May 2023

MA FREIGHT PLAN 23

2023 MASSACHUSETTS FREIGHT PLAN

DRAFT

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LETTER FROM THE SECRETARY AND CEO

On behalf of the Massachusetts Department of Transportation (MassDOT), I am pleased to present the 2023 Massachusetts Freight Plan. This document lays out a vision for a multimodal freight system that is safe, secure, resilient, efficient, reliable, and sustainable, and one that catalyzes economic development while supporting the continued competitiveness of the Commonwealth. The strategies identified in this plan have been developed through a risk-aware, scenario-based process and are intended to be appropriate responses to whatever the future holds. This document is a companion piece to the Massachusetts State Rail Plan, which examines that mode in more detail.

Upholding MassDOT's priority of excellent customer service, the Massachusetts Freight Plan was developed through collaboration with a **Freight Advisory Committee** of industry members and municipal and regional leaders. MassDOT also sought public feedback at two open meetings. We are confident that the strategies proposed herein serve the people of Massachusetts whenever they interact with our transportation system.

This document satisfies Massachusetts's obligation under the **Fixing America's Surface Transportation (FAST) Act** to "develop a freight plan that provides a comprehensive plan for the immediate and long-range planning activities of the State with respect to freight." It also satisfies the Commonwealth's obligation under the **Infrastructure, Investment and Jobs Act (IIJA)** to present an eight-year Freight Investment Plan; designate additional critical urban and rural freight corridors; analyze supply chain cargo flows; inventory commercial ports; describe any existing multistate freight compacts; assess the impact of e-commerce; consider military freight; assess truck parking; and strategize to minimize freight impacts on air pollution, flooding, stormwater runoff, and wildlife habitats.

MassDOT completed its last Freight Plan in 2017. Of the projects prioritized by that effort, MassDOT and its partners have completed Boston Harbor dredging and improvements to freight rail lines. On a freight spine from Conley Terminal to Worcester, Massport is expanding Conley Terminal and with the City of Boston is improving Cypher and E Streets in South Boston. At the same time, MassDOT is substantially improving the I-90/I-495 Interchange, one of the most heavily used freight corridors through Massachusetts. The strategies in this plan will build on those investments, and on completed MassDOT studies that analyzed the impacts of COVID-19 on the freight system and identified truck bottlenecks across the Commonwealth.

Gina Fiandaca
Secretary and CEO, MassDOT

MA FREIGHT PLAN 23

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10 Park Plaza

Boston, MA 02116

857-368-8580

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MASSDOT.CivilRights@state.ma.us

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Massachusetts Department of Transportation
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Boston, MA 02116-3969
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Office hours: 9:00am to 5:00pm

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ARABIC | إن كنت بحاجة إلى هذه المعلومات بلغة أخرى، يُرجى الاتصال بأخصائي الفقرة السادسة على الهاتف

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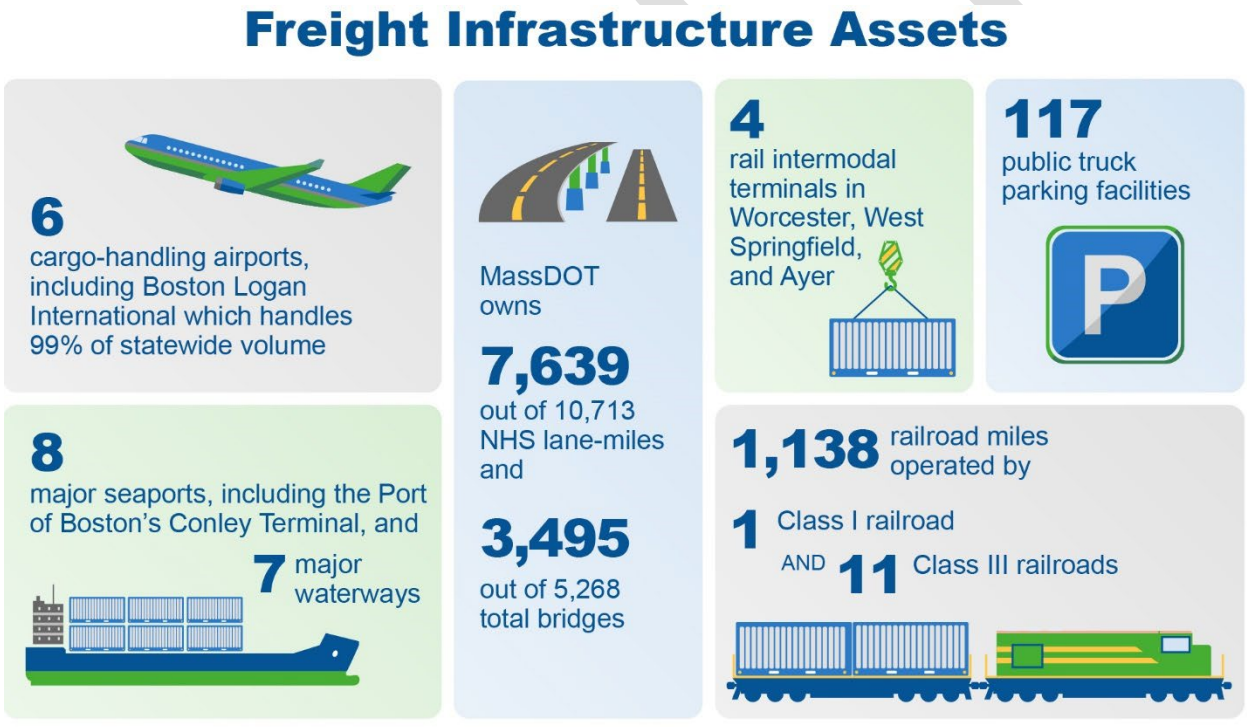
1 INTRODUCTION

Massachusetts' economic vitality and quality of life depend in great part on how well the Commonwealth's freight transportation network moves goods regionally, nationally, and internationally. The Commonwealth's sophisticated network of railroads, highway corridors, ports, pipelines, and air cargo facilities (see Figure 1.1) connect raw materials to businesses and consumers – moving fish caught in Iceland to be processed in New Bedford and concrete from production in the Berkshires to construction sites in Kendall Square – as well as finished goods that are integral to today's economy, such as electronics, pharmaceuticals, and consumer goods from all around the world.

FIGURE 1.1 FREIGHT INFRASTRUCTURE ASSETS



It also serves a critical function in supporting economic development in Massachusetts, and freight-intensive industries contributed to approximately 24 percent of state gross domestic product (GDP) in 2019, supporting 1.29 million jobs, as shown in Figure 1.2. In 2017, the multimodal freight system transported 253 million tons of goods valued at nearly $502 billion to, from, and within Massachusetts, which is expected to approach 351 million tons valued at $888 billion by 2045. Our importance to key industries, including biopharmaceuticals (vaccines), clean technology, and fishing, among others, offers continued prospects for growth. It is imperative that Massachusetts to support its critical system assets and freight-related development, while also proactively preparing for growth that could increase freight volumes and activity. Further compounding the challenges for

freight is the persistent and increasing threat of climate change and emissions, which compromises both the integrity of the multimodal freight system and the stability of homes, businesses, and communities.

FIGURE 1.2 FREIGHT AND ECONOMIC INDICATORS

The *2017 Massachusetts Freight Plan* included MassDOT's an explorative scenario plan, highlighting then-current trends in urbanization, globalization, technology, knowledge, and climate. This Freight Plan builds on that document by identifying and describing the current industry drivers of goods movement in Massachusetts and evaluating how supply chains have impacted the condition and performance of the system, particularly in light of the transformative shocks and changes that have occurred since the onset of the COVID-19 global pandemic in early 2020. This Freight Plan incorporates the latest data and research on freight and supply chain trends, with insight from a broad set of public- and private-sector freight transportation stakeholders, including the Freight Advisory Committee (FAC). Stakeholder input is a key element in helping MassDOT and its partners develop policies, programs, and projects that can help the Commonwealth grow its economy in safe and sustainable ways.

Understanding these complex systems and the role that MassDOT plays in supporting publicly funded projects, policies, and strategies is key to planning for multimodal freight mobility in an uncertain future. Together with the statewide long-range transportation plan, this Freight Plan ensures that Massachusetts has the right tools to keep the Commonwealth's businesses and communities thriving for decades to come.

Purpose of the 2023 Massachusetts Freight Plan

The purpose of the 2023 Massachusetts Freight Plan is to fulfill the obligation of MassDOT to provide a statewide freight plan for approval by the Federal Highway Administration (FHWA) every four years.[1] In Chapter 9 of this document, MassDOT presents a Freight Investment Plan consisting of projects that will receive apportioned funds from the National Highway Freight Program (NHFP). This Freight Plan provides context for MassDOT's investment strategies and choices.

[1] Prior to the passage of the Bipartisan Infrastructure Law (BIL) in 2021, the requirement was to update a Freight Plan every five years.

This Freight Plan also occupies a critical place in MassDOT's family of modal plans. Other documents in this set include the *Massachusetts State Rail Plan*;[2] the *Massachusetts Statewide Aviation System Plan* (SASP);[3] the *Massachusetts Bicycle Plan*;[4] the *Massachusetts Pedestrian Transportation Plan*;[5] and *Focus40: The 2040 Investment Plan for the MBTA*.[6] The agenda for all multimodal planning in Massachusetts is set by the statewide long-range transportation plan (SLRTP). *weMove Massachusetts,* the current SLRTP, was completed in 2012. MassDOT is preparing a superseding SLRTP – *Beyond Mobility*[7] – and the findings of this Freight Plan provide valuable insights into the interactivity of moving people versus moving goods.

This Freight Plan carries forward the work of significant MassDOT freight planning studies conducted since the *2017 Freight Plan* was completed, including:

- ***Exploring Short-Sea Shipping as an Alternative to Non-Bulk Freight Trucking in Southeastern MA* |** Completed in 2021 to study the feasibility of expanding the waterborne distribution of non-bulk freight between New Bedford and Martha's Vineyard.

- ***Understanding the Impacts of the COVID-19 Pandemic on the Massachusetts Freight Network and Planning* |** Completed in 2022 to clarify the short-term, medium-term, and long-term impacts of the pandemic, including a literature review, quantitative analysis, qualitative analysis, data assessment, and recommendations, including deployment of a truck parking availability system; promoting a driver safety campaign; collaboration with on-demand mobility service providers on driver training and monitoring; promotion of workforce upskilling; promotion of multistate freight compacts; and promotion of clear communication channels to address inquiries regarding oversize/overweight (OS/OW) vehicle movement.

- ***Truck Bottleneck Analysis* |** Completed in 2022 to use location-based services (LBS) data to identify highway interchanges at which geometry and traffic congestion produce significant delays for trucks, and the potential causes of delay at those locations. For interchanges where MassDOT is not currently investing or conducting specific planning studies, the analysis also discussed some high-level potential remediations that could be studied by the Department.

The findings of these studies will be incorporated throughout this Freight Plan, as well as findings from other recent plans and studies related to freight and goods movement, including those prepared by the Metropolitan Area Planning Council (MAPC), Massachusetts Executive Office of Energy and Environmental Affairs, and U.S. Department of Transportation.

[2] https://www.mass.gov/service-details/rail-plan.
[3] https://www.mass.gov/lists/massachusetts-statewide-airport-system-plan-msasp-documentation.
[4] https://www.mass.gov/service-details/bicycle-plan.
[5] https://www.mass.gov/service-details/pedestrian-plan.
[6] https://www.mbtafocus40.com/.
[7] https://www.mass.gov/beyond-mobility.

Organization of the Plan

This Freight Plan includes an Executive Summary and a web-based Esri Story Map platform, as well as the remaining chapters of the 2023 Massachusetts Freight Plan:

- Chapter 2 | Vision, Goals, and Regulatory Context.
- Chapter 3 | Stakeholder Outreach.
- Chapter 4 | Key Industries and Recent Supply Chain Developments.
- Chapter 5 | Freight Assets, Demands, and Needs.
- Chapter 6 | Futures for Freight in Massachusetts.
- Chapter 7 | Strategies and Recommendations.
- Chapter 8 | Implementation Plan.
- Chapter 9 | Fiscally Constrained Freight Investment Plan.
- Appendix A | Stakeholder Outreach Materials.

2 VISION, GOALS, AND REGULATORY CONTEXT

Vision, Goals, and Guiding Principles

The vision of the 2023 Massachusetts Freight Plan was approved by the Freight Advisory Committee (FAC) and MassDOT, drawing from *Beyond Mobility*, the *2017 Massachusetts Freight Plan*, and national best practices.

> Supporting **safe, resilient, and secure** multimodal freight movement in Massachusetts through investing in key freight assets to improve **economic competitiveness**, provide **efficient and reliable** freight mobility, and support **healthy and sustainable** communities.

This Freight Plan will realize this vision through the goals shown in Figure 2.1.

FIGURE 2.1 2023 MASSACHUSETTS FREIGHT PLAN GOALS

System Condition

Support an efficient and reliable supply chain through investments in existing infrastructure and supporting technologies to maintain and preserve the existing system.

Safety and Resiliency

Improve statewide safety by funding projects that reduce injuries and fatalities, reduce vulnerability, and improve the resiliency of the system.

Mobility and Reliability

Invest in the multimodal transportation system to improve mobility, connectivity, accessibility, and reliability for people and goods.

Economic Competitiveness

Support multimodal transportation system connectivity, efficiency, and mobility to support businesses and residents and increase national and regional economic competitiveness.

Equity and Environmental Sustainability

Support initiatives and investments that improve equity across the multimodal system, improve local air quality, and minimize impacts to natural, historic, and cultural resources.

In addition to these five goals, MassDOT has two guiding principles for development of this Freight Plan:

1. **Fostering equity and collaboration |** Understanding the needs of all groups and ensuring that the right stakeholders are at the table.

2. **Building organizational capacity |** Ensuring MassDOT has the staff and systems in place to accomplish its goals.

Policy Goals and Requirements

Federal Policy Goals and Requirements

The vision and goals for this Freight Plan support national freight priorities defined in U.S. DOT's National Freight Strategic Plan and supported by the Moving Ahead for Progress in the 21st Century Act of 2012 (MAP-21,)[8] the Fixing American's Surface Transportation (FAST) Act of 2015,[9] and the Infrastructure Investment and Jobs Act (IIJA) of 2021.[10]

Federal Goals for Freight Plans

MAP-21 established seven national freight goal areas to be reflected in state freight plans:

- Improve the safety, security, and resilience of freight transportation.
- Improve the state of good repair of the national freight network.
- Invest in infrastructure improvements and implement operational improvements that strengthen the contribution of the national freight network to the economic competitiveness of the U.S. and that reduce congestion and increase productivity, particularly for domestic industries and businesses that create high-value jobs.
- Improve the economic efficiency of the national freight network.
- Use advanced technology to improve the safety and efficiency of the national freight network.
- Reduce the environmental impacts of freight movement on the national freight network.
- Incorporate concepts of performance, innovation, competition, and accountability into the operation and maintenance of the national freight network.

[8] https://www.govinfo.gov/content/pkg/BILLS-112hr4348enr/pdf/BILLS-112hr4348enr.pdf.
[9] https://uscode.house.gov/view.xhtml?req=granuleid:USC-prelim-title49-section70202&num=0&edition=prelim.
[10] https://www.govinfo.gov/app/details/PLAW-117publ58.

Building upon the goals of MAP-21, the FAST Act identified the need for a National Multimodal Freight Policy and Strategic Plan. The National Multimodal Freight Policy and Strategic Plan is used to inform state freight plans and guide decision-making at both the Federal and state level.

The National Multimodal Freight Policy goals[11] include:

- Invest in infrastructure improvements and implement operational improvements on the highways of the United States that:
  - Strengthen the contribution of the National Highway Freight Network (NHFN) to the economic competitiveness of the United States.
  - Reduce congestion and bottlenecks on the NHFN.
  - Reduce the cost of freight transportation.
  - Improve the year-round reliability of freight transportation.
  - Increase productivity, particularly for domestic industries and businesses that create high-value jobs.
- Improve the state of good repair of the NHFN.
- Use innovation and advanced technology to improve the safety, efficiency, and reliability of the National Highway Freight Network.
- Improve the efficiency and productivity of the NHFN.
- Improve the flexibility of States to support multi-State corridor planning and the creation of multi-State organizations to increase the ability of States to address highway freight connectivity.
- Reduce the environmental impacts of freight movement on the National Highway Freight Network.

Federal Requirements for Freight Plans

Table 2.1 details the requirements for state freight plans established by the FAST Act and IIJA and outlines the *2023 Massachusetts Freight Plan's* compliance with those requirements, providing a crosswalk between each requirement and where it is addressed in the Plan.

[11] 49 U.S. Code § 70101.

TABLE 2.1 MASSACHUSETTS STATE FREIGHT PLAN REQUIREMENTS CROSSWALK

Legislation	Requirement	2023 Freight Plan Reference(s)
FAST Act	Identification of significant statewide freight trends, needs and issues	Chapters 4, 5
	Description of freight policies, strategies and performance measures that will guide freight-related transportation investment decisions	Chapters 2, 7, 8, 9
	Critical multimodal rural freight facilities and rural and urban freight corridors	Chapter 5
	Link to national multimodal freight policy and highway freight program goals	Chapter 2
	Description of how innovative technologies and operational strategies (including ITS) that improve the safety and efficiency of freight movements were considered	Chapter 7
	Description of improvements to reduce roadway deterioration by heavy vehicles (including mining, agricultural, energy cargo or equipment and timber vehicles)	Chapters 7, 9
	Inventory of facilities with freight mobility issues and a description of the strategies the state is employing to address the freight mobility issues	Chapters 5
	Description of significant congestion or delay caused by freight movements and any mitigation strategies	Chapters 5, 7, 8, 9
	Freight investment plan that includes a list of priority projects and describes investment and matching funds	Chapter 9
	Consultation with the state freight advisory committee	Chapter 3
IIJA	Assessment of commercial motor vehicle parking facilities	Chapter 5
	Description of supply chain cargo flows	Chapters 4, 5
	Inventory of commercial ports	Chapter 5
	Discussion of the impacts of e-commerce on freight infrastructure	Chapter 4
	Considerations of military freight	Chapter 5
	Strategies and goals to decrease: 1) the severity of impacts of extreme weather and natural disasters on freight mobility, 2) the impacts of freight movement on local air pollution, 3) the impacts of freight movement on flooding and stormwater runoff, and 4) the impacts of freight movement on wildlife habitat loss	Chapter 7

Massachusetts Policy Goals and Requirements

Economic Development

The Healey-Driscoll administration has outlined the following economic development priorities; this plan will interact with many of them:

- Approach all efforts through an **equity lens**, ensuring that everyone in Massachusetts has the opportunities to access high-quality jobs and careers by supporting wraparound services like childcare and living stipends.

- Undertake historic investment and recommitment to connecting workers everywhere in the Commonwealth to good jobs, including to **critical industries like health care, education, clean energy, advanced manufacturing, and behavioral health**.
- Lead the nation in training and preparing workers to participate in the **clean energy economy** by establishing a Climate Action and Innovation Leadership Council charged with making Massachusetts the best place in the country to start, staff, and grow a firm that solves environmental and climate challenges, as well as tripling the budget for the Massachusetts Clean Energy Center (CEC) to **spur clean tech job growth**.
- Promote and expand Early College efforts across the Commonwealth, providing more young people with **pathways to opportunity and post-secondary success**.
- **Encourage entrepreneurism**, especially for women and people of color by creating an Office of Economic Assistance to advise and assist in developing business plans, facilitate regulatory compliance, and help people access needed capital and borrowing.
- Partner with labor and industry to **create pathways to meaningful opportunities and steady careers** in important sectors.
- Ensure that Massachusetts remains competitive by creating a regulatory environment that **encourages and supports opportunities for start-ups, as well as growth of existing businesses**, which are consistent with our community's vision.
- Bring new resources and attention to Massachusetts' **robust network of vocational and technical high schools**, coordinating those assets with regional community colleges and industries to maximize their impact and fulfill their potential.
- Enact **stronger protections against wage theft** so that workers are better protected.
- **Expand opportunities for employment, housing, and more** for individuals leaving places of incarceration.

Transportation

MassDOT's mission is to deliver excellent customer service to people traveling in the Commonwealth by providing transportation infrastructure, which is safe, reliable, robust, and resilient. We work to provide a transportation system that can strengthen the state's economy and improve the quality of life for all.

Beyond Mobility, the Massachusetts 2050 Long-Range Transportation Plan, is a planning process (Figure 2.2) that will result in a blueprint for guiding transportation decision-making and investments in Massachusetts in a way that advances MassDOT's goals and maximizes the equity and resiliency of the transportation system. As part of that process, MassDOT is undertaking an extensive public input program to develop and articulate a vision for transportation in Massachusetts across multiple goal areas.

FIGURE 2.2 BEYOND MOBILITY PROJECT ROADMAP

Freight Performance Measures

FHWA has established performance measures required for reporting by DOTs under the FAST Act. Freight performance measures are tools to evaluate the level of accountability, efficiency, and effectiveness of the various freight modes and assist with the prioritization and selection of freight improvement projects and programs. These measures are used to monitor the performance of the transportation system using timely and reliable data, to ensure objectives and goals are met, and to identify potential freight bottlenecks.

Since the implementation of the *2017 Massachusetts Freight Plan*, MassDOT has continued to gather and evaluate datasets to identify additional freight performance measures to aid decision-making. The *2023 Massachusetts Freight Plan* freight performance measures are outlined in Table 2.2 under each goal area. MassDOT is working to

calculate the measures and meet the Federal deadlines for reporting. In the future, it will work to revise performance-based planning and programming processes to explicitly include freight measures. MassDOT currently tracks the safety and infrastructure performance metrics listed above and publishes them in its annual *Tracker*.[12] Safety metrics are further discussed in the MassDOT 2023 *Strategic Highway Safety Plan*.[13] Infrastructure metrics are further discussed in the *Transportation Asset Management Plan*.[14]

TABLE 2.2 MASSACHUSETTS FREIGHT PERFORMANCE MEASURES

Performance Measure	Definition	Source
Safety & Resiliency		
Number and rate of truck-involved fatalities on all public roads.	The Department tracks the number and rate of truck-involved fatalities each year	MassDOT
Number and rate of truck-involved serious injuries on all public roads.	The Department tracks the number and rate of truck-involved serious injury crashes each year	MassDOT
Number of highway-rail incidents	The Department tracks the number of highway-rail incidents per 1,000 track miles (5-year rolling avg.)	MassDOT
Number of hazardous materials (HazMat) incidents	The Department tracks the number of reported HazMat incidents per 1,000 track miles (5-year rolling avg.)	MassDOT
Number of train derailments	The Department tracks the number of derailments per 1,000 track miles (5-year rolling avg.)	MassDOT
Asset Preservation		
Percent of Interstate pavements in good condition	Required Federal performance measure; a key indicator for the state of good repair of the freight highway system	MassDOT
Percent of Interstate pavements in poor condition	Required Federal performance measure; a key indicator for the state of good repair of the freight highway system	MassDOT
Percent of non-Interstate National Highway System (NHS) pavements in good condition	Required Federal performance measure; a key indicator for the state of good repair of the freight highway system	MassDOT
Percent of non-Interstate NHS pavements in poor condition	Required Federal performance measure; a key indicator for the state of good repair of the freight highway system	MassDOT
Percent of NHS bridges by deck area classified as good condition	Required Federal performance measure; a key indicator for the state of good repair of the freight highway system	MassDOT
Percent of NHS bridges by deck area classified as poor condition	Required Federal performance measure; a key indicator for the state of good repair of the freight highway system	MassDOT
Percent of grade crossings in poor or non-operable condition	The Department tracks the percentage of grade crossings in poor or non-operable condition	MassDOT

[12] https://www.mass.gov/lists/tracker-annual-performance-management-reports.
[13] https://www.mass.gov/doc/massachusetts-shsp-2023/download.
[14] https://www.mass.gov/doc/2019-transportation-asset-management-plan/download.

Performance Measure	Definition	Source
Percent of grade crossings in good or excellent condition	The Department tracks the percentage of grade crossings in good or excellent condition	MassDOT
286K freight car capacity	Percentage of main lines freight rail miles capable of handling 286k freight cars	MassDOT
Domestic double-stack clearance	Percentage of key route miles with double stack clearance	MassDOT
Mobility & Reliability		
Truck Travel Time Reliability (TTTR) index	Required Federal performance measure; a key indicator of the performance freight highway system. This measure is calculated by dividing the 95th percentile truck travel time on a road segment by the 50th percentile travel time. The closer the index is to 1.0, the more reliable the corridor.	National Performance Management Research Data Set
Economic Competitiveness		
Freight tonnage by mode	Estimation of the annual volume of freight moved by Massachusetts' freight transportation modes (truck, rail, air, water)	FHWA Freight Analysis Framework
Annual hours of delay on freight intermodal connectors	Annual hours of truck delay experienced on freight intermodal connectors	National Performance Management Research Data Set
Equity & Environmental Sustainability		
Carbon dioxide (CO_2) reduction from solar	The Department tracks CO_2 reduction from solar energy generated (in tons)	MassDOT
Fuel-use avoided	The Department tracks fuel-use avoided through electric charging station use (in gallons)	MassDOT
Greenhouse gas (GHG) emissions avoided	The Department tracks GHG emissions avoided through electric charging station sessions (in metric tons)	MassDOT

MassDOT considers truck loading in its pavement designs to ensure adequate service life of the pavement. MassDOT utilizes data from permanent Weigh-In-Motion (WIM) stations to monitor the truck percentages, lane distribution, and loading on major highways. Annual variations in truck loading can be identified when analyzing this WIM data. This data is used when planning future projects and assists in the design of roadway pavement projects.

Measuring GHG and Environmental Impacts of Freight

While climate change caused by GHGs has increased the severity of impacts of extreme weather and natural disasters, freight movement also has impacts on local air pollution, flooding, stormwater runoff, and wildlife habitat loss. Transportation is the largest source of GHG emissions in the Commonwealth, responsible for

37 percent of statewide emissions in 2020.[15] Pollution in the transportation sector – including freight and goods movement – is caused by the combustion of fossil fuels in the engines of cars, trucks, airplanes, and other vehicles.

Massachusetts has long been a leader in proactively mitigating transportation-related impacts on the environment. In addition to continuing to track the environmental-related performance measures outlined in Table 2.2, the 2023 Massachusetts Freight Plan also includes specific strategies designed to make further progress on the aforementioned environmental concerns, while also promoting efficient, reliable, and sustainable freight mobility in the Commonwealth.

[15] https://www.mass.gov/doc/clean-energy-and-climate-plan-for-2025-and-2030/download.

3 STAKEHOLDER OUTREACH

Stakeholder outreach for the 2023 Massachusetts Freight Plan focused on gaining a balance of insight and input on the goals of the plan from freight industry experts and the public. MassDOT conducted this stakeholder outreach through the following efforts, summarized in Table 3.1. Appendix A includes materials for all stakeholder engagement activities.

TABLE 3.1 SUMMARY OF PUBLIC OUTREACH ACTIVITIES

Activity	Date
Freight Advisory Committee Meeting #1	January 10, 2023
Public Information Meeting #1	January 12, 2023
Freight Advisory Committee Meeting #2	February 12, 2023
Neighboring State Interviews	February – March 2023
Freight Focus Groups and Survey	March – April 2023
Freight Advisory Committee Meeting #3	March 23, 2023
Public Information Meeting #2	March 30, 2023
30-Day Public Review of Draft Freight Plan	May 31 – June 29, 2023

Freight Advisory Committee

The Freight Advisory Committee (FAC) consists of public and private sector advisors and stakeholders with industry expertise (Table 3.2). FAC members were asked to share their vision and goals, offer insight on local and regional freight-related issues, trends, and needs, share information with the institutions and organizations they represent, and inform recommendations, solutions, and strategies for freight and goods movement in Massachusetts. Some FAC members had participated in developing the 2017 Freight Plan and opted to continue their involvement for the 2023 Freight Plan, and all were recently engaged as part of the COVID-19 Freight Study.

TABLE 3.2 FREIGHT ADVISORY COMMITTEE MEMBERSHIP

Public Sector	Private Sector/Industry
City of Cambridge	Cumberland Farms
Connecticut Department of Transportation	Genesee & Wyoming Railroad
Federal Highway Administration	Global Partners
Massachusetts Association of Regional Planning Agencies	Maple Leaf Distribution Services
Massachusetts Department of Transportation	Maritime International
Massport	NFI Industries
Port of New Bedford	Trucking Association of Massachusetts
	Unistress Corp.

To get continued input from stakeholders, three FAC meetings were held in 2023: January 10, February 23, and March 16. The meetings were attended by stakeholders virtually, and the study team utilized live poll questions and Q&A to get real-time feedback during the presentation.[16] Highlights from the meeting included:

- Meeting #1 – agenda included an overview of the 2023 Massachusetts Freight Plan timeline, then the proposed Plan vision and goals for FAC member feedback. Members identified safety and resiliency, followed by economic competitiveness and equity and environmental sustainability, as a high priority for the 2023 Freight Plan.
- Meeting #2 – agenda included a presentation on the scenario planning process and findings, as well as the framework for Plan recommendations for FAC member feedback. Members recommended including long-term freight parking areas, awareness of the importance of freight movements, and incentives for electric vehicle use in the Plan recommendations.
- Meeting #3 – agenda included a walk-through of the Draft 2023 Massachusetts Freight Plan for FAC member feedback.

Neighboring States

The study team held one-on-one meetings with neighboring state DOTs to discuss key assets, shared corridors and infrastructure, needs, and opportunities for coordination. These meetings also covered a variety of topics including truck restrictions and permitting, truck parking, workforce development, congestion, new technologies, and new investment opportunities in freight. The meetings were held in late February and early March 2023.

[16] Freight Advisory Committee (FAC) meeting materials available via: https://www.mass.gov/lists/massachusetts-freight-plan-documents.

Community Outreach

The study team held the first public information meeting in January 2023 and the second public meeting in March 2023. The team also held small focus groups and utilized online public surveys to get stakeholder input.

Public Informational Meetings

The first public information meeting presented an overview of the 2023 Freight Plan history, timeline, vision, and goals and utilized live polling questions to get public input. Participants noted safety and resiliency should be the highest priority for the plan. Some other topics suggested for consideration included emissions reductions for freight transportation, mode shift from highway freight to rail freight movement, improvements to capacity, reliability, and competitiveness of freight rail, coordination with other transportation goals, safety, freight access in Western Massachusetts, and changes to warehousing and distribution related to e-commerce.

Public Survey

A public survey was developed to gather public perspectives on how freight moves through the Commonwealth of Massachusetts and how it impacts communities and industries. The survey was open for responses from February to April 2023. Figure 3.1, Figure 3.2, and Table 3.3 present summary detail on the survey respondents, their relationship to the Commonwealth, freight experience, and priorities.

FIGURE 3.1 SURVEY RESPONDENTS' FREIGHT EXPERIENCES AND BELIEFS

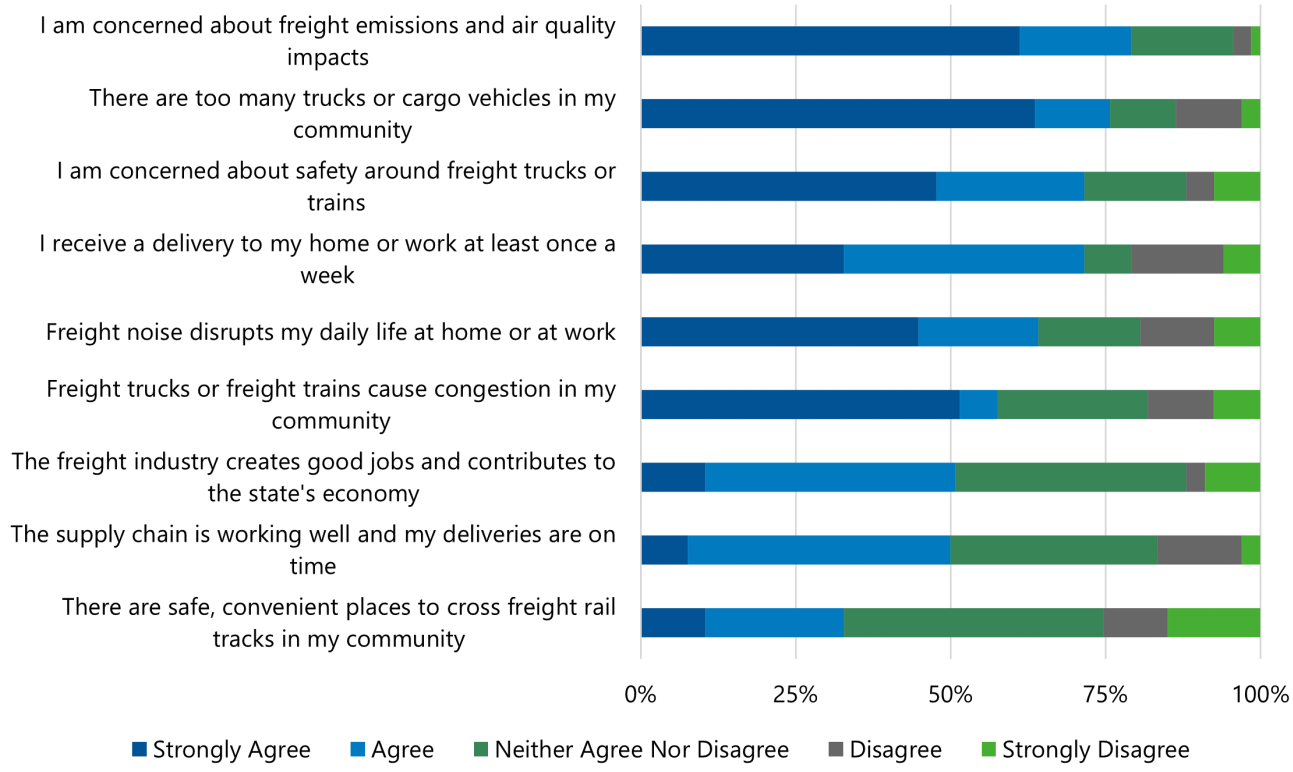
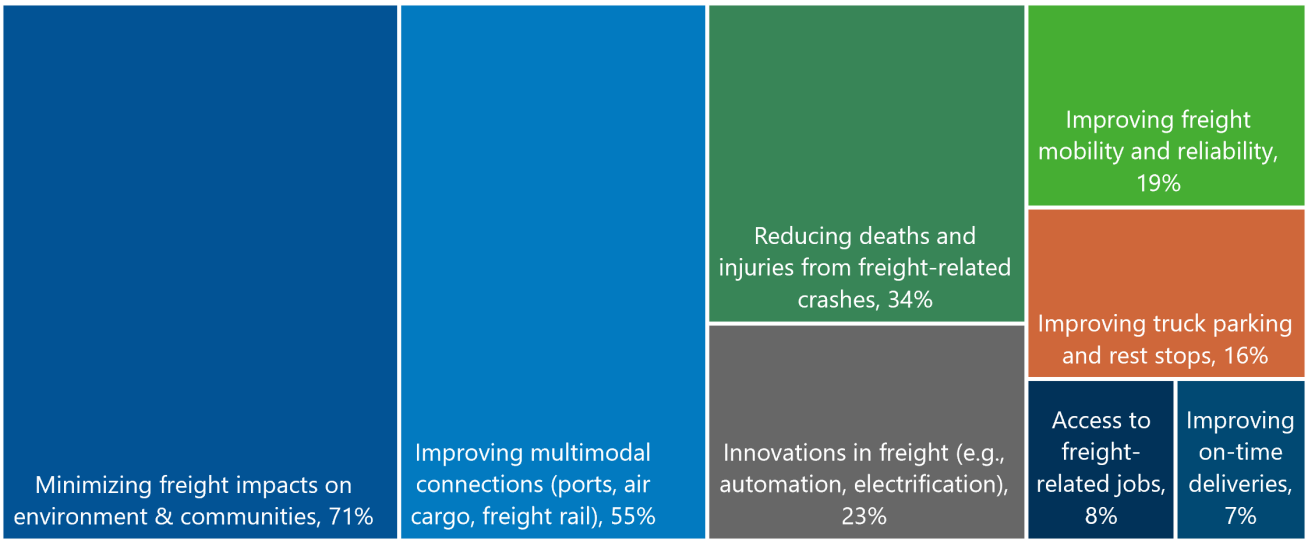


TABLE 3.3 SURVEY RESPONDENTS' RELATIONSHIP TO MASSACHUSETTS

Total Survey Respondents	73
Lives in Massachusetts	67 *(92%)*
Works in Massachusetts	34 *(47%)*
Frequent Traveler to Massachusetts	29 *(40%)*
Owns a Business in Massachusetts	16 *(22%)*
Involved in Massachusetts Freight Operations	9 *(12%)*

Note: As respondents could select more than one category, numbers will not add up to 100%.

FIGURE 3.2 SURVEY RESPONDENTS' PRIORITIES FOR IMPROVING THE MASSACHUSETTS FREIGHT SYSTEM



Focus Groups

Along with the survey, stakeholders were invited to sign-up to participate in small focus groups hosted to discuss topics that include safety, access to employment, small business needs, and general freight industry trends and challenges. With 16 focus group sign-ups, there was a mix of public sector employees, private sector/industry members, community members, and elected/appointed officials. Two focus groups were held so that both represented a mix of perspectives.

Focus group participants shared valuable information about their varied experiences with freight in their communities and industries. Key takeaways included participants recommending that the Massachusetts Freight Plan consider: climate goals and environmental/quality of life impacts; labor-related challenges in the trucking industry; opportunities to work with the Steamship Authority in the Woods Hole region; challenges associated with addressing freight issues at the local level; and needs and opportunities for public private partnerships to address freight issues.

4 KEY INDUSTRIES AND RECENT SUPPLY CHAIN DEVELOPMENTS

Key Industries in Massachusetts

In recent years, the Commonwealth's key industries have been challenged by extreme changes. More persistent than disruption, extreme changes across fishing and seafood, biomedicine, computer and electronics, and chemicals and materials industries have had rippling effects across supply chains within and beyond Massachusetts. This section describes these industries and analyzes recent supply chain developments impacting all industries since the *2017 Massachusetts Freight Plan*, with a special focus on events that have occurred since the onset of the COVID-19 pandemic in 2020.

Fishing and Seafood Industry

Massachusetts is one of the top producers of seafood in the U.S. Several of the nation's productive commercial fishing ports include New Bedford, Gloucester, Provincetown-Chatham, Boston, and Fairhaven. In 2019, Massachusetts generated a value of $679 million in seafood landings, ranking second in the nation, behind Alaska.[17] There were approximately 13,500 commercial fishing vessels that operated in the Northeast region (including the coasts of Massachusetts, Connecticut, Maine, New Jersey, and Rhode Island) from 2015 to 2019. The cumulative value for the Northeast region accounted for an annual average of $1.82 billion in gross landed value.[18]

According to the National Oceanic and Atmospheric Administration (NOAA), commercial harvesters in the Northeast region stopped fishing in 2020 due to instructions from seafood dealers and processors.[19] Restaurant closures caused demand for seafood to drop precipitously. As stay-in-place guidance continued, seafood consumption habits shifted from fresh commercial seafood to frozen and shelf-stable products to meet increased demand for at-home consumption.[20] NOAA reported a decline in U.S. seafood exports by value and volume during 2020, due to limited seafood exports and a downturn in restaurant sales. After 2020, changes in seafood wholesale and retail markets resulted in a decline in the number of federally permitted dealers that purchased

[17] US Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service. 2021. *Fisheries of the United States 2019*. January 2023. https://www.fisheries.noaa.gov/resource/document/fisheries-united-states-2019.
[18] National Oceanic and Atmospheric Administration (NOAA) Fisheries. 2021. *Northeast Fisheries Impacts from COVID-19*. January.
[19] Ibid.
[20] Ibid.

seafood. NOAA also cites climate change impacts causing vast shifts in aquatic populations and threats such as overfishing have necessitated increasingly strict regulations.[21] Nationally, seafood exports from 2019 to 2021 declined 9 percent by weight and increased 13 percent by value,[22] a result of both increased demand for high-value seafood as well as higher prices due to rising energy and freight costs.

In 2021, Massachusetts continued to see a decrease (13 percent compared to 2019) in seafood export volume, but saw an increase (23 percent) in the value of those exports over that same period. (Table 4.1). Despite the decrease in exports by weight, Massachusetts continues to be a lead exporter by value, behind Alaska, Louisiana, Virginia, Oregon, and Mississippi.

TABLE 4.1 MASSACHUSETTS SEAFOOD INDUSTRY EXPORTS, 2019 – 2021

Year	Pounds	Metric Tons	Dollars	Collection
2019	234,197,628	106,231	$681,043,854	Commercial
2020	227,957,435	103,401	$557,470,005	Commercial
2021	203,863,386	92,472	$839,293,410	Commercial

Source: *NOAA Fisheries.*
Note: *2022 data not yet available.*

In 2022, Monterey Bay Aquarium's Seafood Watch, a sustainable seafood advisory list, red-listed American lobster fisheries due to the risks they pose to the endangered North Atlantic right whale, which may further impact demand.[23]

Biomedical Industry

The biomedical industry provides tools and processes for health and medical care. These may include – but are not limited to – pharmaceuticals, vaccines, medical devices, implants, artificial organs, dialysis machines, and personal protective equipment (PPE). In 2019, Massachusetts led the U.S. in medical product exports, valued at $6.1 billion. Hospitals, nursing, and residential care were the largest contributors to the state's GDP, in addition to about 500 medical-device manufacturing companies and a 25,000-person statewide workforce.

IN 2021, MASSACHUSETTS EXPORTED $2.7 BILLION WORTH OF VACCINES FOR HUMAN USE, $1.14 BILLION WORTH OF MEDICAL INSTRUMENTS AND APPLIANCES, AND $1 BILLION WORTH OF FILTERING/ PURIFYING MACHINERY FOR LIQUIDS.

During the COVID-19 pandemic, the biomedical industry changed significantly, with an emphasis on PPE for commercial

[21] National Oceanic and Atmospheric Administration (NOAA) Fisheries. *Understanding Our Changing Climate*. https://www.fisheries.noaa.gov/insight/understanding-our-changing-climate. Accessed January 2023.
[22] NOAA Fisheries - Foreign Fishery Trade Data. https://www.fisheries.noaa.gov/.
[23] https://www.nytimes.com/2022/09/13/science/lobsters-right-whales-maine.html.

and personal use. The growing commercial demand strained the medical equipment industry. In Massachusetts, the Manufacturing Emergency Response Team (MERT) formed in March 2020 to support manufacturers who produced materials that were used by hospitals and medical response teams during the pandemic. Grants from MERT spurred massive production from manufacturers for ventilators, isolation gowns, N95 masks, and face shields, among other items.[24]

A 2022 Massachusetts Biotechnology Council (MassBio) report found that the biomedical industry is continuing growth in the workforce, with 17.2 percent year-over-year employment growth in research and development, second only to California, and a 15.2 percent increase in year-over-year employment in biomanufacturing. The biotechnology sector is also expected to add 20 million square feet of laboratory and manufacturing space by 2024 that would accommodate 40,000 new employees.[25]

Computer & Electronics Industry

Massachusetts has long been home to new and growing technology companies and is known as the nation's first tech hub.[26] In 2019, there were 695 computer and electronic product establishments in Massachusetts employing nearly 54,000 workers. Middlesex, Suffolk, Essex, and Worcester counties have the largest number of employees and establishments in the computer and electronic product sector in the Commonwealth.[27] In addition, Massachusetts is rapidly becoming an incubator for clean technology ("cleantech") companies, which work to reduce environmental impacts through energy efficiency improvements, sustainable use of resources, and/or environmental protection activities. These developments may lead to growth in jobs and output as companies expand their research into this new technology, with 50,000 square feet of laboratory and manufacturing space and 200 new jobs expected by 2045.[28]

In recent years, the industry has been impacted by geopolitical and macroeconomic forces, increased overall demand, and availability of certain electronics, including semiconductor chips. Equipment was difficult to obtain, including semiconductor manufacturing equipment used to make older varieties of chips, and components used in an electronic assembly, such as diodes, capacitors, and substrates. Rising consumer demand for electric vehicles and devices that use 5G technology intensified, increasing the shortage of semiconductors.[29] This resulted in impacts to the consumer electronics, automotive, and manufacturing industries.

Additionally, a shortage in labor and in available equipment slowed the electronics industry enough for the U.S. Department of Commerce (DOC) to reach out to various sectors of the semiconductor supply chain, including design software developers, integrated device manufacturers, materials suppliers, equipment vendors, and

[24] Bem, David. "Chemical Supply Chain Risks." 2020. Webinar: *The US Chemical Supply Chain: Vulnerabilities Highlighted by COVID-19, Chemical Sciences Roundtable*, The National Academies, July 2.
[25] https://readymag.com/MassBio/2022IndustrySnapshot/executive-summary/.
[26] https://www.wgbh.org/news/post/route-128-once-known-road-nowhere-had-traffic-jam-day-it-opened.
[27] USMCA Massachusetts State Fact Sheet. International Trade Administration. https://www.trade.gov/sites/default/files/2020-12/Massachusetts%20USMCA%20State%20Fact%20Sheet_0.pdf.
[28] https://www.bostonglobe.com/2022/12/15/business/general-electrics-new-energy-business-will-move-its-hq-kendall-square/?s_campaign=8315.
[29] U.S. Department of Commerce. 2022. *Results from Semiconductor Supply Chain Request for Information.*

automotive and consumer companies to better understand the issue.[30] Their findings led to the enactment of the federal law "Creating Helpful Incentives to Produce Semiconductors for America and Science Act" (CHIPS Act) in July 2022. This legislation will invest $280 billion in manufacturing and research for domestic production of semiconductors. These actions may lead to further industry growth in Massachusetts.

Chemicals & Material Industry

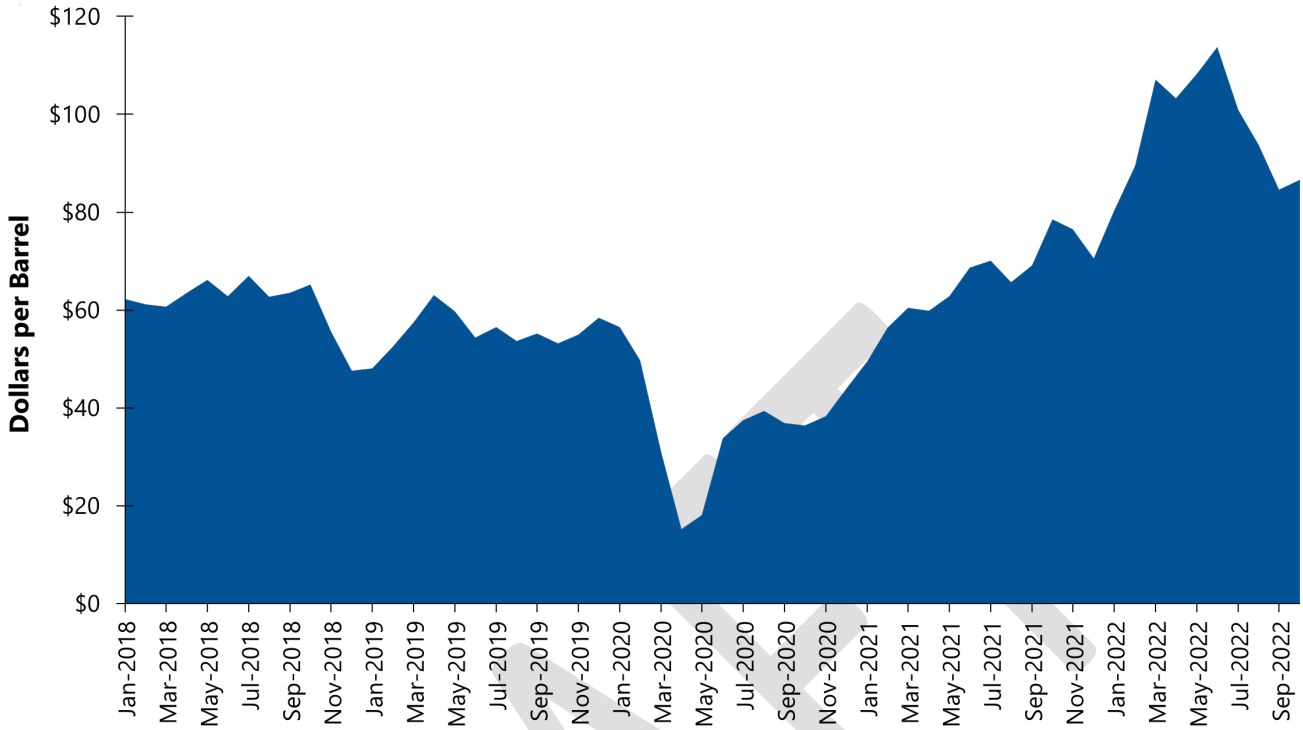
The chemicals and material industry supplies the ingredients needed for manufacturing consumer and industrial products. In 2019, there were 317 chemical industrial establishments in Massachusetts, employing more than 14,700 people. That same year, chemical product manufacturing ranked second among the Commonwealth's top producing manufacturing sectors (valued at $11.6 billion), only after computer and electronic manufacturing, which was valued at nearly $16 billion.[31] The counties with the most employees and establishments in the chemicals sector include Middlesex, Suffolk, Worcester, and Essex counties.[32]

Before 2020, global supply chain practices necessitated raw materials being shipped long distances; reliable, inexpensive transportation via container cargo ships facilitated this model. However, the model's inherent vulnerability was evident as the impact of local and regional issues on world trade became more pronounced after 2020. As a result, this led the chemicals and material industry to focus on minimizing waste and adopting leaner manufacturing practices, while also maximizing productivity.[33]

Crude oil is a key component in materials ranging from fabrics to plastics. Demand for crude oil has remained steady over the pandemic recovery. While the price per barrel dropped significantly in April and May 2020, it has since surpassed pre-pandemic levels, to a high of $108.29 in May 2022 (Figure 4.1). However, energy and chemical companies are shifting their practices to become more sustainable due to consumer awareness and demand. Companies are now exploring decarbonization technologies and opportunities to diversify beyond hydrocarbons.[34] These factors may lead to further innovation and growth in the industry in Massachusetts.

[30] https://www.commerce.gov/news/press-releases/2022/09/commerce-department-releases-rfi-results-chips-program.
[31] https://www.nam.org/state-manufacturing-data/2021-massachusetts-manufacturing-facts/.
[32] US Department of Commerce, International Trade Administration. 2020. *USMCA Massachusetts State Fact Sheet*. June 25.
[33] David Bem. "Chemical Supply Chain Risks." 2020. Webinar: *The US Chemical Supply Chain: Vulnerabilities Highlighted by COVID-19, Chemical Sciences Roundtable*, The National Academies, July 2.
[34] Understanding the Impacts of the COVID-19 Pandemic on the Massachusetts Freight Network and Planning. Massachusetts Department of Transportation, 2022.

FIGURE 4.1 U.S. CRUDE OIL FIRST PURCHASE PRICE (DOLLARS PER BARREL)



Source: US Energy Information Administration.

Recent Supply Chain Developments

The pandemic exposed the fragility of the global supply chain, which has continued to recover from disruptions resulting from labor shortages, equipment availability and scarcity, and ripple effects caused by bottlenecks. Manufacturers, shippers, governments, and carriers have been seeking solutions to improve overall resilience of production and distribution of commodities, which has since become a household topic, as supply chain events have impacted everyone from businesses to consumers. This section discusses recent developments impacting supply chains that are relevant to Massachusetts, using the latest available research, findings from recent plans and studies, Freight Advisory Committee (FAC) member feedback, and stakeholder interviews.

COVID-19 Impacts

The impact of the COVID-19 pandemic continues to have far-reaching consequences across the entire global supply chain and logistics sectors. MassDOT's *Understanding the Impacts of the COVID-19 Pandemic on the Massachusetts Freight Network and Planning* study evaluated the effects of COVID-19 on Massachusetts' freight network and key industries from its onset during the 1st quarter of 2020 through the second quarter of 2022. During this time, the principal events and impacts were as follows:

- **The pandemic caused major shifts in economic activity and concomitant impacts on supply chains and logistics systems, the repercussions of which are still playing themselves out**. After an initial massive

slowdown in activity caused by shutdowns and addressing the direct needs caused by the pandemic (such as the production of personal protective equipment), ongoing social isolation caused demand for consumer durable goods to take off, and with it, demand for freight transportation. This was particularly evident with imports, with the nation's ports and gateway airports handling record volumes during the latter half of 2020 and the first half of 2021. Since then, the growth in demand for consumer goods has tapered off and consumer expenditures have shifted back towards experiences, particularly dining and travel.

- **Macro-economic and geopolitical impacts**. Concerns about economic damage resulting from pandemic-imposed shutdowns led to unprecedented public expenditures to support impacted individuals and businesses during the depths of the pandemic. The result was a rapid economic rebound which was felt particularly strongly in the demand for goods, and associated recovery in employment, trends that were reflected in Massachusetts' economy as well. However, recoveries were wildly uneven, as waves of COVID infections swept across the globe, and countries pursued a range of mitigation strategies. This was particularly the case with China, which maintained a zero-tolerance policy for infections, instituting large-scale lockdowns and cessation of much economic activity wherever COVID-19 infections occurred.

- **Supply chains become strained**. The continuing waves of infections led to frequent slowdowns and interruptions in the production of goods globally. The result was shortages of intermediate and manufactured goods. Furthermore, changing demand affected purchasing decisions that resulted in longer-term effects on certain sectors. For example, the cessation of motor vehicle production early in the pandemic resulted in microchip production shifting towards other applications, thereby taking away capacity to produce microchips for motor vehicles when production resumed. As a result, vehicle manufacturers endured a sustained shortage of chips.

- **E-Commerce surges.** With high concerns about infections and the cessation of retail sales in many categories during the lock-down phase of the pandemic, sales of consumer as well as business-to-business goods shifted to e-commerce platforms. Whereas e-commerce represented approximately 12 percent of all retail sales nationally in Q4 2019, by the end of 2020 they stood at 15 percent, a 25 percent increase. The net effect was substantial growth across the entire e-commerce supply and logistics chain, from escalating demand for ocean container shipping (2021 was a record year for ocean rates), trucking and rail, warehousing, and local delivery. The impacts in warehousing were particularly notable, with Massachusetts gaining 18 new warehouses and 1.8 million square feet by the end of 2020.

- **Freight transportation struggles.** Large swings in the demand for goods resulting from the pandemic caused large spikes demand for transportation, which in turn resulted in high shipping rates, congestion at terminals, equipment and labor shortages, and slow transit times across the modes and geographies, including in Massachusetts. In turn, the combination of unreliability in the supply and logistics chains and elevated demand caused over-ordering, thereby worsening operational performance and increasing demands on labor, equipment, and warehousing.

- **Longstanding shortages in the freight and logistics workforce are exacerbated.** Since the onset of COVID-19, persistent labor and workforce challenges have impacted nearly every sector. This put pressure on many industries, including manufacturing and transportation/logistics, and forced both shippers and carriers

to quickly adapt to massive shifts in demand. The transportation sector was particularly hard-hit – the collapse in demand at the start of the pandemic led to mass layoffs and retirements; then, when demand recovered, the combination of an aging workforce, unfavorable working conditions and pay, and continuing waves of infections complicated recovery efforts and exacerbated a labor shortage that had preceded the pandemic.

The Post-Pandemic Era

With the presence of COVID-19 being largely accepted by societies and the availability of effective mitigation measures through vaccines and treatments, the pandemic and its direct impacts were largely in the past by mid-2022. Nevertheless, its effects will linger for years, simply due to the continuing high levels of infection rates and lasting health impacts. Meanwhile, macroeconomic and geopolitical factors continue to evolve rapidly. In 2022, tensions between Russia and Ukraine culminated in the Russian invasion in February. The invasion had particularly strong impacts on the energy sector, leading to fears of an energy crisis in Europe, which relied heavily on Russian natural gas. A shortage has not occurred and, since then, global energy prices have moderated to pre-invasion levels. In late 2022, China reversed its "zero Covid" policy of lockdowns to contain the pandemic and embarked on a rapid reopening.

During 2022, the combination of surplus wealth from the economic impact payments and household savings increased demand for goods and services, which, along with continued supply chain challenges, resulted in a run-up in prices. By June 2022, inflation hit a 40-year high of 9.1 percent in the U.S., driven by the increased cost of food, housing, energy, and transportation. When compared to the Northeast and the U.S. city average, inflation in the Boston-Cambridge-Newton metro area was highest for household energy and lowest for transportation, and food.[35] In January 2023, the International Monetary Fund reported that the weakening of the U.S. dollar was providing relief to emerging markets, and suggested that a global recession would likely be avoided; growth in global output is projected to slow to 2.9 percent in 2023 from 3.4 percent the previous year, before rebounding to 3.1 percent in 2024. Inflation is expected to decline to 6.6 percent in 2023 (down from 8.8 percent in 2022), and then to fall to 4.3 percent in 2024.[36]

The COVID-19 pandemic had other impacts on intermodal shipping, freight-related industries, e-commerce, supply chain resiliency, technology, and automation, which are described in the following subsections.

Intermodal Shipping

Intermodal shipping logistics are complex due to multiple entities that ship goods to and from different facilities. These entities include ocean carriers, port operators, chassis suppliers, brokers, truckers, warehouse operators, retailers, manufacturers, and railroads. Cooperation between these entities is crucial, given their interdependence to ensure successful shipping of goods; if there is a bottleneck anywhere in the system, the impacts ripple across the supply chain. The following subsections highlight developments in three core components of intermodal shipping: freight rail, ocean container movement, and trucking.

[35] U.S. Bureau of Labor Statistics, Consumer Price Index for All Urban Consumers.
[36] https://www.nytimes.com/2023/01/30/business/economy/imf-world-economic-outlook.html.

Freight Rail

According to the FHWA's Freight Analysis Framework 5 (FAF5), freight rail carriers transport approximately 28 percent of freight in the U.S. on a tonnage basis, after trucking (40 percent), but just 5 percent of total freight is moved by rail in the Commonwealth, with 3.5 million tons originating from Massachusetts in 2019.

Since the onset of COVID-19, there have been persistent labor and workforce challenges impacting nearly every sector. This has put pressure on many industries, particularly manufacturing and transportation/logistics, and forced both shippers and carriers to pivot their operators in order to move essential freight. In the freight rail industry, this has led to operational challenges for both shippers and carriers, and, for some businesses, moving less freight on the freight rail network and more on the freight highway network; in 2022 total carloads were down overall compared to 2021 for all but four commodities – coal, farm products (excluding grain and food), motor vehicles and parts, and nonmetallic minerals.[37]

However, regulators have found that the labor challenges for Class I carriers were years in the making, as most carriers had significantly reduced the size of their operational workforce before the pandemic, making it difficult to provide adequate service to customers in response to fluctuations in demand and service interruptions. For shippers, inconsistent and unreliable freight rail service meant tight car supply and unfilled car orders, delays in transportation for carload and bulk traffic, less frequent service, increased dwell times at various locations, missed switches, and ineffective customer assistance.

Most Class I carriers[38] have implemented Precision Scheduled Railroading (PSR) to streamline and simplify operations, and better match demand with capital assets. Key changes include operating fewer and longer line-haul trains, minimizing enroute switching, and simplified routing networks. The net result has been a substantial increase in profitability. It also has resulted in major reductions in the railroad workforce, which came to be a major challenge during the pandemic. The adoption of PSR has raised questions about the longer-term prospects of the industry, and its willingness to adapt to changing market conditions and pursuit of new business. It will be critical for the industry as a whole to confront and rectify these issues in order to provide competitive service for customers, and to reverse the trend of declining traffic volumes and overall market share.[39]

In December 2022, rail workers were on the verge of a nationwide strike, but Congressional intervention through the 1926 Railway Labor Act required workers to continue operations. The narrowly missed labor strike highlighted key workforce issues, such as the lack of sick leave and tight work scheduling, and four of eight rail labor unions

[37] Association of American Railroads. https://www.aar.org/wp-content/uploads/2023/01/2023-01-04-railtraffic.pdf.
[38] Currently, PSR is in use by the following Class I railroads: Canadian National (adoption of PSR in 1998), Canadian Pacific (adoption of PSR in 2012), CSX (adoption of PSR in 2017), Kansas City Southern (adoption of PSR in 2018), Norfolk Southern (adoption of PSR in 2018), and Union Pacific (adoption of PSR in 2018).
[39] Oliver Wyman, The Great Pivot: Can North American Rail Become a Customer-Centric Growth Industry? https://www.oliverwyman.com/content/dam/oliver-wyman/v2/events/2022/mar/Rail-Finance-2022-Bailey-Speech-Final.pdf

opposed the most recent deal before Congress intervened. These issues persist for workers, which reflects the fragility of labor within rail shipping.[40]

Still, freight rail has shown some signs of growing its labor pool, with the rate of hiring in November 2022 up 4.4 percent compared to November 2021 and up 0.6 percent compared to October 2022.[41] Even though the potential for a nationwide strike was avoided, continued dissatisfaction of rail labor could result in disputes, followed by service disruptions. Whereas the comparatively high pay for railroad jobs once isolated railroads from the longstanding labor shortages facing other transportation sectors, that is no longer the case as working conditions have deteriorated and differences in pay are less large.

Ocean Container Movement

One of the most visible impacts of the COVID-19 supply chain challenges was the backlog of containers at U.S. deepwater ports. Once manufacturers were able to catch up to demand after lockdowns eased, U.S. coastal ports were swiftly overwhelmed by too many container ships, leading to long wait times, container shortages, and rising shipping prices. Even after containers were unloaded, many sat for weeks unclaimed because of shortages of both equipment and drivers needed to transport containerized cargo to warehouses.

Maritime freight costs increased significantly during the pandemic. The Freightos Baltic Index (FBX), a daily freight container index that measures global container freight rates by calculating container spot rates on 12 global tradelines (Figure 4.2), indicated the price to ship a container from China to the East Coast increased by 86 percent between January and December 2020, while on the West Coast container prices for shipments from China increased nearly 180 percent during the same period. The global average price for shipping containers peaked in September 2021 at $10,996 and has since fallen. As of early January 2023, containers cost on average $2,168.

The Port of Boston's Conley Terminal is the only full-service container terminal in New England, supporting 66,000 jobs and generating $8.2 billion in economic impact annually. In January 2022, the Massachusetts Port Authority (Massport) announced the completion of critical infrastructure investments as part of a nearly $850 million plan to modernize the Port of Boston by deepening the harbor to 47 feet and expanding the turning basin to 1,725 feet, adding three new ship-to-shore cranes, and the construction of two 50-foot berths, expanded reefer storage, and new in-and-out gate facilities. In addition, a $75 million Freight Haul Road was opened in 2018 for the trucking community to conveniently access the interstate highways. These investments increased capacity to offer direct connectivity to China, Northern Europe, Vietnam, and India.[42]

[40] Key Freight Rail Union Rejects Deal, Increasing Strike Risk. New York Times. November 21, 2022. https://www.nytimes.com/2022/11/21/business/economy/freight-rail-union-contract.html?searchResultPosition=2.
[41] Surface Transportation Board. https://www.stb.gov/reports-data/economic-data/employment-data/.
[42] https://www.massport.com/massport/media/newsroom/massport-thanks-multiple-partners-celebrates-completion-of-major-port-improvements/.

FIGURE 4.2 FREIGHTOS BALTIC INDEX (FBX) GLOBAL CONTAINER INDEX, 2017 – 2023

Source: Freightos Baltic Index (FBX): Global Container Freight Index. Note: The index does not include bulk shipping rates.

Trucking

The economic challenges that surfaced with COVID-19 have continued to impact industries and markets. Because nearly every good consumed in the U.S. is moved by truck at some point in its supply chain, the trucking industry is impacted by current events, macroeconomic forces, and other industry-specific challenges, including those of other freight modes.

Truck driver attraction and retention has been an issue for the trucking industry for many years. In the past, it has been referred to as a shortage of drivers, but the issue is more related to the challenges of attracting and retaining drivers in the field, as there are many aspects of truck driver training, licensing, and other resources that could be greatly improved to help increase driver attraction and retention. The industry has struggled with early retirement of seasoned drivers and retention of new drivers. According to the American Trucking Association, driver turnover at large truckload fleets was 92 percent at the end of 2020.[43]

Truck drivers are required to comply with Federal hours of service (HOS) requirements, which are designed to increase safety on the roadways and prevent truck drivers from driving while fatigued. As a result, drivers need designated parking for staging, breaks, emergencies, rest and time off, as regulated by the Federal Motor Carrier Safety Administration. Truck parking can be challenging for drivers to locate while they are on the road. Beyond HOS, many other factors influence when and where a driver decides to park, including strict delivery windows, congested roadways, and fines/penalties for missing a pick-up or delivery, among others.

[43] American Trucking Association. "Turnover Remained Unchanged at Large Truckload Fleets in Fourth Quarter." Press Release. March 29, 2021.

Another challenging aspect of the truck driver work environment is that many truck drivers are using their available HOS waiting at customer facilities to drop off or pick up loads, looking for available truck parking, trying to find customer facilities, and roadway congestion while enroute. At shipper facilities, truck drivers are often forced to wait several hours a day to load/unload freight and struggle to maximize their available time spent driving. Securing available truck parking is also a significant challenge. Beyond designated truck parking facilities, many drivers do not have access to basic amenities like bathrooms or food vending at customer facilities.

Beyond the trucking industry, increased demand for labor in sectors such as manufacturing, warehousing, shipping, and delivery has placed pressure on ensuring the Commonwealth has the necessary talent to efficiently move goods throughout the state. Worker pay is one factor that influences the availability and stability of the labor pool for freight-intensive sectors. However, for many low-income and entry-level workers, there are significant barriers to employment that hinder the ability to access and maintain employment, particularly in rural areas. These barriers to employment represent a variety of socioeconomic and geographic factors that incur costs or present logistical challenges for job seekers, including:[44]

- **Workforce readiness** enables employees to be workforce-ready, even at entry-level positions, through training and certification programs. This also includes any barriers associated with obtaining a commercial driver's license in Massachusetts.

- For workers with children, **childcare** can be challenging to secure for lower-income households. Many struggle to earn the money necessary for childcare so that they can leave the home to go to work, and require access to childcare facilities that are affordable, close to their home and workplace, and offer services at times that align with their workday.

- **Transportation** is the most significant barrier to accessing employment. Warehousing and manufacturing jobs are often located in areas far away from other land uses, meaning longer commute times and higher fares. In addition, low-income workers are less likely to have access to a vehicle and will spend a higher share of their income on transportation than higher-income households. While public transit can benefit low-income workers, it can be difficult to serve lower-density areas and geographically dispersed facilities.

- **Affordable housing** has been challenging to obtain in recent years due to significant increases in housing costs across the country. In addition, housing costs are not distributed evenly across the state and some rural areas struggle to meet demand. Many lower-income households can be cost-burdened by housing prices.

[44] https://www.modot.org/sites/default/files/documents/2022-06-30%20FINAL%20Supply%20Chain%20Task%20Force%20Report.pdf.

E-Commerce

E-commerce has grown rapidly and significantly over the past decade, and even more so during the pandemic when consumer demand for e-commerce replaced trips to brick-and-mortar retail locations. E-commerce grew three times faster than the retail sector between 2010 and 2020. These changes, combined with the rise of immediate or same-day deliveries, has decreased average truck trip lengths by 37 percent but increased the number of truck trips overall, particularly in urban areas. Deliveries are now often directed to consumers directly rather than to retail stores (which would otherwise receive multiple items at once) leading to increased truck vehicle miles traveled (VMT) as demand rises.[45] Additionally, as e-commerce has sharply risen during the pandemic, so have customer returns, which accounted for 18 percent of sales in 2022 – $816 billion, up from 17 percent of sales or $761 billion.[46] Retailers and shippers are looking for ways to reduce the cost of "reverse logistics" returns while meeting customers' needs.

SINCE 2010, NEARLY 8,000 WAREHOUSES AND DISTRIBUTION CENTERS HAVE BEEN BUILT IN MASSACHUSETTS.

SOURCE: BUREAU OF GEOGRAPHIC INFORMATION, MASSGIS.

The last leg of delivery – often referred to as the "last mile" or "final 50 feet" – is increasingly dominated by growth in e-commerce, with rapid changes creating significant issues for ground logistics and the built environment that demand a creative response by public and private sectors. Congestion and the lack of well-managed short-stay curb parking are major operational impediments in urban areas. Concerns abound about the local quality-of-life and economic vitality impacts of the noise pollution, carbon emissions, and congestion that result from increased commercial delivery trips.[47] Curb space policies, which traditionally have been focused on private vehicle storage, are commonly insufficient to address growing demand for commercial uses at the curb.[48] Where curb space is unavailable, trucks may be more likely to stop in travel lanes, block bike lanes, or otherwise obstruct streets rather than relocate to where nearby curb space is available; this contributes to congestion that further impacts efficient last-mile delivery.

THE LAST 50 FEET OF COMMERCIAL DELIVERY ACCOUNTS FOR ABOUT 25-50% OF TOTAL TRANSPORTATION SUPPLY CHAIN COST.

SOURCE: URBAN FREIGHT LAB, UNIVERSITY OF WASHINGTON

The size of delivery vehicles also contributes to issues beyond congestion, including degradation to streets and the surrounding landscape and concerns over the safety of other road users. Large vehicles can obstruct visibility, making it harder for other drivers to see people walking and bicycling, and collision severity is correlated with increasing vehicle mass. Some cities have favored widening street widths and turning radii to meet the needs of ever-larger freight and utility vehicles, including on municipal services fleets, rather than pushing for vehicles to be sized appropriately for a human-scaled environment. The potential safety impacts of these choices suggest the need for policies and design approaches to reduce vehicle size and improve street design.[49]

[45] 2040 Freight: Portland Freight Plan: Dominant and Disruptive Trends (Report).
[46] National Retail Federation. 2022 Consumer Returns in the Retail Industry.
[47] 2040Freight: Portland Freight Plan. https://www.portland.gov/transportation/planning/2040freight.
[48] Hidden and in Plain Sight: Impacts of E-Commerce in Massachusetts (MPAC).
[49] Ibid.

Retailers and delivery operators are piloting solutions to address some of these challenges. Package sorting is being optimized in dense urban areas, sometimes occurring in unused or underutilized street front retail spaces, which can be adapted for last-mile use.[50] Crowdsourcing of delivery is a longstanding practice in food and document delivery, and freight delivery companies could use this approach to reduce dwell time between deliveries. As last-mile courier vehicle sizes decrease, advances in autonomous vehicle, drone, and robot technology suggest that further reduction of commercial delivery vehicle impacts may be possible, though concerns about equity, data privacy, and built environment impacts remain unresolved.

Meanwhile, states and cities are leading with policy changes to reduce the impacts of end-phase commercial delivery, especially in urban environments. Curbside managements studies can help assess how curb space is used and to establish management frameworks that optimize multimodal use.[51] Seattle, Toronto, San Francisco, and Washington are all using policies such as dedicated delivery zones, dynamic pricing, and rigorous enforcement to reduce traffic congestion and manage curb zones.[52] The City of New York, through its "Off-Hours Delivery Program," is exploring fee-based incentives to help shift operators and consumers toward more sustainable delivery choices.[53]

Technology and Automation

Technology and automation are advancing all aspects of the supply chain as their increased usage is global and across sectors. As automation is advancing warehousing and distribution, technology continues to grow the capabilities of connected and autonomous vehicles (CAV). The movement of both commodities and finished products is evolving at a fast pace.

Advanced Manufacturing

Artificial intelligence and robotics are playing an increasingly crucial role in fulfillment and distribution centers. This growth in technology and automation adoption could require a substantial degree of workforce reskilling. It is estimated that up to 400,000 Massachusetts workers will need to be re-skilled for new types of employment by 2030.[54]

Recent developments include substantial state investment in the manufacturing industry, which may lead to job and production growth in this sector in the Commonwealth. In March 2022, then Governor Charlie Baker announced $2.8 million in infrastructure grants through the Massachusetts Manufacturing Innovation Initiative (M2I2).[55] Grants were awarded to 99Degrees Custom, manufacturer of tech-integrated apparel in Lawrence, Soliyarn, a maker of smart textiles based in Belmont, and Human Systems Integration (H.S.I.), a wearable technology company headquartered in Walpole. In addition, Mount Wachusett Community College in Gardner, along with three Central Massachusetts vocational schools and the nonprofit Massachusetts Manufacturing

[50] 2040Freight: Portland Freight Plan: Dominant and Disruptive Trends.
[51] Minneapolis curbside management study, https://tooledesign.com/project/minneapolis-curbside-management-study/.
[52] Hidden and in Plain Sight: Impacts of E-Commerce in Massachusetts (MPAC).
[53] Blueprint for Autonomous Urbanism, https://nacto.org/publication/bau2/urban-freight/.
[54] https://www.mma.org/resource/preparing-for-the-future-of-work-in-the-commonwealth-of-massachusetts/.
[55] https://masstech.org/news/baker-polito-administration-awards-28-million-mass-manufacturing-innovation-initiative.

Extension Partnership in Auburn, received $1.57 million in funding for workforce development programs, which partner with local businesses.

Warehousing and Distribution

The warehousing and distribution industry has experienced labor shortages, with robotics and artificial intelligence taking up a growing proportion of tasks. The post-peak-pandemic environment has seen low-wage workers seek education and higher-paying jobs, creating a shortage of employees for positions at fulfillment centers. Robotics, artificial intelligence, and other automation tools introduced pre-pandemic may ameliorate these labor shortages and address the challenges of warehouses, the growth in complexity in stock keeping unit (SKU), and increasing service expectations.

There are early signs of a slowdown in warehouse demand. The average warehouse vacancy rate nationally was 3.2 percent in the third quarter of 2022, up from 3 percent in the previous quarter, although well below the 5 percent average vacancy rate in 2020. In 2021, warehouse rents in the Boston-area market increased 42 percent over the previous two years to an average of just over $12 per square foot. In August 2022, Amazon announced closure of five of its Massachusetts delivery facilities – Milford, Dedham, Everett, Mansfield, and Randolph – as part of a plan to consolidate operations at other newer facilities.[56] Further consolidation may continue to impact industrial land use patterns across the Commonwealth.

Connected and Autonomous Vehicles

Adoption of connected and autonomous vehicles (CAV) – systems that either assist the driver while operating a vehicle or control the vehicle outright – is already impacting the trucking industry. Truck platooning, the practice of having multiple trucks navigated by one truck in a single-file formation, is past the piloting stage in some states, like Texas. Autonomous trucks offer an opportunity for lower emissions and increased safety. Although companies are continuing to innovate, substantial technological hurdles, along with institutional and policy challenges have limited CAV deployment, and which are expected to continue for some time. As of early 2023, 42 states have enacted laws regulating the use of autonomous vehicles on public roads. The Commonwealth's Executive Order 572 (2016) established the Autonomous Vehicles Working Group and created a process for MassDOT to allow testing of CAVs on public roads.[57] Since 2021, five autonomous vehicle-related bills were drafted but failed to pass the legislature.[58]

Due to regulatory obstacles, drone delivery for freight purposes has not advanced sufficiently enough to compete with other freight modes. The allowable use of drones has continued to evolve, with night operations allowed as of April 2021[59] and allowing for drones under 0.55 pounds to fly over people and moving vehicles. While these changes advance drone delivery services, additional action may be undertaken by the Federal

[56] https://www.telegram.com/story/news/2022/08/23/amazon-continues-work-worcester-despite-closures-milford-everett/7873431001/.
[57] https://www.mass.gov/self-driving-systems-in-massachusetts.
[58] https://www.ncsl.org/transportation/autonomous-vehicles-state-bill-tracking-database.
[59] Code of Federal Regulations. Title 14, Chapter I, Subchapter F, Part 107—Small Unmanned Aircraft Systems. https://www.ecfr.gov/current/title-14/chapter-I/subchapter-F/part-107.

Aviation Administration (FAA) to expand regulations and permit more diverse operations. In coordination with federal and industry partners, Massachusetts is working to establish technology and regulation enabling the delivery of emergency medical supplies to both hospitals and remote areas. While regulations and payload size limit the deployment of drones more widely for freight purposes, Massachusetts is leading efforts to enhance drone capabilities that improve transportation in the Commonwealth and the nation.

Other automated technologies have been developed and recently implemented in the marine transportation sector. In February 2022, the Yara Birkeland was the world's first fully electric and completely autonomous cargo ship to complete its voyage, traveling along the Norwegian coast. As of 2020, Boston-based company Sea Machines had installed its autonomous systems on more than 50 vessels, including tug-pushed oil barges along the East and Gulf coasts, small workboats, and oil-drilling support and supply boats.[60] As these technologies are adopted, Massachusetts ports may need to adapt to the needs of shippers and carriers.

Supply Chain Redundancy and Resilience

Stockpiling versus Just-In-Time Delivery

Before the pandemic, companies focused on efficiency and reduced costs at the expense of building sufficient redundancy and flexibility in their supply chains. Just-in-time sourcing, for example, led to reduced inventory costs but also yielded insufficient inventory buffers. At the pandemic's peak, companies with insufficient redundancy and contractual obligations faced supplier delays because of labor shortages or insufficient resources.[61] President Biden signed Executive Order 14017 on February 24, 2021, to assess critical supply chain vulnerabilities and strengthen resiliency in response to the supply chain crisis. Some areas of supply chain vulnerability examined by the administration include vaccine manufacturing, semiconductor chips, large-capacity batteries, critical minerals, cyber security, pharmaceuticals, and active pharmaceutical ingredients.[62]

Supply Chain Thefts and Fraud

Supply chain thefts and frauds expose vulnerabilities due to companies' geographic reach, operational complexity, and/or volume of daily transactions. Types of fraud may include kickbacks on raw materials purchase, free trade zone fraud, intellectual property theft, inventory fraud, and fake business listings.[63] The peak of the pandemic saw an increase in supply chain fraud due to these conditions, which resulted in higher prices and opportunities to counterfeit products. Growth in online sales also created opportunities for hackers to impersonate and steal customer data. CargoNet, a cargo security membership program, reported 1,778 supply chain risk events in the U.S. and Canada in 2022 totaling $223 million in losses, which was 15 percent more than were reported in 2021. The most common stolen goods included household items such as appliances and

[60] https://www.wired.com/story/mayflower-autonomous-ships/.
[61] Real-World Supply Chain Resilience 2021. *BSG*. July 29.
[62] The White House Briefing Room. 2021.Fact Sheet: Biden-Harris Administration Announces Supply Chain Disruptions Task Force to Address Short-Term Supply Chain Discontinuities. June 8.
[63] Supply chain fraud—a holistic approach to prevention, detection, and response. *KPMG*. 2017.

furniture, which often get targeted during long-haul and last-mile distribution, with thefts at warehouses, distribution centers, and parking lots being the most common locations.[64]

Cyber Attacks

Connected and automated vehicles (CAV) are a potentially effective method for addressing truck driver shortages, especially for long-haul transport and last-mile delivery needs. However, the opportunities of CAVs and smart infrastructure bring increased consequences in the event of a cyberattack. Freight systems that depend on digital coordination to function could halt if hackers hold those computers hostage. Businesses, institutions, counties, municipalities, and non-governmental organizations all have a stake in emergency preparedness planning for what would happen in the case of a sophisticated cyberattack. This vulnerability exists statewide, suggesting a compelling motivation for a highly collaborative approach to resilience planning. Redundancies in the system, walls of separation for critical functions, and designing "graceful exits" in software (a concept where software that is disabled fails in a way to minimize disruption) are all opportunities for preventative measures.

MassDOT's "Strategic Planning for CAVs in Massachusetts" study (2018) identified investing in data analytics and cybersecurity for the large stream of data that will be generated by CAVs as one of the key strategies for the future.[65] In December 2022, Governor Baker signed an executive order to establish the Massachusetts Cyber Incident Response Team, which will enhance the Commonwealth's ability to prepare for, respond to, mitigate against, and recover from significant cybersecurity threats, which threaten the continuity of essential government services.

Employee Access to Freight Jobsites

Supporting continued growth in Massachusetts' freight economy will require employers to be able to attract and retain workers to freight-related jobs, including in production and nonsupervisory positions. For lower-wage workers, convenient and affordable access to jobsites can be a determining factor in their employment decisions.

Freight workers are less likely to work in places and during times that are well-served by transit. Many freight warehouse employees work on shift schedules that do not readily align with transit services, which are often designed around the morning-and-evening commutes of office workers. Transit routes continue to be designed for commutes to and from a downtown office core, rather than the more peripheral locations of many industrial parks and freight facilities.

This fundamental land use and transportation mismatch is being exacerbated by continued and accelerating redevelopment of industrial land in urban and suburban locations. Population growth, particularly in urban core locations, has underscored longstanding housing shortages in cities in Massachusetts and across North America. Centrally located industrial sites are often targeted for rezoning and redevelopment for housing and commercial uses. While industrially-zoned land in urban cores becomes more scarce, new industrial zones are rising far from the core where land for larger warehouse and logistics facilities is available and inexpensive but where transit

[64] https://www.cargonet.com/news-and-events/cargonet-in-the-media/2022-theft-trends/.
[65] https://www.mass.gov/doc/strategic-planning-for-connected-and-automated-vehicles-in-massachusetts/download.

service is limited or non-existent and where the walking and bicycling environment is more likely to feel inconvenient or unsafe.

Automation and rising flexibility in work location and schedules are impacting sectors across the economy. Automation may shift the nature of some freight-related jobs from warehousing and logistics toward final-phase delivery as vehicle automation lags behind facility automation. Remote work and flexible work schedules, on the other hand, are unlikely to apply to essential workers in freight industries where work is physical and operates on a carefully managed round-the-clock schedule.

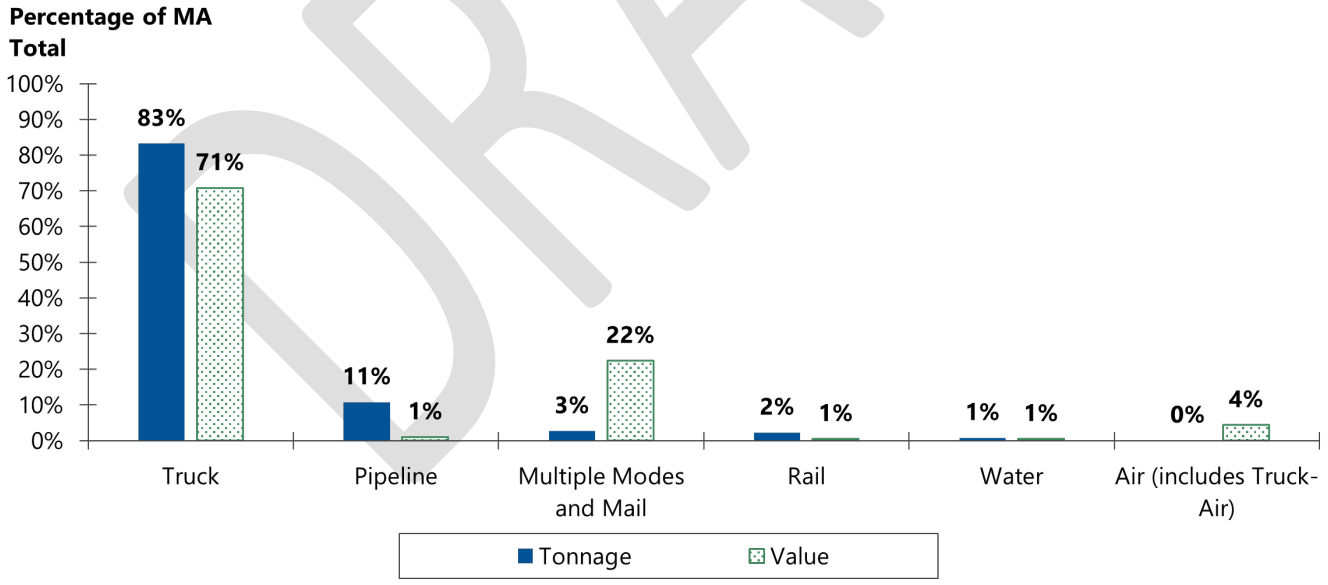
The rise of urban freight operations, however, may open up new opportunities for warehouse workers in the urban core. The trend in some cities toward smaller delivery and service vehicles, and the decreasing average size of shipments in response to on-demand delivery, may present work opportunities for freight workers displaced by automation. The rise in urban warehousing and micro-warehouses, as logistics hubs move closer to final delivery locations, may also shift commutes back toward urban-core locations that are better served by transit, walking, and cycling.

5 FREIGHT ASSETS, DEMAND, AND NEEDS

In order to transport the wide variety of goods, products, and materials used in everyday life, freight, and the methods used to move it, takes many forms. Delivery of new clothing to a regional department store; shipments of fish processed in New Bedford bound for Asia; inbound shipments of lumber and stone for a construction project; and time-sensitive delivery of medical supplies at a local hospital; these are just a few examples of the freight moves each day in Massachusetts.

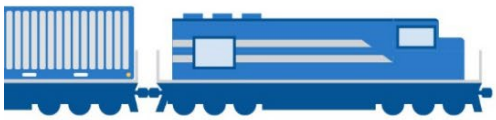
In 2017, the multimodal freight system transported 253 million tons of goods valued at nearly $502 billion to, from, and within Massachusetts, which is expected to approach 351 million tons valued at $888 billion by 2045. The interconnected system of highways, railroads, maritime ports, pipelines, and airports work together to support the supply chains discussed in Chapter 4, in serving the needs of the Commonwealth's residents and industry. Mode selection is dependent on a variety of factors including commodity characteristics, cost-effectiveness, shipment size, and travel time. Modal share on the Massachusetts freight network is illustrated in Figure 5.1, with additional detail in Figure 5.2. The Multiple Modes & Mail category primarily represents rail intermodal traffic, although it also includes other modes including water and air, as well as highway.

FIGURE 5.1 MODAL SHARE ON THE MASSACHUSETTS FREIGHT NETWORK, 2017



Source: FHWA Freight Analysis Framework, Version 5.4.

FIGURE 5.2 CURRENT AND FUTURE FREIGHT FLOWS BY MODE IN MASSACHUSETTS



FREIGHT RAIL

12.9 MILLION TONS VALUED AT $117 BILLION IN 2017,
PROJECTED TO GROW TO 21.6 MILLION TONS
VALUED AT $234.1 BILLION BY 2045

Top Commodities by Weight, 2017		Top Commodities by Value, 2017	
Waste and Scrap	1.9 M	Pharmaceutical Products	$22.4 B
Other Prepared Foodstuffs	1.2 M	Textiles	$17.5 B
Pulp, Newsprint, Paper, and Paperboard	0.9 M	Electronics	$16.6 B

HIGHWAY

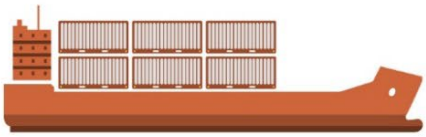
211.3 MILLION TONS VALUED AT $359 BILLION,
PROJECTED TO GROW TO 288.8 MILLION TONS
VALUED AT $608.3 BILLION BY 2045

Top Commodities by Weight, 2017		Top Commodities by Value, 2017	
Gasoline, Aviation Turbine Fuel, and Ethanol	34.8 M	Mixed Freight	$50.2 B
Gravel and Crushed Stone	27.4 M	Pharmaceutical Products	$27.5 B
Non-Metallic Mineral Products	21.9 M	Electronics	$26.5 B

AIR CARGO

142,000 TONS VALUED AT $20.8 BILLION,
PROJECTED TO GROW TO 259,000 TONS
VALUED AT $36.9 BILLION BY 2045

Top Commodities by Weight, 2017		Top Commodities by Value, 2017	
Electronics	0.03 M	Electronics	$7.8 B
Precision Instruments	0.02 M	Precision Instruments	$5.1 B
Meat, Poultry, Fish & Seafood	0.02 M	Pharmaceutical Products	$3.4 B



PORTS & WATERWAYS

180,000 TONS VALUED AT $45 MILLION,
PROJECTED TO DECREASE TO 101,000 TONS
VALUED AT $30 MILLION BY 2045

Top Commodities by Weight, 2017		Top Commodities by Value, 2017	
Other Coal and Petroleum Products	0.1 M	Gasoline	$25 M
Gasoline, Aviation Turbine Fuel, and Ethanol	0.06 M	Mixed Freight	$21 M

Source: FHWA Freight Analysis Framework, Version 5.4.

Road Infrastructure

Roadways are by far the most used infrastructure for transporting goods of all types and over distances ranging from cross-country long-hauls to first- and last-mile deliveries.

Road Infrastructure | Inventory

MassDOT operates nearly 3,000 centerline miles of highways and over 36,000 miles of roadway infrastructure are operated by MassDOT and its partners.[66] Several freight-related designations have been applied to these roads. These designations are significant because they allow National Highway Freight Program funding to be used on these corridors:

- Nearly 800 miles of highways in Massachusetts are on the **National Highway Freight Network (NHFN)**, the system designated by the U.S. Department of Transportation (USDOT) to strategically direct Federal resources toward the improvement of freight movement.[67]
- Approximately 210 miles are designated as **Critical Rural Freight Corridors (CRFC) and Critical Urban Freight Corridors (CUFC)**. IIJA increased the number of miles MassDOT can designate to a maximum of 300 CRFC miles and 150 CUFC miles.
- FHWA and the Department of Defense (DoD) have also identified nearly 600 miles of highways that are important to military transportation on the **Strategic Highway Network (STRAHNET)** as primary links or connectors. While most of this mileage is comprised of urban interstates, urban and rural infrastructure contribute to national security and emergency preparedness.

The mileage on designated systems in Massachusetts as of 2023 is provided in Table 5.1. A map of the NHFN, CRFCs, and CUFCs in Massachusetts is provided in Figure 5.3, and the STRAHNET and connectors is shown in Figure 5.4. In the Commonwealth, the STRAHNET is primarily comprised of interstate highways, except for the designation of MA-28 north to MA-25 and MA 25 west to I-495 as a STRAHNET connector to Camp Edwards near Hyannis.

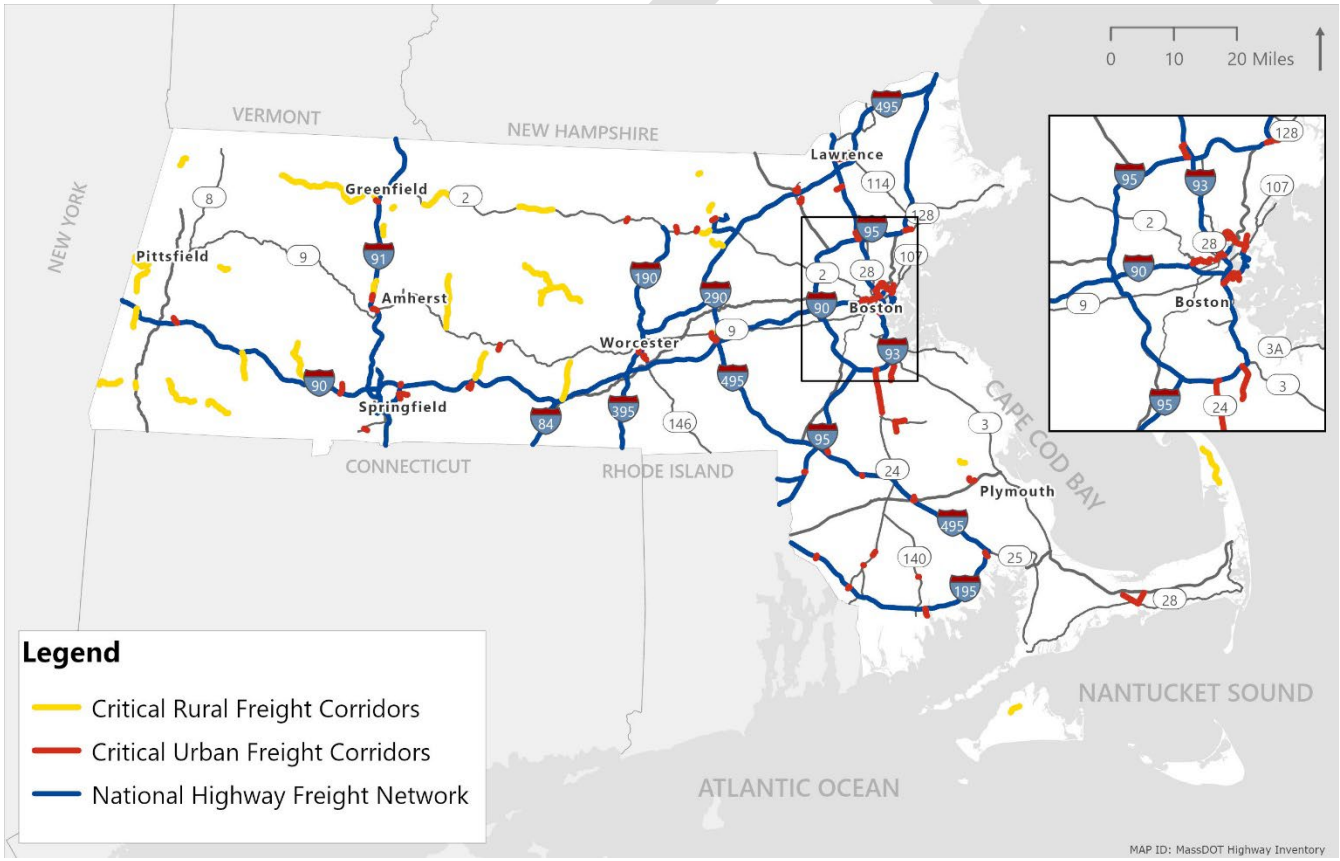
[66] 2020 Massachusetts Road Inventory Year End Report, 2021, Massachusetts Department of Transportation, https://www.mass.gov/doc/2020-road-inventory-year-end-report/download.
[67] FHWA, Table of National Highway Freight Network Mileages by State, https://ops.fhwa.dot.gov/Freight/infrastructure/nfn/maps/nhfn_mileage_states.htm.

TABLE 5.1 CENTERLINE MILEAGE UNDER FREIGHT DESIGNATIONS IN MASSACHUSETTS

Network	Centerline Mileage
National Highway System	3,343.68
Interstates	567.89
National Highway Freight Network	794.65
Critical Urban Freight Corridors	74.40
Critical Rural Freight Corridors	133.42
Strategic Highway Network	595.50

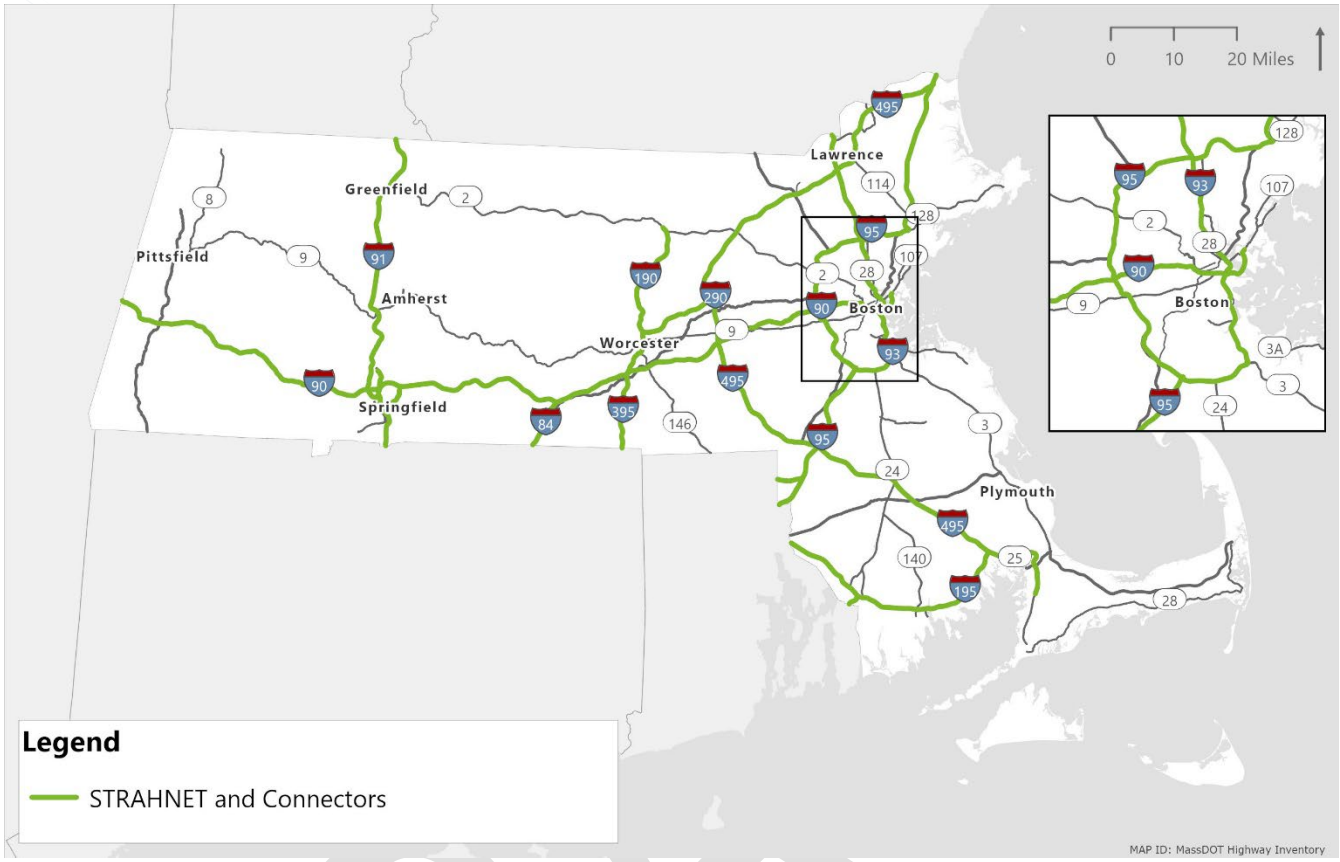
Source: MassDOT, FHWA.

FIGURE 5.3 ROADWAY INFRASTRUCTURE FREIGHT DESIGNATIONS IN MASSACHUSETTS, 2023



Source: FHWA.

FIGURE 5.4 STRAHNET HIGHWAY NETWORK AND CONNECTORS

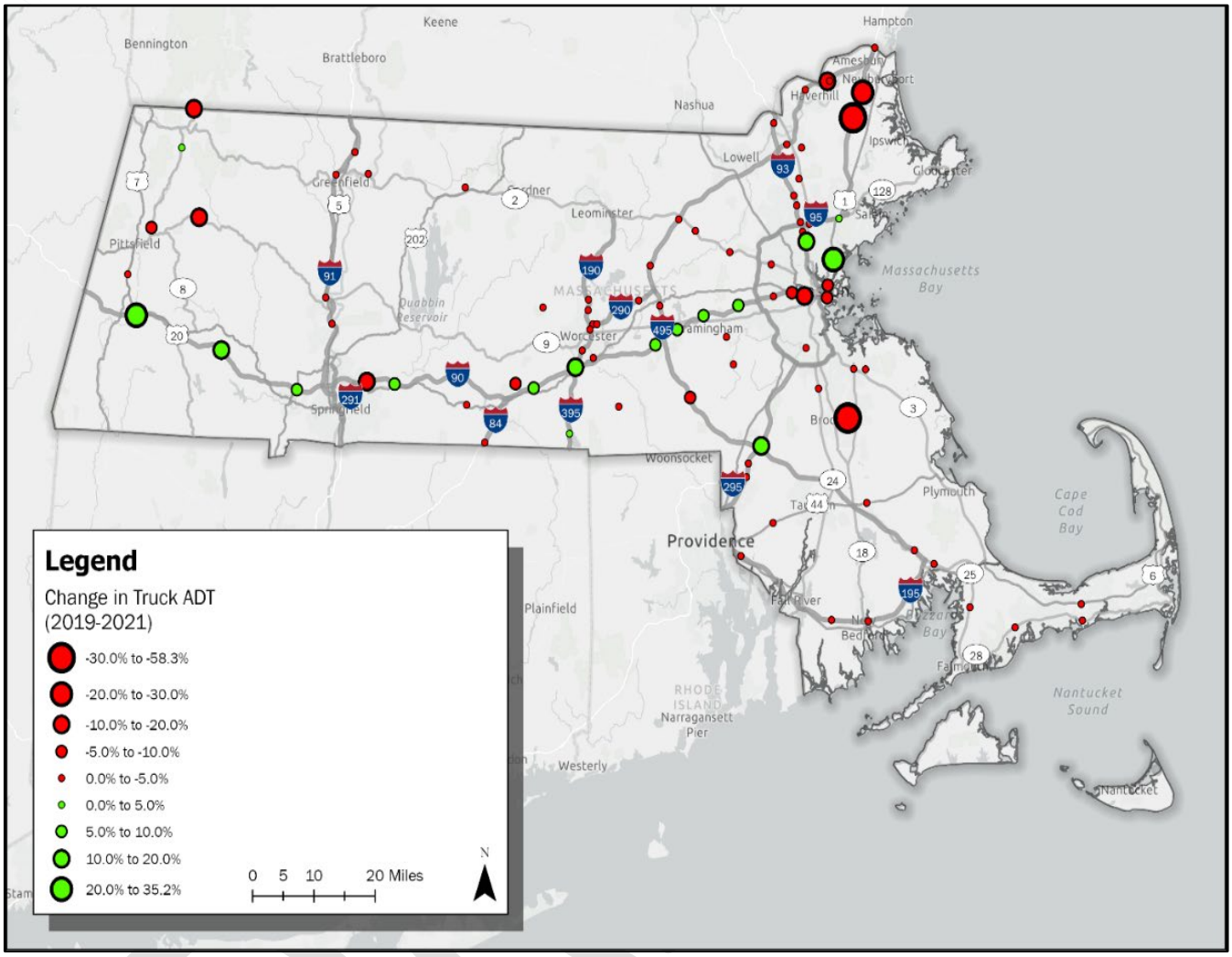


Source: U.S. Department of Defense.

Road Infrastructure | Demand

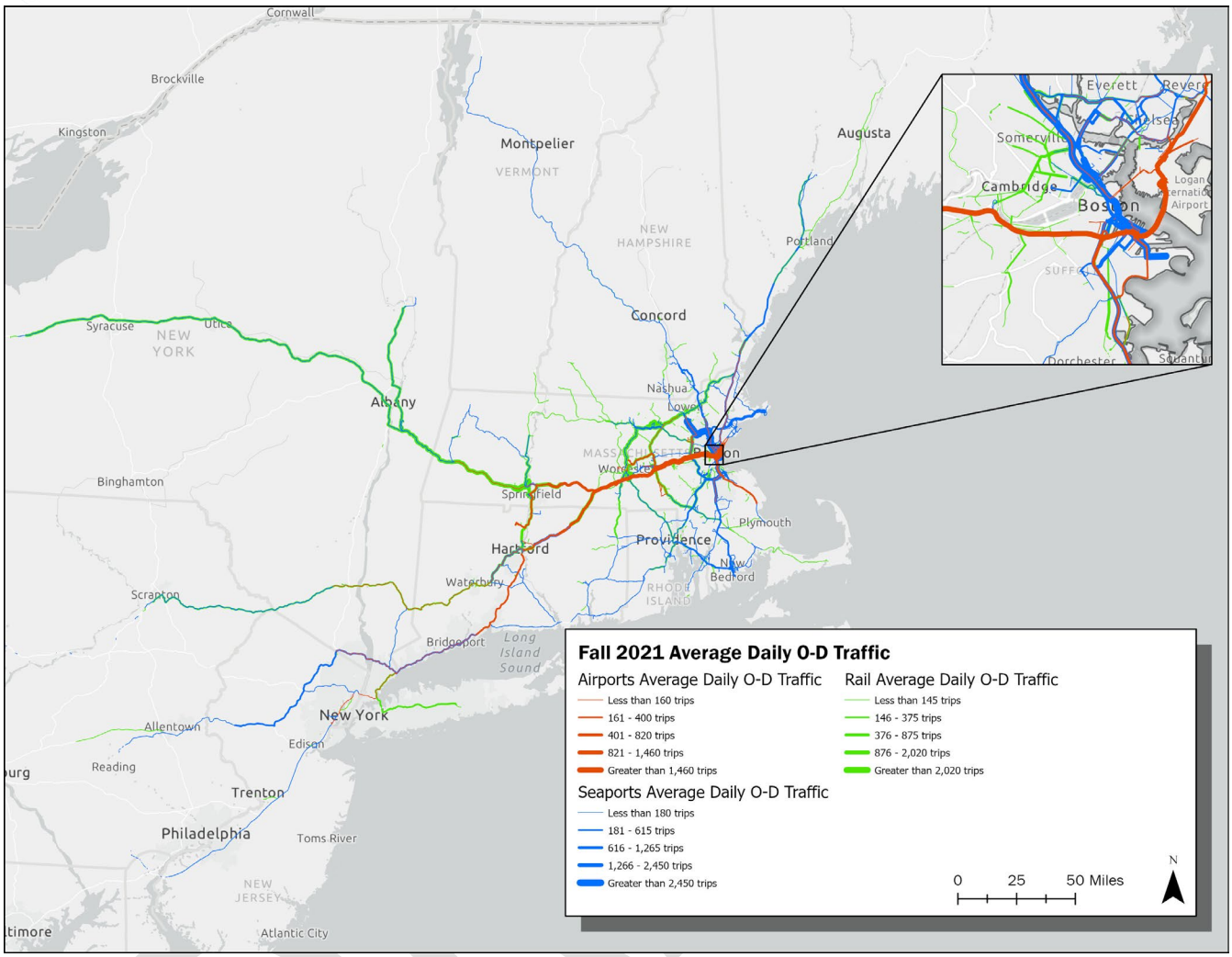
MassDOT has monitored truck volume on its highways closely since the *2017 Massachusetts Freight Plan* was published. MassDOT's automated traffic count stations recorded the highest increases in truck volumes on I-90, which is the primary route for handling freight from the west to all of New England. Stations that recorded more than 500 average annual daily traffic (AADT) from 2019 to 2021 include I-93 at Stoneham, I-95 at Foxborough, and I-290 at Auburn. Origin/destination location-based services (LBS) data demonstrated that routes used by heavy trucks (greater than 26,000 pounds) did not substantially change from 2019 to 2021. Additionally, more heavy trucks left Massport's Conley Terminal heading to the FedEx warehouses west of Billerica in 2021, which may be a result of operational changes during the pandemic's recovery period. Figure 5.5 and Figure 5.6 illustrate these trends on a map.

FIGURE 5.5 PERCENT CHANGE IN AVERAGE DAILY TRUCK VOLUMES, 2019 – 2021



Source: MassDOT Traffic Count Data.

FIGURE 5.6 TOP ROUTES FOR TRUCKING, FALL 2021



Source: MassDOT StreetLight Data.

Road Infrastructure | Needs

Highway conditions related to safety, congestion, bottlenecks, truck parking, and asset condition all impact how infrastructure serves both goods movement and the general public. This section discusses highway needs from the perspective of freight transportation.

Safety

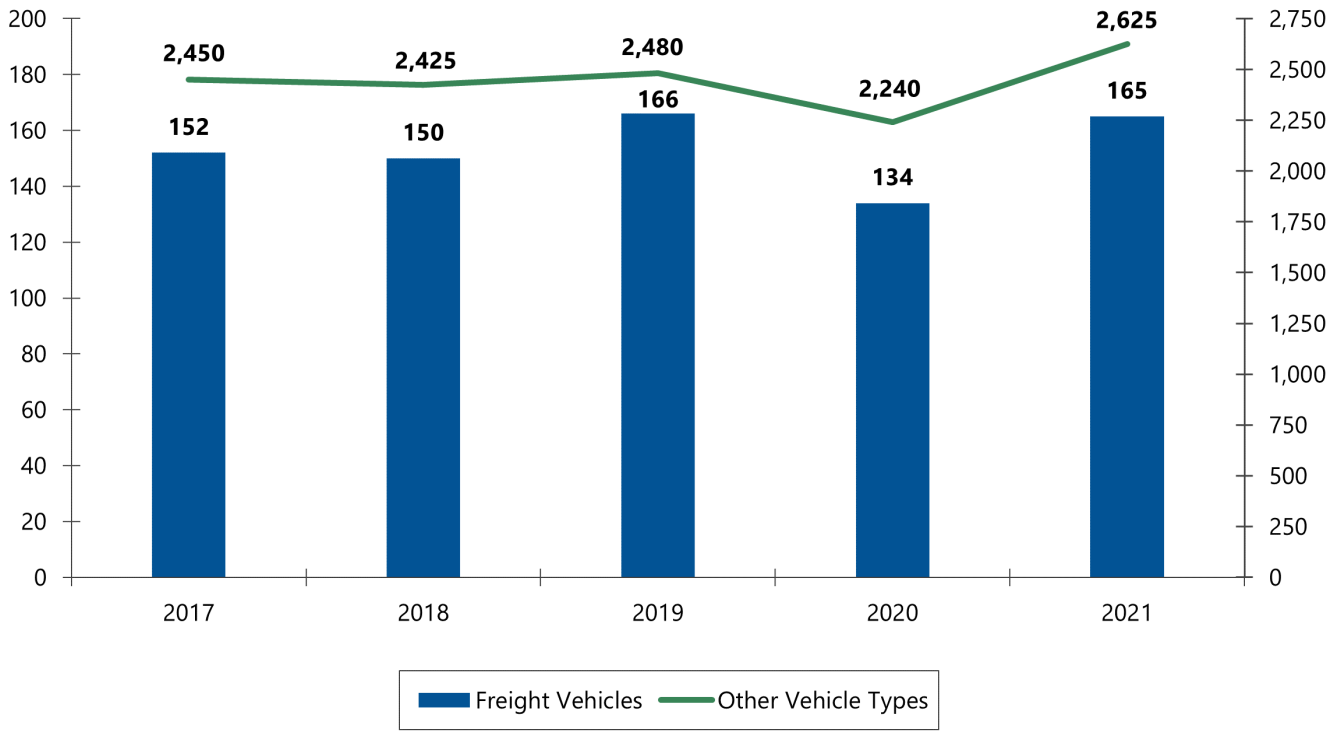
The Commonwealth of Massachusetts' top priority is ensuring the safety of all roadway users. Massachusetts has adopted the Safe System Approach, which anticipates that human mistakes will occur and focuses on lowering impact energy on the human body during collisions to below dangerous levels. The 2023 Strategic Highway Safety Plan (SHSP) identified that the number of serious injuries involving trucks has remained steady in recent years. To better understand crashes involving trucks such as single-unit, tractor-trailer, semi-trailer, or other

heavy trucks, MassDOT has analyzed prevalent factors and locations in the latest five years of available crash data (2017 to 2021).

Fatal and Serious Injury Crashes Involving Trucks

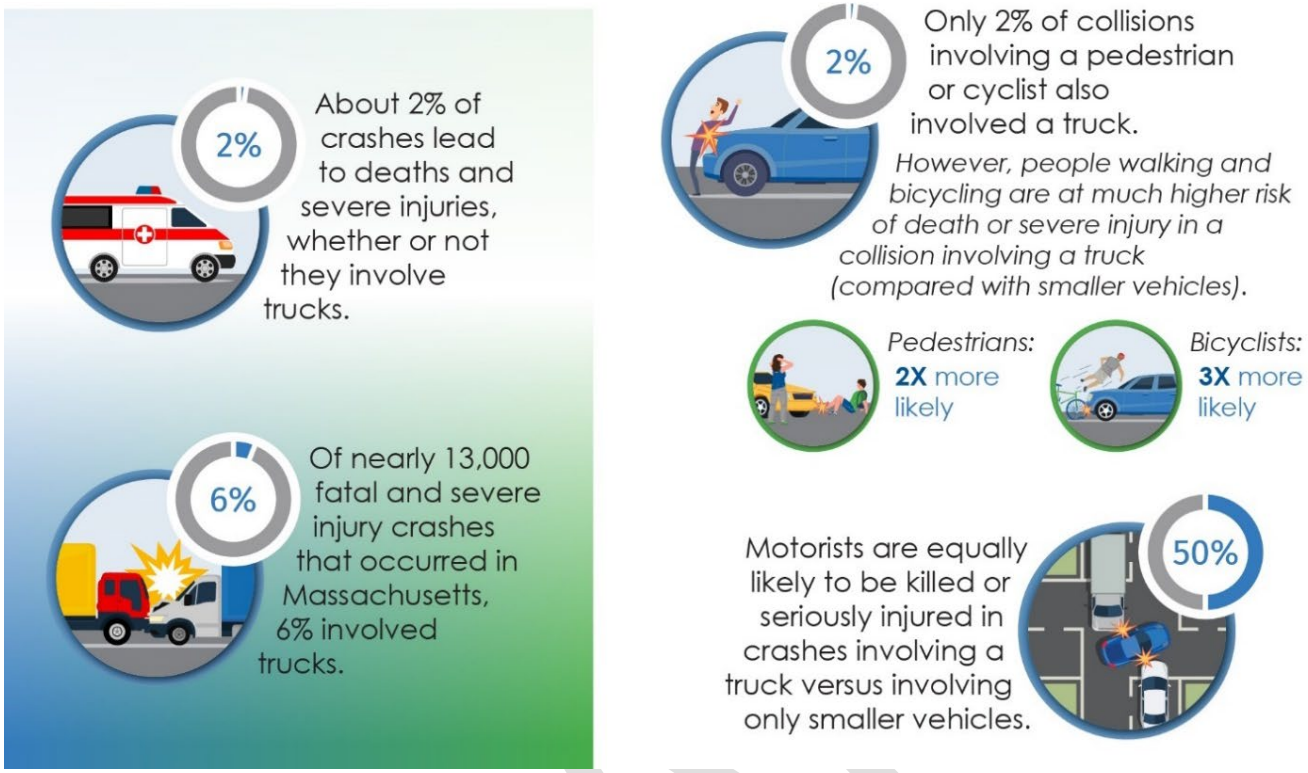
There were 43,022 truck-involved crashes in Massachusetts between 2017 and 2021, an average of 8,600 annually. This time period included 767 truck-involved fatal or serious injury crashes, as illustrated in Figure 5.7. Figure 5.8 and Figure 5.9 summarize key statistics for truck-involved crashes between 2017 and 2021.

FIGURE 5.7 FATAL OR SERIOUS INJURY CRASHES BY YEAR, 2017 – 2021



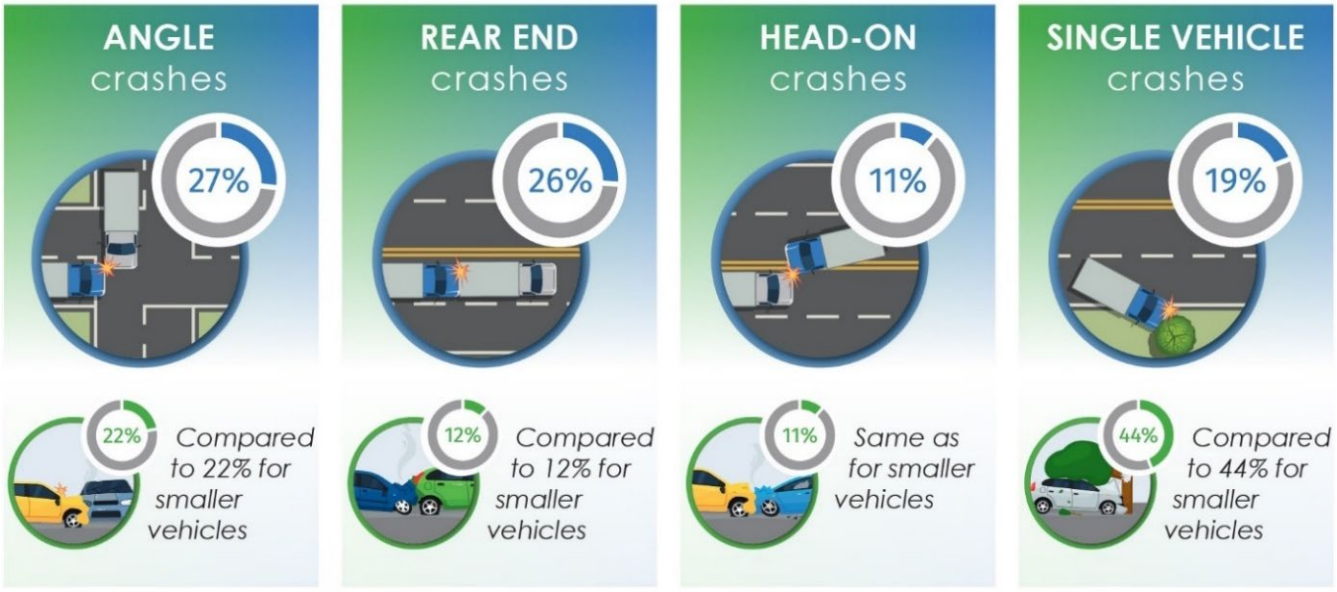
Source: MassDOT.

FIGURE 5.8 TRUCK-INVOLVED CRASHES IN MASSACHUSETTS, 2017 – 2021



Source: MassDOT.

FIGURE 5.9 FATAL AND SEVERE INJURY TRUCK-INVOLVED COLLISION TYPES, 2017 – 2021

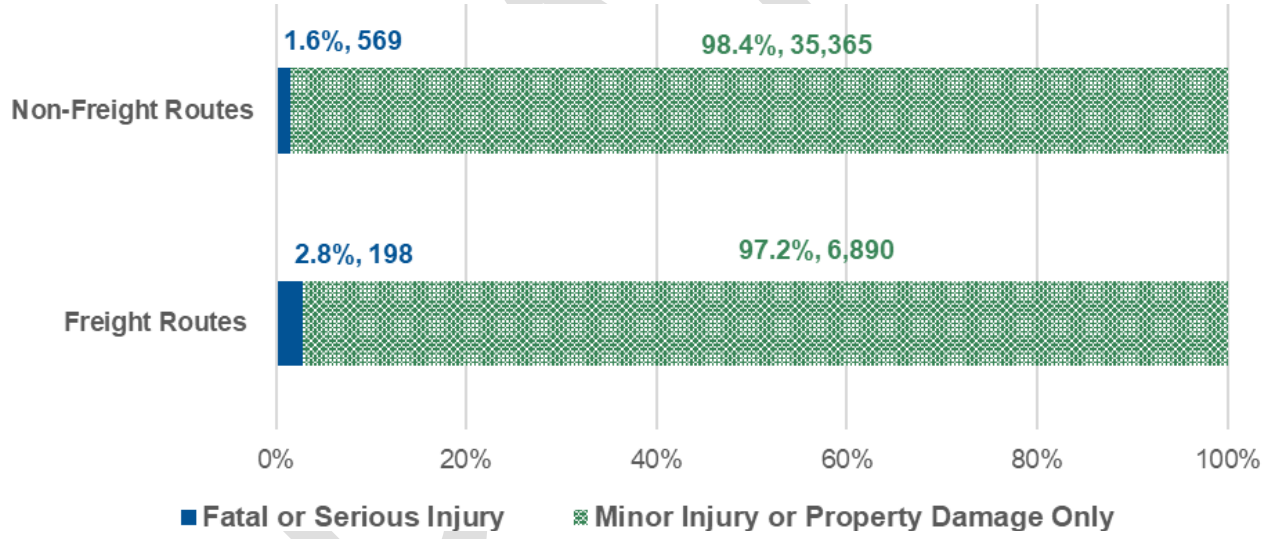


Source: MassDOT.

Figure 5.10 shows the distribution of truck-involved fatal/serious injury and minor injury/property damage only crashes across freight-designated and non-freight-designated routes. Between 2017 and 2021, 74 percent of truck-involved fatal and serious injury crashes and 83 percent of minor injury and property damage only crashes occurred on non-freight routes (i.e., not on the NHFN, CUFCs, or CRFCs). The crashes on designated freight routes were slightly more likely to result in fatality or serious injury (2.8 percent of all truck-involved crashes on designated freight routes) when compared to crashes on non-freight routes (1.6 percent of all truck-involved crashes on non-freight-designated routes). Freight routes are often designated on higher classification, higher speed roads designed for longer-distance trips, which are also associated with higher crash severity (see discussion on contributing infrastructure factors below).

The presence of trucks on the roadway can indirectly contribute to collisions, even when the truck is not involved. As larger vehicles, trucks can block other road users' view of each other, signs, or traffic control devices. Federal Motor Carrier Safety Administration (FMCSA) found in 2020 that 2.9 percent of fatal passenger vehicle crashes in 2020 were attributed to the obscured vision of non-truck drivers.[68]

FIGURE 5.10 DISTRIBUTION OF TRUCK-INVOLVED CRASHES ACROSS FREIGHT-DESIGNATED AND NON-FREIGHT-DESIGNATED ROUTES, 2017 – 2021



Source: MassDOT.

Truck-Involved Fatal and Serious Injury Crashes Involving Non-Motorized Road Users

Non-motorized road users include people who walk or use a wheelchair, other mobility devices, bicycle, or micromobility devices such as scooters or skateboards. These users are typically more vulnerable to crash risks on roadways than motorists, who are protected by their vehicles. The five-year crash data showed that pedestrians are twice as likely as motorists to be killed or seriously injured in a truck-involved crash. Similarly, bicyclists are three times as likely as motorists to be killed or seriously injured in a truck-involved crash.

[68] FMCSA 2020 Large Bus and Truck Crash Facts https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/2022-10/LTBCF%202020-v5_FINAL-09-20-2022%20508%2010-3.pdf.

The greater severity of truck-involved crashes with non-motorized users is associated with the greater size and weight of trucks and other commercial vehicles. Compared to passenger cars, trucks cannot slow as quickly and require more time to reduce their impact energy or come to a stop before a collision can occur. Larger vehicles, such as tractor-trailers, also have larger blind spots, which can prevent drivers from seeing non-motorized users. Trucks are generally designed with higher underside clearance than the typical passenger vehicle, which presents a risk that a non-motorized user will be swept under a vehicle's wheels during a collision. Vehicle modifications, such as lateral protective devices (also known as side guards), can reduce the severity of collisions for non-motorized users.

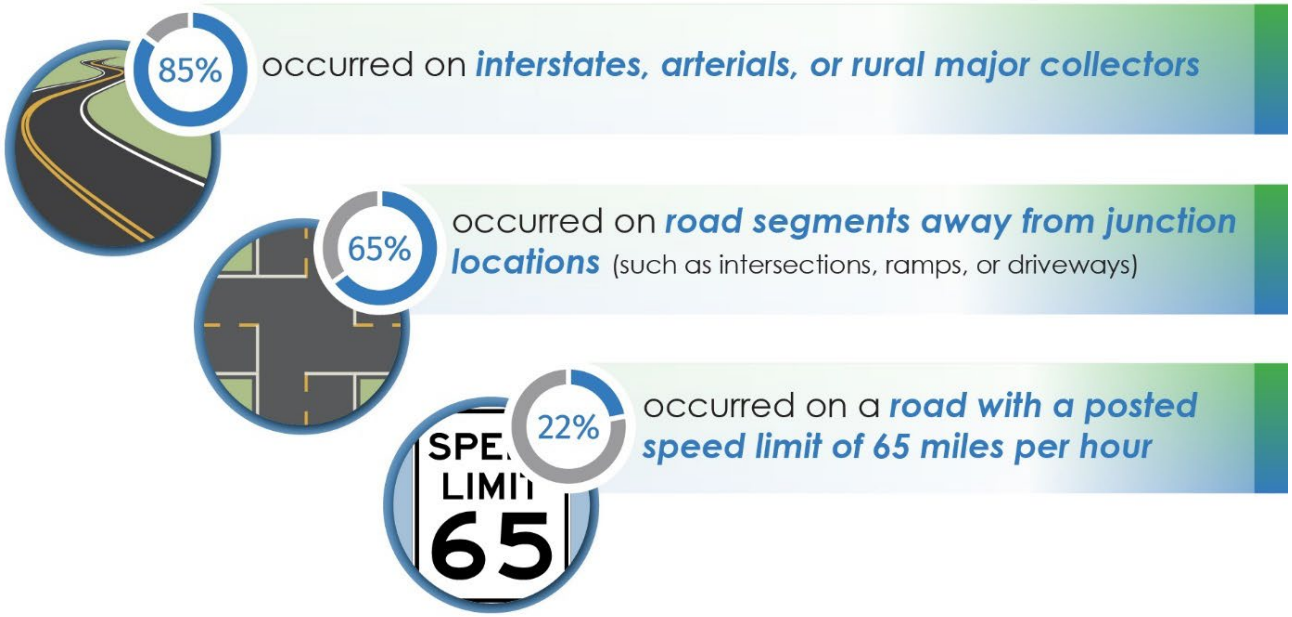
Contributing Factors for Truck-Involved Crashes

By identifying factors that contribute to crashes, Massachusetts and its partners can identify targeted actions with the greatest potential to save lives and prevent severe injuries. These may include:

- **Crash events |** Analyzing the conditions, actions, and vehicle movements before and during a crash can identify contributing factors that lead to more severe outcomes.
- **Infrastructure factors |** Infrastructure-related factors have a strong influence on the likelihood and severity of crashes, such as lane configuration, traffic signal timing, posted speed limits, and intersection design. Reviewing and changing how roads are designed and operated can directly mitigate these factors.
- **Environmental factors |** Environmental factors such as time-of-day and roadway conditions (caused by weather events) cannot be directly controlled, but engineering solutions and education and safety programs can reduce risk.
- **Behavioral factors |** Alterations to roadway design and operations may also reduce risks of unsafe driving behaviors, such as distracted, impaired, and drowsy driving. Driver education and enforcement activities can also encourage people to make safer decisions when operating a vehicle.

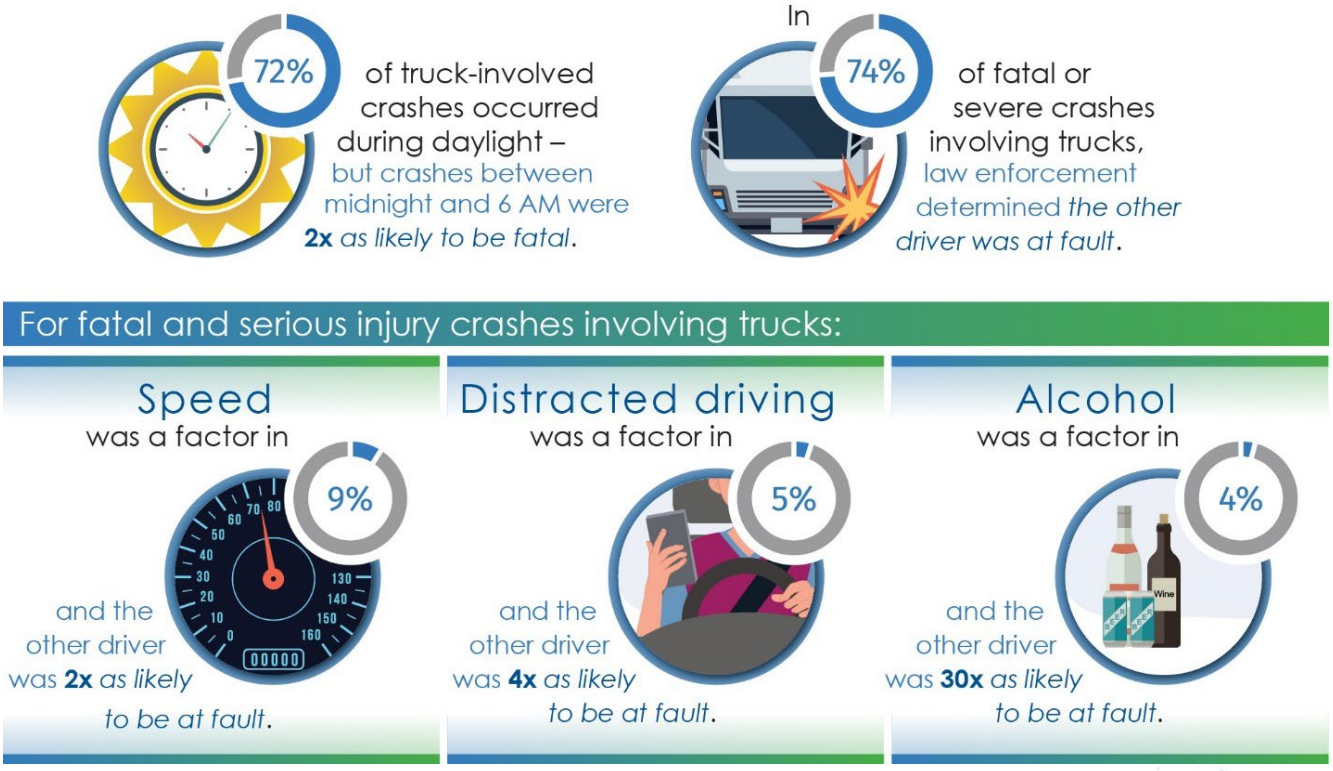
Figure 5.11 and Figure 5.11 summarize some key findings related to infrastructure, environmental, and behavioral factors that contributed to truck-involved crashes in Massachusetts between 2017 and 2021.

FIGURE 5.11 FATAL AND SEVERE INJURY TRUCK-INVOLVED CRASHES BY ROAD TYPE AND POSTED SPEED, 2017 – 2021



Source: MassDOT.

FIGURE 5.12 BEHAVIORAL AND ENVIRONMENTAL FACTORS IN TRUCK-INVOLVED CRASHES, 2017 – 2021



Source: MassDOT.

Hot Spots for Truck-Involved Crashes

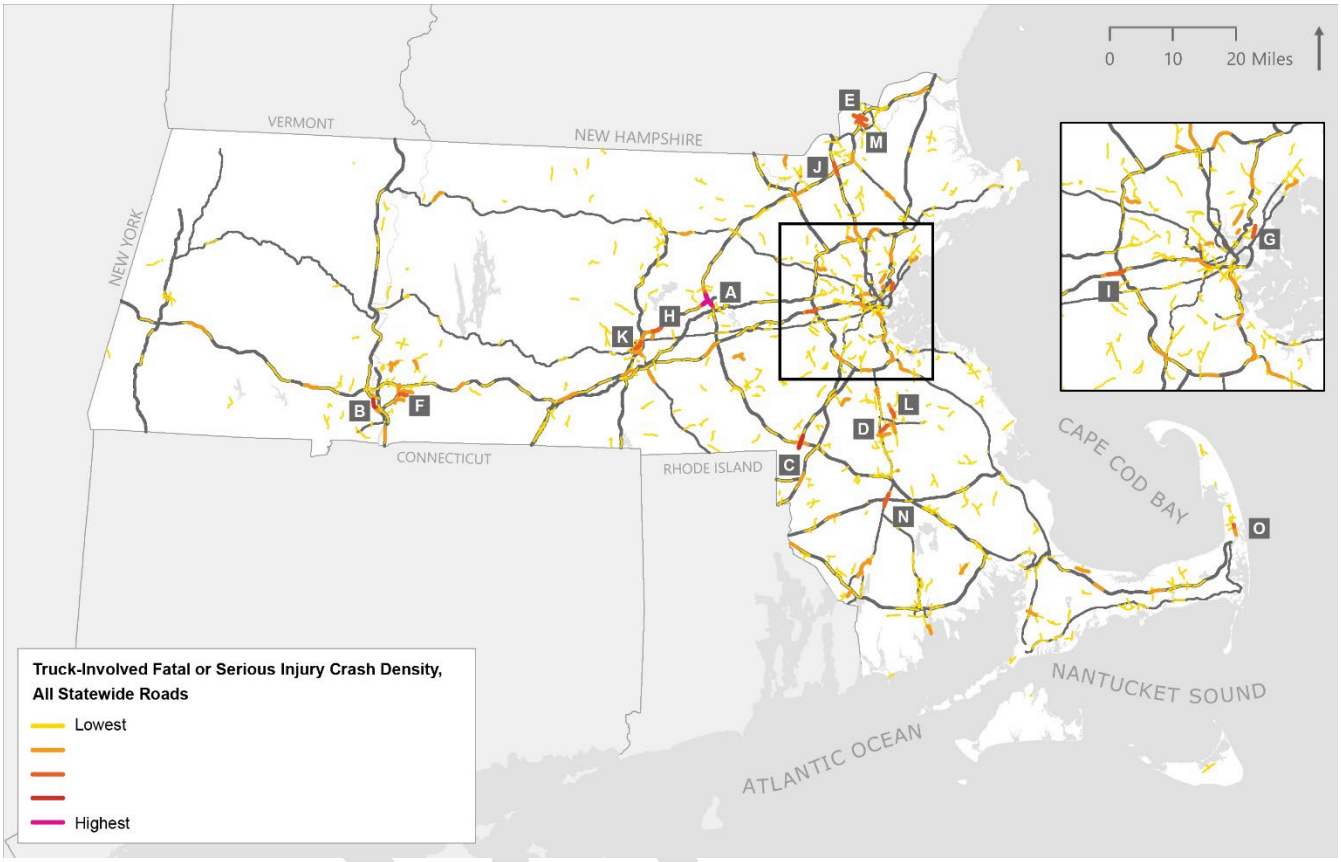
There are several roadway segments that have a high concentration of truck-involved fatal or serious injury crashes across Massachusetts. These hotspots identified in Table 5.2 have at least three truck-involved fatal or serious injury crashes that occurred on each segment between 2017-2021. Figure 5.13 shows a heat map of fatal and serious injury crashes involving trucks on roadways across the Commonwealth.

TABLE 5.2 ROAD SEGMENTS WITH THE HIGHEST NUMBER OF TRUCK-INVOLVED FATAL AND SERIOUS INJURY CRASHES, 2017 – 2021

	Road Segment	Location	Number of Incidents
A	I-290/I-495 Interchange	Marlborough	10
B	Riverdale Street	West Springfield	4
C	I-495/US-1 Interchange	Plainville	4
D	Belmont Street	Brockton	3
E	I-495 Interchange 108 (Broadway/MA-97)	Haverhill	3
F	Cottage Street	Springfield	3
G	Eastern Avenue	Chelsea	3
H	I-290 Interchange 25 (Main Street)	Shrewsbury	3
I	I-90/I-95 Interchange	Weston	3
J	I-93/I-495 Interchange	Andover	3
K	Main Street	Worcester	3
L	North Montello Street	Brockton	3
M	I-495 Interchange 107 (River Street/MA-110/MA-113)	Haverhill	3
N	MA-24 Interchange 20 (US-44)	Raynham	3
O	US-6	Eastham	3

Source: MassDOT.

FIGURE 5.13 ROAD SEGMENTS WITH TRUCK-INVOLVED FATAL AND SERIOUS INJURY CRASHES, 2017 – 2021



Source: MassDOT.

Congestion, Delay, and Bottlenecks

Congestion, delay, and bottlenecks contribute to increased cost of shipping and increased emissions from freight transportation. A 2022 MassDOT analysis of highway bottlenecks identified 17 bottleneck locations, including two locations identified by the American Transportation Research Institute (ATRI) as being in the top 100 truck bottlenecks nationally in 2023 (I-95 at I-90 ranked 90th; I-95 at I-93 ranked 99th).[69] Bottlenecks were identified using the unitless "Total Delay for Trucks" from the National Performance Management Research Dataset (NPMRDS) and in consultation with the Freight Advisory Committee (FAC) and Regional Planning Agency (RPA) staff. These bottleneck locations are listed in Table 5.3. Recommendations will be further addressed in Chapter 7.

[69] ATRI, Top 100 Truck Bottlenecks—2023, https://truckingresearch.org/2023/02/07/top-100-truck-bottlenecks-2023/.

TABLE 5.3 LIST OF HIGHWAY BOTTLENECKS IN MASSACHUSETTS, 2022

Bottleneck	Municipality	Bottleneck	Municipality
I-90/I-93	Boston	I-95/US-3	Burlington
I-90/MA-3	Braintree	I-93/US-1	Boston
I-93/I-95	Reading	I-495/US-3	Chelmsford
I-93/MA-24	Randolph	I-95/I-495	Foxborough
I-93/I-95	Canton	I-95/US-1	Dedham
I-90/I-95	Weston	I-495/US-20	Marlborough
I-90/I-290/I-395	Auburn	I-290/I-495	Marlborough
I-90/I-495	Hopkinton	I-84/I-90	Sturbridge
I-93/I-495	Andover		

Truck Parking

Safe, secure truck parking is essential for public safety, driver quality-of-life, and economic competitiveness in Massachusetts. Truck drivers must take breaks at regular intervals to comply with federal hours-of-service (HOS) regulations. Just as importantly, truck drivers need parking to stage (or wait) for customer pick-ups and drop-offs to ensure on-time arrivals.

A 2019 MassDOT study, *Freight Planning for Immediate and Robust Strategies*, conducted an inventory of truck parking locations within the Commonwealth and just across the state boundaries to better understand where truck parking is currently available (Figure 5.14). This inventory includes all types of truck parking, including service plazas, truck stops, rest areas, and pullouts for truck parking. The study found that truck parking areas at service plazas along I-90 were frequently overcrowded. The study also recommended constructing new truck stops and/or expanding existing truck stops in specific locations, which will be discussed in Chapter 7.

FIGURE 5.14 EXISTING TRUCK PARKING LOCATIONS IN MASSACHUSETTS AND IN ADJACENT STATES

Source: "Freight Planning for Immediate and Robust Strategies", MassDOT (2019).

Pavement and Bridge Condition

The Federal pavement condition performance measures are expressed as the percentage of both Interstate and non-Interstate NHS roads in good or poor condition according to an FHWA metric that incorporates International Roughness Index (IRI), several types of cracking, rutting, and raveling. Pavement in good condition suggests that no major investment is needed. Pavement in poor condition suggests that major reconstruction is needed due to either ride quality or a structural deficiency.

Massachusetts bridges are 25 years older than the national average, which, combined with harsh winters and traffic from a growing state, has resulted in a considerable repair backlog. Based on National Bridge Inventory (NBI) data, Massachusetts is 47th in the nation for bridge condition in the NHS. Today's conditions persist despite the $3 billion investment of the Accelerated Bridge Program (2008-2018), which rehabilitated or replaced nearly 300 bridges and postponed further decline of conditions. However, significant and ongoing investment is needed to rehabilitate or replace legacy infrastructure and sufficiently fund maintenance and preservation.

Table 5.4 presents performance for the infrastructure condition (PM2) measures for the 2021 baseline year as well as the current two-year and four-year statewide targets established by MassDOT. Performance measures and targets are tracked in greater detail in MassDOT's Transportation Asset Management Plan.[70]

[70] https://www.mass.gov/service-details/massdot-asset-management.

TABLE 5.4 MASSDOT TARGETS FOR HIGHWAY INFRASTRUCTURE CONDITION, 2021 – 2025

Performance Measure	Current (2021)	2-Year Target (2023)	4-Year Target (2025)
Bridges in good condition	16%	16%	16%
Bridges in poor condition	12.2%	12%	12%
Interstate Pavement in good condition	71.8%	70%	70%
Interstate Pavement in poor condition	0%	2%	2%
Non-Interstate Pavement in good condition	34%	30%	30%
Non-Interstate Pavement in poor condition	3%	5%	5%

Source: MassDOT.

Oversize/Overweight Vehicle and Hazardous Cargo Movements

Oversize/overweight (OS/OW) vehicle movements are necessary for many heavy load industries such as mining, energy-related cargo or equipment (e.g., wind turbines), and agriculture. However, these movements have a greater impact on roadway wear and tear and safety. In Massachusetts, trucks may not exceed a gross vehicle weight of 80,000 lbs., which is consistent with Federal standards. Permits are also necessary for trucks operating in the Commonwealth that exceed:

- A width, including load, of 8 ft. 6 in.
- A height, including load, of 13 ft. 6 in.

There are also restrictions on vehicle height depending on the desired travel route (such as tunnels) and the vehicle type.[71] All hazardous cargo is prohibited in the Boston tunnel highway system and there are daytime and nighttime routes designated for non-radioactive hazardous materials to and from Boston along I-93.[72]

MassDOT is currently conducting the research project "Methods to Identify Problematic Carriers and Prevent Infrastructure Damage" as a part of the MassDOT Research Program with funding from FHWA State Planning and Research (SPR) funds.[73] This research project will compile a comprehensive classification of relevant existing data sources, fields, and their framework of interoperability from multiple state agencies and departments. The objective of this study is to develop recommendations and procedures to use shared datasets, enabling MassDOT to identify and analyze height and/or weight restricted Massachusetts transportation infrastructure and prevent damage from problematic use by commercial carriers.

[71] https://www.mass.gov/info-details/commercial-truck-permits-height-and-weight-limitations.
[72] https://www.mass.gov/service-details/hazardous-material-route-designation.
[73] https://www.mass.gov/doc/methods-to-identify-problematic-carriers-and-prevent-infrastructure-damage-0/download.

Freight Rail

The transport of freight by rail is second only to highway freight transportation in the Commonwealth. Although rail represents a relatively small percentage of total freight in Massachusetts, rail provides a critical and efficient method to move specific industry goods over longer distances over 500 miles. Furthermore, rail freight must travel through Massachusetts to reach most of New England from the rest of the U.S. Thus, the rail network is important to both the Commonwealth and the entire region.

Freight Rail | Inventory

In contrast to the highway, air, and water modes that rely almost entirely on publicly owned and maintained infrastructure, freight railroads in the U.S. use mostly privately owned infrastructure. After four decades of relative stability, 2022 saw significant changes in the composition of Massachusetts' freight rail operators. A principal driver of this change was the June 2022 acquisition of New England's largest regional railroad, Pan Am Railways (PAR), by Class I railroad CSX. As a result, freight service across the 1,138-mile Massachusetts rail system is now provided by 12 railroads, which are comprised as follows:[74]

- One Class I (major) railroad, defined as having minimum operating revenues of $943.9 million or more in 2021.
- Eleven Class III (local) railroads, defined as having operating revenues of $42.4 million or less.

Table 5.5 lists the freight railroads currently operating in the Commonwealth. A map of the rail system in Massachusetts as of mid-2022 is presented in Figure 5.15

CSX is the largest operator in Massachusetts, followed by various Genesee & Wyoming subsidiary railroads – the Connecticut Southern, New England Central, and the Providence and Worcester. CSX operates a 20,000-mile network serving the eastern half of the U.S. and locations in Ontario and Quebec. North America's third largest Class I railroad in terms of revenue, CSX generated $14.9 billion USD in 2022, handling 3.3 million carloads and 3 million intermodal units with a workforce of approximately 25,000.

Class II railroad PAR (known as the Guilford Rail System prior to 2006) was the second largest railroad in the Commonwealth in terms of mileage and traffic volume until its acquisition by CSX. PAR maintained operations in five New England states and New York with over nearly 1,200 track miles; in recent years, most mileage operated by PAR and its subsidiaries in Massachusetts was owned by other parties. This included Pan Am Southern (PAS), a joint venture between PAR and the Norfolk Southern Railway Company (NS) that was initiated in 2009 with the objective of improving freight rail service along the former Boston and Maine corridor between Ayer and Mechanicville. As a competitive consideration for the acquisition of PAR by CSX, the PAS joint venture arrangement was revised to bring in a new short line, Genesee and Wyoming subsidiary Berkshire and Eastern, to provide local freight service on the PAS trackage. This operation is expected to commence sometime during 2023

[74] For purposes of classifying carriers by size, the Surface Transportation Board's thresholds for 2021 were used. See https://www.stb.gov/reports-data/economic-data/.

and, thus, is not listed in Table 5.5. As part of the transaction, NS gained trackage rights over CSX's main lines between Voorheesville, NY and Ayer, MA for intermodal and automotive traffic. This route will allow NS to operate one daily domestic double-stack service into the Ayer intermodal facilities, which is presently not feasible along the PAS route due to the clearance-restricted Hoosac Tunnel.

TABLE 5.5 MASSACHUSETTS FREIGHT RAILROADS BY OPERATOR AND MILEAGE[1]

Railroad	Reporting Mark	Parent Company/ Ownership	Operated Miles	Owned Miles
Class I Railroads				
CSX	CSX		507	203
Class III (Local) Railroads				
Bay Colony Railroad	BCLR		6	6
Connecticut Southern Railroad	CSO	Genesee & Wyoming	7	0
Fore River Transportation Corp.	FRVT	MWRA	3	0
Grafton & Upton Railroad	GU		23	15
Housatonic Railroad	HRRC		38	0
Massachusetts Central Railroad	MCER		25	2
Massachusetts Coastal Railroad	MC		60	0
New England Central Railroad	NECR	Genesee & Wyoming	91	54
Pan Am Southern[2]	PAS	CSX/NS	188	111
Pioneer Valley Railroad	PVRR	Pinsley	17	17
Providence and Worcester	PW	Genesee & Wyoming	123	76
Total Active Mileage			**1,138**	

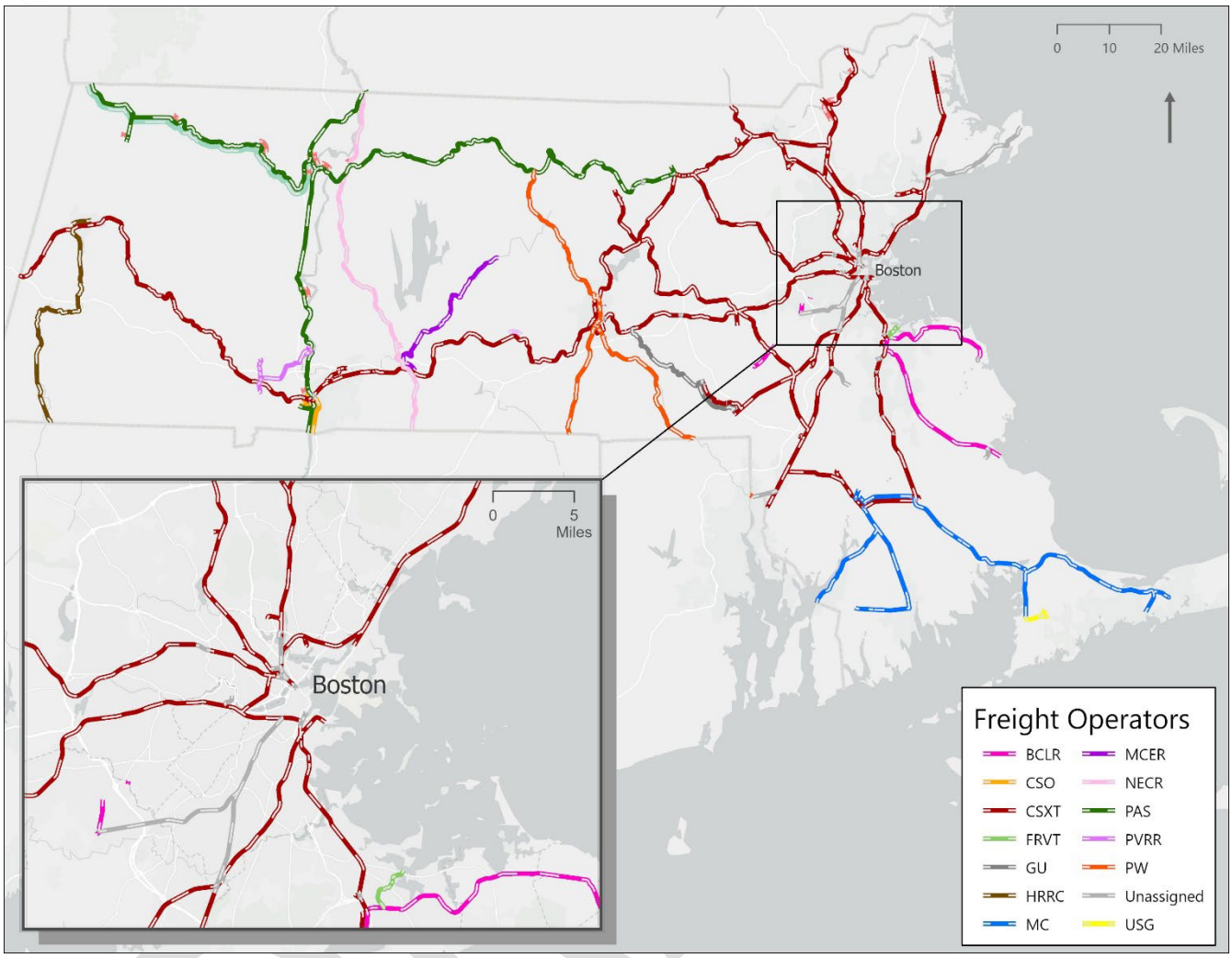
[1] *Association of American Railroads Fact Sheet, 2021; 2023 Massachusetts State Rail Plan.*

[2] *Berkshire & Eastern scheduled to commence operations over Pan Am Southern trackage in 2023.*

CSX plans to make significant investments in infrastructure across the PAR network, including track upgrades. The merger application reported that there were approximately 216 miles of line segments across PAR's entire five-state network that are subject to train speed restrictions due to deferred maintenance or capital investment needs, with 191 miles under long-term speed restrictions.

While freight rail operations are performed by private entities, the Commonwealth – through MassDOT and the MBTA – is the largest owner of rail rights of way at 642 miles, followed by CSX at 203 miles, and Genesee and Wyoming's 3 operating subsidiaries at 130 miles. This public ownership has a direct impact on freight service, particularly from the standpoint of capital investment and long-term strategic intentions. Starting in the 1970s, the Commonwealth has played an increasingly important role in directing investment into both the publicly and privately owned elements of the rail network that are utilized for freight and includes such projects as the recent CSX Worcester intermodal terminal reconstruction and upgrades on PAS trackage.

FIGURE 5.15 MASSACHUSETTS RAIL NETWORK, 2022



Source: U.S. Bureau of Transportation Statistics.

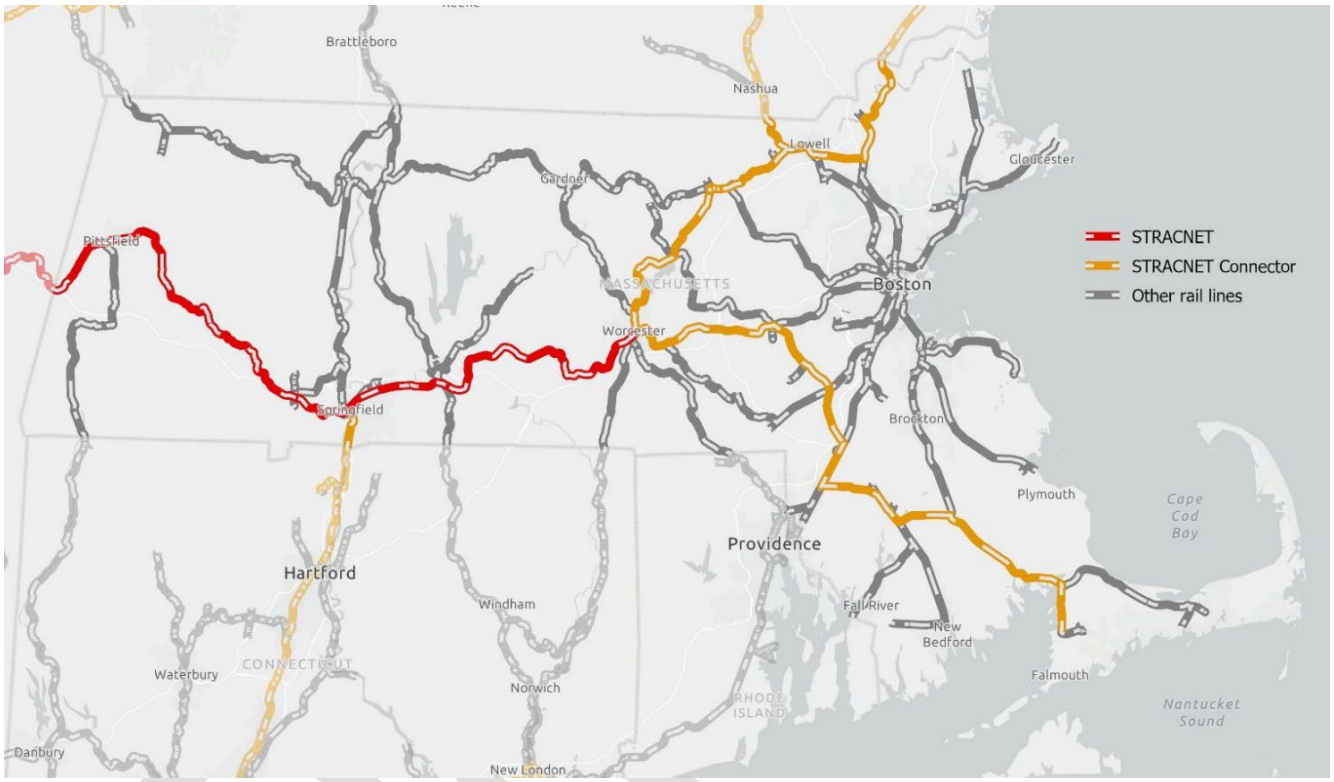
CSX serves two intermodal terminals in Massachusetts in Worcester and West Springfield. PAS operates the Ayer intermodal yard on behalf of NS and the PW serves an independent intermodal terminal in Worcester. At present, these are the only public intermodal terminals in New England and, therefore, serve both the Commonwealth and broader New England. Terminals specializing in the handling of motor vehicles are located in East Brookfield (CSX) and Ayer (PAS/NS). To serve the needs of carload shippers, CSX and the other railroads operate numerous smaller regional, interchange, and industry yards. CSX's nearest system yards are in Selkirk, NY and Portland, ME (Rigby). Rail service is directly available at the ports in New Bedford and Fall River, as well as the Chelsea Creek area in Boston Harbor. In addition, there are several publicly accessible transload facilities located across the Commonwealth that allow the transfer of goods (usually bulk or break-bulk) between rail and highway.

Strategic Rail Corridor Network

The U.S. Army's Transportation Engineering Agency, The Railroads for National Defense Program (RND), in conjunction with the U.S. Federal Railroad Administration (FRA), established the Strategic Rail Corridor Network

(STRACNET) to ensure Department of Defense's (DOD) minimum rail needs are identified and coordinated with appropriate transportation authorities. The RND program has identified over 36,000 miles of key railroad corridors serving 126 defense installations as vital for the movement of military supplies and personnel. The STRACNET and Defense Connector Lines in Massachusetts are illustrated in Figure 5.16.

FIGURE 5.16 STRACNET RAIL NETWORK AND FACILITIES



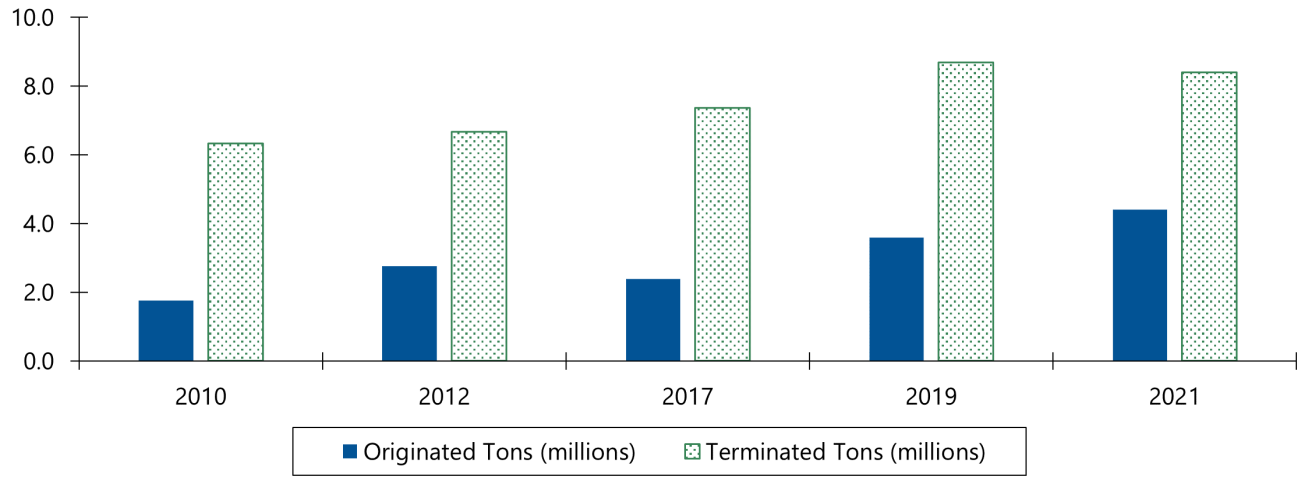
Source: U.S. Department of Defense.

Freight Rail | Demand

Since 2010, the volume of freight handled by Massachusetts railroads has been on a general upward trajectory. Overall unit volume increased by 15 percent between 2010 and 2021, while tonnage increased by 58 percent, from 8.1 to 12.8 million tons (Figure 5.17). Reflecting primarily consumer-driven demand, in 2021 intermodal freight accounted for 25 percent of total tonnage, waste at 19 percent, chemicals at 11 percent, food products at 10 percent, and lumber & wood products at 7 percent (Figure 5.18). While there have been some shifts among primary commodities since 2010, overall, the patterns have been rather stable. Approximately 43 percent of the tonnage growth experienced between 2010 and 2021 are associated with outbound waste, which went from 400,000 tons to 2.4 million tons. This led to an increase in the proportion of outbound versus inbound volumes from 22 percent in 2010 to 34 percent in 2021.[75]

[75] Association of American Railroads State Fact Sheets for 2010, 2012, 2017, 2019, and 2021. These provide a more consistent and accurate perspective of traffic trends than would be available through the Surface Transportation Board's Public Use Waybill Sample.

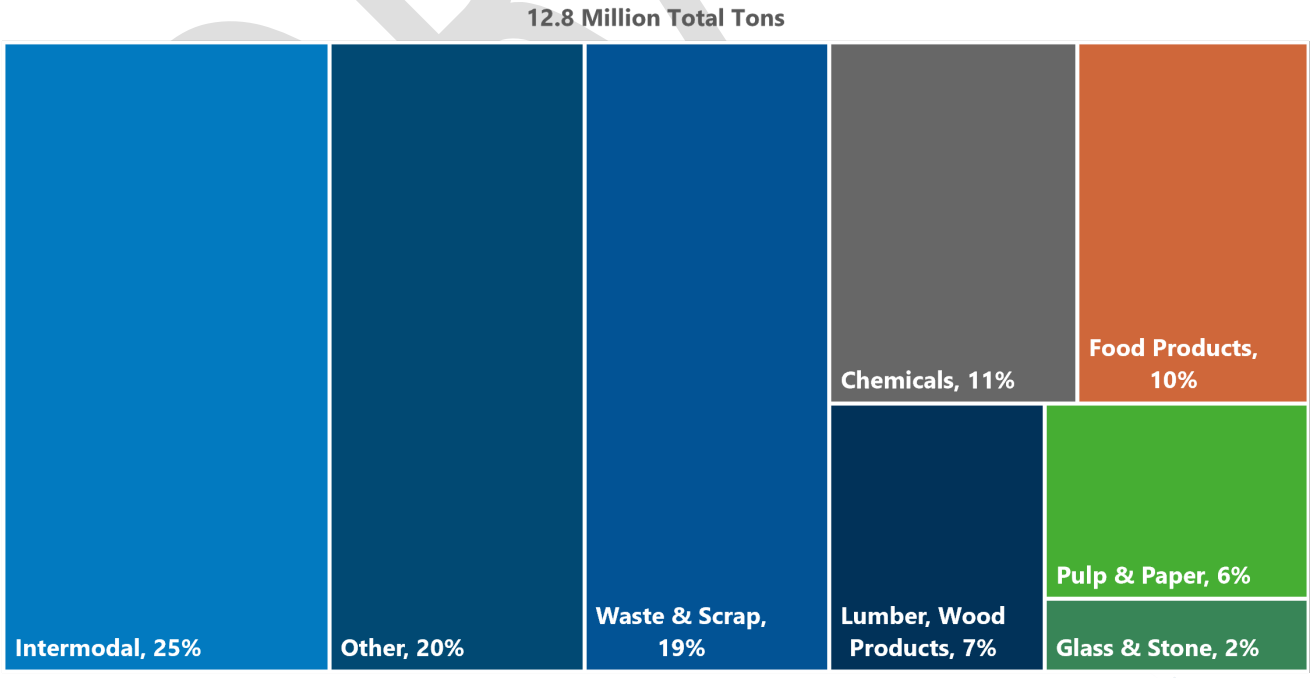
FIGURE 5.17 MASSACHUSETTS RAIL TONNAGE ORIGINATED VERSUSTERMINATED, 2010 – 2021 (MILLIONS)



Source: Association of American Railroads State Fact Sheets for 2010, 2012, 2017, 2019, and 2021.

Integral to rail traffic growth in Massachusetts has been intermodal service, which is comprised of containers and trailers utilizing rail for long-haul transport in lieu of highway. Intermodal volumes made solid gains through 2017, increasing from 1.9 million tons in 2010 to 3.3 million tons in 2017. Subsequent performance has been uneven, with declines between 2017 and 2020. This was followed by a recovery to 3.2 million tons in 2021, driven by the pandemic boom in consumer goods.

FIGURE 5.18 DISTRIBUTION OF PRIMARY RAIL COMMODITIES, 2021



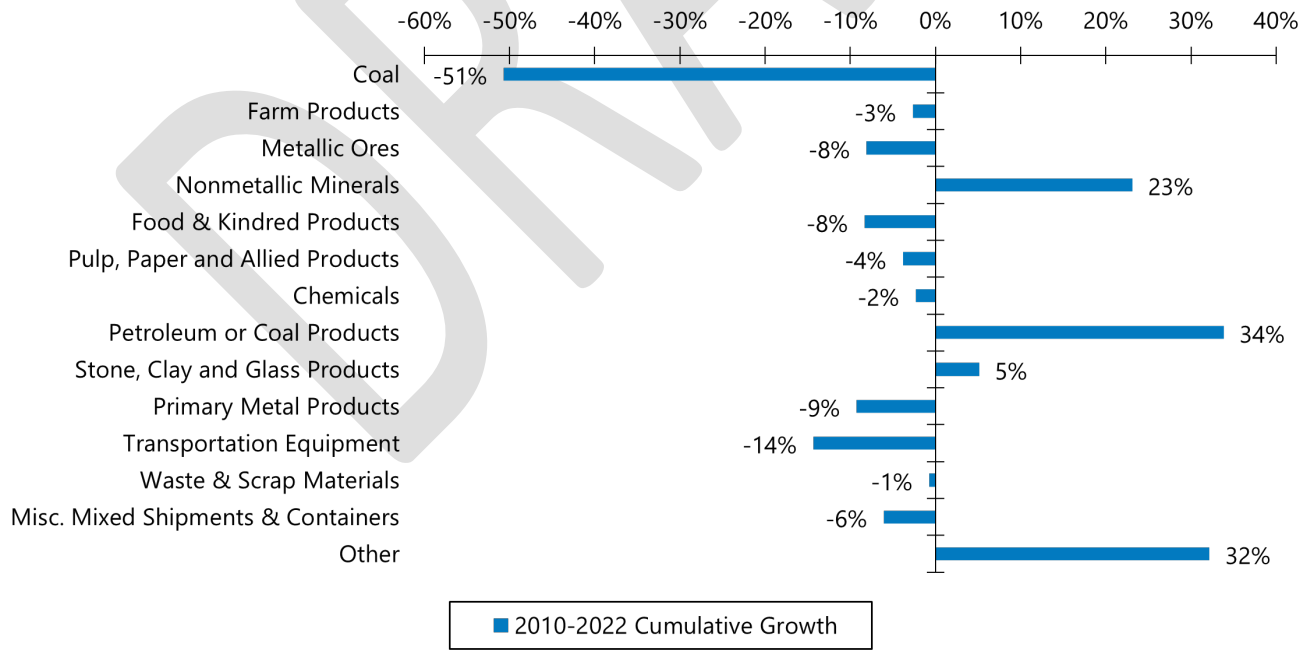
Source: Association of American Railroads State Fact Sheet, 2021.

National Trends

Over the past decade, the financial performance of Class I railroads has reached new heights amidst declining traffic volumes. Between the most recent peak years of 2014 and 2021 tonnage declined an average of 2.5 percent per year, while unit volumes dropped an average of 1.1 percent per year, reflecting an ongoing shift from carload to intermodal. This decline has been heavily driven by changes in the industrial sectors that have been most reliant on rail service. Compounding these shifts have been deteriorating operational performance due to labor shortages, supply-chain volatility, and reduced resilience resulting from the strategies associated with PSR (discussed in Chapter 4) that Class I railroads have broadly implemented since 2015 to more closely align capacity with demand.

As a result of the COVID-19 pandemic, rail freight tonnage fell by 11 percent and carload volumes fell by 7 percent between 2019 and 2020. The commodities most negatively impacted included coal, nonmetallic minerals, primary metal products, and mixed shipments and containers (intermodal). The only commodities that saw an increase in tonnage were farm products and food/kindred products. Subsequently, 2021 saw an increase in both tonnage (6 percent growth) and carload volumes (5 percent growth) over 2020, although both were still shy of pre-pandemic levels. In 2022, carload and intermodal traffic experienced an overall decline of 2.8 percent on a unit basis, with trends varying considerably across the major commodities and markets.[76] The overall trends in tonnage volumes handled by Class I railroads since 2010 are shown in Figure 5.19

FIGURE 5.19 CUMULATIVE GROWTH IN CLASS I RAIL TRAFFIC TONNAGE BY COMMODITY, 2010 – 2022



Source: Association of American Railroads Commodity Statistics.

[76] Association of American Railroads, *Weekly Railroad Traffic*, January 4, 2023, https://www.aar.org/wp-content/uploads/2023/01/2023-01-04-railtraffic.pdf.

Looking ahead, the prospects for rail traffic volumes are unclear. The FHWA's long-range forecast of freight demand from 2021 anticipates national freight rail tonnage volumes grow at an annual rate of 0.15 percent between 2017 and 2030, based on expectations of overall freight traffic growth across all modes of approximately 0.91 percent annually. This growth is substantially below projected GDP growth and reflects expectations that the US economy will continue to shift away from producing goods, and that population growth will continue at the low levels seen in the late 2010's. Most freight traffic growth would occur on highways, with slow growth being a precursor to a highly competitive freight transportation market.

Overshadowing all other rail freight markets has been the decline in coal, which was long the single highest tonnage commodity handled by rail and the largest source of revenues. Coal demand for electricity generation has dropped since 2008 when volumes peaked at 7.7 million carloads originated. By 2016, just 3.7 million carloads of coal were originated by rail, less than one-half of that of 2008. Subsequently, overall coal production declined at an annualized rate of 6.7 percent from 2016 to 2021. In 2021, with 3.3 million carloads, coal accounted for 27 percent of originated tonnage for U.S. railroads, a larger volume than any other commodity. However, revenues from coal had slipped to third place, accounting for 11 percent of Class I revenues.

In addition to coal, other top carload markets for railroads include chemicals, motor vehicles, and grain and farm products. Chemicals stood in third place behind coal and intermodal for Class I railroads in terms of both units (carloads and trailers/containers) originated and gross revenue as of 2015. By 2021, the transportation of chemicals supplanted coal as the second largest source of rail freight revenue. While chemical revenues have grown, the sector has not provided much volume growth for the railroads; from 2016 to 2021, Class I railroad traffic from chemicals grew only 0.2 percent each year, following a lengthy period of solid volume growth.

Freight Rail | Needs

Safety and Security

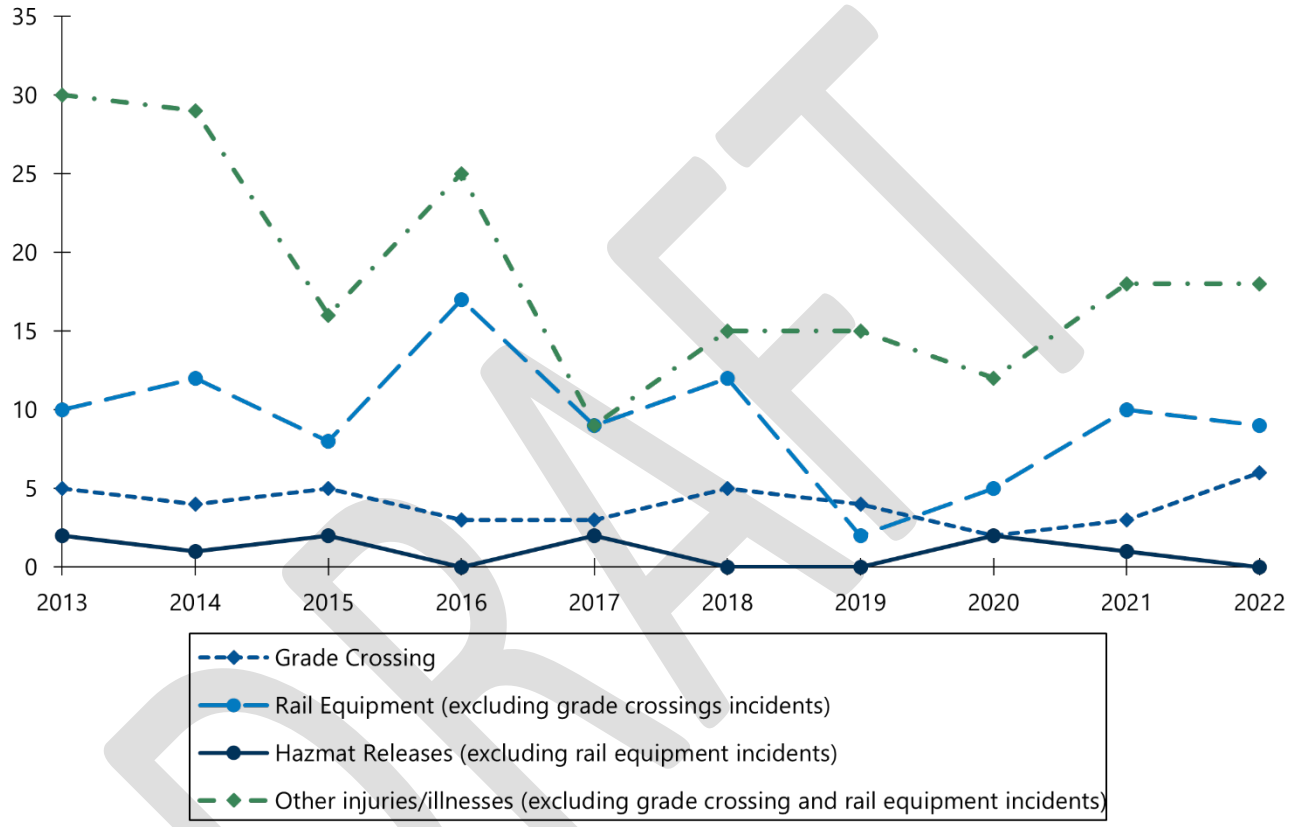
With the unique ownership structure of the nation's railroad network comes an equally unique structure of railroad safety governance. Regulation and oversight of railroad operations and safety typically occurs at the federal level. Nationally uniform railroad laws, regulations, and orders related to railroad operations, safety and security pre-empts state and local authority. Therefore, along privately-owned lines, safety systems are controlled by the private owners and regulated by the Federal Railroad Administration (FRA). In the Commonwealth, many of the lines are publicly owned and therefore the public owner (the MBTA or MassDOT) provides capital support for safety systems. However operating safety remains the responsibility of the freight or passenger rail operator.

The FRA has been continually raising railroad safety standards over the past decade including recent requirements for the installation of advance technologies in train signal systems and mandates on improved standards for rail tank cars. In the Commonwealth, MassDOT continuously invests in the maintenance and upgrade of state-owned rail lines so that they may exceed all safety standards and works with the state's freight railroads by supporting their safety initiatives to improve highway-grade crossings and improved infrastructure.

Reports published by the FRA and Pipeline Hazardous Material Safety Administration (PHMSA) were used to identify freight rail safety incidents in Massachusetts between 2013 and 2022. The freight rail safety incidents were classified as grade crossing incidents, incidents involving rail equipment, hazmat releases, and other injuries/illnesses. Figure 5.20 shows the freight rail incident trends by type between 2013 and 2022.

In total, there were 331 distinct incidents, 20 fatalities, and 182 people injured. Table 5.6 lists the number of rail incidents by type, the impact of these incidents by fatalities, and people injured.

FIGURE 5.20 MASSACHUSETTS FREIGHT RAILROAD INCIDENTS BY YEAR, 2013 – 2022



Source: FRA Forms 54, 55A, and 57. PHMSA Incident Statistics.

TABLE 5.6 MASSACHUSETTS FREIGHT RAILROAD SAFETY, INCIDENTS BY TYPE, 2013 – 2022

Incident Type	Number of Incidents	Fatalities	People Injured
Grade Crossing	40	4	18
Rail Equipment (excluding grade crossings incidents)	94	0	4
Hazmat Releases (excluding rail equipment incidents)	10	0	0
Other injuries/illnesses (excluding grade crossing and rail equipment incidents)	187	16	160
Trespassers	36	15	22

Incident Type	Number of Incidents	Fatalities	People Injured
Railroad Workers and Contractors	149	1	136
Other[1]	2	0	2
Total	**331**	**20**	**182**

Source: FRA Forms 54, 55A, and 57. PHMSA Incident Statistics.

[1] *The other incidents included a non-trespasser was struck by a car while at a freight rail terminal and the other incident was a non-trespassed who slipped* and fell while at a railyard.

Grade Crossing Safety

Safety at grade crossings is a national priority as grade crossing incidents are highly preventable yet the cause of the most injuries and fatalities of the rail industry nationwide. The FRA considers the only safe grade crossing to be the grade crossing that does not exist i.e., railroads crossing roadways on separate grades. Over the past four decades, numerous safety initiatives have succeeded at substantially decreasing the frequency of grade crossing incidents, but they continue to represent the largest share of rail safety incidents.

The installation of active warning devices, such as flashing lights and gates, has aided in alerting roadway users to the dangers of an approaching train or other rail equipment and reduced the risk of crashes. However, a high proportion of incidents still occur at grade crossings with active warning devices. Such incidents are very rarely attributed to warning device failure, but are related to roadway users' disregard of the warnings.

In Massachusetts, there were 120 grade crossing incidents between 2013 and 2022. A third of these (40 incidents) involved rail freight operations, of which 75 percent occurred at crossings with active warning devices. There was only one incident where the roadway user was not considered at fault for the crash, due to vegetation-obstructed sight distance at a grade crossing without active warning devices. Over the 2013 to 2022 period, 18 people were injured at grade crossings (16 vehicle occupants and two pedestrians) and four people were killed (three vehicle occupants and one pedestrian). These freight rail grade crossing incidents occurred mainly between motor vehicles and freight trains at public crossings, but six incidents occurred at private crossings.

Rail Equipment Incidents

There were 94 incidents involving freight rail operations in Massachusetts between 2013 and 2022. These incidents resulted in reported damages of $6.7 million. Four people, all railroad workers, were injured during these incidents. Derailments were the most frequent rail equipment incident, representing nearly 80 percent of all incidents (73 incidents). There were 13 derailments that resulted in 38 damaged hazmat cars collectively, only two of which released hazardous materials. Table 5.7 summarizes the type and number of incidents and the number of people injured. Obstruction and raking collisions were the most consequential, resulting in four injuries and $1.7 million of track and equipment damages. There were no fatalities due to these rail equipment incidents during this time period.

TABLE 5.7 MASSACHUSETTS FREIGHT RAIL EQUIPMENT INCIDENTS BY TYPE, 2013 – 2022

Type of Incident	Incident Count	People Injured	Track and Equipment Damages
Derailment	73	0	$3,931,714
Obstruction	11	3	$1,406,220
Raking collision	3	1	$250,588
Fire/violent rupture	2	0	$400,400
Side collision	2	0	$63,835
Other (flood, coupling too fast, sinkhole)	3	0	$640,684
Grand Total	**94**	**4**	$6,693,441

Source: FRA Forms 54, 55A, and 57.

Note: A raking collision occurs when some part of a railcar or its contents strikes a train on an adjacent track, or with a fixed structure such as a bridge.

Hazmat Releases

Most hazmat releases occur at shipper facilities or in freight terminals and yards during loading and unloading. In Massachusetts between 2013 and 2022, there were 12 hazmat release incidents reported to PHMSA, two of which involved derailments already reported within the rail operations incidents. The other 10 hazmat releases were caused by a variety of issues such as leaking gaskets or releases during loading or unloading. Three of the incidents had more than one liquid gallon released (LGA), but none of the releases was classified as serious.

TABLE 5.8 MASSACHUSETTS HAZMAT RELEASES BY CAUSE, 2013 – 2022

Cause	Quantity Released (LGA)	Railcars Released	Incidents
Improper Preparation for Transportation	4	10	4
Derailment	1	2	2
Human Error	30	1	1
Conveyor or Material Handling Equipment Mishap	1	1	1
Misaligned Material, Component, or Device	1	1	1
Freezing	100	1	1
Broken Component or Device	<1	1	1
Deterioration or Aging	<1	1	1
Total	**138**	**18**	**12**

Source: PHMSA Incident Statistics.

Note: Hazardous materials are reported as liquid gallons (LGA), solid pounds (SLB) or gas cubic feet (GCF).

Critical Needs

Freight rail needs in Massachusetts are derived from previous rail planning studies, information gleaned from industry research, and stakeholder interviews. Critical needs include the following:

- **Ensuring that the rail industry has a workforce that is well trained and sufficient in size to handle anticipated rail traffic efficiently.** Effective training (including vocational programs) and developing a workplace environment attractive to a new generation of workers are key components to the future success of the freight rail industry.

- **Improving system resiliency and market relevance by supporting competitive service**, achieving a state of good repair and addressing the impacts associated with climate change.

- For carload service, a major long-term concern is **ensuring continued availability and access to suitable land parcels for rail-oriented industries.** This includes avoiding potentially conflicting development, such as constructing housing on or adjacent to prime rail-served industrial sites, which could result in pressures to eliminate industrial activity.

- For intermodal service, **ensuring sufficient capacity at terminals to accommodate continued growth** to serve existing markets and (potentially) additional ones. While CSX's Worcester terminal redevelopment resulted in expanded terminal capacity, the Ayer terminal that NS uses is expected to reach capacity in the coming years without substantial expansion and/or reconstruction.

- **Ensuring that the interests of freight rail users are reflected in decision making for publicly owned rail lines**. This includes ensuring that infrastructure upgrades support the use of modern freight cars from a weight (286,000 pound weight limit) and dimensional (particularly around passenger platforms and domestic doublestack clearances on key routes) standpoint, appropriate accommodations for freight service (such as retention and upgrade of industry yards, industry connecting tracks, etc.), and operating agreements that allow freight carriers to competitively serve industries by providing appropriate access and reasonable costs.

- **Continued support of the Commonwealth's Industrial Rail Access Program** (IRAP). This program has been effective in advancing the continued use and development of freight rail service to Massachusetts industries.

- **Public support in transitioning to a zero emissions future**. The public policy focus has primarily been on highway transportation, and while the available technologies for rail operations are similar to highway, requirements differ considerably. Furthermore, on its own the rail industry may not have access to the massive amounts of capital that will be necessary to undertake a timely transition on its own.

Ports and Waterways

Ports and waterways provide access to transportation options that are cost-effective and produce lower greenhouse gas emissions than other modes. In Massachusetts, port activity is essential to the seafood, construction, and energy sectors as well as the import and export of consumer goods.

Ports and Waterways | Inventory

There are eight major seaports in Massachusetts, listed in Table 5.9. Massachusetts also hosts seven major waterways that facilitate multimodal freight connections to road and rail: New Bedford/Fairhaven Harbor, Mount Hope Bay in Fall River, Woods Hole Channel (road only), Broadway Channel, and Greater Boston's Boston Harbor, Chelsea River, and Mystic River.[77] These facilities are highlighted in Figure 5.21.

TABLE 5.9 INVENTORY OF MAJOR SEAPORTS IN MASSACHUSETTS

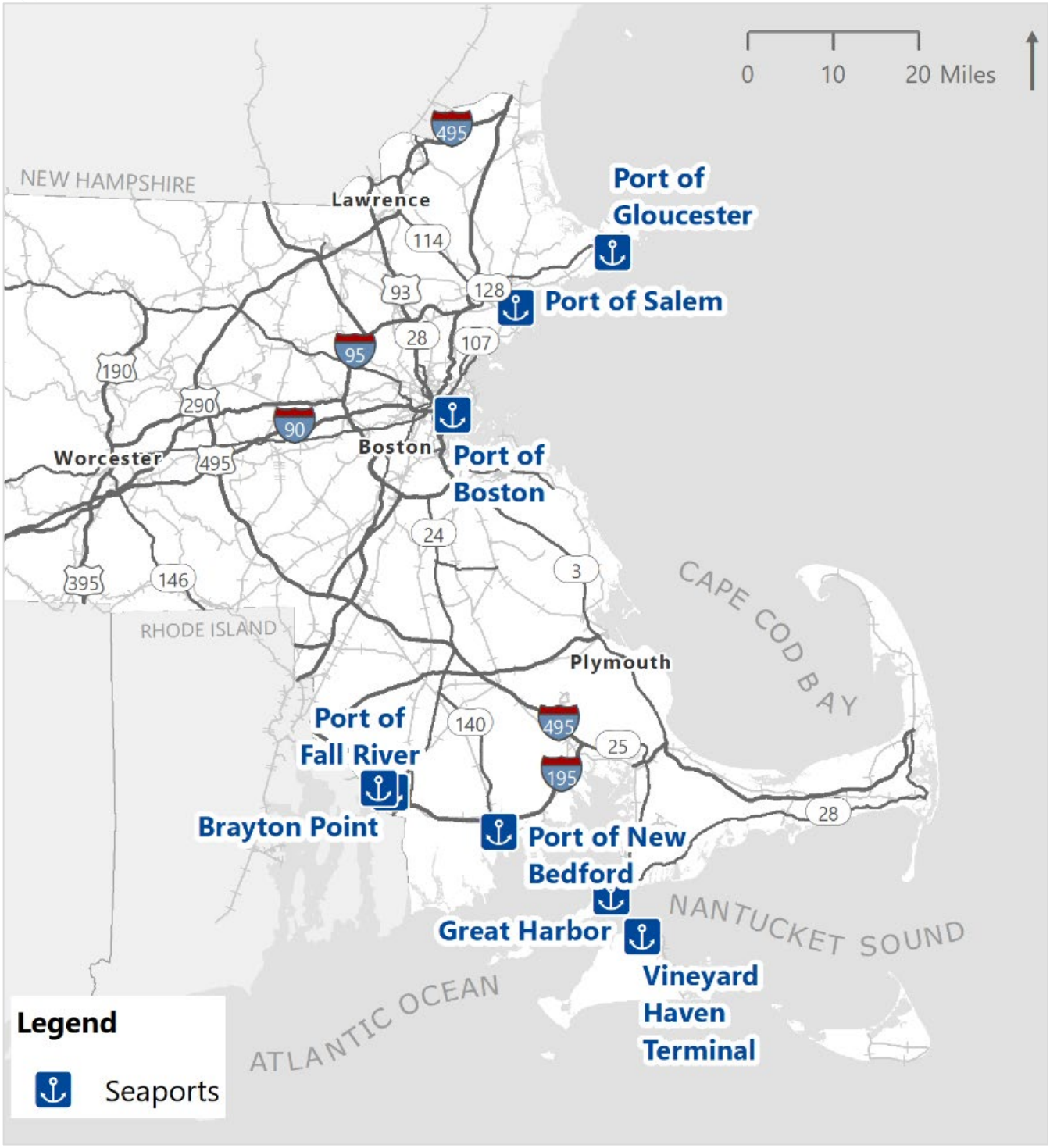
Name	Facility Description	Key Commodities	
Brayton Point	• Deep-water port with 34' draft depths. • Contains an HVDC converter station, crane building, and 20,000 SF of warehouse and office space. • Former coal port redeveloped for renewable energy.	• Vehicles • Petroleum products • Natural gas	• Bulk cargo • Salt • Building supplies
Great Harbor	• Steamship Authority's Woods Hole Terminal for passenger ferry and freight service to Martha's Vineyard. • Construction Phase 5 of 6 of the Woods Hole Reconstruction Project began in 2022. • Hosts prominent marine research vessels.	• Bulk cargo	
Port of Boston	• Handled 98% of waterborne tonnage in Massachusetts in 2019 – 2020. • Conley Terminal is the only full-service container terminal in New England and features two deep channels of 47' and 51', two new 50-foot berths, and seven low-profile STS cranes.	• Vehicles • Lumber and logs • Iron and steel • Leather • Recycled paper • Machinery • Frozen seafood	• Furniture • Petroleum & products • Bulk gypsum • Liquid sulfur • Cement
Port of Fall River	• 8.6-acre facility with a 96,000 SF terminal storage building and two 500-foot berths; the South berth is 600' long and the West berth is 400' long.	• Paper • Latex and chemicals • Frozen fish	• Coal and lignite • Vehicles • Equipment
Port of Gloucester	• Regional commercial fishing hub. • Two 300-foot vessel berths, one 600-foot berth, and one 800-foot berth.	• Seafood	
Port of New Bedford	• 29-acre facility, including 21 acres of heavy-lift capacity and 1,200 feet of bulkhead, with 800 feet of deep draft berthing and 400 feet of barge berthing space. • The highest grossing commercial fishing port in US.	• Seafood • Frozen fish • Petroleum	• Aggregates • Imported fruits

[77] Freight rail access is available at Fall River, New Bedford, and Chelsea Creek. Boston Harbor trackage located in South Boston and Charlestown (Mystic River) is not in use at present.

Name	Facility Description	Key Commodities
Port of Salem	• 32-foot draft depths (second deepest port in Massachusetts).	• Petroleum • Seafood
Vineyard Haven Terminal	• Primary freight entry point to Martha's Vineyard. • 325-foot Union Wharf that provides berthing for two vessels at a time.	• Commercial goods

Source: U.S. Army Corps of Engineers, Massport, MassDOT.

FIGURE 5.21 MAP OF MAJOR SEAPORTS IN MASSACHUSETTS

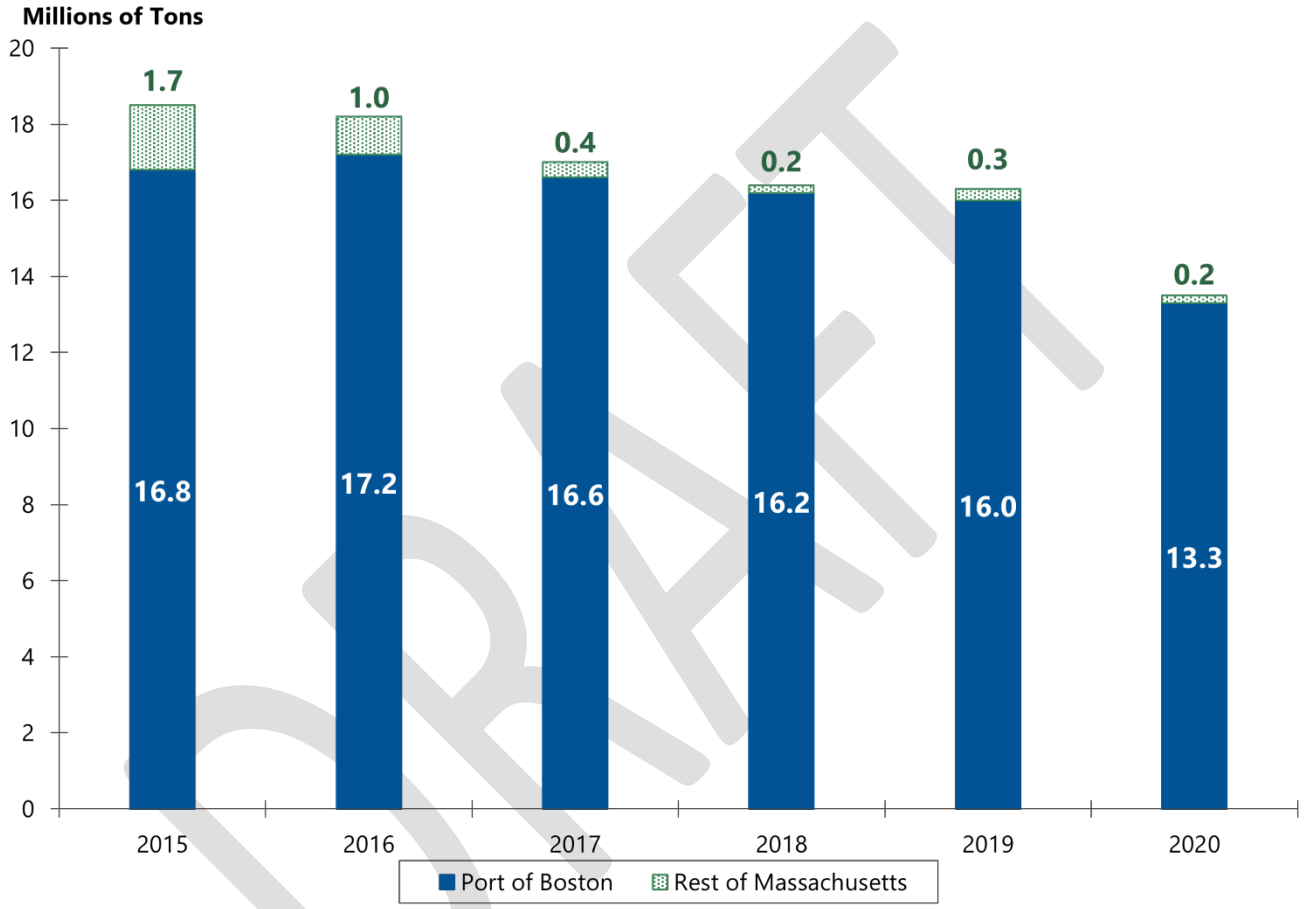


Source: USDOT, Bureau of Transportation Statistics.

Ports and Waterways | Demand

Tonnage processed by all Massachusetts seaports is shown alongside tonnage for the Port of Boston in Figure 5.22 for the years 2015 – 2020. Note that tonnage at ports other than Boston declined prior to the 2020 pandemic year.

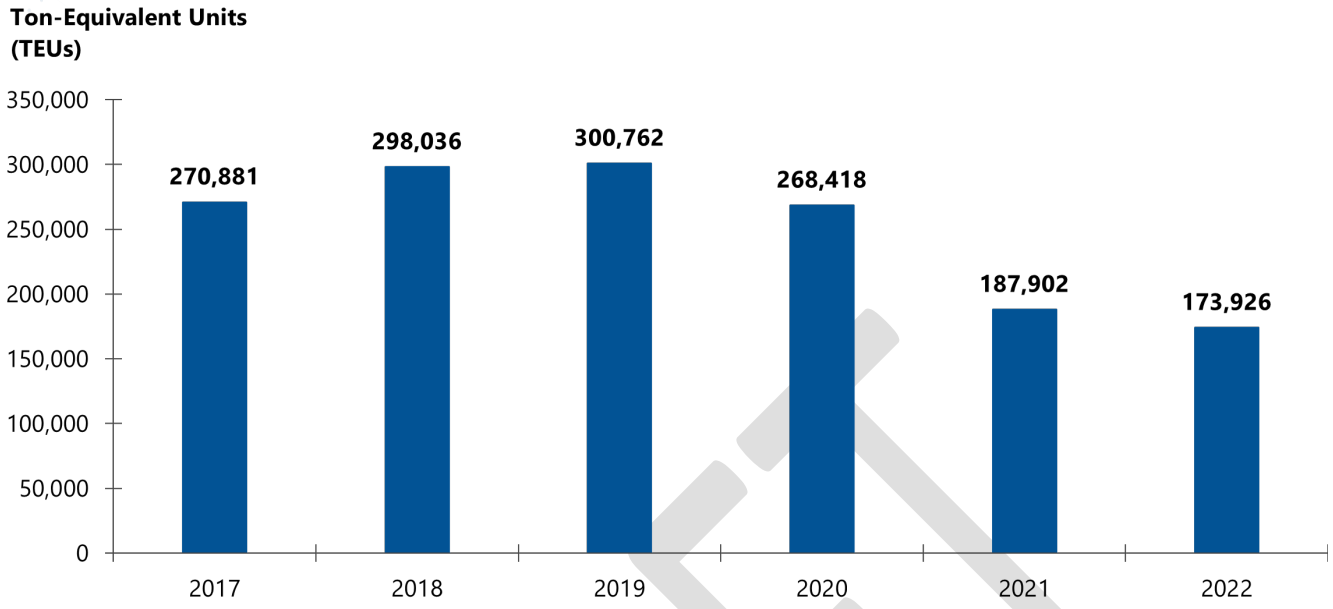
FIGURE 5.22 TONNAGE AT MASSACHUSETTS PORTS AND AT THE PORT OF BOSTON, 2015 – 2020



Source: Waterborne Commerce Statistics Center, U.S. Army Corps of Engineers. https://usace.contentdm.oclc.org/digital/collection/p16021coll2/id/7555.

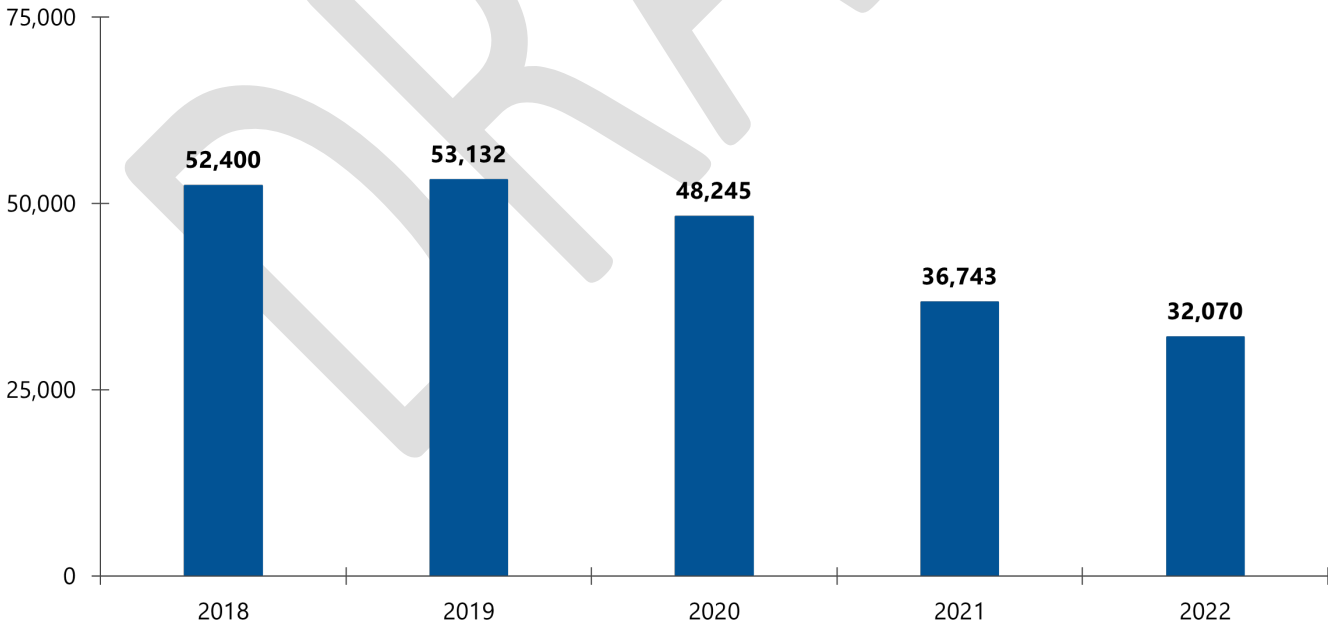
Port of Boston data for the Conley Terminal container port and Autoport are shown in Figure 5.23 and Figure 5.24, respectively. In each case, the Port has yet to recover from the Pandemic after observing some tonnage being moved through other ports due to sudden changes in ship schedules. In the first quarter of 2023, tonnage appeared to be improving and moderate growth (3-7 percent) is forecasted by Massport for the next few years. After $850 million of investment in Conley Terminal, the port is now able to offer four new services with six vessel calls per week, growing from seven to more than two dozen port connections, include Vietnam and India.

FIGURE 5.23 CONTAINER TRAFFIC AT CONLEY TERMINAL, 2017 – 2022



Source: *Massport. https://www.massport.com/conley-terminal/about-the-port/port-statistics/conley-terminal/monthly-volume-summary/.*

FIGURE 5.24 VEHICLES LANDED AT THE BOSTON AUTOPORT, 2018 – 2022



Source: *Massport. https://www.massport.com/conley-terminal/about-the-port/port-statistics/autoport/.*

Ports and Waterways | Needs

Port of Boston

Waterside Conditions: Berthing and Dredging

Since the publication of the *2017 Massachusetts Freight Plan*, Massport has continued to pursue an expansion and enhancement of waterside facilities at Conley Terminal. The new 1,275-foot wharf with two new berths is supported by three new cargo cranes, all taller than those previously on-site. In addition, Massport has dredged the Boston Harbor channel to a depth of 47 feet (previously 40 feet). These improvements will allow larger container ships to call at Boston and increase the port's competitiveness on the Eastern Seaboard. **This project satisfied an immediate strategy "modernize container terminal facilities" from the 2017 Freight Plan.**

Landside Connectivity

Increased traffic congestion and conflicts between commercial and passenger traffic continue to threaten truck access to Conley Terminal. The neighboring Seaport District, also part of South Boston, has experienced unprecedented development over the last 20 years, attracting thousands of new residents and jobs. The South Boston Waterfront population grew 271.1 percent from 2000 to 2010. Careful planning is needed to balance the transportation needs of the three main stakeholders in the area – industrial park businesses, seaport businesses, and South Boston residents – and expanding freight road designations in South Boston may further these efforts. **Doing so will partially satisfy an immediate strategy "maintain uncongested access to airports, seaports, and rail terminals in mixed-use urban settings" from the 2017 Freight Plan.**

Expanded Infrastructure and Service Offerings

Massport is exploring the development of South Boston Marine Multiport's North Jetty as a multi-purpose cargo handling facility in a public-private partnership to become a distribution center for bulk goods and project cargo (such as components for offshore wind development). The revitalization of the North Jetty would provide an opportunity to meet dry bulk and special cargo demands in Boston and throughout the New England region. The development of this facility would require reconstruction of the existing pier and bulkhead, maintenance dredging of the berth, construction of mooring and support infrastructure, elevation and rehabilitation of nearly 14 acres of adjacent uplands, and improvements to Fid Kennedy/Northern Avenue/Haul Road as a new, key freight spine to support these activities.

Massport also expects better utilization of berths on Chelsea Creek, which may benefit from Massport-owned rail right of way which is operated by CSX. MassDOT collaborated with Massport to purchase the Mystic Branch right of way in Charlestown for future use as a freight corridor, either a rail connection or a truck route. The Mystic Branch right of way is the only potential direct rail-to-dock multimodal connection in Massachusetts, and there is a need for maintaining the potential of the right of way for freight by rail in the future.

Other Massachusetts Ports

- **New Bedford |** There is demand to fully dredge the local channel to its authorized depth of -30 MLLW. There are at least 22 different properties and areas that need and are eligible for Enhanced Remedy Phase V dredging. Additionally, a significant component of the MBTA's South Coast Rail project that will bring passenger service to Fall River and New Bedford entail infrastructure improvements that will allow improved freight rail service to the area, including service to the ports of New Bedford and Fall River. These improvements are being leveraged through new freight rail customer investments, including a 2022 MassDOT IRAP grant of $361,669 to Ice Cube Cold Storage Maritime for rail access improvements.[78]

- **Vineyard Haven |** A 2020 MassDOT research project identified Vineyard Haven as the most feasible site on Martha's Vineyard to receive shipments of non-bulk freight from off-Cape points of origin using Steamship Authority infrastructure. Vineyard Haven's working waterfront may offer alternative sites. Landside traffic circulation is likely a critical challenge for such an expansion and MassDOT will be studying challenges in 2023.

Air Cargo

Airports provide fast, reliable transportation options to shippers and receivers. Due to size limitations and the relatively higher cost compared to other modes, air freight is used when goods are time-sensitive and high-value, and relatively lower volumes compared to other freight modes.

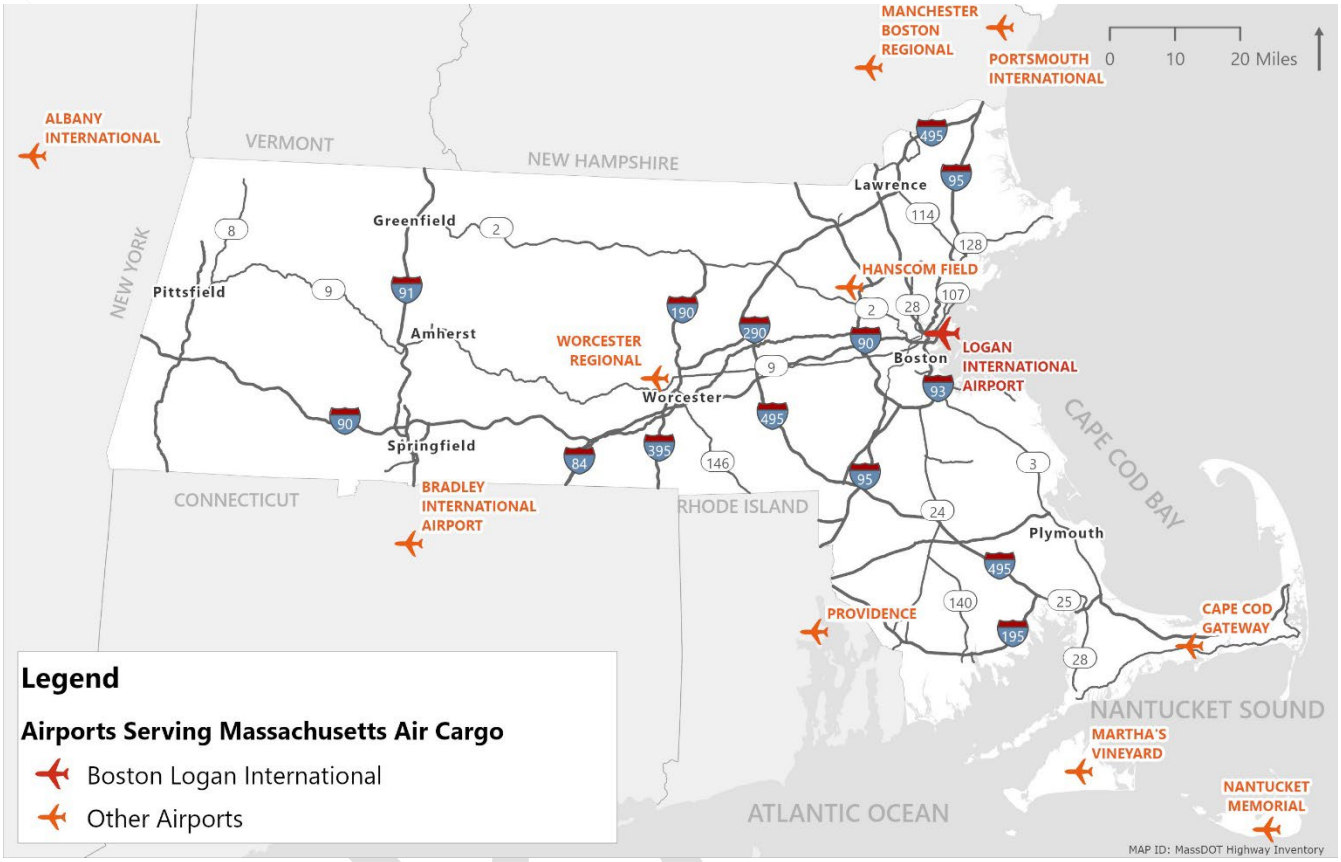
Air Cargo | Inventory

Air cargo in Massachusetts is primarily processed at Boston Logan International Airport (99 percent). Logan Airport cargo is approximately evenly split between integrated logistics shippers ("all-cargo" carriers such as FedEx and United Parcel Service) and passenger airlines that carry cargo in the luggage hold (known as "belly" freight). A critical component of belly freight is international air service, which carries the majority of belly cargo at Logan. Six other airports offer commercial service across the Commonwealth and can accept belly cargo from passenger flights; five of these reported processing cargo in 2021.

Regionally, cargo operations exist at airports in surrounding states: T.F. Green International in Rhode Island; Bradley International in Connecticut; Manchester-Boston Regional and Pease International in New Hampshire; and Portland International Jetport in Maine. General aviation airports across Massachusetts can accept cargo carried in smaller aircraft. These locations are mapped in Figure 5.25.

[78] https://www.southcoasttoday.com/story/news/local/2022/09/08/state-rail-grant-benefit-new-bedford-port-seafood-firm-add-5-jobs/8025686001/

FIGURE 5.25 AIR CARGO FACILITIES SERVING MASSACHUSETTS



Air Cargo | Demand

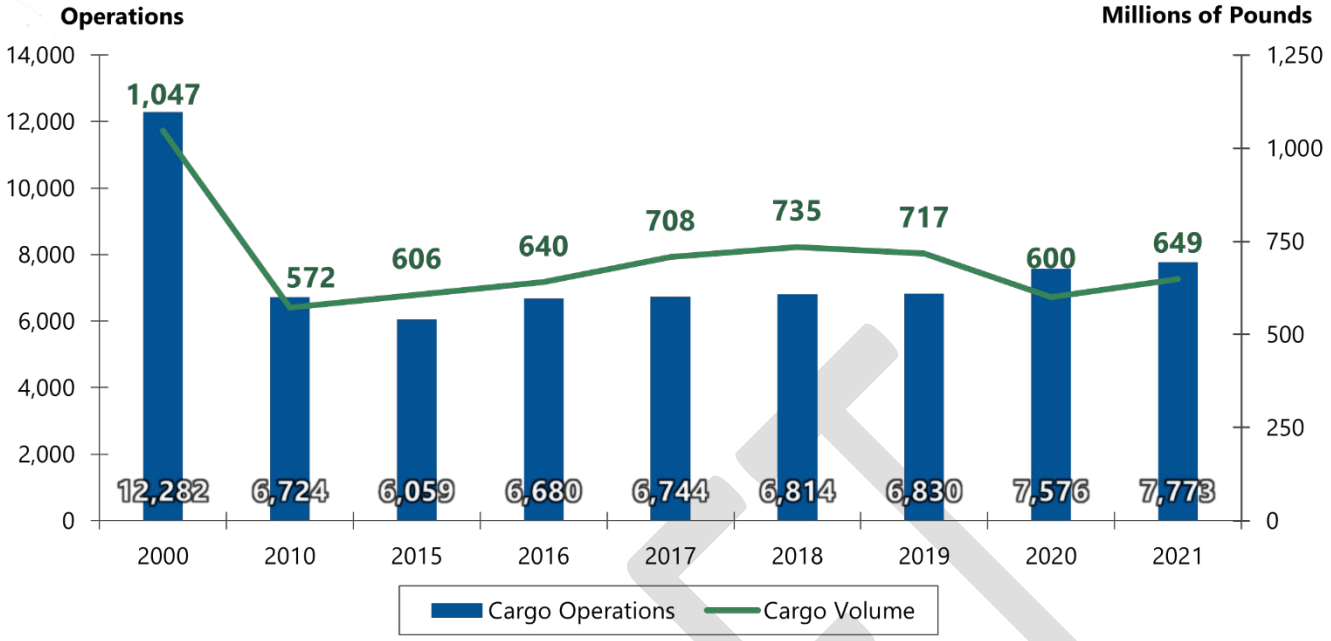
Per Massport,[79] in 2021 Logan Airport ranked 25th among U.S. airports in total air cargo volume.[80,81] Total air cargo volume at Logan Airport declined to 600 million pounds in 2020, compared to over 717 million pounds in 2019. However, Logan Airport's total air cargo volume increased to 649 million pounds in 2021, which represents 90.5 percent of 2019 volumes.

Air cargo is carried either in the belly compartments of passenger aircraft or by dedicated all-cargo carriers, such as FedEx, UPS, and DHL in all-cargo aircraft. The express/small package category continued to dominate Logan Airport cargo activity, accounting for 71 percent and 62 percent of the total non-mail cargo volumes in 2020 and 2021, respectively.

Figure 5.26 shows cargo aircraft operations and cargo volume trends at Logan Airport. In both 2020 and 2021, the number of dedicated all-cargo aircraft operations at Logan Airport exceeded 2019 cargo activity levels by 11 percent and 14 percent, respectively, although total cargo volumes remained below 2019 cargo levels.

[79] Boston Logan International Airport 2020/2021 Environmental Data Report, November 2022. https://www.massport.com/media/menn3uln/2020-2021-logan-environmental-data-report.pdf p. 2-30 – 2-32.
[80] U.S. DOT. T-100 Database. Total cargo volume includes mail.
[81] Air cargo includes express/small packages, freight, and mail.

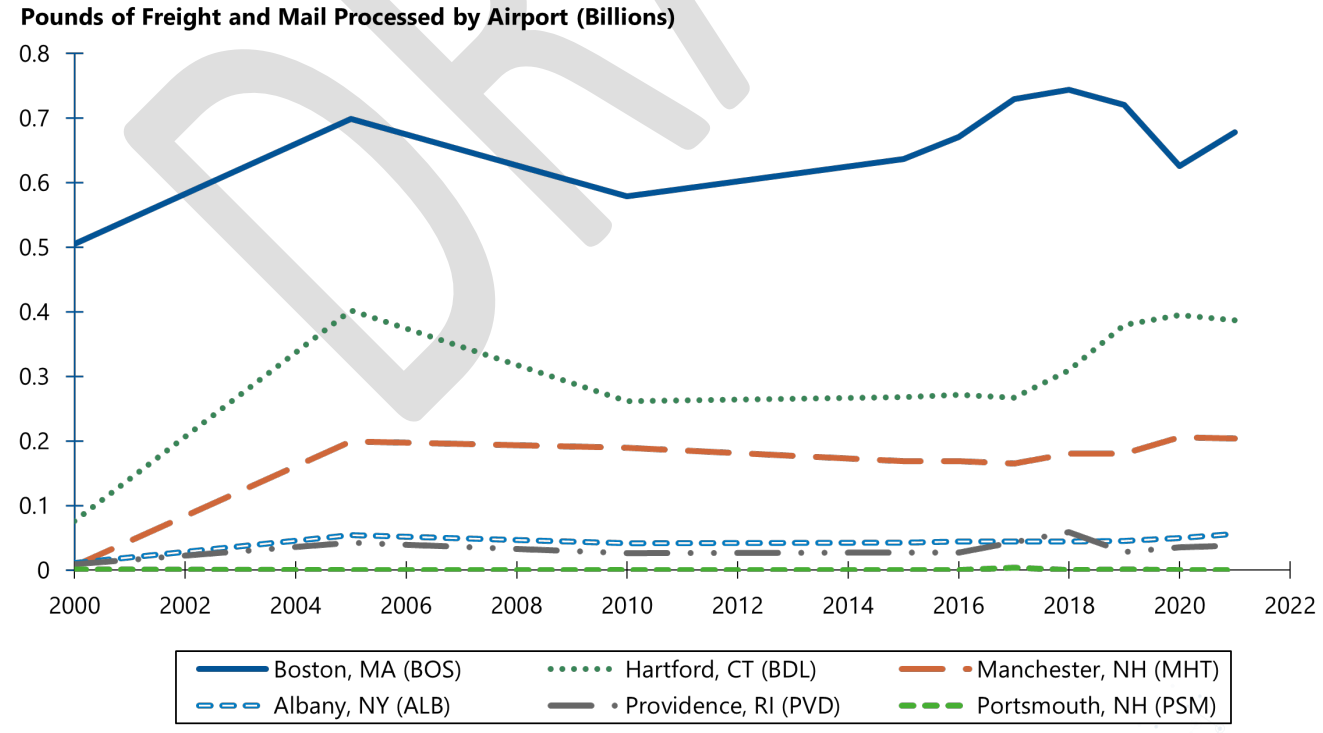
FIGURE 5.26 CARGO AND MAIL OPERATIONS AND VOLUME AT LOGAN AIRPORT, 2000 – 2021



Source: Bureau of Transportation Statistics T-100 Data.

Compared to 2000, all-cargo operations over 2021 at Logan Airport declined by 37 percent, while total cargo volume declined by 38 percent. Figure 5.27 places trends at Logan in a regional context, illustrating historical fluctuations and highlighting the steep plummet from 2019 due to the pandemic.

FIGURE 5.27 FREIGHT AND MAIL BY YEAR AT AIRPORTS SERVING MASSACHUSETTS, 2000 – 2021



Source: Federal Aviation Administration. Form 41 T-100 All Carrier Statistics Data. 2000, 2005, 2010, 2015 – 2021.

Massport reported observations of air cargo demand at Logan:

- FedEx was the largest air carrier by cargo volume carried through Logan Airport in 2020 and 2021, transporting over 278 and 297 million pounds[82] (each representing approximately 46 percent of Logan Airport's total cargo volume), respectively.
- UPS was the next largest cargo operator and accounted for approximately 11 percent of Logan Airport's cargo volume in 2020 and 2021.
- Passenger airlines (via belly cargo) carried 31 percent (188 million pounds) of Logan Airport's cargo in 2020 and 39 percent (255 million pounds) in 2021. In comparison, 412 million pounds and 395 million pounds flew on all-cargo carriers in 2020 and 2021.

Massport's roadmap to net zero greenhouse gas (GHG) emissions by 2023 includes pursing electrification and decarbonization initiatives at both Logan Airport and Conley Terminal, and opportunities may be available through the Northeast Regional Hydrogen Hub funding opportunity through the U.S. Department of Energy.

Air Cargo | Needs

Landside Connectivity

Massport has indicated a need for a better roadway connection to the North Service Area and North Cargo Area. In addition, the Coughlin Bypass plays a key role in connecting Logan Airport to key industrial areas in Chelsea, Everett, Route 1A, and beyond – and along with other connecting truck routes – is essential for goods movement to and from Logan facilities and enables truck drivers to avoid the use of local streets. In general, protecting freight access and designated freight corridors is increasingly important given the surge in residential and commercial development in Boston.

Cargo Handling Facilities

There is an increasing demand for air cargo – largely attributed to growing demand for e-commerce. However, capacity for dedicated air cargo has shrunk over time. Logan Airport has seen its square footage for cargo processing reduced by 50 percent in recent years to make space for passenger facilities. The Terminal E Modernization project will increase Logan Airport's capacity for international belly freight. Massport continues to pursue opportunities to make air cargo processing at Logan more efficient to get the most value out of limited space, such as off-airport processing to allow cargo to move through the facility without being stored at the airport. The Logan Airport cargo operation includes several service areas owned by Massport on the airport property, as shown in Figure 5.28. Cargo is serviced from two areas on the airfield; as of 2019, approximately 1.2 million square feet of warehouse space was within 15 miles of the airport. Other details include:

- On-Airport (274,000 square feet):
  - North Cargo Area: 1 warehouse (17,000 sf) and 3 aircraft positions

[82] This includes express/small packages, freight, and mail.

  - South Cargo Area: 5 warehouses (257,000 sf) and 6 aircraft positions

- Off-Airport (30+ businesses in approximately 1.2 million square feet):
  - Chelsea (Eastern Avenue and Griffen Way): 264,000 square feet (ground floor), with approx. 200 truck docks serving 13 companies
  - East Boston (McClellan Highway & Chelsea Street): approx. 300,000 square feet, with 150 truck docks serving 13 companies
  - South Boston (at or close to Conley Terminal): approx. 425,000 square feet, with 70 truck docks serving 6 companies
  - International Cargo (North at Route 128): 170,000 square foot facility

In addition to Logan, Massport continues to explore opportunities to increase Worcester Regional Airport's attractiveness as a gateway for additional air freight and has invested more than $100 million on upgrades and marketing of this location in recent years.

FIGURE 5.28 CARGO AREAS AT LOGAN INTERNATIONAL AIRPORT

Source: Massport

6 FUTURES FOR FREIGHT IN MASSACHUSETTS

MassDOT has established Scenario Planning as a core element of its planning processes, beginning with the *2017 Massachusetts Freight Plan* and including *Focus40* (the MBTA long-range plan)[83] and *Beyond Mobility*.[84] Scenario Planning brings awareness of uncertainty and risk into decision-making.

For this Freight Plan, MassDOT has carried forward the scenario planning process from *Beyond Mobility* including the variables and plausible futures. This aligns the Freight Plan with the Department's long-range plan and helps ensure consistency in recommendations.

DEFINITION OF SCENARIO PLANNING

A process to support decision-making that helps urban and rural planners navigate the uncertainty of the future in the short and long term.

A scenario planning process begins by scanning the current reality, projected forecasts, and influential internal and external factors to produce a set of plausible potential futures (i.e., scenarios).

It then develops a series of initiatives, projects, and policies that may help support a preferred scenario, a component of a scenario, multiple scenarios, or all scenarios.

Indicators that a scenario component is likely to occur may be established to alert planners that the likelihood of a scenario becoming a reality is higher, prompting them to take action on appropriate tactics such as allocating funding and moving into implementation.

—American Planning Association (APA)

Fundamentals of Scenario Planning

In general, a scenario plan does the following:[85]

- **Defines a question** that includes a subject (what you are studying), a horizon (how long into the future you are looking), and an objective (what you are trying to influence or accomplish).
- **Identifies a set of variables** whose behavior will drive change out to the horizon. For each of these, the study typically establishes both a snapshot of the current state and the ongoing trend for each variable, based on recent history.
- **Envisions scenarios (or plausible futures)** either by establishing a range of possible progressions for each of the variables and weaving them together in ways that make sense or by working with expert

[83] https://www.mbtafocus40.com/region-in-2040.
[84] https://beyond-mobility-massdot.hub.arcgis.com/#future.
[85] https://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP08-36Task145/NCHRP_08_36_145_FINAL_Report.pdf.

advisors to define storylines and snapshots of futures and analyzing how variables could evolve to make each a reality.

- **Achieves productive outcomes,** potentially by identifying a desired future and then identifying strategies and actions that would make it more likely. Alternatively, this could be achieved by identifying strategies and actions that could be helpful in the widest possible range of equally plausible futures. It may also be helpful to set milestone time points at which it would become clear how the future is playing out.

The above process was followed in the *2017 Massachusetts Freight Plan* and will be continued for this plan. The Scenario Planning process first identified "drivers of global change"; then plotted possible outcomes for each driver; and finally developed plausible futures based on logical combinations of those pathways. The drivers identified were urbanization, globalization, technology, knowledge, and climate, which were assembled into three plausible futures titled "Commonwealth Quo", "Innovation Acceleration", and "Picket Fences". The products of this effort from the 2017 Plan are summarized in Figure 6.1. The three plausible futures are shown alongside an approximation of the reality of the past five years on the same four axes.

FIGURE 6.1 REVIEW OF SCENARIO PLANNING IN THE *2017 MASSACHUSETTS FREIGHT PLAN*

Trends

As "drivers of the future" were identified for the *2017 Massachusetts Freight Plan*, the 2023 Freight Plan draws on the trends described in *Beyond Mobility*. These trends were identified by a collaborative effort of subject matter experts from across the Department in late 2021. Research to support these trends was conducted in early 2022 and included government, industry, academic, and journalistic sources.

Each trend was studied as a combination of several related variables. Table 6.1 summarizes the freight angle on each trend and its accompanying variables.

TABLE 6.1 *BEYOND MOBILITY* TRENDS, VARIABLES, AND FREIGHT-SPECIFIC CONSIDERATIONS

Trend	Variables	Freight-Specific Considerations
Climate Change	• Sea level rise • Extreme temperatures & energy needs • Severe weather	• Threats to the well-being of the freight workforce. • Damage and disruptions to critical electricity, roadways, runways, railroad tracks, and businesses/facilities. • Changes to patterns of national and global trade as businesses and consumers adapt and evolve. • Limitations on future development.
Future-of-Work	• Flexible work schedules • Labor shortage • Telepresence	• Challenges with attracting and retaining workers in freight-intensive sectors. • Barriers to job access such as childcare, affordable housing, transportation, and workforce readiness.
People & Places	• Aging population • Household size • Migration to Massachusetts • Housing • Workplaces	• Shifting demographics result in changes to consumer demand & spending, exacerbated by same-day or next-day delivery expectations. • Conflicts between residential areas and the traffic and noise generated by freight facilities (e.g., distribution centers, truck parking, railyards, seaports). • Vehicle size and weight concerns, including delivery vehicles in residential areas. • Friction between residential and industrial land uses in an environment of high land values and a shortage of housing.
Prosperity	• Cost of transportation • Income inequality • Knowledge Economy • Racial wealth gap	• Unpredictable product shortages and freight transportation services hurt businesses & workers. • Concerns with wage growth, as well as the size and diversity of labor pool, making recruitment to new populations increasingly critical for freight-intensive jobs. • Economic benefits are not equal across freight-intensive sectors.
Technology	• Automation • E-Commerce • Electricity & alternative energy • New mobility	• Complicated relationship between new technologies, regulations, infrastructure, and behaviors. • Growth in renewable energy is critical, but vulnerable to economic shifts and other variables. • New vehicle types have different energy usage, size & weight, safety considerations, and costs. • E-commerce has brought frequent freight traffic to city centers with millions of square feet in Massachusetts to warehousing & distribution. • Increased vehicle miles traveled results in more congestion and wear and tear on roadway infrastructure. • Intelligent transportation systems (ITS) and active transportation and demand management (ATDM) systems may evolve to better support truck operations and safety.

Scenarios

In explorative scenario planning, scenarios are defined as a set of equally plausible futures that together represent a broad swath of uncertainty for each trend. *Beyond Mobility* accomplished this by defining scenarios around the three pathways used in the trends analysis: with the past five years (approximately) as a baseline, each trend can accelerate, maintain its current course, or plateau/reverse in the years ahead.

Broadly, then, the scenarios presented here represent a status quo in Massachusetts that accelerates in its recent changes, continues on a straight line, or begins to revert in some areas. Each scenario was refined and revised with the intent that the conditions described were realistic and would logically take place simultaneously. The three scenarios produced for *Beyond Mobility* and adopted for the 2023 *Massachusetts Freight Plan* are:

- **Hybrid and Diverse |** In this scenario, increased automation, telework, and flexible scheduling transform work in Massachusetts. At the same time, we see more international in-migration and domestic out-migration due to rapid technological innovation and climate change.
- **Ahead as Before |** In this scenario, a strong Knowledge Economy is challenged by high cost-of-living and a racial wealth and income gap in the Boston Area, while new opportunities arise in manufacturing and energy in other regions of Massachusetts.
- **Close and Connected |** In this scenario, employment largely resumes in-person. Substantial growth in manufacturing – spurred in part by 3D printing and micromanufacture – and a weakening information sector spread housing demand more evenly in a divided economy.

For each of these scenarios, this section presents a general narrative and then a "freight angle". In addition, each scenario is defined graphically using all the variables analyzed in *Beyond Mobility* (each trend in the prior section rolls up several variables).

It is important to note:

- **Each of these scenarios is viewed as equally likely.**
- **Each of these scenarios is viewed broadly as equally desirable.**
- **The future is likely to comprise elements of all of the scenarios.**

This contrasts with studies in which trends are either assumed to be constant or are generated through educated guesswork. The flaw of planning based on a single forecast is that, if the "most likely" future fails to occur, investments may be less effective, ineffective, or even counterproductive. There is also an opportunity cost – investing in the wrong solutions implies that not enough was invested in the right ones.

Scenario 1 | Hybrid and Diverse

IN THIS SCENARIO, FREIGHT-INTENSIVE JOBS HAVE SUBSTANTIALLY DISAPPEARED DUE TO INNOVATION AND AUTOMATION. THE POPULATION OF MASSACHUSETTS GROWS SLIGHTLY BUT BECOMES SUBSTANTIALLY YOUNGER AND MORE DIVERSE.

This scenario is roughly what happens if all 5 – 10-year trends from 2012 – 2022 accelerate through 2050. It is named after hybrid work and telepresence, as these are defining facets of Bay Staters' lives – 40 percent of workdays are remote, including the vast majority of those in white collar industries. Eased Federal immigration policies and the continued strength of the Commonwealth's academic brand cause inward migration to skyrocket, but this trend is countered by substantial domestic out-migration as hybrid workers choose to move to rural areas or to cheaper metropolitan areas. This trend is only exacerbated by soaring housing prices, which have increased by more than 25 percent, accounting for inflation. As work-from-home has spread housing demand across the Commonwealth, the growth in housing prices and resulting displacement is significantly greater in some areas farther from Boston, complicating freight and residential land use conflicts.

Biotechnology explodes in Massachusetts, with laboratory facilities centered in mixed-use "villages" in inland areas of the Commonwealth. Freight-intensive jobs and goods movement delivery are increasingly automated due to innovation and a stagnant labor pool. Substantial investments in ITS are necessary to manage a high degree of automated freight movement, including long-distance trucks and neighborhood delivery drones on sidewalks and in curb areas.

Summers have become hotter (30+ more days per year over 90 degrees) and the whole year has become wetter, making some parts of the state more vulnerable to flood damage. The shift of all types of industry and commerce away from the coast and other flood-prone areas both relieves and complicates freight movement and access to freight-intensive jobs. While more capacity is available on roads in the South Boston, East Boston, Everett, and Chelsea areas for freight traffic from seaports and airports, the distributed economic "villages" are not all equally accessible by highway or rail for delivery of raw materials, shipping of products, and provision of food, fuel, and consumer goods to facilities and distribution hubs.

Scenario 2 | Ahead as Before

This scenario is roughly what happens if all 5 – 10-year trends from 2012 – 2022 maintain through 2050. It is characterized by the continued popularization of hybrid work models in industries where it is possible, with approximately one-fifth of working days being remote. As older workers leave the workforce, they are not replaced by younger generations, leading to persistent labor shortages and inflation as higher wages filter down to consumer prices.

Massachusetts's Knowledge Economy maintains its strength in biotechnology but plateaus in other high-tech sectors, as employers could no longer justify the high cost-of-living in Boston relative to competing metropolitan areas. Biotechnology in particular has unique freight needs that become more prominent in this scenario. Historically, biomanufacturing in Massachusetts was limited to research samples, which required small, rapid, critical shipments that often used air cargo. In the aftermath of COVID-19, the Commonwealth could see the development of large-scale manufacturing facilities for RNA vaccines for a variety of diseases. The cargo movement needs for these clusters become paramount in a concentrated biotech economy.

IN THIS SCENARIO, A STRONG KNOWLEDGE ECONOMY IS CHALLENGED BY A HIGH COST-OF-LIVING IN THE BOSTON AREA, WHILE NEW OPPORTUNITIES IN MANUFACTURING AND ENERGY ARISE IN OTHER REGIONS OF MASSACHUSETTS.

Much of the area's conventional office square footage is converted to or replaced by research labs and distribution centers for e-commerce. Housing prices continue to be high but do not experience exponential growth, as communities build a moderate number of new residences. The dynamic of current trends continuing at current pace leads to ever-intensifying challenges and needs along current lines. Needs for truck parking, freight workforce development, driver assistance and automation, asset management, and congestion/bottleneck improvement become more prominent with each passing year.

Scenario 3 | Close and Connected

This scenario is roughly what happens if all 5 – 10-year trends from 2012-2022 plateau or reverse through 2050. The ultimate transition of COVID-19 to an endemic disease brings workers back to the traditional office through a combination of corporate pressure and desire to maintain a work-life balance. Automation supports but does not supplant freight-intensive employment, and manufacturing grows in Central, Western, and Southeastern Massachusetts through on-shoring and 3D printing as automation makes American workers more productive overall than unassisted labor in developing countries.

IN THIS SCENARIO, EMPLOYMENT LARGELY RESUMES IN-PERSON, AND SUBSTANTIAL GROWTH IN MANUFACTURING AND OTHER INDUSTRIAL ACTIVITY OCCURS OUTSIDE I-495, WHILE THE KNOWLEDGE ECONOMY CLUSTERS INSIDE I-495.

At the same time, the combination of remote schooling and successively smaller generations causes the consolidation of a plateaued Knowledge Economy in Boston, Cambridge, and Somerville. As non-biotech, high-tech companies are also seeking space close to these institutions, job density in Kendall Square, the Seaport, and Longwood continues to grow. The concentration of affluence and business activities in a single urban center places substantial strains on the current freight system. Coupled with the relative weakness of automation and electrification, communities in the urban core struggle to manage last-mile deliveries and the curb. This is a particularly acute issue in high-demand mixed-use districts such as Kendall Square, Longwood/Fenway/Kenmore, and the South Boston Waterfront. At the same time, congestion threatens to choke off critical freight nodes in South Boston, East Boston, Everett, and Chelsea.

Housing costs approximately plateau across the Commonwealth as a divided economy (knowledge inside I-495, industrial outside) spread demand for housing evenly. Nonetheless, underserved residents are effectively priced outside of Route 128, and adequate job access for freight-intensive workers becomes a critical concern. In addition, electric and autonomous commercial vehicles fail to gain adoption and the demand for long-distance trucking services and drivers continues to increase in order to bring Massachusetts all of the food and consumer goods it does not produce.

Implementing Scenarios – Robust Decision-Making

While all of the scenarios discussed in the prior section are seen as equally likely and desirable, recommendations must serve immediate needs in line with the vision and goals outlined in Chapter 2. As was the case for the *2017 Massachusetts Freight Plan*, the Department has employed "Robust Decision-Making" (RDM),[86] a process by which potential recommendations are grouped into five categories, which are outlined in Chapter 7.

[86] https://www.rand.org/pubs/external_publications/EP67834.html.

7 RECOMMENDATIONS & STRATEGIES

The 2023 Massachusetts Freight Plan carries forward the recommendations framework established in the *2017 Massachusetts Freight Plan*, which was based on three categories as defined by the FHWA: infrastructure improvements, operational innovations, and policies. MassDOT expanded the final category to "policies and people" to emphasize the human element of the freight system, which recognizes the importance of the workforce and the community, aligning with MassDOT's focus on customer service.

The strategies presented in this chapter were derived from the following sources:

- Findings from the research and technical analysis, as discussed in Chapters 4 and 5.
- MassDOT priorities, as documented in ongoing or recent prior studies, such as *Understanding the Impacts of the COVID-19 Pandemic on the Massachusetts Freight Network and Planning* (2022).
- Priorities for other Massachusetts agencies engaged in freight, including Commonwealth agencies, Massport, regional planning agencies, and municipalities.
- Industry priorities as gathered through stakeholder interviews and engagement with the Freight Advisory Committee.
- Best practices from FHWA, other states, municipalities, and academia.

Each strategy is organized within four categories, which are designed to help MassDOT prioritize when each should be actioned. These categories include:

- **Immediate Strategies** address a current or near-term need. They are worthwhile ideas today, no matter what the future holds. *For example, improving the condition of freight system assets.*
- **Robust Strategies** address issues that are expected to arise in the future and will likely be appropriate across all possible scenarios. *For example, protecting freight system assets and operations from climate change and extreme weather impacts.*
- **Hedging Strategies** might not be needed, but if they are, we would need to start implementing them now. *For example, encouraging low-impact freight and industrial development in urban locations.*
- **Shaping Strategies** allow Massachusetts agencies to influence – and hopefully direct – trends for the future. *For example, improving and preserving freight connections to/from Boston's waterfront freight facilities.*

This process allows for Massachusetts to be resilient and prepare for circumstances beyond what the scenarios described. Table 7.1 and Table 7.2 summarize the strategies by category.

TABLE 7.1 SUMMARY OF STRATEGIES AND RECOMMENDATIONS – IMMEDIATE

Type	Immediate Strategies
Infrastructure Improvements	• Improve the condition of freight network assets • Build and expand truck parking facilities on primary truck routes across Massachusetts in alignment with recent studies and recommendations • Resolve identified truck bottlenecks • Upgrade freight rail lines in Massachusetts to 286K standard • Maintain uncongested last-mile access to freight-generating facilities • Build right-sized distribution centers inside Route 128 • Develop delivery areas in urban districts and town centers • **Analyze and improve lighting conditions on corridors with higher rates of truck-involved crashes** • **Improve safety at highway-rail grade crossings** • **Incorporate rumble strips into new and existing interstate & rural roadways**
Operational Innovations	• Develop Intelligent Transportation Systems (ITS) and Active Transportation and Demand Management (ATDM) • **Establish a framework for prioritizing multimodal freight projects with a focus on equity** • **Emphasize the need for timely and accurate reporting of crash data involving freight vehicles or at-grade rail crossings**
Policies & People	• Support policies to reduce greenhouse gas emissions from transportation • Harmonize interstate oversize/overweight movements, permitting, and large truck restrictions across New England • Coordinate freight planning with neighboring states • Support and promote freight-related workforce development • Provide collaborative guidance and support to MPOs and local governments in integrating freight, distribution, and loading into their planning and zoning land use decision-making processes • **More fully integrate freight planning into MassDOT activities** • **Promote driver education on stopping distances when operating at higher speeds and/or on high-speed roads** • **Promote road user education on safe vehicle operation and visibility around trucks**

*Note: Strategies denoted in **dark blue** are new to the 2023 Massachusetts Freight Plan.*

TABLE 7.2 SUMMARY OF STRATEGIES AND RECOMMENDATIONS – ROBUST, HEDGING, AND SHAPING

Type	Robust Strategies	Hedging Strategies	Shaping Strategies
Infrastructure Improvements	• Protect freight system assets and operations from climate change and extreme weather impacts • Build standardized small package drops • Encourage increased use of underutilized gateway infrastructure (ports and airports) • Identify and preserve appropriate existing industrial sites for freight-intensive development	• Electrify truck stops	• **Reduce the number of at-grade crossings** • **Improve and preserve freight connections to/from Boston's waterfront freight facilities**
Operational Innovations	• **Study and perform curbside demand management** • **Explore and incorporate real-time and other new data sources to better understand freight movements** • **Use critical freight corridors to support and advance projects that improve multimodal freight mobility**	• Improve the efficiency of air cargo processing at Logan Airport and in surrounding areas	• **Encourage e-bicycle/cargo bicycle delivery** • **Deploy safety upgrades such as convex/crossover mirrors, lane departure warning, blind spot detection, and backup cameras in MassDOT truck fleet** • **Deploy lateral protective devices (side guards) in MassDOT truck fleet**
Policies & People	• **Consider opportunities to improve MassDOT design guidance, policies, and procedures to protect against extreme weather and reduce local air pollution, flooding & stormwater runoff, and wildlife habitat loss** • **Promote efforts to increase fatigue awareness among truck drivers and operators**	• **Improve freight worker access to transit** • **Support low-impact freight and industrial development in urban locations** • **Support action to preserve industrial land uses in the Boston area**	• **Study and update building codes to allow for more efficient deliveries** • **Study and modify municipal zoning codes to allow for neighborhood micro-hubs and other in-town warehouse spaces** • **Support efforts to reduce distracted driving and control the use of handheld electronic devices while driving** • **Study and support the development of Advanced Air Mobility (AAM)**

*Note: Strategies denoted in **dark blue** are new to the 2023 Massachusetts Freight Plan.*

Immediate Strategies

Infrastructure Improvements

Improve the Condition of Freight Network Assets

MassDOT currently tracks the condition of its highway pavement, bridges, tunnels, and signage through inspections and FHWA reporting. Further, MassDOT has significant records of the condition of rail track, right-of-way, and bridges. MassDOT reported in 2021 that 12.2 percent of its bridges, 3 percent of its lane-miles of non-Interstate pavement, and 0 percent of its Interstate pavement are in "poor" condition.

Continued investment to improve the state-of-good repair of these assets – to inventory and inspect them – aligns with MassDOT's first investment priority. While MassDOT places its first priority on reliability when making capital investments, it is always possible to do more and to do better.

Pursuing this strategy may involve:

- Creation of a feedback mechanism for the industry to report infrastructure issues that significantly impact their business (bridge weight limits, for example).
- For MassDOT-owned assets, inclusion of a priority boost into project selection tools for assets and projects located on the National Multimodal Freight Network.
- For locally owned assets, inclusion of a priority boost into Municipal Small Bridge Program selection processes for assets and projects located on the National Multimodal Freight Network.
- Consideration of heavy truck traffic as part of the asset condition project selection process.

Build and Expand Truck Parking Facilities on Primary Truck Routes Across Massachusetts in Alignment with Recent Studies and Recommendations

The lack of adequate rest and service facilities for trucks along major corridors impacts both the efficiency and the safety of the freight system. MassDOT's "Freight Planning for Immediate and Robust Strategies" study recommendations focus in large part on addressing the need for truck parking along several Interstates throughout the Commonwealth, specifically:

- Implementation of new truck stop facilities at three target areas – I-395 near the state line, I-95 near the I-93 interchange, and I-495 north of the I-290 interchange – to eliminate gaps between truck parking facilities, which has the potential to enhance the efficiency of the freight truck industry and improve safety on the Commonwealth's roadways.
- Expansion of existing facilities where demand exceeds supply, including the I-95 Service Plaza (southbound) south of I-90 and all 11 service plazas on I-90.

MassDOT has completed additional work, "Statewide Truck Parking Improvements" (2022), which looked more closely at three target area locations for additional truck parking and identified four sites to be advanced for further consideration:

- Berlin – Taylor Road off of Route 62 (Central Street), in close proximity to the exit 26 interchange with I-495.
- Westwood – Canton Street, near University Avenue, approximately ¾ miles from the exit 13 interchange with I-95.
- Sharon – U.S. Route 1, approximately ½ mile from exit 9 interchange with I-95.
- Oxford – Sutton Avenue, adjacent to the exit 4 interchange with I-395.

The study also identified three existing sites for expansion potential – Charlton Service Plaza Eastbound, Charlton Service Plaza Westbound, and Newton Service Plaza Eastbound.

Pursuing this strategy may involve:

- Collaboration between local, regional, state, and multistate authorities to consider expansion or development of recommended truck parking sites.
- Collaboration between local, regional, state, and multistate authorities to manage zoning, permitting, taxation, traffic, and other logistical and quality-of-life issues.
- Public-private partnerships between state and local authorities and private truck stop operators to defray the risk of opening facilities.
- Development of smartphone apps and variable message signboards to allow drivers to view available spaces, reserve spaces, and receive directions, particularly for new facilities.

Resolve Identified Truck Bottlenecks

Chapter 5 discusses key bottlenecks identified in the 2022 truck bottleneck analysis conducted by MassDOT. The assessment identified 17 bottleneck locations throughout the Commonwealth using the National Performance Management Research Dataset (NPMRDS), truck speeds, and reliability metrics. Each of the bottleneck approaches has a unique feature or features that may be contributing to excess queueing, delay, and unreliability, and the study identified solutions for each, categorized by complexity and order of magnitude cost (see Table 7.3). Solutions with a low cost or low complexity may be easier to address than those with a higher cost or complexity and could be undertaken in the near-term to improve mobility and reliability of freight on Massachusetts highways.

TABLE 7.3 COST OF POTENTIAL BOTTLENECK SOLUTIONS

Solution Type	Complexity (Cost)	Potential Solutions Recommended
Traffic Control Changes	Low ($)	• Restripe and/or resurface travel lanes • Install advanced warning signs • Traffic signal retiming along connecting corridors • Minor lighting improvements • Access management on connecting arterials
Transportation Demand Management	Moderate ($-$$)	• Incentivize transit use • Price or manage parking at destinations • Implement or adjust congestion pricing
Lower-Intensity Capital Projects	Moderate ($$)	• Major lighting installations • Ramp design changes not requiring major structural upgrades
Major Reconstruction and Closures	High ($$-$$$)	• Ramp closure or reconstruction • Full interchange closure or reconstruction

Source: MassDOT, Truck Bottleneck Analysis (2022). Note that some potential solutions are policy oriented.

Pursuing this strategy may involve:

- Pursing traffic control changes and transportation demand management improvements at select truck bottleneck locations, such as I-93 and MA-24 in Randolph and I-90, I-290, and I-395 in Auburn.
- Pursuing future studies, such as I-90 and I-93 in Boston and I-93 and US-1 in Boston.

Upgrade Freight Rail Lines in Massachusetts to 286K Standard

Freight rail traffic in Massachusetts would be significantly more efficient if key lines were upgraded to the national 286K weight standard. Since the *2017 Massachusetts Freight Plan*, several enhancements have been made, including upgrading track to 286K weight standard on Massachusetts Coastal Railroad between Mansfield and Attleboro, as well as between Framingham, Fall River, and New Bedford. In addition, MassDOT received an FRA BUILD Grant to rehabilitate the New England Central Railroad (NECR) freight corridor in western Massachusetts and upgrade it to a 286K weight standard.

In the long-term, the owners and customers of key lines would benefit from further increases to the 315K weight standard.

Pursuing this strategy may involve:

- Massachusetts agencies collaboratively prioritizing rail lines for 286K upgrades.
- Investments by MassDOT on its own lines and those owned by others (through grants, public-private partnerships, or other means) to replace deficient bridges and culverts and to improve track and right-of-way where necessary to achieve a 286K rating.

Maintain Uncongested Last-Mile Access to Freight-Generating Facilities

The major port gateways to Massachusetts are located in dense and developing urban neighborhoods in East Boston, South Boston, Chelsea, Everett, and New Bedford. Increasing congestion has become one of the principal obstacles to the Boston Seaport District reaching its potential as an economic driver, while also thriving as a booming mixed-use development area. The mixed-use nature of these locations results in conflicts between the needs of truck traffic and that of motorists.

The ability to move freight through the South Boston area in a timely manner is critical to the continued success of port operations. The Conley Terminal currently has efficient access to the Interstate Highway System and along the freight spine between Boston, Worcester and points west. In order to ensure the continued health of its port, Massachusetts must preserve existing truck routes and enhance truck connections to ensure that trucks can continue to access the Conley Terminal efficiently.

Pursuing this strategy may involve:

- Educating officials, the business community, and the public of the benefits of port access for trucks.
- Limiting or monitoring general use of existing access and haul roads in South Boston and East Boston.
- Collaborating with MassDOT, Massport, the City of Boston, and the Massachusetts Convention Center Authority (MCCA) to improve connections between South Boston and the Interstate Highway System to serve Conley Terminal and other maritime and industrial businesses in the Port of Boston.
- Massachusetts agencies collaboratively accounting for the needs of trucks when designing infrastructure and operations (signal timing, etc.) on streets adjacent to major port facilities in Boston, Chelsea, Everett, and New Bedford.

Build Right-Sized Distribution Centers Inside Route 128

It has now become standard for online retailers to offer the option of same-day or next-day delivery. In order to meet these delivery demands, e-commerce companies must locate in close proximity to consumers to guarantee short-term deliveries, often within or near dense urban areas. Complicating the challenge is that industrial areas are becoming more difficult to preserve as urban development and population growth continues.

Pivoting to frequent small deliveries may be a viable alternative for companies that fulfill high volumes of same-day deliveries inside the Route 128 area. However, it will be important to implement freight-efficient land use practices and monitor locations with increased e-commerce demand to minimize impacts and disruption.

Pursuing this strategy may involve:

- Reviewing and implementing strategies developed in NCHRP 998: Planning Freight-Efficient Land Uses: Methodology, Strategies, and Tools.[87]
- Educating officials, the business community, and the public of the benefits of distribution centers in urban areas.
- Engaging with industry and with local officials to collaboratively target areas with strong road and rail connections for distribution use.

Develop Delivery Areas in Urban Districts and Town Centers

Streets in urban areas are continuing to become busier and, unlike suburban shopping centers, these neighborhood hubs do not have dedicated delivery facilities. Consequently, trucks double-park and unload in public parking, travel lanes, bike lanes, and bus stops.

This both impedes the efficient flow of consumer supply chains and creates congestion for all road users. Therefore, it will be important to determine appropriate locations for delivery areas that minimize truck traffic in residential neighborhoods.

Pursuing this strategy may involve:

- Implementing strategies developed in NCHRP 998: Planning Freight-Efficient Land Uses: Methodology, Strategies, and Tools.
- Educating officials, the business community, and the public of the benefits of loading and unloading access for trucks.
- Collaborating with local officials to document and assess the magnitude of the problems caused by informal loading in business centers and neighborhoods.
- Analyzing potential interventions, including shared loading spaces and routes in town centers, geometry improvements in areas where loading and unloading will be encouraged, or metered parking for trucks.

[87] https://www.trb.org/Publications/Blurbs/182807.aspx

Analyze and Improve Lighting Conditions on Corridors with Higher Rates of Truck-Involved Crashes

At night and in dark, unlit conditions, truck drivers may not have the ability to react appropriately once a hazard or change in the road ahead becomes visible by headlights. Therefore, adequate lighting should be applied continuously along segments and at spot locations such as intersections and other crossings in order to reduce the chances of a crash. Adequate lighting that is at or above minimum acceptable standards for horizontal and vertical illuminance levels provides safety benefits to all road users. FHWA cites research on crashes involving all vehicle types that indicates continuous lighting on both rural and urban highways (including freeways) can reduce crashes by 28 percent and 33 percent – 38 percent at rural and urban intersections at night.[88]

Pursuing this strategy may involve:

- Applying lighting to provide full coverage along the roadway or strategic placement of lighting along corridors where it is needed the most.
- Installing lighting poles that have breakaway features, are shielded, or are placed far enough from the roadway to reduce the probability and/or severity of fixed-object crashes.
- Use lighting technology that allows precise control of lighting direction to decrease excessive light that could affect the nighttime sky or spill over to adjacent properties.

Improve Safety at Highway-Rail Grade Crossings

The 2022 Highway-Rail Grade Crossing Safety Action Plan (SAP) identified nine strategies for improving safety at highway-rail grade crossings in Massachusetts. While long-term elimination of at-grade crossings is a goal in the Commonwealth (addressed in *shaping strategies*), other lower-cost opportunities to improve safety exist and could be implemented in the near-term.

Pursuing this strategy may involve:

- Developing a statewide program to improve visibility of the train dynamic envelope at crossings and of public passive crossings.
- Advancing techniques to make crossings more discernible to drivers at or near crossings.
- Developing a program to identify, assess, and improve pedestrian crossings.
- Continued participation in Federal Railroad Administration (FRA) webinars on highway-rail grade crossing safety and trespass prevention.
- Continuing to promote/enhance MassDOT's public awareness campaign about railroad safety crossings.

[88] FHWA, Proven Safety Countermeasures. https://highways.dot.gov/safety/proven-safety-countermeasures/lighting.

- Work cooperatively with FRA and FHWA to advance new technologies for grade crossing advance warning systems.

Incorporate Rumble Strips into New and Existing Interstate and Rural Roadways

Longitudinal rumble strips are milled or raised elements on the pavement intended to alert drivers through vibration and sound that their vehicle has left the travel lane. They can be installed on the shoulder, edge line, or at or near the center line of an undivided roadway. When placed at edge or center lines, rumble strips can increase the visibility and durability of the pavement marking during wet, nighttime conditions, and can improve the durability of the marking on roads with snowplowing operations.

Pursuing this strategy may involve:

- Installing milled center line rumble strips and milled edge line or shoulder rumble strips with bicycle gaps or only installing rumble strips in specific locations where they will not impact people bicycling.
- Considering noise impacts to surrounding properties in the placement of rumble strips.
- Ensuring state of good repair so that the effects of the larger tires on trucks do not dimmish the alerting properties of the rumble strips.

Operational Innovations

Develop Intelligent Transportation Systems (ITS) and Active Transportation and Demand Management (ATDM)

Intelligent transportation systems (ITS) programs are intended to enable safer vehicles and roadways, enhance mobility, limit environmental impacts, promote innovation, and support transportation system information sharing. In freight, ITS systems can be used to route trucks and guide drivers, and to share information among public and private organizations.

Pursuing this strategy may involve:

- Collaborating with key stakeholders to identify potential ITS strategies for implementation over a 5- to 10-year timespan.
- Evaluating the ITS proposals for consistency with statewide goals and developing feasibility analyses for the preferred options.

Establish a Framework for Prioritizing Multimodal Freight Projects with a Focus on Equity

The 2023 Massachusetts Freight Plan established five goal areas that define MassDOT's priorities for improving freight and goods movement in the Commonwealth, as discussed in Chapter 2. These goal areas define specific ways by which they can be advanced:

- System condition – support an efficient and reliable supply chain through investments in existing infrastructure and supporting technologies to maintain and preserve the system.
- Safety and resiliency – improve statewide safety by funding projects that reduce injuries and fatalities, reduce vulnerability, and improve the resiliency of the system.
- Mobility and reliability – invest in the multimodal transportation system to improve mobility, connectivity, accessibility, and reliability for people and goods.
- Economic competitiveness – support multimodal transportation connectivity, efficiency, and mobility to support residents and businesses and increase regional and national economic competitiveness.
- Equity and environmental sustainability – support initiatives and investments that improve equity across the multimodal system, improve local air quality, and minimize impacts to natural, historic, and cultural resources.

It is recommended that MassDOT use these goal areas as a framework for prioritizing and funding multimodal freight projects.

Pursuing this strategy may involve:

- Collaboration within MassDOT to change freight project prioritization process and generate intra-agency consensus about scoring weights across goal areas.
- Discussions with or input from the general public about the process and methodology.

Emphasize the Need for Timely and Accurate Reporting of Crash Data Involving Trucks or At-Grade Rail Crossings

Crash data that is accurate, of good quality, and available soon after the date of the incident is the core of any successful effort to improve roadway safety. Many disciplines – highway design, transportation planning, operations, road maintenance, law enforcement, education, emergency response services, policymakers, infrastructure program management, road safety management, and public health – use crash data to identify problem areas, select and deploy countermeasures, and monitor the impact of countermeasures. Because crashes involving trucks or at-grade rail crossings are infrequent compared to all other crash types, as discussed in Chapter 5, quality data that captures all incidents is especially important.

Pursuing this strategy may involve:

- Partnering with local agencies to better understand the challenges in providing quality crash data, and processing and providing timely data.

Policies and People

Support Policies to Reduce Greenhouse Gas Emissions from Transportation

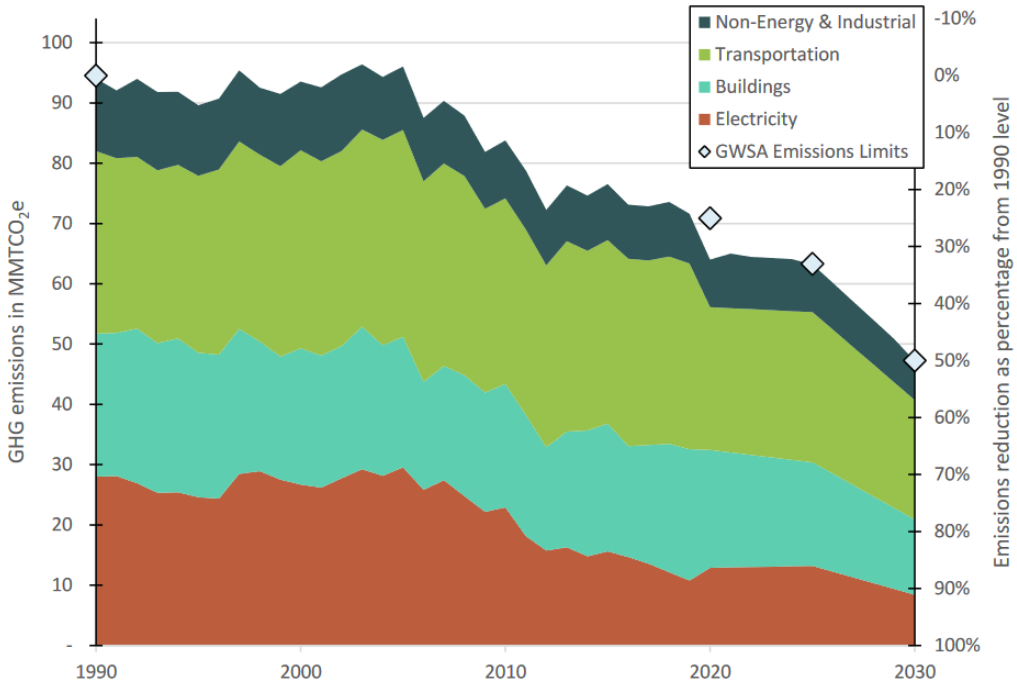
In 2021, the Global Warming Solutions Act of 2009 was amended to set limits on greenhouse gas (GHG) emissions for 2025 and 2030, including both economy-wide emissions reduction requirements and specific limits on major sources of global warming pollution. As part of a letter issued along with the Clean Energy and Climate Plan for 2025 and 2030 (2025/2030 CECP), the Secretary of the Executive Office of Energy and Environmental Affairs determined that the Commonwealth's economy-wide emissions limits are a 33 percent reduction from 1990 level in 2025, and a 50 percent reduction in 2030.

Figure 7.1 shows the historical GHG emissions in Massachusetts by four major sectors of the economy, including transportation. Transportation is the largest source of GHG emissions in the Commonwealth, responsible for 37 percent of statewide emissions in 2020. Pollution in the transportation sector is caused by the combustion of fossil fuels in the engines of cars, trucks, airplanes, and other vehicles. The 2025/2030 CECP contains strategies for reducing GHG emissions that promote alternatives to personal vehicle travel and implementing coordinated advanced clean vehicle emissions and sales standards, and expanding electric vehicle incentives. Table 7.4 shows that the sector-specific GHG emissions sublimit for transportation is set at an 18 percent and a 34 percent reduction from the 1990 level in 2025 and 2030, respectively.

MassDOT's actions under the CECP are focused on developing and implementing the Massachusetts' National Electric Vehicle Infrastructure Program Deployment Plan, investing in programs that make the Commonwealth's streets more complete, and funding the electrification of public transit buses. Nevertheless, shifting freight from trucks to rail or maritime freight modes would support the CECP's goals by reducing truck VMT and associated freight transportation-related emissions. Rail and maritime modes emit significantly fewer tons of CO_2 per million ton-miles as compared to trucks.[89]

[89] https://www.nationalwaterwaysfoundation.org/file/28/tti%202022%20final%20report%202001-2019%201.pdf.

FIGURE 7.1 HISTORICAL AND MODELED GHG EMISSIONS AND STATUTORILY REQUIRED EMISSIONS REDUCTION IN MASSACHUSETTS



Source: *https://www.mass.gov/doc/clean-energy-and-climate-plan-for-2025-and-2030/download*.

TABLE 7.4 HISTORICAL AND MODELED GHG EMISSIONS AND STATUTORILY REQUIRED EMISSIONS REDUCTION IN MASSACHUSETTS

Transportation	1990	2010	2015	2020	2025	2030
GHG Emissions (MMTCO2e)	30.2	30.8	30.4	23.7	24.9	19.8
Percent Reduction (Increase) from 1990		(2%)	(1%)	22%	18%	34%

Source: *https://www.mass.gov/doc/clean-energy-and-climate-plan-for-2025-and-2030/download*.

Key strategies in the CECP that will support the reduction of GHG emissions from the freight sector include:

- The Advanced Clean Trucks rule, which requires an increasing percentage of zero-emission medium and heavy-duty vehicles sold to be zero emissions vehicles.
- The MOR-EV Trucks program, which provides subsidies for medium- and heavy-duty vehicles in Massachusetts, from Class 2b trucks to Class 8 tractor trailers and buses.
- Programs that provide incentives to businesses to decrease emissions from high-mileage, low-radius fleets.

Harmonize Oversize/Overweight Movements, Permitting, and Large Truck Restrictions Across New England

Stakeholder outreach with Massachusetts' neighboring states revealed that there are challenges with streamlining oversize/overweight (OS/OW) movements, permitting, and large truck restrictions across New England. Inconsistencies can create confusion, potentially leading to hindering freight flows across states and excess VMT.

MassDOT is improving its permitting system, but permits for a single journey must be obtained separately from each state. Data systems at neighboring agencies cannot share information, procedures and forms are not standardized and interoperable, and may vary among the states. All of these factors limit the efficiency of shipments that cross state lines. Coordination across New England could facilitate more efficient movement of OS/OWs.

Pursuing this strategy may involve:

- Coordinating with neighboring states to understand current practices and challenges and develop solutions to address permitting and large truck restrictions across the region.
- Drawing upon professional relationships to research ways in which oversize/overweight permitting can be harmonized with neighboring states.

Coordinate Freight Planning with Neighboring States

As part of the freight planning process, MassDOT has engaged in dialogue with its neighboring states to share information, discuss trends and issues, share investment priorities, and coordinate policy and programming ideas to improve freight and goods movement in the region. Continuing coordination with other states in the region after the 2023 Freight Plan will keep states informed of emerging needs, of multi-state grant opportunities, and of the benefits to the freight system as a whole.

Pursing this strategy may involve:

- Reviewing freight plans for other New England and northeastern states and identifying opportunities for collaboration in reaching common goals.
- Identifying key multi-state freight corridors for cooperative study and collaborative support.
- Notifying our neighbors of potential cross-state impacts of freight-related projects (such as a large-scale manufacturer located on a border or a port that draws demand from multiple states).

Support and Promote Freight-Related Workforce Development

The labor and workforce challenges resulting from the COVID-19 pandemic have made a workforce strategy for freight-related jobs more imperative. Before the pandemic, the aging/retirement of skilled technical labor across all freight modes and a lack of efforts to recruit among young people put pressure on supply chains across the

U.S. Artificial intelligence and robotics play an increasingly crucial role in fulfillment and distribution centers. This growth in technology and automation adoption could require a substantial degree of workforce upskilling and reskilling, with up to 400,000 Massachusetts workers projected to need to be reskilled for new types of employment by 2030.[90] MassDOT, along with other state agencies such as the Executive Office of Labor and Workforce Development (EOLWD), should take steps to support and promote workforce development to meet demand and address the current labor shortage.

Pursuing this strategy may involve:

- Coordinating with EOLWD, the Executive Office of Housing and Economic Development (EOHED) and other municipal, regional, and state entities to develop a workforce strategy for freight-related jobs and professions.
- Considering strategies that incorporate workforce upskilling that complements rather than competes with warehouse automation.

Provide Collaborative Guidance and Support to MPOs and Local Governments in Integrating Freight, Distribution, and Loading into Their Planning and Zoning Land Use Decision-Making Processes

The National Cooperative Highway and Freight Research Programs (NCHRP and NCFRP) have studied issues that arise in incorporating freight concerns with smart growth, and have detailed the following as key community goals/concerns regarding freight:

- Communication – Communities are frequently called first when a problem occurs, are first-responders to emergencies, and deal with local neighborhoods when they try to build transportation projects.
- Traffic flow and congestion – Trucks must share road space with vehicles that behave very differently than they do and require different roadway geometry and infrastructure. Trains obstruct traffic when they occupy grade crossings. Air passenger flow consumes capacity from cargo.
- Safety – Major safety concerns arise at grade crossings, and also along rail and highway corridors.
- Economic development – Relocation of freight facilities and operations to redevelop property for other uses.
- Environmental and quality-of-life concerns – This includes emissions, noise, and vibrations.

Pursing this strategy may involve:

- *At the local level*, engaging with communities to address loading and delivery needs in their comprehensive plans, land use decisions, complete streets plans, parking studies, and zoning requirements.

[90] https://www.mma.org/resource/preparing-for-the-future-of-work-in-the-commonwealth-of-massachusetts/.

- *At the regional level*, engaging with regional leaders and MPOs to identify the best sites for freight uses both on the periphery of urban centers and closer in, then developing region-level feasibility assessments of these sites and how their use for freight can be encouraged.

More Fully Integrate Freight Planning into MassDOT Activities

The 2023 Freight Plan occupies a critical place in MassDOT's family of modal plans. Other documents in this set include the *Massachusetts State Rail Plan*, the *Massachusetts Statewide Aviation System Plan* (SASP), the *Massachusetts Bicycle Plan*; the *Massachusetts Pedestrian Transportation Plan*; and *Focus40: The 2040 Investment Plan for the MBTA*. An important component of all multimodal planning in Massachusetts is set by the statewide long-range transportation plan (SLRTP). Freight interacts with all of these modes, and the integration of freight planning into plans, studies, and programming is necessary.

Pursuing this strategy may involve:

- Developing a set of freight considerations that can be applied to MassDOT location or corridor studies.

Promote Driver Education on Stopping Distances when Operating at Higher Speeds and/or On High-Speed Roads

Trucks, especially when fully loaded, can weigh up to 20 times more than a typical passenger vehicle. Vehicle weights impact their stopping distance, and many drivers may not realize the additional stopping distance that trucks require. For comparison, a fully loaded tractor-trailer traveling at 65 MPH may need up to two times the distance of a passenger vehicle to come to a full stop. Education for freight and passenger vehicle drivers can help communicate that proper spacing around trucks is necessary because they require more stopping distance.

Pursuing this strategy may involve:

- Considering updates to drivers education manuals to include information on truck stopping distances.
- Developing safety campaign messaging and materials as part of the Traffic Safety Initiatives that can be published and distributed by MassDOT and partnering agencies and organizations.
- Working with truck operators to promote education among truck drivers.
- Partnering with local and regional agencies and organizations to add information on stopping distances to their safety campaigns.

Promote Road User Education on Safe Vehicle Operation and Visibility Around Trucks

Education and safety campaigns about safe operation and visibility around trucks can help increase the awareness by passenger vehicle drivers and other road users on the need to be visible to truck drivers. Trucks and other large vehicles have large blind spots that hinder drivers' abilities to see smaller vehicles and vulnerable road users. Their presence on the roadway can make it difficult for other road users to see traffic control devices or

other users. Additionally, trucks have a wide turning radius that requires additional room when turns are being made.

Pursuing this strategy may involve:

- Developing safety campaign messaging and materials as part of the Traffic Safety Initiatives that can be published and distributed by MassDOT and partnering agencies and organizations.
- Considering updates to drivers' education to include information on truck visibility.
- Partnering with local and regional agencies and organizations to add truck visibility information to their safety campaigns.
- Reviewing MassDOT's guidance regarding traffic control device installation and updating, if necessary, to ensure visibility for all users.

Robust Strategies

Infrastructure Improvements

Protect Freight System Assets and Operations from Climate Change and Extreme Weather Impacts

The 2022 Massachusetts Climate Change Assessment[91] documented anticipated impacts to transportation and facility infrastructure in the Commonwealth, including damage to inland buildings (including manufacturing and freight-generating facilities); to electrical transmission and utility infrastructure; to rails and loss of rail service; to coastal buildings and ports; to roads and loss of road service; and loss of energy production and resources.

This assessment demonstrated the need to maintain a state of good repair for multimodal freight assets to ensure systems can operate following emergencies and disasters, including extreme heat, intensifying storms, and high precipitation events.

[91] https://www.mass.gov/doc/2022-massachusetts-climate-change-assessment-december-2022-volume-i-executive-summary/download.

Pursuing this strategy may involve:

- Further analyzing and implementing transportation recommendations from the 2022 Massachusetts Climate Change Assessment.
- Coordinating with industries to develop climate change resiliency plans for key Massachusetts supply chains.

Build Standardized Small Package Drops

Standardized, centralized package drop facilities, such as Amazon Locker, have been available for much of the past decade. These lockers are often located in leased spaces at private businesses, including schools, post offices, and gas stations. A customer can select a location for package delivery and is sent a code to open the locked box when their shipment arrives. As an additional service, some facilities can be used as drop-off locations for merchandise returns.

In urban and suburban environments, mailboxes represent a semi-standard drop-off point for envelopes. However, without an equivalent solution for packages, issues such as frequent deliveries, theft, and increased truck VMT on local roadways can impact communities. This strategy may also mitigate the impacts of increasing passenger-vehicle deliveries of parcels and other consumer goods.

Pursuing this strategy may involve:

- Building relationships among State and local officials and the business community to share information on trends in home delivery of small packages and the development of automated delivery methods.
- Studying the impact of passenger-vehicle deliveries on the network to mitigate negative impacts.

Encourage Increased Use of Underutilized Gateway Infrastructure (Ports and Airports)

The COVID-19 pandemic put immense pressure on our nation's gateways – including the Port of New York/ New Jersey and the Ports of Los Angeles and Long Beach – leading to questions about how to increase the use of underutilized gateways. In Massachusetts, air cargo is processed primarily through Logan Airport in Boston, with minor out-of-state operations at airports in Providence, Hartford, Manchester, and Portland, Maine. Massachusetts has the potential to greater use the Ports of Boston and New Bedford that have capacity and opportunities for growth.

Pursuing this strategy may involve:

- Coordinating with Massport on opportunities for growth and development.
- Engaging with industry, facility owners, and other stakeholders to explore potential service expansion.
- Identifying incentives or infrastructure improvements that would be necessary for service expansions at appropriate facilities with willing owners and communities.

Identify and Preserve Appropriate Existing Industrial Sites for Freight-Intensive Development

In urban environments where light industrial (warehousing and distribution) is often associated with traffic, noise, and emissions, it can be difficult to secure and preserve appropriate sites. However, the on-demand nature of retail (e-commerce and home delivery) continues to create the need for distribution facilities near population centers.

Pursing this strategy may involve:

- Sharing data and expertise with interested local governments to develop a plan for maintaining selected sites for light industrial use, and for ensuring that benefits are maximized, and negative impacts minimized for the community.
- Identify State-level funding sources to assist communities with preserving light industrial sites and improving their connectivity.

Operational Innovations

Study and Perform Curbside Demand Management

Curbside management programs collect and analyze data to understand how curbside space is used, set goals and priorities for that use, and use clearly communicated and consistently enforced regulations to manage activity more efficiently at the curb. Regardless of what happens in the future, curb demand and related congestion is an issue that is likely to persist.

Previous studies by MassDOT and other regional entities have considered this issue and have recommended various approaches. This includes considering bus- and truck-only streets, collecting additional data on shared transit-and-freight priority, collecting additional data on rapid food delivery (RFD) and rideshare trips, requiring RFD platforms to increase access to e-bikes and EVs for delivery drivers, package lockers for last mile delivery, and drones and cargo bikes.

Data collection is key for understanding turnover frequency, types of delivery, times of curbside activity, and overall curb capacity. MassDOT could provide tools and/or funding for municipalities to take inventory of their curb spaces, while also providing a series of model strategies for identifying curb priorities and regulations. This would allow municipalities to test strategies, such as an app-based reservation system for commercial loading and unloading.

Pursuing this strategy may involve:

- Researching and sharing best practices for inventorying curbside spaces with municipal governments, including the MassDOT reports *The Future of the Commonwealth's Curb*, *Separated Bike Lane Planning and Design Guide,* and the *Municipal Resource Guide for Walkability*.

- Developing model policy language for prioritizing and managing curbside space.
- Considering adding the completion of a curbside management study as a precondition for receiving certain MassDOT grant funds, such as the MassDOT Complete Streets Funding Program.

Explore and Incorporate Real-Time and Other New Data Sources to Better Understand Freight Movements

Disruptions can happen across all freight transportation modes, leading to concerns about safety and reliability of freight shipments and the overall mobility and safety of freight movements to and from Massachusetts' industries and consumers. Investments in freight data and tools could be leveraged to better understand freight movements, particularly in emergency or extreme weather events.

Pursuing this strategy may involve:

- Increasing MassDOT's suite of data and tools to include real-time truck parking information, signage inventory, and low clearance locations.

Use Critical Freight Corridors to Support and Advance Projects That Improve Multimodal Freight Mobility

FHWA administers formula funding to states for freight projects located on the Primary Highway Freight System (PHFS), portions of the Interstate Highway System not part of the PHFS, and Critical Urban and Critical Rural Freight Corridors (CU/CRFCs). Continuing to re-evaluate these designations, in coordination with the state's MPOs, will ensure that Federal funds can go to priority projects across the state's highway system, as well as make projects more competitive for discretionary funding opportunities. Massachusetts is permitted to designate up to 300 miles of CRFCs and up to 150 miles of CUFCs to be included in the national designation.

Pursuing this strategy may involve:

- Coordinating with Massport, MPOs, and municipalities to identify potential future multimodal freight corridors that may benefit from CU/CRFC designation.
- Submitting freight-related applications for U.S. DOT discretionary grant funding opportunities.

Policies and People

Consider Opportunities to Improve MassDOT Design Guidance, Policies, and Procedures to Protect Against Extreme Weather and Reduce Local Air Pollution, Flooding and Stormwater Runoff, and Wildlife Habitat Loss

With the Bipartisan Infrastructure Law (BIL), FHWA requires state freight plans to include strategies to decrease a) the severity of impacts of extreme weather and natural disasters on freight mobility, b) the impacts of freight

movement on local air pollution, c) the impacts of freight movement on flooding and stormwater runoff, and d) the impacts of freight movement on wildlife habitat loss. However, even before BIL, Massachusetts has been a leader in proactively mitigating transportation-related impacts on the environment:

- The impact of freight movement on **local air pollution** is being addressed through the Commonwealth's commitment to supporting policies that reduce greenhouse gas emissions from transportation, as described in *immediate strategies*.
- MassDOT conducts project reviews in accordance with the Massachusetts Environmental Policy Act (MEPA) and the National Environmental Policy Act (NEPA), which identify potential impacts to **environmental resources** and permitting requirements for roadway and bridge construction projects.
- MassDOT's **stormwater program** promotes and maintains stormwater management systems along MassDOT roadways. It provides stormwater-related design guidance, including an Impaired Waters Program to reduce MassDOT's contribution of pollutants to those waterbodies through the construction of stormwater control measures, and requires plans to control erosion, sedimentation, and other pollutants during construction of all MassDOT projects, among other activities.
- MassDOT's Environmental Services (ES) section reviews proposed projects and provides advice on **wetland and water quality** issues, which are home to critical wildlife habitats that contribute to a healthy and functioning ecosystem. ES works with Department of Environmental Protection (DEP) and U.S. Army Corps of Engineers (USACE) to prepare and/or review wetland permits and wetland/stormwater mitigation designs, delineate wetland boundaries, conduct habitat evaluations, and determine wetland functions and values. ES also works with USACE, U.S. Coast Guard, DEP, and local conservation commissions to review projects and policies related to wetland and water quality protection to refine its **best management practices** and **context sensitive designs**.

Pursuing this strategy may involve:

- Continuing to monitor opportunities to improve MassDOT design guidance, policies, and procedures to produce a measurable, positive impact on environmental concerns.

Promote Efforts to Increase Fatigue Awareness Among Truck Drivers and Operators

Truck driver fatigue is an ongoing safety issue that impacts roadway safety. Driver fatigue may be due to a lack of adequate sleep, extended work hours, strenuous work or non-work activities, or a combination of other factors. Truck drivers and operators should be educated to recognize the signs and dangers of drowsiness, rules and regulations regarding driver work shifts, and tips to stay well-rested and alert while driving.

Pursuing this strategy may involve:

- Working with truck operators to promote education among truck drivers.

Hedging Strategies

Infrastructure Improvements

Electrify Truck Stops

Idling at truck stops can be a source of both emissions and noise pollution in surrounding neighborhoods. Plugging in trucks when they would otherwise be idling may prevent these impacts.

Pursuing this strategy may involve:

- Reaching out to current and prospective truck stop operators to identify a small pilot study of electrification.
- Implementing public-private partnerships to install electrification equipment and track its usage.

Operational Innovations

Improve the Efficiency of Air Cargo Processing at Logan Airport and in Surrounding Areas

There is an increasing demand for air cargo – largely attributed to growing demand for e-commerce. However, capacity for dedicated air cargo in Massachusetts has reduced over time, and Logan Airport has seen its square footage for cargo processing reduced by 50 percent in recent years to make space for passenger facilities. The Terminal E Modernization project will increase Logan Airport's capacity for international freight, but may decrease capacity for dedicated all-cargo flights.

Massport continues to pursue opportunities to make air cargo processing at Logan more efficient to get the most value out of limited space. Should demand for air cargo in Massachusetts exceed Logan's maximum capacity, it may be prudent to consider the need for a cargo reliever beyond the Greater Boston area, as well as any projected increases in truck VMT from those facilities to reach Massachusetts-based businesses.

Pursuing this strategy may involve:

- Updating the 2010 Massachusetts Statewide Airport System Plan.
- Coordinating with Massport to further study and evaluate air cargo development opportunities.

Policies and People

Improve Freight Worker Access to Transit

Freight workers are often employed at locations, and at times of day, that are poorly aligned with existing transit services, which are often designed around the needs of employees commuting to central-city work locations during daytime hours. Expanded transit access could better meet the needs of industrial workers.

Pursuing this strategy may involve:

- Incorporating a greater awareness of the needs of workers in service realignment planning and as location and corridor studies are developed.

Support Low-Impact Freight and Industrial Development in Urban Locations

Current industrial zoning practices are rigid and focus on separation of uses. For major industrial land uses, this separation is necessary and practical for health and safety reasons. However, many smaller-scale industrial businesses, including many freight-related ones, operate with few such environmental externalities. Separation of such uses induces trips that could be shortened or eliminated by locating low-impact freight businesses nearer to the customers they serve and businesses with whom they interact. Passing home rule zoning laws that allow for flexibility to define these small-scale freight and other industrial activities can locate some freight-industry employment much closer to customers, employees, and transit services.

Pursuing this strategy may involve:

- Working with state housing agencies to provide funding, model ordinances, and other technical assistance to municipalities to modify zoning codes to allow for small-scale industrial production and freight logistics operations in mixed-use urban settings.
- Providing funding for local studies, plans, and projects that assess and mitigate the impact of freight activity on local roadways.

Support Action to Preserve Industrial Land Uses in the Boston Area

In the Boston area, high land values and high demand for housing continue to put pressure on existing industrial and warehousing land uses, limiting potential growth of industries that benefit from waterfront freight access and/or proximity to Boston-based consumers. To preserve parcels most appropriate for future industrial, manufacturing, and warehousing land uses, action may be required now to prevent permanent conversion to non-industrial uses.

Pursuing this strategy may involve:

- Collaborating with Massport, the City of Boston, and South Boston-based industries to identify growth opportunities and identify priority parcels for warehousing and industrial development.
- Exploring the potential of establishing an industrial business zone (IBZ) program to protect and promote urban industrial activity.

Shaping Strategies

Infrastructure Improvements

Reduce the Number of At-Grade Crossings

One of the recommendations from the 2022 Highway-Rail Grade Crossing Safety Action Plan (SAP) is to reduce the total number of grade crossings and/or the risk exposure from grade crossings across the Commonwealth. The best improvement to an at-grade crossing is to eliminate a grade crossing altogether, which may include grade separation through the use of a bridge, embankment, and/or tunnel; crossing closure or consolidation; or track relocation.

Pursuing this strategy may involve:

- Evaluating the opportunity at each of the high-risk crossing locations identified in the SAP for crossing elimination.
- Considering additional crossings for elimination, especially where crossing elimination would provide substantial additional benefits, such as environmental or community benefits.

Improve and Preserve Freight Connections to/from Boston's Waterfront Freight Facilities

The Port of Boston has long been a hub of multimodal freight and economic activity. The neighboring Seaport District, formerly an industrial area, has experienced unprecedented development over the last 20 years, attracting thousands of new residents and jobs. The South Boston Waterfront population grew by 271 percent from 2000 to 2010 and has continued to grow over the past decade.[92] This rapid growth has led to increased traffic congestion and conflicts between commercial and passenger traffic in the Seaport.

In 2022, the Massachusetts Convention Center Authority Board approved a revised Master Plan for the Boston Convention & Exhibition Center that estimates the expansion will generate an additional140,000 hotel night stays per year in Boston and Cambridge, on top of the current average of 415,000.[93] In the same year, the BPDA Board also approved several large mixed-use development projects in the neighborhood. Comprehensive planning is needed to balance the transportation needs of industrial park businesses, seaport businesses, and South Boston residents. It will be critical to both improve and preserve freight assets and connections in the South Boston area to support the industrial tenants while balancing the safety and quality of life needs of neighboring residents.

[92] The South Boston Waterfront: At A Glance. https://www.bostonplans.org/neighborhoods/south-boston-waterfront/at-a-glance.

[93] Chesto, J. (2022, June 16). Another try to expand Southie convention center. *The Boston Globe*. https://www.bostonglobe.com/2022/06/16/business/another-try-expand-southie-convention-center/.

Pursuing this strategy may involve:

- Collaborating with Massport, the City of Boston, and South Boston-based industries to identify priority projects to improve multimodal freight movement.

Operational Improvements

Encourage E-Bicycle/Cargo Bicycle Delivery

Partnerships with e-bicycle and e-cargo bike manufacturers can spur innovation while cutting costs for municipalities. Experimenting with appropriate levels of effort and funding necessary to pilot e-bicycle and e-cargo bicycle delivery operations could take the burden off local municipalities to innovate. In addition, it could also be helpful to e-bike/e-cargo bike manufacturers by minimizing the number of public agencies to coordinate with, and instead coordinating directly with a statewide group representing all municipalities that are interested in participating. Cities such as Portland, OR[94] and Madison, WI[95] are piloting deliveries by cargo bikes or e-cargo bikes. Boston will launch a pilot of commercial e-cargo bike deliveries in the Allston neighborhood in Spring 2023.[96]

Pursuing this strategy may involve:

- Subsidizing pilot programs for small- to mid-sized cities.

Deploy Safety Upgrades Such as Convex/Crossover Mirrors, Lane Departure Warning, Blind Spot Detection, and Backup Cameras in MassDOT Truck Fleet

Truck drivers have several large blind spots when in trucks or other large vehicles that hinder or completely block the drivers' ability to see other road users and their surroundings. Convex mirrors are curved mirrors that give drivers wider views of the road than can be provided by flat mirrors. Crossover mirrors are mounted on the front hood of trucks and give drivers a view of anything passing 1 foot in front of the vehicle. Because of the height of large trucks, it can be difficult for truck drivers to see what is happening directly in front of/beyond the hood of the vehicle, for example, pedestrians crossing in front of the truck.

Equipping vehicles with monitoring systems for lane departure warning, blind spot detection, and backup cameras has become commonplace in passenger vehicles manufactured over the past decade. Lane departure warnings usually use cameras mounted to the front of vehicles that monitor lane markings. The system notifies drivers if the vehicle starts to leave the marked lane while the turn signal is off. Blind spot warning systems detect vehicles in blind spots while driving and notify the driver. Some systems provide an additional warning if the

[94] https://www.smartcitiesdive.com/news/portland-or-city-employees-to-pilot-e-cargo-bikes/589677/.
[95] https://madison.com/wsj/business/biking-at-work-madison-tests-electric-cargo-bike-from-local-manufacturer-saris/article_d50605b2-359c-5658-a6e2-d6e2c994e7ac.html.
[96] https://www.boston.gov/departments/transportation/boston-delivers.

driver activates the turn signal while a vehicle is present in a blind spot. Backup cameras provide drivers with a view of the area surrounding the rear of the truck via a display inside the cab when the vehicle is in reverse gear.

Although these technologies have not been fully deployed across passenger and trucking fleets, there have been studies on the efficacy of the systems. For example, an Insurance Institute for Highway Safety analysis of crashes for all vehicle types in 25 U.S. states shows that lane departure warning systems reduced crashes of all severities by 11 percent and crashes with injuries by 21 percent.[97] Additionally, a study on blind spot warning systems shows that the technology contributes to a 23-percent reduction in lane change injury crashes.[98]

Pursuing this strategy may involve:

- Retrofitting MassDOT's existing fleet of trucks and large vehicles with convex and crossover mirrors, and encouraging local jurisdictions to retrofit their trucks and large vehicle fleets with convex and crossover mirrors and purchase new fleets with such mirrors.

Deploy Lateral Protective Devices (Side Guards) in MassDOT Truck Fleet

Truck lateral protective devices (sometimes referred to as "side guards") are vehicle-based safety devices designed to keep pedestrians, bicyclists, and motorcyclists from being run over by a large truck's rear wheels in a side-impact collision. During a crash with a truck or other vehicles with high ground clearance, vulnerable road users can fall into the exposed space between the front and rear wheels and suffer fatal injuries. Lateral protective devices work by physically covering that exposed space, shielding vulnerable road users from being swept underneath the truck's rear wheels. This technology can be retrofitted onto existing trucks or incorporated into new vehicle fleets. Based on studies conducted in the United Kingdom, lateral protective devices are an effective technology for reducing the number of truck-involved vulnerable road user fatalities and the severity of injuries, especially for bicyclists. After the national mandate for lateral protective devices in the UK, there was a 61-percent drop in cyclist fatalities and a 20-percent drop in pedestrian fatalities in lateral protective device relevant collisions with trucks.[99]

Pursuing this strategy may involve:

- Retrofitting MassDOT's existing fleet of trucks and large vehicles with lateral protective devices.

[97] Intelligent Transportation Systems (ITS) Deployment Evaluation https://www.itskrs.its.dot.gov/its/benecost.nsf/ID/3892f198007a234085258187006f93d6.
[98] Intelligent Transportation Systems (ITS) Deployment Evaluation https://www.itskrs.its.dot.gov/its/benecost.nsf/ID/9e81c5c7193cd5d885258448005b625b.
[99] U.S. Department of Transportation, Volpe Center https://www.volpe.dot.gov/LPDs.

Policies and People

Study and Update Building Codes to Allow for More Efficient Deliveries

Updating zoning codes to include language about off-street loading docks can help alleviate congestion and address intense demand for curb space. Zoning language should require off-street loading docks for buildings of a certain size, specify loading dock dimensions, facilitate docks serving multiple businesses whenever possible, and distinguish loading zones from storage spaces.[100]

Commercial zoning regulations should also be updated to also require readily accessible mail rooms or parcel lockers to decrease dwell time at the curb.[101]

Pursuing this strategy may involve:

- Studying the impact of zoning on freight and goods movement.
- Encouraging the Massachusetts Office of Grants and Research's (OGR) Highway Safety Division[102] or the Massachusetts Executive Office of Energy and Environmental Affairs through its Planning Assistance Grant[103] to make building code changes a condition for disbursement of state grant program funds.

Study and Modify Municipal Zoning Codes to Allow for Neighborhood Micro-Hubs and Other In-Town Warehouse Spaces

MassDOT could encourage cities to develop or zone for empty or underutilized real property as neighborhood micro-hubs, providing last-mile warehouse space for deliveries. Pilot projects around the globe have proven the success of neighborhood-based, last-mile deliveries for managing logistics closer to delivery points, reducing total delivery miles travelled, facilitating delivery by bicycles and small vehicles, and activating underutilized spaces.[104]

A neighborhood delivery hub pilot in Seattle by the Urban Freight Lab of University of Washington found significant benefits from a four-month experiment in 2020. This pilot included a modular neighborhood kitchen, a parcel locker, and a hub for e-cargo bike deliveries. The summary report found that e-cargo bikes removed 0.65 truck miles per packaged delivered while also traveling 50 percent fewer miles per package. However, the pilot delivered fewer packages per hour by e-cargo bike compared to traditional trucks, due to poor bicycle infrastructure, lack of clear access to buildings, poor routing tools, and time spent locking the bike during

[100] https://planning.org/planning/2019/nov/freightcantwait/.
[101] https://planning.org/planning/2019/nov/freightcantwait/.
[102] https://www.mass.gov/traffic-safety-initiatives.
[103] https://www.mass.gov/service-details/planning-assistance-grants.
[104] https://nacto.org/wp-content/uploads/2021/06/BuildingHealthyCities_UrbanFreight_DeliveryMicrohubs.pdf.

deliveries. These are factors that could be addressed in implementation of a permanent program and through complementary modifications to zoning and development codes.[105]

Pursuing this strategy may involve:

- Studying the feasibility of micro-hub development.
- Working with the Massachusetts Executive Office of Energy and Environmental Affairs' Land Use and Management office to draft model zoning code language or policy language for municipalities to adopt to allow for neighborhood micro-hubs.

Support Efforts to Reduce Distracted Driving and Control the Use of Handheld Electronic Devices While Driving

Beyond distractions caused by using a handheld electronic device, other situations inside and outside of the vehicle can lead to distractions. Distractions inside the vehicle can include eating or reading. Distractions outside of the vehicle can include looking at a passing building, billboard, or person. Anything that is drawing the driver's attention and taking their eyes away from the road is a distraction. Educating truck drivers can help remind drivers of the dangers of distractions and tips to remain attentive for safe operations.

Commercial motor vehicle (CMV) drivers, which include truck drivers, are prohibited from texting and holding a mobile phone while driving. Additionally, Massachusetts Hands-Free Law bans drivers from using any electronic devices while operating a motor vehicle unless the device is used in hands-free mode. Research shows that the odds of being involved in a safety-critical event (e.g., crash, near-crash, unintentional lane deviation) are 23 times greater for CMV drivers who text while driving than for those who do not.

Pursuing this strategy may involve:

- Working with truck operators to promote education among truck drivers.
- Referencing tips and guidance provided by the FMCSA on distracted driving.
- Developing safety campaign messaging and materials as part of Traffic Safety Initiatives that can be published and distributed by MassDOT and partnering agencies and organizations.
- Increasing educational programming to truck drivers and operators about compliance with the Hands-Free Law.
- Increasing enforcement of Hands-Free Law for truck operators, including exploring an increase of fines to CMV drivers or fines to the truck operator.

[105] https://www.seattleneighborhoodhub.com/_files/ugd/86f1fc_55a01fbac0a34d20b3946aa41eefc16d.pdf.

Study and Support the Development of Advanced Air Mobility (AAM)

AAM encompasses using electric Vertical Takeoff and Landing (eVTOL) aircraft and small uncrewed aerial systems (sUAS) and offers a new form of mobility that utilizes electric aircraft and drones, enabling shorter flights within cities and suburbs, between rural airports and urban centers, and across various distances not served by traditional airlines.

Pursuing this strategy may involve:

- Studying the feasibility of AAM for freight deliveries.

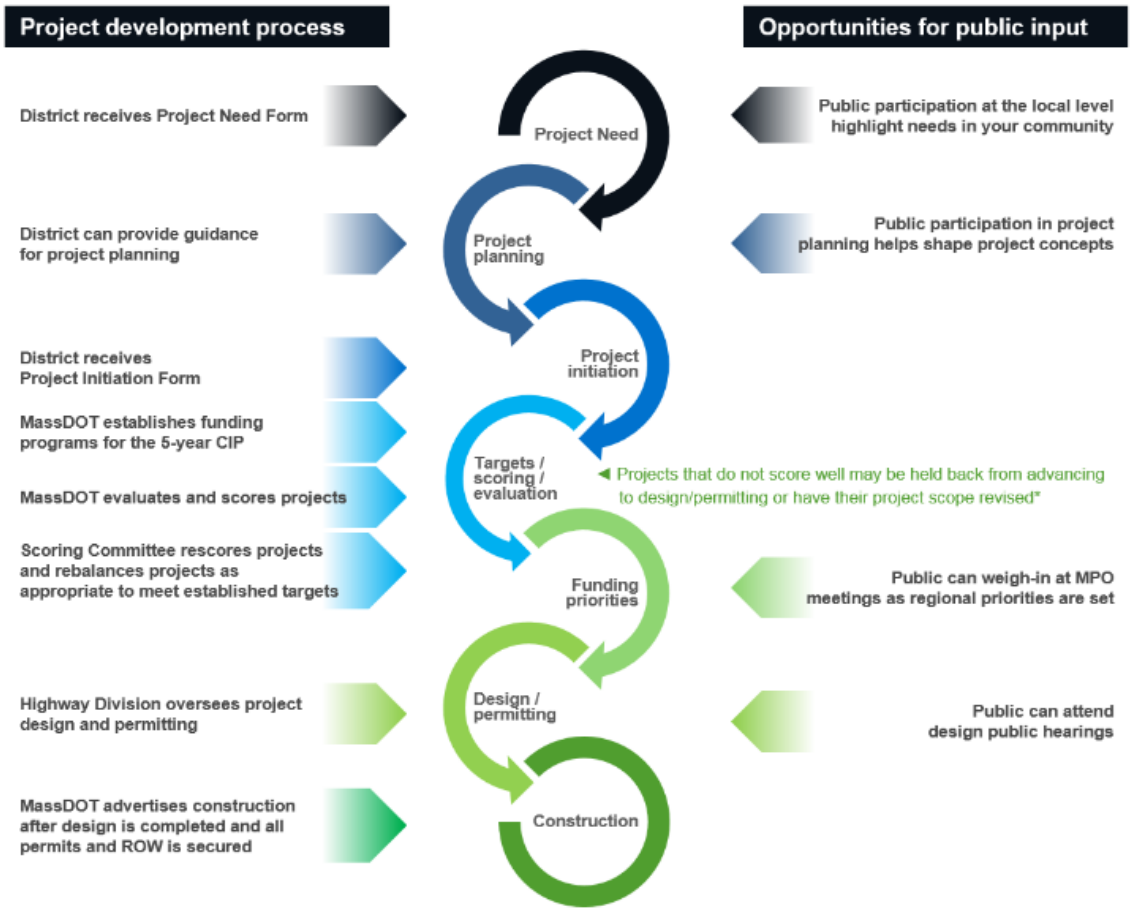
8 IMPLEMENTATION PLAN

The 2023 Freight Plan identifies strategies that work in the widest range of plausible futures. The next step is turning the strategies into projects.

Figure 8.1 illustrates MassDOT's project development process. This chapter seeks to answer three questions about these strategies:

- **Who** proposes projects?
- **Where** does funding come from?
- **Who** manages projects and resulting assets?

FIGURE 8.1 MASSDOT PROJECT DEVELOPMENT PROCESS



** The targets/scoring/evaluation step was one of the recommendations of the Project Selection Advisory Council which was created by the General Court to assist MassDOT in creating uniform project selection criteria for transportation investments.*

Who Proposes Projects?

Commonwealth of Massachusetts

MassDOT

MassDOT owns major roads in all regions of Massachusetts, including all Interstates and divided highways. It also takes the lead in determining trucking restrictions on roads. Through its Rail and Transit Division, MassDOT owns many freight rail lines. Through the MBTA, MassDOT owns all major rail corridors in the immediate Boston area.

Massport

Massport owns the major airports and most of the seaports in Massachusetts:

- Logan International Airport in Boston.
- Worcester Regional Airport.
- Hanscom Field in Bedford.
- Conley Terminal and Boston Autoport in Boston.

In addition, Massport is a significant landowner in the South Boston Waterfront neighborhood and is in the process of selling and leasing properties for dense mixed-use development.

Massport is a public authority, but not a Massachusetts government agency. It sustains itself from internal revenues, and does not use tax dollars. It is governed by a seven-member board that includes the Secretary of Transportation as an ex-officio member, but MassDOT does not have any other formal link to Massport.

Other State Agencies

State organizations with an interest in the health and impacts of the freight system include:

- The **Massachusetts Development Finance Agency (MassDevelopment)** is the Commonwealth's public lender and developer. It coordinates public support for and benefits from private development on the South Boston Waterfront and operates state piers in Gloucester, New Bedford, and Fall River (distinct entities from the port authorities in these locations).
- The **Executive Office of Energy and Environmental Affairs (EEA)**, which includes the Department of Environmental Protection (DEP). EEA is responsible for setting and meeting emissions reduction targets, regulating energy and utilities, and protecting environments that may be threatened by freight activity.

Federal Government

The Federal Government's role in the freight system includes both laws passed by Congress and rules and policies enacted by agencies in the Executive Branch. Some of these agencies are described below.

Federal Highway Administration

The Federal Highway Administration (FHWA) funds and regulates state DOTs, municipalities, and private industry in the management and maintenance of roads. FHWA rules govern performance measurement and condition management for pavement, bridges, signage, and sign structures.

FHWA distributes funding under dozens of programs, including Interstate Maintenance, the Highway Bridge Program, the National Highway Performance Program, and the National Highway Freight Program.

Federal Motor Carrier Safety Administration

The Federal Motor Carrier Safety Administration (FMCSA) regulates the registration and licensure of trucking companies, drivers, and vehicles. Its official strategy includes:

- Developing and enforcing data driven regulations that balance safety with efficiency.
- Harnessing safety information systems to focus on higher-risk carriers in enforcing safety regulations.
- Targeting educational messages to carriers, commercial drivers, and the public.
- Partnering with stakeholders including Federal, State, and local enforcement agencies, the motor carrier industry, safety groups, and organized labor on efforts to reduce bus and truck-related crashes.

Important FMCSA rules include mandatory rest and licensure requirements for drivers, though the licensure process itself is facilitated by states.

Federal Railroad Administration

The Federal Railroad Administration (FRA) regulates private and public rail operations, including both passenger and freight. It oversees inspection of rail lines and writes and enforces safety regulations. It also provides federal aid grants to railroad owners through state DOTs.

Maritime Administration

The Maritime Administration (MARAD) runs programs to promote use of waterborne transportation and to maintain the viability of the U.S. merchant marine. It manages the Marine Highway Program and provides assistance to U.S.-flag domestic shippers.

Environmental Protection Agency

The Environmental Protection Agency (EPA) regulates emissions from freight industries and reviews potential infrastructure projects for environmental impacts. In addition, the EPA's regional office receives feedback from the public about emissions and noise from freight facilities.

Other Federal Agencies

Federal agencies with an interest in the health and impacts of the freight system include:

- The **Federal Aviation Administration (FAA)**, which provides grants for airport infrastructure through the Airport Improvement Program (AIP).
- The **Department of Homeland Security (DHS)** which includes the agencies that inspect and clear international freight at customs (TSA, CBP) as well as the U.S. Coast Guard.
- The **U.S. Department of Commerce**, which governs the US position on international trade and the **Economic Development Administration (EDA)**.
- The independent, Congressionally-mandated **Surface Transportation Board (STB),** which regulates rail service and collects and disseminates data on rail traffic.
- The **Department of Labor**, which governs the relationship between workforce and management

Municipalities

Massachusetts cities and towns own many key freight facilities, including:

- Roads and bridges, including some that are on the National Highway System (NHS) and the National Multimodal Freight Network (NMFN).
- All significant airports not owned by Massport.
- All major public seaport facilities not owned by Massport, including the Port of New Bedford and the Raymond L. Flynn Marine Park in Boston.

Freight Industries

The freight system is inherently a public-private partnership. Private carriers and forwarders make use of infrastructure funded by the public sector through Federal and State Aid. In many cases, industry must partner with MassDOT, Massport, and others to apply for funding or to maintain infrastructure. In addition, industry owns and funds its own private assets.

Motor Carriers

Motor carriers can be either for-hire ("trucking companies") or private corporations that operate their own fleets (retail chains or Amazon, for example). They handle the administrative side of the trucking industry, and as such are primarily concerned with conditions that impact the business environment, including health of infrastructure, permitting for OS/OW and hazmat, operations restrictions (time and weight), and licensure issues for their workforce. Motor carriers own a fleet of vehicles, and often own home facilities for maintenance. The legislative interests of motor carriers in Massachusetts are represented by the Trucking Association of Massachusetts (TAM).

Rail Carriers

Three classes of railroad companies service the U.S. – Class I, Class II, and Class III railroads – as discussed in Chapter 5. The primary function of rail carriers is to operate locomotives that pull train cars. Rail carriers also own most freight rail trackage in Massachusetts west of Worcester, although MassDOT and the MBTA have been purchasing lines over time. The Boston Line west of Worcester, the Providence and Worcester Railroad (P&W), Pan Am Railways (PAR), and New England Central Railroad (NECR) remain in private hands. Rail carriers conduct federally-mandated inspections of any lines they own, and can receive federal grants for improvements in partnership with MassDOT.

Air Carriers

Air carriers own, charter, and operate aircraft. They include integrated logistics carriers that operate air fleets (UPS, FedEx, DHL, and Amazon), cargo airlines, and passenger airlines that carry freight. While no air carrier directly owns a facility in Massachusetts, they are key stakeholders in any infrastructure improvement at Logan International Airport.

Freight Forwarders and the Shipping Community

Freight forwarders receive cargo from shippers (or pick it up), hold it at warehouses if needed, bring it to airports, seaports, or rail terminals, and do the same in reverse for incoming shipments. They use primarily public infrastructure at seaports and airports (loading doors and docks) and operate their own off-site facilities for processing and distribution. All of these stakeholders are key partners in any efficiency or operational improvements planned at the port facilities.

Distributors

Distributors receive shipments from producers and send them out to homes and retail outlets. Their primary function is regional storage in warehouses and distribution centers, but many of them also operate private truck fleets. They are often but not always sector-specific (milk and dairy, consumer goods).

Regional Bodies

Regional bodies include metropolitan planning organizations (MPOs), economic development councils (EDCs), and chambers of commerce. MPOs develop transportation improvement plans (TIPs) and Regional Transportation Plans (RTPs) to identify projects in their regional transportation networks. MPOs also identify each region's section of the National Multimodal Freight Network.

The Public

The public has many, sometimes competing, expectations of the freight system:

- Goods will arrive to nearby stores or to their homes quickly and reliably at all times and from all destinations.
- Trucks will operate safely and comfortably in mixed traffic and will not add noticeably to traffic congestion.
- Moving and idling trucks and trains will not produce noise or air pollution that impacts quality-of-life.
- Industrial uses and distribution will not be an aesthetic detriment in urban and waterfront neighborhoods.

The public expresses feedback through direct contact with state government, the freight industry, and retail businesses.

Where Does Funding Come From?

All of the strategies listed in Chapter 7 will require some degree of funding to be implemented. This section briefly describes the major funding sources available for use on the freight system and permissible applications for each.

Agency Revenue and Bonds

MassDOT Bonds and Revenue

- Bond Cap, Taxes and Fees – MassDOT primarily funds its capital budget through General Obligation Debt (a.k.a. "GO Bonds" or "Bond Cap"). The Bond Cap can be used to fund projects on most MassDOT-owned elements of the freight system. The debt service is paid through revenue from gasoline and diesel excise tax, motor vehicle license, registration, and title fees, and the motor vehicle sales tax.
- Tolls – Toll revenue in Massachusetts is eligible for use only on the facilities where it is collected.

Massport Revenue

- Aviation – Aviation revenues include rentals (of gates and hangars), landing fees, parking concessions (including rental car fees), and shuttle bus fares. Aviation revenues are subject to rates and charges as regulated by the FAA.
- Maritime – Maritime revenues include container loading and unloading fees, tariffs, facility rentals (including for seafood processors at Fish Pier), parking, and the Cruiseport.
- Real Estate – Real estate revenues include leases and rentals as well as fees.

As Massport is a self-sustaining authority, all Massport revenue must be used at Massport facilities.

Federal Aid

Federal Aid is allocated to MassDOT from several Federal agencies.

FHWA

The Highway Division receives reimbursement on freight system projects from FHWA through several programs, including:

- The National Highway Freight Program (NHFP) can be applied to infrastructure and operations enhancement projects on the National Highway Freight Network (NHFN).
- The Railway-Highway Crossings Program (Section 130) provides funding for the elimination of hazards at grade crossings.
- The National Highway Performance Program (NHPP) provides support for the condition and performance of the National Highway System (NHS), for the construction of new facilities on the NHS, and to ensure that investments of Federal-aid funds in highway construction are directed to support progress toward the achievement of performance targets established in a state's asset management plan for the NHS.
- The Surface Transportation Block Grant Program (STBG) provides flexible funding to best address state and local transportation needs. It can be applied on most highway and rail facilities.
- Congestion Mitigation/Air Quality (CMAQ) is applicable on projects that will help Massachusetts meet the requirements of the Clean Air Act.
- The Carbon Reduction Program (CRP) provides funding for projects that reduce transportation emissions or for the development of carbon reduction strategies.
- Off-System Bridge funding is used for bridges that see less traffic, in order to expand high-quality system access.
- The Highway Safety Improvement Program (HSIP) is eligible for use on safety improvements.

Discretionary Grant Opportunities

The passage of BIL expanded the number of discretionary grant opportunities available for transportation planning and construction projects, and notably freight-specific projects. Table 8.1 presents key funding programs dedicated to freight transportation projects.

TABLE 8.1 SELECT GRANT AND FORMULA FUNDING PROGRAMS FOR FREIGHT TRANSPORTATION PROJECTS

Program	2023 Funding Authorization	Description
Rebuilding American Infrastructure with Sustainability and Equity (RAISE)	$2.3 Billion	Supports a wide range of surface transportation projects of local and/or regional significance.
Infrastructure for Rebuilding America (INFRA)	$1.53 Billion	Provides funding to state and local governments for projects of regional or national significance, with a focus on freight needs. IIJA also raises the cap on multimodal projects to 30% of program funds.
Mega Projects	$1.2 Billion	Similar to RAISE and INFRA grants, Mega grants support a wide range of transportation projects, with emphasis on particularly large and complex projects.
Promoting Resilient Operations for Transformative, Efficient, and Cost-Savings Transportation (PROTECT)	$1.4 Billion (FY22-26)	Supports resilience improvements to protect surface transportation assets, including highway projects, and port facilities.
Consolidated Rail Infrastructure and Safety Improvements Program (CRISI)	$1.43 Billion (FY22)	Supports projects that improve safety, efficiency, and reliability of intercity passenger and freight rail.
Bridge Investment Program	$2.4 Billion (FY22)	Authorizes funding to reduce the number of national bridges in 'poor' condition or in 'fair' condition at risk of falling into 'poor' condition.
Port Infrastructure Development Program	$662 Million	Authorizes funding to upgrade nationwide ports with an emphasis on addressing resiliency and reducing pollution.
America's Marine Highways (AMH)	$25 Million	Supports concepts for new services or expansion of existing Marine Highways, including port and landside infrastructure development.
Airport Improvement Program	$1.5 Billion	Provides grants for the planning and development of public-use airports, including for cargo-related uses.
Railroad Crossing Elimination Grant Program	$500 Million	Provides funding for the elimination or improvement of highway-rail grade crossings.
Rural Surface Transportation Grant Program	$300 Million	Improve and expand surface transportation infrastructure in rural areas to increase connectivity, improve safety, and support the movement of people and freight, in order to generate regional economic growth.

Program	2023 Funding Authorization	Description
Reconnecting Communities Pilot Program – Planning Grants and Capital Construction Grants	$195 Million	Supports planning grants and capital construction grants, as well as technical assistance, to restore community connectivity through the removal, retrofit, mitigation, or replacement of eligible transportation infrastructure facilities. This includes studying the impacts related to freight mobility.

Source: FHWA.

FAA

The FAA provides funds to airport sponsors (cities, towns, counties, port authorities, states, etc.) through its Airport Improvement Program (AIP). In Massachusetts, Massport uses very little AIP funding due to its independent revenue streams, so AIP funds are typically applied to infrastructure projects at municipal airports. MassDOT must provide matching funds for between 5 percent and 25 percent of project costs, depending on the size of the airport.

State Aid to Municipalities

Chapter 90

MassDOT provides municipal aid for roadway projects through the Chapter 90 Program. Chapter 90 projects are 100% reimbursable, meaning that municipalities are not required to contribute to uses include resurfacing and related work, bridges, right-of-way acquisition, shoulders, side road approaches, landscaping, drainage, sidewalk, traffic control and service facilities, and lighting.

Based on the amount approved, each of the Commonwealth's 351 municipalities are allocated a portion of overall Chapter 90 Program funds each state fiscal year. Municipalities are allocated funds based a composite of three factors:

- Road miles – 58.33 percent;
- Population – 20.83 percent; and
- Employment – 20.83 percent.

After the total apportionment for a city or town is calculated, municipalities apply for reimbursements on a project-by-project basis.

Municipal Small Bridge Program

The program provides funding to municipalities for the replacement, preservation, and rehabilitation of eligible bridges. To be considered for funding, bridges must be on a local public way and must be on the State Bridge

Inventory with a span between 10 and 20 feet. The program provides grants in two phases for the design and construction of bridge projects.

Complete Streets Program

MassDOT provides funding to cities and towns for the development of "Complete Streets" plans, which could include provisions for freight loading areas in business districts.

Local Bottleneck Reduction Program

This program seeks to fund innovative solutions to address congestion bottlenecks on local roadways to improve traffic flow. Project locations are proposed by municipalities, with the option to partner with a Regional Transit Authority and are considered by MassDOT for funding through a competitive application process. Every municipality in the Commonwealth is eligible for this program. Selection is based primarily on bottleneck related congestion and delay metrics. Project design for selected applicants is performed by MassDOT-led consultants funded through the program. Project implementation is conducted entirely by the municipality.

Industrial Rail Access Program

Public-private partnerships (P3s) are common in many areas of the freight system, as key assets (rail lines and port facilities, for example) are owned privately. The Industrial Rail Access Program (IRAP) is a P3 that combines funding to help eligible applicants invest in industry-based freight rail infrastructure improvement projects. Owners may apply on their own for MassDOT grants to be used for new industrial sidings and opening or reopening branch lines. The goals of the program are to stimulate economic development, grow Massachusetts corporations, keep manufacturing jobs and create new jobs through increased efficiency, production capacity, and improved distribution logistics.

Putting It All Together

This Implementation Plan for the 2023 Massachusetts Freight Plan is designed to help advance the recommendations detailed in Chapter 7. Those strategies are summarized in Table 8.2 (immediate), Table 8.3 (robust), Table 8.4 (hedging), and Table 8.5 (shaping).

TABLE 8.2 IMPLEMENTATION PLAN FOR 2023 MASSACHUSETTS FREIGHT PLAN – IMMEDIATE STRATEGIES

Strategy	Strategy Type	Proponent	Funding	Management
Improve the condition of freight network assets	Infrastructure	MassDOT, Massport, MPOs, municipalities, industry, the public	Federal Aid, MassDOT, Massport, industry, municipalities	MassDOT, Massport, Asset owners
Build and expand truck parking facilities on primary truck routes across Massachusetts in alignment with recent studies and recommendations	Infrastructure	MassDOT, municipalities, private operators	Federal aid, discretionary grants, MassDOT	Private operators, municipalities
Resolve identified truck bottlenecks	Infrastructure	MassDOT, municipalities, industry	Federal aid, MassDOT	MassDOT
Upgrade freight rail lines in Massachusetts to 286K standard	Infrastructure	MassDOT, industry	Federal aid, MassDOT, private railroads	Industry
Maintain uncongested last-mile access to freight-generating facilities	Infrastructure	MassDOT, Massport, municipalities, industry	Federal aid, MassDOT, Massport, municipalities, industry	MassDOT, Massport, municipalities
Build right-sized distribution centers inside Route 128	Infrastructure	Industry	Municipalities, Industry	Municipalities, Industry
Develop delivery areas in urban districts and town centers	Infrastructure	Municipalities, industry	Municipalities, Industry	Municipalities, Industry
Analyze and improve lighting conditions on corridors with higher rates of truck-involved crashes	Infrastructure	MassDOT, municipalities	Federal aid, MassDOT, municipalities	MassDOT, municipalities
Improve safety at highway-rail grade crossings	Infrastructure	MassDOT, municipalities, industry	Federal aid, MassDOT, municipalities	MassDOT, industry
Incorporate rumble strips into new and existing interstate & rural roadways	Infrastructure	MassDOT, municipalities	MassDOT, municipalities	MassDOT, municipalities
Develop Intelligent Transportation Systems (ITS) and Active Transportation and Demand Management (ATDM)	Operational	MassDOT	Federal aid, MassDOT, industry	MassDOT, industry
Establish a framework for prioritizing multimodal freight projects with a focus on equity	Operational	Commonwealth, MassDOT, MPOs, municipalities	Federal aid, Commonwealth, MassDOT, MPOs, municipalities, non-governmental organizations, private freight stakeholders	MassDOT, municipalities, non-governmental organizations, private freight stakeholders

Strategy	Strategy Type	Proponent	Funding	Management
Emphasize the need for timely and accurate reporting of crash data involving freight vehicles or at-grade rail crossings	Operational	MassDOT, state and local law enforcement	N/A	MassDOT, State and local law enforcement
Support policies to reduce greenhouse gas emissions from transportation	Policies	Commonwealth, MassDOT, Executive Office of Energy and Environmental Affairs (EOEA), MPOs, municipalities, private freight stakeholders	Federal aid, Commonwealth, municipalities, private freight stakeholders	MassDOT, Executive Office of Energy and Environmental Affairs, MPOs, municipalities, industry, private sector
Harmonize interstate oversize/overweight movements, permitting, and large truck restrictions across New England	Policies	MassDOT, neighboring states, industry	N/A	State DOTs
Coordinate freight planning with neighboring states	Policies	MassDOT, neighboring states, industry	N/A	State DOTs
Support and promote freight-related workforce development	Policies	Commonwealth, MA Dep't of Higher Education, community colleges, private sector	N/A	Commonwealth, MA Dep't of Higher Education, community colleges, private sector
Provide collaborative guidance and support to MPOs and local governments in integrating freight, distribution, and loading into their planning and zoning land use decision-making processes	Policies	MassDOT, Executive Office of Housing and Economic Development, MPOs, municipalities	N/A	MPOs and municipalities
More fully integrate freight planning into MassDOT activities	Policies	MassDOT	N/A	MassDOT
Promote driver education on stopping distances when operating at higher speeds and/or on high-speed roads	Policies	MassDOT - Registry of Motor Vehicles	N/A	Registry of Motor Vehicles
Promote road user education on safe vehicle operations and visibility around trucks	Policies	MassDOT - Registry of Motor Vehicles	N/A	Registry of Motor Vehicles

TABLE 8.3 IMPLEMENTATION PLAN FOR 2023 MASSACHUSETTS FREIGHT PLAN – ROBUST STRATEGIES

Strategy	Strategy Type	Proponent	Funding	Management
Protect freight system assets and operations from climate change and extreme weather impacts	Infrastructure	MassDOT, Massport, municipalities, railroads, MPOs, industry, general public	Federal aid, MassDOT, Massport, municipalities, railroads, other private stakeholders	Asset owners
Build standardized small package drops	Infrastructure	Industry	Industry	Industry
Encourage increased use of underutilized gateway infrastructure (ports and airports)	Infrastructure	MassDOT, Massport, port and airport operators, railroads, industry	N/A	Asset owners
Identify and preserve appropriate existing rural and industrial sites for freight-intensive development	Infrastructure	Private freight stakeholders, MPOs, municipalities, Executive Office of Housing and Economic Development, MassDOT	MassDOT, Executive Office of Housing and Economic Development	Executive Office of Housing and Economic Development, MPOs, municipalities
Study and perform curbside demand management	Operational	MassDOT, MPOs, municipalities	Federal aid, MassDOT, MPOs, municipalities	MPOs, Municipalities
Explore and incorporate real-time and other new data sources to better understand freight movements	Operational	MassDOT, MPOs	Federal aid, MassDOT	MassDOT, MPOs
Use critical freight corridors to support and advance projects that improve multimodal freight mobility	Operational	MassDOT, Massport, MPOs, municipalities	Federal aid, MassDOT	MassDOT, Massport
Consider opportunities to improve MassDOT design guidance, policies, and procedures to protect against extreme weather and reduce local air pollution, flooding & stormwater runoff, and wildlife habitat loss	Policies	MassDOT, Executive Office of Energy and Environmental Affairs	N/A	MassDOT, Executive Office of Energy and Environmental Affairs
Promote efforts to increase fatigue awareness among truck drivers and operators	Policies	MassDOT	N/A	MassDOT

TABLE 8.4 IMPLEMENTATION PLAN FOR 2023 MASSACHUSETTS FREIGHT PLAN – HEDGING STRATEGIES

Strategy	Strategy Type	Proponent	Funding	Management
Electrify truck stops	Infrastructure	MassDOT, municipalities, industry, trucking companies	Federal aid, P3s, private industry	Truck stop operators
Improve the efficiency of air cargo processing at Logan Airport and in surrounding areas	Operational	Massport	Massport, private air cargo stakeholders	Massport, private air cargo stakeholders
Improve freight worker access to transit	Policies	MassDOT, Massachusetts Bay Transportation Authority, Regional Transit Authorities	N/A	MPOs, transit operators
Support low-impact freight and industrial development in urban locations	Policies	MassDOT, Massport	N/A	MPOs, municipalities
Support action to preserve industrial land uses in the Boston area	Policies	MassDOT, Massport, municipalities	N/A	MPOs, Massport, municipalities

TABLE 8.5 IMPLEMENTATION PLAN FOR 2023 MASSACHUSETTS FREIGHT PLAN – SHAPING STRATEGIES

Strategy	Strategy Type	Proponent	Funding	Management
Reduce the number of at-grade crossings	Infrastructure	MassDOT, Massport, municipalities, industry	Federal aid, MassDOT, municipalities	MassDOT, MPOs, municipalities, industry
Improve and preserve freight connections to/from Boston's waterfront freight facilities	Infrastructure	Massport, MassDOT, industry, municipalities	Federal aid, MassDOT, Massport, municipalities	MassDOT, Massport, municipalities
Encourage e-bicycle/cargo bicycle delivery	Operational	Delivery companies	Federal and state aid, private freight stakeholders	MassDOT, private freight stakeholders
Deploy safety upgrades such as convex/crossover mirrors, lane departure warning, blind spot detection, and backup cameras in MassDOT truck fleet	Operational	MassDOT, general public	MassDOT	MassDOT
Deploy lateral protective devices (side guards) in MassDOT truck fleet	Operational	MassDOT, general public	MassDOT	MassDOT
Study and update building codes to allow for more efficient deliveries	Policies	Municipalities	N/A	Municipalities
Study and modify municipal zoning codes to allow for neighborhood micro-hubs and other in-town warehouse spaces	Policies	Municipalities	N/A	Municipalities
Support efforts to reduce distracted driving and control the use of handheld electronic devices while driving	Policies	MassDOT, trucking industry, non-governmental organizations	N/A	MassDOT
Study and support the development of Advanced Air Mobility (AAM)	Policies	MassDOT	Federal and state aid	MassDOT

9 FISCALLY-CONSTRAINED FREIGHT INVESTMENT PLAN

Per the FAST Act and IIJA, state freight plans shall include a list of priority projects and describe how the National Highway Freight Program (NHFP) funds would be invested and matched.

The Capital Investment Plan (CIP) serves as the definitive capital planning document for MassDOT. The CIP is the annual prioritized list of all projects using all sources of available funding. The CIP is developed in concert with the five-year State Transportation Improvement Program (STIP), which incorporates the federal funding levels and programs included in the Bipartisan Infrastructure Law (BIL), to maximize federal funding available to the Commonwealth's regional and state agencies.

Projects programmed in the CIP that best meet the goals of the Freight Plan are selected to use National Highway Freight Program funding. Each project is screened to make sure it meets at least one statutory requirement for use of NHFP funds.

Table 9.1 documents MassDOT's fiscally constrained Freight Investment Plan (FIP). The project list will be updated following the development of the CIP and STIP.

TABLE 9.1 MASSACHUSETTS FREIGHT INVESTMENT PLAN, FFY 2023 – FFY 2027

Funding Program	Project Description	TPFC		FFY 2023	FFY 2024	FFY 2025	FFY 2026	FFY2027
Freight Plan Flex to Rail & Transit[1]	Freight Plan Flex to FRA	$5,600,000	NHFP Federal Funds	$4,480,000	–	–	–	–
			Non-Federal Funds	$1,120,000	–	–	–	–
Roadway Reconstruction[2]	HOPKINTON-WESTBOROUGH-RECONSTRUCTION OF I-90/I-495 INTERCHANGE	$300,942,837	NHFP Federal Funds	$11,188,991	$10,511,663	$16,308,640	$5,827,243	$23,078,765
			Non-Federal Funds	$1,243,221	$1,167,963	$1,812,071	$647,471	$2,564,307

[1] *East Deerfield Freight Intermodal Project Flex to FRA (Federal Railroad Administration)*

[2] *Construction; HIP+NHPP+NFA+NFP+Other FA = $300,942,837; Project funded over six fiscal years (2022-2027)*