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Exploring Short-Sea Shipping as an Alternative to Non-Bulk Freight Trucking in Southeastern MA

Kristen Uiterwyk

Jack Wiggin

Kimberly Starbuck

Allison Novelly

Craig Johnson

massDOT
Massachusetts Department of Transportation

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Principal Investigator(s)
Dr. Kristin Uiterwyk
University of Massachusetts Boston

Research and Technology Transfer Section
MassDOT Office of Transportation Planning

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16. Abstract

The Island of Martha's Vineyard relies on the transport of goods and people via Steamship Authority Vessels operating from Woods Hole in Falmouth, MA. The purpose of this research project was to study the feasibility of expanding the waterborne distribution of non-bulk freight between mainland Massachusetts and the island of Martha's Vineyard. The study focused on understanding the congestion and emissions impacts resulting from any change in port(s) of origin. Based on an analysis of information gathered from the Steamship Authority, interviews, document reviews, and the MOVES tool, this study concluded that (1) the Port of New Bedford is suited, based on location and existing infrastructure, to serve as an additional port for freight ferry service — though upgrades to existing infrastructure would be required, (2) impacts to traffic volume resulting from transporting some percentage of freight through an off-Cape port would be minimal, and (3) operating a freight ferry roughly three trips/day from New Bedford, as modeled in this analysis, would increase emissions as compared to the current scenario of all non-bulk freight passing through Woods Hole.

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Exploring Short-Sea Shipping as an Alternative to Non-Bulk Freight Trucking in Southeastern MA

Final Report

Prepared By:

The Urban Harbors Institute & Flagship Management
Kristin Uiterwyk
Principal Investigator

Urban Harbors Institute
University of Massachusetts Boston
100 Morrissey Blvd.
Boston, MA 02125

Prepared For:

Massachusetts Department of Transportation
Office of Transportation Planning
Ten Park Plaza, Suite 4150
Boston, MA 02116

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Disclaimer

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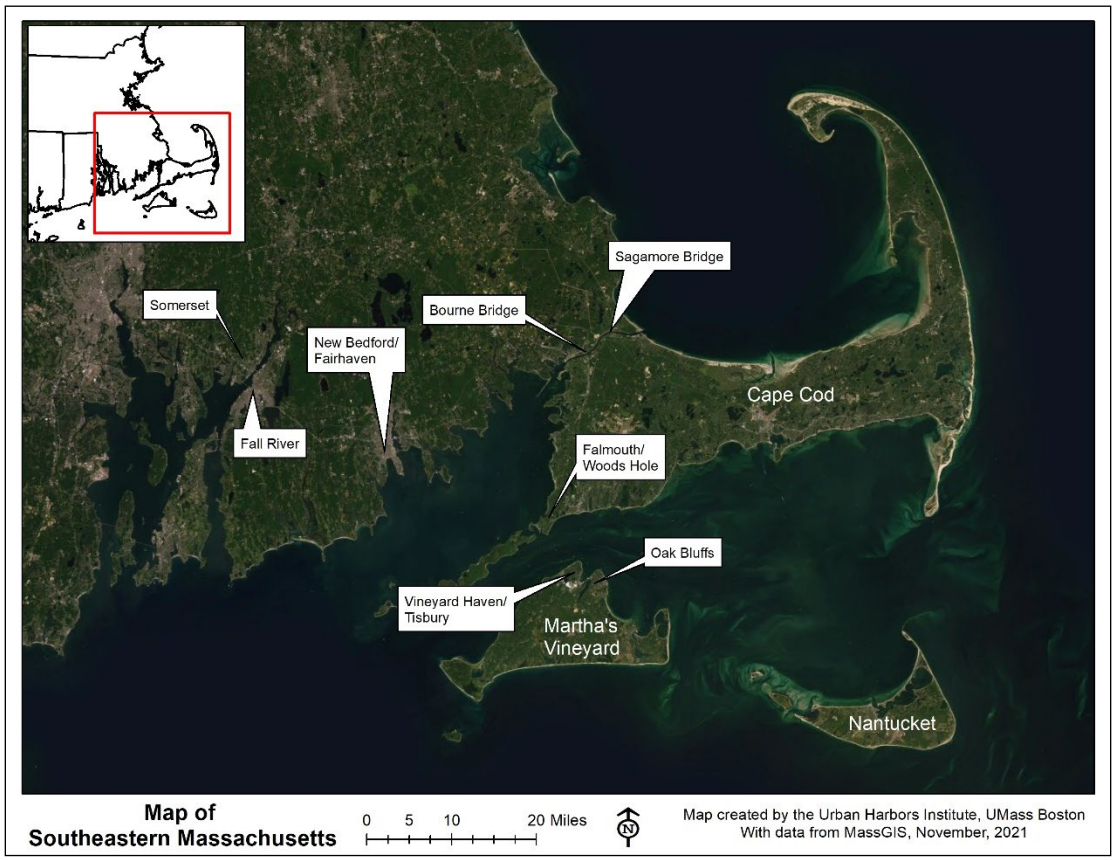
Executive Summary

This study, Exploring Short-Sea Shipping as an Alternative to Non-Bulk Freight Trucking Southeastern MA, was undertaken as part of the Massachusetts Department of Transportation (MassDOT) Research Program. This program is funded with Federal Highway Administration (FHWA) State Planning and Research (SPR) funds. Through this program, applied research is conducted on topics of importance to the Commonwealth of Massachusetts transportation agencies.

Research Need

The purpose of this research project was to examine the potential to shift the port of departure/return from Woods Hole, MA, to an alternative Massachusetts port, and how that shift could impact roadway congestion and total emissions from trucks and ferries carrying non-bulk freight to and from Martha's Vineyard. The purpose of this potential shift would be to remove freight trucks from roadways leading to, from, and on Cape Cod by utilizing waterborne transportation for a greater portion of the trip. This is consistent with the interest of the nation and the Commonwealth to better incorporate navigable waterways into the freight transportation system when a waterborne mode (short-sea shipping) reduces roadway congestion and proves more efficient and environmentally beneficial. Figure 1 shows a map of Southeastern Massachusetts.



Goals/Objectives

- Understand current waterborne freight practices and condition and capacity of the ports in Southeastern Massachusetts.
- Analyze the potential to shift some amount of non-bulk freight to an alternative mainland port to reduce the impacts of freight trucks on roadway congestion and air quality.
- Characterize and quantify the effects of this potential shift on traffic congestion and emissions.

Methodology

The project consisted of three tasks:

1. Assess the practical alternative Massachusetts ports to handle additional freight traffic. For each port this entailed an assessment of the capacity and condition of land- and water-side infrastructure, road access, navigability of the waterways, current maritime operations, public policies, long-range plans, and planned investments in facilities.
2. Assess the divertible freight truck traffic by reviewing data and information from past studies, MassDOT's Transportation Data Management System, and the Steamship Authority.
3. Quantify the potential difference in roadway congestion and truck and vessel emissions between the existing condition of moving non-bulk freight through Woods Hole and a shift to moving at least some of this freight through an alternative mainland port.

Review of current non-bulk freight shipping to Martha's Vineyard and assessment of alternative mainland ports

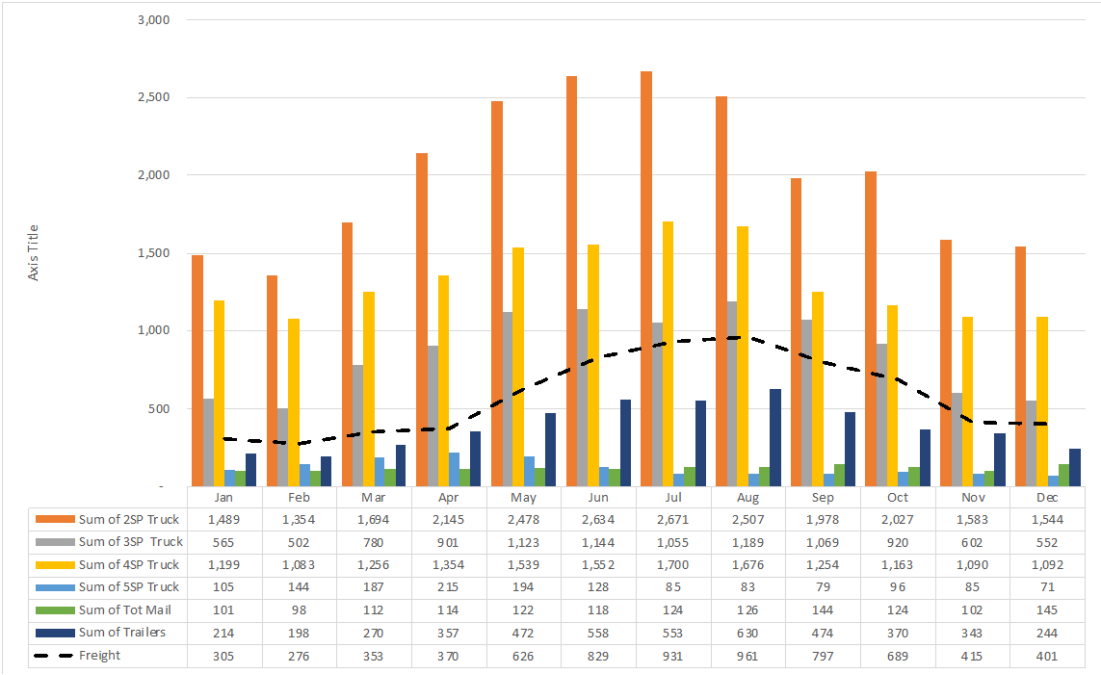
In accordance with the Enabling Act of the Woods Hole, Martha's Vineyard and Nantucket Steamship Authority (the Steamship Authority), the shipment of all non-bulk freight between mainland Massachusetts and the islands of Martha's Vineyard and Nantucket is conducted, licensed, or permitted by the Steamship Authority. Currently, virtually all non-bulk freight is carried on Steamship Authority vessels operating between Woods Hole on the mainland and Vineyard Haven and Oak Bluffs on Martha's Vineyard. The freight is carried both on freight vessels (with some limited passenger capacity) and on the Authority's passenger and vehicle ferries (Table 1).

Table 1: Steamship Authority vessels

Vessel Name	Primary Use(s)
M/V Eagle	Freight and Passenger
M/V Gay Head	Freight
M/V Governor	Freight
M/V Island Home	Passenger, vehicle, and freight
M/V Katama	Freight
M/V Martha's Vineyard	Passengers and vehicles
M/V Nantucket	Passengers and vehicles
M/V Sankaty	Freight
M/V Woods Hole	Passenger, vehicle, and freight

Data for calendar year 2019 was used to characterize current conditions, as that is the most recent year with complete data unaffected by the COVID-19 pandemic. In that year the Steamship Authority carried 53,366 freight trucks on one-way trips between Woods Hole and Martha's Vineyard.

Using the Steamship Authority's Occupied Vessel Capacity Report for 2019 and the Authority's definition of freight trucks as those occupying two to five spaces on their vessels plus mail trucks, Figure 2 illustrates the monthly distribution of freight trucks carried on Steamship Authority vessels between Woods Hole and Martha's Vineyard.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sum of 2SP Truck	1,489	1,354	1,694	2,145	2,478	2,634	2,671	2,507	1,978	2,027	1,583	1,544
Sum of 3SP Truck	565	502	780	901	1,123	1,144	1,055	1,189	1,069	920	602	552
Sum of 4SP Truck	1,199	1,083	1,256	1,354	1,539	1,552	1,700	1,676	1,254	1,163	1,090	1,092
Sum of 5SP Truck	105	144	187	215	194	128	85	83	79	96	85	71
Sum of Tot Mail	101	98	112	114	122	118	124	126	144	124	102	145
Sum of Trailers	214	198	270	357	472	558	553	630	474	370	343	244
Freight	305	276	353	370	626	829	931	961	797	689	415	401

Note: Dashed line indicates amount carried on freight vessels. Chart includes trailers, but their numbers are not included in freight truck totals.

Figure 2: Freight truck distribution 2019

These 53,366 freight trucks travel roadways leading to or from Woods Hole. To attribute the origins of trucks carrying freight to Martha's Vineyard, we relied on data compiled by a project team member for an earlier study. Almost 40 percent of freight trucks going to or

from the ferry terminal in Woods Hole pass through New Bedford coming from the west or northwest. A nearly equal percentage passes through Wareham coming from points north. A smaller percentage (22 percent) of freight originates on Martha's Vineyard and Cape Cod.

Alternative mainland ports

Information was compiled on existing conditions and potential capacity for additional freight shipping for several ports and harbors along the Southeastern coast of Massachusetts: New Bedford, Fairhaven, Fall River, Somerset, and Wareham. Information was drawn from statewide studies of ports and harbors, national databases, and studies, reports and plans prepared for individual ports. Information was collected on landside access (roadways), port infrastructure, current port operations and activities, navigability of the harbor and approach channels, and over-water distance to Martha's Vineyard. Additionally, the community's interest in serving as terminal for non-bulk freight shipping to Martha's Vineyard was discerned through review of policy documents and interviews with officials. Detailed port profiles and data sources are presented in Chapter 2 of this report.

While each port had notable qualities, New Bedford was determined to be most advantageous based on its relative proximity to Martha's Vineyard and overall physical assets. The Port of New Bedford has ready access from the Interstate highway (I-195), considerable waterfront infrastructure including terminal locations suitable for non-bulk freight shipping, adequate harbor and channel depths, and an active maritime economy. Most importantly, New Bedford is the closest port (of those studied) to Martha's Vineyard in terms of nautical miles and time underway. This conclusion does not suggest or assume political support or the availability of funding that may be needed to enable the service.

Assessment of current traffic volumes and congestion and the divertible freight truck traffic

Traffic volume was examined in the context of (1) highway access to the Cape over the Bourne and Sagamore bridges, and (2) local Falmouth roadways.

Data from MassDOT's Transportation Data Management System was used to characterize traffic volume on the roadways leading to Cape Cod and Woods Hole. Using Annual Average Daily Traffic (AADT) for the Sagamore Bridge and the Bourne Bridge, approximately 38,668,465 vehicles passed over the Bourne and Sagamore Bridges (combined) in 2019. If all 53,366 freight trucks going to or coming from Woods Hole go over one of these two bridges, these trucks represent 0.138 percent of total bridge traffic.

In terms of congestion on the bridges, the Cape Cod Commission uses the following volume to capacity (V/C) ratios to determine a roadway's congestion (Table 2).

Table 2: Levels of congestion

V/C Ratio Threshold	Level of Service (LOS)
0.8	C or Better
0.9	D
1.0	E
>1.0	F

Based on Cape Cod Commission analyses, most traffic monitoring in the vicinity of the bridges shows a failing congestion grade during summer months. For the main roads leading to Woods Hole, the Average Annual Daily Traffic (AADT) on Route 28 south of Brick Kiln Road going both north and south was 21,089 vehicles in 2019. In 2018 AADT on Woods Hole Road (south of Oyster Pond Road) was 7,966.

If it can be assumed that all freight trucks travelling to and from the Steamship Authority terminal in Woods Hole during 2019 passed each of these two points, then:

- Trucks travelling on the Steamship Authority ferries made up 0.693% of those vehicles on Route 28 south of Brick Kiln Road.
- Trucks travelling on the Steamship Authority ferries made up 1.84% of those vehicles on Woods Hole Road (south of Oyster Pond Road).

The roadways leading to the Woods Hole ferry terminal receive a congestion grade of C or better in the analyses performed by the Cape Cod Commission.

Though freight trucks are a very small percent of total traffic on Falmouth roadways, community members in Falmouth have long expressed concerns about noise, safety, congestion, and degradation of community character associated with freight trucks travelling the local roadways. The Steamship Authority has worked to reduce noise and safety concerns through size limits to trucks departing on the 5:30 A.M. vessel, but community members continue to seek additional measures to reduce the disruptions caused by freight trucks servicing the Island.

Analysis of truck and vessel emissions associated with shipping of non-bulk freight to Martha's Vineyard

Emissions were calculated for trucks and vessels carrying non-bulk freight between Tisbury, MA and Woods Hole in Falmouth, MA in 2019 (the most recent year with complete data unaffected by the COVID-19 pandemic). For comparison, we modeled emissions generated by trucking a portion of this freight to and from the State Pier in New Bedford and then shipping it to the terminal in Vineyard Haven. The methodologies for these calculations are described below. To conduct our analysis, we:

1. Identified the emissions associated with a single one-way vessel trip for (1) a vessel travelling between Woods Hole and Vineyard Haven, and (2) a vessel travelling between New Bedford and Vineyard Haven, based on engine tier.
2. Identified the emissions for a single one-way combination or single-unit truck trip, using intercept points to estimate mileage and using emissions data from the Federal Highway Administration.
3. Modeled the emissions of both vessels and trucks based on:
    a. "Existing Conditions" emissions, using 2019 numbers, for the number of freight trucks and vessels that transported freight between Woods Hole and Martha's Vineyard, and
    b. "Scenario Condition" emissions, using 2019 numbers, for the shipment of freight between New Bedford or Woods Hole and Martha's Vineyard.

4. Compared the emissions from the "existing conditions" and "scenario conditions" calculations

Understanding the caveats listed below, results indicate that when considering the combined vessel and truck emissions produced in the shipment of non-bulk freight between Martha's Vineyard and mainland Massachusetts in 2019, shipment of some freight through the New Bedford State Pier under our proposed scenario conditions would generate roughly between 20-50% more NO_X and approximately 20% more CO_2 than would be emitted under current conditions (depending on vessel engine tier).

Important caveats

Several important caveats are needed to accurately interpret the results of this analysis:

1. Origin and destination points for freight trucks were not available, therefore truck routes were categorized based on likely intercept points, and emissions calculations were estimated from those intercept points.
2. Freight trucks are carried on a variety of Steamship Authority vessels, including those not dedicated to freight. However, for purposes of this analysis, the model assumed that all trucks were transported to/from Vineyard Haven via a standard 220-foot supply vessel with an average capacity of 16 trucks, allowing emissions to be compared across existing and scenario conditions.
3. Emissions calculations were based on current shipping practices, and do not take into consideration such things as strategies to reduce the overall number of freight trucks (*e.g.,* through freight consolidation) or emissions related to different types of vessels.
4. The City of New Bedford has not expressed to the report's authors a specific interest in a freight ferry service. Therefore, while the New Bedford State Pier was used in the scenario presented, this does not mean that the City has endorsed a freight ferry service.

Table of Contents

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List of Tables

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List of Figures

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1.0 Introduction

Coastal areas in Southeastern Massachusetts are heavily reliant on trucking for freight distribution, which has a relatively large environmental footprint. Truck freight in Southeastern Massachusetts is dependent on increasingly congested transportation choke points, such as the Cape Cod Canal Bridges, which are due to be reconstructed in the coming decades. Comparable communities on Long Island Sound have begun emphasizing waterborne distribution of bulk and non-bulk freight to reduce reliance on highway infrastructure. Shifting a greater proportion of freight to short distance waterborne modes of distribution (short-sea shipping) has the potential to reduce environmental impacts, reduce truck congestion, and provide competitive pricing for small-scale manufacturers aiming for local markets.

The purpose of this study was to examine the potential effects of shifting the port of departure/return for non-bulk freight traveling to Martha's Vineyard from Woods Hole, MA to an alternative Massachusetts port, and how that shift could impact highway congestion and total truck and ferry emissions. The reasoning for this potential shift would be to remove freight trucks from roadways leading to and on Cape Cod by utilizing waterborne transportation for a greater portion of the trip. This is consistent with the interest of the nation and the Commonwealth to better incorporate navigable waterways into the freight transportation system when a waterborne mode (short-sea shipping) reduces roadway congestion and proves more efficient and environmentally beneficial.

The main goals/objectives of this study include: 1) reviewing the current waterborne freight practices and capacity in Southeastern Massachusetts; 2) analyzing the capacity for shifting some volume of non-bulk freight truck shipping to waterborne modes; and 3) analyzing the impacts of potential shifts from truck freight to waterborne freight on traffic congestion and emissions in the Commonwealth.

The rest the report is organized as such: Chapter 2 provides an overview of the short-sea shipping of non-bulk freight between mainland Massachusetts and the islands of Martha's Vineyard and Nantucket, assesses the feasibility of potential alternative ports and identifies a promising alternative scenario; Chapter 3 quantifies the impacts of non-bulk freight movement to/from the Island through Woods Hole on traffic volume and congestion and those of the identified alternative scenario; Chapter 4 estimates air pollutant emissions by trucks and vessels moving non-bulk freight between mainland Massachusetts and Martha's Vineyard, comparing current operation and the identified alternative scenario; and, Chapter 5 summarizes the key conclusions and reiterates several important caveats of the study.

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2.0 Alternative Routes/Ports Analysis

This chapter presents an overview of current non-bulk freight shipping activities between the mainland and Martha's Vineyard, including A) an overview of short-sea shipping in Southeastern Massachusetts, and B) harbor profiles including descriptions of existing freight volumes and near future capacity for non-bulk freight in New Bedford/Fairhaven, Fall River, Somerset, Falmouth (Woods Hole), Oak Bluffs, and Tisbury (Vineyard Haven), Massachusetts.

2.1 Overview of Short-Sea Shipping in Southeastern Massachusetts

In accordance with the Enabling Act of the Woods Hole, Martha's Vineyard and Nantucket Steamship Authority (the Steamship Authority), the shipment of all non-bulk freight between mainland Massachusetts and the islands of Martha's Vineyard and Nantucket is conducted, licensed, or permitted by the Steamship Authority:

"Except as provided in this act, no person shall operate a vessel for the carriage of vehicles or freight for hire or resale by water between the mainland and the island of Martha's Vineyard or the island of Nantucket or between said islands unless licensed or permitted in writing to do so by the Authority."[1]

The Enabling Act, which is limited to freight shipment in Massachusetts, does provide exceptions to the Steamship Authority's purview related to services provided or contracted before May 30, 1973 or the operations of existing service from the port of New Bedford to the island of Martha's Vineyard by the motor vessel *Manisee* or a replacement vessel. As of the writing of this report, those exceptions are not currently being exercised.

2.1.1 Existing Steamship Authority Operations

Currently, the Steamship Authority provides non-bulk freight shipping on both vessels dedicated to freight shipment as well as its passenger and car ferries. Some of the most common types of freight brought to Martha's Vineyard include mail, express packages, fuel, food (38% of all truck trips), and building material (17% of all truck trips), while waste and recyclables are shipped off-island (13% of all truck trips).[2] Their freight shipment schedules vary based on the season and destination. For example, during the summer months of 2020 (June 17, 2020 through September 8, 2020), the Steamship Authority's schedule included round-trip freight trips to Vineyard Haven seven times a day Sunday-Saturday between the hours of 6:15 AM and 8:30 PM. They offered an additional three round-trip freight trips per day Monday-Friday. During the late fall/early-

[1] Enabling Act of the Woods Hole, Martha's Vineyard and Nantucket Steamship Authority, St. 1960, c. 701, § 5.

[2] Martha's Vineyard Commission. 2015. Martha's Vineyard Transportation Plan—Draft 2015. Online at: https://www.mvcommission.org/sites/default/files/docs/Draft%20MVTP%202015_0.pdf.

winter (October 21, 2020-January 2, 2021) they scheduled six daily round-trip freight trips between Woods Hole and Vineyard Haven, and two additional trips on Fridays and Sundays.

During the late-winter months (January 4, 2020-March 15, 2020), the Steamship Authority offered two round-trip freight trips to Nantucket Monday-Saturday, and an additional round-trip freight trip Monday-Friday. During the summer months (June 17, 2020 –September 8, 2020), they offered three round-trip freight trips each day. During the spring (April and May) the Steamship Authority offers between three and five round-trip freight trips per day.

Table 3: Steamship Authority freight transport vessels

Vessel Name	**Entered service with the Steamship Authority***	**Primary Use(s)**
M/V Eagle	1987	Freight and Passenger
M/V Gay Head	1989	Freight
M/V Governor	1989 (built in 1954)	Freight
M/V Island Home	2007	Passenger, vehicle, and freight
M/V Katama	1988	Freight
M/V Martha's Vineyard	1993	Passengers and vehicles
M/V Nantucket	1974	Passengers and vehicles
M/V Sankaty	1994	Freight
M/V Woods Hole	2016	Passenger, vehicle, and freight

*Note that some vessels may have provided service elsewhere prior to joining the Steamship Authority's fleet.

Some of these vessels can accommodate trucks up to 70 feet long and much of the freight is transported by Cape Cod Express, Carroll's Trucking, Sun Transportation, FedEx, UPS, Hallsmith-SYSCO, and Sid Wainer & Sons.[3] In some cases, freight is brought to the islands on large trailers (50-70 feet long and 80,000lbs. loaded) and transferred onto smaller trucks (25-35 feet) for delivery.[4] Gasoline and propane are brought to Martha's Vineyard in trucks on Steamship Authority's ferries. Barges also deliver gasoline, kerosene, diesel, and heating fuel oil to R.M. Packer's Shell oil terminal.[5]

Given the restrictions on shipment of non-bulk freight, current operations are limited to the following routes:

- Hyannis to Nantucket terminal (1 Steamboat Wharf, Nantucket, MA), operated by the Steamship Authority
- Woods Hole to Oak Bluffs terminal (1 Seaview Avenue, Oak Bluffs, MA), operated by the Steamship Authority
- Woods Hole to Vineyard Haven terminal (1 Water Street, Vineyard Haven, MA), operated by the Steamship Authority

[3] Martha's Vineyard Commission. 2015. Martha's Vineyard Transportation Plan – Draft June 2015. Online at: https://www.mvcommission.org/sites/default/files/docs/Draft%20MVTP%202015_0.pdf.
[4] Martha's Vineyard Commission. 2015. Martha's Vineyard Transportation Plan – Draft June 2015. Online at: https://www.mvcommission.org/sites/default/files/docs/Draft%20MVTP%202015_0.pdf.
[5] Martha's Vineyard Commission. 2015. Martha's Vineyard Transportation Plan – Draft June 2015. Online at: https://www.mvcommission.org/sites/default/files/docs/Draft%20MVTP%202015_0.pdf.

Hy-Line Cruises, which provides vessel service between Cape Cod and the islands, provides passenger service only and any freight transported by their vessels is limited to that which can fit on a hand dolly, such as furniture, boxes, kayaks, building material, and commercial items.[6]

Patriot Party Boats also provides service between Cape Cod and Martha's Vineyard, travelling between Oak Bluffs and Falmouth. These vessels are not licensed by the Steamship Authority due to their small size, but they do conduct some freight shipments such as auto parts and building supplies.[7]

Volumes of non-bulk freight to each port are not publicly available, but the Steamship Authority does provide information about the number of trucks that travel from the mainland to the islands. The number of trucks travelling between the mainland and the islands is usually at its highest in May, June, and July and at its lowest in January and February. It is worth noting that the tables below include commercial and non-commercial trucks and that some of the trucks making these trips are not full or are only partially full, thus there is no clear volume of freight to be concluded from these numbers.

Table 4: Trucks to/from Martha's Vineyard (2010-2020)

	Jan	Feb	March	April	May		June	July	Aug	Sept	Oct	Nov	Dec	Totals
2010	7591	7183	9602	10510	11516		11759	10632	9965	10178	9733	8832	8960	116461
2011	7439	7227	9439	3367	11272		11679	10631	10256	9893	9798	8747	8434	114782
2012	7322	7460	9150	9887	11505		11106	10480	10271	9457	9143	8854	8323	112958
2013	7739	6857	9020	10562	12281		11669	11461	10491	10604	10779	8891	8568	118922
2014	7620	7588	9115	11011	12170		12084	11419	10091	11144	11067	8936	9135	121380
2015	7290	6862	9594	11326	12590		12516	11841	10511	11483	11480	9956	9629	125078
2016	8441	8107	10921	11795	12988		13157	11773	11202	11582	11343	10482	9794	131585
2017	8806	8267	10611	12283	14177		13807	12133	11970	11049	12634	11031	9938	136706
2018	8783	8845	8811	11925	14037		13801	12718	12453	12183	12522	11065	10492	137635
2019	9352	9029	11607	12801	14134		13680	13066	12474	12308	11825	10788	10228	141292
2020	9588	9496	8873	5483	9111		12771							55322

Note: Traffic Statistics represent one-way totals. A round trip passage is counted as two. Includes noncommercial trucks.

Source: Steamship Authority Business Summaries, 2019 (all months)

[6] Hy-Line Cruises Freight Policy. Available online: https://hylinecruises.com/freight/.

[7] Martha's Vineyard Commission. 2015. Martha's Vineyard Transportation Plan – Draft June 2015. Online at: https://www.mvcommission.org/sites/default/files/docs/Draft%20MVTP%202015_0.pdf.

Table 5: Trucks to/from Nantucket (2010-2020)

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Totals
2010	2500	2393	2991	3587	4040	4342	4098	3743	3312	3288	3021	2860	40175
2011	2407	2463	3121	3364	4002	4325	3904	3717	3261	3141	3020	2873	39598
2012	2557	2601	3297	3632	4314	4268	3922	3694	3195	3312	3170	2837	40799
2013	2702	2549	3114	3857	4694	4192	4422	3942	3532	3695	3227	3300	43226
2014	2793	2635	3178	4122	4942	4466	4505	3972	3834	3942	3344	3464	45197
2015	2969	2626	3836	4287	4986	4905	4907	4199	4081	3797	3635	3555	47783
2016	2978	3072	4074	4522	5213	4948	4740	4738	4317	4101	4113	3698	50514
2017	3461	3162	3936	4832	5409	5174	4869	4849	4178	4682	4235	3895	52682
2018	3255	3553	3592	4922	5714	5057	4944	4827	4533	4672	4023	3830	52922
2019	3716	3408	4311	5084	5832	5134	5104	4722	4683	4445	3935	3662	54036
2020	3570	3448	3468	2060	3967	4829							21342

Note: Traffic Statistics represent one-way totals. A round trip passage is counted as two. Includes noncommercial trucks.
Source: Steamship Authority Business Summaries, 2019 (all months)

2.1.2 Pilot Programs

In 2000, the Steamship Authority conducted a pilot program to transport freight between New Bedford and Martha's Vineyard. This was, reportedly, the result of a push by New Bedford for a share of ferry service, a proposal that also found support among Falmouth residents. This also resulted in the inclusion of New Bedford as a voting member of the Steamship Authority.[8]

The Authority contracted with Hvide Marine Incorporated to operate a freight service between the New Bedford State Pier and the Steamship Authority's Vineyard Haven terminal that ran two times a day, five days a week from May 1, 2000 through October 31, 2000. The service was limited to trucks 20 feet and over to minimize the number of large trucks that would need to pass through Woods Hole. The service carried a total of 1,900 trucks (one-way) or an average of 14.5 trucks per day. The rate charged per truck was in parity with that charged on the Woods Hole to Martha's Vineyard route. Revenues covered only around 15 percent of the cost of the service.

In 2001, the Steamship Authority contracted with Hvide to provide the same service, except over a longer period, from April 2, 2001 through November 30, 2001. Trucks less than 20 feet in length were allowed during this pilot. A total of 3,030 trucks were carried on a one-way basis and revenue covered about 22 percent of cost.

The Steamship Authority's Board voted to have the Authority itself operate the service in 2002, but was unable to get permission from the City of New Bedford to use the State Pier, so the service never operated.

[8] Steamship Authority, 2016. Preliminary Report on the Feasibility of Providing Freight Service between New Bedford and Martha's Vineyard. Online at: https://www.steamshipauthority.com/writable/versioned_downloadable_forms/path/new_bedford-marthas_vineyard_freight_service_report_-_2016-04-12.pdf

2.1.3 Additional Feasibility Studies

Ten years later, in 2012, Steamship Authority staff analyzed the financial feasibility of the Steamship Authority operating a freight service between New Bedford and Martha's Vineyard. The analysis adjusted the number of days, length of the vessel's operating day, and frequency of service, but ultimately concluded it was not feasible.

In 2015, the Falmouth and New Bedford members of the Steamship Authority Board again asked Steamship Authority staff to revisit the possibility, looking at all options and all resources, including:

- whether the freight service should be year-round or seasonal,
- whether it should be self-supporting,
- whether certain shippers or commodities should be required to use the service,
- what types of vehicles should be allowed to use the service, and
- what sources of funding might be available for the service.

If the Steamship Authority were to provide the service itself, the below questions would also need answers:

- should the Steamship Authority decrease the number of truck spaces that are available on trips between Woods Hole and Martha's Vineyard, and
- should the Steamship Authority use its "spare" vessel to provide the service.

Or, if the Steamship Authority were to have a private operator provide the service, policy questions to be decided included:

- whether the Steamship Authority should work with only one operator or issue a request for proposals,
- whether the Steamship Authority should allow the private operator to use the Steamship Authority's facilities,
- whether the Steamship Authority should be responsible for the private operator's reservations and tickets,
- whether the Steamship Authority should determine what rates and fares the private operator can charge, and
- who should assume the financial risk of the service, the Steamship Authority or the private operator.

The Steamship Authority staff conducted an analysis of all variables and alternatives and, on April 12, 2016, issued a "Preliminary Report on the Feasibility of Providing Freight Service between New Bedford and Martha's Vineyard,"[9] which recommended the following (subject to a public review and comment process):

- Steamship Authority entertain proposal from Packer Marine to provide barge and tug service to transport roll-on/roll-off freight from New Bedford to Martha's Vineyard
- Engage Craig Johnson, Marine Executive Recruiter with Flagship Management LLC, to determine if any private operators are interested in providing the service at their own financial risk under license from the Steamship Authority.

[9] *Ibid.*

- Join with regional and local officials to seek funding from the appropriate state agency(ies) to:
  - construct, operate and maintain a freight ferry terminal in New Bedford
  - offset the Steamship Authority's deficit for running a New Bedford to Martha's Vineyard service
- Once funding is secured, and if no private operator is interested in providing the service, the Steamship Authority lease/charter a vessel from a private operator and run the service as follows:[10]

  1. two round trips per day on weekdays for 22 weeks during the summer,
  2. Steamship Authority provides ticketing and reservation services integrated with their other routes so customers can choose to take different routes coming and going,
  3. first trip of the day from New Bedford designated as a hazardous cargo trip. Unfilled spots would be available to other trucks and cars,
  4. customers traveling between New Bedford and Martha's Vineyard with their vehicles (both trucks and automobiles) would be able to make reservations on that route the same way they are able to make reservations from Woods Hole,
  5. on the Steamship Authority's other freight trips, auto customers are allowed to travel standby on all freight trips,
  6. non-hazardous freight shippers are allowed to ship their trucks to Martha's Vineyard without drivers as long as they assure Steamship Authority that their driver will meet the vessel on Martha's Vineyard so the truck can be immediately driven off the vessel,
  7. operate as a summer-seasonal service for an initial three-year period, and
  8. New Bedford route would have same fares as the Woods Hole route.

The public comment process that followed elicited a few comments.[11] New Bedford Mayor Mitchell confirmed the City is interested in developing freight opportunities, but that any proposal would need to be consistent with the March 2016 New Bedford Waterfront Framework Plan which reimagined the State Pier as, "a new center for the waterfront tourism experience." The plan did not accommodate a ferry service for vehicles or freight trucks and certain cargoes, such as municipal solid waste from the Islands, would be incompatible. There was interest in exploring possibilities of the South Terminal or Northern Waterfront District where, in September 2016, the City noted they were considering developing a multi-modal transportation facility in the Northern Waterfront.

Whether this location would be feasible for freight shippers largely depended on how much additional time would be needed to travel by boat from New Bedford to Martha's Vineyard. However, freight shippers who travel entirely by ferry between New Bedford and Martha's Vineyard will benefit from a reduction in their trucks' fuel and maintenance costs. The

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[10] These 8 points incorporate minor modifications made to the proposal by the Steamship Authority following receipt of public comments.

[11] Steamship Authority, 2017. Responses to the Public Comments Received Regarding the Preliminary Report on the Feasibility of Providing Freight Service between New Bedford and Martha's Vineyard. Online at: https://www.steamshipauthority.com/writable/versioned_downloadable_forms/path/responses_to_public_comments_-_2017-03-02.pdf

Steamship Authority did not believe that a shift in departure terminals would result in an increase in the cost of goods on the island that are shipped entirely by ferry from New Bedford.

The Steamship Authority also commissioned Craig Johnson of Flagship Management to explore whether any private operators might be interested in providing the New Bedford freight service at their own financial risk under a license agreement with the Steamship Authority and, if so, under what terms and conditions. Johnson's report, completed in August 2017, assessed three sites in New Bedford (State Pier, Marine Commerce Terminal, and Shuster property); looked at companies that could supply an appropriate vessel (i.e., a vessel with good fuel economy, 75-125 gal/hr., large decks, at least 130 ft long x at least 40 ft wide); identified a handful of companies that could be interested in operating the service; and interviewed shippers that use the Woods Hole service. The shippers were largely supportive of the proposed service from New Bedford, particularly those shippers closer to and west of New Bedford. A few companies were against a service if it reduced the number of trips offered from Woods Hole to Martha's Vineyard. A few of the companies said they would use the service if they were able to drop a truck in New Bedford and pick it up on Martha's Vineyard as currently done on the Nantucket run (*i.e.,* driverless while on the vessel).

Based on Johnson's August 2017 report, the Steamship Authority issued "A Proposed Service Model for a Freight Service between New Bedford and Martha's Vineyard".[12] The proposal included:

1. A private ferry operator providing the service (at its own financial risk) with no subsidy from the Steamship Authority, except for allowing the operator to use the Steamship Authority's reservation system and the Steamship Authority's Vineyard Haven terminal,[13] and coordinating schedules to enable shippers to use both services.
2. The New Bedford State Pier (now managed by MassDevelopment) as the New Bedford terminal. Steamship Authority would work with the City, MassDevelopment, other municipalities, and government agencies to obtain funding to repair the State Pier.
3. A private operator with whom the Steamship Authority would enter into a license agreement.
4. A service that would initially operate as follows:
    a) private operator uses the Vineyard Haven terminal
    b) two roundtrips per day on weekdays for 22 weeks during the summer with potential to operate on weekends. (Shippers generally ship on weekdays.)
    c) Steamship Authority provides reservation and ticketing services, integrated with existing services
    d) nonhazardous shippers could ship trucks without drivers as long as truck is met by its driver when the vessel arrives in port
    e) first daily one-way trip from New Bedford tentatively designated as a "hazardous cargo" trip

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[12] Craig Johnson (Flagship Management). 2017. Initial Report on the Possibility of a Freight Ferry Service Between Martha's Vineyard and New Bedford. Online at: https://www.steamshipauthority.com/writable/versioned_downloadable_forms/path/flagship_management_initial_report_-_2017-08-10_copy1.pdf

[13] The only other feasible terminal is Packer Marine's facility on Beach Road in Vineyard Haven. Oak Bluffs' terminal is not suitable because wooden docks cannot support trucks over 80,000 pounds. However, if New Bedford service was to start, some "other SSA trips could be transferred to Oak Bluffs to reduce traffic and scheduling conflicts.

f) passengers and vehicles would be able to make reservations in the same way they can on the Steamship Authority 's other freight services and also on a stand-by basis
g) initial period of several years, with potential to extend.

2.2 Harbor Profiles

The following section provides profiles of the ports identified in the scope, including information about existing conditions and potential shipping activity. The ports covered in this section include New Bedford/Fairhaven, Fall River, Somerset, Falmouth (Woods Hole), Oak Bluffs, and Tisbury, Massachusetts.

2.2.1 New Bedford/Fairhaven

Image: Google Earth

Figure 3: New Bedford aerial image

The Port of New Bedford is a deep-water commercial port located in the New Bedford/Fairhaven Harbor on the south coast of Massachusetts. New Bedford has been a port city since the 18th century and its waterfront has supported a rich variety of maritime activities over its history. The Town of Fairhaven on the eastern shore of the harbor across from New Bedford also has a strong working waterfront with publicly- and privately-owned berthing facilities for the commercial fishing fleet, significant marine repair and recreational boat marina operations, shipyard, charter, and excursion boat services. While Fairhaven's maritime businesses may have a role in supporting a freight service from this harbor, New Bedford's landside and waterfront infrastructure is currently more suited to a freight operation. Portions of both the New Bedford and Fairhaven waterfronts are classified as Designated Port Areas (DPAs) by the Massachusetts Office of Coastal Zone Management, the purpose of which is to preserve and promote maritime industry. DPAs are subject to specific provisions, including land use restrictions under

Massachusetts General Law Chapter 91, which encourage the creation or expansion of water-dependent industrial facilities, such as waterborne freight services, in developed harbor areas.

In recent years New Bedford is most widely recognized for commercial fishing—it is the highest grossing commercial fishing port in the United States with more than 500 commercial scallopers and fishermen at the center of an industry cluster that includes seafood processors and distributors, fueling companies, equipment manufacturers, and maritime services. In 2015, approximately 140 million pounds of seafood were landed in New Bedford Harbor and an additional 250 million pounds of domestic and international seafood was processed.[14] In fact, most of the seafood processed in New Bedford arrives frozen and leaves frozen.

The New Bedford/Fairhaven Harbor is more than fishing, however. Its location, port infrastructure, and landside transportation assets support traditional maritime businesses including cargo shipping and handling, cruise ships, bulk and break-bulk cargo facilities, shipyard and vessel and rig repair and maintenance, passenger ferry operations, and recreational boating. More recently, bolstered by state and local policies and investment, the Harbor is positioned to become a center for the nascent U.S. offshore wind industry.

The Port supports a diverse market of cargo and handles/transports more than $230 million in bulk commodities and break-bulk cargo. In 2015, a total of 280,000 tons of cargo moved through the marine facilities owned by the Port of New Bedford, including petroleum, aggregates, and imported fruits. Not all infrastructure in the Harbor falls under the control of the New Bedford Port Authority.[15] Most of the city's waterfront is privately-owned or leased, and the State owns two major facilities and has partial ownership of the Pope's Island Marina.

New Bedford/Fairhaven Harbor has a federal channel with an authorized depth of -30 feet and width of 350 feet. It has not been fully dredged by the Army Corps of Engineers in more than 50 years but, in 2015, the Commonwealth of Massachusetts completed an Interim Federal Channel Dredging Project, removing 117,000 cubic yards of material from the federal navigation channel inside and outside of the hurricane barrier. This project brought the channel depth to -28.5 feet Mean Lower Low Water (MLLW) which facilitates ships delivering cargo and equipment to multiple port facilities including the Marine Commerce Terminal, and the New Bedford State Pier.

Dredging has been a particular challenge in New Bedford Harbor since 1980 when the U.S. Environmental Protection Agency (EPA) determined the Harbor was contaminated and a threat to public health from years of discharge from local manufacturers.[16]

The Harbor is protected by the New Bedford hurricane barrier which stretches across the water from the south end of New Bedford to the Town of Fairhaven. The barrier's 150-foot opening closes during hurricane conditions and coastal storms making it one of the safest harbors on the eastern seaboard.

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[14] Martin Associates and Apex Companies, LLC. 2016. Economic Impact Study of the New Bedford/Fairhaven Harbor. Prepared for The New Bedford Harbor Development Commission. Online at: https://portofnewbedford.org/wp-content/uploads/2019/04/Full-2019-Martin-Report.pdf

[15] *Ibid.*

[16] *Ibid.*

Massachusetts Route 6 crosses the Harbor over the New Bedford-Fairhaven Bridge which consists of three bridge spans interspersed among two mid-harbor islands, Fish and Pope's Islands. The middle span is a swing bridge over the harbor's main shipping channel allowing vessels to pass through into the northern harbor area. The east and west spans are fixed. The bridge was completed in 1903 and is classified as functionally obsolete which limits the utilization of the deep-water port facilities in the north portion of inner harbor and the movement of local marine traffic. A project to replace the bridge is requested in the Southeastern Massachusetts MPO 2040 Long Range Transportation Plan.

Existing Conditions Related to Shipping

The New Bedford Port Authority (NBPA, formerly the Harbor Development Commission) was created by the Massachusetts General Court under Chapter 762 of the Acts of 1957. It is an autonomous body charged with managing the Port including all City-owned waterfront property; its mission is to keep New Bedford on top as the number one U.S. fishing port, expand existing businesses, and capitalize on new opportunities to maximize the Port's potential as an economic engine to create jobs and strengthen the New Bedford economy.[17]

City-owned properties managed by the NBPA are utilized almost exclusively by the fishing industry:

- Homer's Wharf: houses some of the waterfront's seafood processing companies and provides berthing for commercial fishing vessels.
- Leonard's Wharf (aka Merrill's Wharf): home to fishing boats and most of the Port's lobster boats.
- Steamship Wharf (significant recent repairs and improvements with NBPA and Seaport Council funds): houses many fishing and lobster boats. Once served as a terminal for ferries operating between New Bedford, Martha's Vineyard, and Nantucket, and for service from Boston, New York City, and New London. Expansion is possible but limited due to proximity of the State Pier and the large vessels berthed there which impede maneuvering capabilities.
- Fisherman's Wharf (originally two piers – City Pier #3 and #4): provides additional berthing for the New Bedford fishing fleet and is currently overcrowded with limited space for expansion. Also docked here are the Alert (II), a passenger ferry to Cuttyhunk Island, and the Acushnet, Whaling City Tour's vessel providing harbor tours and launch and water taxi service. Dockage on these piers is available on a first come, first served basis.
- Coal Pocket Pier: used for berthing fishing and lobster boats and has assigned docking. Due to the Pier's size and orientation, expansion is not possible.

[17] Port of New Bedford. Online at: https://portofnewbedford.org/the-new-bedford-port-authority/

Table 6: Berthing in New Bedford harbor[18]

Facility	Linear feet of berthing space	Number of Berths	Number of Vessels
Steamship	1,300	15	50
Leonard's	950	12	40
Fisherman's	940	9	30
Homer's	850	12	30
Coal Pocket	260	4	10

To support additional port services, the NBPA licenses exclusive and non-exclusive use of several berths on the Central Waterfront. Currently, these docking spaces are licensed to Cuttyhunk Water Taxi (a passenger/cargo ferry service) and Whaling City Launch Service.

The NBPA manages the 204-slip recreational marina at Pope's Island and also arranges and manages contracts with multiple cruise ship lines to use berthing facilities at State Pier.

The State also owns and manages several sites along the city's waterfront. The New Bedford State Pier is located at the heart of New Bedford's central waterfront and is a hub for cargo operations and passenger activity. The Pier is owned by the Commonwealth of Massachusetts through the Department of Conservation and Recreation (DCR). Under a Memorandum of Understanding by and between the Massachusetts Development Finance Agency (MassDevelopment) and DCR, the New Bedford State Pier is managed by MassDevelopment. Among the maritime activities on the State Pier are the SeaStreak ferries to Martha's Vineyard and Nantucket and the Cuttyhunk Ferry.

The New Bedford Marine Commerce Terminal, completed by the State in 2015 and managed by the Massachusetts Clean Energy Center, is a multi-purpose facility developed as the first facility in the nation specifically designed to both handle bulk, break-bulk, container shipping, and large specialty marine cargo, and to support the construction, assembly, and deployment of offshore wind projects.[19] Its 29-acre facility, including 21 acres of heavy-lift capacity, 1,200 feet of bulkhead, including 800 feet of deep draft berthing and 400 feet of barge berthing space has significantly expanded New Bedford's waterfront infrastructure. It has easy roadway connections to interstate highway system via I-95 or I-495 (via connections through New Bedford Route 18 and MA Route 140 and/or Route I-195).

In addition, there are several privately-owned facilities along the waterfront. Maritime International, 276 MacArthur Drive, has one of the largest USDA-approved cold treatment centers on the East Coast for the use of restricted imported fruit.

[18] Port of New Bedford. Online at https://portofnewbedford.org/other-harbor-users

[19] Sasaki, Cecil Group, UMass Donahue Institute, FXM Associates, and Apex. 2016. New Bedford Waterfront Framework Plan.

Several barge operations move aggregate and break-bulk cargo to the Islands of Martha's Vineyard and Nantucket:

- R.M. Packer Company Inc., with a terminal at 352 Herman Melville Blvd., is a marine transport and fuel storage operation. Packer also owns the only deepwater dock in Vineyard Haven capable of offloading large items from barges, and a bulk fuel terminal on Beach Road in Vineyard Haven. Packer supplies home heating oil and gasoline, both retail and wholesale on the Island. Packer's Tisbury Towing and Transportation Co. transports gasoline and other petroleum products between New Bedford and Vineyard Haven.
- Toscana Corporation, a tug and barge company, operates out of Fish Island. Its 110-foot by 35-foot open-deck barge transports oversized or overweight cargo to Nantucket. The barge can carry up to 1,000 tons of bulk commodities such as aggregate and sand that if carried by truck would be roughly equivalent to thirty-five tractor trailers carrying thirty-five tons each on the Steamship Authority's vessels. The tug generally makes two trips per week to Nantucket, a 10-hour trip usually via Woods Hole, but occasionally through Quicks' Hole. The terminal facility is just off I-195, provides full access to the barge deck for large trucks, and has ample staging areas for queuing and parking. Toscana doesn't do any business on Martha's Vineyard because the Steamship terminal there isn't usable for bulk transfer.
- Two other tug companies operate from Fish Island: 41 North Offshore keeps its tug 'Kodiak' there and Tucker-Roy Marine Towing and Salvage has its workboats based there.
- Gateway Towing operates from the "Sand dock" off Herman Melville Boulevard. Sand is loaded onto barges and taken to New Haven, CT.
- The North Terminal area has potential, but is a complex area for redevelopment that is dependent on decisions by many small property owners and large future public investments such as the EPA expanded bulkhead project (the creation of 1500 linear feet of additional bulkhead with clean soil from future dredging operations) and the South Coast Rail extension.
- The Sprague Energy and Global terminal handles petroleum used by bunkers who fuel fishing vessels in the Harbor as well as distributors that provide fuel to residential customers. According to the Framework Plan[20] this site has possible future cargo potential. The site is owned by a combination of the Commonwealth Gas Company and the Sprague Oil Company. Though some portions of the site are used, much is vacant and underutilized. Efforts to redevelop are complicated by significant environmental contamination.

In addition to the cargo moving through the Harbor, ferries operating from New Bedford/Fairhaven Harbor take passengers back and forth to Martha's Vineyard, Cuttyhunk Island, and Nantucket:

- Seastreak Ferry from the State Pier to Martha's Vineyard: between May – October to Oak Bluffs (1 Seaview Avenue), or from November 25-29 to Vineyard Haven and from May to October to Nantucket.

[20] *Ibid.*

- The Cuttyhunk Ferry Company operates ferry service year-round between the State Pier (South Bulkhead) and Cuttyhunk Island.
- The Cuttyhunk Water Taxi operates an 18-ft passenger vessel from 52 Fisherman's Wharf to Menemsha, Martha's Vineyard, and Cuttyhunk.

Potential for Short-Sea Shipping

There is potential for and interest in short-sea shipping from the Port of New Bedford. This is reflected in several studies, plans, and policy documents concerning the port. Realizing this potential depends on future investments in port infrastructure and the economics of the service and competing uses.

In 2012-2013, the New Bedford Harbor Development Commission led The East Coast Marine Highway Initiative Partnership, which sponsored a study to develop strategies for the establishing viable Marine Highway services along the M-95 Marine Highway Corridor.[21] Such services would provide freight shippers with waterborne alternatives to truck and rail transportation. Following an initial screening of potential services based on cost per load, a short-haul loop linking New England and Mid-Atlantic ports, with a focus on New Bedford and Baltimore was among several selected for further analysis. The study detailed the myriad factors affecting service viability and ultimately concluded that even for the highest performing routes, operating costs exceed expected revenues. The study includes recommendations for overcoming the challenges and catalogs the benefits of marine highway services including reduced congestion on roads and highways, fewer greenhouse gas emissions, improved safety, and additional sealift military resources that support national defense.

The 2016 New Bedford Waterfront Framework Plan suggests "[t]he possibility also exists for marine highway (short-sea shipping) in New Bedford. The market viability hinges, in part, on operational issues such as filling ships with cargo on the back haul. Yet, short-sea shipping is a land consumptive operation and would need significant real estate to thrive in New Bedford." [22] The framework plan process highlighted the need for additional waterfront improvements. Next steps include deeper investigation of expansion of cold storage and other needs for cargo on sites such as Marine Commerce Terminal or Eversource/Sprague waterfront, and improvements to road configurations in the South Terminal area to allow for large truck access and egress.

The New Bedford Regeneration Committee's 2014 report also noted that forecasts suggest that maritime cargo in the U.S. will grow dramatically in the coming years. Most of this increase will come from containerized freight loaded at the nation's largest ports, but there is potential that surging demand will lead to the development of hub-and-spoke short-sea shipping lanes along the East Coast that could benefit the Port of New Bedford.[23]

The Regeneration Committee's report says that, in the near term, the State Pier should continue to support break-bulk cargo handling, a business which has grown in recent years. The report

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[21] Parsons Brinckerhoff *et al*. 2013. East Coast Marine Highway Initiative M-95 Study Final Report. East Coast Marine Highway Initiative Awarding Authority.

[22] Sasaki, Cecil Group, UMass Donahue Institute, FXM Associates, and Apex. 2016. New Bedford Waterfront Framework Plan.

[23] New Bedford Regeneration Committee. 2014. Uniting in Pursuit of Growth and Opportunity, Final Report.

continues, however, to suggest that in the long run the highest and best uses of the State Pier are not industrial. While the vast majority of industrial ports offer some public access to the waterfront, the public is almost completely shut out from New Bedford Harbor. The State Pier represents a singular opportunity to transform New Bedford's land-locked downtown into a water-side public retail and dining destination akin to those in other industrial ports, such as Baltimore, Boston, and Portland. Developing the State Pier with these goals (retail, dining, and other waterfront public activities) in mind would not compromise the Port's cargo business, which can be better supported in the more industrial areas of the Harbor, nor the commercial fishing industry, which does not land fish on the pier.

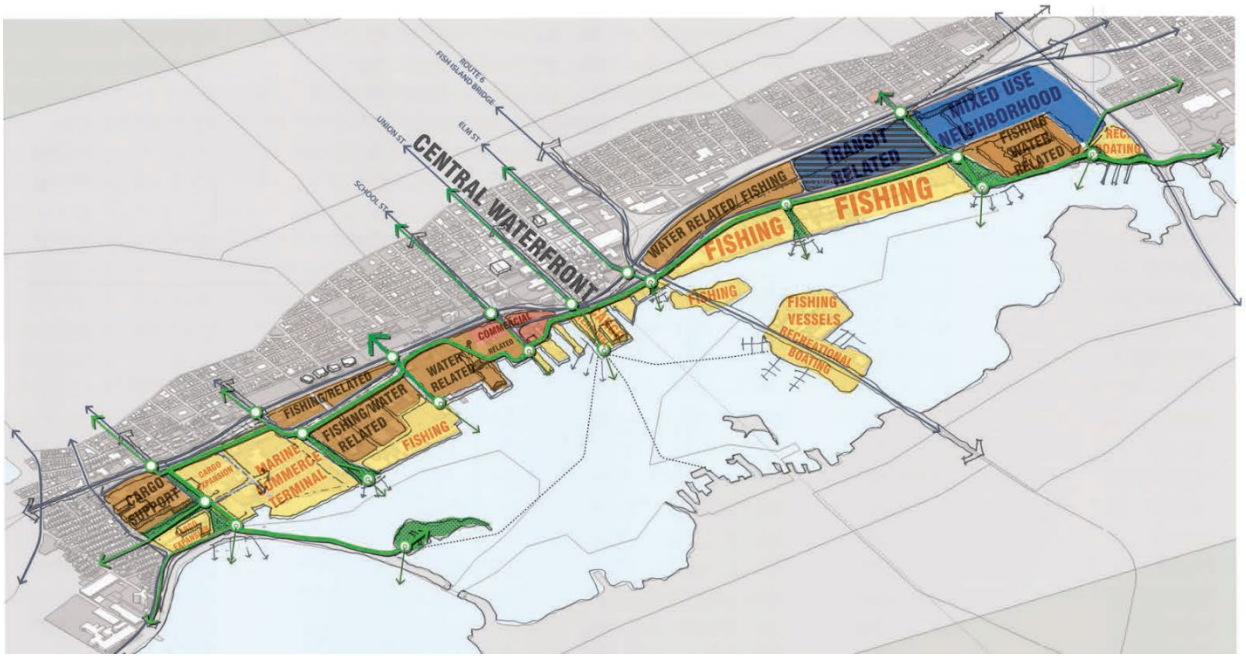

Figure 4: Future New Bedford waterfront

The New Bedford Waterfront Framework Plan[24] sees the Central Waterfront area as a "critical 'hinge point' between New Bedford's waterfront and commercial downtown. The plan envisions the future of the State Pier as 'a new center for the waterfront tourism experience' complementing the investments made to improve the streetscape and pedestrian access to the area." The plan foresees a gateway building, fish market, welcome center, retail, recreational boating, and ferry service on the State Pier, but not a ferry service for vehicles and passengers, let alone one for freight trucks. At over eight acres, State Pier's large size allows it to continue to accommodate cargo operations, fishing vessels, ferry operations, and parking while adding a more multi-functional public zone.

It is worth noting that in August 18, 2016, the New Bedford City Council adopted a motion requesting that the Governor, Legislature, Seaport Economic Council, and the Steamship Authority, "look into the feasibility of installing a ferry service for cargo, vehicles, etc. at the State Pier," saying that "there is already an existing port at that location, this ferry service would

[24] Sasaki, Cecil Group, UMass Donahue Institute, FXM Associates, and Apex. 2016. New Bedford Waterfront Framework Plan.

not only lessen the congestion that exists at Woods Hole, but would provide an economic boom to New Bedford."[25]

The Port's Strategic Plan[26] noted that the City is interested in having a modest number of supporting uses like restaurants or retail in areas that cannot be readily used by industry, such as along the front of the State Pier, providing an opportunity to educate and improve the public's appreciation of our maritime industries.

The Strategic Plan calls for the City to work with the state agencies that control major facilities in the Port to promote the expansion of the port's cargo business. Although the Port is not large enough to receive major container ships, its tonnage of refrigerated break bulk cargo has increased significantly in recent years in part because of the growing recognition of the port's advantage as a distribution point to New England and Eastern Canadian food retailers. There is room for further growth, including possibly in the business of short-sea shipping, but it will require clear coordination about marketing and leasing arrangements with the state agencies that operate in the Harbor. This plan further suggests that full development of North Terminal would expand access for fish processors, international shipping companies, and island freight services.

These planning documents seem to support future development of short-sea shipping from private properties that now support bulk shipping, those properties targeted for future redevelopment, or the South Terminal area. The Steamship Authority-sponsored report[27] recommended the New Bedford State Pier as the New Bedford terminal for a potential freight ferry service to Martha's Vineyard.

The recent (2015) dredging of the federal channel increased water depth to facilitate anticipated cargo operations and the increase of shipping activities within the Harbor and reduced limiting restrictions on the size of commercial ships that can enter the Harbor. The increased depth to a minimum depth of -30' MLLW of the berth at the State Pier allows larger vessels to call on and remain at the State Pier without concern for tides.

There are several infrastructure projects in various stages of planning that would have a significant economic impact on the Harbor, region, and Commonwealth. Much of this is from Port of New Bedford's Strategic Plan 2018-2023.[28]

- The North Terminal expansion project, currently planned as three phases, will provide up to 1,600 feet of additional bulkhead berthing space with deep water access, multi-modal connections to road and rail. The development of North Terminal would expand access for fish processors, international shipping companies, and island freight services. In addition, as the offshore wind industry continues to develop, the expansion of North

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[25] Steamship Authority. 2017. Responses to the Public Comments Received Regarding the Preliminary Report on the Feasibility of Providing Freight Service between New Bedford and Martha's Vineyard. Online at: https://www.steamshipauthority.com/writable/versioned_downloadable_forms/path/responses_to_public_comments_-_2017-03-02.pdf

[26] New Bedford Port Authority. 2018. Port of New Bedford Strategic Plan 2018-2033.

[27] Steamship Authority, 2017. A Proposed Service Model for a Freight Service between New Bedford and Martha's Vineyard

[28] New Bedford Port Authority. 2018. Port of New Bedford Strategic Plan 2018-2033.

Terminal would provide the Port with the capacity to handle two separate offshore wind installation projects in the future.

- State Pier: The state recently invested approximately $4 million to refrigerate the warehouses on the State Pier, which will enable the break-bulk cargo business on the pier to operate year-round. As detailed in several recent studies, after years of neglect, the state must now repair the buildings and significant portions of the pier's structure, either by replacing pilings or by building a bulkhead around the facility. Because the facility hosts the port's ferry and primary cargo-handling terminals, the renovations, which are estimated to be between $20-25 million, are urgently needed.[29] However, long-term investment cannot begin until there is an understanding between the NBPA, the City and the State about future uses for the pier.
- The State Pier Ferry Terminal is a terminus for ferries between Martha's Vineyard and Cuttyhunk in the Elizabeth Islands. The central location of the ferry terminal at State Pier is important for the continued success of the ferry and excursion boats.[30]
- The Route 6 Bridge is nearing the end of its useful life. Of the repair or replace options being further explored, a new bridge will allow better commercial access improving waterside connections between the lower and upper harbors, directly benefiting the North Terminal Project.
- MassDOT has classified the New Bedford-Fairhaven Bridge as "functionally obsolete." The bridge is a physical barrier to North Terminal for larger vessels and stymies the growth of the cargo and offshore wind industries. The lower harbor lacks space for continued development, leaving the upper harbor ripe for growth, but until the bridge is replaced to allow for wider clearance, the Northern Harbor will not realize its full economic potential. Of two proposed options, the NBPA will continue to press the state administration to fund the replacement of the bridge, which would cost approximately $100 million rather than repair it at a cost exceeding $45 million in the coming years.[31]
- The City has studied the extension of the waterfront freight rail from State Pier to the New Bedford Marine Commerce Terminal. This rail extension to the Marine Commerce Terminal would open up new cargo development opportunities as well as access for the fish processors along South Terminal. The preferred alignment offers the opportunity to create a large waterside site with immediate freight and truck access.
- Repairs are needed along the city's five commercial fishing piers that were constructed in the early 20th century. Pier 3, Steamship Pier, Coal Pocket Pier, Homer's Wharf, and Leonard's Wharf sustain the bulk of the harbor's fleet and will need substantial repairs in the coming years.
- Pope's Island Marina Upgrades: With 198 seasonal slips and dozens of transient moorings, Pope's Island Marina has significant capacity to serve as the Port's primary

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[29] *Ibid.*

[30] Sasaki, Cecil Group, UMass Donahue Institute, FXM Associates, and Apex. 2016. New Bedford Waterfront Framework Plan.

[31] New Bedford Port Authority. 2018. Port of New Bedford Strategic Plan 2018-2033. Online at: https://portofnewbedford.org/strategic-plan-2018-2023/

recreational boating center. Renovations are needed to handle today's larger and more energy-intense recreational vessels. Many of the docks and slips need repair or replacement, and the entire marina is in need of electrical upgrades.

- Union Wharf in Fairhaven is another project that will provide infrastructure upgrades to allow economic growth, revitalizing an underutilized facility and providing badly needed additional berthing space to the harbor's fleet of vessels.
- There remains a desire to bring the federal channel to its authorized depth of -30 MLLW. Additionally, there are at least 22 different properties/areas that need and are eligible for the state Enhanced Remedy Phase V dredging. One option that has been evaluated is to conduct the Phase V program in coordination with the USACE's Federal Channel Dredging. A survey of users indicated that the combined projects would provide waterfront access for 60 additional commercial fishing vessels now offloading at out of state ports; the ability to compete for about 100,000 tons of bulk cargo now handled at marine terminals in Providence, RI that are destined for the New Bedford area and currently trucked to New Bedford; and the addition of new or expanded processing operations and ship repair and maintenance support to accommodate the 60 additional fishing vessels that would supply about 7 million pounds of additional landings.[32]

2.2.2 Fall River

Fall River is a city in Bristol County, Massachusetts, and is located on the eastern shore of Mount Hope Bay and at the mouth of the Taunton River. Mount Hope Bay has been an important part of Fall River's industrial economy—past and present—providing vessel access both for commercial and passenger use. Ferry service to Newport and Block Island is available out of Mount Hope Bay, and recreational sailing is a common activity in the region. The Taunton River, which flows to Mount Hope Bay, is approximately 40 miles long, and provides important nursery and foraging habitat for a variety of commercially and recreationally important fish species including striped bass, blue fish, herring, and rainbow smelt.

Today, Fall River's coastline is a mix of commercial, industrial, and residential uses. Fall River has an extensive waterfront including a historic downtown area, which can be divided into three subareas: south waterfront (arts, museums, and parks including Battleship Cove and the Fall River State Pier), central waterfront (Route 79, Davol Street, and neighborhoods), and north waterfront (former Shell Oil site).[33] The Fall River Redevelopment Authority (FRRA) has recently sponsored two urban renewal plans, one of which focuses on these waterfront areas, and the other focuses on the downtown area.

The Fall River State Pier is one of several state piers owned by the Commonwealth of Massachusetts and is located on the eastern bank of the Taunton River.[34] The Department of Conservation and Recreation is responsible for the oversight of the Fall River Pier Lines (the

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[32] Martin, 2016.

[33] Fall River Development Authority. Fall River Waterfront Urban Renewal Plan. September 2018. Online at: https://www.fallriverma.org/wp-content/uploads/2018/06/20180904-Waterfront-URP-Draft-low-res.pdf

[34] Karl F. Seidman Consulting Services and UrbanFocus LLC. Massachusetts State Piers: A Business and Operations Assessment. August 2016. Online at: https://files.masscec.com/state-piers-report-8-2-16_0.pdf

management firm of the pier) and guides major repairs and renovations.[35] Fall River Pier Lines has operated the State Pier facility since 1954 and is responsible for pier management and operations.[36]

Source: Clean Energy Center

Figure 5: Fall River State Pier parcels

The Port of Fall River has a deepwater harbor with a channel of 35 feet and is the second most active port in Massachusetts (Boston being the most active).[37] The Fall River State Pier is 8.6 acres and includes two berths of 27 feet draft MLW; the South berth is 600' long and the West berth is 400' long, as well as a 96,000 square foot terminal storage building.[38] The port also has strong transportation infrastructure, with direct connections to three rail tracks.[39]

The Fall River State Pier hosts a large amount of nautical activity, including modern cargo vessels, fishing vessels, a high speed ferry between Block Island and Newport, the Battleship Cove Museum, historic navy ships, and cruise ships.[40] To assist the larger vessels, the port also

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[35] *Ibid*.
[36] *Ibid*.
[37] World Port Source. Online at: http://www.worldportsource.com/ports/commerce/USA_MA_Port_of_Fall_River_1514.php
[38] Fall River Line Pier, Inc., Marine Terminal Operations. Online at: http://fallriverlinepier.com/
[39] *Ibid*.
[40] Fall River Line Pier, Inc., Marine Terminal Operations. Online at: http://fallriverlinepier.com/shipping/dockage/

has tug boats and service vessels.[41] The battleship USS Massachusetts, a World War II memorial, and three other U.S. Navy vessels are berthed just northward of the State Pier along the Taunton River.[42]

Fall River State Pier has a Roll-on, Roll-off ramp, and primarily imports and exports household goods and vehicles from Cape Verde, Azores, Brazil, Haiti, the Dominican Republic, and other areas in the Caribbean basin.[43] The Fall River Line Pier manages the general cargo and breakbulk industry that utilizes the pier, with Atlantic Shipping being the main cargo operator for the Fall River State Pier.[44] Atlantic Trade provides the imported products to stores and utilizes the pier's storage space.[45]

Regarding possible future plans to update Fall River, the Fall River Redevelopment Authority (FRRA) has recently developed two urban renewal plans which contain potential recommendations on how to update Fall River's waterfront and downtown area (The Fall River Waterfront Urban Renewal Plan and The Fall River Harbor and Downtown Plan). The main objectives behind the Waterfront Urban Renewal Plan are to redevelop vacant land, and link that new development to the waterfront and adjacent neighborhoods, the Battleship Cove District, and the Shell Oil site.[46] The main objectives behind the Harbor and Downtown Plan are to create tourism-related destinations, and a plan for new investments in the waterfront and downtown area for service-related sectors.[47]

Additionally, there has been interest by local stakeholders in converting parts of the pier from cargo activity to mixed-use development, including retail, a café, and a children's center.[48] The Battleship Cove Museum also has plans to expand and has completed a master plan.[49] Further, some stakeholders are interested in expanded cargo operations from Atlantic Shipping and a metal recycling firm.[50] That said, these recommendations have not been evaluated by state agencies for potential or practicality.

Potential for Short-Sea Shipping

Anecdotal information suggests that Fall River may not be an ideal location for a short-sea shipping terminal, as the distance to travel by vessel from Fall River to reach Cape Cod and the Islands is quite lengthy (Figure 1). This distance impacts the practicality of utilizing this terminal

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[41] Fall River Line Pier, Inc., Marine Terminal Operations. Online at: http://fallriverlinepier.com/shipping/
[42] Urban Harbors Institute. 2015 State of Our Harbors. 2015.
[43] Fall River Line Pier, Inc., Online at: http://fallriverlinepier.com/
[44] Fall River Line Pier, Inc., Massachusetts State Piers: A Business and Operations Assessment. August 2016. Online at: https://files.masscec.com/state-piers-report-8-2-16_0.pdf
[45] *Ibid*.
[46] Fall River Waterfront Urban Renewal Plan. September 2018. Produced by the Fall River Development Authority. Online at: https://www.fallriverma.org/wp-content/uploads/2018/06/20180904-Waterfront-URP-Draft-low-res.pdf
[47] Fall River Harbor and Downtown Plan. Online at: https://harriman.com/fall-river-harbor-and-downtown-plan/
[48] *Ibid*.
[49] *Ibid.*
[50] *Ibid.*

for short-sea shipping, as it will lead to enhanced vessel greenhouse gas emissions and increased time spent traveling for crew and products.

2.2.3 Woods Hole

Image: Google Earth

Figure 6: Woods Hole aerial image

Great Harbor, in Woods Hole, is located on the southern tip of Falmouth on Cape Cod. The harbor is situated with Buzzards Bay to the west and Vineyard Sound to the southeast. The Elizabeth Islands are directly southwest, separated from the mainland of Cape Cod by the Woods Hole Strait (Figure 1).

The harbor is notably home to many prominent scientific research organizations, including the Woods Hole Oceanographic Institution, Marine Biological Laboratory, Northeast Fisheries Science Center, USGS Coastal and Marine Science Center, and their associated research vessels.

The harbor supports extensive recreational boating activity, including a large mooring field in Great Harbor and the connected Eel Pond, and the Woods Hole Yacht Club; commercial fishing; as well as sightseeing and charter boats. In addition, the harbor hosts the Steamship Authority terminal for passenger ferry and freight service to Martha's Vineyard.

The US Army Corps of Engineers (USACE) has conducted several major projects in the harbor, beginning in the 1870s with removing navigational hazards in the form of shoals and boulders at

the entrance of Great Harbor and through the Woods Hole Strait.[51] Following that, USACE constructed a breakwater in Great Harbor as well as stone piers and retaining walls at some of the wharves, dredged a channel into Little Harbor, and also dredged the Woods Hole Channel.[52] The current channel (the Strait) is 2,500 feet long, 13 feet deep, and 300 feet wide.[53] A 1,300-foot-long branch channel (Broadway), 13 feet deep, and 300 feet wide, turns southeast from Woods Hole Channel towards Vineyard Sound east of Nonamesset Island.[54]

The Steamship Authority offers passenger, automobile, and truck freight ferry service from Woods Hole to both Vineyard Haven and Oak Bluffs on Martha's Vineyard. The traditional passenger and cargo ferries can carry a combination of passengers, cars, and trucks, with some trips specifically designated as freight vessel trips, with limited passenger service available. In the summer months of 2020, for the Woods Hole to Vineyard Haven route, the Steamship Authority scheduled ten round-trip freight vessel trips per day from Monday to Friday, and seven on Saturday and Sunday. In addition, there are also unscheduled freight vessel trips which are available to operate if needed. During the same time period, there were two unscheduled freight vessel trips per day from Monday to Thursday, and one unscheduled trip on Friday. From Monday to Saturday, one freight vessel trip per day is able to carry hazardous material, with two hazardous materials trips available on Wednesday.

During this time, there were no exclusive freight vessel trips scheduled from Woods Hole to Oak Bluffs. During the late spring (mid-May to mid-June) and fall (after Labor Day to late October), however, there are three freight vessel trips per day from Woods Hole to Oak Bluffs. During the late fall, winter, and early spring months (late October to mid-May), there are no trips of any kind schedule from Woods Hole to Oak Bluffs.

During the summer months of 2020, the Steamship Authority also scheduled nine daily round-trips to Vineyard Haven and ten daily round-trips to Oak Bluffs, with an added trip on Friday, Saturday, and Sunday to each location, that were not designated as freight vessel trips. These trips carry passengers and automobiles, and also are able to accommodate freight trucks.

Table 7: Ferry cargo to islands 2019 [55]

	From the Mainland to Martha's Vineyard and Return*	**Total for Martha's Vineyard and Nantucket***
Passengers	2,425,787	3,004,436
Automobiles	414,967	478,990
Trucks	141,292	195,328

Note: Traffic statistics represent one-way totals. A round-trip passage is counted as two.

[51] US Army Corps of Engineers. No date. Woods Hole Channel Navigation Project. Online at: https://www.nae.usace.army.mil/Missions/Civil-Works/Navigation/Massachusetts/Woods-Hole/
[52] *Ibid.*
[53] *Ibid.*
[54] *Ibid.*
[55] Steamship Authority. 2020. Traffic Report 1995-2020. Online at: https://www.steamshipauthority.com/writable/versioned_downloadable_forms/path/june_2020_traffic_statistics_for_website.pdf

Comparing the Woods Hole to Martha's Vineyard route to the total Steamship Authority traffic, this route accounts for approximately 81 percent of the total passenger traffic, 87 percent of the total automobile traffic, and 72 percent of the total truck traffic.

Woods Hole Terminal Reconstruction Project

In planning for continued operations, the Steamship Authority determined the need to conduct a reconstruction of the Woods Hole Ferry Terminal to address outdated and deteriorating infrastructure, improved ADA access, and address flooding concerns.[56]

Already completed elements of the project include the initial feasibility study, a temporary terminal building in Woods Hole, and a new Steamship Authority administration building in Falmouth that opened in early 2018. In December 2017 Jay Cashman, Inc. was awarded the marine construction contract for the waterside work, the aspect of the project that comprises the majority of the budget and is the most time intensive. "The overall [waterside and terminal building] project entails the phased demolition of all of the existing waterfront structures that include the current three ferry slips and supporting utilities to be replaced with three new ferry slips, two passenger loading piers, and comprehensive utility and stormwater management improvements. Following the waterside construction, landside improvements include site re-grading, a new ferry terminal building and equipment storage building, bus berths and overall reconstruction of site utilities and vehicle accommodations."[57] The majority of on-site construction work will be completed during the off-season from September to May to minimize the impact to ferry operations and the local community.[58] The project has an updated budget of approximately $93 million and an estimated completion date of May 2025 at the earliest.[59]

Potential for Short-Sea Shipping

There is at least one unscheduled freight trip per day that can be utilized as needed throughout the year from Woods Hole to Vineyard Haven. In addition, the Steamship Authority has the ability to add an extra trip per day to Vineyard Haven by running the vessels at a faster speed and shortening the turn-around time between trips.[60] This strategy has not been implemented due to the lack of demand for an additional trip.[61] As a result, the Steamship Authority has additional capacity built into their schedule and operations that can be utilized if and when necessary.

Over the past several years there have been increasing complaints from the residents of Falmouth, particularly those who live on Woods Hole Road approaching the harbor, about the noise, speeding, and traffic caused by passing freight trucks. In response to the Steamship

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[56] Massachusetts Department of Environmental Protection. 2017. Chapter 91 Recommended Final Decision. Online at: https://www.steamshipauthority.com/writable/files/WHTRP/chapter_91_license_recomm._final_decision_-_2016-025.pdf

[57] The Steamship Authority. No date. Woods Hole Terminal Reconstruction Project. Online at: https://www.steamshipauthority.com/WHterminalreconstruction

[58] *Ibid.*

[59] The Steamship Authority. 2020. 2020 Port Council Meeting Minutes. Online at: https://www.steamshipauthority.com/writable/files/port_council_minutes_2020_through_june.pdf

[60] Davis, Bob. Personal Communication. August 7, 2020.

[61] *Ibid.*

Authority's proposed 2020 schedule, including a 5:30AM freight trip from Woods Hole to Vineyard Haven, 50 Falmouth residents submitted a signed petition to "object to the scheduling of freight from Woods Hole prior to 6:00AM due to the sleep deprivation caused by the early morning noise impact of Steamship Authority-related freight trucks on Falmouth and Woods Hole residents".[62] Similar concerns continued to be voiced in response to the Steamship Authority's proposed 2021 schedule.[63]

In response to this these concerns, beginning in 2018 the Steamship Authority adopted specific new operating policies for the 5:30AM freight trip to minimize the noise generated by these trucks during their early morning drive to the terminal. These policies include (1) limiting the size of the trucks on the 5:30AM trip to less than 40 feet in length; (2) requesting that freight shippers instruct their drivers not to exceed the speed limit in Falmouth, or 35 miles per hour, whichever is lower; and (3) reviewing all of the Steamship Authority's efforts to mitigate truck noise, including prohibiting trucks from arriving at the terminal earlier than necessary to be processed and loaded onto the ferry.[64] In addition, the Steamship Authority has developed a Woods Hole/Falmouth Noise and Traffic Mitigation Working Group that will hold monthly public meetings to hear and address ongoing concerns.[65]

[62] The Steamship Authority. 2019. Report Issued under Section 15A of the Authority's Enabling Act on the Proposed 2020 Summer Operating Schedules of the Woods Hole, Martha's Vineyard and Nantucket Steamship Authority. Online at: https://www.steamshipauthority.com/writable/versioned_downloadable_forms/path/report_-_proposed_2020_summer_operating_schedules_-_final.pdf

[63] The Steamship Authority. 2020. Report Issued under Section 15A of the Authority's Enabling Act on the Proposed 2021 Summer Operating Schedules of the Woods Hole, Martha's Vineyard and Nantucket Steamship Authority. Online at: https://www.steamshipauthority.com/writable/versioned_downloadable_forms/path/report_-_proposed_2021_summer_operating_schedules_with_appendices_-_2020-08-18_approved_part1.pdf

[64] *Ibid.*

[65] The Steamship Authority. 2020. Revised Meeting Notice Woods Hole/Falmouth Noise and Traffic Mitigation Working Group. Online at: https://www.steamshipauthority.com/writable/files/wh_noise-traffic_mit._working_group_-_2020-08-26_-_revision_1.pdf

2.2.4 Somerset

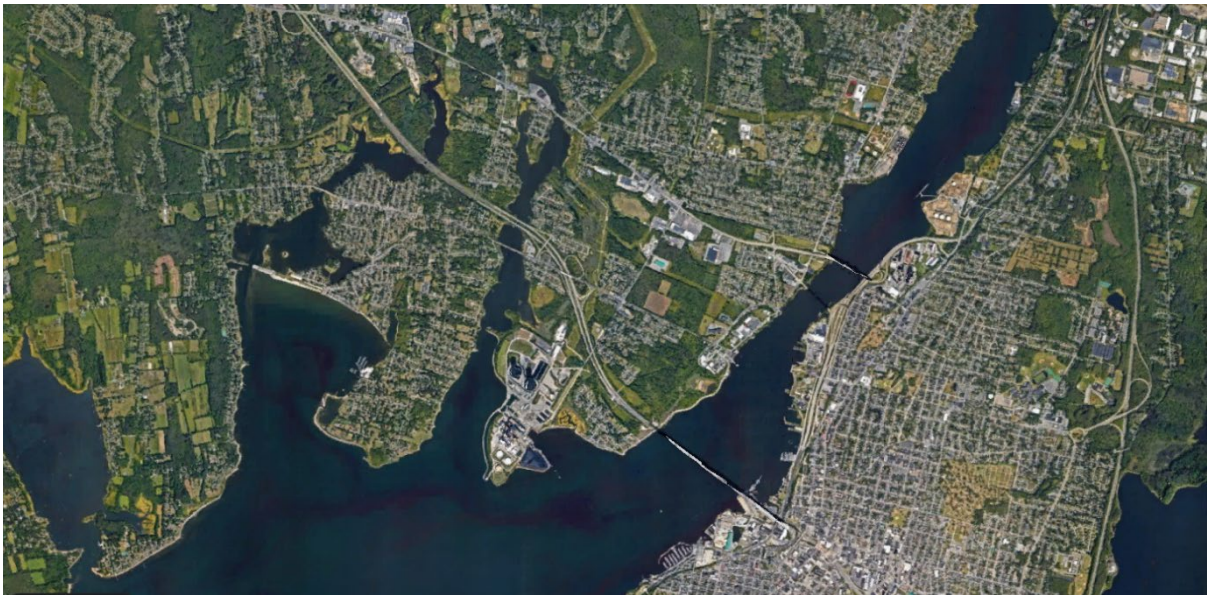

Image: Google Earth

Figure 7: Somerset, MA aerial view

Somerset is a town in Bristol County, Massachusetts which has a population of more than 18,000 people, and is located to the west of Fall River on both the Taunton and Lee Rivers (Figure 1). The Somerset portion of the Taunton River is mainly brackish water, and current water-dependent activities in Mount Hope Bay and this portion of the river include mostly recreational boating and fishing.

Years ago, Somerset was a significant shipping community with heavy commercial use. Specifically, Brayton Point within Somerset was the site of a major coal port for 50 years; however, the fuel oil distribution facilities closed in 2017. Brayton Point was then acquired by the Commercial Development Company (CDC) in 2018. After reconstruction and renovation, Brayton Point opened in 2019 as the Brayton Point Commerce Center to primarily be used as support for offshore wind.

The newly established center is capable of component manufacturing, staging, maintenance, and operation for offshore wind and other related sectors.[66] Surrounded by the waters of Mount Hope Bay, neighboring land uses include a primarily town-owned wetland (Ripley Street Parcel) and a residential neighborhood of more than 100 homes, situated to the southwest of the property.[67]

The Brayton Point Commerce Center is accessible on its eastern side by a 34.5-foot (10.5 m) deep dredged channel that approaches the parcel from the southeast.[68] The southeastern side of the center contains the facility wharf and dock. The wharf is 700 feet long and 60 feet wide, and

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[66] Brayton Point Commerce Center. About the Project. Online at: http://www.braytonpointcommercecenter.com/about/

[67] Massachusetts Clean Energy Center. Massachusetts Offshore Wind Ports & Infrastructure Assessment: Brayton Point Power Point Site, Somerset MA. May, 2017. Online at: https://files.masscec.com/Brayton_Point_FinalReport%20%28FV2%29_0.pdf

[68] *Ibid*.

was primarily utilized for offloading coal from ships.[69] Additionally, a swing-arm offloading pipe is available for offloading liquid products.[70] A 500-foot fuel offloading pier extends to the southeast from the wharf, and contains transfer piping. Another berth, which is 650 feet, is adjacent to the fuel offloading pier southeast from the wharf.[71]

Source: The Massachusetts Clean Energy Center

Figure 8: Brayton Point Commerce Center parcels

While offshore wind is not yet in Massachusetts waters, the Brayton Point center has already begun heavy lift port operations.[72] Brayton Point now can handle bulk cargo, heavy lift cargoes, and building materials from both domestic and international locations, including dry bulk carriers up to 64,000 DWT ultramax bulkers.[73] The first cargo shipment included 30,000 MTs of deicing salt from the Atacama Desert Region of Chile in 2019.[74] As of March, 2020 Brayton

[69] *Ibid*.
[70] *Ibid*.
[71] *Ibid*.
[72] Commercial Development Company, Inc. Brayton Point Commerce Center Receives First Cargo Shipment to New Marine Commerce Terminal. Online at: http://www.cdcco.com/press-release/brayton-point-commerce-center-receives-first-cargo-shipment-to-new-marine-commerce-terminal/?fbclid=IwAR0-cvXimk_JnO2x7w4Yx6AZdC3Z1dkjPp-CLxxwqQkqsReiupi0KHKUiwk
[73] *Ibid*.
[74] *Ibid*.

Point has received nine vessel calls, which included offshore wind research vessels, yacht transporters, bulk carriers, and tug and barge units.[75]

CDC is leasing the property to Panagea and Carver Stevedoring (also known as Patriot Stevedoring and Logistics) to conduct cargo and port operations at the Brayton Point site.[76] It is anticipated that Panagea will likely bring international ocean freight into Brayton Point. All cargos must be precleared with Patriot Stevedoring and Logistics, who manages the port operations at Brayton Point.[77]

Potential for Short-Sea Shipping

Given that Brayton Point just re-opened and offshore wind is still in the planning stages, there is potential capacity at the site for short-sea shipping operations. Anecdotal information collected through interviews confirmed this, noting that Somerset could have the space to support short-sea shipping vessels, cargo, and activity. That said, similar to Fall River, Somerset may not be an ideal location for a short-sea shipping terminal, given the distance from Martha's Vineyard as compared with other sites. Further, interviews with town representatives suggest that though capacity may exist at the site, the town is not interested in freight activity that brings trash into the port.

2.2.5 Oak Bluffs

Source: Google Earth

Figure 9: Oak Bluffs aerial view

[75] Commercial Development Company, Inc. Brayton Point Redevelopment Project Moves Closer to Viability as Manufacturing & Logistics Hub for Offshore Wind. Online at: http://www.cdcco.com/press-release/brayton-point-redevelopment-project-moves-closer-to-viability-as-manufacturing-logistics-hub-for-offshore-wind/

[76] NewportRI.com. Newport-based Pangaea to conduct port operations at Brayton Point. Online at: https://www.newportri.com/news/20191104/newport-based-pangaea-to-conduct-port-operations-at-brayton-point

[77] Moran Shipping Agencies, Inc. Online at: http://ri.ports.moranshipping.com/Pages/Terminal%20Information.aspx?TID=14&PID=5

Oak Bluffs, located on the northeastern side of Martha's Vineyard, is roughly nine miles from the ferry docks in Woods Hole and is one of the two island-based ports used by the Steamship Authority to ship freight to and from the Island. Oak Bluffs Harbor, located just north of the Steamship Authority's dock, supports a variety of uses including commercial fishing and recreational boating. With slip and mooring fees, fuel sales, docking fees, and other revenue, the harbor is an important economic resource, generating approximately one million dollars annually for the town. The enclosed harbor and facilities therein require ongoing maintenance such as replacement of pilings and dredging of the entry channel. Discussions are underway about raising the height of the stone jetties and considering other improvements to provide for better protection against storms and flooding.[78]

The Steamship Authority's wooden dock, located just south of the enclosed harbor, can accommodate one ferry at a time. The pier consists of staging areas for passengers as well as for cars and trucks. The wooden dock can support trucks up to 80,000 pounds. Landside, an additional staging area for cars and trucks can accommodate a few dozen vehicles. Staging area and dock improvements were conducted in 2010.[79]

In the spring of 2020, engineering work at the Oak Bluffs terminal indicated a need to repair or replace 35 pilings to maintain current levels of activity at the site. The project was put out to bid and work is underway to make those repairs.[80] The Town is also exploring options to make the area more resilient to the impacts of climate change, siting the need for repairs to the seawall and improvements at the ferry docks themselves.

In its recent master planning process, the town indicated that Oak Bluffs experiences a higher impact than other island communities relative to the ferry service, noting traffic congestion, the need for additional capacity to respond to an emergency, and the use of harbor and dock space. The plan also acknowledges some benefits of the ferry service, mostly having to do with passenger use (embarkation fee revenue and tourist traffic) as well as dock space revenue.

The Oak Bluffs ferry terminal is used for approximately half of the Steamship Authority's daily trips to Martha's Vineyard during the summer[81], however most of the trips are primarily passenger and car trips. During the summer months of 2020, the Steamship Authority scheduled 11 roundtrip trips per day to Oak Bluffs from Woods Hole on Fridays, Saturdays, and Sundays. The Steamship Authority ran one less trip per day during the remainder of the week.[82] The Steamship Authority does not use the Oak Bluffs terminal during the winter months for regularly-scheduled service, but does schedule trips to Oak Bluffs between mid-May and mid-

[78] Oak Bluffs Master Plan Update Committee. 2019. Oak Bluffs Comprehensive Master Plan.
[79] Martha's Vineyard Commission. 2015. Martha's Vineyard Transportation Plan—Draft June 2015. Online at: https://www.mvcommission.org/sites/default/files/docs/Draft%20MVTP%202015_0.pdf
[80] Steamship Authority. 2020. Minutes of the Woods Hole, Martha's Vineyard and Nantucket Steamship Authority: The Meeting in Public Session: May 12, 2020. Online at: https://www.steamshipauthority.com/writable/files/ssa_minutes_public_session_through_may_19_2020.pdf.
[81] Oak Bluffs Master Plan Update Committee. 2019. Oak Bluffs Comprehensive Master Plan.
[82] Steamship Authority. 2929 Martha's Vineyard Ferry Schedule. Online at: https://www.steamshipauthority.com/writable/versioned_downloadable_forms/path/2020approvedoperatingschedules_20200803rev.pdf.

October.[83] These trips were scheduled on the *M/V Nantucket* and the *M/V Martha's Vineyard* in 2020—both primarily car and passenger vessels.

Potential for Short-Sea Shipping

The Oak Bluffs terminal could be explored as a possible destination for any new short-sea shipping activities originating from New Bedford or other off-Cape harbors. The terminal's current 80,000 pound limit for vehicles would need to be addressed either through infrastructure improvements or through limits to truck sizes and/or weights. Due to the exposed nature of this docking facility, it is unlikely that reliable year-round service would be a possibility here. Further, any expansion of seasonal services would need to take into consideration factors such as impacts to traffic congestions—which is already an issue in the area—and scheduling of trips—during the summer months, the high level of use at this facility leaves little room for additional trips.

The waterfront of the enclosed harbor to the north of the Steamship Authority's dock is currently occupied by other uses. In addition, the shallow water depths within the enclosed harbor, the mooring fields within the harbor, and channel restrictions make it unlikely that freight service could operate in this area.

2.2.6 Vineyard Haven, Tisbury

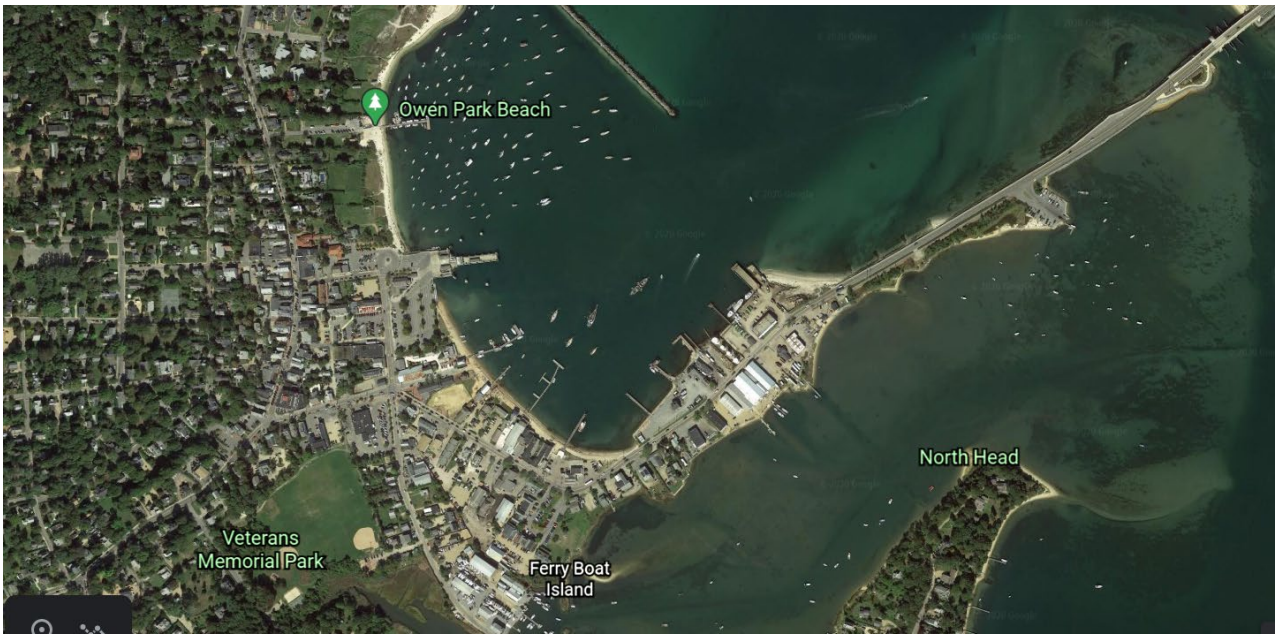

Image: Google Earth

Figure 10: Vineyard Haven aerial view

The village of Vineyard Haven in the town of Tisbury, MA rises up from the harbor and provides a pedestrian-friendly downtown area that attracts residents and visitors. Along the waterfront, Vineyard Haven is the site of the larger and more sheltered of the Steamship Authority's two on-

[83] *Ibid.*

island ports used to ship freight to and from the island. The land to the east of the ferry terminal includes private terminals and working waterfront uses such as ship building, excursion vessels, and shipping activities. The harbor itself is very active during the summer season, supporting ferry and freight service, and commercial and recreational boating and fishing.

The working waterfront in Tisbury is part of the Vineyard Haven Harbor District of Critical Planning Concern (DCPC). The DCPC regulations "seek to maintain the Vineyard Haven Harbor as a year-round working waterfront with facilities for loading and unloading bulk cargo; to promote the Town's longstanding tradition of marine industries, services and maritime hospitality including ship design, building, and repair, traditional sail training and sailing yacht charters, and the provision of necessary services to visiting mariners; to enhance and protect views of the harbor and pedestrian access along the waterfront by discouraging waterfront development and by maintaining the beaches in their natural, unimpeded and unimproved condition; to protect fish, shellfish and wildlife habitats and improve water quality; to provide residents with opportunities for marine recreation; and to promote harbor safety, avoid harbor congestion and prudently manage the limited navigational resources of the harbor."[84]

The DCPC regulations also prohibit the maneuvering of a ferry more than 150 feet long and in an arc of 180 degrees or more (this restriction does not apply to lawfully conducted activities authorized prior to August 11, 2000).

Built in 1994/1995, the Steamship Authority's Vineyard Haven terminal operates year-round. The 325-foot Union Wharf provides berthing for two vessels at a time. A staging area for vehicles exists at the base of the pier, and another staging area exists just south of the pier adjacent to Water Street. The terminal handles as many as seven round-trip freight trips a day during winter months (January-March). During the summer season, the number of trips increases to as many as 11 a day.

Flooding at the Steamship Authority's facility was a prominent concern in the town's Municipal Vulnerability Preparedness (MVP) Plan, which noted that even a two-day shut down of ferry service can have an impact on the entire island, especially during the off-season when the Oak Bluffs terminal is closed. As such, the MVP Plan recommends a comprehensive supply chain vulnerability assessment. [85]

While Vineyard Haven is the primary terminal for transporting freight to the island, the Town has made a concerted effort to minimize the impact of freight and other large vessels due to congestion and capacity issues in Vineyard Haven. To that end, around 1999, the harbormaster and the Steamship Authority made an agreement that only one of the Steamship Authority's vessels could be underway in the inner harbor at any given time.[86]

In addition to the freight service provided by the Steamship Authority, R.M. Packer Company operates a bulk fuel terminal on Beach Road, the only deepwater dock in the harbor that is suitable for offloading large cargo from barges. Tisbury Towing (under the same ownership as

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[84] Vineyard Haven Harbor District of Critical Planning Concern (DCPC) Regulations. Online at: https://www.tisburyma.gov/sites/g/files/vyhlif1321/f/uploads/vineyard_haven_harbor_dcpc_regulations.pdf.

[85] Horsely Witten Group. 2018. Summary of Findings: Tisbury Municipal Vulnerability Preparedness Workshop. Online at: https://www.tisburyma.gov/sites/g/files/vyhlif1321/f/uploads/tisbury_mvp_report_reduced.pdf.

[86] Veno, William G. 2000. Martha's Vineyard Port Areas Infrastructure Capacity Study. Online at: https://www.mvcommission.org/sites/default/files/docs/portareainfrastructurestudy.pdf

R.M. Packer Company) transports gasoline and other petroleum products to the island from New Bedford. In an interview with the Vineyard Gazette, Ralph Packer suggested that his enterprises resulted in 34,000 less cars travelling over the Bourne Bridge in a year.[87] Anecdotal reports indicate that the site has been committed to serving offshore wind for the next four to five years.[88]

Potential for Short-Sea Shipping

Vineyard Haven is the most feasible site on Martha's Vineyard to receive shipments of non-bulk freight from off-Cape points of origin given the Steamship Authority's existing infrastructure and the fact that the terminal operates year-round.

In addition, Vineyard Haven's other sites along the town's working waterfront may provide an alternative site for non-bulk freight shipping. In particular, the facility owned by R.M. Packer may offer opportunities.

Should a change in port of origin result in additional freight coming through Vineyard Haven, considerations should be given to how additional vessel traffic could result in increased harbor congestion, a need to revise existing ferry schedules, impacts to other harbor uses, and a need to address landside traffic circulation issues.

2.3 Conclusions

Based on our initial research, we have made the following observations and conclusions:

1. Shipping non-bulk freight between locations off Cape Cod and the islands (Martha's Vineyard and Nantucket) has potential, but many factors would play a role in its viability, such as the site of the mainland port and the length of the journey, licensing conditions with the Steamship Authority (*e.g.,* limits on sizes of trucks, prices of trips), political will, and scheduling of port facilities on-island. Other options exist to reduce truck traffic in Woods Hole and emissions overall. These options include:
    a. Freight consolidation off-Cape to ensure that the trucks going to the islands are at maximum capacity, rather than sending over trucks only partially full
    b. Reduction of waste generated on island to decrease the number of garbage trucks needing to make the trip off-island
    c. Short-sea shipping from locations outside of Massachusetts that might result in fewer trucks on state roads and fewer emissions.
2. The mainland off-cape port in Massachusetts that is best positioned to handle non-bulk freight is New Bedford; however, shipping non-bulk freight to the islands is not a priority

[87] Sennott, W., Wells, J. 2019. R.M. Packer Ordered to Pay Hefty Fines for Environmental Violations. Vineyard Gazette. October 31, 2019. Online at: https://vineyardgazette.com/news/2019/10/31/rm-packer-ordered-pay-hefty-fines-environmental-violations.

[88] Discussion during the Steamship Authority's 8/26/2020 Woods Hole/Falmouth Noise and Traffic Mitigation Working Group.

use of the waterfront for the City. Other ports may be too far from the islands to make short-sea shipping financially viable.

3. The demand for freight on the island is largely fixed, barring some significant change in activities on-island (*e.g.,* major development projects). Further, the Steamship Authority currently has capacity to transport additional freight. Given these factors, it does not seem that there is unmet demand for freight shipping. If freight were to be shipped from a non-Cape site however, it is possible that the newly freed capacity could result in changes in schedules, an increase in the number of passenger cars transported, or some other modification to current practices.

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3.0 Congestion Impact Analysis

The movement of freight between mainland Massachusetts and the islands of Nantucket and Martha's Vineyard is essential to the economy, culture, and security of the island communities. Almost all non-bulk freight that travels to and from Martha's Vineyard passes through Woods Hole aboard Steamship Authority vessels. The current methods of transporting freight via vessels necessitates the use of trucks.

The focus of this chapter is to quantify the impacts of non-bulk freight movement to/from the Island through Woods Hole on traffic volume and congestion. This analysis will inform the exploration of potential reductions in emissions from shippers having access to a mainland port closer to their origins. Specifically, this chapter presents 1) an overview of traffic conditions in 2019 as they relate to the movement of freight trucks travelling on board Steamship Authority vessels and 2) an estimate of the reduction of trucks on key road segments in the study area if an off-Cape ferry service could be established.

3.1 Existing Conditions

3.1.1 Types of Freight Transported by the Steamship Authority

Some of the most common types of non-bulk freight brought to Martha's Vineyard via trucks include mail, express packages, fuel, food (38% of all truck trips), and building material (17% of all truck trips), while waste and recyclables are shipped off-island (13% of all truck trips).[89]

Freight is transported on Steamship Authority vessels in trucks operated by several different carriers, most notably Cape Cod Express, Carroll's Trucking, Sun Transportation, FedEx, UPS, Hallsmith-SYSCO, and Sid Wainer & Sons.[90]

Patriot Party Boats also provides limited seasonal shipment of freight such as auto parts and building supplies[91] between Falmouth and Oak Bluffs.

3.1.2 Current Number of Trucks Moved by the Steamship Authority

As noted in Chapter 2, in accordance with the Enabling Act of the Woods Hole, Martha's Vineyard and Nantucket Steamship Authority, all non-bulk freight shipped between mainland Massachusetts and the islands of Martha's Vineyard and Nantucket is conducted, licensed, or

[89] Martha's Vineyard Commission. 2015. Martha's Vineyard Transportation Plan—Draft 2015. Online at: https://www.mvcommission.org/sites/default/files/docs/Draft%20MVTP%202015_0.pdf.
[90] Martha's Vineyard Commission. 2015. Martha's Vineyard Transportation Plan – Draft June 2015. Online at: https://www.mvcommission.org/sites/default/files/docs/Draft%20MVTP%202015_0.pdf.
[91] Martha's Vineyard Commission. 2015. Martha's Vineyard Transportation Plan – Draft June 2015. Online at: https://www.mvcommission.org/sites/default/files/docs/Draft%20MVTP%202015_0.pdf.

permitted by the Steamship Authority.[92] This shipment of freight occurs on vessels dedicated to freight shipment as well as on passenger and car ferries.

Some freight is brought to the islands on large trailers (50-70 feet long and 80,000lbs. loaded) and transferred onto smaller trucks (25-35 feet) for delivery.[93] In addition, some gasoline and propane are brought to Martha's Vineyard on Steamship Authority vessels.

Non-bulk freight shipment to Martha's Vineyard occurs on the following routes:

- Woods Hole to Oak Bluffs terminal (1 Seaview Avenue, Oak Bluffs, MA), operated by the Steamship Authority
- Woods Hole to Vineyard Haven terminal (1 Water Street, Vineyard Haven, MA), operated by the Steamship Authority

Of the two on-island ports, most freight passes through Tisbury. This is due to limiting factors at the Oak Bluffs terminal including seasonal closures and the exposed nature of the pier.

Numbers of trucks specifically carrying non-bulk freight and volumes of non-bulk freight to each port are not publicly available. Further, some trucks making these trips are empty (*e.g.,* making return trips) or only partially full, thus it is not possible to calculate a clear volume of freight based on the number of trucks per vessel. We can, however, estimate the number of freight trucks based on the number of parking spaces they require. The table below describes commercial and non-commercial trucks travelling on Steamship Authority vessels, as categorized by the number of parking spaces required.

[92] Enabling Act of the Woods Hole, Martha's Vineyard and Nantucket Steamship Authority, St. 1960, c. 701, § 5.

[93] Martha's Vineyard Commission. 2015. Martha's Vineyard Transportation Plan – Draft June 2015. Online at: https://www.mvcommission.org/sites/default/files/docs/Draft%20MVTP%202015_0.pdf.

Table 8: Trucks travelling to/from Martha's Vineyard

Trucks & Trailers	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1 Space													
2018	5,562	5,709	5,315	7,510	8,664	7,977	7,009	6,731	7,640	7,856	7,284	6,929	84,186
2019	5,893	5,848	7,578	8,072	8,678	8,104	7,431	6,893	7,784	7,495	7,326	6,824	87,926
2020	6,112	6,200	5,423	3,164	5,481	7,769	7,515	7,218	7,367	8,201	6,895	6,867	78,212
2 Space (20' less than 35')													
2018	1,422	1,465	1,570	2,075	2,657	2,845	2,870	2,782	2,230	2,327	1,963	1,692	25,898
2019	1,590	1,452	1,806	2,259	2,600	2,752	2,795	2,633	2,122	2,151	1,685	1,689	25,534
2020	1,665	1,593	1,540	924	1,568	2,381	2,566	2,399	2,263	2,167	1,665	1,646	22,377
3 Space (35' less than 55')													
2018	561	518	602	826	1,015	1,187	1,028	1,075	950	999	564	607	9,932
2019	565	502	780	901	1,123	1,144	1,055	1,189	1,069	920	602	552	10,402
2020	456	498	530	334	591	794	792	765	711	822	768	814	7,875
4 Space (55' less than 65')													
2018	1,176	1,049	1,167	1,300	1,523	1,642	1,735	1,784	1,264	1,242	1,169	1,171	16,222
2019	1,199	1,083	1,256	1,354	1,539	1,552	1,700	1,676	1,254	1,163	1,090	1,092	15,958
2020	1,215	1,067	1,225	911	1,339	1,710	1,707	1,534	1,423	1,536	1,303	1,402	16,372
5 Space (65' and greater)													
2018	62	104	157	214	178	150	76	81	99	98	85	93	1,397
2019	105	144	187	215	194	128	85	83	79	96	85	71	1,472
2020	140	138	155	150	132	117	100	60	96	98	111	78	1,375
Total	**27,723**	**27,370**	**29,291**	**30,209**	**37,282**	**40,252**	**38,464**	**36,903**	**36,351**	**37,171**	**32,595**	**31,527**	**405,138**

Using this table, we can estimate that the number of freight trucks carried on Steamship vessels to Martha's Vineyard was as follows (using trucks requiring two to five spaces).

Table 9: Freight trucks to Martha's Vineyard

Year	Number of trucks requiring 2-5 spaces
2018	53,449
2019	53,366
2020	47,999

3.1.3 Traffic Data

Traffic volume was examined in the context of (1) the Bourne and Sagamore bridges, and (2) local Falmouth roadways.

Bourne and Sagamore Bridges

According to MassDOT's Transportation Data Management System (MS2), the Annual Average Daily Traffic (AADT) for the Sagamore Bridge (Location ID 708) and the Bourne Bridge (Location ID 707) for Years 2015 – 2019 were:

Table 10: Annual average daily traffic (AADT)

Year	Sagamore AADT	Bourne AADT	Total AADT
2019	61,701	44,240	105,941
2018	53,884	46,496	100,380
2017	55,245	46,621	101,866
2016	48,481	44,536	93,017
2015	50,871	45,173	96,044

Using the daily annual average, we can calculate that approximately 38,668,465 vehicles passed over the Bourne and Sagamore Bridges (combined) in 2019.

105,941 vehicles/day x 365 days/year

These annual averages do not reflect seasonal variation at the bridges, which can be significant. For example, in 2017, the summer annual average daily traffic over both the Sagamore and Bourne Bridges was 130,817 vehicles per day, as compared to the annual average daily total of 101,886 for both bridges.

If we assume that all trucks travelling via vessel between Woods Hole and Martha's Vineyard also pass over either the Bourne or Sagamore bridges, then in 2019, the 53,366 freight truck trips on Steamship Authority Vessels represented approximately 0.138% of all traffic travelling over the bridges that year.

53,366 truck trips on Steamship Authority vessels / 38,668,465 vehicles passing over the bridges

The AADT data, gathered by MassDOT, combines cars and trucks, *i.e.,* there is no way to separate the data by vehicle type. Although it is possible to determine the size vehicle traveling over these bridges, as they are classified into vehicle length classes in feet (0-13, 13-35, 35-61, and 61+), the Bourne and Sagamore Bridges data for 2019 included some gaps and could not be used to calculate numbers or percentages of vehicles by size.

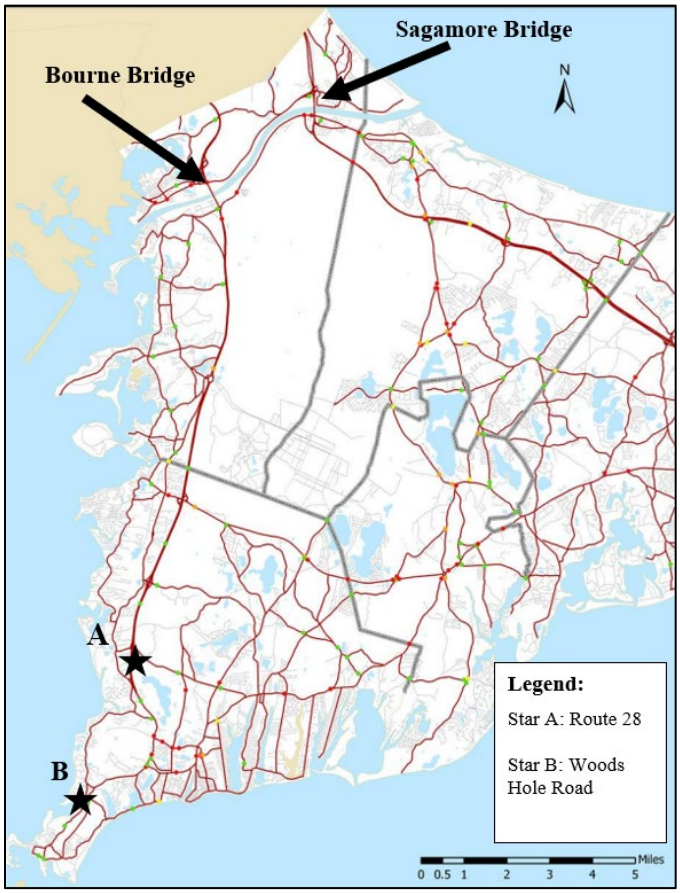
In terms of congestion on the bridges, the Cape Cod Commission uses the following volume to capacity ratios to determine a roadway's congestion:[94]

[94] Cape Cod Commission. 2016. 2016 Regional Transportation Plan.

Table 11: Congestion per volume to capacity ratios

V/C Ratio Threshold	Level of Service (LOS)
0.8	C or Better
0.9	D
1.0	E
>1.0	F

Based on Cape Cod Commission analyses, most traffic monitoring in the vicinity of the bridges shows a failing congestion grade during summer months (Figure 11).[95]



Source: Cape Cod Commission

Figure 11: Cape Cod volume to capacity ratios

Falmouth Roadways

In 2019, the Average Annual Daily Traffic (AADT) on Route 28 south of Brick Kiln Road going both north and south was 21,089 vehicles, which had grown from 21,005 in 2018 (Location ID:

[95] Cape Cod Commission. 2016. 2016 Regional Transportation Plan.

S18-028-096-11, Star A on Figure 11). Additionally, in 2018 the AADT on Woods Hole Road (south of Oyster Pond Road, Star B) was 7,966.[96]

If one assumes that all trucks travelling to and from Martha's Vineyard during 2019 passed each of these two points, then:

- Trucks travelling on the Steamship Authority ferries made up 0.693% of those vehicles on Route 28 south of Brick Kiln Road.
- Trucks travelling on the Steamship Authority ferries made up 1.84% of those vehicles on Woods Hole Road (south of Oyster Pond Road).

Though freight trucks are a very small percent of overall traffic on Falmouth roadways, community members in Falmouth have voiced concern over the impact that freight activity to and from Martha's Vineyard has on the local roadways and community character. In addition to complaints about noise, residents are concerned about congestion and safety on roadways nearest to the ferry terminal. The Steamship Authority has worked to reduce noise and safety concerns through size limits to trucks departing on the 5:30AM vessel, however community members continue to seek additional measures to reduce the disruptions caused by freight trucks servicing the Island.

The roadways leading to the Woods Hole ferry terminal receive a congestion grade of C or better in the analyses performed by the Cape Cod Commission (Figure 11).[97]

3.2 Potential Shifts in Freight Movement and Related Impacts

One key factor that influences whether a shift in freight movement to an alternative port earlier on the route would be possible is the desirability of that port and its operations. Time and cost savings are critical factors to consider, which are influenced by predictability of traffic and congestion, length of trip, and schedules.

Should demand exist for an additional off-Cape port, a standard 220-foot supply vessel with a deck size of 145 feet long by 35 feet wide, including the ramp (*e.g.,* a vessel similar in size *to* the *M/V Katama* freight vessel already in use by the Steamship Authority)[98] could carry a variety of trucks of different sizes. For emissions modeling purposes in deliverable 3, we estimate that a vessel such as this would carry a combination of trucks equivalent to eight tractor-trailers and eight box trucks for each one-way trip. Using a base estimate of 16 trucks/vessel trip, a service offering an average of one round trip/day could move 11,680 trucks/year (Table 12). To move all 53,366 freight trucks travelling in 2019, a service would have needed to offer an average of more than four round trips/day.

Given the seasonal fluctuation in demand for freight over the course of a year, it is unlikely that a freight service would offer the same number of trips per day. A more realistic scenario would be

[96] Cape Cod Traffic Counts Viewer. Online at: https://www.capecodcommission.org/our-work/traffic-counts/
[97] Cape Cod Commission. 2016. 2016 Regional Transportation Plan.
[98] Steamship Authority. Vessels. Online at: https://www.steamshipauthority.com/about/vessels

offering the highest number of trips during summer weekdays and the lowest number of trips during winter weekends.

In addition to demand, other factors could contribute to the scheduling of ferry services out of a port other than Woods Hole. For example, to reduce traffic, a new service might focus on offering more trips during summer months when Cape Cod roads are most congested. Additionally, for purposes of addressing noise concerns from Falmouth residents, a new service might run in the early morning to replace the 5:30AM trip out of Woods Hole.

Table 12: Freight trucks transported by scenario

	1 round trip/day	2 round trips/day	3 round trips/day	4 round trips/day
Number of trucks per day	32	64	96	128
Number of trucks per week	224	448	672	896
Number of trucks per year	11,680	23,360	35,040	46,720

Given that the number of trucks using Steamship Authority vessels represents less than 0.2% of all traffic passing over the Bourne and Sagamore Bridges, it is unlikely that shifting these vessels to an earlier port of origin will have much impact on bridge traffic. Further, impacts to the overall volume on Falmouth roadways, generally, might also be negligible. However, removing trucks from Falmouth roadways—especially if strategically timed— might have noticeable impacts on volume and congestion in the immediate vicinity of the ferry terminal and may reduce noise and safety hazards.

If efforts were made to reduce volume and/or congestion through the removal of freight trucks from local roadways, it would be important to ensure that cars and smaller trucks seeking to travel by ferry would not take the place of the rerouted freight trucks and reduce any benefits associated with the decrease in truck numbers.

3.3 Conclusions

Roadway volume attributed to non-bulk freight in 2019, analyzed as the percent of total road traffic, shows that less than 0.14% of traffic passing over the Bourne and Sagamore bridges, and less than 2% of traffic on Woods Hole Road (south of Oyster Pond Road) was attributed to freight trucks travelling on Steamship Authority ferries. Efforts to reduce congestion by shifting some or all freight trucks to an off-Cape port would likely have minimal results.

While freight trucks are a small portion of the Cape's total traffic, the shipment of freight via truck is impacted by general congestion on Cape Cod roadways which may increase travel time and influence a shipping company's desire to operate from a Cape Cod-based port.

To better understand the various impacts these freight trucks have on Falmouth, the community may benefit from an analysis that explores roadway speed, safety, noise and other factors of interest.

Additionally, stakeholders could explore other options to reduce the impacts of freight trucks on roadways, including freight consolidation, shifts in ferry schedules, and strategies to reduce

overall traffic such as enhanced public transportation to reduce the number of single occupancy vehicles on Cape Cod roads.

Should a new off-Cape port be identified, it will be important to ensure that shifting operations to an off-Cape location does not simply transfer the issues to a new location.

4.0 Emissions Impact Analysis

This chapter presents an analysis of greenhouse gas (GHG) emissions by trucks and vessels moving non-bulk freight between mainland Massachusetts and Martha's Vineyard. The analysis compares the emissions that result from trucking and shipping this freight to and on vessels operating out of (1) Woods Hole Steamship Authority Terminal in Falmouth, MA, the "existing condition," and (2) shifting a portion of this freight through the State Pier in the Port of New Bedford, the "scenario condition." For both, the on-island destination is the Steamship Authority (SSA) terminal in Vineyard Haven, MA.

The methods and data contained in this chapter should allow readers to conduct their own analyses of different scenarios if desired. However, to fully understand the information presented in this report and in any future analyses using this data, it is necessary to clarify the following:

1. The truck emissions presented here are an underestimation of actual emissions. Data are not available on the points of origin for freight trucks travelling to Woods Hole, therefore mileage calculations begin from intercept points that all trucks would pass through along traffic routes to and from the mainland terminals.
2. New Bedford was selected as a port for a potential new ferry service based on the results of the analysis of mainland ports presented in Chapter 2. The selection of New Bedford is purely for purposes of analysis and is in no way an indication that the City has endorsed its involvement in freight shipment activities to and from Martha's Vineyard.
3. The analysis is based on existing conditions and current practices (*e.g.,* vessels and trucks similar to those currently used). It does not look at practices such as freight consolidation that could reduce the number of overall truck and vessel trips, nor does it consider future shifts in the amount of freight shipped on and off the Island.
4. The intent of the scenario selected is not to suggest that this is the *best* scenario, but instead to provide an alternative to existing conditions for comparison purposes.
5. While the focus of this chapter is on emissions, several other factors would likely inform any decision to move any freight shipment to New Bedford. Those factors might be financial, logistical, and/or based on matters pertaining to equity, environmental justice, safety, other harbor uses, and/or additional factors.

4.1 Methodology

We calculated estimates of emissions from the trucks that carried non-bulk freight to and from the Woods Hole SSA terminal and emissions from the vessels that moved these trucks across Vineyard Sound to the SSA terminal in Vineyard Haven in 2019 (the most recent year with complete data unaffected by the COVID-19 pandemic). For comparison, we modeled emissions generated by trucking a portion of this freight to and from the State Pier in New Bedford and then shipping it to the terminal in Vineyard Haven. The methodologies for these calculations are described below.

To conduct our analysis, we:

1. Identified the emissions associated with a single one-way vessel trip for (1) a vessel travelling between Woods Hole and Vineyard Haven, and (2) a vessel travelling between New Bedford and Vineyard Haven, based on engine tier.
2. Identified the emissions for a single truck trip, based on intercept points/distance travelled.
3. Modeled the emissions of both vessels and trucks based on:
    a. "Existing Condition" emissions, using 2019 numbers, for the number of freight trucks and vessels that transported freight between Woods Hole and Martha's Vineyard, and
    b. "Scenario Condition" emissions, using 2019 numbers, for the number of freight trucks that would be transported on roughly three round-trip vessel passages per day, as well as related vessel emissions for those passages.
4. Compared the emissions from the "existing conditions" and "scenario conditions" calculations.

4.1.1 Vessel Emissions

The calculation of emissions from marine vessel engines is a function of trip duration, operational patterns, and vessel type. To determine vessel emissions, we identified a) vessel routes, b) vessel types and capacity, and c) fuel consumption.

Vessel Routes

The shipping route between the State Pier in New Bedford and the SSA terminal in Vineyard Haven (Figure 1) (the "New Bedford Route") was based on Hvide Marine's (Seabulk) experience operating a freight service out of New Bedford in 2000 and 2001 under agreement with the SSA. The existing "Woods Hole" route to Vineyard Haven was obtained through observations of Automatic Identification System (AIS) data.[99]

Figure 12: New Bedford State Pier image

[99] Online at www.marinetraffic.com

New Bedford Route. We estimated emissions of vessels travelling between the New Bedford State Pier and the SSA terminal in Vineyard Haven. Despite its current physical condition, the State Pier's size and location makes it one of the best options for shipping freight via trucks, assuming it can be repaired to safely support them. Multiple assessments, including engineering reports, repair requests, and other various rehabilitation proposals (see deliverable from Task 1 for more information) document the condition as well as the costs associated with making repairs and upgrades. Funding and local/state support would be required to make the State Pier a viable terminal for an island freight operation.

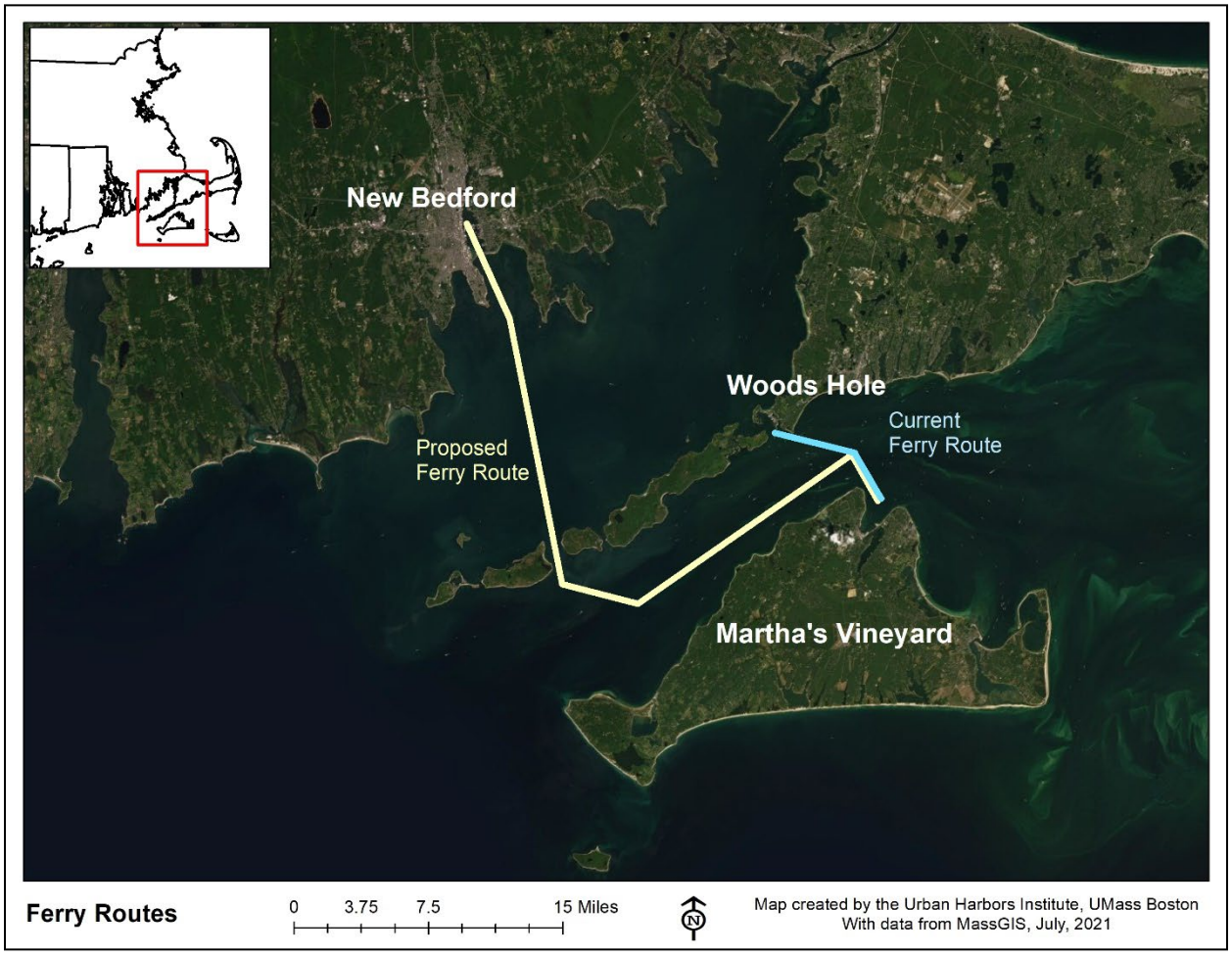


Figure 13: Current and potential ferry routes

While the most direct route between New Bedford and Vineyard Haven is through Woods Hole passage, the heavy currents, congestion, and other safety factors make navigation through that area difficult. Instead, vessels would likely transit through Quicks Hole, which adds approximately 30 minutes to the trip, but provides a consistently navigable and safer route between New Bedford and Martha's Vineyard.

We estimated an average trip time of 2.5 hours for a one-way trip between New Bedford and Vineyard Haven. This estimate is based on the experience of the pilot freight service operated by Hvide Marine between New Bedford and Martha's Vineyard in 2000-2001 and includes time spent underway and time maneuvering at the dock.

Figure 14: Quicks Hole image

Woods Hole Route. The Woods Hole route (see Figure 13) is the existing route used to transport non-bulk freight via Steamship Authority vessels. The estimated duration of this trip is 75 minutes, including time spent maneuvering and underway.

Figure 15: Steamship Authority, Woods Hole

Vessel Types and Capacity

This analysis was based on a standard 220-foot supply vessel with a deck size of 145 feet long by 35 feet wide, including the ramp, which is the same dimensions as the *M/V Katama* freight vessel (See Figure 16) already in use by the Steamship Authority.[100]

With this size, we estimated the vessel could carry a variety of trucks of different sizes. For modeling purposes, we estimated that a vessel would carry a combination of trucks equivalent to eight tractor-trailers and eight box trucks for each one-way trip.

The Steamship Authority reports that 53,366 trucks (20-65 feet+) made a one-way trip to/from Martha's Vineyard in 2019. [101] Due to the fact that some freight vessels also transport cars, and some car ferries also transport freight trucks, we based our existing condition and scenario calculations on the number of freight vessels that would be needed to transport 53,366 trucks if they only travelled via freight vessel.

We calculated emissions for both routes based on the same type of Offshore Supply Vessels with different levels of engine emissions, consistent with the standards established for Tier I though

[100] Steamship Authority. Vessels. Online at: https://www.steamshipauthority.com/about/vessels
[101] Steamship Authority. Number of Trucks Carried To/From Martha's Vineyard, 2018-2020. Personal communication with Sean Driscoll, July 3, 2021.

Tier IV engines[102]. For purposes of comparison, we used the same rate of fuel consumption for the Woods Hole route and the New Bedford route.

Source: Steamship Authority

Figure 16: M/V Katama

Fuel Consumption

Trip duration is used to estimate the number of gallons of fuel burned by vessel per trip. The amount of fuel burned is the basis for determining the carbon emissions for each trip. It is important to note that for diesel engines rated with the same power output, the number of gallons of fuel burned per hour does not change based on engine's emission tier, therefore the carbon emissions are the same regardless of emission tier of engine in a vessel. Additionally, the duration of the trip also provides an estimate of kilowatt hours of work performed by a diesel vessel engine, which can translate into the amount of NO_x emissions for each tier of engine.

Vessels transition between different operational modes during a trip—*e.g.,* maneuvering at the docks and in transit/underway—and time in each mode is associated with a speed and engine load with distinct emissions characteristics. For this study an average operational capacity of 77 percent was used for all vessel emission calculations based on an analysis of vessel operational patterns revealed by Automatic Identification System (AIS) data[103] for the existing Woods Hole to Vineyard Haven route and the experience of Hvide Marine's operation of a freight service from New Bedford to Martha's Vineyard in 2000 and 2001.

Freight vessels used by the SSA for the Woods Hole service and assumed for the New Bedford route operate on marine diesel fuel.

Vessel Emission Calculations

When calculating vessel emissions, the primary interest is in CO_2 and NO_X, therefore these are the focus of our analysis.

NO_X was determined by calculating the average kilowatts (kW) for the vessel engine multiplying by the maximum allowable NO_X limit for each tier of vessel engine, as shown in Table 13.

[102] As described in 40 CFR 1042.

[103] Online at: www.marinetraffic.com

The CO_2 calculation involved multiplying the fuel burned per hour (110 gal/hr) times the length of the trip and then dividing by 10.084 kg Carbon/gallon of Diesel Fuel.[104] These calculations represent a one-way trip of one vessel.

Table 13: NOx limits for ship engines*

Regulation	Nox limit
Tier I	17 g/kWh
Tier II	14.4 g/kWh
Tier III	3.4 g/kWh
Tier IV	1.8 g/kWh

***(amendments to Marpol Annex VI)**

Table 14: Emissions for one-way trips

				New Bedford			Woods Hole		
Engine Type	**NO_X limit (g/kWh)**	**KW (3800 HP Engine) 77%**	**Gal/ hr**	**NO_X emission (kg)**	**CO_2 emission kg)**	**Transit time (hrs)**	**NO_X emission (kg)**	**CO_2 emission kg)**	**Transit time (hrs)**
Tier I	17	2181 kw	100	92.69	2,521	2.5	27.81	756.3	0.75
Tier II	14.4	2181 kw	100	78.52	2,521	2.5	23.55	756.3	0.75
Tier III	3.4	2181 kw	100	18.54	2,521	2.5	5.56	756.3	0.75
Tier IV	1.8	2181 kw	100	9.81	2,521	2.5	2.94	756.3	0.75

4.1.2 Truck Emissions

We used a three-step process to calculate and compare emissions released by freight trucks under "existing conditions" (*e.g.*, traveling to Woods Hole for vessel departure) and "scenario conditions" (*e.g.*, rerouting some trucks to New Bedford for vessel departure):

- Step 1: Determine Freight Truck Routes – First, we consulted with freight experts to determine the common routes taken by freight trucks in Massachusetts which would board vessels in Woods Hole. We determined intercept points and associated miles travelled.
- Step 2: Calculate Emissions Released by Each Freight Truck – To calculate freight truck emissions, we utilized emission data from the Federal Highway Administration[105] for NO_X, VOC, CO_2, and PM10. In particular, we used the data provided for combination trucks and single-unit trucks.

[104] EPA. 2005. Average Carbon Dioxide Emissions Resulting from Gasoline and Diesel Fuel. (See: https://nepis.epa.gov/Exe/tiff2png.exe/P1001YTG.PNG?-r+75+-g+7+D%3A%5CZYFILES%5CINDEX%20DATA%5C00THRU05%5CTIFF%5C00001251%5CP1001YTG.TIF).

[105] Federal Highway Administration. 2016. Freight Quick Facts Report. Online at: https://ops.fhwa.dot.gov/publications/fhwahop16083/ch2.htm

- Step 3: Calculate Truck Emissions for 2019 Existing Conditions and Scenario Conditions – To determine a change in truck emissions, we calculated the emissions released under "Existing Conditions" with all trucks traveling to Woods Hole, and "Scenario Conditions" with the addition of a New Bedford ferry service (*e.g.*, some trucks would now travel to the New Bedford State Pier instead of Woods Hole). The example schedule for a New Bedford ferry service consists of 1-3 roundtrip vessel trips per day from the New Bedford State Pier to Vineyard Haven, Martha's Vineyard.

Figure 17: Martha's Vineyard freight vessel

Step 1: Determine Freight Truck Routes

As a first step to calculating truck emissions, we categorized the current routes that trucks are utilizing when transporting freight between Woods Hole and Martha's Vineyard. For the scope of this project, we were not able to determine each truck's *entire trip from origin to destination*, as each truck's actual starting point, specific route, and time of travel were not known. Because of this, we selected "intercept points" along common truck routes (*e.g.*, Wareham and New Bedford) to calculate emissions. We used the same route *to and from* the ferry terminal.

Based on existing data[106], most freight trucks departing on a ferry from Woods Hole travel through either Wareham (38%) or New Bedford (39%) to ultimately reach Woods Hole (see Table 15). A small percentage (22%) of freight originates on Martha's Vineyard and Cape Cod.

[106] The data used for this analysis draw from a previous unpublished study by Craig Johnson, a member of this project team.

Table 15: Non-bulk freight intercept points

Intercept Points	Wareham	New Bedford	Martha's Vineyard	Cape Cod
Percent total	38.207%	39.262%	17.111%	5.420%

Since we could not determine each truck's route in entirety from start to finish, the emissions calculations herein should be considered an underestimation of the full emissions generated by moving freight between the mainland of Massachusetts and Martha's Vineyard**.**

Wareham Intercept Point. For purposes of our calculations, freight truck trips originating from or returning to points north or northwest of Wareham were intercepted at the intersection of I-495 and I-195, with those travelling to Woods Hole taking a route from MA-25 E to MA-28 S to Woods Hole Road to Crane Street to Cowdry Road. See Figure 18 and Table 16 for the route and mileage between Wareham and Woods Hole.

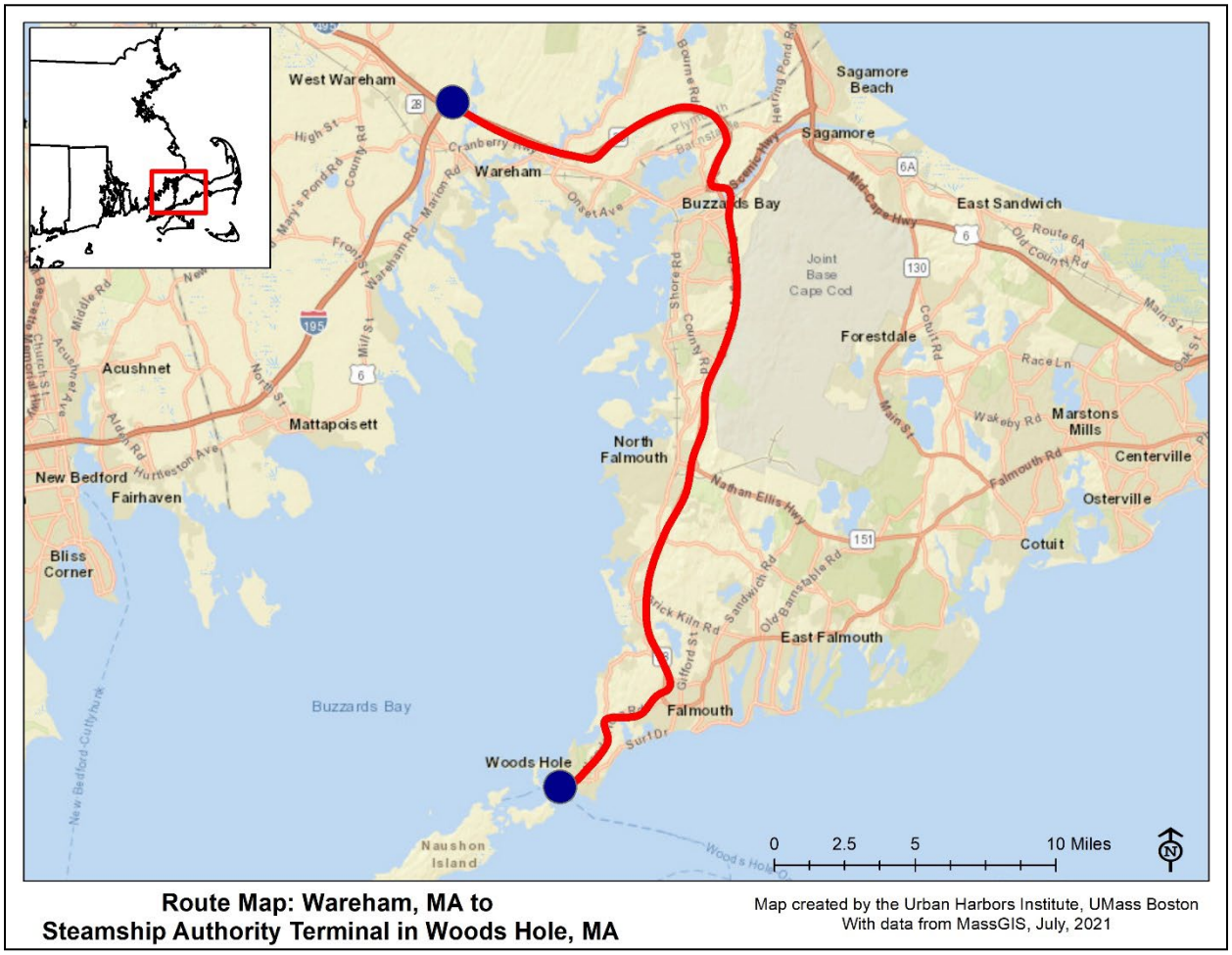


Figure 18: Wareham to Woods Hole route

Table 16: Wareham to Woods Hole roads

Road	Miles
MA-25 E	10
MA-28 S	0.8
MA-28 S	4
MA-28 S	9.6
MA-28 S	0.3
Woods Hole Road	3.3
Crane Street	0.056629
Cowdry Road	0.070833
Total Miles	**28.127**

Additionally, we assumed freight trucks travelling through Wareham to New Bedford took I-195 west to MA-18 S. See Figure 19 and Table 17 for the route and mileage between Wareham and the New Bedford State Pier.

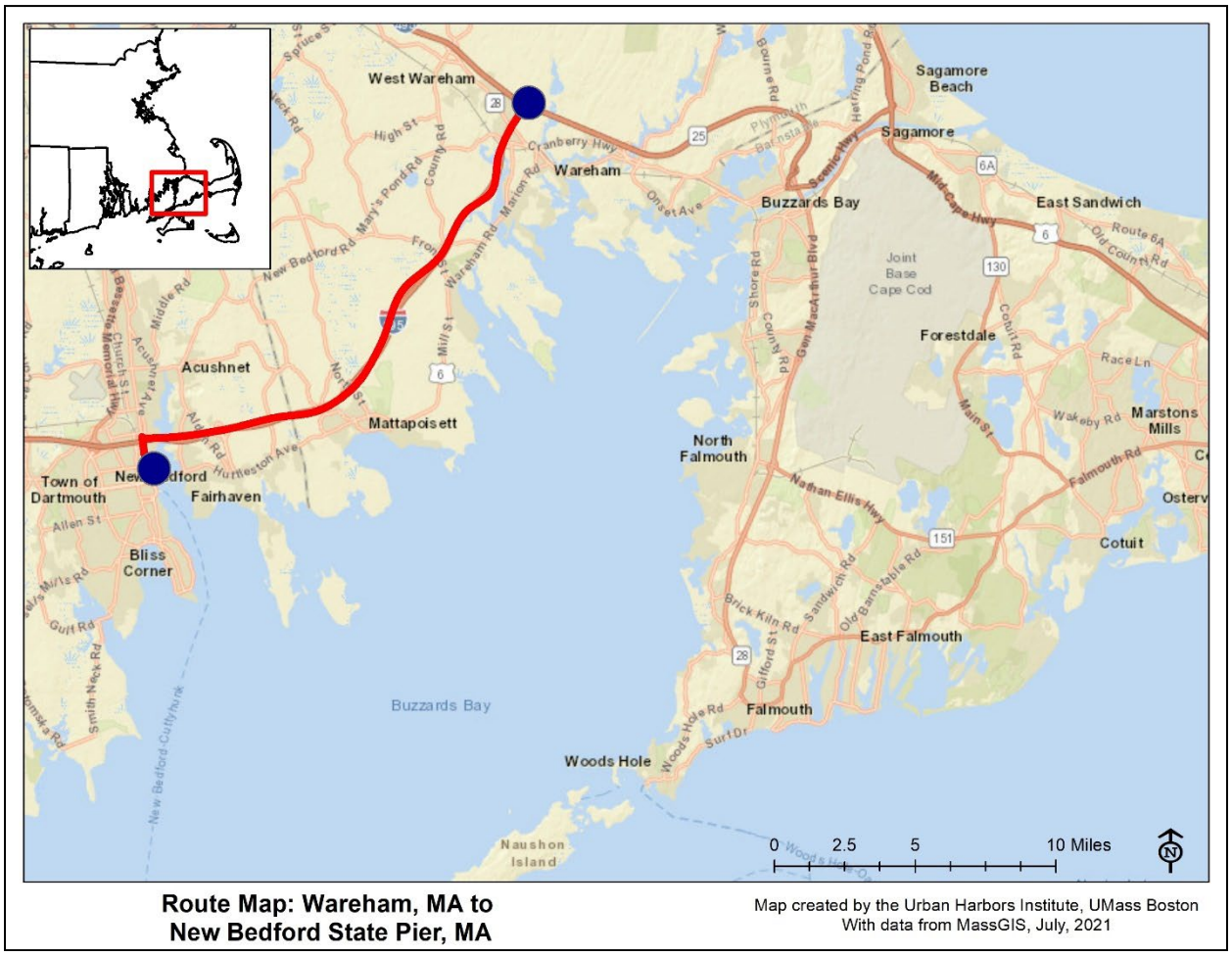


Figure 19: Wareham to New Bedford route

Table 17: Wareham to New Bedford roads

Road	Miles
I-195 W	14.5
MA-18 S	1.7
Total Miles	**16.2**

New Bedford Intercept Point. For the purposes of our calculations, freight truck trips originating west of New Bedford and traveling to Woods Hole began at the intersection between I-195 and MA-18S and took via I-195 to MA-25 E to MA-28 S to Woods Hole Road to Crane Street to Cowdry Road (Figure 20 and Table 18).

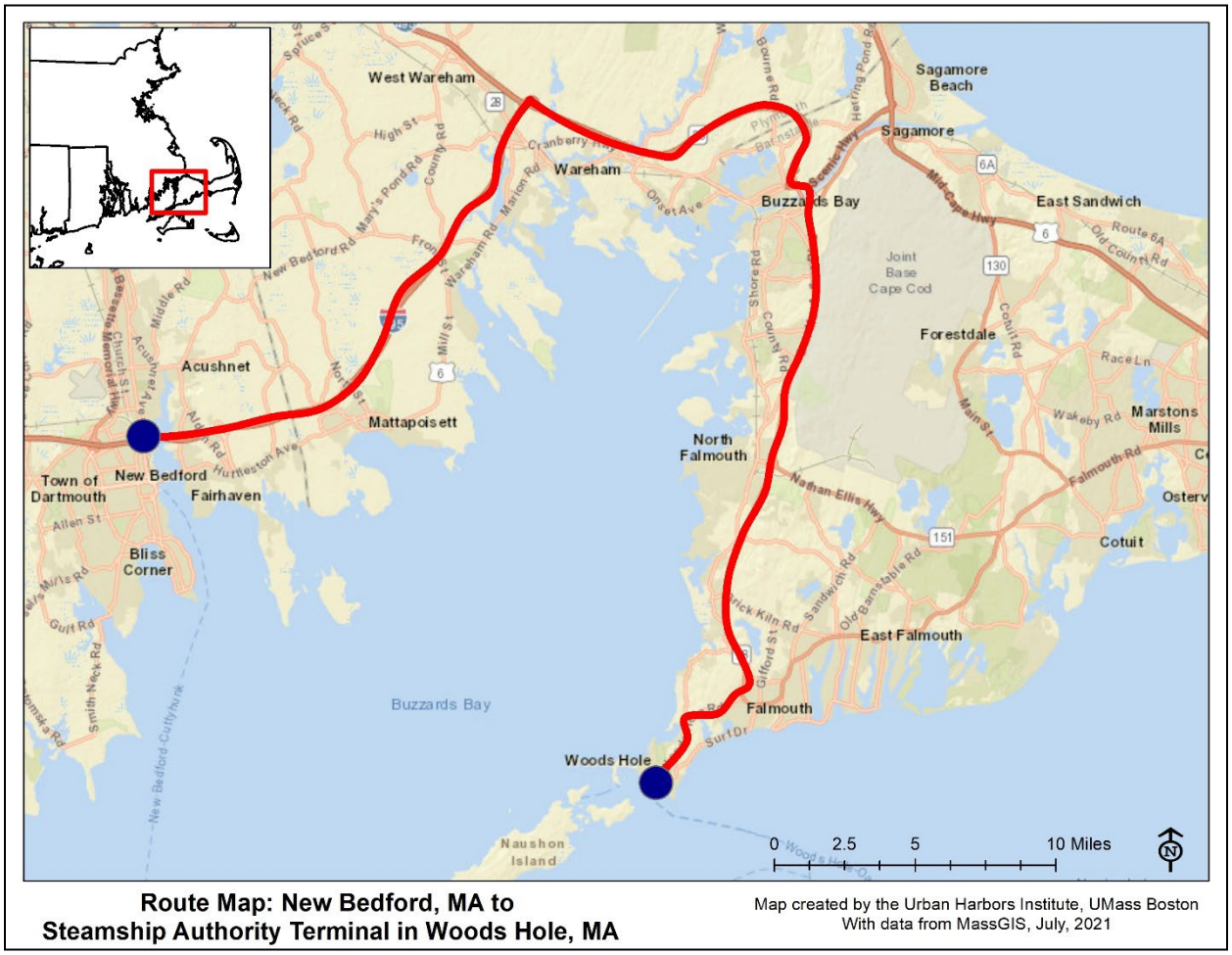


Figure 20: New Bedford to Woods Hole route

Table 18: New Bedford to Woods Hole roads

Road	Miles
I-195	14.7
25E	10
28S	0.8
28S	4
28S	9.6
28S	0.3
Woods Hole Road	3.3
Water Street	0.085038
Luscombe Ave.	0.060985
Total Miles	**42.846**

Freight trucks travelling from the intersection between I-195 and MA-18S to New Bedford State Pier took MA-18 S to State Pier (Figure 21 and Table 19).

Figure 21: I-195 to New Bedford route

Table 19: I-195 to New Bedford roads

Road	Miles
MA-18 S	1.7

Martha's Vineyard and Cape Cod Origin. Freight originating on Martha's Vineyard is distributed widely on- and off-Cape and likely consists of produce, landscape supplies, and other freight. We were unable to obtain specific information about the destination of these trucks carrying freight that originates on-Island. Therefore, we assume trucks originating on Martha's Vineyard would travel to the Bourne rotary, and disperse from the bridge. Similarly, we assume trucks originating on Cape Cod would travel from the Bourne rotary to Woods Hole (Figure 22 and Table 20).

We utilized the route between Bourne and Woods Hole to calculate emissions for both the Martha's Vineyard and Cape Cod origin trips, as exact starting points and destinations for these trucks are not known.

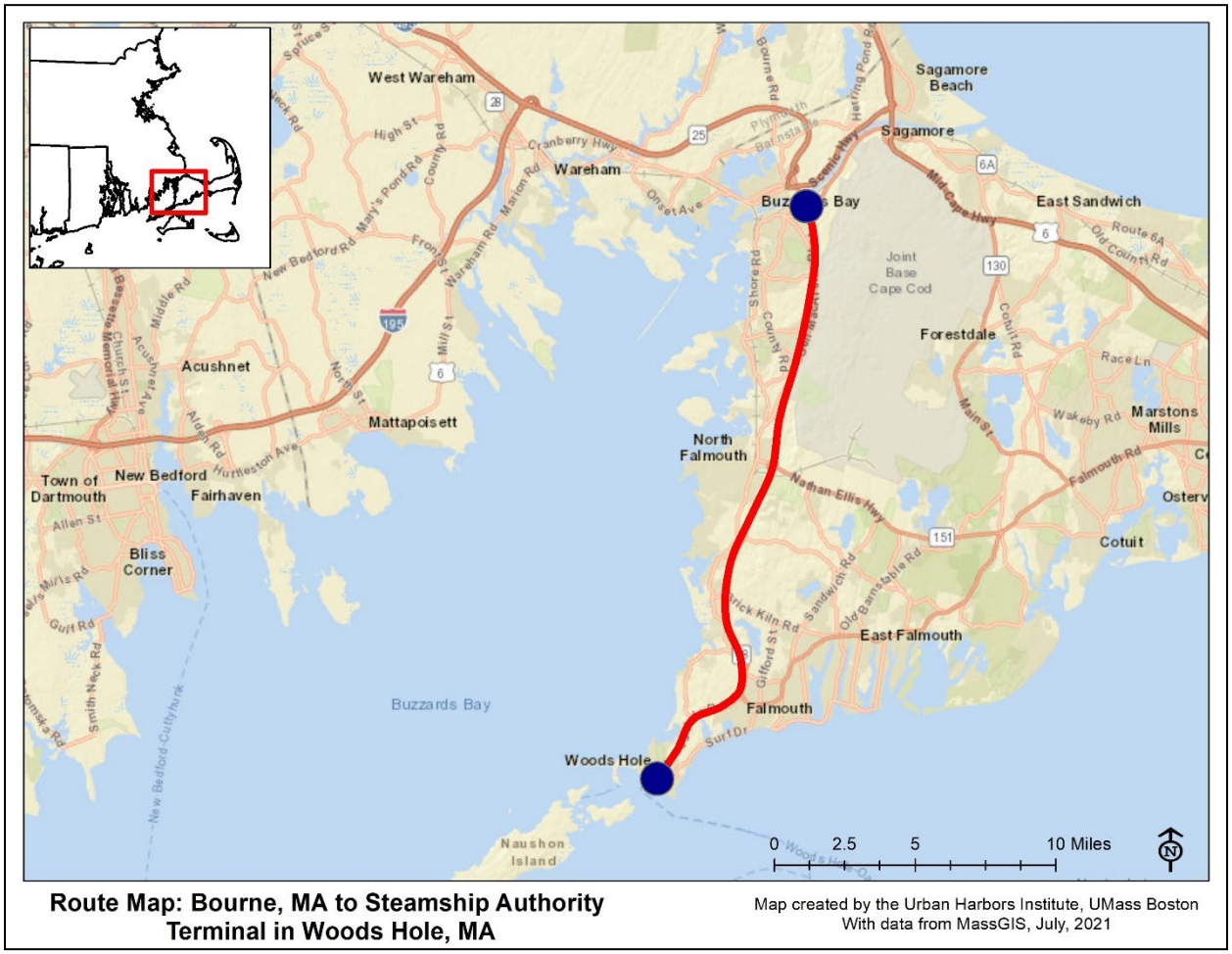


Figure 22: Bourne Bridge to Woods Hole route

Table 20: Cape Cod to Woods Hole roads

Road	Miles
MA-28 S	4
MA-28 S	9.6
MA-28 S	0.3
Woods Hole Road	3.3
Crane Street	0.056629
Cowdry Road	0.070833
Total Miles	17.327

Step 2: Calculate Emissions Released by Each Freight Truck

For truck emissions, we utilized 2015 emissions data from the Federal Highway Administration for single-unit and combination trucks (Table 21).[107]

Table 21: Emissions data for freight trucks

Truck Type	Emission Type	Amount of Emissions (grams/mile)
Combination Trucks	Nox	9.02
	PM10	0.367
	VOC	0.862
	CO_2	1,879.40
Single-Unit Trucks	Nox	4.09
	PM10	0.211
	VOC	0.88
	CO_2	1,133.30

Based on data provided by the Steamship Authority about the number of trucks, by size, travelling on its vessels in 2019, the number of trucks between 20 and 35 feet in length is nearly equal to that of trucks 35-feet and greater (Table 8).

Step 3: Truck Emissions for 2019 Existing Conditions and Scenario Conditions

We calculated the truck emissions for the 2019 "Existing Conditions" and "Scenario Conditions" to determine the change in truck emissions if a New Bedford ferry service was implemented.

Existing Conditions. The number of commercial trucks carried by SSA ferries between its Woods Hole terminal and Martha's Vineyard is the basis for estimating the existing contribution of these vehicles to traffic volumes on roadways leading to the Woods Hole terminal and on emissions. Monthly data on the number of trucks carried by the SSA to and from Martha's Vineyard for the years 2018, 2019, and 2020 along with an explanation of how it counts

[107] Federal Highway Administration. 2016. Freight Quick Facts Report. Online at: https://ops.fhwa.dot.gov/publications/fhwahop16083/ch2.htm

commercial trucks was obtained directly from the SSA. Data on trucks carried are also contained in the Authority's annual reports[108], in a summary of monthly traffic statistics compiled for the years 1996 to present[109], and in the SSA's Vessel Capacity Report for calendar year 2019.[110] The Steamship Authority's Vessel Capacity Report provides information on the number and sizes of trucks carried on each vessel traveling between Woods Hole and Martha's Vineyard each day of the year. It also provides the vehicle capacity of each vessel and amount and percent of capacity occupied. This is the only source of data with sufficient granularity to reveal the pattern of truck trips over the course of a day, a week, or a season.

The SSA from Woods Hole reports the number of freight trucks carried on one-way trips between Woods Hole and Martha's Vineyard during the past three years is[111]:

- 2018 - 53,449 trucks
- 2019 - 53,366 trucks
- 2020 - 47,999 trucks

The Steamship Authority also tracks vehicles by rough size categories equating to the number of parking spaces they require on the vessel. For 2019, there was a nearly even split between 2-space trucks (trucks 20 - 34 feet long) and three-, four-, and five-space trucks (35 – 65+ feet). These space classifications can be used to estimate the number of single-unit (2-space) and combination (3-space and greater) trucks carried via ferry. For purposes of our calculation, we estimated that 50% of all trucks were single-unit trucks, and 50% were combination trucks.

Further, using the data presented in Table 15, we calculated approximations of the number of trucks that would pass through each intercept point, as shown in Table 22.

Table 22: Existing conditions—number of trucks

Intercept Point	Total Number of One-Way Truck Trips (2019)
Wareham	20,389
New Bedford	20,952
Cape Cod	2,893
Martha's Vineyard	9,132
Total	**53,366**

[108] Woods Hole, Martha's Vineyard and Nantucket Steamship Authority 2019 Annual Report. https://www-steamship-assets.s3.amazonaws.com/versioned_downloadable_forms/path/ssa2875_annual_report_2019_web.pdf

[109] Woods Hole, Martha's Vineyard and Nantucket Steamship Authority Traffic Report 1996-2021. https://www-steamship-assets.s3.amazonaws.com/versioned_downloadable_forms/path/may_2021_monthly_traffic_statistics.pdf

[110] Steamship Authority, 2019 Occupied Capacity Report (in Excel format), www.smartcitizenstaskforce.org accessed February 2021.

[111] Steamship Authority. 2018-2020. Personal communication with Sean Driscoll, July 3, 2021.

***Scenario Conditions*.** To illustrate the emissions generated from a freight ferry service from New Bedford, we postulated a ferry schedule which reflects expert opinion and data on the number of trucks traveling at different times of year. We made the following assumptions in developing the ferry schedule:

- Nearly all freight trucks with an intercept point of New Bedford (I-195) would utilize the new ferry service - *Primarily due to the close proximity of the New Bedford State Pier to I-195, compared to Woods Hole*
- Most freight trucks with an intercept point of Wareham would still utilize the normal Woods Hole ferry service, with a few trucks utilizing the New Bedford ferry service - *The number of miles a truck would travel from Wareham to the New Bedford State Pier is less than traveling from Wareham to Woods Hole, but the amount of time on a ferry from New Bedford to/from Martha's Vineyard (2.5 hours) doubles compared to the Woods Hole to/from Martha's Vineyard trip (75 minutes). We assume a small number of trucks may be interested in using the new service to avoid traffic crossing the Cape Cod bridges, pending space available on boats*
- All freight trucks originating on Martha's Vineyard and Cape Cod would continue to utilize the Woods Hole ferry service - *A freight ferry service out of the New Bedford State Pier is a long distance from Cape Cod and Martha's Vineyard, and we assume these freight trucks would not want to drive an additional distance to use the new service*
- Each freight vessel could carry up to 16 trucks (eight single-unit trucks, and eight combination trucks) one-way between the New Bedford State Pier and Vineyard Haven - *Three roundtrip vessel trips per day could carry up to 96 trucks/day to and from Vineyard Haven*

Utilizing these assumptions, the data indicate that 1 - 3 roundtrip ferries from New Bedford State Pier to Martha's Vineyard could be offered daily depending on the season and day of the week. Because more trucks generally travel to/from Martha's Vineyard during the summer and winter weekdays compared to summer and winter weekends, the example schedule provides for more ferry trips to/from New Bedford to Martha's Vineyard during the summer and winter weekdays.

Example Ferry Schedule Between New Bedford State Pier and Vineyard Haven, Martha's Vineyard

Summer Weekday: (Monday – Thursday, May 17 – September 13)

72 days

AM - Trip 1
- Depart NB 5:30AM - Arrive MV by 7:30
- Depart MV 8:00AM - Arrive NB 10:00

Midday - Trip 2
- Depart NB 11AM - Arrive MV 1:00PM
- Depart MV 1:30PM - Arrive NB 3:30

PM - Trip 3
- Depart NB 4:00PM - Arrive MV 6:00
- Depart MV 6:00PM - Arrive NB 8:00

Summer Weekend: (Friday – Sunday, May 17 – September 13)

54 days

AM - Trip 1

- Depart NB 5:30AM - Arrive MV by 7:30
- Depart MV 8:00AM - Arrive NB 10:00

Winter Weekday: (Monday – Thursday, January 1 – May 16; September 14 – December 31)

137 days

AM - Trip 1

- Depart NB 5:30AM - Arrive MV by 7:30
- Depart MV 8:00AM - Arrive NB 10:00

Midday - Trip 2

- Depart NB 11AM - Arrive MV 1:00PM
- Depart MV 1:30PM - Arrive NB 3:30

PM - Trip 3

- Depart NB 4:00PM - Arrive MV 6:00
- Depart MV 6:00PM - Arrive NB 8:00

Winter Weekend: (Only Saturday, January 1 – May 16; September 14 – December 31)

102 days

AM - Trip 1

- Depart NB 5:30AM - Arrive MV by 7:30
- Depart MV 8:00AM - Arrive NB 10:00

Given the above schedule, Table 23 contains a breakdown of trucks for the scenario conditions involving an additional ferry service departing from New Bedford (compared to existing conditions in Table 22).

Table 23: Trucks using specified routes

Route	Total Number of One-Way Truck Trips (2019)
Wareham–Woods Hole	17,087
New Bedford–Woods Hole	830
Bourne–Woods Hole (origin Martha's Vineyard)	9,131
Bourne–Woods Hole (origin Cape Cod)	2,893
Wareham–New Bedford State Pier	3,302
New Bedford–New Bedford State Pier	20,122
Total	**53,365**

4.2 Results

The results of our analyses are presented as:

1. Modeled truck emissions under existing (2019) conditions and scenario conditions
2. Modeled vessel emissions under existing (2019) conditions and scenario conditions
3. Modeled total emissions under existing (2019) conditions and scenario conditions

4.2.1 Modeled truck emissions under existing (2019) conditions and scenario conditions

Since we could not determine the origin of each truck, the emissions calculations are for the portion of the truck trip between the intercept point and the mainland port. So, while the emissions for the total truck trip is not known, this method does permit an equitable comparison of truck emissions between existing conditions and the scenario.

Based on our calculations, we anticipate the creation of a new freight ferry service from New Bedford could reduce *truck* emissions by approximately 48%. Under the scenario conditions, approximately 23,000 trucks would utilize the new ferry service from New Bedford, and 30,000 would continue to use the existing Woods Hole ferry service. Note: These estimates are based on truck transit data from 2019, and may change in future years.

Table 24: Estimated truck emissions

Emission Type	Existing Conditions Emissions	Scenario Conditions Emissions
NOx (kg)	11,009	5,324
PM10 (kg)	485	235
VOC (kg)	1,463	707
CO_2 (kg)	2,529,961	1,223,469

4.2.2 Modeled vessel emissions under existing (2019) conditions and scenario conditions

Using the estimate that 16 freight trucks (eight single-unit and eight combination trucks) could fit on a standard 220-foot supply vessel, approximately 3,336 vessel trips would be needed to move 53,366 trucks between Woods Hole and Martha's Vineyard. In total, the emissions generated by the vessel activity would result in 2,523,017 kg of CO_2. Emissions for NO_X would vary based on engine emission tier type and would range from approximately 92,767 kg to 9,822 kg.

Table 25: Estimated vessel emissions, Woods Hole[112]

Regulation	NOX limit (g/kWh)	KW (3800 HP Engine) 77%	Transit time	Gal/Hr	NO_X emission (kg)	CO_2 emission (kg)
Tier I	17	2181 kw	0.75 Hours	100	92,766.65	2,523,016.80
Tier II	14.4	2181 kw	0.75 Hours	100	78,578.81	2,523,016.80
Tier III	3.4	2181 kw	0.75 Hours	100	18,553.33	2,523,016.80
Tier IV	1.8	2181 kw	0.75 Hours	100	9,822.35	2,523,016.80

Under a scenario in which approximately three roundtrips originate from New Bedford each day[113], 1,464 one-way vessel trips would occur per year to and from that port, and 1,872 one-way vessel trips would continue to operate out of Woods Hole in order to meet demand (based on 2019 freight truck numbers). Estimated NO_X emissions would vary based on engine emission tier type and would range from approximately 187,758 kg to 19,880 kg. Estimated CO_2 emissions would total approximately 5,106,538 kg.

Table 26: Estimated vessel emissions, scenario

				New Bedford Route (1,454 trips/year)			Woods Hole Route (1,872 trips/year)		
Vessel Engine Type	NOX limit (g/ kWh)	KW (3800 HP Engine) 77%	Gal/ Hr	Transit Time (hrs)	NO_X emission (kg)	CO_2 emission (kg)	Transit Time (hrs)	NO_X emission (kg)	CO_2 emission (kg)
Tier I	17	2181 kw	100	2.5	135,701.82	3,690,744	0.75	52,056.11	1,415,793.60
Tier II	14.4	2181 kw	100	2.5	114,947.42	3,690,744	0.75	44,094.59	1,415,793.60
Tier III	3.4	2181 kw	100	2.5	27,140.36	3,690,744	0.75	10,411.22	1,415,793.60
Tier IV	1.8	2181 kw	100	2.5	14,368.43	3,690,744	0.75	5,511.82	1,415,793.60

Table 27: Total estimated vessel emissions—scenario

Vessel Engine Type	NO_X emission (kg)	CO_2 emission (kg)
Tier I	187,758	5,106,538
Tier II	159,042	5,106,538
Tier III	37,552	5,106,538
Tier IV	19,880	5,106,538

[112] Woods Hole Route—Existing (2019) Conditions—3,336 trips/year

[113] As noted in the schedule above, winter demand would not necessitate three trips/day for the duration of the winter, thus the number of trips is slightly lower than if three round-trips operated every day.

4.2.3 Modeled total emissions under existing (2019) conditions and scenario conditions

When considering the combined vessel and truck emissions produced in the shipment of non-bulk freight between Martha's Vineyard and mainland Massachusetts in 2019, shipment of about half of the freight through the New Bedford State Pier in our proposed scenario conditions would generate approximately 20-50% more NO_X and approximately 20% more CO_2 than would be emitted under current conditions (depending on vessel engine tier) (Tables 28 and 29).

Table 28: Combined emissions—modeled existing (2019) conditions

Vessel Engine Type	NO_X emission (kg)	CO_2 emission (kg)
Tier I	103,775.97	5,052,977.78
Tier II	89,588.13	5,052,977.78
Tier III	29,562.65	5,052,977.78
Tier IV	20,831.67	5,052,977.78

Table 29: Combined emissions—modeled scenario conditions

Vessel Engine Type	NO_X emission (kg)	CO_2 emission (kg)
Tier I	193,082	6,330,007
Tier II	164,366	6,330,007
Tier III	42,876	6,330,007
Tier IV	25,204	6,330,007

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5.0 Conclusions

This report assesses the practicality of alternative Massachusetts ports to handle additional freight traffic between mainland Massachusetts and Martha's Vineyard by examining the capacity and condition of land- and water-side infrastructure, road access, navigability of the waterways, current maritime operations, public policies, long-range plans, and planned investments in facilities. The New Bedford State Pier is identified as the most promising port for diverting some of the non-bulk freight from the current port in Woods Hole.

The study effort to quantifying the potential difference in roadway congestion between the existing condition of moving non-bulk freight through Woods Hole and a shift to moving some of this freight through a New Bedford port indicates that the impact on roadway congestion would have minimal results. Roadway volume attributed to non-bulk freight in 2019, analyzed as the percent of total road traffic, shows that less than 0.14% of traffic passing over the Bourne and Sagamore bridges, and less than 2% of traffic on Woods Hole Road (south of Oyster Pond Road) was attributed to freight trucks travelling on Steamship Authority ferries.

The study also compared the emissions generated from the shipping non-bulk freight between Martha's Vineyard and mainland Massachusetts in 2019 under (1) existing conditions, *i.e.,* all freight passes through Woods Hole, and (2) scenario conditions *i.e.,* almost half of all freight leaves through New Bedford on vessels scheduled roughly three times each day, year-round, while the remaining freight is transported via the terminal at Woods Hole.

In sum, the study results indicate that a shift to scenario conditions as modeled in this report, would generate additional NO_X and CO_2 emissions and have little impact on traffic volume both on Cape Cod and to/from Cape Cod via the Bourne and Sagamore Bridges.

Several important caveats are needed to accurately interpret the results of this analysis:

1. Origin and destination points for freight trucks were not available, therefore truck routes were categorized based on likely intercept points, and emissions calculations were estimated from those intercept points. As a result, the truck emissions presented in this paper underestimate overall truck emissions related to the transport of non-bulk freight between mainland Massachusetts and Martha's Vineyard.
2. Freight trucks are carried on a variety of Steamship Authority vessels, including those not dedicated to freight. However, for purposes of this analysis, all trucks were transported to/from Vineyard Haven via a standard 220-foot supply vessel with an average capacity of 16 trucks, allowing emissions to be compared across existing and scenario conditions. For this reason, the "current (2019) condition" vessel emissions are an estimate of emissions and should not be interpreted as actual emissions.
3. Emissions calculations were based on current shipping practices, and do not take into consideration such things as strategies to reduce the overall number of freight trucks (*e.g.,* through freight consolidation) or emissions related to different types of vessels.
4. The City of New Bedford has not expressed to the report's authors a specific interest in a freight ferry service. Therefore, while the New Bedford State Pier was used in the scenario presented, this does not mean that the City has endorsed a freight ferry service.