Study on Opportunities for, and Barriers to, Increasing the Effectiveness of Marine Highways Designated under the U.S. Marine Highway (USMH) Program in Addressing Components in the Maritime Environmental and Technical Assistance (META) Program

Photo courtesy of Port of Greater Baton Rouge

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List of Acronyms

Acronym	Term
AAPA	American Association of Port Authorities
AWO	American Waterways Operators
COB	Container-on-Barge
EPA	Environmental Protection Agency
FY	Fiscal Year
MARAD	Maritime Administration
META	Maritime Environmental and Technical Assistance
MTS	Maritime Transportation System
MSW	Municipal Solid Waste
NDAA	National Defense Authorization Act
NOFO	Notice of Funding Opportunity
RoRo	Roll-on/Roll-off
U.S.C.	United States Code
USCG	U.S. Coast Guard
USDOT	United States Department of Transportation
USMH	United States Marine Highway
VMT	Vehicle Miles Traveled

Executive Summary

This Study is submitted in accordance with Section 3521(d) of the National Defense Authorization Act for Fiscal Year 2024 (Pub. L. 118–31), which directs the Maritime Administration (MARAD) to identify opportunities for, and barriers to, increasing the effectiveness of Marine Highways designated under 46 U.S.C. § 55601 in addressing at least two elements of the Maritime Environmental and Technical Assistance (META) Program, as codified at 46 U.S.C. § 50307.

The United States Marine Highway (USMH) Program was established to support the use of navigable waterways as extensions of the surface transportation system, with the goal of improving freight mobility, relieving landside congestion, and strengthening the resiliency of domestic freight infrastructure. The META Program supports the development and demonstration of emerging technologies and practices that improve the efficiency, safety, and performance of the maritime transportation system. Although these two programs operate under distinct statutory authorities, they are complementary in purpose and practice.

This Study finds that many projects funded under the USMH Program already advance META objectives, even when not explicitly designed to do so. Terminal upgrades, vessel retrofits, operational enhancements, and cargo-handling innovations implemented through USMH grants frequently contribute to improved throughput, better safety outcomes, and more reliable freight service—all of which align with META's programmatic aims. The growing use of container-on-barge (COB) services, increased interest in real-time scheduling and data systems, and broader adoption of intermodal technologies underscore the natural points of alignment between infrastructure-focused investments and performance-oriented innovation.

In evaluating the intersection between the USMH and META programs, the Study draws upon the experience of over 60 Marine Highway projects funded by MARAD since 2010. Examples from Virginia, Louisiana, Washington, New York, and the Great Lakes demonstrate how even modest investments in equipment and service support can yield measurable improvements in operational reliability, cargo flow, safety, and port performance. These examples serve as a foundation for the recommendations presented in this report.

However, this Study identifies barriers that limit fuller alignment between marine highway development and META outcomes. These include infrastructure deficiencies, access to capital for equipment modernization, fragmented regulatory processes, and stakeholder coordination. These barriers, while not unique to marine transportation, present challenges to the USMH Program, which can rely on underutilized corridors, smaller operators, and complex intermodal interfaces.

The Study's findings are consistent with both MARAD's statutory regulations reflecting MARAD's authority under 46 U.S.C. §§ 55601 and 50307 and aligns with the agency's broader role under 49 U.S.C. § 109. The Study affirms that voluntary alignment between Marine Highway investments and META program objectives offers significant public benefit and can be achieved without requiring statutory changes. MARAD can improve the value and impact of Marine Highway projects while advancing broader maritime innovation and operational excellence.

Introduction

The Maritime Administration (MARAD) plays a critical role in shaping the future of maritime transportation in the United States. As part of its mandate to enhance the efficiency, resiliency, and competitiveness of the Nation's maritime infrastructure, MARAD continuously evaluates and refines its programs to address evolving challenges and opportunities. This Study explores how MARAD can identify opportunities for, and barriers to, increasing the effectiveness of marine highways designated under the United States Marine Highway (USMH) Program in addressing components outlined in the Maritime Environmental and Technical Assistance (META) Program. By aligning these two Programs, MARAD optimizes the utilization of the Nation's marine highways as an efficient mode of freight transportation while advancing META's goal of developing new, state-of-the-art technologies. The collaborative efforts required from federal agencies, industry stakeholders, and other key partners assist in achieving the shared goals of the USMH and META Programs, which will result in a more resilient and competitive U.S. Maritime Transportation System (MTS).

Section 3521 (*Reports on Maritime Industry, Policies, and Programs*) of the National Defense Authorization Act for Fiscal Year 2024 (FY24 NDAA (Pub. L. 118-31, December 22, 2023)) requires the Maritime Administrator to complete and make publicly available a Study in which MARAD must identify opportunities for, and barriers to, increasing the effectiveness of marine highways designated under the USMH Program ((46 United States Code (U.S.C.) § 55601)), in addressing two or more of the components described in clauses under META (46 U.S.C. § 50307(a)(2)). These are as follows:

- Improving environmental performance, including reducing air emissions, water emissions, or other ship discharges (46 U.S.C. § 50307(a)(2)(A)(i).
- Improving environmental performance, including increasing fuel economy or the use of alternative fuels and alternative energy (including the use of shore power) (46 U.S.C. § 50307(a)(2)(A)(ii).
- Improving environmental performance, including reducing incidental vessel-generated underwater noise, such as noise from propeller cavitation or hydrodynamic flow (46 U.S.C. § 50307(a)(2)(A)(iv)); or
- Improving the efficiency and safety of domestic maritime industries (46 U.S.C. § 50307(a)(2)(B)).

This Study is MARAD's response to the FY24 NDAA requirement.

While the USMH Program supports transportation system expansion and modal shift, the META Program supports technological innovation and system performance improvement. Increasing the effectiveness of Marine Highways in addressing META program elements means ensuring that projects improve the operational efficiency and safety of maritime freight movement.

This Study provides an assessment of how Marine Highways can align more directly with META objectives. It identifies where current practices support integration, highlights the structural and procedural barriers that limit alignment, and offers recommendations to strengthen future coordination. This includes ensuring that the USMH Program, through its project

evaluation, grantmaking, and technical assistance activities, encourages and rewards investments that also advance META goals.

Overview of the META Program

META supports the study, research, development, assessment, and deployment of emerging technologies and practices related to the MTS. Through META, MARAD collaborates with industry stakeholders, governmental agencies, and research institutions to identify, study, evaluate, test, demonstrate, improve, or support emerging marine technologies and practices to meet United States federal and international standards and guidelines. META projects encompass a wide range of topics, from air and water quality to vessel-generated underwater noise. The projects' results aim to inform stakeholders in support of improving the efficiency and safety of domestic maritime industries.

Overview of the USMH Program

The USMH Program aims to enhance different aspects of the nation's transportation system to promote efficiency and resilience. The Program encourages the use of marine transportation as a viable alternative to highways and railways while enhancing overall transportation efficiency. The USMH Program seeks to optimize the use of waterways and leverage their capacity to accommodate freight and reduce congestion on land-based transportation networks.

In addition to promoting the use of the nation's waterways, the USMH Program promotes freight mobility and reliability. Marine highways offer an additional transportation option for shippers, providing added flexibility and resilience in logistics operations. By diversifying the transportation network, the USMH Program aims to strengthen the resilience of supply chains, particularly in times of disruption or emergencies. Marine highways serve as alternative transport routes when traditional land-based routes face congestion, damage, or accessibility challenges due to natural disasters or unforeseen events.

Beyond the benefits to transportation efficiency and resilience, the USMH Program supports economic development and enhances the competitiveness of U.S. businesses and industries. By offering efficient and cost-effective transportation options, marine highways help reduce shipping costs, expand market access, and stimulate trade. This, in turn, fosters job creation, spurs investment, and fuels economic growth in port communities and regions served by marine highways.

Finally, the USMH Program promotes innovation and collaboration within the maritime industry, transportation sector, and government agencies. By promoting partnerships and knowledge-sharing, the Program seeks to identify and implement solutions to challenges related to infrastructure development, equipment and vessel needs, market demands, and technological advancements. Through collaborative efforts, stakeholders work together to drive continuous improvement and innovation in marine transportation, which are critical to the success of the USMH Program.

Overall, the objectives of the USMH Program are aligned with broader national goals related to transportation efficiency, economic prosperity, and resilience. By promoting the development and utilization of marine highways, the Program contributes to building a more integrated and efficient transportation system.

The United States has a versatile and expansive network of navigable waterways, including rivers, bays, channels, coasts, the Great Lakes, open-ocean routes, and the Saint Lawrence Seaway System. Under statutory authority granted under 46 U.S.C. § 55601, the USMH Program aims to relieve landside congestion and generate other public benefits by increasing the efficiency of the surface transportation system through the development and promotion of marine highway transportation.

The USMH Program currently includes 35 Marine Highway Transportation Routes that span over 27,000 miles. These marine highways extend over various regions and waterways nationwide, each serving distinct transportation needs and contributing to the country's multimodal transportation network. These navigable waterways, designated by the Secretary of Transportation, run roughly parallel to existing landside routes and serve as extensions of the surface transportation system. For example, the M-95 stretches from Maine to Florida and is the designation for the shipping lane along the Atlantic Coast, paralleling Interstate Highway I-95.[1]

The M-95 is a critical artery along the Eastern seaboard, linking significant ports such as New York/New Jersey, Norfolk, and Miami. Serving as vital corridors for containerized cargo, roll-on/roll-off (RoRo) cargo, and bulk commodities, these routes facilitate the efficient movement of goods along the Atlantic coast.

Venturing southward, the M-10 crosses waterways along the Gulf of America, connecting ports from Texas to Florida. Key routes include connections between Houston, New Orleans, Mobile, and Tampa, supporting the transportation of petroleum products, chemicals, and agricultural goods.

In the north, the M-90 connects the Great Lakes and the St. Lawrence Seaway, linking ports in the United States and Canada. This vital trade route is a lifeline for bulk commodities such as iron ore, coal, grain, and other raw materials.

On the Pacific Coast, the M-5, M-84, and M-580 encompass waterways such as the Puget Sound and the Columbia River, serving ports in Washington, Oregon, Idaho, and California. These routes facilitate the movement of containerized cargo, forest products, and agricultural goods, bolstering regional trade and commerce.

The Inland River Marine Highway System, including the M-35, M-55, M-65, and M-70, encompasses the vast network of inland rivers, including the Mississippi and Ohio Rivers and their tributaries. These are critical arteries for bulk commodities like grain, coal, petroleum, and chemicals, connecting the heartland to coastal ports and international markets.

In addition to these marine highways, various other designated routes crisscross territorial, coastal, and inland waterways, catering to specific regional transportation needs and fostering trade between domestic and international markets.

[1] https://www.maritime.dot.gov/grants/marine-highways/marine-highway

Figure 1: United States Marine Highway Routes (Source: MARAD)

The status of designated marine highways involves ongoing efforts to enhance infrastructure, encourage the use of marine highways, improve operational efficiency, and address funding and stakeholder coordination challenges. MARAD continues to work with federal, state, and local partners to support developing and utilizing marine highways as integral components of the Nation's multimodal transportation system. For the most up-to-date information on specific designated marine highways and their status, visit the Program's website.[2]

In addition, the USMH Program provides discretionary grants administered by MARAD. Funds for the USMH Program are awarded competitively to projects that provide a coordinated and capable alternative to landside transportation or promote marine highway transportation.

The USMH Program awarded 69 grants totaling $107 million from FY2010 to FY2024. During that same period, there were 63 unfunded applications totaling $249 million, indicating the level of unmet demand for the Program.

The FY23 NDAA made several amendments to the USMH Program, including:

- expanding the definition of marine highway transportation to include bulk, liquid, and loose cargo (in addition to previously eligible types of freight, including intermodal cargo containers, RoRo, unitized freight, and freight vehicles carried aboard commuter ferry boats); and
- expanding the definition of marine highway transportation to include shipments of eligible cargo from U.S. ports to or from ports in Canada and Mexico.

These recent statutory changes provide additional marine highway transportation opportunities and further USMH Program growth.

[2] United States Marine Highway Program | MARAD (dot.gov)

Overall, the USMH Program is vital in promoting a multimodal transportation system that moves goods across the country as efficiently as possible. The Program has diverted cargo from other modes to marine highways, which reduces Vehicle Miles Traveled (VMT) on the Nation's roadways and saved public funds that would otherwise be needed for road or railroad maintenance or repair expenditures. Investing in the USMH Program is a strategic investment in the Nation's infrastructure and contributes to the long-term competitiveness of the U.S. transportation sector.

Stakeholders Involved in the USMH Program

The USMH Program is a collaborative endeavor that draws a continuum of stakeholders from across the transportation landscape, including governmental bodies and private enterprises. The U.S. Department of Transportation (USDOT) provides overarching guidance and support, ensuring that the USMH Program harmonizes with transportation policies and objectives on a national scale.

MARAD has a central role in coordinating with ports, state departments of transportation, localities, public agencies, and private sector entities on the development of landside facilities and infrastructure to support and broaden marine highway transportation. MARAD also promotes waterways as a viable alternative to land-based shipping and transportation by highlighting the benefits of using waterborne routes for commerce.[3]

MARAD organizes its outreach activities into Gateway regions situated throughout the U.S.. Offices in these regions are led by Gateway Directors who work with MARAD headquarters staff, state and local authorities, congressional representatives at the local and district level, and a broad range of port, shipper, and carrier stakeholders to cooperate on projects, identify federal and state funding opportunities, and address community challenges in the ports and their inter-modal connections. The Gateway Offices provide direct technical assistance to maritime stakeholders throughout the Nation and support the USMH Program's goals alongside MARAD's other programs and initiatives.

Other essential stakeholders include:

- Port authorities are critical connections within the maritime infrastructure network and play a pivotal role in the program's success. They operate and manage facilities, terminals, and infrastructure necessary for the seamless operation of marine highways, ensuring smooth cargo flow and logistical efficiency.
- Shipping companies and carriers are at the forefront of physically transporting goods along designated marine highway routes. These entities deploy and operate vessels that operate on the Nation's waterborne corridors, assisting in the efficient movement of cargo and ensuring reliable transportation services. Terminal operators assume crucial responsibilities, overseeing the loading and unloading of cargo, managing equipment, and coordinating intermodal connections to facilitate seamless cargo transfers.
- Maritime workers, including vessel crews and longshoremen, are crucial to facilitate the efficient movement and loading/unloading of freight at ports and intermodal facilities. State and local governments provide essential support, funding, regulatory oversight, and

infrastructure investments to advance marine highway development within their respective jurisdictions.

- Industry associations, such as the American Association of Port Authorities (AAPA) and the American Waterways Operators (AWO), engage in advocacy efforts and policy initiatives to foster the utilization of marine highways and supportive policies. In parallel, community groups often advocate for preferred transportation practices and greater engagement in port and waterfront development projects.
- Finally, Federal, state, and local agencies, including the U.S. Coast Guard (USCG), the Environmental Protection Agency (EPA), and various departments of transportation, play instrumental roles in regulatory compliance, safety oversight, permitting, and infrastructure planning endeavors related to marine highways.

The success of the USMH Program relies on effective collaboration and coordination among these stakeholders. Together, they foster the development of efficient and resilient marine transportation corridors that underpin the Nation's economic growth and global competitiveness.

Opportunities for Alignment between the USMH and META Programs

Although the USMH and META programs were established under different statutes and serve distinct purposes, their overlapping interests present important opportunities for coordination. This section identifies areas where Marine Highway infrastructure and service development efforts under the USMH Program can advance the efficiency, safety, and technological goals outlined in the META Program.

Operational efficiency is an important area where the USMH Program aligns with META objectives. By leveraging marine highways for freight transportation, businesses can benefit from reduced transit times, lower operating costs, and improved supply chain resilience. Marine highways offer a reliable and cost-effective alternative to land-based routes.

The USMH Program plays a role in advancing the objectives of META by promoting technological innovation and operational efficiency within the maritime industry. Through its emphasis on advocating for the increased usage of the nation's marine highways, adoption of innovative technologies, and enhancement of operational practices, the USMH Program contributes significantly to the collective efforts to create a more efficient maritime transportation system.

Through research, development, and technical assistance initiatives, META promotes the adoption of cutting-edge technologies and practices that improve maritime transportation's safety, efficiency, and reliability. By integrating these innovations into marine highway operations, the USMH Program can enhance its competitiveness and effectiveness in meeting the evolving needs of shippers and stakeholders. In addition, META helps identify emerging trends, challenges, and opportunities in the maritime sector by convening stakeholders, conducting research, and facilitating dialogue. This strategic insight enables the USMH Program to align its priorities, investments, and initiatives with broader industry trends and needs, ensuring that marine highways remain relevant and responsive to market demands.

Alignment of the USMH and META Programs holds significant importance for several reasons. Work performed under META supports effective solutions that enhance the overall efficiency and effectiveness of the MTS.

Further, the Programs facilitate the achievement of shared interests in resiliency and technical advancements in the maritime sector. The USMH Program focuses on promoting the use of marine highways for freight transportation, which contributes to reducing congestion and other impacts associated with traditional modes of transportation. By aligning with META's objectives, the USMH Program can amplify its public benefits and maximize its positive impact on freight transportation.

Finally, improving integration enhances stakeholder engagement and support for both programs, including investigating opportunities to streamline or minimize regulatory and permitting complexity. By involving a wide array of stakeholders, including government agencies, industry partners, non-governmental organizations, and community groups, in joint initiatives, the Programs benefit from a broader range of expertise, perspectives, and resources. This fosters buy-in and collaboration, ultimately leading to more impactful outcomes.

USMH Projects Aligning with META Objectives

Since the inception of the USMH Program in FY2010, MARAD has supported a variety of port, vessel, and intermodal projects that, while not explicitly designed to meet META objectives, have advanced operational practices consistent with META's statutory aims. Many of these projects incorporate efficiency, safety, or system optimization features that reflect voluntary alignment with META program elements under 46 U.S.C. § 50307(a)(2). This section identifies select project types and characteristics that illustrate how USMH-supported investments have supported META-aligned outcomes in practice.

Terminal Equipment and Cargo Handling Improvements

Numerous USMH grants have funded acquisition of cargo handling equipment that improved operational efficiency and reduced turnaround times. Examples include:

- Red Hook Container Terminal (New York/New Jersey): Received funding for yard tractors and scheduling system enhancements to support COB operations. These investments enabled greater terminal throughput and reduced cargo transfer errors.
- Port of Monroe (Michigan): Acquired a crawler crane to increase container handling capacity and support short-sea shipping services on Lake Erie. The project improved lift reliability and decreased manual handling risks.

These projects align with META's emphasis on operational efficiency and port system improvement.

Vessel Optimization and Modernization

Several grants have supported investments in vessel retrofits or replacements aimed at increasing capacity, improving fuel use, or enhancing reliability. Examples include:

- Washington State Ferries: Received funding to design and partially convert a Jumbo Mark II ferry to hybrid-electric propulsion. Although the project was driven by service modernization goals, it also reflected META-compatible advances in vessel fuel economy and system reliability.

- SEACOR AMH (Louisiana): Used multiple grants to build and deploy purpose-built container barges for service on the Mississippi River (M-55 Corridor). These vessels improved loading efficiency, reduced tow configuration time, and expanded capacity for containerized freight.
- Tidewater M-84 Barge Service Expansion (Oregon/Washington): Tidewater Barge Lines was awarded funding to acquire a specialized barge capable of supporting increased shipments of municipal solid waste along the Columbia-Snake River corridor. The project helped shift long-haul waste shipments from road to river, improving modal efficiency and supporting freight operations in line with META energy and safety objectives.

Intermodal Integration and Terminal Access

USMH projects have also contributed to improved intermodal connectivity and scheduling efficiency, including:

- Port of New Orleans (France Road Terminal): Grant funds were used to acquire material handling equipment to reduce truck idle time, enable more efficient barge loading, and streamline drayage interfaces for containerized cargo.
- America's Central Port (Illinois): Upgraded dockside and intermodal facilities to support COB operations on the M-35 and M-55 corridors. The project reduced dwell times and improved equipment standardization across terminals.

Such projects help ports meet the performance goals outlined in META by reducing handling variability and improving multimodal throughput.

Operational Safety Enhancements

Several Marine Highway projects included investments that improved safety outcomes, workforce readiness, and equipment reliability. For example:

- Port of Virginia (James River Expansion): Multiple awards were used to acquire and retrofit barges and acquire support equipment to improve cargo handling and refrigerated container operations. These enhancements reduced crew exposure to hazardous conditions and streamlined loading practices.
- Paducah-McCracken County Riverport (Kentucky): Acquired shoreside container handling equipment with improved operator controls and safety features to support its developing COB service.

Summary of META-Consistent Elements in USMH Projects

Across more than a decade of Marine Highway investment, MARAD has observed voluntary incorporation of the following META-aligned elements in USMH-funded projects:

META Objective	Common USMH Project Features
50307(a)(2)(A)(i): Reduce air emissions, water emissions, or other ship discharges;	Port or terminal upgrades enabling modal shift, cargo handling equipment reducing truck idling
50307(a)(2)(A)(ii): Improve fuel economy or energy use	Vessel and equipment modernization, barge optimization
50307(a)(2)(A)(iv): Reduce vessel-generated noise	Improved operational scheduling, barge handling enhancements
50307(a)(2)(B): Improve maritime industry efficiency and safety	Terminal improvements, yard equipment, and equipment upgrades

Barriers to Alignment and Program Effectiveness

Barriers to alignment of the two programs include issues related to infrastructure, equipment, and vessels, financial, stakeholder coordination, technological, public perception, and awareness. These barriers can hinder the development and utilization of marine highways for freight transportation, impacting their ability to achieve META objectives. Overcoming these barriers requires collaborative efforts and targeted solutions to enhance the efficiency and reliability of marine highways.

Infrastructure Limitations

Infrastructure limitations encompass various challenges related to port facilities, terminal infrastructure, and intermodal connections. Marine highways rely on a robust network of port facilities, terminals, and intermodal connections to operate efficiently. However, inadequate infrastructure, such as outdated or undersized terminals, insufficient berth space, and limited road and rail connections, can constrain the capacity and usability of marine highways and result in the inefficient flow of cargo. Inadequate infrastructure contributes to inefficiencies in cargo movement along marine highways. Congested ports, insufficient terminal capacity, and navigational challenges can result in delays, increased transit times, and higher logistics costs, reducing the attractiveness of marine transportation as a viable option.

Lack of infrastructure resilience can lead to disruptions in marine highway operations, affecting the reliability of cargo delivery. Issues such as navigational hazards,

insufficient intermodal connectivity, and terminal congestion can disrupt supply chains and compromise the dependability of marine transportation services. These disruptions can undermine the competitiveness of marine highways compared to other modes of transportation. Inefficient infrastructure increases transportation costs, reduces service reliability, and limits the overall capacity of marine transportation networks, diminishing their ability to compete effectively with road, rail, and air transport options.

Addressing transportation infrastructure limitations is important to realize the potential of marine highways. By investing in infrastructure upgrades aligned with META objectives, policymakers can enhance accessibility, improve efficiency, bolster reliability, and enhance competitiveness, thus facilitating the integration of marine highways into a more efficient and resilient transportation system.

Inadequate or Outdated Vessels and Equipment

Inadequate or outdated equipment, such as cranes, forklifts, and cargo-handling machinery, can slow down cargo handling processes at ports and terminals, leading to delays and increased transit times. In addition, these deficiencies may result in capacity constraints within marine transportation networks. Limited availability of vessels, barges, and containers can restrict the volume of cargo that can be transported via marine highways, limiting their ability to meet demand and scale operations effectively.

Older vessels can impact the competitiveness of marine highways relative to other modes of transportation. Higher operating costs, reduced reliability, and limited capacity can deter shippers and logistics providers from utilizing marine transportation, undermining efforts to promote modal shift and reduce congestion on roadways.

Addressing these barriers is essential to enhancing the effectiveness of marine highways and aligning them with the objectives of META. Investments in modernizing and expanding equipment and vessels can improve operational efficiency, increase capacity, enhance safety, and strengthen the competitiveness of marine transportation and marine highways as a component of a multimodal transportation system.

Regulatory and Permitting Complexity

Jurisdictional complexities and regulatory frameworks can create administrative burdens, regulatory uncertainties, and legal challenges for marine highway projects. Inconsistent regulations, overlapping jurisdictions, and regulatory gaps across federal, state, and local agencies may complicate permitting processes, licensing requirements, and compliance obligations, adding complexity and costs to project development and implementation.

Regulatory barriers related to licensing and permitting may delay project approvals, hinder infrastructure development, and impede the expansion of marine highway services, limiting their effectiveness in addressing META objectives. Barriers may also arise from differences in regulations across different modes of transportation. In addition, regulatory barriers can give rise to legal and liability concerns for marine transportation operators. Non-compliance with regulatory requirements may undermine the financial viability and operational stability of marine highway projects.

Addressing the range of regulatory issues can strengthen the alignment of the USMH Program with META objectives. Streamlining regulatory processes, harmonizing regulatory requirements across jurisdictions, providing regulatory clarity and certainty, and fostering collaborative regulatory approaches among government agencies and industry stakeholders can help mitigate regulatory barriers and promote the development of efficient, reliable, and competitive marine transportation networks.

MARAD has a coordination role in streamlining federal reviews, creating model permitting templates, and working with other agencies to clarify expectations related to META technologies. This coordination can reduce project delays and increase applicant confidence in pursuing ambitious innovations.

Access to Investment Capital

Barriers to investment can impede the effectiveness of marine highways projects in addressing the components outlined in META. These financial constraints include investment and cost-effectiveness considerations that can hinder the development, operation, and competitiveness of marine transportation initiatives, as well as access to investment capital relative to alternatives.

High upfront capital costs associated with vessel acquisition, retrofitting, and infrastructure upgrades can pose financial barriers, particularly for small operators, startups, and disadvantaged communities seeking to participate in marine transportation projects. Limited access to affordable financing, loan guarantees, or other capital financing sources to support marine highway initiatives can create financial challenges and inhibit participation in the marine highway transportation sector.

Uncertainty surrounding the financial viability and return on investment of marine highway projects can deter private sector participation and hinder investments from investors, lenders, and financial institutions. Concerns about revenue generation, market demand, and cost-recovery mechanisms may discourage private sector partnerships and limit access to project financing, equity investments, or credit facilities essential for project development and implementation. Mitigating these risks through effective risk management strategies and risk-sharing mechanisms is essential to attracting financing for marine highway initiatives.

Economic and market uncertainties, such as fluctuations in fuel prices, changes in consumer demand, or shifts in trade patterns, can impact the financial viability of marine highway projects. Uncertain market conditions may affect the projection of future revenues and cash flows, influencing investment decisions and project financing.

Addressing these financial constraints and barriers requires a comprehensive approach that involves leveraging public and private funding sources, optimizing project financing structures, mitigating risks, and demonstrating the economic viability and societal benefits of marine highway investments. Collaborative efforts between government agencies, industry stakeholders, financial institutions, and the investment community are essential to overcome these challenges. By overcoming these challenges, marine highways and the USMH Program can be a cost-effective, highly efficient, and resilient transportation solution that aligns with META objectives.

Stakeholder Coordination

Stakeholder coordination is critical to support the effectiveness of marine highways and the marine highway program in addressing components in META. Potential barriers can hinder the planning, implementation, and competitiveness of marine highway projects, thereby limiting their ability to achieve META objectives.

Inadequate coordination among stakeholders in the marine transportation sector, including government agencies, port authorities, shipping companies, longshoremen, and local communities, can lead to fragmented decision-making, conflicting priorities, and inefficient resource allocation. Competing interests, conflicting objectives, and divergent perspectives on regulatory, financial, and operational issues may impede progress on marine highway projects, delay approvals, and undermine project support, hindering the overall effectiveness of the USMH Program.

Inadequate public participation processes, including insufficient opportunities for public input, a lack of transparency, and limited access to information, can also undermine stakeholder coordination efforts. Meaningful engagement of stakeholders, including affected communities and industry representatives, is essential for building consensus, addressing concerns, and fostering support for marine highway projects. Additionally, limited transparency and information-sharing practices can result in resistance to marine highway projects within affected communities and interest groups.

Community opposition and public perception issues can undermine stakeholder coordination and support for marine highway projects. Concerns about noise, local traffic, or competing land uses may lead to opposition from residents and community organizations. Addressing these concerns requires proactive engagement, transparent communication, and meaningful stakeholder participation.

Limited engagement with tribal and indigenous communities, whose lands and resources may be affected by marine highway projects, may lead to conflicts and delays in project implementation. Failure to consult with tribal governments, respect indigenous rights, and incorporate tribal concerns into project planning processes can result in resistance to marine highway projects in these communities.

By involving a wide array of stakeholders, including government agencies, industry partners, non-governmental organizations, and community groups in joint initiatives, the Programs benefit from a broader range of expertise, perspectives, and resources. This fosters buy-in and collaboration, ultimately leading to more impactful outcomes. Stakeholder coordination requires proactive efforts to foster collaboration, enhance communication, and improve decision-making processes. Establishing multi-agency partnerships, engaging industry stakeholders, addressing community concerns, and incorporating tribal perspectives are essential. By addressing coordination barriers, marine highways and the USMH Program can strengthen partnerships, build consensus, and enhance capacity to achieve META objectives.

Technology Adoption and Integration Gaps

The USMH Program plays a pivotal role in advancing the objectives of META by promoting technological innovation and operational efficiency within the maritime industry. Both programs facilitate the achievement of shared interests in resiliency and technical advancements in the maritime sector.

Outdated or inadequate technological infrastructure within the marine transportation industry can constrain the implementation of modernization initiatives and hinder the adoption of digital technologies essential for enhancing efficiency, safety, and overall performance. Legacy systems, manual processes, and obsolete equipment may impede data collection, analysis, and decision-making processes, limiting the ability of marine highway operators to optimize vessel operations, route planning, and cargo management.

Technological barriers are obstacles that can impede the effectiveness of marine highways in addressing the components outlined in META. These barriers encompass various challenges related to the adoption, integration, and utilization of advanced technologies and digital solutions within the maritime transportation sector. The importance of technological barriers lies in their potential to hinder innovation, limit operational efficiency, and obstruct the achievement of META objectives.

Through research, development, and technical assistance initiatives, META promotes the adoption of cutting-edge technologies and practices that improve maritime transportation's safety, efficiency, and reliability. By integrating these innovations into marine highway operations, the USMH Program can enhance its competitiveness and effectiveness in meeting the evolving needs of shippers and stakeholders. In addition, META helps identify emerging trends, challenges, and opportunities in the maritime sector by convening stakeholders, conducting research, and facilitating dialogue. The strategic insights of META can enable the USMH Program to align its priorities, investments, and initiatives with broader industry trends and needs, ensuring that marine highways remain relevant and responsive to market demands.

Future Alignment Opportunities

To better align the USMH Program with the statutory objectives of the META Program, this Study identifies the following future opportunities.

1. Investigate incorporating META objectives into grant guidance and evaluation metrics. MARAD should investigate updating its Notice of Funding Opportunity (NOFO) language and internal scoring rubrics to include META objectives as a formal evaluation factor. Greater integration of META components into the USMHP's NOFO as selection considerations would encourage applicants with projects that support the development and deployment of emerging marine technologies and practices to apply. The USMH Program's ability to fund planning studies offers the potential for knowledge exchange in addition to targeted infrastructure improvements.
2. Create Technical Assistance Modules. Develop sector-specific guidance materials to help applicants understand and design projects that meet water discharge, energy performance, acoustic, and safety objectives.

3. Enhance Federal Coordination. Work with other administrations, such as the U.S. Army Corps of Engineers and the U.S. Coast Guard, to align grant funding with national research and compliance goals.
4. Prioritize Underrepresented META Areas. Investigate funding and tracking projects that address water discharge and underwater noise, which are currently underrepresented among USMH-funded initiatives.
5. Support Corridor-Level Planning. Encourage regional partnerships that evaluate infrastructure, equipment, and permitting needs to support META-compliant project development at the corridor scale.
6. Highlight Innovation. Foster and encourage applicants to submit USMHP projects that would help provide data of wider interest across the maritime industry and fill knowledge gaps. Work with grantees to spotlight and disseminate information about successes that result from their funding award. Promote META Program projects to potential USMH Program applicants and state departments of transportation for their awareness.
7. Advance Technology Validation. Investigate the META Program's authority to fund pilot projects that document the real-world performance of candidate solutions relevant to domestic maritime industry modernization.

Conclusion

The USMH and META Programs were created to fulfill distinct but complementary purposes: one focused on expanding and improving the use of navigable waterways for domestic freight movement, the other on advancing innovation, safety, and performance in maritime operations.

This Study, conducted in response to Section 3521(d) of the FY24 NDAA, finds that while there is no statutory requirement to integrate the two programs, there are opportunities for voluntary alignment.

Marine Highway projects that invest in terminal upgrades, vessel modernization, workforce readiness, and operational technology can directly support META's statutory goals of improving fuel efficiency, reducing vessel-generated noise, reducing operational risks, and strengthening the domestic maritime industry's overall performance.

At the same time, this Study identifies barriers to such alignment—including infrastructure limitations, access to capital, fragmented regulatory processes, gaps in data and measurement, and limited coordination capacity among project sponsors.

The opportunities outlined in this report present a pathway for MARAD to enhance the effectiveness of the USMH Program in supporting META objectives, without imposing prescriptive mandates. By pursuing these actions, MARAD can continue to elevate the strategic role of Marine Highways in the national freight system and encourage innovations that enhance the competitiveness and safety of U.S. maritime operations.

Continued engagement with stakeholders—public, private, and tribal—will be essential to advancing this vision and ensuring that Marine Highways serve as both an operational asset and a platform for continuous improvement.