. It would be useful to be able to access these funds for port infrastructure (docks, warehouses, and equipment) as well as for connecting infrastructure such as rail lines and highways.

Consider CO_2 Reduction Program. Future environmental taxes based on CO_2 emissions could provide the rationale to subsidize NAMH or to reduce shippers' incentives to utilize trucks by levying higher taxes. In addition, any sort of emissions trading system would put the coastwise mode in an advantageous position and stimulate its popularity among shippers. In Europe, carbon taxes and cap and trade programs have been established as a means of incorporating greater modal equity into the market.

Discussions with congressional staffers indicate that this would probably need to be an entirely new program. Some have proposed modifying the CMAQ scheme, but this would

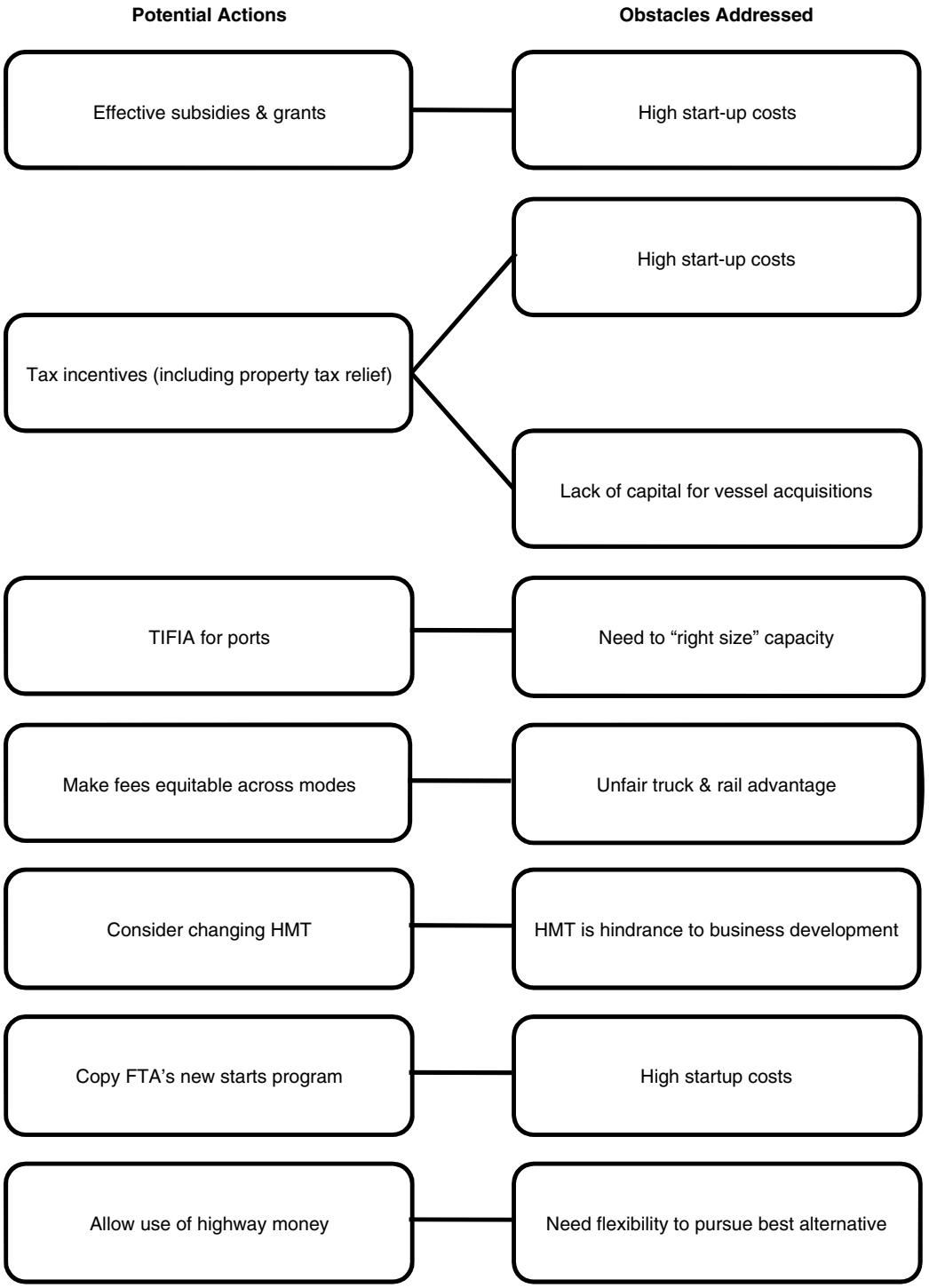

Figure 13. Economic framework potential actions—universal: legislative.

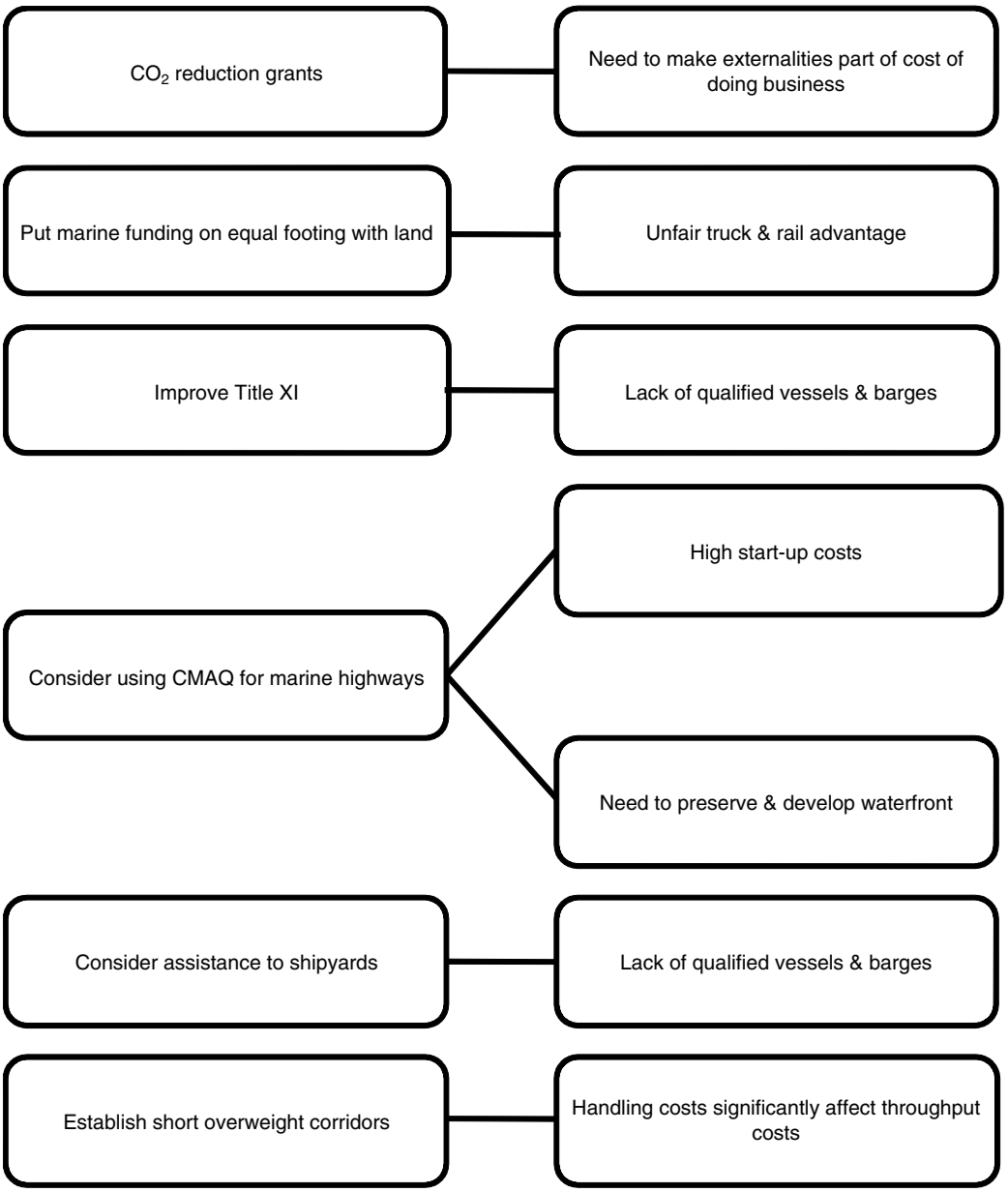

Figure 13. (Continued).

be very difficult to change. CMAQ specifically focuses on addressing nonattainment issues, not overall air pollution. Part of the thinking behind the current CMAQ allocation scheme is that many metropolitan areas are contending with pollution created elsewhere, and therefore require additional funding to address nonattainment issues.

Fund Marine Infrastructure on an Equal Footing with Land Infrastructure. Most government planning and funding processes are geared to highway transportation. Congress could provide incentives and requirements for metropolitan planning organizations and state departments of transportation with marine services within their jurisdictions to more actively consider such services in their planning.

Federal Government—Canada

Assist Smaller Canadian Ports in Constructing Ro/Ro Facilities. Most of the literature indicates that a high percentage of ports could handle Ro/Ro traffic with very few modifications or upgrades. (*4*, *8*, *45*, *46*) However, it appears that several of the smaller Canadian ports lack such facilities or the financial means to construct them. (*16*) Canadian authorities could look at assisting with the construction of Ro/Ro ramps where new or expanded services are proposed.

Consider Removing Various Marine-Only Fees or Make Fees More Equitable across Modes. This is a complex issue that goes beyond the scope of this study. However, it seems

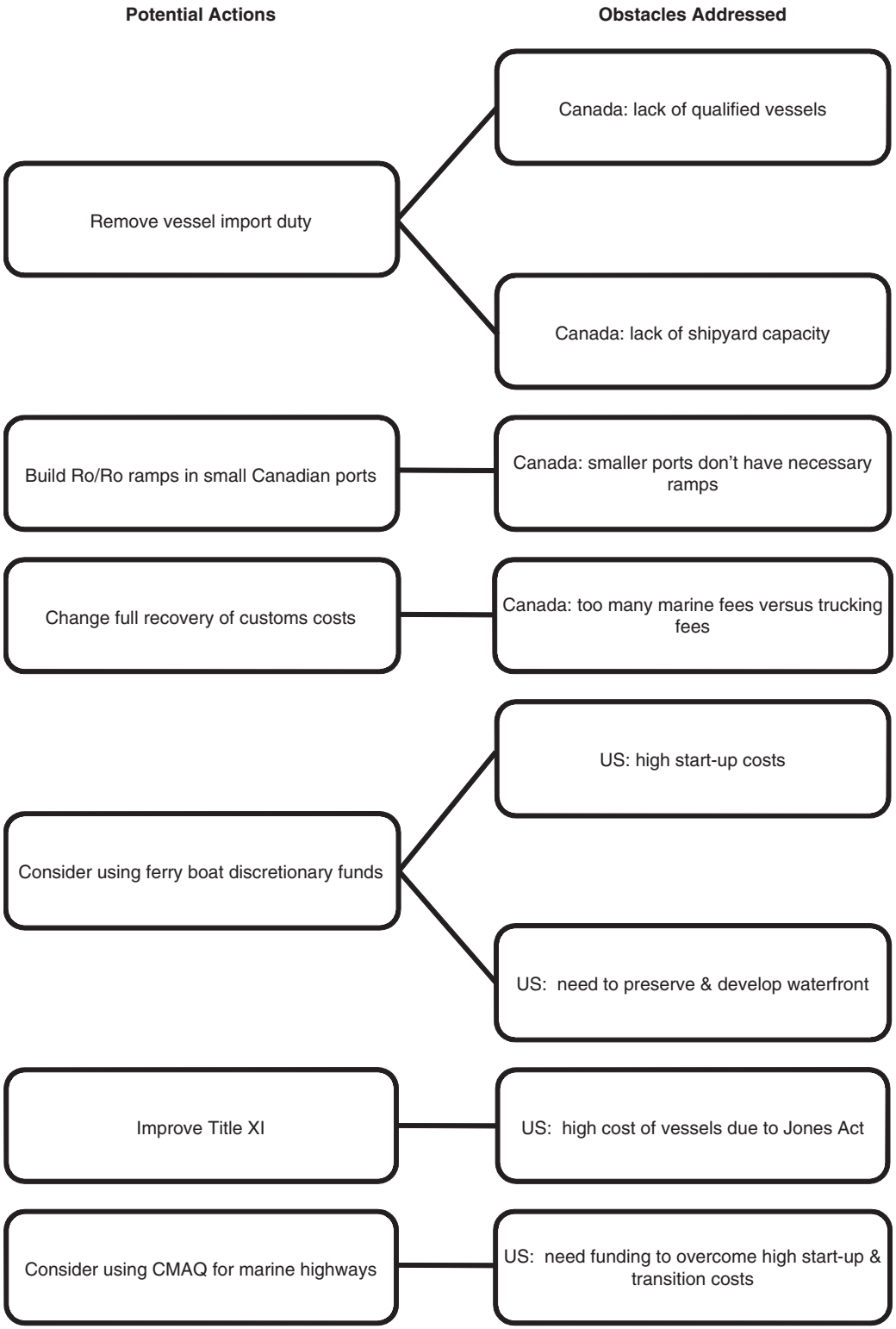

Figure 14. Economic framework potential actions—regional: legislative.

Table 8. Economic framework potential actions specific to stakeholders: legislative.

Potential Actions	Obstacles Addressed
Make fees equitable across modes	Operators: port & marine fees are a barrier
Improve Title XI to stimulate shipbuilding	Shipyards: Title XI too cumbersome & complex

that in order to treat the various modes equitably, it will be important to be able to identify all of the various fees and taxes imposed by transportation services using a given mode, provide the rationale for the fee, and explain how the revenue will be used. It is desirable to have consistency in how fees and taxes are levied for the modes to be able to compete on the merits of their services rather than on costs affected by government actions.

Consider Removing the Vessel Import Duty in Canada. Eliminating the 25% vessel import duty would be a means of lowering the initial capital cost of vessels and increasing the supply. If the duty is left in place, then consideration could be given to using the receipts to seed a revolving fund that would aid operators in acquiring vessels for NAMH services.

Federal Government—United States

Consider Changes to HMT for all North American Non-Bulk Shipments. Eliminating HMT for all North American non-bulk shipments would improve the cost structure of services and enable NAMH services to compete for high-value cargoes.

If the HMT scope is not changed, a non-refundable tax credit could be offered for NAMH operators. Such a scheme could include the following characteristics (this is not a definitive list):

- The credit could be offered to companies engaged in transporting either products or people between any two U.S. ports, or originating in a port in either Canada or Mexico and ending in a U.S. port.
- The credit could be incremental, meaning that companies would claim the credit on their corporate tax returns based on the increase in products or people shipped in the current tax year over a base period of the preceding three tax years.
- The credit could be the greater of 10% of the increase in value of items shipped for the tax year, or an amount based on the increase in tonnage of items shipped. This tonnage portion of the credit could provide different credit amounts per ton for grain, coal, sand, salt, iron ore, or other bulk cargo.
- The credit could be nonrefundable, meaning that it would offset only positive current tax liability of the carrier. If the carrier has a tax loss for the year, the credit could be carried back two years and forward for five years. (*47*)

Research Possible Amendments to Title XI. Because of the difficulties with Title XI funding, further research is needed to quantify the actual benefits and to understand the successes and failures of the program. At a minimum, the application and compliance processes could be simplified and the debt/equity ratio requirements relaxed.

Consider a Program Similar to the FTA's New Starts Program. Grants could be targeted to improve ports and terminals, including the purchase or lease of equipment, construction of intermodal connectors, and vessel construction or modification, with a mandate to meet high environmental standards.

Consider Using a Portion of CMAQ Funds to Fund Marine Highways Projects Approved by MARAD. The federal government could promote the use of CMAQ funds for projects contained within one state or that involve two or more non-attainment areas in different states. Research is needed to determine the potential rule changes that would be required.

Allow States to Use Highway Money on Marine Projects with a Beneficial Effect on the Highway System. Research is needed on the specific characteristics that would need to be included in NAMH projects to make them eligible for highway funds.

Consider Assistance to Shipyards. As discussed earlier in this report, government could provide some means of lowering the capital risk for investors in U.S. ships through programs such as the currently unfunded federal Title XI Program, although further research would first be needed. Additionally, as it has in other cases, government could provide tax incentives such as accelerated depreciation for investment in new shipbuilding infrastructure.

Research is needed into the feasibility of compensating NAMH operators for including militarily useful features in new ship construction. Any such program would need to contain a contingency plan for continuing to serve shippers in the event of a mass deployment.

It might be possible to use the small shipyard grant program more effectively by targeting it toward the construction of marine highway vessels. Further funding along the lines of ARRA and the Omnibus Appropriations Act of 2009 could use essentially the same guidelines with the proviso that the construction of marine highway vessels would receive priority.

Consider Targeting Some FBD Funds for NAMH (Freight) Transportation Options. Currently, the FBD program focuses on passengers and their vehicles. Government could consider amending it to specifically include freight transport.

Local Initiatives

Offer Property Tax Relief

Local authorities could consider offering property tax relief for those companies developing or renovating ports and terminals for the NAMH market. Such effort would create employment and generate tax revenue that contributes to the social good of the area.

Establish Short Overweight Corridors

In Texas and on the West Coast, state governments have established short overweight corridors between specific origins and certain consolidation or distribution areas that allow complete overweight supply chains. State governments could consider this approach for specific ports, as it would enable shippers to enjoy the full advantage of the lack of weight restrictions in marine transport. Examples of this approach include areas discussed in the following paragraphs.

Brownsville, Texas. In 1997, the state legislature passed legislation that permitted overweight freight haulers from Mexico to use two state roads to reach the Port of Brownsville. Under the program established by the Port of Brownsville, shippers can order specialized oversize/overweight permits online. The permits cover travel between Gateway International Bridge or the Veterans International Bridge at Los Tomates and the Port of Brownsville for vehicles weighing no more than the Mexican Legal Weight Limit or 125,000 lb and not exceeding the allowable permittable axle load. Additionally, the dimensions of the load and vehicle may not exceed 12 ft wide, 15.5 ft high, or 110 ft long.

Chambers County, Texas. In 2005, the Texas legislature authorized haulers of ocean-going cargo containers to carry loads up to 25% over the 80,000-lb legal weight limit on portions of two state roads (5 mi) connecting the Cedar Crossing Business Park to a barge terminal. This location across the Houston Ship Channel from the Port of Houston posed a challenge for shippers who wanted to use the maximum capacity of cargo containers but were precluded by state weight limits. To be legal, they had to divide loads and have trucks take a 20-mi detour to the port.

San Francisco, California. The Port of San Francisco, in conjunction with the San Francisco Department of Parking and Traffic, has established an overweight corridor that connects all of the major cargo handling facilities and also is accessible to the many trucking and warehousing facilities situated along Third Street between the freeways and the waterfront. It is permissible, under permit, to haul vehicles with a total weight of 93,000 lb, as opposed to the 80,000-lb limit applicable to roadways strictly under State of California jurisdiction. This allows cargo payloads of approximately 50,000 to 60,000 lb. The San Francisco Department of Parking and Traffic grants the truck permits per tractor at a cost of $90, and they are valid for one year. The permits stipulate the following authorizations:

- Any style chassis is okay,
- Permits are valid for one year,
- Only one permit is required per tractor,
- Any tractor is okay,
- No signs or placards are required,
- Auto liability insurance of $500,000 is required,
- Usable 24 h,
- Normal speed limits apply, and
- Both 20-ft and 40-ft containers are okay.

Los Angeles/Long Beach, California. The LA/LB heavy container corridor was created to aid in the movement of overweight 40-ft or larger ocean-going containers on designated city streets in and around the Port of Los Angeles. The City of Los Angeles, City of Long Beach, and State of California Department of Public Works approved a measure that allows permits to be granted for overweight container loads in the port area. The permits allow the gross vehicle weight of the truck, chassis, container, and contents to be at 95,000 lb or 43,130 kg (with proper equipment).

Oroville, Washington. Washington State allows large trucks to use a stretch of roadway in the northern portion of the state that was previously not allowed. SB 6857 opened up a 4-mi stretch of State Route 97 to large trucks. The new law authorizes the Washington State Department of Transportation (WSDOT) to designate the portion of roadway from the Canadian border to the city of Oroville as a heavy-haul industrial corridor. The bill allows overweight vehicles to travel along the designated stretch of roadway. The heavy-haul distinction would authorize WSDOT to issue special permits to overweight vehicles operating in the corridor up to a gross vehicle weight of 137,788 lb. Special permits would cost $100 each month, or $1,000 (including a $200 discount over the monthly rate) annually.

Planning and Operations

Industry and Planning

The potential industry and planning activities related to planning and operations are shown in Figure 15, Table 9, and Table 10, which associate the potential actions with the obstacles they address.

Select the Market, Then the Vessel

It is critical for operators to identify their markets (customers) first and then acquire the equipment to meet the need, rather than obtaining a vessel and trying to impose a set solution on the marketplace.

There does not appear to be a true lack of capital for ventures that have a first-rate business plan. The main obstacle appears to be that of convincing potential investors of the worthiness of a business proposition. It is very difficult to redeploy a vessel asset as opposed to truck or rail equipment.

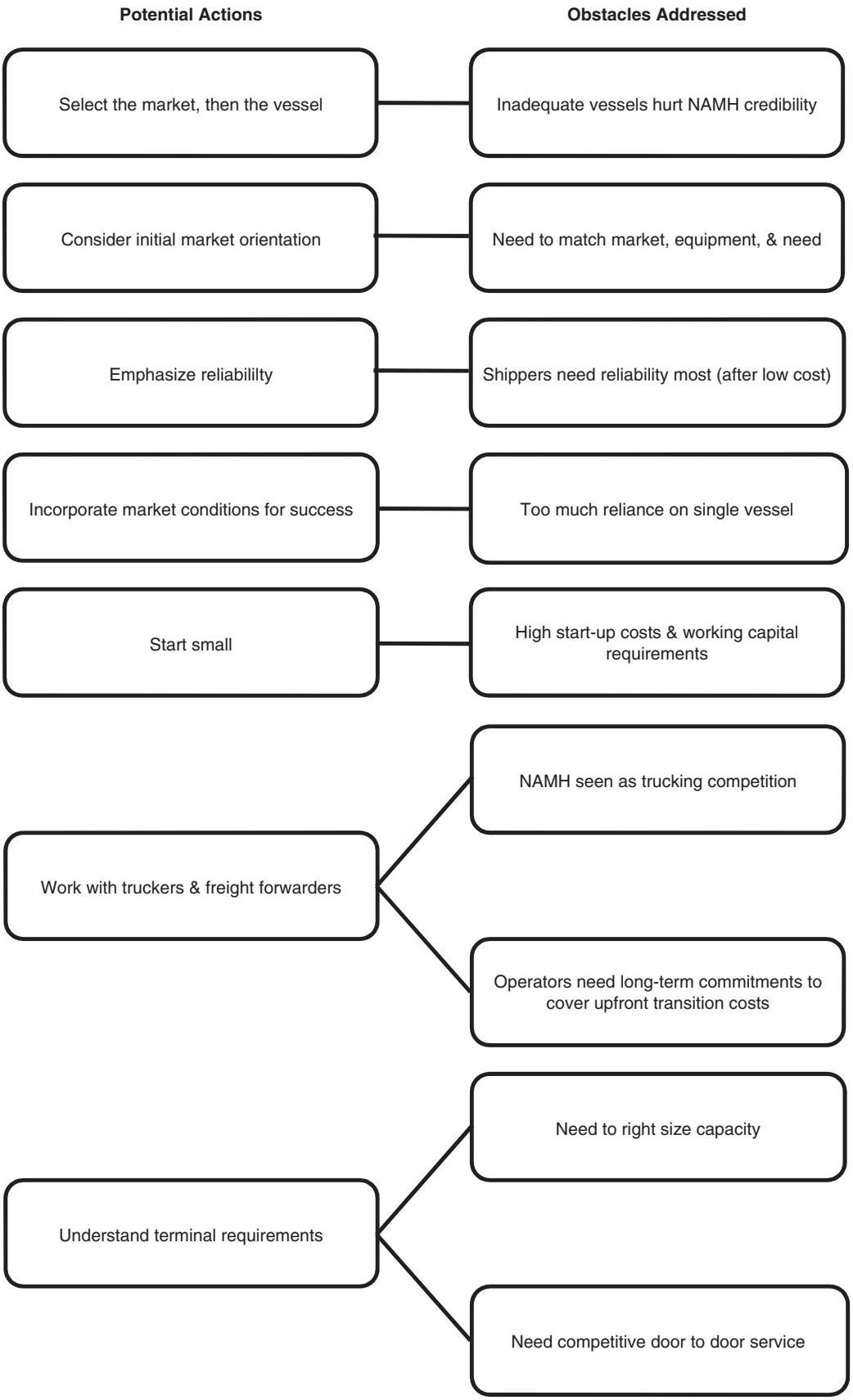

Figure 15. Planning and operations potential actions—universal: industry/planning.

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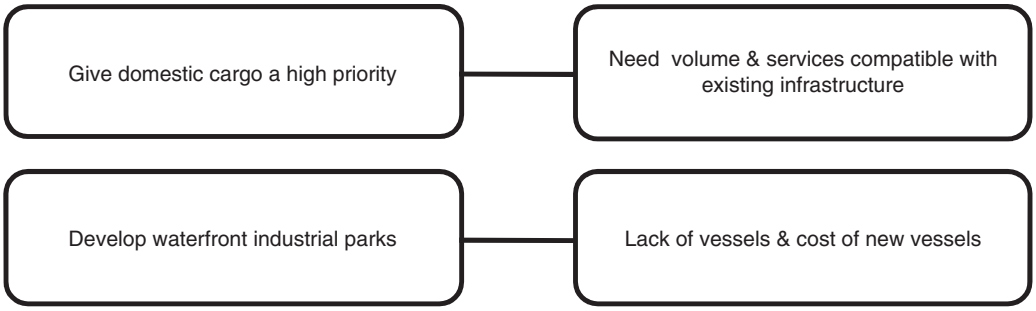

Figure 15. (Continued).

It was emphasized by several interviewees that it is important to have long-term contracts in the early stages of business development. This allows the operator to weather any downturns in the business cycle or any unforeseen obstacles, such as natural disasters or rate wars.

It is important to create greater cargo demand rather than vessel supply. Stimulating vessel construction without cargo should be discouraged.

Consider Market Orientation

Great Lakes NAMH has its best potential for success in two areas: the bulk commodity market and short-distance Ro/Ro and container service. The bulk commodity market is excluded from this analysis, so the focus is on Ro/Ro and container service. However, there are no dedicated container vessels currently operating NAMH service on the Great Lakes. Thus, at least in the short run, NAMH on the Great Lakes must focus on the short-distance Ro/Ro market (which can be served by tug-barge combinations and by ferries with truck Ro/Ro capability).

The general cargo market seems likely to be a very difficult market in which to expand cross-border NAMH operations for a variety of reasons. The general cargo markets generally involve smaller individual shipments that will need to be consolidated for water movement and thus increase the overall time involved in making a shipment. This, coupled with the effects of advance manifest rules and other security procedures, makes cross-border general cargo moves even more difficult and costly than they are in the already competitive domestic markets.

Several studies and interviewees suggested that it would be prudent to start by targeting overweight and empty containers. They are harder for traditional services to manage and would therefore be less subject to strong competition from other modes.

When pursuing feeder services, it is prudent to market directly to ocean carriers and not to individual customers. Ocean carriers typically arrange the service and pay for it.

Table 9. Planning and operations potential actions—regional: industry/planning.

Potential Actions	Obstacles Addressed
Understand terminal requirements	Canada: some ports may need Ro/Ro infrastructure
Explore operational strategies	United States: need to determine if container on barge for international freight will work

Table 10. Planning and operations potential actions specific to stakeholders: industry/planning.

Potential Actions	Obstacles Addressed
Consider initial market orientation	Operators: ocean carriers may or may not be good business
Explore operational strategies	Operators: “shoestring” budgets vulnerable to unexpected market conditions
Work with truckers & freight forwarders	Operators: need effective supply chain & marketing mechanisms

It should be noted that efforts to establish the appropriate market orientation would be greatly aided and improved by the availability of baseline market data and freight flows at the national and regional levels to understand the best markets for marine highway services.

Emphasize Reliability

Operators must guarantee schedule reliability. This will almost certainly involve the use of more than one vessel in the service. Operators need to develop fleets, not bank on one vessel being sufficient. Reliability is the most important service factor—even more so than the actual transit time. Even just-in-time enterprises are built on delivery windows, not actual speed of delivery. It is *delivery* time that counts, not transit speed. Barges can sail over weekends when truckers are not active. Furthermore, there are often huge delays at rail interchange points. Because of this, barges can sometimes offer faster delivery times than the other two modes.

Incorporate Market Conditions for Success into Plans

Policy makers and NAMH entrepreneurs should concentrate on the following opportunities:

- Routes where NAMH can help to overcome traffic or border congestion (enabling it to be highly competitive with ground transportation in terms of both cost and transit time);
- Routes where there is no adequate rail alternative or where interline transfers would be required (one major shipper stated that rail infrastructure is poor in the Deep South but shippers tend to be fairly distant from the ports);
- International routes that are not subject to either Canadian or Mexican cabotage legislation or U.S. Jones Act restrictions, which could alleviate severe congestion and which (in the case of Canada) would not be restricted by the closure of the St. Lawrence Seaway;
- For coastwise NAMH operations, freight movements that have origins and destinations relatively close to coastal ports;
- Traffic corridors with enough density to enable relatively large vessels that provide scale economies in terms of operating and capital cost to be deployed with high enough service frequency to be competitive with trucking and/or rail (cargoes must be of sufficient volume to provide breakeven levels to start and, ideally, contracts should be for long-term periods rather than "spot cargo");
- Heavy and/or hazardous shipments currently moving over the road, such as chemicals;
- Close proximity of terminals to major cargo origins and destinations;
- The availability of sufficient terminal capacity for a dedicated domestic NAMH terminal; and
- Competitive handling costs at origin and destination ports.

Inland COB service may emerge in "seam" markets that are a long dray from major intermodal hubs and can derive adequate volume from agricultural or industrial activity, especially from ethanol and steel mini-mill projects.

Start Small

Enter a new market with the *smallest* vessels that meet the economic requirements of the service and then grow the service by increasing ship size or number (and frequency) of vessels.

Work with Truckers and Freight Forwarders

This is a critical area for further assessment. The European experience has shown that successful marine highway operators consider both rail and trucking as partners. (*48*) The need for cost-competitive services in North America would indicate that the same should be true on this continent as well. Operators should target large trucking companies with broad geographic scope, who have tractors in both origin and discharge ports. The bottom line is that NAMH must work with truckers to develop door-to-door services.

Understand Terminal Requirements

When considering where expanded NAMH operations may have the highest probability of success, it is important to look at several factors, including the following:

- Modal access—Potential NAMH ports/terminals must have effective, efficient access to other modal networks (highway and rail). This is critically important because trucks and/or rail will be used to make the final door-to-door delivery of products moved by NAMH. There must be efficient access to the interstate system and either Class I rail mainlines or short-line railroads that provide efficient interchange services.
- Berth availability—As discussed earlier, NAMH operations calling at some major deepwater seaports often do not receive a high priority for berthing, particularly in comparison to large, ocean-going containerships. Ports that can regularly offer berths may be better able to attract NAMH traffic.
- Efficient operations—Potential NAMH ports/terminals must have the ability to load and offload ships and barges quickly and efficiently. For international (Lo/Lo) movements, cranes are usually required. Ro/Ro movements, more

common for domestic shipments, often do not require as much cargo handling infrastructure.

Other factors to consider include:

- Unobstructed water access with navigation and depth alongside of at least 9 ft for inland operations and 15 ft for coastal,
- Availability of a dedicated waterfront terminal with sufficient acreage and independent gate,
- Availability of adjacent area to provide off-terminal parking for truck lines,
- Proximity to large distribution centers and truck terminals, and
- Proximity to major intermodal yards.

Give Domestic Cargo a High Priority

Public-sector transportation planning organizations should concentrate their NAMH shipping initiatives on domestic cargo, which tends to be Ro/Ro cargo. Many international shippers (that tend to use ocean containers on Lo/Lo vessels) are not interested in NAMH operations, customs requirements for international shipments can introduce delay, and there are issues with managing the positioning of containers, making NAMH a less attractive option in comparison to other modes.

Miscellaneous Operational Strategies

Several other strategies might prove productive:

- Offer operator-provided incentives such as extended free storage time for cargo beyond what is ordinarily provided.
- Try to eliminate "touches" where possible. When dealing with feeder services, look into direct ship-to-barge transfers to eliminate the port in the process.
- Focus on Ro/Ro initially. Less landside infrastructure and equipment are required, and operations are simpler.

Intensify Research into Vessel Design and Construction Strategies

Eliminate high-speed vessel design from research programs. The types of vessels that are capable of high speeds experience strong degradation in speed and efficiency with large cargo loads. The routes that are being proposed such as New York to Florida would never work with high-speed vessels because one could never operate a ship like that in winter weather. The literature suggests that investments in vessel capacity and cargo handling equipment may yield better returns and better level of service than investments in ship propulsion. (*49*) Government could sponsor more research into what could be standardized across a range of marine highway vessels.

Public Sector (Non Legislative)

The potential public sector (non-legislative) actions related to planning and operations are shown in Figure 16 and Table 11, which associate the potential actions with the obstacles they address.

Encourage Hazardous Materials to be Carried Offshore and Away from Population Centers

Each day, 800,000 shipments of hazardous materials occur within the United States. Moving potentially dangerous cargoes offshore would not only help alleviate landside congestion but would also spur coastal shipping operations. Removing the transportation of hazardous materials through some of the nation's most crowded urban centers would make sense from a safety and security perspective. If the policy is structured correctly, this is an opportunity to work with railroads. Although handling hazardous cargoes can be a profitable enterprise for railroads, in many cases the risk of sending hazardous shipments through rapidly urbanizing areas is making the long-term benefit/cost ratios of these operations less appealing. In examining projections of urban development for the next two decades, it seems highly likely that some of these hazardous shipments now handled by railroads will need to shift either to newly constructed extra-urban rail routes or to alternative modes.

Develop a Comprehensive National Freight Transportation Strategy

This vision would be national, and perhaps even continental, in scope. It would approach the system from an intermodal perspective, appreciating how road, rail, and water transportation can fit together to move freight and passengers more efficiently.

A national freight policy could be established in the United States and Canada, with funding and incentives properly aligned with the goals of the policy. As suggested earlier, marine transportation might be thought of in much the same way as railroads. Note that there are only a handful of Class 1 railroads. Although there may be a larger number of NAMH operators, the truly profitable routes will be relatively few.

As part of the national freight policy, mechanisms could be established for planning and funding multi-jurisdictional projects. Highway and rail planning has provided some good models that could be transferred to the marine mode.

One component of a national freight transportation strategy might be to require states to build their own freight transportation plans and tie the level of surface transportation funding to the existence (or lack thereof) of such a plan. A national strategy would provide a foundation and a unifying framework for the various state strategies. For example, a legislative proposal for the new surface transportation bill

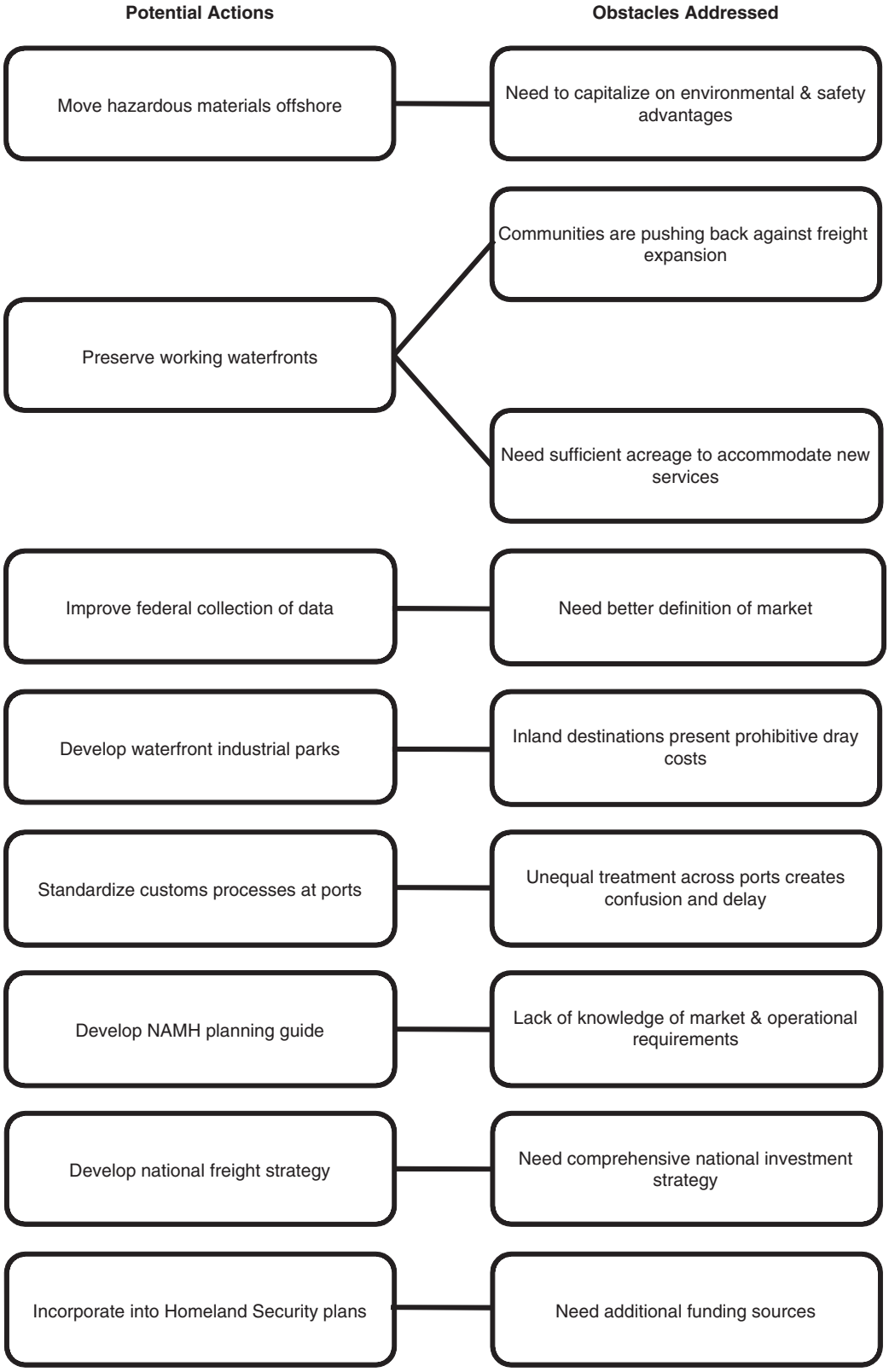

Figure 16. Planning and operations potential actions—universal: government/non legislative.

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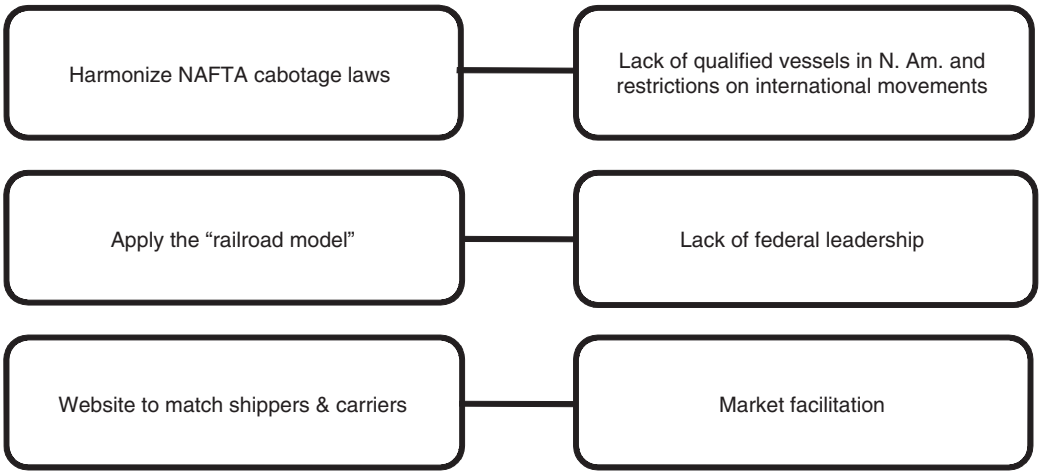

Figure 16. (Continued).

has been drafted that calls for a national freight and mobility policy and requires states to develop a state freight transportation policy.

Preserve Working Waterfronts

Industrial ports are in short supply, and will become more important as traffic congestion increases on America's interstate highways and rail networks. Once a working waterfront is lost to housing or retail shops it is nearly impossible to bring it back. Ports are an undervalued, but vital, national resource. Foresight is required to prevent their gentrification so that they will be ready to serve America's revitalized marine transportation system.

Incorporate America's Marine Highways Program into Homeland Security and Infrastructure Protection Plans

Security could be a plus for marine transportation. It is much more difficult to disrupt marine trade than it is to disrupt highway or rail traffic. To disrupt the latter two, one would only need to blow up a bridge or a segment of rail. Marine traffic is more redundant and resilient. Marine assets can be redeployed relatively quickly and can call at a wide variety of ports and terminals, even when highways, rail lines, and bridges are out of service. Furthermore, the vessels and warehouse facilities involved in marine freight transportation could provide support to the Department of Homeland Security in the event of an emergency.

Improve Federal Collection of Transportation Statistics

Accurate analyses and effective decisions require accurate and organized data. Shipment data collected and disseminated by government could be restructured for easier and more meaningful access. It is especially important to provide better origin and destination data.

Harmonize Regulations and Cabotage Legislation among NAFTA Partners

There is a need for expanded, and more substantive, cooperation between NAFTA partners sufficient to achieve tangible progress in moving toward a harmonized marine transporta-

Table 11. Planning and operations potential actions—regional: government/non legislative.

Potential Actions	Obstacles Addressed
Preserve working waterfronts	US West Coast: lack of affordable waterfront property
Develop waterfront industrial parks	US West Coast: lack of affordable waterfront property
Standardize customs processes at ports	US: unequal treatment across ports
Work out 24-h rule accommodation	Great Lakes: difficult to comply with 24-h rule

tion regulatory framework within the free trade area, including cabotage arrangements, HMT, customs processing, and advanced notification and documentation requirements.

Simply amending the Jones Act most likely would be counterproductive. For example, if the cabotage provisions in the Jones Act were unilaterally eliminated, a Canadian interest could buy a very cheap foreign vessel, pay the 25% Canadian import duty, and still "have a leg up" on U.S. interests.

Develop Waterfront Industrial Parks

Cross-border NAMH services focused on the semi-finished goods market appear to have some early promise. The biggest issue is proximity of the shippers to load points and the restructuring of many of these industries (particularly in Canada). One option that might work to help develop this market would be government involvement in the development of waterfront industrial parks or sites for production, warehousing, and distribution facilities. This would require government to specifically place economic development and job creation programs related to marine highway development and renewable energy development ahead of real estate development and speculation.

Land-use planning needs to be structured to encourage manufacturers and distribution centers to stay close to the waterfront. The most cost-effective services are those that are able to capture the low costs of water transit without incurring the relatively high costs of drayage, handling, and storage.

Consider Applying the "Railroad Model"

The way the railroad system was built in the United States could provide the foundation for an approach to build the marine highway system. The proceeds of government loans and grants of public lands furnished a large part of the working capital of the early railroads. The federal and state governments decided to guarantee the securities issued by the railroads. The federal government even went so far as to provide preliminary surveys in some cases. Because of this aid, the railroads were able to open up great expanses of the "western territory" to settlement and cultivation even before a critical amount of demand had built up. Most of the country was still unsettled and there was little prospect of profitable demand levels, but the government recognized that railroads had to be built in advance of settlements in order to facilitate immigration. A similar approach may be needed to develop a new NAMH system. Keep in mind that the new marine system may have only a few large operators in well-defined routes, similar to Class 1 railroads.

Standardize Customs Processes at Ports so That Ports Are Treated Equally

Large ports tend to have customs service available for more hours in the day than smaller ports do—as well as weekend service, on occasion. This is a limiting factor for small ports attempting to generate more NAMH service. If hours could approach a certain level of standardization, this would remove customs service as a competitive factor between ports.

Work out 24-Hour Rule Accommodation for Great Lakes

Due to short trip lengths and other considerations, collaboration between U.S. Customs and operators would be needed to develop a system and methodology that will work around the 24-h rule in the Great Lakes region.

Consider Designing a NAMH Planning Guide

Interviewees felt it would be helpful to develop a NAMH planning guide that would explain all of the various cost and service factors a start-up business should consider. Such a guide, which MARAD might undertake to develop, could summarize such information for the benefit of potential entrepreneurs and investors.

Sponsor a Website to Match Shippers with Carriers

There are subscription Internet sites already in existence that allow carriers and shippers to post and match requirements. "Internet Truck Stop" charges only $35/month and it is a very active site. Similar sites targeting marine freight may be of value.

Legislative

The potential legislative actions relating to planning and operations are shown in Figure 17, Figure 18, and Table 12, which associate the potential actions with the obstacles they address.

Federal Government—United States

Consider Proposed Jones Act Modifications Independently from Marine Highway Development. Serious discussions regarding marine highway development have often been sidetracked into a debate over the viability of the Jones Act. If Congress attempts to change portions of the Jones Act, the United States could inadvertently place itself in violation of its GATT agreements and then there could very well be international pressure to abolish all Jones Act provisions.

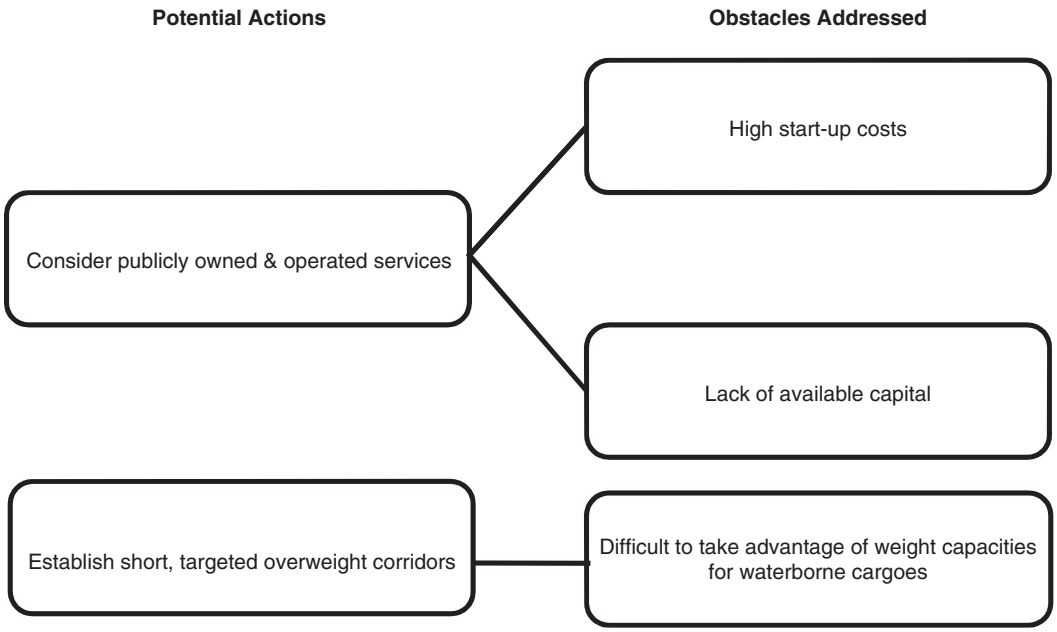

Figure 17. Planning and operations potential actions—universal: legislative.

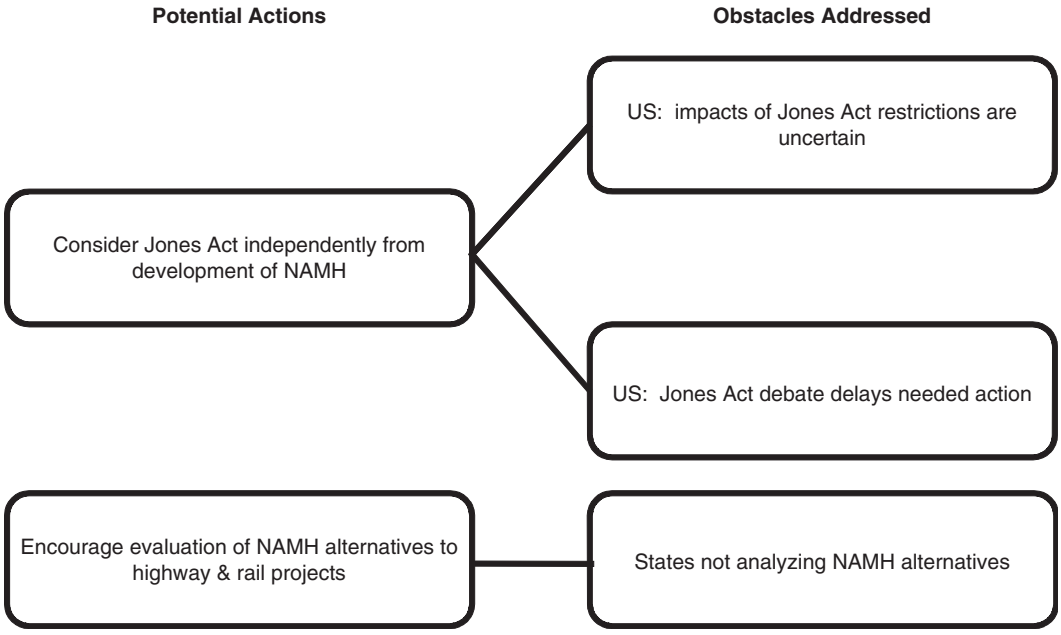

Figure 18. Planning and operations potential actions—regional: legislative.

Table 12. Planning and operations potential actions specific to stakeholders: legislative.

Potential Actions	Obstacles Addressed
Establish framework for planning & funding multi-jurisdictional projects	Agency/Government: no practical framework for multi-jurisdictional projects—no systems approach

Furthermore, if provisions of the Jones Act are amended, the issue will arise regarding what should be done with current operators who have established their businesses under the provisions of the Jones Act and are now going to have competitors who did not have to follow the same provisions. Finally, since the Jones Act is also seen as a part of a national defense strategy, it is highly unlikely that Congress would consider major revisions.

Consider Publicly Owned and Operated Services to Solve Specific Transportation Issues. Publicly owned transportation services already exist—ferry services, regional railroads, and others. These types of operations could be models for establishing publicly owned freight transportation services that would be designed to meet specific needs. The public entity could be a state, a regional commission, a local government, or a specially constituted authority. If and when such a service becomes steady and profitable, the public entity could then consider privatization options and encourage more private sector development.

Consider Marine Transportation Alternatives When Evaluating Highway or Rail Projects, Especially When National Environmental Policy Act (NEPA) Processes Are Involved. Under federal law (NEPA), when transportation projects could have a potentially strong adverse impact on the surrounding natural and human environment, the planners of the project are required to consider alternatives for avoiding or reducing such impacts. However, rarely is a marine transportation service considered as a realistic alternative for lessening adverse impacts. HR 1780 (Smart Planning for Smart Growth Act of 2009) was introduced on March 30, 2009. One of its provisions would require states and metropolitan planning organizations to consider "short sea shipping" as a strategy for reducing greenhouse gases in their plan formulations. HR 2454 (Clean Energy and Security Act of 2009) contains exactly the same provision.

Potential Topics for Follow-on Research

Several distinct topics for future research were noted during the course of this project.

Involvement of Department of Homeland Security and Department of Defense in the Development of NAMH

There are several ways in which the Department of Homeland Security or the Department of Defense could be directly involved in the development of NAMH. It would be worthwhile to investigate the concept of building in militarily useful features in new ship construction (such as roll-on/roll-off ramps and heavy weight-bearing decks) that could be paid for by the U.S. Department of Defense as part of a military sealift contingency program such as the current Maritime Security Program. Research on a contingency plan also is needed for continuing to serve shippers in the event of a mass deployment.

Another possibility is to have the military—not the NAMH operator—add specific components. One such scenario would call for the military to own the vessels and allow operators to lease, with contractual arrangement that would prevent the operator from completely losing the use of its vessels in the event of a military call up.

Also, research is needed to develop a plan for utilizing marine assets (vessels and warehouses) in the event of a large-scale emergency situation, whether natural or man-made.

Lowering the Capital Risk

There are several ways the federal government could lower the capital risk for investors in U.S. ships through programs such as the currently unfunded federal Title XI Program. An evaluation of the strengths and weaknesses of Title XI, along with an evaluation of alternative approaches, is needed.

Combining and Strengthening Stimulus Funding

Research is need into the possibility of combining appropriate aspects of Europe's Marco Polo Program, EPA's SmartWay Program, and the ARRA stimulus package. Further investigation is needed into the legal challenges and how to prioritize competing projects.

Diverting Heavy and Hazardous Shipments to Water

From a strictly environmental and public safety viewpoint, it would appear that diverting heavy and hazardous shipments to water would be desirable. However, there are several serious concerns. The appropriate level of liability needs to be determined. Do NAMH operators have the appropriate equipment, training, and experience to be able to handle hazmat safely and efficiently? Should society be concerned about operators attempting to operate on a "shoestring budget" while transporting hazardous materials? If hazmat shipments by water should be encouraged, what is the best way to do so?

Developing Scenarios and Expected Outcomes

Research is needed that will test the assumptions and models described in this report. It would be very useful to decision makers and society at large to take particular potential actions, assume their implementation, and develop potential outcomes and impacts.

NAMH Planning Guide

Research is needed into the concept of a planning guide for NAMH. What should be in the guide? Who should develop the guide, and who should the target audience be? How should it be disseminated?

Implications of Elimination of HMT

This report mentions the possible trade treaty implications of the elimination of the HMT. In addition to trade issues, it is necessary to quantify the effect the elimination of HMT would have on shippers and on the federal government.

Building the NAMH Vessel Fleet

There are a multitude of issues involved in the concept of building new vessels for use in NAMH services. For instance, some type of standardization is needed. Could the government broker the design? What basic elements should be included in the design?

The issue of capacity and financing is important. Which shipyards could be involved in making these vessels? What training, capital, and equipment would they need? How many vessels are needed? How much would it cost to design and then build them?

The issue of the operation of these vessels also is important. What will it cost to operate these vessels? Where would they be deployed? How could the military and the private sector share the vessel?

Several of the nation's universities have researchers that are versed in the quantitative, engineering, and economics aspects involved in the building of a new fleet. Research is needed into the best vehicle the government could use to move vessel fleet development forward.

Evaluating Funding by Mode

There is much discussion on the issue of equity in the funding schemes used for the various modes. Railroads pay for much of their own infrastructure. Highway and NAMH operators pay fuel taxes and an assortment of other fees and taxes. Research is needed into taxation and funding schemes by mode, and an appropriate methodology for assessing whether there are equity issues that need to be addressed.

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APPENDIX A

Table of Interviewee Characteristics

Category	Subcategory	Region	Reason for Inclusion	Vessel Type
Agency/Association	Industry	DC	National association promoting interests of port authorities	
Agency/Association	Industry	Great Lakes	Actively involved in NAMH issues in Great Lakes region	
Agency/Association	Regional Planning	East Coast	Regional association very involved in evaluating NAMH	
Agency/Association	Government	DC	Only US agency directly focused on maritime issues	
Agency/Association	MPO	Gulf Coast	Planners from area that is actively evaluating NAMH	
Agency/Association	MPO	East Coast	Funding 64 Express project with CMAQ funds	
Agency/Association	Government	Great Lakes	Involved in trying to develop more business for Seaway	
Agency/Association	MPO	Great Lakes	Association with understanding of Seaway and Great Lakes issues	
Legislative (5 interviewees)	Committee Staff	DC	Insight into legislative history and issues	
Operator	Shallow Draft	East Coast	Start-up venture being subsidized with CMAQ funds	Barge
Operator	Deepwater	East Coast	Successful East Coast NAMH operator	Barge
Operator	Deepwater	Gulf Coast	Starting up new venture in Gulf after successfully building an inland waterway operation	Vessel
Operator	Shallow Draft	Great Lakes	Very active freight ferry dealing with international issues	Barge/Ferry
Operator	Deepwater	West Coast	Startup venture on West Coast	Barge
Operator	Deepwater	Great Lakes	Long-time operator in Great Lakes looking at new NAMH opportunities	Barge (ATB)
Operator	Deepwater	East Coast-Canada	Successful NAMH operator in Canadian Atlantic area	Vessel
Operator	Shallow Draft	Gulf Coast and Inland Waterways	Widely discussed inland NAMH operator	Inland Barge
Operator	Shallow Draft	Gulf Coast	Start-up venture on Gulf Coast	Inland Barge
Operator	Deepwater	West Coast	Long-time operator on West Coast	Barge
Operator	Deepwater	Gulf Coast	Start-up operator in Gulf	Barge
Operator (planned)	Deepwater	East Coast	Went through intensive analysis and effort to start NAMH operation	Ferry
Operator (planned)	Deepwater	Gulf and East Coast	Proposed venture for Gulf and East Coasts	Vessel
Shipyard		Gulf Coast	Mid-tier shipyard capable of building ocean going barges	
Shipyard	Ship Design	Gulf Coast	Mid-tier shipyard actively evaluating NAMH opportunities	
Shipyard		Gulf Coast	Mid-tier shipyard actively evaluating NAMH opportunities	

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Category	Subcategory	Region	Reason for Inclusion	Vessel Type
Shipyard		West Coast	Mid-tier shipyard actively evaluating NAMH opportunities	
Shipyard		West Coast	Mid-tier shipyard actively evaluating NAMH opportunities	
Shipyard	Design	East Coast	Designs ocean-going barges and ATBs for multiple clients	
Shipyard		West Coast	Mid-tier shipyard actively evaluating NAMH opportunities	
User	Manufacturer	Gulf Coast	Shipper that has been approached by potential start-up operators	
User	Retailer	Gulf Coast	Perishable products	
User	Retailer	Gulf Coast	Shipper that has been approached by potential start-up operators	
User	Trucker	West Coast	Trucker that has looked for opportunity to be involved in NAMH	

APPENDIX B

Table of North American Marine Highway Ventures

Canadian Domestic Ventures

Venture	Service Area	Cargo	Vessel Information	Period	Factors Identified to Date
Great Lakes Feeder Lines www.glfl.ca	Halifax–Montreal	Containers and breakbulk	Ro/Ro - Lo/Lo, double-skin, single-decker, fully fitted container vessel with stern ramp leading to weather deck Germany 1988 220 TEU	2008–present	Had been delayed from starting for several years; Unscheduled service in Atlantic Canada region; Only one vessel
McKeil www.mckeil.com	Great Lakes region Hamilton–Montreal container service	Truck competitive bulk cargoes, some containerized, some project cargoes Containers	Specialized tug barges (one self-propelled barge) *Alouette Spirit* has retractable roof and bow ramp; *Niagara Spirit* is ITB retrofitted for containers	2005–present for GL service 2009–present[1]	
Oceanex www.oceanex.com	Montreal–St. John's–Halifax	Mixed cargo including containers	Vessels range from 450–1,000 TEU Japanese construction	1997–present (current operational model started in 2005)	3-day Montreal–St. John's transit; Serves partially captive market; Halifax–Montreal rail rates make service unviable
SPM Container Line	St. Pierre et Miquelon, Halifax, Portland and Boston	Autos, Containers	*M/V Shamrock* Length 119.99 m Beam 18 m Draft 5.40 m Deadweight 4,850 dwt Cargo capacity (TEU) 396 TEU Cranes 2 x 40 t Speed 16 kn Fuel consumption 26.7 MT IFO 180 per day	1994–July 2004 (vessel was arrested)	

[1] This service is actually offered by Sea 3, Inc., a wholly owned subsidiary of Hamilton Port Authority. McKeil provides the tug-and-barge service.

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East Coast Ventures

Venture	Service Area	Cargo	Vessel Information	Period	Factors Identified to Date
64 Express www.64express.com	Port of Norfolk to Richmond	Containers (including large rolls of paper)	Shallow draft barges with tugs operated by Norfolk Tug Company	Started Dec 8, 2008	Subsidized with CMAQ funding for 3 years; Twice weekly service; Big driver is Hampton Roads congestion
Albany Express Barge www.portofalbany.com/pages03/container.html	New York/New Jersey to Albany, NY	Containers (primarily loaded with bulk commodities, such as logs and silicon)	River barges	April 2003–February 2006	Twice weekly service; Shippers reluctant to use service; Accessed six terminals in the Port of NY/NJ; Price was not competitive, and subsidy ended
Columbia Coastal www.columbia-coastal.com	East Coast ports from Maine to Miami, Concentrated in the Northeast Eff. 3/29/09: Portland, ME to NY/NJ	Standard containers, reefers, and project cargo New service is containerized wood pulp	5 deep draft barges with capacity of 450–912 TEU. Seeking to acquire ATBs.	1990–present	Not competitive with truck for distances under 350 mi or with rail for over 500 mi; Prefers using ocean containers as opposed to Ro/Ro cargo (increased density on vessel); Service offered only to shipping lines and only to international containers; Maine DOT covering some of the wharfage charges for new service; Calls Baltimore & Norfolk twice weekly
Hale Container Line	New York–Philadelphia–Baltimore–Norfolk New York–Boston St. John's–Boston–New York		Barge with 420 TEU capacity for first 2 rotations; Containership *Lanette* for 3rd	Feb 1985–N/A (defunct); 3rd rotation terminated Nov 1987	First rotation weekly; Second rotation twice weekly; Third rotation did not meet volume expectations
Maybank Industries www.maybankindustries.com	Port of Charleston to Nucor steel plant	Iron ore, scrap steel, and coal	2,000–3,000 ton barges	Two terminals opened in 2003 and 2006	Frees foreign flag vessels from travelling upriver
McAllister Brothers, Inc.	Boston–New York/New Jersey	Containers	Barges	1976–Mar 1988	Not a fixed time schedule; Stiff rate competition; Operational problems (barge grounding)

Gulf of Mexico Ventures

Venture	Service Area	Cargo	Vessel Information	Period	Factors Identified to Date
Americas Marine Express (Subsidiary of Kirby Corporation)	Memphis–Santo Tomas (Guatemala)–Puerto Cortez (Honduras)	U.S. exports of auto parts, appliances, food additives, fruits and vegetables, and machinery, and import of furniture, sporting goods, apparel, and other consumer goods	Container vessel service to New Orleans; Chinese built, European chartered *Baltimar Euros* (3,200-ton vessel, 298 ft long, 48 ft beam, with a cargo carrying capacity of 256 TEU)	Early 1994–August 1994	Bi-weekly service; Undercut by price competition from rail; Trucks able to compete on time and rates

Venture	Service Area	Cargo	Vessel Information	Period	Factors Identified to Date
CG Railway (Subsidiary of International Shipholding Corp.) www.cgrailway.com	Mobile–Coatzacoalcos, Mexico	Railcars (beer, steel products, paper and forest products, and wood pulp)	Two converted semi-submersible LASH vessels with double-decker rail configuration (115 rail cars per vessel)	March 2000–present	Service every 4 days; Fairly even trade balance; Competes with traditional land routes; Full member of American Association of Railroads; Participates in car service, car interchanges, and car hire rules; Has ability to carry all types of railcars; Offers through rates/single billing
CIS Shipping (AKA Gulf of Mexico Express)	Mobile–Veracruz	Beer	Ro/Ro	1999–2000	Lack of cargo; Trucking rates were too competitive; Transit times were more efficient by land
Crowley Liner Services	Lake Charles–Progreso	Mainly textiles ("Section 807" traffic)	3 Ro/Ro vessels	1999	Size of investment; Change in customs tariff
Gulf Bridge Ro/Ro	Mobile–Tuxpan	Mainly autos	M/V *Dolores* 872 TEU, 1,158 cars and 85 over-the-road trailers	1998–1999	Weekly service; Vessel charter expired, owner sold vessel, and Gulf Bridge unable to find a replacement
Gulf Caribbean Transport	Tampa–Tampico	Cars, trucks, heavy equipment	Ro/Ro with 425-vehicle capacity	March 2001–September 2002	Weekly voyages; Lack of demand; Tampico may be too close to border; Auto manufacturers did not want to jeopardize relationship with existing service providers; GCT went bankrupt in Feb 2002
Linea Peninsular www.lineaships.com	Panama City–Progreso	Textiles and oil field equipment & supplies (claim 100% of "Section 807" traffic)	5 general cargo ships (all approximately 3,000 deadweight tons, with capacity of 154 TEU)	1984–present	Four voyages weekly; Controls own fleet of trucks in both countries and promises 4-day door-to-door deliveries.
Mexican Gulf Lines	Gulfport–Tuxpan–Progreso	Refrigerated containers	N/A	July 1993–December 1993	Undercapitalized, insufficient start-up working capital; Did not have marketing resources; Lack of demand; Location
Mexus Ro/Ro Ltd.	Houston–Tuxpan	48- and 53-ft trailers	Chartered Ro/Ro vessel	September 1994–August 1995	Lack of research and no contracts for cargo when initiated; Oversized and expensive-to-operate vessel
NYK Bulk	Corpus Christi–Veracruz	Autos	Ro/Ros of approx. 25,000–27,000 GRT (541-ft length overall, and 90.6-ft beam).	1999–2000	Designed to be short-term; Responded to UP's lack of multi-level rail cars

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Venture	Service Area	Cargo	Vessel Information	Period	Factors Identified to Date
Protexa Burlington International	Galveston–Coatzacoalcos–Altamira–Veracruz	Primarily grain in rail cars	Four rail barges, each with 54 rail cars	1993–1994	Too much debt for Mexican partner; BN gained new border gateway via merger with Santa Fe RR
Sea Lion Ocean Freight (Subsidiary of American River International)	Tampa–Veracruz	Orange juice concentrate, chemicals, tile, beer, automobiles	General cargo ship with 226 TEU capacity (*M/V Mint Dart*, draft 5m)	1997	Non-stop service every 10 days; Improved border crossing for trucks
Seabridge Freight www.seabridgefreight.com	Port Manatee–Brownsville	Containers (first shipment was containerized tile and pipe)	Ocean-going deck barge—340 x 90 (capacity of 450 TEU/9000 tons)	Started late 2008	10-day service
Yucatan Express (Scotia Prince)	Tampa–Puerto Morelos Tampa–Cancun (Mexico)	Containers	Ro/Pax	2002	Twice-weekly service; Navigational/dredging issues in Puerto Morelos; Needed more ports/volume especially after losing Morelos

Inland Waterways/Other

Venture	Service Area	Cargo	Vessel Information	Period	Factors Identified to Date
Detroit–Windsor Truck Ferry www.truckferry.com	Detroit, MI and Windsor, ON	Primarily directed at hazmat; Some over-dimensional and expedited cargoes	Tug-barge (flat deck); up to 30 trucks per movement	1990–present	Scheduled service, generally requires reservations; 5 round trips daily; Hours dictated by Canadian Customs availability; 80–85% of revenues come from hazmat
Ingram Barge www.ingrambarge.com	New Orleans–Paducah	Containerized rubber	Inland barges	2006–present	Responded to tenders from Continental Tire; Ingram has pulled back some because of Continental's exclusive focus on price
Osprey Line www.ospreyline.com	Houston–New Orleans New Orleans–Memphis	Containers Containers	Inland barge Inland barge	2000–present 2004–2009	Formally served Florida via self-propelled container vessel; After Hurricane Katrina, lost New Orleans business and westbound transit cost burden was too great; Marketing focus on heavy and out-of-gauge cargoes; Controls terminal and trucking operations; Discontinued Memphis service due to lack of international northbound cargo; Houston–New Orleans service is on inducement basis; No scheduled service at this time
Rochester–Toronto Ferry	Rochester, NY–Toronto, ON	Primarily passengers and some Ro/Ro	Catamaran passenger-vehicle ferry (maximum of 10 trucks and 150 cars)	2004–2005	Route only cut across a corner of the lake and didn't save many highway miles; Problems with cost of Canadian customs service

West Coast Ventures

Venture	Service Area	Cargo	Vessel Information	Period	Factors Identified to Date
Cabrillo Shipping	Los Angeles/Long Beach–Ensenada	Refrigerated seafood	Barge	1996–N/A (defunct)	Joint venture with Tri-Net Logistics, a subsidiary of Mitsui & Co (USA) Inc.; Large variability in demand
Horizon Lines www.horizon-lines.com	Tacoma–Oakland (extension of Hawaii string)	Diverse cargo/ vehicles	See vessel information at the end of this appendix	1999 (as CSX Lines)–present	Provides supplemental cargo for domestic string; Not actively soliciting this freight
Matson http://www.matson.com	Los Angeles/Seattle/ Vancouver Seattle/Oakland	Containers (feeder service), vehicles, personal goods	2100 TEU vessel (surplus)	1994–2000 (coastal service—Guam and Hawaii trades still active)	Does not usually take coastal movements; Has better use for vessel; Rail competition is strong; Coastal service not profitable—couldn't cover capital costs; Limited service (weekly); Couldn't handle large domestic and overweight containers; Drayage costs too high; High stevedoring costs (ILWU); Overall lack of demand
Tidewater www.tidewater.com	Columbia River system	Containers, grain, wood chips	120-ft deck barges	1932–present	Utilizes several small container river ports; Able to combine containers with other cargo barges; Regularly scheduled service; Economical terminal costs
Seaspan www.seaspan.com	British Columbia	Containers and Trailers	4 Ro/Ro, 26-38 trailers (one can take 15 rail cars, one can take 22)	1970–present	Principally serves Vancouver Island
Sause Brothers www.sause.com	PNW–Southern California Long Beach–Ensenada	Lumber Containers	Ocean barges (wide variety) Ocean barges	1950s–present 1998–N/A (now defunct)	Service was "grandfathered" when ILWU was created; Too much variability in demand
Eco Transport www.eco-transport.com	Oakland/Stockton	Containers	Tug-barge service, up to 350 containers (700 TEU) per shipment (plans include 3 barges)	Proposed for summer 2010 (Received $750,000 from Bay Area Quality Management District; Port of Stockton says it needs money for cranes.)	Regularly scheduled barge service coordinated with ocean-going vessel calls; Door-to-door service; Value-added services include container storage, product warehousing, and bulk commodity terminal facilities capable of receiving unit trains and loading containers to max capacity (overweight)

Linea Peninsular uses the following vessels:

Vessel Name	Vessel Type	Deadweight Tons	TEU Capacity	Speed
Progreso	General Cargo Ship	3,053	154	11.4 knots
Juan Diego	General Cargo Ship	3,038	154	11.6 knots
Kopersand	General Cargo Ship	3,036	154	11.4 knots
Campeche Bay	General Cargo Ship	3,145	154	11.0 knots
Bienville	General Cargo Ship	3,041	154	11.5 knots

Horizon has the following five vessels that have provided spot service to the coastal trade:

Vessel Name	Vessel Type	Deadweight Tons	TEU Capacity	Speed
Horizon Tacoma	Containership	20,668	1,172	20.0 knots
Horizon Eagle	Containership	39,276	2,824	23.0 knots
Horizon Enterprise	Containership	31,423	2,325	21.0 knots
Horizon Falcon	Containership	39,420	2,824	22.5 knots
Horizon Hunter	Containership	39,266	2,824	22.5 knots

Seaspan has the following four ferries:

Vessel Name	Vessel Type	Deadweight Tons	Rail Car Capacity	Trailer Capacity	Speed
Carrier Princess	Rail/vehicles carrier	3,429	22	38	18 knots
Princess Superior	Rail/vehicles carrier	4,941	15	38	15 knots
Seaspan Doris	Ro/Pax	2,000	0	42	12 knots
Seaspan Greg	Ro/Pax	N/A	0	26	12 knots

APPENDIX C

Tabulation of Shipper Requirements

To succeed, a North American Marine Highway must possess two major characteristics:

- It must provide a time/cost tradeoff that is competitive with that of other modes (particularly trucking), and
- It must be reliable and as seamless as possible. (*1, 2, 3, 11*)

The most important attributes in a shipper's choice of mode are preference for remaining with the current service, travel time, and cost. (*3, 14*)

Specific requirements noted in the literature are as follows:

- Must think in terms of door-to-door deliveries and consider the whole supply chain. (*4*) The ability of the transportation system to provide reliable door-to-door services across continents, countries, and modes of transportation is becoming increasingly important to the private-sector freight industry. (*5, 10*) Shippers want an integrated transport package. (*10, 14*)
- Service would have to be at least weekly. (*4*) For domestic 53-foot truck service, second-day service is the lowest possible level. (*6*) Some studies indicate one-third of shippers want daily service; another one-third want 2–3 times per week. (*7*) Same-day service is technically impossible and should be left for trucks. Second-day delivery should be the aim of intra-regional coastal service and is possible with both the high-speed and fast ferries. (*8*) Some (motor) carriers felt that daily frequency would be a requisite in high-volume corridors, while others believed that two- to three-day service frequency would be adequate, particularly in the early stages of service development. (*9*) Frequency is a key variable to many shippers. (*11*) Many interviewees indicated that in order to compete effectively with trucks, NAMH operations must offer regularly scheduled service. A minimum requirement of container shippers was weekly. (*5*) Frequency of departures has a significant positive effect on the allocation of cargo shipments toward the option providing the greatest frequency. (*13*)
- Fixed-day departure. (*10*) The result has been a shift away from a focus on speedy transit times to more of a priority placed on cargo integrity, timeliness (not necessarily speed), and reliability. This phenomenon will tend to favor a cost-effective, reliable, NAMH service. (*4*)
- Transit time and frequency of service are key factors. (*10, 11, 14*) Must minimize dwell time in port. (*11*)
- In some cases, must compete with frequent train service. (*4*)
- In Canada, focus on import cargo. (*4*) In U.S., focus on domestic cargo. (*2, 9*)
- Consider self-propelled vessels and frequent service to speed up deliveries. (*12*)
- Major customers should be the truckers and intermodal marketing companies. (*2*)
- Being fast is not as critical as being reliable. (*2, 13, 14*)
- There was a strong consensus that a NAMH service fully integrated into the domestic transportation system must be set up for 48-ft and 53-ft trailers and/or containers (*2, 9*).
- Motor carriers tended to be more interested in using their own equipment for a NAMH operation and consequently looked at Ro/Ro trailer vessel operations as being more attractive than Lo/Lo containership operations. (*9*)
- Ground carriers interviewed frequently used domestic rail intermodal service as a benchmark for cost and service comparisons to a NAMH shipping alternative. (*9*)
- Marine carriers will have to provide marine containers. Motor carriers are generally willing to provide highway trailers if used in a roll-on/roll-off vessel service, but not marine containers, seeing that as the role of the ocean carrier or perhaps a third-party provider. (*9*)
- Customs clearance was perceived to be more difficult for shipping than for trucking and this perception may be more of a barrier than expected. Efforts must be undertaken to convince the Department of Homeland Security to reduce the advance notification requirements on NAFTA-originating shipments to terms more suitable to their geographic proximity. (*10*)
- Service must be complementary to trucking. (*2*)

- Time-sensitive shippers need good system to track/manage freight. (*11*)
- Service must be as easy to use as trucking. (*11*)
- Late cut-offs and early deliveries will be important to make the NAMH service competitive. (*11*)

One barge company takes exception to two aspects (at least for inland shipments): This company believes that reliability is a "red herring" and scheduled service is a myth and unnecessary. (*15*)

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APPENDIX D

Compilation of Potential Obstacles to the Development of Marine Highways

Service/Marketing

Issue	Comments	References
Perception by others	Shippers and freight forwarders see water transportation as slow and old-fashioned … NAMH shipping is generally slower and less frequent than rail or road … Skepticism about the service's ability to provide adequate transit time and reliability … IMCs (Intermodal Marketing Companies) either are not aware of NAMH services or choose not to use them, making it difficult for NAMH to increase its market share … Many shippers feel that barge transit times are less reliable than truck or rail because of weather factors … It has a poor service image, it is seen as a segmented industry, and it is perceived to be a complex system involving many actors. The missing link that requires most attention is to convince shippers and forwarders presently using road transport to abandon their sole reliance on road and rail transport and give more serious consideration to alternative modes such as NAMH as a backbone for integrated door-to-door transport … However, shippers in the general cargo market will see lack of daily services with faster travel times as a competitive disadvantage for NAMH services as compared to truck and even rail services. It takes time to convince cargo owners to change their habits, and they need to see reliable and regular services before doing so, making it difficult to fund the start-up phase. NAMH is perceived as a slow mode, and inappropriate for just-in-time delivery systems … Not perceived to be competitive with trucks … Past failures make shippers reluctant to switch.	*1, 2, 3, 4, 5, 6, 8, 10, 14, 21, 31, 33, 43*
Lack of supply chain orientation/lack of modal integration	U.S. shippers are quite concerned about purchasing a service requiring multiple carrier contracts … Any possibility of commercial viability almost certainly hinges on a service that combines feeder operations with door-to-door (domestic or cross-border) service, so as to achieve a sufficient volume to allow sailings at a regularity sufficient to meet the expectations of shippers of higher value, more time-sensitive cargoes … However, feeder service obligations are likely to tie any such NAMH operation to the schedules of deepsea carriers. It may, therefore, only be quite providential that such departure times, or indeed frequencies, meet the needs of door-to-door shippers … Many NAMH companies are too small to operate total logistics chains and they are characterized by individualism that makes it difficult to cooperate with others in the industry … Insufficient integration with other transport modes in the transport chain; NAMH can have difficulty in meeting "just-in-time" requirements … Lack of supply chain orientation by carriers and integration with other modes.	*1, 4, 21, 40*
Schedule reliability	Susceptible to inclement weather conditions.	*6, 10, 33*
Trip frequency	Trucks can operate on demand. Rail carriers can offer daily or twice-daily service. No one has documented any NAMH operators in the United States offering daily service. Delivery schedules increasingly need to fit just-in-time delivery requirements … Fixed-day departure every two weeks is not acceptable to a majority of exporters … Only a small percentage of the market is interested in a NAMH option with biweekly service.	*6, 8, 10, 40*
Insufficient demand	Viable cross-border NAMH services will require relatively high-volume shipping lanes to generate sufficient demand for frequent services (a necessary pre-condition to compete with trucking). This may be difficult to develop in the primary corridors of cross-border movement on the West Coast.	*33*
Difficulty in selling feeder service to ocean carriers	Fewer and fewer carriers or alliances control larger and larger blocs of cargo, and the number of potential customers of a feeder service is reduced … Steamship lines often do not realize the full costs of trucking operations and thus mistakenly believe barge service is overpriced … Bills for "hidden costs" come into different departments and different individuals at the steamship company.	*2, 7*
International cargoes	On Canada's Atlantic Coast, a NAMH based purely on international cargo is not financially viable since the largest customers of Canadian National Railway (CN) also pay the lowest rates to the railway … Coastwise between major ports: large ports already served by foreign liners, imports/exports tend to move east-west to/from these ports, versus north-south … If the larger shipping lines decided to chase the cargo that a NAMH operator carried, they could jeopardize the existence of the service.	*8, 9, 40*

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Issue	Comments	References
Market issues	The biggest barrier to NAMH operations in Canada is the lack of a defined market … Inadequacy of meaningful statistics, data, and information … Furthermore, the possibility is complicated by the seasonality of the exported goods … There is a lack of statistical data that make accurate analysis of trade flows between ports and regions difficult; this creates problems both for commercial development and policy making … The academic community needs a far better picture of freight movements within the United States in order to support further analysis of the potential benefits of coastal shipping, as well as to capture the currently under-appreciated externalities of freight movements, such as pollution. Accurate and precise freight data along America's coastlines simply do not exist.	*10, 11, 12, 21, 40*
Transit time	Transit times for the barge services are not competitive even with current congestion levels at the border … Great Lakes ports have experimented with the concept of bringing in containers by ocean vessel but have found that shippers preferred the shorter timeline of rail-truck intermodal movements from the ocean ports for containerized cargo … Vessel performance leads to a lack of speed when compared to its competitors on U.S. trade corridors, especially highways and roads … Transit times are cited in surveys more than any other factor as a major problem.	*4, 12, 13, 21, 31, 33*

Cost Issues

Issue	Comments	References
High fees for ports and land-based services	Another obstacle to NAMH container feeders is modal interchange costs, or handling costs … The cost of the vessels (even the higher costs of U.S.-built Jones Act vessels), was found to represent only 14% of the total cost per trailer. The most significant costs for NAMH on a per trailer basis remain the landside costs including truck drayage to and from the terminals, port costs, and fuel costs … Research has shown that the economic viability of marine highways is influenced to a significantly greater degree by landside costs such as truck drayage and terminal costs than by vessel capital costs … Often times the cost barrier comes in the form of transport onto or off a smaller port facility instead of the on-dock storage or cargo handling costs.	*10, 14, 31, 33*
Terminal lease costs are too high	Especially on the West Coast, the cost of land acquisition in a port area is prohibitive and the lease rates for waterfront property are very high.	*14*
Lack of capital	Private financiers are unwilling to take the plunge … Reluctance to invest millions of dollars on untested ideas … Difficult to obtain financing in today's environment.	*15, 22, 34,*
Economic load requirements	The volume of freight handled in a single block (typically 400–1,000 TEU) restricts the frequency of shipments compared to other competitive modes of intermodal transport. Trucking typically handles 2 TEU at a time and intermodal trains handle roughly 250 TEU per train … The larger the vessels, the lower the frequency to handle the same volume. This creates a barrier to entry into shipping routes as the volume of cargo must be sufficient to enter the market with an economically sized vessel … The need to consolidate loads and the associated impacts on frequency of service clearly puts NAMH at a disadvantage, particularly for general cargo moves, when compared to rail or trucking.	*2, 33, 40*
Increased lead time	Cargo has to be accumulated at the outbound dock ahead of time (a particular issue for high-value goods because of increased inventory costs).	*31*

Infrastructure

Issue	Comments	References
Terminal handling equipment	Most Great Lakes ports do not have the necessary equipment to handle containers efficiently, and justifying such investment is difficult.	*1*
Driver hours-of-service rules	Time spent by drivers with their vehicles on a ferry is considered to be on-duty time, thus providing no benefit with regard to driver hours-of-service regulations.	*1*
Port infrastructure	… Locks/dams, channels, bridge clearances … Many of the underutilized ports that would benefit from increased NAMH operations do not have sufficient infrastructure (berths, cranes, access) … Ground storage capacity is currently at a premium at most ports. The current policy of managing capacity through surcharges will discourage growth of comparatively low-revenue domestic transportation … Information systems support to coordinate "hand-offs" between motor carriers, ports, and ocean carriers would be a critical service component to ensure a seamless service … Initial capital costs, including vessel procurement costs and port infrastructure-related costs, are much higher in NAMH than in trucking, which deters carriers to invest in such business … Potentially insufficient terminal capacity and added congestion on port access routes … Diverting over-the-road truck volume into port areas for marine highways service use may compound existing traffic congestion issues in and around the ports … Port infrastructure constraints do not appear to be a major obstacle to expanded services … However, bringing shippers physically closer to carriers by creating warehouse and processing sites near the water may be an important incentive for development of NAMH and this could be difficult given municipal tax policy in British Columbia, zoning rules, environmental permitting requirements in coastal areas, and community opposition to port expansion in both Canada and the United States.	*15, 16, 17, 18, 33, 34*

Government/Regulatory

Issue	Comments	References
Harbor Maintenance Tax	Some trucks move by water from the United States to Canada, but return to the United States by bridge to avoid paying the tax … Horizon is "waiting to see what happens with the Harbor Maintenance Tax." … HMT is an identified cost of anywhere from US$75 to US$120 on a 20-ft box … This tax may amount to around 2.5% of the total cost of a NAMH movement along the Atlantic Coast. It adds to the cost of the NAMH mode as well as introducing the "annoyance factor" of an additional layer of administrative paperwork that does not encumber a trucking movement … HMT still accounts for 6%–10% of the total costs per trailer load on the Pacific Coast … To use a NAMH carriage alternative, the highway carrier must contact every shipper with freight in the trailer to seek permission to subject each shipment to the HMT at the expense of the shipper or importer. The domestic shipper/importer will calculate the added cost (HMT) of shipping by water and make a business decision whether the time and money saved on the congestion avoidance route is worth the added tax and document filing obligation. If it agrees to incur the added costs associated with HMT, the domestic shipper/importer will need to declare accurately the shipment contents and value of the merchandise shipped … A vessel that carries multiple cargoes such as the Detroit–Windsor Truck ferry is unable to attract additional business such as UPS trucks because each shipper in the truck will have to pay the tax, creating a paperwork issue on less-than-truckload cargoes … It serves to stimulate rather than discourage a shift to the use of land modes, and therefore works at variance with the thrust of the arguments for encouraging NAMH … HMT is the prime example on the U.S. side exemplifying this situation. Application of this tax encourages cross-border traffic to move by land rather than by water … The single most important impediment to the development of NAMH in the United States is the Harbor Maintenance Tax.	*1, 17, 19, 20, 21, 22, 23, 24, 26, 27, 28, 31, 34, 36, 40, 43*
Costs vs. public benefit	There is no mechanism to credit a potential operator with these external benefits ... If coastal shipping produces economies, it is not clear where the savings will be realized—the carrier, the cargo owner, or the consumer. Thus, it is hard to determine who should invest to make the necessary improvements to enhance the efficiency of coastal shipping.	*4, 25*
Customs clearance	Advance notice of 24 hours is required by U.S. Customs and Border Protection (CBP) for cargo traveling from Canada (or Mexico) by water … In the case of a truck trailer, a shipper must provide CBP with advance notice of only 1 hour prior to arriving at the border crossing. For shipments moving by rail, the notice requirement is 2 hours. For a similar shipment moving into the United States via water where there is no driver on board, however, CBP requires at least 24 hour's advance notice prior to the cargo being loaded onto the vessel … Customs clearance was perceived to be more difficult for shipping than for trucking and this perception may be more of a barrier to service adoption than expected … Inconsistencies in the application of rules and procedures (particularly in relation to customs) are another consideration. Differentials in the timeliness or availability of services or differences in cargo inspection procedures (that delay loading or unloading of cargo or passengers) … This problem is exacerbated by the non-availability to marine movements of customs services on a 24/7 basis, while such services are available for most land-mode border crossings … There is currently an imbalance in the way security and customs rules are being applied on both sides of the border and harmonization of these procedures may be critical to development of a viable NAMH service. The application of 24-hour rules is the most often cited example of this inequity … Because the Detroit–Windsor Ferry operates a truck ferry service, Animal and Plant Health Inspection Service (APHIS) agricultural quarantine inspection (AQI) fees are collected twice—once on the vessel ($490.00) and then again on the truck ($5.25). If a truck crosses a bridge or tunnel, the fee only applies to the truck ($5.25) … A serious challenge to developing NAMH within the Great Lakes region will be the Canadian government policy of charging any new international marine operation the full cost recovery of customs services. These identical services are provided to bridges and tunnels without charge … Canadian Customs has limited the hours that they would clear vessels on cross-border trade. U.S. Customs charges overtime and travel expenses to clear vessels. Truck and rail operators are able to have 24-hour service with no recovery charges … Anything that constitutes more demanding or lower-quality customs treatment in comparison with that applied to land alternatives disadvantages marine movements in relation to an all-land route … Administrative barriers because of rather complex documentation and procedures in ports and the veterinary checks … Canadian cost recovery fees … Clearly, the service would benefit from more harmonized documentary procedures (including, of course, the use of a single waybill).	*12, 21, 26, 27, 28, 33, 40, 43*

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Issue	Comments	References
Federal policies	Inequity in infrastructure-related subsidies to land-mode operators (e.g., through the provision of "way" facilities [i.e., roads and railways], the cost of which is not fully recovered from users of that infrastructure) … "In this country, of course, state and local governments take their lead—and their approach to funding—from the federal government. Unlike the European model, we continue to consider the U.S. Department of Transportation reauthorization as essentially a "highway" bill, with virtually no attention given to the marine transportation system or to stimulating SSS" … Industry involvement with DOT/Metropolitan Planning Organization (MPO) planning efforts can be limited. State DOTs and MPOs often conduct long-range planning on a 20- to 30-year timeframe, while the private-sector freight industry often conducts long-range planning on a 6- to 18-month timeframe. This mismatch in planning horizons complicates efforts to fully engage the private-sector freight community in a process that they perceive to be long, cumbersome, and overly bureaucratic.	*15, 29, 31, 40*
Security	New security requirements and customs rules (advance manifest requirements) will make cross-border services less attractive as compared to trucking and as compared to domestic marine services. This is a particular concern for southbound movements from Canada into the United States … While these new security regulations are designed to prevent terrorist activities on vessels and ports serving international trade, the increased costs and potential cargo shipment delays resulting from these rules may make cross-border NAMH operations less attractive to potential shippers and operators … In North America, as elsewhere, one of the major impediments to the further development of coastal shipping is the limit on cabotage. In the United States, the Jones Act (1920) is widely recognized as a serious constraint … Marine highways are not yet being considered as part of transportation improvement plans developed at the state level.	*4, 14, 33*
Cabotage	Cabotage rules (Coasting Trade Act in Canada and Jones Act in United States) do not seem to be a significant barrier in cross-border NAMH services. There were only a few carriers who indicated that multi-port per country services would be necessary to generate economical services given demand patterns and distances between ports. Some carriers approved of the cabotage restriction so that cross-border NAMH did not become the vehicle by which domestic shipping was undercut by the other country's carriers (similar concerns as those expressed by motor carriers) … No carriers that were interviewed noted that the Coasting Trade Act or the Jones Act were a specific concern or hindrance to them with regard to cross-border NAMH … The Jones Act, which requires that ships engaged in domestic maritime trade be U.S.-built, U.S.-owned, U.S.-flagged, and U.S.-operated, was cited by many interviewees as a key obstacle to expanding the use of NAMH operations in the region … Canadian cabotage restrictions and duties create sunk costs that can not be recovered if the service is unsuccessful … Duties, in conjunction with other maritime fees, make new entry into NAMH services extremely costly and risky.	*30, 31, 33, 38*
Municipal issues	(In Canada) the following municipal factors were listed as being factors that hinder NAMH: • Municipal levies on waterfront property (see next section), • Zoning restrictions and land use planning, • Municipalities acting locally rather than regionally, and • Governance electoral cycle. The British Columbia (B.C.) Port Competitiveness Committee, which was formed in 1999, concluded that excessive municipal property taxes were making many terminal operators unprofitable and discouraging new investment in infrastructure. In some jurisdictions, taxes on port tenants equaled the rent paid to port authorities. Property taxes for B.C. terminals are 3% to 6.9% of assessed value.	*33*

Operational Constraints

Issue	Comments	References
Lockage and speed restrictions	In several areas of the Great Lakes, for instance, gains from higher speeds will be lost while traveling through locks and restricted-speed zones. For example, traversing the 27-mi Welland Canal between Lake Ontario and Lake Erie requires approximately 11 hours.	*1*
Winter shutdown	Suggestions to shippers that they use NAMH for 9 months, and then temporarily switch to other modes during the winter, are difficult to sell.	*1, 8, 31*

Issue	Comments	References
Local port operational requirements	Massachusetts: The law requires barge tankers to have tugboat escorts and follow specified routes and sets minimum staffing requirements and mandatory drug and alcohol testing ... Gate charges are not often counted as a cost when comparing trucking to marine … The Right Whale Rule kills exposed water marine highway services and drives cargo to trucks … "With the new port security, many of my truckers are not authorized to go into the ports, and they actually are not willing to go into a port" … Drayage to and from the ports … Drayage costs, port charges, and handling costs are viewed as significant obstacles and NAMH services are viewed as not being able to meet shipper requirements in many cases … Handling costs are likely to be a major cost component for every type of service that is envisioned. Many of the existing domestic NAMH services that are successful are operating out of private facilities or in situations in which lower skilled labor (often non-union) can be employed … Since ocean-going containerships are the primary customers of these ports, they typically have preference when it comes to berth, labor, and equipment availability. This is a particular concern for lift-on/lift-off ships, which require a significant amount of labor and equipment for loading and off-loading cargo … Deepwater ports often require the use of other services, including pilotage, tug assist, and line-handling services … Drayage costs to the load point and from the delivery point to the receiver are also significant costs … Delays in ports are a serious issue … Port charges that are sometimes very high and not transparent … Shippers see ports as obstacles to just-in-time business … The ratio of terminal costs to total costs tend to be too high, to the point where intermodal options are rendered non-competitive.	*3, 4, 7, 9, 10,12, 32, 33, 34, 40, 41*
Labor issues	ILA assessments can be high … "We tend to avoid anything that has to do with the International Longshore and Warehouse Union (ILWU)" … Perceived risk of potentially costly delays for traffic moving through ports due to the involvement of longshore labor as part of the transportation service … Waterfront labor practices on the Pacific Coast were seen as presenting a major potential hurdle with a possible lack of concessions on labor productivity … A number of carriers mentioned that the use of unionized labor for on-dock handling activities is an obstacle to NAMH, given the tremendous pressure to keep handling costs down to be competitive with trucking. These carriers argue that the types of handling operations associated with NAMH operations frequently require lower skill levels as compared to deep sea container operations and the current union rules do not take this into account … The cost of labor for rehandling at each origin and destination port has the potential to offset any gains in per ton-mile cost savings of the waterborne option … Restrictive labor regulations and practices … Labor rules and requirements were an often-cited obstacle to cross-border NAMH. This complaint by carriers may be based on comparison of costs when shipping from private terminals, which may not be unionized, as opposed to public ports … High union labor rates can potentially act as a barrier against increased NAMH operations … High stevedoring cost.	*3, 10, 12, 15, 31, 33, 34, 43*
Container chassis management	Motor carriers are looking to the ocean carriers to assume the responsibility for chassis supply and coordination.	*34*

Vessel-Related Issues

Issue	Comments	References
Lack of vessels that qualify under the Jones Act or Canadian cabotage law	While many nations protect their coastal fleets through laws similar to the Jones Act, none—other than the United States—require that their ships be domestically built … There is a lack of vessels that are appropriate for use in NAMH operations … There is a shortage of vessels suitable for use in NAMH trade … There are few adequate vessels sailing under the Canadian flag.	*15, 22, 31, 35, 38*
Vessel costs and availability	A key constraint on the development of NAMH services is the very high cost of suitable new vessels from U.S. shipyards that make them unemployable in any other service thereby creating a significant business risk for any investor contemplating such a start-up service … Lack of capital financing guarantees for new ship construction through the Title XI program … Ocean carriers perceived that the high capital cost of U.S.-built ships was the single largest obstacle to successful implementation of domestic coastal NAMH services … Initial capital costs, including vessel procurement costs and port infrastructure-related costs, are much higher in NAMH than in trucking, which deters carriers to invest in such business … Amazingly, the Jones Act was barely mentioned by marine operators … High U.S. shipyard construction costs … The capital investment by the transport operator is so much greater that there is considerable work on the part of all players to make the mode a viable alternative … The extremely high cost of commercial vessels built by U.S. shipyards must be addressed … The risk capital just isn't there to make it happen right now … These vessels are expensive to construct and maintain, requiring a long-term commitment by shippers who would use a NAMH service … Many of us believe that the principal problem is the absence of available financing … There will be no 20-year or 25-year vessel financing without a Title XI program or some similar government guarantee … The larger challenge for shipbuilding in the United States is the ability to secure series production … The cost of equipment is another important discriminator between truck and coastal shipping. The high number of vessels envisioned for an NAMH service, and the infrastructure to support them, would take a large third-party logistics provider (3PL), trucking company, or consortia of small service providers in order to amass sufficient capital and market share for a service to be successful.	*6, 14, 15, 19, 23, 24, 31, 34, 36, 37, 38, 39, 43*

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Issue	Comments	References
Vessel operating requirements	Manning levels for self-propelled vessels engaged in domestic commerce are much higher than for tug-barge combinations moving an equivalent amount of freight … Horizon advocates moving the ubiquitous 53-ft trailers off the highways. They admit, however, that this will be a difficult thing to do with existing domestic marine assets.	*34, 39*

Other

Issue	Comments	References
Flow imbalance	Flows are significantly imbalanced—northbound flows of 51.8 million trailer-loads versus 26.4 million trailer-loads southbound … Possibility of a high volume of empty equipment repositioning … The trade imbalance also creates an obstacle based on the difficulty of generating back-haul loads. Reducing cabotage obstacles might be one way of expanding back haul markets … However, this is a problem faced by competing modes so its differential impact on NAMH may not be that significant a factor … This affects regularity of service … We also concluded that the trade is unbalanced and, without the opportunity to engage in cabotage on the return leg, it is highly likely there will be poor capacity utilization northbound.	*21, 33, 34, 40, 41*
Rate competition	Recognizing that coastal competition constitutes only a small percentage of the business of land-mode operators, there is a risk of non-compensatory pricing on those routes that compete with NAMH so as to discourage diversion … Shippers seem to expect services discounted below truck rates and these cost goals are difficult to achieve.	*33, 40*
Resistance from port authorities	Some ports perceive NAMH services as adding to congestion and emission problems in their area, even though they might be beneficial from a systems perspective … A redistribution of emissions from inland to coastal communities are a roadblock to acceptance.	*14*
Miscellaneous	The risk of loss or damage is enhanced by the inclusion of additional handling points … (In Canada) truckers are generally paid per kilometer driven, rather than on overall mileage; thus there is a disincentive to use Ro/Ro services … Developing a national transportation policy also conflicts with the local nature of infrastructure development. Most intermodal infrastructure projects begin at the local level and must meet state environmental regulations. Funding comes largely from state and local sources and the private sector … Difficulties in competitive pricing … To sum up, the shorter the distance, the less likely NAMH is competitive against the truck mode on cost. The longer the distance, the less likely NAMH will be truck-competitive on transit time. In short, NAMH has difficulty meeting the service and price requirements of shippers … NAMH would be much more competitive if more manufacturing plants and consumer markets were within 5 mi of water … Bringing the shippers closer to the load points could help make NAMH more cost competitive (as was the case in the past). However, many of the bulk raw materials shippers that traditionally used this service are in decline or restructuring of the industries has moved production locations farther from water loading points … The more common operation for bulk transport is to load directly on barge from a production site with appropriate bulk handling equipment … There is a lack of "port partnering." … Canadian icebreaking fees, even when there's no ice … NAMH operations are subject to "way" charges (one example being pilotage and another being marine services fees), to which competing modes (e.g., road, rail) are not subject.	*12, 15, 21, 30, 31, 33, 36, 40, 42, 43*

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APPENDIX E

Marine Highways Legislation with Committee Referrals

Marine Highway Promotion

Bill Number	Date Introduced/ Sponsors	Short Title	Relevant Provisions	Committee(s)
HR 3288	7/22/2009 Olver (MA 1)	Consolidated Appropriations Act, 2010	Provides $7 million for the Secure and Efficient Ports Initiative. The funding will allow MARAD to designate and support specific projects that will create new or expanded services along designated marine highway corridors. In addition, the funding will allow for the collection of data to support the expanded use of a secure national marine highway. None of the funds may be used to create a new legacy system. (Included in MARAD operations budget.)	House Appropriations Senate Appropriations
S 1390 Related to: HR 2647	7/2/2009 Levin (MI) No cosponsors	National Defense Authorization Act for FY '10	Establishes short sea transportation grants. Projects must be designed to help relieve congestion, improve transportation safety, facilitate domestic and international trade, or encourage public-private partnerships; may include development, modification, and construction of marine and intermodal cargo facilities, vessels, port infrastructure and cargo handling equipment, and transfer facilities at ports. Eligible applicants are: a state or other public entity, or the sponsor of any short sea transportation project designated by the secretary under the America's Marine Highway Program. (No funding provisions.) Subsumed into HR 2647.	Senate Committee on Armed Services (sent to the House on 7/28/09)
S 1308	6/19/09 Lautenberg (NJ) No cosponsors	Maritime Administration Authorization Act of 2010	Subsumed into S 1390.	Senate Commerce, Science, and Transportation (approved)
HR 2647 Related to: S 1390	6/2/09 Skelton (MO 4)	National Defense Authorization Act for Fiscal Year 2010	Same relevant provisions as S 1390 above.	House Committee on Armed Services Subcommittee on Military Personnel Subcommittee on Seapower and Expeditionary Forces Subcommittee on Readiness Subcommittee on Strategic Forces Subcommittee on Air and Land Forces Subcommittee on Terrorism, Unconventional Threats, and Capabilities (sent to Senate on 7/6/09)
S 1036	5/14/09 Rockefeller (WV) 1 cosponsor	Federal Surface Transportation Policy and Planning Act of 2009	One goal is to increase the proportion of national freight transportation provided by non-highway or multimodal services by 10% by 2020. Requires secretary of DOT to develop appropriate performance criteria and data collections systems for each federal surface transportation program.	Senate Commerce, Science, and Transportation

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Bill Number	Date Introduced/ Sponsors	Short Title	Relevant Provisions	Committee(s)
HR 3221 Related to: HR 6 HR 2701	7/30/07 Pelosi (CA 8) 18 cosponsors	New Direction for Energy Independence, National Security, and Consumer Protection Act	This bill was subsumed into HR 6.	House Energy and Commerce House Education and Labor House Foreign Affairs House Small Business House Science and Technology House Agriculture House Oversight and Government Reform House Natural Resources House Transportation and Infrastructure House Armed Services
HR 2701 Related to: HR 6 HR 3221	6/13/07 Oberstar (MN 8) 15 cosponsors	Transportation Energy Security and Climate Change Mitigation Act of 2007	Incorporated into HR 3221. Orders the secretary of transportation to establish a short sea transportation program and designate short sea transportation projects to be conducted under the program to mitigate landside congestion. Also orders the secretary to designate short sea transportation routes as extensions of the surface transportation system. Orders the secretary, in consultation with federal entities and state and local governments, to develop strategies to encourage the use of short sea transportation for transportation of passengers and cargo. The secretary shall— (1) assess the extent to which states and local governments include short sea transportation and other marine transportation solutions in their transportation planning; (2) encourage state departments of transportation to develop strategies, where appropriate, to incorporate short sea transportation, ferries, and other marine transportation solutions for regional and interstate transport of freight and passengers in their transportation planning; and (3) encourage groups of states and multistate transportation entities to determine how short sea transportation can address congestion, bottlenecks, and other interstate transportation challenges. Orders the secretary of transportation to enter into memoranda of understanding with the heads of other federal entities to transport federally owned or generated cargo using a short sea transportation project designated under Section 55601 when practical or available. Orders the secretary to develop proposals for short-term incentives to encourage the use of short sea transportation. Authorizes the secretary, subject to the availability of appropriations, to make loan guarantees for the financing of the construction, reconstruction, or reconditioning of a vessel that will be used for a short sea transportation project designated under Section 55601. There is authorized to be appropriated $25 million to carry out this section for each of fiscal years 2008 through 2011. Orders the secretary to establish a board to identify and seek solutions to impediments hindering effective use of short sea transportation. Authorizes the secretary to conduct research on short sea transportation, regarding—(1) the environmental and transportation benefits to be derived from short sea transportation alternatives for other forms of transportation; (2) technology, vessel design, and other improvements that would reduce emissions, increase fuel economy, and lower costs of short sea transportation and increase the efficiency of intermodal transfers; and (3) identify and seek solutions to impediments to short sea	House Transportation and Infrastructure

Bill Number	Date Introduced/ Sponsors	Short Title	Relevant Provisions	Committee(s)
			transportation projects designated under Section 55601. Short sea transportation is defined as the carriage by vessel of cargo—(1) that is—(A) contained in intermodal cargo containers and loaded by crane on the vessel; or (B) loaded on the vessel by means of wheeled technology; and (2) that is—(A) loaded at a port in the United States and unloaded at another port in the United States or a port in Canada located in the Great Lakes Saint Lawrence Seaway System; or (B) loaded at a port in Canada located in the Great Lakes Saint Lawrence Seaway System and unloaded at a port in the United States.	
HR 6 Related to: HR 2701 HR 3221	1/12/07 Rahall (WV 3) 198 cosponsors	Energy Independence and Security Act of 2007	Essentially the same provisions as HR 2701 above, except that no appropriations are specifically authorized. Allows the Capital Construction Fund to be used for vessels engaged in short sea shipping.	House Ways and Means House Natural Resources House Budget House Rules House Transportation and Infrastructure
HR 2443	6/12/03 Young (AK) 3 cosponsors	Coast Guard and Maritime Transportation Act of 2004	Orders the secretary of transportation to conduct a study that evaluates short sea shipping market opportunities on the Great Lakes, including the expanded use of freight ferries, improved mobility, and regional supply chain efficiency. Also authorizes the Great Lakes National Maritime Enhancement Institute to analyze the effect of the Harbor Maintenance Tax on Great Lakes shipping.	House Transportation and Infrastructure Subcommittee on Coast Guard and Maritime Transportation Senate Commerce, Science, and Transportation

Note: Shaded rows contain bills that have become public law.

Harbor Maintenance Tax

Bill Number	Date Introduced/ Sponsors	Short Title	Relevant Provisions	Committee(s)
HR 3486 Related to: S 1509	7/31/09 Higgins (NY 27) 12 cosponsors	Short Sea Shipping Act of 2009	Exempts non-bulk domestic and Great Lakes–U.S. shipments from Harbor Maintenance Tax.	House Ways and Means
S 1509 Related to: HR 528 HR 638 HR 3486 S 551	7/23/09 Stabenow (MI) 2 cosponsors	Great Lakes Short Sea Shipping Enhancement Act of 2009	Exempts the following from Harbor Maintenance Tax: commercial cargo (other than bulk cargo) loaded at a port in the United States located in the Great Lakes Saint Lawrence Seaway System and unloaded at another port in the United States located in such system, and commercial cargo (other than bulk cargo) unloaded at a port in the United States located in the Great Lakes Saint Lawrence Seaway System that was loaded at a port in Canada located in such system.	Senate Finance
HR 2355	5/12/2009 Richardson (CA 37) 11 cosponsors	MOVEMENT Act of 2009	Establishes a National Goods Movement Improvement Fund to provide funding for infrastructure projects. More than triples the Harbor Maintenance Tax to fund projects near ports to facilitate the movement of freight. (If enacted, the proposal would likely cause an adverse reaction from the World Trade Organization, as our international trading partners have had long-standing concerns about the HMT. An amendment to mandate that all HMT revenues be used only for their authorized purposes may alleviate these concerns.)	House Committee on Transportation and Infrastructure Subcommittee on Highways, Transit and Pipelines Subcommittee on Coast Guard and Maritime Transportation Subcommittee on Railroads, Pipelines, and Hazardous Materials Subcommittee on Water Resources and Environment House Ways and Means
S 551 Related to: HR 528 HR 638 S 1509	3/9/09 Lautenberg (NJ) 5 cosponsors	None	Amends the Internal Revenue Code to exempt from the Harbor Maintenance Tax commercial cargo (other than bulk cargo) loaded at: (1) a port in the U.S. mainland and unloaded at another such port after transport solely by coastal route or river or unloaded at a port in Canada located in the Great Lakes Saint Lawrence Seaway System; or (2) such a port in Canada and unloaded at a port in the U.S. mainland.	Senate Finance

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Bill Number	Date Introduced/ Sponsors	Short Title	Relevant Provisions	Committee(s)
HR 638 Related to: HR 528 S 551 S 1509	1/22/09 Cummings (MD 7) No cosponsors	Short Sea Shipping Promotion Act of 2009	Exempts from the Harbor Maintenance Tax certain commercial cargo loaded or unloaded at U.S. ports, specifically, cargo that is: (1) loaded at a port in the United States and unloaded at another port in the United States or a port in Canada located in the Great Lakes Saint Lawrence Seaway System, or (2) loaded at a port in Canada located in the Great Lakes Saint Lawrence Seaway System and unloaded at a port in the United States.	House Ways and Means
HR 528 Related to: HR 628 S 551 S 1509	1/14/09 McHugh (NY 23) 9 cosponsors	Short Sea Shipping Act of 2009	Exempts certain shipping from the Harbor Maintenance Tax, specifically, cargo that is loaded at: (1) a port in the United States mainland and unloaded at another port in the United States mainland after transport solely by coastal route or river or unloaded at a port in Canada located in the Great Lakes Saint Lawrence Seaway System, or (2) a port in Canada located in the Great Lakes Saint Lawrence Seaway System and unloaded at a port in the United States mainland.	House Ways and Means
S 3199 Related to: HR 981 HR 1499 S 1683	6/25/08 Lautenberg (NJ) 8 cosponsors	None	Amends the Internal Revenue Code to exempt from the Harbor Maintenance Tax commercial cargo (other than bulk cargo) loaded at: (1) a port in the U.S. mainland and unloaded at another such port after transport solely by coastal route or river or unloaded at a port in Canada located in the Great Lakes Saint Lawrence Seaway System; or (2) such a port in Canada and unloaded at a port in the U.S. mainland.	Senate Finance
S 2345	11/13/07 Baucus (MT) No cosponsors	American Infrastructure Investment and Improvement Act of 2007	Exempts commercial cargo (other than bulk cargo) loaded or unloaded at U.S. ports in the Great Lakes Saint Lawrence Seaway System from the Harbor Maintenance Tax.	Senate Finance
S 1683 Related to: HR 981 HR 1499 S 3199	6/22/07 Stabenow (MI) 2 cosponsors	Great Lakes Short Sea Shipping Enhancement Act of 2007	Amends the Internal Revenue Code to exempt from the Harbor Maintenance Tax commercial cargo (other than bulk cargo) loaded or unloaded at U.S. ports in the Great Lakes Saint Lawrence Seaway System.	Senate Finance
HR 1701	3/26/07 Weldon (FL 15) 4 cosponsors	Blue Water Highway Act of 2007	Amends the Internal Revenue Code to exempt from the Harbor Maintenance Tax certain cargo shipped between U.S. mainland ports, specifically: (1) cargo contained in intermodal cargo containers and loaded by crane on a vessel or cargo loaded on a vessel by means of wheeled technology in a port in the U.S. mainland for transportation to another port in the U.S. mainland solely by coastal route or river (or combination thereof), and (2) the unloading of cargo described in paragraph (1) in a port in the U.S. mainland.	House Ways and Means
HR 1499 Related to: HR 981 S 1683 S 3199	3/13/07 Cummings (MD 7) 5 cosponsors	Short Sea Shipping Promotion Act of 2007	Amends the Internal Revenue Code to exempt from the Harbor Maintenance Tax cargo contained in intermodal cargo containers and loaded by crane on a vessel, or cargo loaded on a vessel by means of wheeled technology, that is: (1) loaded at a U.S. port and unloaded at another U.S. port or a port in Canada located in the Great Lakes Saint Lawrence Seaway System; or (2) loaded at a port in Canada located in the Great Lakes Saint Lawrence Seaway System and unloaded at a U.S. port.	House Ways and Means
HR 981 Related to: HR 1499 S 1683 S 3199	2/12/07 Jones (OH 11) 8 cosponsors	Great Lakes Short Sea Shipping Enhancement Act of 2007	Amends the Internal Revenue Code to exempt from the Harbor Maintenance Tax commercial cargo (other than bulk cargo) loaded or unloaded at U.S. ports in the Great Lakes Saint Lawrence Seaway System.	House Ways and Means
HR 5889	7/26/06 Jones (OH 11) 1 cosponsor	Great Lakes Short Sea Shipping Enhancement Act of 2006	Amends the Internal Revenue Code to exempt from the Harbor Maintenance Tax commercial cargo (other than bulk cargo) loaded or unloaded at U.S. ports in the Great Lakes Saint Lawrence Seaway System.	House Ways and Means

Bill Number	Date Introduced/ Sponsors	Short Title	Relevant Provisions	Committee(s)
HR 3319	7/18/05 Weldon (FL 15) 3 cosponsors	Short Sea Shipping Tax Exemption Act of 2005	Amends the Internal Revenue Code to exempt from the Harbor Maintenance Tax certain cargo shipped between U.S. mainland ports, specifically: (1) cargo contained in intermodal cargo containers and loaded by crane on a vessel or cargo loaded on a vessel by means of wheeled technology in a port in the U.S. mainland for transportation to another port in the U.S. mainland solely by coastal route or river (or combination thereof), and (2) the unloading of cargo described in paragraph (1) in a port in the U.S. mainland.	House Ways and Means
S 1230	6/14/05 Grassley (IA) No cosponsors	Highway Reauthorization and Excise Tax Simplification Act of 2005	Exempts commercial cargo exported from the United States from the Harbor Maintenance Tax.	Senate Finance
HR 3	2/9/05 Young (AK) 79 cosponsors	SAFETEA-LU	Exempts commercial cargo exported from the United States from the Harbor Maintenance Tax.	House Transportation and Infrastructure Subcommittee Highways, Transit, and Pipelines
HR 3882	3/3/04 English (PA 3) No cosponsors	None	Amends the Internal Revenue Code to exempt from the harbor maintenance excise tax ferry trailer cargo that is in a truck trailer or semitrailer on a ferry for the sole purpose of being transported between two ports due to traffic congestion on the nearest international bridge.	House Ways and Means
HR 3550 Related to: S 1072	11/20/03 Young (AK) 145 cosponsors	Safe Accountable, Flexible, and Efficient Transportation Equity Act of 2004	Exempts exported commercial cargo from the harbor maintenance excise tax.	House Transportation and Infrastructure Subcommittee Highways, Transit, and Pipelines House Education and the Workforce House Energy and Commerce House Judiciary House Resources House Science
HR 2564	6/23/03 Capuano (MA 8) 6 cosponsors	None	Amends the Internal Revenue Code to apply the Harbor Maintenance Tax to certain ports used to import commercial cargo worth more than $100 million. Negates the tax on a port for any year after a period of three consecutive years in which $100 million or less cargo was imported through the port and no federal funds were used for construction, maintenance, or operation, as well as for subsequent years so long as the preceding year's cargo was $100 million or less.	House Ways and Means
S 1310	6/23/03 Kerry (MA) No cosponsors	None	Amends the Internal Revenue Code to apply the Harbor Maintenance Tax to certain ports used to import commercial cargo worth more than $100 million. Negates the tax on a port for any year after a period of three consecutive years in which $100 million or less cargo was imported through the port and no federal funds were used for construction, maintenance, or operation, as well as for subsequent years so long as the preceding year's cargo was $100 million or less.	Senate Finance
S 1072 Related to: HR 3550	5/15/03 Inhofe (OK) 3 cosponsors	Safe, Accountable, Flexible, and Efficient Transportation Equity Act of 2004	Exempts exported commercial cargo from the harbor maintenance excise tax. (Was incorporated into HR 3550.)	Senate Environment and Public Works Subcommittee on Transportation and Infrastructure Subcommittee on Competition, Foreign Commerce, and Infrastructure
HR 5199	7/24/02 Dunn (WA 8) 7 cosponsors	United States Port Opportunity and Revitalizing Trade Act of 2002	Amends the Internal Revenue Code to exempt certain ports located near foreign international container ports from the Harbor Maintenance Tax.	House Ways and Means
S 2787	7/24/02 Murray (WA) 1 cosponsor	U.S. Port Opportunity and Revitalizing Trade Act	Amends the Internal Revenue Code to exempt certain ports located near foreign international container ports from the Harbor Maintenance Tax.	Senate Finance
HR 4835	5/23/02 Capuano (MA 8) 4 cosponsors	None	Amends the Internal Revenue Code to apply the Harbor Maintenance Tax to certain ports used to import commercial cargo worth more than $100 million. Negates the tax on a port for any year after a period of three consecutive years in which $100 million or less cargo was imported through the port and no federal funds were used for construction, maintenance, or operation, as well as for subsequent years so long as the preceding year's cargo was $100 million or less.	House Ways and Means

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Bill Number	Date Introduced/ Sponsors	Short Title	Relevant Provisions	Committee(s)
HR 2737	8/2/01 Borski (PA 3) 27 cosponsors	Support of Harbor Investment Program Act	Amends the Internal Revenue Code to repeal the Harbor Maintenance Tax.	House Ways and Means House Transportation and Infrastructure Subcommittee on Water Resources and Environment Subcommittee on Coast Guard and Maritime Transportation
HR 1260	3/24/99 Borski (PA 3) 47 cosponsors	Support of Harbor Investment Program Act	Amends the Internal Revenue Code to repeal the Harbor Maintenance Tax.	House Ways and Means House Transportation and Infrastructure Subcommittee on Water Resources and Environment
HR 5896	8/12/92 Studds (MA 10) 2 cosponsors	None	Amends the Internal Revenue Code to reduce the Harbor Maintenance Tax. Prohibits such tax from being imposed more than once per cargo movement under the same bill of lading, regardless of how many times a cargo is loaded or unloaded under the same bill of lading.	House Public Works and Transportation Subcommittee on Water Resources House Ways and Means
HR 5654	7/22/92 Levin (MI 17) 1 cosponsor	None	Amends the Internal Revenue Code to extend the exemption from the Harbor Maintenance Tax for intraport movements to cargo movement between a U.S. port and a port located in a foreign country that is within 5 miles of such U.S. port (a unified port). Declares that such exemption does not apply to: (1) cargo landed in such foreign country before landing in the unified port; or (2) cargo destined for use outside the United States and outside such foreign country.	House Ways and Means
HR 5835 Related to: HR 4867	10/15/90 Panetta (CA 16) No cosponsors	Omnibus Budget Reconciliation Act of 1990	Increases HMT from 0.04% to 0.125%, effective January 1, 1991.	House Budget
HR 4867 Related to: HR 5835	5/17/90 Stangeland (MN 7) No cosponsors	Water Resources Development Act of 1990	Amends the Internal Revenue Code to increase the harbor maintenance fee (port use tax) from 0.04% to 0.125% of the value of the cargo involved.	House Public Works and Transportation Subcommittee on Water Resources House Ways and Means
S 2470	4/19/90 Chafee (RI) No cosponsors	Harbor Maintenance Act of 1990	Amends the Internal Revenue Code to increase the excise tax on any port use (Harbor Maintenance Tax).	Senate Finance
HR 6	1/3/85 Howard (NJ 3) 18 cosponsors	Water Resources Development Act of 1986	Amends the Internal Revenue Code to impose an excise tax on the value of commercial cargo loaded onto or unloaded from commercial vessels at U.S. ports. Provides an exemption from such tax: (1) for cargo loaded in, or destined for, Alaska, Hawaii, or any possession of the United States; (2) where the transportation of such cargo has been subject to the excise tax for fuels used in commercial transportation on inland waterways; (3) for the government of the United States; and (4) bonded commercial cargo entering the United States for transportation and direct exportation to a foreign country. Sets the initial rate at 0.04% of cargo value.	House Public Works and Transportation Subcommittee on Water Resources House Interior and Insular Affairs Subcommittee on Water and Power Resources House Merchant Marine and Fisheries House Ways and Means

Note: Shaded rows contain bills that have become public law.

APPENDIX F

Quebec Province Assistance Program Aiming to Reduce or Avoid Greenhouse Gas Emissions

The program began on October 1, 2007, and will run until 2013. The aim of the program is to reduce or avoid greenhouse gas (GHG) emissions generated by freight transportation. The program has two components:

- Component A: Projects with infrastructure expenditure; and
- Component B: Projects without infrastructure expenditure.

The same project can not receive assistance from both Components A and B.

Any project is eligible if it aims to reduce or avoid GHG emissions through the improved integration of transportation modes or the use of rail or marine transportation. Companies, municipal organizations, and other legally constituted organizations with a place of business in Quebec are eligible.

The applicant must validate the reduction or the avoidance of GHG emissions at the time of application through a Canadian Standards Association-recognized organization for the application of ISO 14064 Standard (guidelines for organizations regarding quantification and reporting of greenhouse gas emissions and removals).

Projects are evaluated according to the following criteria:

- Impact on the tonnage of GHG emissions reduced or avoided during the project period;
- The project's long-term viability (potential for reducing GHG emissions beyond the 2006–2012 action plan on climate change reference period);
- The project's economic spin-offs;
- Environmental, economic, and social co-benefits (reduction in atmospheric pollutants, decrease in road maintenance costs, road safety, etc.);
- Possibility of other viable transport alternatives;
- Complementarity with other transportation modes.

Projects with Infrastructure Expenditure

The financial aid takes the form of a grant. Projects are admissible at all times. Eligible expenses include:

- Track construction and preliminary/preparatory works;
- Construction, development, or improvement of buildings, areas, or tanks intended for the handling or storage of cargo;
- Acquisition and installation of handling equipment;
- Construction, development, or improvement of piers;
- Rehabilitation of transport infrastructures;
- Lease, purchase, or improvement of rail, marine, or intermodal transportation material and equipment;
- ISO 14064 certification fees.

The purchase of land is not eligible.

The financial contribution is set at a maximum of $500 per ton of GHG emissions reduced or avoided for the project as a whole. The financial contribution cannot exceed 50% of eligible expenses, up to a maximum of $6 million per project. The proponent's financial contribution must correspond to at least 33% of eligible expenses associated with the project.

The financial contribution is paid in three installments:

1. The first third of the contribution is paid upon production of the supporting documentation for the eligible expenses.
2. The second third is paid after the first year of operation, following submission of a report certifying the tonnage of GHG emissions reduced or avoided. The program reserves the right to reduce its contribution to the project if the GHG emissions reduced or avoided do not meet the goals set at the project's outset.
3. The balance of the contribution is paid when a final report is submitted certifying the tonnage of GHG emissions reduced or avoided after the first three years of project operation, or before the end of the fifth year. The Quebec Ministry of Transport will adjust its contribution in line with the quantity of GHG emissions reduced or avoided.

The Ministry of Transport, Québec (MTQ), may increase its contribution if the targets set at the outset are exceeded and there is room in the budget.

If the project receives financial contributions from other Government of Québec departments and agencies in relation to the project's eligible expenses, these amounts will be deducted from the program's contribution.

If the project receives a financial contribution from the Government of Canada in relation to eligible expenses, the MTQ reserves the right to adjust the program's contribution.

Projects without Infrastructure Expenditure

An applicant can obtain financial aid if s/he implements a transportation solution allowing for GHG emissions to be reduced or avoided, even if the applicant does not invest in infrastructure. Dry and liquid bulk freight projects aiming to avoid GHG emissions are not eligible. Eligible projects must be received by the program before March 31 and September 30 of each year.

The financial contribution is set at a maximum of $250 per ton of GHG emissions reduced or avoided for the project as a whole. The financial contribution cannot exceed $3 million per project. One-fifth of the financial contribution is paid after each year of operation over a five-year period following submission of a report certifying the tonnage of GHG emissions reduced. The MTQ reserves the right to reduce its contribution to the project if the quantity of GHG emissions reduced or avoided does not meet the goals set at the project's outset. The balance of the contribution is paid when the final report is submitted certifying the tonnage of GHG emissions reduced at the end of the fifth year of operation. The program will adjust its contribution in line with the quantity of GHG emissions actually reduced or avoided.

If the project receives a financial contribution in relation to eligible expenses from other Government of Québec departments or agencies or from the Government of Canada, the program reserves the right to adjust its contribution.

APPENDIX G

Annotated Bibliography

A Decision Tool for Identifying the Prospects and Opportunities for Short Sea Shipping. M. Yonge, Maritime Transport and Logistics Advisors, LLC, United States, and L. Henesey, Blekinge Institute of Technology, Karlshamn, Sweden. Presented at 85th Annual Meeting of the Transportation Research Board, Washington, D.C., January 25, 2006. Available at http://advanced maritimetechnology.aticorp.org/short-sea-shipping/06-0423.pdf as of June 30, 2009.

This paper addresses the results of a project commissioned by the Canaveral Port Authority to gain additional information and analysis to consider how SSS should be included in its strategic plans. It identifies a list of critical decision factors that may support or impede the initiation of a SSS service at that port.

A National Short Sea Shipping Initiative. Testimony of Anastassis Margaronis, Santa Maria Shipowning & Trading, Inc., before the House Committee on Coast Guard and Maritime Transportation, Washington, D.C., February 15, 2007. Available at http://www.santamariashipping.com/short_shipping_initiative_02-07.html as of June 30, 2009.

This statement provides some insight into what could be done to spark more shipbuilding in the United States. Title XI and possible legislative action are both mentioned.

America's Deep Blue Highway: How Coastal Shipping Could Reduce Traffic Congestion, Lower Pollution, and Bolster National Security. Institute for Global Maritime Studies in cooperation with the Fletcher School of Law and Diplomacy, Tufts University, Medford, MA, September 2008. Available at http://www.igms.org/docs/americas_deep_blue_highway_IGMS_report_sept_2008.pdf as of June 30, 2009.

This is a very detailed analysis of coastal shipping. It provides a description of coastal shipping as it currently exists and discusses U.S. coastal shipping policies. It goes into considerable detail in describing the potential environmental, national security, and economic benefits of coastal shipping. The authors present 10 recommendations for public and private sector decision-makers. A study appendix contains a national list of prospective coastal shipping ports. Another appendix summarizes previous coastal shipping studies. Appendix 3 summarizes recent legislative activity regarding short sea shipping.

Analysis of the Potential Market for Short Sea Shipping Services over the Ports of Fall River and New Bedford. Prepared for Massachusetts Department of Business and Technology and Seaport Advisory Council by Reeve & Associates, Yarmouthport, MA, with Global Insight and KKO and Associates, March 29, 2006. Available at http://advancedmaritimetechnology.aticorp.org/short-sea-shipping/fall%20river%20and%20new%20bedford.pdf as of June 30, 2009.

This report assesses the market potential for SSS operations (coastal shipping) to connect the ports of Fall River and New Bedford (ports of Bristol County) with other U.S. ports that would provide a new mode of transportation for freight that is currently moving over the highway. The authors conclude that there is a strong probability of success for such services. They explain the factors they believe would contribute to success, but also identify several obstacles. The authors

also conclude that the reason several prior ventures have failed is due to high costs on both the vessel and port side and slow acceptance of this alternative transport mode. Additionally, most of these earlier short sea initiatives were carried out prior to the current conflux of highway congestion, driver shortages, and high fuel costs that are creating a more favorable environment for short-sea shipping transport alternatives.

A Shipbuilder's Assessment of America's Marine Highways. General Dynamics NASSCO, San Diego, CA, July 30, 2006.

This document summarizes the current state of America's marine highways from NASSCO's perspective. It identifies several obstacles and proposes strategies to overcome them. The authors make a couple of interesting points not specifically emphasized elsewhere, such as (1) Jones Act vessels are more expensive, but their actual "cost penalty" is only about 7% to 9% and this could be reduced through some standardization of design, and (2) it would be better to initiate a service with several small vessels than just one or two large ones, primarily due to redundancy of equipment and frequency of service. They also state that contrary to expectations, the cost of labor in the United States is not a prohibitive factor in the overall cost of a U.S.-built vessel. The United States ranks third or fourth in the hourly cost of labor compared to other key shipbuilding nations. When compared to world-class shipyards, the key differential in shipbuilding cost is volume.

A Survey of Short Sea Shipping and Its Prospects in the USA. Anastassios N. Perakis and Athanasios Denisis, Department of Naval Architecture & Marine Engineering, University of Michigan, Ann Arbor, MI. *Maritime Policy & Management,* Vol. 35, No. 6, December 2008. Available at http://americasmarinehighways.com/userfiles/MPM-PerakisDenisis-SSSsurvey.pdf as of June 30, 2009.

There are obstacles, administrative barriers, and challenges to the success of SSS in both North America and Europe that should be addressed. Several successful operations on both sides of the Atlantic make a strong case in favor of SSS. SSS can develop customized and technologically advanced solutions that will further integrate it into the intermodal transportation chain and will improve its image among shippers as a mode that can provide reliable door-to-door transportation. This paper reviews several studies on the subject and discusses the latest developments on SSS in the United States and in Europe. It also addresses the major issues and benefits of SSS and examines the prospects for potential short sea operations in the United States.

Atlantic Canada Short Sea Shipping Background Study. Prepared for Transport Canada by MariNova Consulting Ltd., Halifax, NS, Canada and Dr. Mary R. Brooks, Dalhousie University, Halifax, NS, Canada, 2003. Available at http://www.tc.gc.ca/pol/en/acf/shortseaS/workshop/Atlantic_Canada_SSS.pdf as of June 30, 2009.

This study presents a detailed analysis of relevant domestic and international coastal marine services and regulatory impediments relating to the introduction of additional SSS on the East Coast. It summarizes recent developments in SSS from a corporate and strategic perspective in Atlantic Canada, Europe, and the United States. A description of recent developments in terms of technology also is included. The authors identify regulatory impediments relating to the introduction of additional SSS on the East Coast. They also summarize crosscutting issues to be addressed as Canada moves forward toward an SSS agenda.

Bi-State Domestic Freight Ferries Study. A.L.C. de Cerreno, M. E. Robins, P. Woods, A. Strauss-Wieder, and R. Yeung, Rudin Center for Transportation Policy & Management, New York University, Robert F. Wagner Graduate School of Public Service, New York, September 2006. Available at http://wagner.nyu.edu/rudincenter/files/domesticFreightFerries.pdf as of June 30, 2009.

This study is a detailed analysis of the feasibility of freight ferries as an alternative for domestic truck freight movements that cross the Hudson River via existing bridges and tunnels. It focuses on intra-harbor ferries that would carry domestic freight that would otherwise be transported by truck over the roadway network. In addition, this study concentrates on the key factors that have spurred freight ferry markets and use in other locations, rather than trying to identify specific

routes or locations. The most important conclusion of the study is that a freight ferry would not provide the time and/or cost savings necessary to attract general freight movement given current, "tolerable" levels of congestion and shippers' preference for single-line (all highway) service. Thus, without public policy intervention and leadership, it is unlikely that a ferry market for trucks will readily develop on its own.

Charleston as an S3 Port. Presentation by John E. Cameron, TradeWorthy, Inc. at America's Marine Highways Workshop, Charleston Technology Institute, Charleston, SC, October 21–23, 2008. Available at http://advancedmaritimetechnology.aticorp.org/short-sea-shipping/nsrp-pdmt-americas-marine-highways-workshop-october-2008/John%20Cameron%20Operators%20Panel.pdf as of June 30, 2009.

This presentation mentions several marine highway ventures currently operating in Charleston that have been successful so far. They include a lightering service that takes coal and scrap from ocean carriers to barges that in turn move the cargo 5 mi farther inland to power and steel plants. The port also receives refined product and chemical raw material from "hub" ports elsewhere. Additionally, the port receives aviation fuel from deep draft vessels and moves it by barge to military installations. Some outbound military hardware shipments also arrive by barge. The presentation mentions challenges faced by Charleston and other East Coast ports in developing coastal shipments.

Columbia Snake River System and Oregon Coastal Cargo Ports Marine Transportation System Study, Appendix C: Short Sea Shipping in the Columbia/Snake River System. Prepared for the Center for Economic Development Education and Research by Pacific Northwest Waterways Association, Portland, OR, June 2005. Available at http://advancedmaritimetechnology.aticorp.org/short-sea-shipping/columbia%20snake%20river.pdf as of June 30, 2009.

This paper discusses the reasons for success of container services on the Columbia/Snake River System. Three major factors are identified: cooperation, commodity mix, and geography. Ports, barge lines, shippers, and steamship lines were all committed to making the concept successful. Freight was low value, non time-sensitive cargo that could afford the extra couple days of transit time in exchange for the lower transportation cost. Further, the cargo was concentrated in very close proximity to the river system. The paper also describes how geography played a role. The paper examines three possibilities for further expansion: feeder service for containerized cargo currently moving in domestic and international trade, shifting current domestic cargo movements from road and rail to water, and the generation of new domestic cargo movements utilizing the economic efficiencies of coastwise SSS.

CREATES3. *Ships and Shipping,* Vol. 7 No. 7, Baird Publications, Southbank, Australia, April 2007, p. 20.

This article describes a research project funded by the European Commission that brings together some of the leading companies in SSS and ship design with the aim of developing a new generation of short sea vessels utilizing advanced design and manufacturing techniques.

Cross Border Shortsea Shipping Study. Prepared for Transport Canada by Cambridge Systematics, Inc., Oakland, CA with Moffatt & Nichol Engineers, May 2004. Available at http://resources.wcog.org/border/sss_phase1report.pdf as of June 30, 2009.

The study focuses on the U.S.-Canada Cascade Gateway Region in the Northwest. It summarizes the existing SSS services (both domestic and cross-border) that may provide a building block in the development of any future services and describes how legal, regulatory, institutional, operational, and economic factors will affect success of a future service. It notes a number of factors that have contributed to the decline of cross-border services. It discusses various vessel types that could be used. The authors conclude that cabotage rules (Coasting Trade Act in Canada and Jones Act in United States) do not seem to play a significant role in cross-border short sea services; neither do port infrastructure constraints.

Cross Harbor Freight Movement Major Investment Study. Prepared by Edwards and Kelcey Engineers, Inc., for New York City Economic Development Corporation, New York, May 2000. Available at http://www.crossharborstudy.com/finalrep.pdf as of July 7, 2009.

The purpose of this study was to develop a strategy for improving the region's movement of goods across New York Harbor. During the first year of the MIS, 15 conceptual alternatives and implementation strategies were identified. Through an extensive screening process, these strategies were narrowed to three alternatives that then underwent rigorous analysis, including (1) Transportation Systems Management (TSM)/railcar float system—an alternative that combines improved railcar barge service with new rail barges and transfer bridges; (2) rail freight tunnel between Staten Island, NY, and Brooklyn; and (3) rail freight tunnel between Jersey City, NJ, and Brooklyn. Each alternative was analyzed with respect to freight market diversion to rail, benefits, capital and operating costs, benefit-cost, and financing.

Driving Factors and Potential Impacts of Future Increases in Short Sea/Inland Waterway's Share of Total Freight Movements. Commission Briefing Paper 4B-09. Prepared by Reeve & Associates, Yarmouthport, MA, for National Surface Transportation Policy and Revenue Study Commission, January 11, 2007. Available at http://transportationfortomorrow.org/final_report/pdf/volume_3/technical_issue_papers/paper4b_09.pdf as of June 30, 2009.

This paper focuses on the diversion of traffic from highways to coastal shipping. It states that the marine highways' main advantage is cost competitiveness. A number of truckload operators were reported as saying that the slower speeds would not be a strong disadvantage for significant volumes of freight given the cost differential. A key constraint is the high cost of U.S. shipbuilding for Jones Act vessels. These vessels would be unemployable in other services, thereby creating additional risk.

Feasibility Assessment of Short Sea Shipping to Service the Pacific Coast. Prepared by TranSystems/Manalytics International, San Francisco, CA, CDI Marine Company, Severna Park, MD, Matthew P. Tedesco, Seattle, WA, and Westar Transport, Selma, CA for Center for the Commercial Deployment of Transportation Technologies, Long Beach, CA, December 2006. Available at http://advancedmaritimetechnology.aticorp.org/short-sea-shipping/CCDOTT%20WEST%20COAST%20PHASE%20I%20PM%20REPORT.pdf as of August 28, 2009.

The objective of this study is to demonstrate the preliminary market, economic, and technical feasibility of a commercial short sea service on the Pacific Coast that handles domestic and international (feeder) freight moving between major transportation hubs and population centers. The effort also addresses the potential emissions of SSS compared to traditional trucking and the military applications of short sea service and vessels, including their scope for contributing to military deployment requirements.

Feeder Port: Bi-State Port is East Coast Hub for All-Water Container Feeder Services. *Via Port of New York-New Jersey,* New York, Vol. 39, No. 6, June 1987.

This article provides excellent background on the Northeast services provided by McAllister Brothers and Hale Container Line in the 1980s.

Financing with the Maritime Administration's Capital Construction Fund. H. Clayton Cook, Seward & Kissel LLP, Washington, D.C. *Marine Money International,* Stamford, CT, October 2007, pp. 47–56. Available at http://www.sewkis.com/files/Publication/cd9ed626-1de1-410e-a62f-4331fa0eb081/Presentation/PublicationAttachment/c8fb1ad3-c60a-488c-97a2-049e55e92967/200710_HClaytonCook.pdf as of June 30, 2009.

This article shows how the Capital Construction Fund could help businesses needing to finance the construction of new vessels. It cites statistics on the use of the CCF and Title XI programs since WWII. It also discusses changes to CCF included in HR 3221. This bill was later incorporated into HR 6, which was later passed into law.

Four Corridor Case Studies of Short-Sea Shipping Services: Short-Sea Shipping Business Case Analysis. Submitted to U.S. Department of Transportation, Office of the Secretary, by Global Insight, Lexington, MA, in Association with Reeve & Associates, August 15, 2006. Available at http://advancedmaritimetechnology.aticorp.org/short-sea-shipping/DOT_SSS_final_report_v2_11.pdf as of June 30, 2009.

This study evaluates four potential traffic lanes as business case studies for the SSS concept in order to identify the potential for market viability of such services, as well as any key challenges

to that success being achieved, and the steps that may be taken to overcome any such obstacles. The commercial feasibility of a SSS operation for each of the corridors was evaluated on the basis of potential costs and benefits from a number of perspectives including transportation cost, transit times, schedule reliability, required investment and foregone investment in other modal facilities and infrastructure, environmental impact, job creation, and national security issues.

Freight Transportation, Short Sea Shipping Option Shows Importance of Systematic Approach to Public Investment Decisions. Report No. GAO-05-768. U.S. Government Accountability Office, Washington, D.C., July 2005. Available at http://advancedmaritimetechnology.aticorp.org/short-sea-shipping/SSS%20Options%20-%20GAO%20Report.pdf as of July 7, 2009.

This report describes (1) why SSS is being considered and factors affecting its viability, (2) the department's role in the development of this option, and (3) issues that should be considered by public transportation decision makers when making investment decisions about this option or other types of projects for addressing freight mobility challenges. This report is based on a review of pertinent studies, federal activities, and an examination of two new SSS operations.

Gateways, Corridors and Competitiveness: An Evaluation of Trans-European Networks and Lessons for Canada. Paper presented by Roger Vickerman, Centre for European, Regional and Transport Economics, University of Kent, Canterbury, United Kingdom, at Canada's Asia-Pacific Gateway and Corridor Initiative, Vancouver, BC, Canada, May 2–4, 2007. Available at http://www.gateway-corridor.com/roundconfpapers/documents/Vickerman_Roger_Vancouver.pdf as of June 30, 2009.

In this paper, the author analyzes the Trans-European Networks (TEN) Program to see if it has accomplished its stated objectives and then looks at how lessons learned could be applied to Canada. The author concludes that, overall, these projects are not producing the economic benefit to users and shippers that was expected. He points out that although the TEN has principally been about investment in new capacity, measures to improve the performance of the existing network could be equally as important. The author applies concepts gleaned from the analysis of the TEN Program that could be relevant to Canada.

Greater Vancouver Short-Sea Container Shipping Study Pre-Feasibility Report. Novacorp International, Vancouver, BC, Canada, in association with JWD Group, January 2005. Available at http://www.gvgc.org/pdf/GVGC_Executive_Summary_SSS_PreFeasibility_Report_Final.pdf as of June 30, 2009.

The main objective of this study was to determine the likely commercial viability of an SSS network connecting the lower Canadian mainland's container terminals with remote short sea terminals and nearby container businesses along the Fraser River. It provides several important conclusions, including that intra-regional short sea container shipping in Greater Vancouver offers promising, commercially viable, private sector opportunities; it is critical for short sea container terminals to be strategically located close to (or have sufficient land to establish) a variety of container industry facilities and businesses and to have, on-site or nearby, rail inter-modal capability; and the levels of freight required to secure sufficient base, container transfer volume commitments are relatively low and are achievable.

Great Lakes Marine Transportation System. White Paper Prepared for the Midwest Freight Corridor Study, Richard D. Stewart, Great Lakes Maritime Research Institute, Superior, WI, April 12, 2006. Available at http://wupcenter.mtu.edu/education/great_lakes_maritime/lessons/Grt-Lks-Maritime_Transportation_System_Report_Stewart.pdf as of June 30, 2009.

This paper provides a good overview of the Great Lakes Marine Transportation System. It contains an historical perspective of the system and a comprehensive description of the current system. It discusses both the physical and non-physical challenges to optimizing the system. The paper also offers some possible opportunities for optimizing the system.

Green Ships Can Fight Global Warming. Stas Margaronis, Santa Maria Shipping LLC, Santa Rosa, CA, 2008. Available at http://www.greenships.org/greenships.pdf as of June 30, 2009.

This is primarily a promotional piece for SSS, but it provides good insights into technological and financial needs of U.S. shipyards.

Harbor Maintenance Funding. John F. Frittelli, Congressional Research Service, Washington, D.C., January 13, 2004.

This report provides a history of the Harbor Maintenance Tax, an assessment of the current situation, the impact of large containerships, alternative funding options, and issues for Congress to address.

High Speed Ferry and Coastwise Vessels: Assessment of a New York/Boston service. Prepared by National Ports and Waterways Institute, University of New Orleans, for Center for the Commercial Deployment of Transportation Technologies (CCDoTT), Long Beach, CA, May 2003. Available at http://advancedmaritimetechnology.aticorp.org/short-sea-shipping/NY_Boston_Final.pdf as of June 30, 2009.

As it assesses the feasibility of a New York/Boston coastwise service, this study describes the desired characteristics of the terminals that would handle this freight. It analyzes transit time and service frequency requirements. The study also identifies and evaluates the Columbia Coastal New York/Boston Service and the New York Barging Initiative. It also includes quite a bit of discussion on vessel characteristics and potential utilization by the military.

In Search of the Link between Ship Size and Operations. Christa Sys, Ghent University, Tweekerkenstraat, Gent, Belgium. *Transportation Planning and Technology,* Taylor & Francis Limited, Reading, Berkshire, United Kingdom, Vol. 31, No. 4, August 2008, pp. 435–463. Available at http://pdfserve.informaworld.com/672437_751309485_901811710.pdf as of June 30, 2009.

The paper assesses the link between ship size and operations, given current discussions about the increase in container vessel scale. It finds that (1) ship size and operations are linked; (2) optimal ship size depends on transport segment (deep-sea vs. short sea shipping), terminal type (transshipment terminals vs. other terminals), trade lane (east-west vs. north-south trades) and technology; and (3) a ship optimal for one trade can be suboptimal for another. It specifically discusses "intraregional" (SSS) trade.

Letter to President's Advisory Panel on Federal Tax Reform. American Association of Port Authorities, Alexandria, VA, April 4, 2005. Available at http://www.aapa-ports.org/files/PDFs/AAPAletter_advisorypanel_taxreform.pdf as of June 30, 2009.

This letter from AAPA to the Advisory Panel describes the Harbor Maintenance Tax and how much domestic cargoes contribute to the Harbor Maintenance Fund. The letter advocates the exemption of domestic shipping from the HMT.

Markets for Short-Sea Shipping in the United States. Remarks by John G. Reeve, Reeve & Associates, Yarmouthport, MA, at NSRP PDMT Short Sea Shipping Workshop, Orlando, FL, April 19–20, 2007. Available at http://advancedmaritimetechnology.aticorp.org/short-sea-shipping/nsrp-pdmt-short-sea-shipping-workshop-april-19-20-2007-presentations/2A_Reeve_Markets.pdf as of June 30, 2009.

This presentation discusses domestic freight flows in a general sense. It discusses the issues of traffic density, scheduling, and vessel strings. It proposes the "best" vessel type for the development of coastal traffic. It presents a comparison of marine highway costs versus truck and rail for the North Atlantic/South Atlantic and Gulf Coast/North Atlantic corridors. It closes by emphasizing the high cost of building vessels in U.S. shipyards.

Motorways of the Sea Port Requirements: The Viewpoint of Port Authorities. Ana C. Paixao Casaca, Amarrações e Serviços Maritimos, ESPRIM - Centro de Acostagens, Lda, Lisboa, Portugal. *International Journal of Logistics: Research and Applications,* Taylor & Francis, London, UK, Vol. 11, No.4, August 2008, pp. 279-294. Available at http://www.informaworld.com/smpp/ftinterface~content=a791807242~fulltext=713240930, as of June 30, 2009.

The European Commission sees Motorways of the Sea as a floating infrastructure capable of consolidating freight along certain trade routes where ports are special interfaces characterized by particular features. To identify these features, an investigation was carried out by means of an e-mail survey questionnaire. The findings show the viewpoint of port authorities regarding this matter and suggest a list of 21 prerequisites that ports can use to assess their potential as a Motorway of the Sea interface. In addition, they can be used by governmental bodies when deciding whether to financially support Motorways of the Sea interface projects.

Motorways of the Sea. James D. Frost, MariNova Consulting, Halifax, NS, Canada. *Great Lakes Seaway Review,* Vol. 34, No. 3, Jan/Mar 2006, pp. 55–56.

This article summarizes a study done to analyze the possibility of moving international container cargo between the Port of Halifax and southwestern Ontario. The study concludes that even though there is considerable interest in SSS from a marketing perspective, with existing rail rates between Halifax and Toronto, a short sea service based purely on international cargo, is not financially viable since the largest customers of CN also pay the lowest rates to the railway. It also concludes that SSS does not offer enough frequency for domestic shipments. The article summarizes policy and regulatory matters that need to be addressed.

NAFTA and Short Sea Shipping Corridors. Mary R. Brooks, Atlantic Institute for Market Studies Commentary, Halifax, NS, Canada, November 2005. Available at http://www.aims.ca/library/AtlanticaBrooks.pdf as of June 30, 2009.

This article summarizes current and potential marine services within NAFTA and lists key regulatory barriers to short sea NAFTA corridor development.

Operational Development of Marine Highways to Serve the Pacific Coast. Paper presented by D. Bagnell, C. Saunders, R. Silva, and M. P. Tedesco, at Transportation Research Board Annual Meeting, Washington, D.C., January 2009.

This paper examines market volumes, service times, vessel characteristics, and economics for marine highways serving the Pacific Coast. The authors conclude that current truck rates are not high enough for marine highways to compete on the basis of cost in short next-day turnaround markets such as northern to southern California. Marine highways are viable for longer routes such as California to the Pacific Northwest, where truck rates are higher and both distance and trucking hours of service regulations permit vessels to be time competitive at slower speeds.

Operator's Perspective. Remarks by T. Presti, National Shipping of America, San Francisco, CA, at the NSRP PDMT Short Sea Shipping Workshop, Orlando, FL, April 19–20, 2007. Available at http://advancedmaritimetechnology.aticorp.org/short-sea-shipping/nsrp-pdmt-short-sea-shipping-workshop-april-19-20-2007-presentations/3B_Presti_Operator_Perspective.pdf as of July 1, 2009.

This presentation describes the attempts of National Shipping of America to establish a service between Freeport, TX, and Chester, PA. It describes the obstacles faced by shippers using rail or truck services between these two markets and how NSA's service can overcome them. It also describes the "sales points" it is using to promote its service and gives a detailed description of the vessel NSA plans to use.

Potential Impact of Short Sea Shipping in the Southern California Region. Prepared for METRANS by Hanh Dam Le-Griffin and James E. Moore II, University of Southern California, Los Angeles, February 2006. Available at http://advancedmaritimetechnology.aticorp.org/short-sea-shipping/04-04_Final_southern%20california.pdf as of July 27, 2009.

This study evaluates the potential of SSS in the context of the West Coast. This evaluation finds that SSS could be a viable strategy within a regional port system. It identifies opportunities for redirecting empty container flows to secondary ports, as well as with international movements to and from the manufacturing areas on the U.S.-Mexico border. The use of Ro/Ro vessels was determined to be suitable for initial operations.

Potential Policies and Incentives to Encourage Movement of Containerized Freight on Texas Inland Waterways. Report 0-5937-1. C. James Kruse, and Curtis A. Morgan, Texas Transportation Institute, Texas A&M University, and Nathan Hutson, Center for Transportation Research, University of Texas for Texas Department of Transportation, Austin, TX, March 2009. Available at http://tti.tamu.edu/documents/0-5937-1.pdf as of July 7, 2009.

This report is designed to answer three basic questions: (1) Why is the Texas Department of Transportation (TxDOT) interested in moving more cargo by water? (2) What are the potential benefits of moving more cargo by water? (3) What specific steps can TxDOT or the State of Texas take to encourage more waterborne freight movements? In this report, the authors describe the need for increased utilization of marine freight options, look at the challenges involved, and describe the potential benefits of increasing the utilization of marine freight options. The authors

provide a summary of relevant programs in Europe and the activities of other gulf states. The report recommends several steps TxDOT could pursue in the short term to encourage more waterborne shipments along the coast.

Several appendices provide detailed background material on federal issues, legislation, the Energy Independence and Security Act of 2007, and the role of waterborne freight in Texas.

Potential Short Sea Shipping Market for the West Coast. Remarks by Bill Kruse, TranSystems/Manalytics International, San Francisco, CA at NSRP PDMT Short Sea Shipping Workshop, Orlando, FL, April 19-20, 2007. Available at http://advancedmaritimetechnology.aticorp.org/short-sea-shipping/nsrp-pdmt-short-sea-shipping-workshop-april-19-20-2007-presentations/2B_Kruse_Markets.pdf as of July 1, 2009.

These remarks discuss a study of shippers and intermediaries regarding their perceptions on SSS. Listed are the barriers that were identified and what might be done to encourage more SSS is mentioned.

Proposal for a Regulation of the European Parliament and of the Council Establishing the Second "Marco Polo" Programme for the Granting of Community Financial Assistance to Improve the Environmental Performance of the Freight Transport System ("Marco Polo II") (COM/2004/0478 final—COD 2004/0157). European Parliament, August 6, 2009. Available at http://eur-lex.europa.eu/smartapi/cgi/sga_doc?smartapi!celexplus!prod!DocNumber&lg=EN&type_doc=COMfinal&an_doc=2004&nu_doc=0478 as of January 4, 2010.

Relying on the proven mechanisms of the current Marco Polo Program, the commission proposes two new types of action: Motorways of the Sea and Traffic Avoidance. The objective is to reduce international road freight. Marco Polo II also enlarges the scope of the program to all neighbors of the European Union. It stresses the role of rail freight and clarifies the scope for certain infrastructure measures. Based on an independent ex-ante evaluation, the commission proposes an overall budgetary envelope of 740 million EUR for the period 2007–2013, i.e., roughly 106 million EUR per year. This will shift more than 140 billion tonne-kilometres of freight off the road (equivalent to 7 million truck journeys of 1000 kilometres) and will reduce CO2 emissions by 8400 million kg.

Putting Marine Highways on the Map. Presentation by Paul Bea, Coastwise Coalition/PHB Public Affairs, Washington, D.C., to Short Sea Shipping Symposium (UMass Dartmouth), March 26–27, 2008. Available at http://www.umassd.edu/sustainability/bea.pdf as of July 1, 2009.

This presentation puts forth several federal policy changes the Coastwise Coalition believes are important to the success of SSS.

Reducing Freight Greenhouse Gas Emissions in the California Corridor: The Potential of Short Sea Shipping. Paper presented by B. Zou, M. Smirti, and M. Hansen, University of California at Berkley, at Transportation Research Board Annual Meeting, Washington, D.C., January 2009. Available at http://www.uctc.net/papers/856.pdf as of July 1, 2009.

The authors claim that an SSS service on the West Coast is justifiable from both demand and operational perspectives. They state that reliability is key to the SSS's market penetration. The economic potential of SSS is dependent on carrier-based efforts, but government intervention can incentivize its development.

Restructuring the Marine Transportation Industry: Global Overview of Sustainable Development Practices. C. Comtois, Centre for Research on Transportation, Université de Montréal, Montreal, QC, Canada, and B. Slack, Centre for Research on Transportation, Concordia University, Montreal, QC, Canada, for Ministère des Transport Quebec, Montreal, QC, Canada, April 2007. Available at http://www.mtq.gouv.qc.ca/portal/page/portal/Librairie/Publications/en/ministere/etudes/rtq0701.pdf as of July 1, 2009.

The focus of this study is sustainable development practices, but one chapter focuses specifically on short sea shipping. It describes the operational challenges confronting SSS as an industry. The authors include regulatory issues (tax, documentation, and tolls), intermodal integration, physical constraints, port issues, and economics from both private and public perspectives. The study includes an analysis of the potential of SSS for the Great Lakes–St. Lawrence Seaway system.

Short-Sea and Coastal Shipping Options Study: Final Report. Prepared for I-95 Corridor Coalition by Cambridge Systematics, Cambridge, MA, November 2005. Available at http://advancedmaritimetechnology.aticorp.org/short-sea-shipping/SSS%20Study%20-%20I95%20Cooridor%20Coalition.pdf as of July 1, 2009.

This study presents a thorough analysis of the SSS marketplace on the East Coast. It details those ports that currently utilize SSS operations, describes the primary SSS operators, and describes the key issues that affect SSS operations in the region. The study also details the results of more than 40 interviews with SSS stakeholders within the I-95 Corridor Coalition region, incorporating general findings, current obstacles to SSS, the potential effects and impacts of increased SSS operations, and the potential role of MPOs, DOTs, and port authorities in promoting SSS. Using FHWA data, it maps key flows to highlight the primary freight movements that are most applicable to SSS operations. Finally, it details conclusions about the potential for expanded SSS operations, and provides recommendations for potential next steps in supporting SSS activities and initiatives.

Short Sea Developments in Europe: Lessons for Canada. Mary R. Brooks, Dalhousie University, Halifax, NS, Canada, and James D. Frost, CPCS Transcom, Ottawa, ON, Canada. Working Paper No. 10 for North American Transportation Competitiveness Research Council, July 2009. Available at http://myweb.dal.ca/mrbrooks/TRC%20WP%2010.pdf as of September 10, 2009.

This paper explores the European experience from two perspectives: (1) it looks at both public- and private-sector investment in new short sea services and in short sea service design and vessel deployment and (2) it discusses the regulatory environment and the EU-wide promotion programs put in place to support this investment from a public policy perspective. The paper closes with conclusions that may be drawn for Canadian public policy developers.

Short Sea Shipping: A Canadian Perspective. Mary R. Brooks, Dalhousie University, Halifax, NS, Canada, and James D. Frost, MariNova Consulting Ltd., Halifax, NS, Canada. *Maritime Policy & Management,* Vol. 31, No. 4, October–December 2004, pp. 393–407. Available at http://pdfserve.informaworld.com/325805_751309485_713724044.pdf as of July 1, 2009.

This paper explores the key issues with respect to further development of SSS from a Canadian perspective. It looks at both Canadian domestic activity as well as cross-border trade with the United States. The paper concludes with questions that Canadian policymakers need to address.

Short Sea Shipping in North America: Policy and Institutional Issues. Presentation by M.R. Brooks and J.R.F. Hodgson, Dalhousie University, Halifax, NS, Canada, and J.D. Frost, MariNova Consulting Ltd., Halifax, NS, Canada, to North American Marine Conference, Vancouver, BC, April 19, 2006. Available at http://www.tc.gc.ca/policy/acf/shortseaS/namc2006/brooks.pdf as of July 1, 2009.

Six policy issues are presented and discussed. Among the most pertinent to this NCFRP study are (1) U.S. Harbor Maintenance Tax, (2) modal differences in Customs notice requirements, and (3) resistance to modal switching.

Short Sea Shipping in North America: Understanding the Requirements of Atlantic Canadian Shippers. M.R. Brooks and Valerie Trifts, Dalhousie University, Halifax, NS, Canada. *Maritime Policy & Management,* Vol. 35, No. 2, April 2008, pp.145–258.

This paper builds a model to explain how shippers purchase freight transportation services and then, using that model, examines how they make choices between service options in order to predict how they will likely make choices when faced with a new transport mode option—short sea shipping—which does not exist on the routes examined. Currently, shippers in the geographic market use trucks as their primary transport mode because shipping lines serving global markets do not proactively solicit the short sea business and rail shipments are very circuitous to this destination.

Short Sea Shipping Market Study. J.D. Frost, D. Hawkins, P. Morin, and R. Hodgson, MariNova Consulting Ltd., Halifax, NS, Canada for Transport Canada, Transportation Development Centre, Montreal, QC, Canada, September 2005. Available at http://www.tc.gc.ca/innovation/tdc/projects/marine/a/5563.htm as of July 1, 2009.

This study was initially predicated on international container cargo moving between the Port of Halifax and southwestern Ontario. It concludes that a short sea service based purely

on international cargo is not financially viable. Unfortunately, SSS does not offer domestic shippers enough frequency for domestic shipments. A major hurdle to overcome is that of providing uninterrupted service in winter. The report also discusses several Canadian policy and regulatory matters. The authors suggest routes that they believe have the highest probability of success for East Coast Canadian ports.

Short Sea Shipping on the East Coast of North America: An Analysis of Opportunities and Issues. M.R. Brooks and J.R. Hodgson, Dalhousie University, Halifax, NS, Canada, and J.D. Frost, MariNova Consulting Ltd., Halifax, NS, Canada, March 31, 2006. Available at http://advancedmaritimetechnology.aticorp.org/short-sea-shipping/ShortSeaShipping_dalhousie.pdf as of July 1, 2009.

This study analyzes four key aspects of SSS: the demand for the service, shipper requirements, commercial potential, and the business and regulatory climate. It identifies four potential markets, although the traffic flow is significantly imbalanced. It discusses what shippers want in terms of transit time, customs procedures, pricing, and the Harbor Maintenance Tax. It analyzes vessel requirements and notes the lack of availability of suitable vessels. It suggests that partnering with trucking interests would be an effective way to develop such a service. Finally, it addresses policy and regulatory issues.

Short Sea Shipping Port Probability Study. Commissioned by Canaveral Port Authority. Prepared by Maritime Transport & Logistics Advisors, LLC, Ft. Lauderdale, FL, March 4, 2005.

This study addresses the U.S. Department of Transportation's recent focus on the Marine Transportation System, SSS, and a national transportation policy that involves all modes of travel; the State of Florida's Strategic Intermodal System; and the Port Authority of New York and New Jersey's Port Inland Distribution Network (PIDN), which was operating at the time of the study. The study includes the results of interviews of key transportation sectors and chapters on new technologies, geographic considerations, operational results, and new initiatives.

Short Sea Shipping (S3) Roadmap. John Malone and Matthew P. Tedesco, Seattle, WA, September 30, 2007. Available at http://advancedmaritimetechnology.aticorp.org/short-sea-shipping/Final%20Roadmap.pdf as of July 1, 2009.

This document is the final deliverable under the National Shipbuilding Research Program (NSRP) project entitled "Shipbuilding Opportunities in Short Sea Shipping." The document proposes investment areas and tasks to (1) engage U.S. shipbuilders in the advancement of SSS as a potential market, (2) provide benefit to U.S. commercial shipbuilding in general, and (3) provide benefit to U.S. Navy ship construction programs. The analysis is limited to tasks that are within the scope and charter of the NSRP.

Short Sea Shipping Workshop: Current State Document. Prepared for National Shipbuilding Research Program by John Malone and Matthew P. Tedesco, Seattle, WA, April 2007. Available at http://advancedmaritimetechnology.aticorp.org/short-sea-shipping/current_state_pdf.pdf as of July 1, 2009.

This document was prepared as a discussion guide for the National Shipbuilding Research Program Short Sea Shipping Workshop held in Orlando in April 2007. Among the items discussed are regulatory and legislative considerations directly related to the development of SSS.

Short-Sea Vessel Service and Harbor Maintenance Tax. National Ports and Waterways Institute, University of New Orleans, October 2005. Available at http://advancedmaritimetechnology.aticorp.org/short-sea-shipping/HMT.pdf as of July 1, 2009.

This paper makes the case for the exemption of SSS services from the Harbor Maintenance Tax. It provides some in-depth analysis of the effect the HMT has on the cost structure of SSS services and looks at how much the proposed exemption would affect federal revenues.

Statement of Collister Johnson, Jr. Statement by the Administrator, Saint Lawrence Seaway Development Corporation, Washington, D.C., before the Subcommittee on Coast Guard and Maritime Transportation, Committee on Transportation and Infrastructure, U.S. House of Representatives, February 15, 2007. Available at http://transportation.house.gov/Media/File/Coast%20Guard/20070215/SLSDC%20SSS%20Johnson.doc as of July 1, 2009.

These remarks focus on (among other things) the idea of reducing cross-border congestion and the concept of increasing Great Lakes cross-shipments. They specifically identify the barriers of the Harbor Maintenance Tax and U.S. Customs regulations as the two most significant obstacles.

Study on Potential Hub-and-Spoke Container Transhipment Operations in Eastern Canada for Marine Movements of Freight (Short Sea Shipping). Prepared for Transport Canada by James Frost and Marc-André Roy, CPCS Transcom Limited, April 2007. Available at http://www.tc.gc.ca/policy/report/acf/tp14876/menu.htm as of September 10, 2009.

The objectives of this study were to (1) improve the understanding of existing container hub-and-spoke operations and the factors contributing to their success, (2) situate regional SSS movements in the international hub-and-spoke container context, (3) identify and evaluate the success of existing and potential future SSS initiatives on the East Coast of Canada, including opportunities at the design stage of freight movements, and (4) gauge the advantages, disadvantages, and perceptions of SSS on the East Coast of Canada.

Testimony Regarding Maritime Administration Title XI Loan Guarantee Program. Testimony by H. Clayton Cook, Jr., Seward & Kissel LLP, Washington, D.C., before the Subcommittee on Seapower and Expeditionary Forces, Committee on Armed Services, U.S. House of Representatives, March 15, 2007. Available at http://advancedmaritimetechnology.aticorp.org/short-sea-shipping/HAS%20031507%20FNL%20PKG%20%282%29.pdf as of July 1, 2009.

This testimony explains the need for better long-term financing for the purchasers of U.S.-built vessels. It supports the Title XI program and offers a few modifications that, in the opinion of the author, would make the program more effective.

The Abandoned Ocean: A History of United States Maritime Policy. A. Gibson and A. Donovan, University of South Carolina Press, Columbia, SC, 2000.

This book provides background on the legal framework for domestic marine transportation in the United States and the domestic shipbuilding industry. It explains, in proper historical detail, the original rationale behind many of the policies that govern maritime policy in the United States and, as such, provides a framework for assessing the extent to which the basic conditions underpinning those policies have changed. It also ties together changes in maritime policy with other modes of transportation as well as the confluence of military with commercial interests.

The Competitiveness of Short Sea Shipping in Multimodal Logistics Supply Chains: Service Attributes. Ana C. Paixao Casaca and Peter B. Marlow, Transport and Shipping Research Group, Cardiff Business School, Cardiff, United Kingdom. *Maritime Policy & Management,* Vol. 32, No. 4, October–December 2005, pp. 363–382 Available at http://pdfserve.informaworld.com/382436_751309485_727771787.pdf as of July 1, 2009.

This paper identifies service attributes of short shipping operations that are most important to the success of such operations. It provides a good overview of current European logistics, the European SSS industry, and issues that are important to the success of SSS ventures.

The Development of Short Sea Shipping in the United States. Comments submitted by S.P. Flott, Chairman, SeaBridge Inc., Arlington, VA, before the Subcommittee on Coast Guard and Maritime Transportation, Committee on Transportation & Infrastructure, U.S. House of Representatives, February 15, 2007. Available at http://transportation.house.gov/hearings/Testimony.aspx?TID=5460&NewsID=32 as of July 1, 2009.

The comments describe the plans of Seabridge, Inc. to introduce high-speed, scheduled, long-haul roll-on/roll-off freight and passenger ferry services between major population centers along the East and Gulf Coasts, using an innovative vessel design and state-of-the-art port facilities. Also discussed is the idea of teaming with long-haul truckers to develop the service.

The Development of Short Sea Shipping in the United States. Statement of Gregg M. Ward, Vice President, Detroit–Windsor Truck Ferry, Detroit, MI, before the Subcommittee on Coast Guard and Maritime Transportation, Committee on Transportation and Infrastructure, U.S. House of Representatives, February 15, 2007. Available at http://transportation.house.gov/Media/File/Coast%20Guard/20070215/Ward.pdf as of July 1, 2009.

These remarks discuss the experience of the Detroit–Windsor Truck Ferry. Mr. Ward makes the claim that the Harbor Maintenance Fee is the single most important barrier the operation faces. He also notes the double collection of agriculture and quarantine inspection fees from the U.S. Department of Agriculture, Animal, and Plant Health Inspection Service (APHIS). Other obstacles include Canadian customs policies, Canadian icebreaking fees, and the lack of transparency of hazardous materials crossing the Detroit–Windsor bridge. He suggests specific measures Congress should investigate.

The Development of Short Sea Shipping the United States: A dynamic Alternative. Thesis submitted by Peter H. Connor to the Department of Ocean Engineering, Massachusetts Institute of Technology, Cambridge, MA, 2004. Available at http://hdl.handle.net/1721.1/33427 as of July 7, 2009.

This paper takes a look at the current uses of SSS in the United States, as well as the system used in Europe. The technology associated with this concept is described and high-speed vessel design is investigated. Issues related to the integration of SSS are examined, including customer requirements, capital financing, and government policy.

The Economics of Motorways of the Sea. Alfred J. Baird, Maritime Research Group, Napier University Transport Research Institute, Edinburgh, United Kingdom. *Maritime Policy and Management,* Vol. 34, No. 4, August 2007, pp. 287–310. Available at http://pdfserve.informaworld.com/32732_751309485_781383776.pdf as of July 1, 2009.

There is a mismatch whereby transport policy throughout Europe accepts the continued state financing of roadway and railway infrastructure but not seaway infrastructure. The author argues that the seaway-equivalent infrastructure of roadways and railways is the deck of a ship. This argument is convincing for a number of reasons, not least because it is relatively easily demonstrated that the sea itself is anything but a free highway (if indeed it is a highway at all), whereas ports simply act as nodes, not as transport platforms. Acknowledgement of what actually comprises seaway infrastructure could have far-reaching implications for the future attractiveness and competitiveness of maritime transport, and should result in more adequate policy mechanisms being introduced to help overcome market distortions and ensure a level playing field between sea and land transport.

The Future of Intermodal Transportation in Memphis and the Mid-South Region (Conference). Presentation by Craig Philip, CEO, Ingram Barge Company, November 9, 2007. Available at http://cifts.memphis.edu/12007_11-09_Ingram_Barge_Future_of_Intermodal_Transportation_cep.ppt as of July 1, 2009.

This presentation discusses the types of markets and commodities that are most suited for a new container-on-barge venture. Transit times and schedule reliability are presented as factors the barge industry can deal with successfully. The presentation closes with several visuals of the work Ingram Barge has done in transporting containers of rubber from New Orleans to Paducah, KY.

The Harbor Maintenance Tax & Congestion Relief. American Association of Port Authorities, Alexandria, VA, September 1, 2005. Available at http://www.aapa-ports.org/files/PDFs/HMT_Coastwise_Paper_01Sept05.pdf as of July 1, 2009.

This brief white paper advocates the exemption of domestic shipping from the Harbor Maintenance Tax and provides some financial justification for doing so.

The Impact of the Trans-European Transport Networks on the Development of Short Sea Shipping. Ana C. Paixao Casaca and Peter B. Marlow, Transport and Shipping Research Group, Cardiff Business School, Cardiff, United Kingdom. *Maritime Economics & Logistics,* Vol. 9, No. 4, December 2007, pp. 302–323. Available at http://pdfserve.informaworld.com/680014_751309485_791807242.pdf as of July 1, 2009.

This paper assesses the impact of the Trans-European Transport Networks (TEN-T) on SSS. To achieve this, the paper describes the SSS market segment, puts the TEN-T policy into a historical perspective, and carries out an assessment of the impact of the TEN-T on SSS. One interesting finding is that although capital has traditionally been seen as the main barrier to

entering into this industry, shipping skills and industry knowledge are becoming the new barriers to overcome.

The Jones Act: An Overview. John F. Frittelli, Congressional Research Service, Washington, D.C., July 8, 2003.

This report provides a brief overview and history of the Jones Act. It discusses the arguments that both proponents and critics make regarding the Jones Act.

The Present and Future of the St. Lawrence-Great Lakes Waterway: What are the issues? J.C. Lasserre, Professor, Université Lumière Lyon 2, Lyon, France, for Transportation Development Centre, Safety and Security, Transport Canada, August 1997. Available at http://www.tc.gc.ca/innovation/tdc/publication/pdf/13000/13085e.pdf as of July 1, 2009.

Although not the focus of the paper, marine highways are mentioned in the paper and it provides insight into the attempts of Manchester Lines to provide a marine highway service from Montreal.

Towards a Short Sea Shipping Strategy. Presentation by Rick Bryant, British Columbia Chamber of Shipping, Vancouver, BC, Canada, to North American Marine Conference, Vancouver, BC, Canada, April 20, 2008. Available at http://www.tc.gc.ca/policy/acf/shortseaS/namc2006/bryant.pdf as of July 1, 2009.

This presentation provides a list of recommendations the Chamber of Shipping believes should be advanced to promote SSS. Recommendations range from marketing to regulatory to taxation issues.

Twin Ports Intermodal Freight Terminal Study: Evaluation of Shipper Requirements and Potential Cargo Required to Establish a Rail-Truck-Marine Intermodal Terminal in the Twin Ports of Superior, Wisconsin and Duluth, Minnesota. Richard D. Stewart, University of Wisconsin–Superior; Robert J. Eger III, University of Wisconsin–Milwaukee; and Libby Ogard and Frank Harder, Tioga Group and Associates, Philadelphia, PA, July 15, 2003. Available at http://www.dot.state.mn.us/ofrw/PDF/Twin%20Ports%20Intmdl%20Terminal%20Study%20-%20FINAL.pdf as of July 1, 2009.

This study examines the potential for an intermodal freight terminal in the metropolitan areas of Duluth, MN, and Superior, WI (Twin Ports). Geographic regions in the United States and Canada are assessed for potential intermodal cargo. Existing intermodal terminals in comparable metropolitan areas are examined and key success factors derived. Major shippers in the region are surveyed to determine freight volume, transportation requirements, and destinations of inbound and outbound freight. Intermodal marketing companies and other third-party providers are surveyed to determine their requirements for an intermodal freight terminal. Reebie (Transearch®) freight flow data between 66 business economic areas (BEAs, which are areas designated by the Department of Commerce; each BEA typically represents a major economic center—e.g., there are six BEAs in Iowa) and the Twin Ports were analyzed for freight volume by mode, destinations, lanes, and load balance. The establishment of a Ro/Ro marine service with Thunder Bay, Ontario, Canada, is examined as a feeder for an intermodal terminal. Operating railyards in the Twin Ports are cataloged and evaluated as potential intermodal terminals. An overall determination of the Twin Port's suitability as an intermodal terminal is presented along with recommendations for implementation.

U.S. Short Sea Shipping: Prospects and Opportunities. Submitted to Short Sea Shipping Cooperative by G.A. Lombardo and C.Q. Guan, Center for Maritime Studies, United States Merchant Marine Academy, Kings Point, NY, and R.F. Mulligan, Western Carolina University, Cullowhee, NC, November 1, 2004. Available at http://advancedmaritimetechnology.aticorp.org/short-sea-shipping/SSS%20Prospects%20and%20Opportunities%20-%20USMMA.pdf as of July 1, 2009.

This study conducts an economic analysis of SSS, examining the cost of building a mono-hull Ro/Ro vessel and the resultant required freight rate for profitable operations. Informed stakeholders were surveyed about the internal and external factors affecting the operations of SSS services. An assessment of port terminal infrastructure needs is presented. Brief discussions of military applications and public policy considerations are offered. One recommendation is for operators to form strategic alliances with trucking companies who could ship a portion of their cargoes via sea.

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APPENDIX H

Acronyms

3PL	Third-Party Logistics
APHIS	Animal and Plant Health Inspection Service
AQI	Agricultural Quarantine Inspection
ARRA	American Recovery and Reinvestment Act of 2009
ATB	Articulated Tug/Barge
BEA	Business Economic Area
CBP	U.S. Customs and Border Protection
CCDoTT	Center for the Commercial Deployment of Transportation Technologies
CMAQ	Congestion Mitigation and Air Quality Improvement Program
CN	Canadian National Railway
COB	Container-on-Barge
CoR	European Committee of the Regions
DWT	Deadweight Tons
EC	European Community
EU	European Union
FBD	Ferry Boat Discretionary Program
GATT	General Agreement on Tariffs and Trade
GHG	Greenhouse Gas
GRT	Gross Registered Tonnage
HMT	Harbor Maintenance Tax
ILA	International Longshoremen's Association
ILWU	International Longshore and Warehouse Union
ITB	Integrated Tug/Barge
LA/LB	Los Angeles/Long Beach
Lo/Lo	Lift-on/Lift-off
LCL	Less Than Container Load
LTL	Less Than Truck Load
MARAD	U.S. Maritime Administration
MoS	Motorways of the Sea
MPO	Metropolitan Planning Organization
MTQ	Ministry of Transport, Québec
NAFTA	North American Free Trade Agreement
NAMH	North American Marine Highways
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NSRP	National Shipbuilding Research Program
NVIC	Navigation and Inspection Circular

NYNJR	New York New Jersey Rail
PAREGES	Programme d'aide visant la réduction ou l'évitement des émissions de gaz à effet de serre
PIDN	Port Inland Distribution Network
Ro/Pax	Roll-on/Roll-off/Passenger
Ro/Ro	Roll-on/Roll-off
S3	Short Sea Shipping
SNAME	Society of Naval Architects & Marine Engineers
SSS	Short Sea Shipping
TEN-T	Trans-European Transport Network
TEU	20-Ft Equivalent Unit
TIFIA	Transportation Infrastructure Finance and Innovation Act of 1998
TSM	Transportation Systems Management
TTI	Texas Transportation Institute
TxDOT	Texas Department of Transportation
WSDOT	Washington State Department of Transportation

Abbreviations and acronyms used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI–NA	Airports Council International–North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation