Report on the Safety Impacts of Ethanol Transportation by Rail

through Boston, Cambridge, Chelsea, Everett, Somerville, & Revere

March 29, 2013

Prepared by:

Massachusetts Department of Transportation

Office of Transportation Planning

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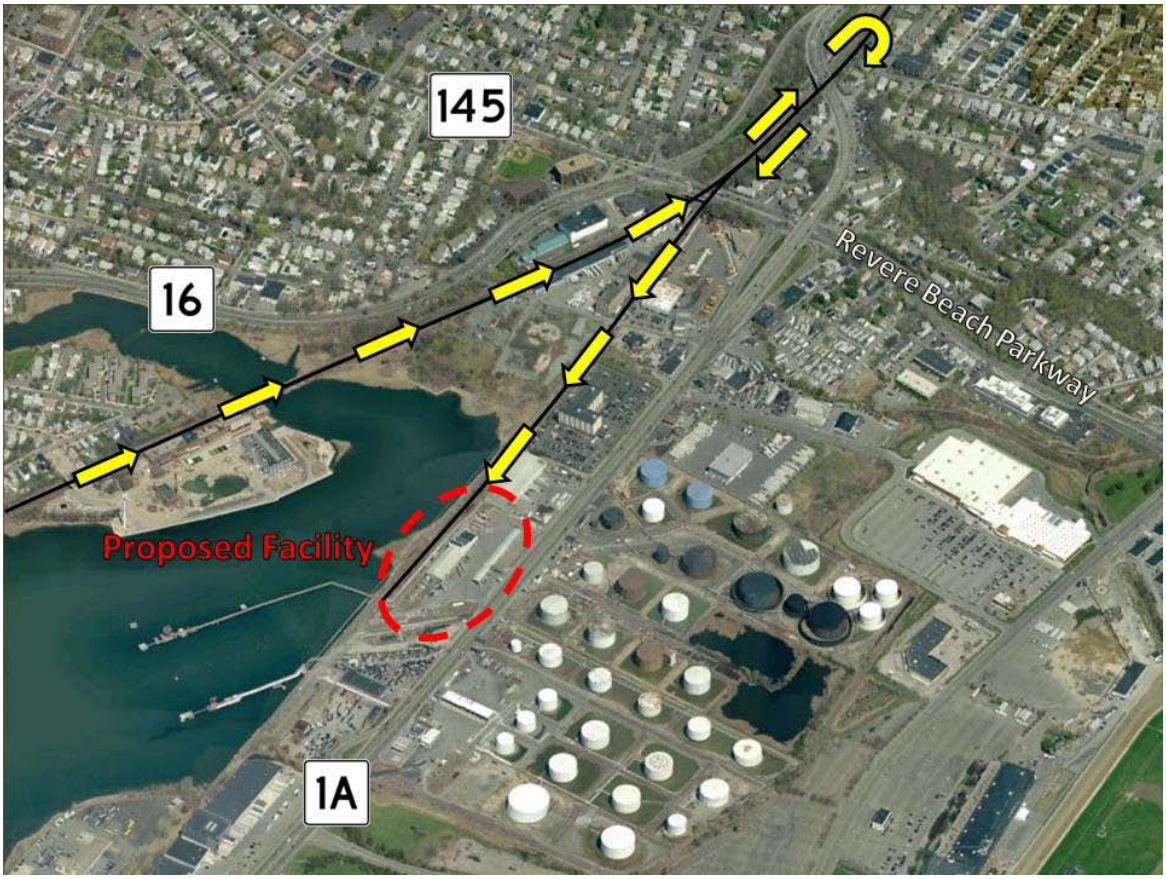
1.1 Summary of the Global Terminal Project History

Global Partners, LP (Global) operates a bulk petroleum storage terminal located on Route 1A (Lee Burbank Highway) in Revere, Massachusetts. At this facility, Global stores and mixes gasoline, ethanol, and other fuels for distribution to the New England market. The ethanol shipped to and stored at the facility is primarily used to mix with gasoline, as required by the Clean Air Act Amendments of 1990, in order to reduce carbon monoxide emissions and other impacts of gasoline.

Global intends to upgrade and modernize the existing railcar unloading facility at its Revere terminal. These site improvements will be made in coordination with a project by Pan Am Southern Railroad to upgrade the rail line spur that connects to the facility; these improvements would allow Global to receive ethanol by railcar. The proposed delivery of ethanol by rail would supplement and possibly replace existing deliveries by barge and truck.

The rail deliveries of ethanol would principally originate in the Midwest and be moved through Western Massachusetts and ultimately to the Revere location. It is expected that the rail deliveries will primarily be unit trains, a term for a freight train consisting of railcars hauling only one dedicated commodity.

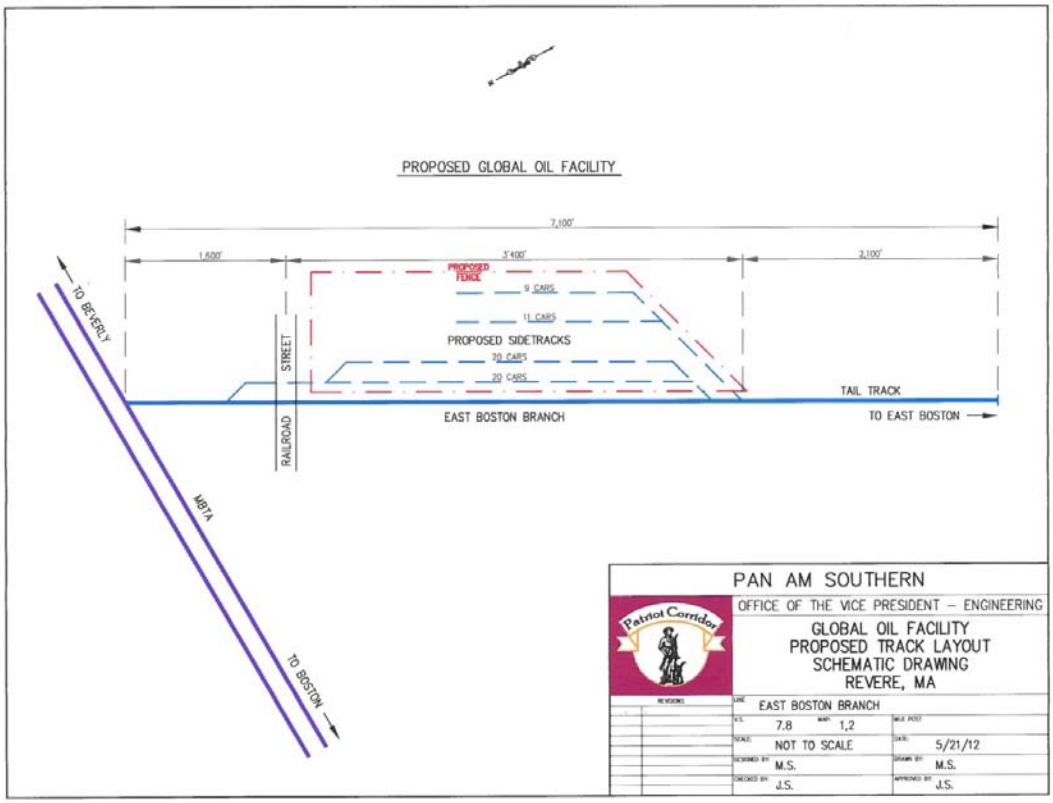
Figure 1-1: Rail Route to the Global Facility in Revere



As shown in Figure 1-1, the Global terminal is adjacent to rail lines owned by the Massachusetts Bay Transportation Authority (MBTA) and the terminal has an existing rail spur that connects the Global terminal to those rail lines. In order to modernize the existing off-loading facility on the terminal so that it can accommodate ethanol unit trains, Global's proposed project would split the existing rail spur into two adjacent tracks, each designed to hold a total of 20 rail cars at one time for unloading. The proposed modernization project includes installation of an upgraded drainage trench system running the length of the off-loading facility. This drainage trench system would be connected to the terminal's existing oil-water separator. In addition, a new impervious containment system would be installed to comply with U.S. EPA's current spill prevention, containment and countermeasures (SPCC) requirements. The pumps for the off-loading facility would be placed on the existing concrete pad adjacent to the spur and associated piping would be installed along the spur. In addition, a new vapor recovery system would also be installed on the existing concrete pad adjacent to the spur. The area will also be incorporated into the facility security and response plans.

Simultaneously with the proposed modernization of Global's existing rail off-loading facility, Pan Am Southern Railroad plans to perform maintenance and upgrades to the rail lines outside the terminal, reducing the number of tracks outside the terminal from five tracks to three. Additional railcars would be stored adjacent to the terminal in a fenced-in, secured access area on a portion of the rail lines. A full schematic of the proposed railroad infrastructure is shown in Figure 1-2.

Figure 1-2: Track Schematic of Proposed Improvements Adjacent to the Global Facility in Revere



1.2 Summary of Massachusetts Legislation

Ethanol, like gasoline, is a flammable liquid. Residents of the communities near the Global terminal have expressed concerns about the safety of transporting ethanol unit trains through their cities. In response to these concerns, the Massachusetts Legislature included Section 24 in Chapter 242 of the Acts of 2012. This provision charges the Massachusetts Department of Transportation (MassDOT) with executing a study on the potential public safety issues associated with ethanol transportation by rail through the cities of Boston, Cambridge, Chelsea, Everett, and Revere. The text of Section 24 is shown below.

> *Section 24. Notwithstanding any general law or special law or rule or regulation to the contrary, the Massachusetts Department of Transportation shall commission a study to determine the impact on the public safety of transporting ethanol by train through the cities of Boston, Cambridge, Chelsea, Everett and Revere. Public safety issues to be studied shall include, but not be limited to, the proximity to residences, elderly housing complexes, schools, hospitals, health care facilities and other population and demographic characteristics and emergency response capabilities. The report shall be completed not later than 6 months after the effective date of this act, and copies of the report shall be provided to the house and senate committees on ways and means, the executive office of public safety and security and the department of environmental protection. The department of environmental protection shall not issue a license under chapter 91 of the General Laws for the transportation of ethanol through the cities of Boston, Cambridge, Chelsea, Everett and Revere until it has received the report.*

At the request of the City of Somerville and the study's Technical Advisory Group, the study area was expanded to include Somerville. It is included in this report, despite the geographic restrictions in the legislation, because it is essentially surrounded by the other cities listed in the legislation; each of the potential ethanol rail routes also passes through Somerville; and it has population density and development patterns that are similar to those of the other cities listed in the legislation.

With the addition of the City of Somerville, MassDOT has issued this report to evaluate the potential safety impacts of transporting ethanol by train through the cities of Boston, Cambridge, Chelsea, Everett, Somerville, and Revere. The remainder of Chapter 1 of this report outlines the relevant regulations governing the transportation of ethanol by rail and provides a description of the civic engagement process utilized to inform the public about this report. Chapter 2 of this report identifies the rail routes within the study area communities that may be used to transport ethanol and evaluates the current physical and operational conditions along those routes. Chapter 3 evaluates the public safety impacts of transporting ethanol by rail by identifying the potential safety risks (based on rail accident reports and an assessment of potentially exposed populations) and comparing them to the existing safety procedures and emergency response capabilities of the cities, railroads and terminal operators. Chapter 4 summarizes the findings of this study and provides recommendations for further action.

1.3 Review of Relevant Regulations

Regulations Pertaining to Global Facility's Proposed Project

Global plans to upgrade the track and sidings along its property to accommodate storage and unloading of ethanol trains. Because the facility is located in a Designated Port Area (DPA), these changes are subject to Chapter 91 of the Massachusetts General Laws, which governs activities on Massachusetts' waterfronts, including filled tidelands and Designated Port Areas. As a result, Global needs a Chapter 91 license from the Massachusetts Department of Environmental Protection (DEP) in order to make improvements in this area. The license is not related to the transportation of ethanol by railroad, only to the physical changes at the Global facility. DEP has held a public hearing on the proposed project, but has withheld the issuance of the Chapter 91 license at the direction of the Legislature through Section 24 of the Transportation Bond Bill outlined above.

The proposed improvements are also subject to regulation under the Massachusetts Wetlands Protection Act because they are within 200 feet of Chelsea Creek and within the 100-year floodplain. Global filed a notice of intent with DEP on February 22, 2011 and was issued an order of conditions on May 4, 2011. The order of conditions includes instructions from DEP and the City of Revere's Conservation Commission that Global must follow to ensure protection of the wetlands and riverfront areas within the project limits.

Regulations Pertaining to the Transportation of Ethanol by Train to the Global Facility

The rail lines that will carry the proposed ethanol unit trains within the study area communities are owned by the MBTA as part of the commuter rail system that serves eastern Massachusetts. The MBTA commuter rail system comprises 270 miles of railroad tracks and related rail properties. These rail properties are operated pursuant to agreements that govern the relative rights and obligations of the MBTA and the railroad companies that sold the rail lines to the Commonwealth of Massachusetts or the MBTA. These agreements address the parties' roles in the operation and maintenance of freight only, passenger only, and shared use rail lines.

When the rail lines were sold to the MBTA or the Commonwealth for passenger rail operations, the railroad that sold the line generally retained the right to operate freight service over that line. Such an agreement is in place between CSX and MassDOT on the Grand Junction railroad through Boston and Cambridge which is one of the five rail lines that could potentially carry ethanol trains through the study area. The remaining four of the five lines that could potentially carry ethanol trains through the study area (the Fitchburg Line, the Lowell Line, the Haverhill Line, and the Newburyport/Rockport Line) were acquired from the Boston & Maine Railroad in 1976 and are subject to an exclusive easement to provide rail freight transportation service benefiting the Boston & Maine Railroad. Pan Am Railways, as the successor to the Boston & Maine Railroad, owns an exclusive easement to provide rail freight transportation service along its rail lines.

Railroads are regulated almost exclusively at the federal level. Railroad operations are under the jurisdiction of the Surface Transportation Board (STB), and railroad safety standards are governed by the

Federal Railroad Administration (FRA), while railroads are required to work with the federal Department of Homeland Security (DHS) on security issues.

Under STB rules, state or local laws and regulations are preempted for railroad operations in order to ensure uniform regulation of railroad operations and to safeguard interstate commerce. The federal preemption provision is contained in 49 U.S.C. 10501(b), as broadened by the Interstate Commerce Commission (ICC) Termination Act of 1995, Pub. L. No. 104-88, 109 Stat. 803 (1995) (ICCTA).

These laws shield railroad operations that are subject to the STB's jurisdiction from the application of many state and local laws, including local zoning and permitting laws and laws that would have the effect of managing or governing rail transportation. This preemption, therefore, limits state or local actions from blocking or regulating the rail transportation of ethanol, or any other railroad activity that is regulated at the federal level.

As an example, Pan Am Railways, which runs the Boston & Maine railroad, owns a railroad yard in Ayer, Massachusetts. In 1997, in order to expand its storage capacity, Pan Am purchased land, the San Vel site, which lies across the street from its railroad yard and is bounded by two railroad tracks. The Town of Ayer imposed a set of 36 conditions on issuance of any permit for construction on that property, and additionally the Board of Health declared the proposed plan to be a noisome trade, causing Pan Am's activities to be banned outright. These local ordinances were brought before the federal court and it was found that the Town of Ayer was violating the preemption afforded to railroad operations.

1.4 Technical Advisory Group (TAG) Meetings

Working with city staff, elected officials, and neighborhood groups, MassDOT collaboratively developed a technical advisory group made up of more than 25 key stakeholders to reflect the community interests in the study area. In addition to staff from MassDOT's Office of Transportation Planning (OTP) and its Rail and Transit Division, the stakeholders include officials from the Massachusetts Executive Office of Public Safety and Security, the Massachusetts Department of Public Health, the Massachusetts Department of Environmental Protection, the Massachusetts Department of Fire Services, the City of Boston, the City of Cambridge, the City of Chelsea, the City of Everett, the City of Somerville, the City of Revere, Alternatives for Community & Environment, Inc., the Chelsea Collaborative, Global Partners, LP, Renewable Fuels Association, and representatives of the communities.

MassDOT held a series of technical advisory group meetings as part of each study task to solicit feedback and ensure full understanding of the study process and products.

1st Technical Advisory Group Meeting

The first technical advisory group meeting was held on January 10, 2013 at the conference room of the MassDOT Office of Transportation Planning located at 10 Park Plaza in Boston. The primary topics of the meeting were: (1) a review of the Transportation Bond Bill legislation and the proposed scope of work and schedule for the study; (2) the findings to date related to Task 1, which included a summary of the proposed Global project and the regulations related to the transportation of ethanol by rail; and (3) the

potential rail routes for ethanol transportation. A full meeting summary is available in the appendix of this report.

2nd Technical Advisory Group Meeting

The second technical advisory group meeting was held on January 24, 2013 at the city council chambers in the Revere City Hall located at 281 Broadway in Revere. The primary topics of the meeting were: (1) a review of the comments from the first meeting on January 10, 2013; (2) the findings to date related to Study Task 2, which included a summary of the physical and operation conditions along the rail routes in the study area;, and (3) the findings to date related to Study Task 3, which included a review of ethanol train accidents and the distribution of maps showing the populations that could be exposed to safety risks associated with ethanol in the case of an accident. A full meeting summary is available in the appendix of this report.

3rd Technical Advisory Group Meeting

The third technical advisory group meeting was held on February 7, 2013 at The Chelsea Collaborative, located at 318 Broadway in Chelsea. The primary topics of the meeting were: (1) a review of the new project schedule, as members of the legislature had recently requested an extension of the deadline of the report's due date; (2) comments from a public meeting at East Boston High School and additional meetings with other interested parties: (i.e. the Chelsea Public Schools and New England Produce Center) ; and (3) the findings to date related to Study Task 3, which included a review of national ethanol train accidents, accidents in Massachusetts from 2008 to 2012, distribution of maps showing the populations potentially exposed to ethanol during rail shipment and emergency response capabilities of the communities in the study area. A full meeting summary is available in the appendix of this report.

4thTechnical Advisory Group Meeting

The fourth technical advisory group meeting was held on March 8, 2013 at the conference room of the MassDOT Office of Transportation Planning located at 10 Park Plaza in Boston. The primary topics of the meeting were: (1) a review of the draft presentation for the neighborhood meeting at the Argenziano School in Somerville; and (2) comments on the draft study findings to date. A full meeting summary is available in the appendix of this report.

5thTechnical Advisory Group Meeting

The fifth technical advisory group meeting was held on March 15, 2013 at the conference room of the MassDOT Office of Transportation Planning located at 10 Park Plaza in Boston. The primary topics of the meeting were: (1) a review of the draft report findings; and (2) comments on the draft study findings. A full meeting summary is available in the appendix of this report.

1.5 Public Informational Meetings

The civic engagement plan for this study also included additional coordination with the public through attendance at informal neighborhood meetings, special briefings with local officials, and a public informational meeting.

Neighborhood Public Meetings

East Boston High School

A meeting was held on February 6, 2013 at the East Boston High School, located at 81 White Street, East Boston. The primary purpose of the meeting was to (1) meet with the local communities, (2) inform them of the study and any findings to date, and (3) to get any feedback which could be beneficial to the study. A full meeting summary is available in the appendix of this report.

Argenziano School in Somerville

A meeting was held on March 11, 2013 at the Argenziano School, located at 290 Washington Street, Somerville. The primary purpose of the meeting was to (1) meet with the local communities, (2) inform them of the study and findings to date, and (3) to get any feedback which could be beneficial to the study. A full meeting summary is available in the appendix of this report.

Chelsea Collaborative in Chelsea

A meeting was held on March 18, 2013 at the Chelsea Collaborative, located at 318 Broadway, Chelsea. The primary purpose of the meeting was to (1) meet with the local communities, (2) inform them of the draft findings, and (3) to get feedback which could be beneficial to the study. A full meeting summary is available in the appendix of this report.

Informal Neighborhood Meetings

Chelsea Public Schools

A meeting was held on February 6, 2013 with the representatives from Chelsea Public Schools, at City Hall, in Chelsea. The primary purpose of the meeting was to (1) meet with the key members of the school system, (2) inform them of the study and any findings to date, and (3) to get any feedback which could be beneficial to the study. A full meeting summary is available in the appendix of this report.

New England Produce Center

A meeting was held on February 7, 2013 with the New England Produce Center in Chelsea. The primary purpose of the meeting was to (1) meet with representatives of local businesses, (2) inform them of the study and any findings to date, and (3) to get any feedback which could be beneficial to the study. A full meeting summary is available in the appendix of this report.

Chelsea Business Owners

MassDOT attended a meeting held on February 26, 2013 with business owners in Chelsea. The primary purpose of the meeting was to (1) inform the meeting attendees of the study and any findings to date, and (3) to get any feedback that could be beneficial to the study.

Massachusetts Emergency Management Agency

A meeting was held on March 13, 2013 with the Massachusetts Emergency Management Agency in Framingham. The primary purpose of the meeting was to (1) meet with representatives of state emergency preparedness agencies, (2) inform them of the study and any findings to date, and (3) to get

any feedback which could be beneficial to the study. A full meeting summary is available in the appendix of this report.

1.6 Project Web Site

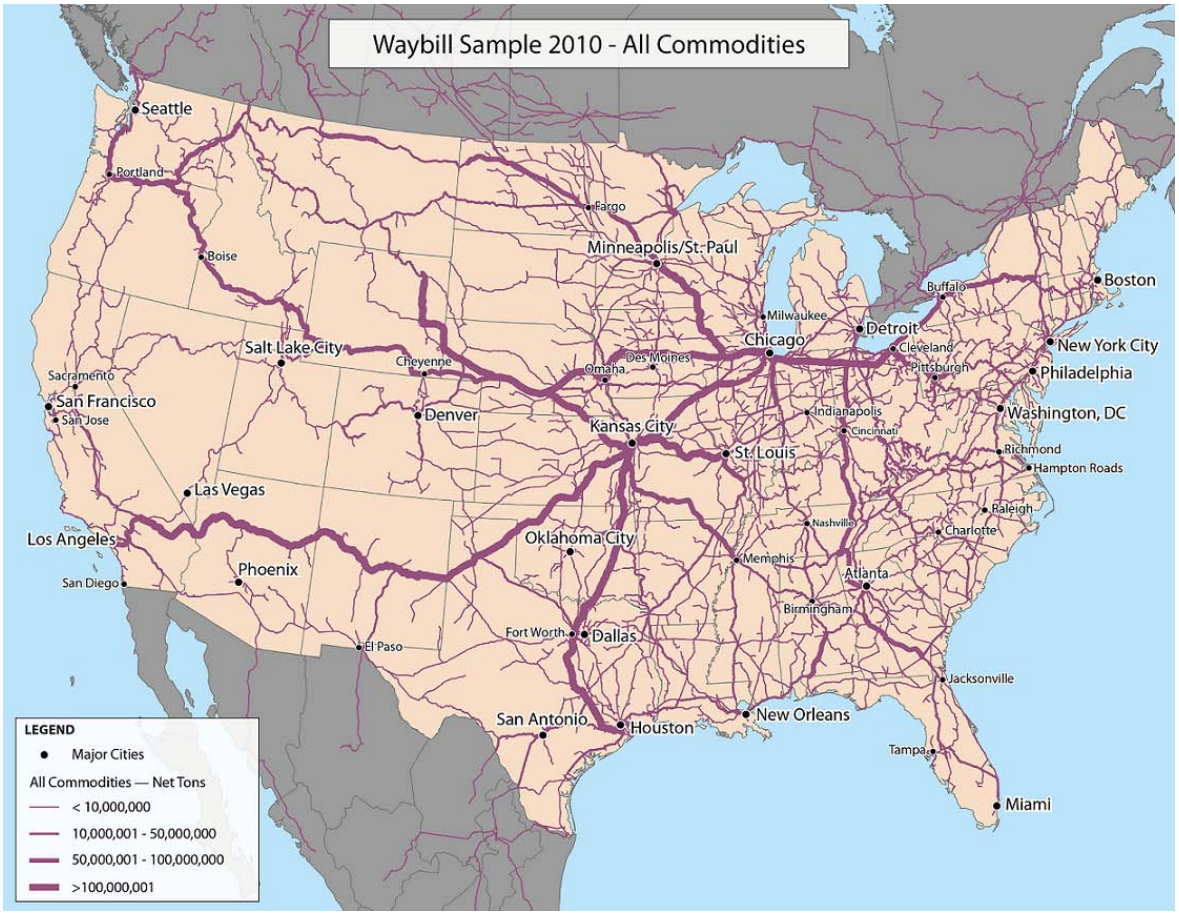
MassDOT established a bilingual project website for the study: www.mass.gov/massdot/ethanolsafety . The website was utilized as a tool for sharing information on the study, including the draft materials and information on public meetings.

Chapter 2: Identification of Rail Routes and Assessment of their Condition

2.1 Definition of railroad routes accessing the site

Determining the railroad routes that may carry ethanol through the study area requires an understanding of the national freight rail system that serves Massachusetts. A map of the national railroad system is shown below in Figure 2-1. This map depicts the general route and quantity of freight that travels across the United States. Railroads carry ethanol and many other commodities through both sparsely populated areas and densely populated areas of the country.

Figure 2-1: The National Freight Railroad System



There are many railroads in Massachusetts, most of which are smaller regional routes that distribute freight to local destinations. However, there are three primary rail routes that connect Massachusetts to the national railroad network, and that are used to transport freight longer distances into and out of the Commonwealth. The first two routes traverse the state in an east-west direction, while the third crosses the state from the north-south. The first of the east-west routes is the Pan Am Southern Mainline, which approximately parallels Route 2, entering Massachusetts in Williamstown and connecting to the MBTA Fitchburg commuter rail line in Fitchburg. The second east-west route is the CSX mainline, which approximately parallels the Massachusetts Turnpike, entering Massachusetts in West Stockbridge and

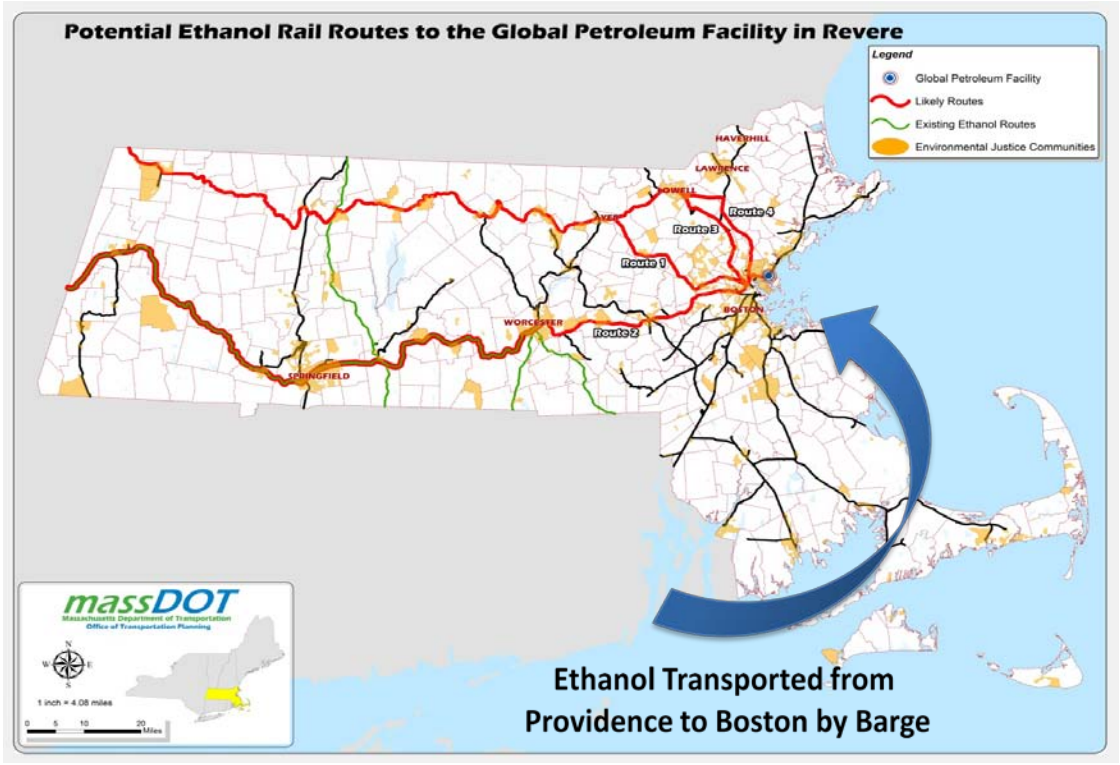
traveling through Pittsfield, Springfield, and then Worcester, where it connects to a number of rail lines, including the MBTA Worcester Commuter Rail Line, which is also the freight connection into Boston. These two routes link to the four possible routes that could be used to transport ethanol to the Global facility in Revere. These routes are highlighted in Figure 2-2.

Currently, ethanol is transported through Massachusetts on the CSX mainline and the New England Central Railroad to Worcester. From Worcester the ethanol trains are transported down to the Motiva Terminal in Providence where the ethanol is transferred to a barge for delivery to Global and other facilities. Barges typically carry between 680,000 and 2.5 million gallons of ethanol per vessel. As shown in Figure 2-2, ethanol trains currently pass through many dense urban areas; these include Pittsfield, West Springfield, Springfield, Greenfield, and Worcester in Massachusetts, as well as Providence, Rhode Island.

The north-south route, called the New England Central Railroad, enters into Massachusetts in Northfield from Vermont. The route primarily heads due south until Amherst, where it veers to the south-east until it crosses the Massachusetts Turnpike in Palmer. Once in Palmer the route heads due south again until it crosses the border into Connecticut in Monson. The route then re-enters Massachusetts in Webster and heads directly to into Worcester. At the freight terminal in Worcester freight that carries on to Providence then heads south-east into Providence crossing at Blackstone. Given that ethanol is primarily produced in the Midwest, this route will likely not be involved in the transportation of ethanol to the study area.

Figure 2-2 shows the potential routes that would be used to transport ethanol to the Global facility.

Figure 2-2: The Massachusetts Freight Railroad System & Potential Ethanol Routes



Rail Routes within the Study Area

As shown in Figure 2-2, there are a number of routes that Global could use to transport ethanol by rail directly to its Revere terminal. These rely upon either of the two main east-west rail routes through the Commonwealth, the Pan Am Southern Mainline and the CSX Mainline, which would then connect to one of four rail routes to access Revere. The Pan Am Southern Mainline could access the study area via the Fitchburg Commuter Rail Line (Route 1), the Lowell Commuter Rail Line (Route 3), or the Haverhill Commuter Rail Line (Route 4), while the CSX Mainline would access the study area via the Worcester Commuter Rail Line (Route 2).

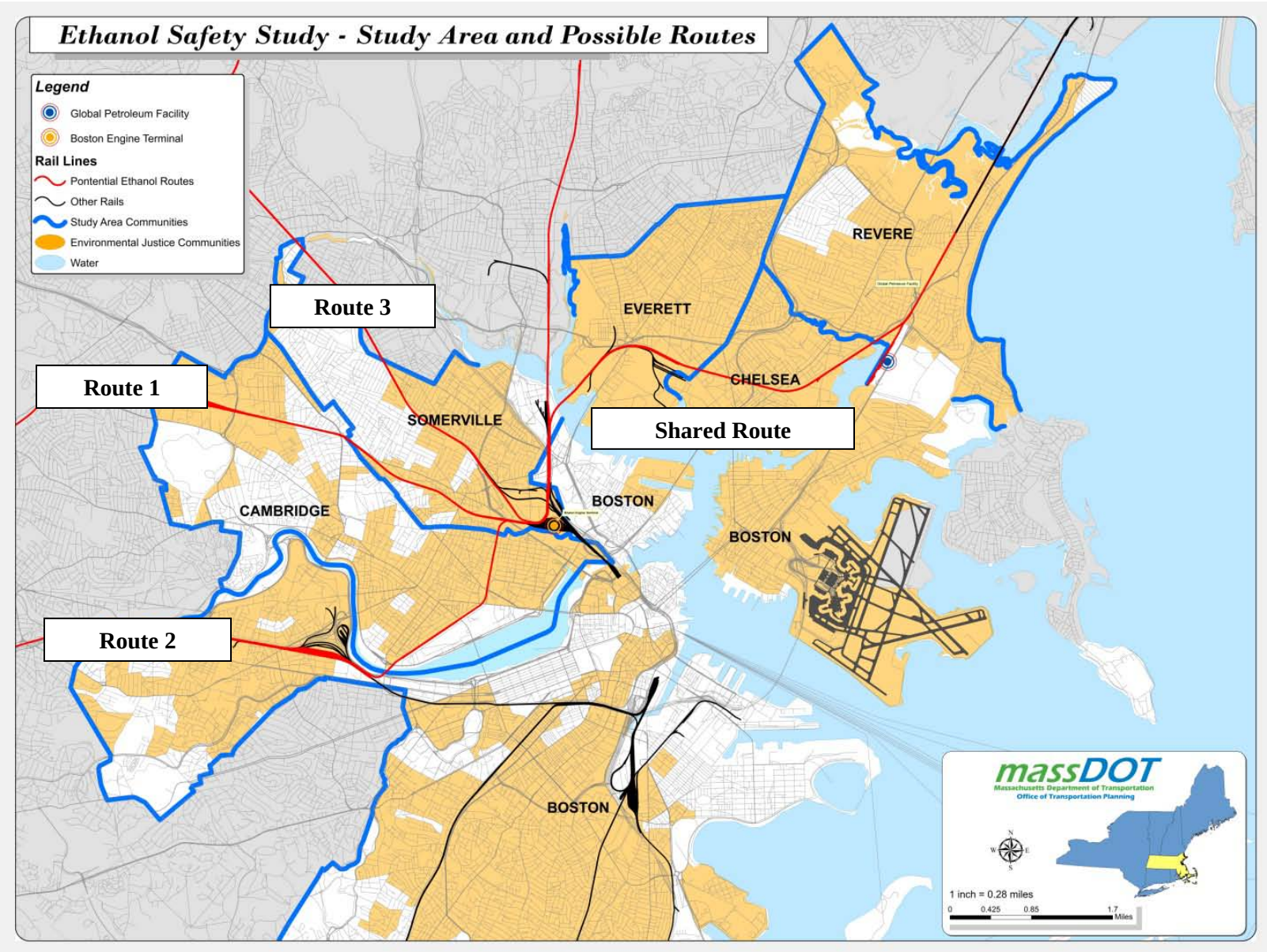
Once in the study area, each of these four routes would rely on the same route to make the connection between Somerville and Revere. That route accesses the Haverhill Commuter Rail Line in the vicinity of the Boston Engine Terminal and proceeds north into Somerville. At Assembly Square, the route switches to the Newburyport/Rockport Commuter Rail Line, crossing the Mystic River and passing through Everett and Chelsea to enter Revere. Once in Revere, the route continues north to approximately Revere Street where trains would need to make a reverse move to be switched to the spur track that leads to the Global facility. This Shared Route is shown in Figure 2-3.

Based upon current plans for the upgrade of Global's facility, the primary rail route that is expected to be used for transporting ethanol through the study area to its final destination in Revere is the Pan Am Southern Mainline. Route 1, which accesses the study area via the Fitchburg Commuter Rail Line, would be the most direct route for the transportation of ethanol to Global's facility. This potential route heads east along the Fitchburg commuter rail line into Somerville where the route would curve around the Boston Engine Terminal (BET) to access the Shared Route.

While Route 1 is the most direct rail route, two other possible rail routes – Route 2 and Route 3 - have been selected for a full evaluation as part of this report. Route 2 uses the CSX Mainline and enters the study area in Allston and travels through Brighton by means of the Worcester Commuter Rail Line. The route then crosses the Charles River via the Gran Junction Railroad Bridge and passes through Cambridge into Somerville where the route would curve around the Boston Engine Terminal (BET) to access the Shared Route. Like Route 1, Route 3 uses the Pan Am Southern Mainline but accesses the study area via the Lowell Commuter Rail Line into Somerville where the route would curve around the Boston Engine Terminal (BET) to access the Shared Route. Route 4 which could possibly carry ethanol utilizing the Haverhill Commuter Rail Line was not selected for a full evaluation because of operational considerations (additional distance, an added reverse move, etc.) that make its use unlikely.

Figure 2-3 shows the three routes chosen for a full evaluation and the approximate limits of the shared route that would be used by all three routes.

Figure 2-3: Possible Ethanol Rail Routes in the Study Area



There are four other rail routes within the study area that were not selected for consideration because they are not expected to carry ethanol. The Newburyport/Rockport Commuter Rail Line north of Revere Street in Revere was not included in the analysis because it lacks a connection to the remainder of the freight rail network. The Fairmount/Providence/Stoughton Commuter Rail Lines and the Old Colony Commuter Rail Lines were not included in the analysis due to the circuitous route necessary to connect to the Global facility. The Boston Mainline through downtown Boston was not included because there is no possible connection to the Global facility beyond the Grand Junction and because hazardous materials are not permitted to pass through the Prudential Tunnel in Boston.

Detailed Rail Route Descriptions

Route 1 accesses the study area at the Belmont/Cambridge line and heads east through Cambridge along the Fitchburg Commuter Rail Line passing under the Alewife Brook Parkway and through Porter Square. At Porter Square, the route passes into Somerville roughly paralleling Somerville Avenue into Union Square where it then passes under the McGrath Highway in the vicinity of the Twin City Plaza, to access the Boston Engine Terminal (BET), where it then joins the Shared Route.

Route 2 accesses the study area at the Newton/Boston line and heads east along the Worcester Commuter Rail Line which parallels the Massachusetts Turnpike through Allston and Brighton. The route passes through Beacon Park Yards in Allston, with trains then switching onto the Grand Junction route that crosses the Charles River and passes into Cambridge. In Cambridge, the Grand Junction route parallels Vassar Street until it turns north crossing Broadway and Cambridge Street before it enters Somerville, crossing under the McGrath Highway, in the vicinity of the Twin City Plaza, to connect to the BET, where it then joins the Shared Route.

Route 3 accesses the study area at the Medford/Somerville line and heads southeast along the Lowell Commuter Rail Line through a portion of Somerville and then enters Medford, leaving the study area. The route then re-enters Somerville and the study area, crossing under Broadway near Ball Square and following the Lowell Commuter Rail Line between Medford Street and Highland Avenue. The route then crosses under the McGrath Highway just north of the intersection with Highland Avenue and passes through the Inner Belt neighborhood to connect to the BET, where it joins the Shared Route.

The **Shared Route** starts at the BET then traverses the Haverhill Commuter Rail Line heading north. At Assembly Square in Somerville, the route switches to the Newburyport/Rockport Commuter Rail Line, crossing the Mystic River and passing through Everett and Chelsea to enter Revere. Once in Revere, trains would undertake a reverse move to enter the spur track that leads to the Global facility. To do this, the train would travel along the Newburyport/Rockport commuter rail line as far north as Revere Street and then run in reverse and be switched onto the East Boston spur to access the Global facility.

2.2 Physical Conditions of the Rail Routes

The rail routes within the study area are owned and maintained by the MBTA and MassDOT. Therefore, they share some similar physical characteristics, including track condition, track maintenance, signal control, and general operating speeds. Other physical characteristics, such as number of tracks, right-of-way width, and number of at-grade crossings vary with each route.

Each of these routes was purchased from a freight railroad and the freight railroads retain the right to operate freight service over the tracks through a permanent easement. Pan Am Railways (as the successor to the Boston and Maine Railroad) owns the freight easements over Route 1, Route 3, and the Shared Route. CSX Transportation owns the freight easements over Route 2, including the Grand Junction.

Railroad Track Condition

The MBTA and MassDOT currently maintain the railroad tracks that are used for MBTA commuter rail passenger service to Class 3 railroad standards as defined in the *Track Safety Standards Compliance Manual*. This manual provides a classification system to measure overall track quality based on the condition of the roadbed, track geometry, track structure, and track devices. As shown in Table 2-1, the classifications range from "excepted" through Class 9. Each class of railroad track carries separate speed limits for freight trains and passenger trains.

Table 2-1: FRA Classification Requirements Allowable Speeds

Over track that meets all of the requirements prescribed in this part for	The maximum allowable speed for freight trains is	The maximum allowable speed for passenger trains is
Excepted	10 mph	N/A
1	10 mph	15 mph
2	25 mph	30 mph
3	40 mph	60 mph
4	60 mph	80 mph
5	80 mph	90 mph
6	110 mph	
7	125 mph	
8	160 mph	
9	200 mph	

The MBTA contracts out the operation of its commuter rail system, including the maintenance of the tracks, to the Massachusetts Bay Commuter Railroad (MBCR). As a safeguard of the track condition and passenger safety and comfort, the MBTA has stipulated that MBCR must maintain all railroad tracks to Class 4 standards. This ensures that, even if the track should deteriorate somewhat between inspections, it is always compliant with the desired Class 3 standards. The MBTA also provides continuously welded track along the commuter rail lines; this provides added safety for rail operations by removing the rail joints, which can be a source of derailments if they are allowed to deteriorate significantly. It should be noted that the Grand Junction through Cambridge, while maintained to meet Class 3 railroad standards does not have continuously welded rail. Similarly, the East Boston Spur in Revere is currently an "excepted" track without continuously welded rail. However, upgrades will be required to the East Boston spur before ethanol trains utilize it.

Signaling Equipment

The MBTA signaling systems are controlled by one of two control centers, the North Side center for commuter rail lines into North Station, and the South Side center for commuter rail lines into South Station. These two stations communicate with the signal systems through a mix of fiber optic cables, copper cables, and wireless communications infrastructure that follows the rail right-of-way. The signals add a factor of safety to the rail routes both because they help control train movements and also because they allow for detection of missing rail segments and open switches. However, it should be noted that neither the Grand Junction line through Cambridge nor the East Boston Spur in Revere are signalized.

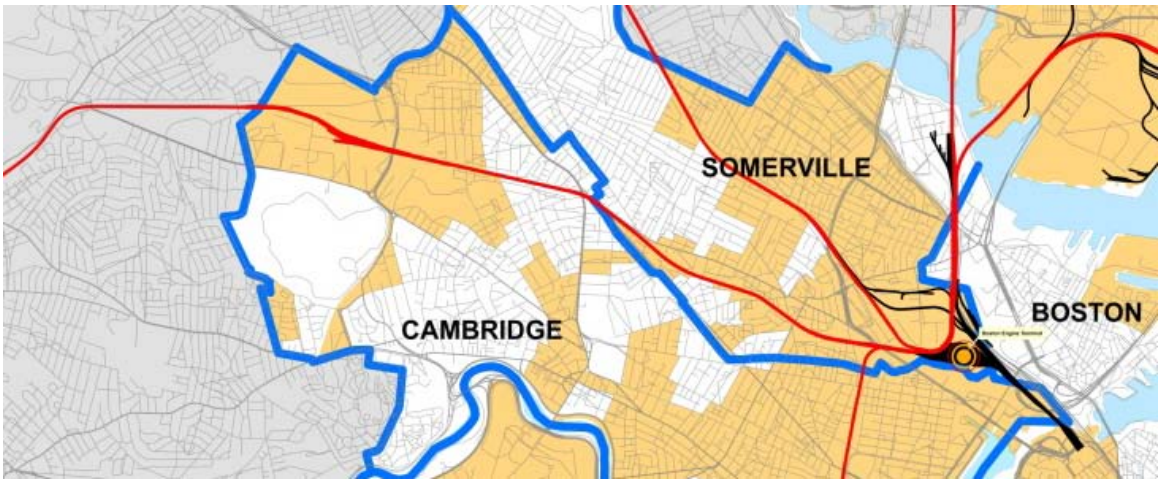
At-Grade Crossings

There are two types of warning indicators for all at-grade public railroad crossings: passive and active. Passive crossings are indicated by signs approaching the crossing informing drivers and pedestrians that a crossing is approaching. This could be in the form of street signs, or painting markings. Active warning signs are indicated by flashing lights and/or the use of gates to physically stop vehicles or pedestrians from crossing the tracks when a train is approaching, passing, or moving away from the crossing. A complete inventory of the crossings along each of the routes is included below in the description of each route.

Right-of-Way

The right-of-way width of most railroad lines in Massachusetts is approximately 70 feet. Any locations with wider right-of-way are noted in the description of each route.

Figure 2-4: Route 1 - Fitchburg Line to the Boston Engine Terminal (BET)

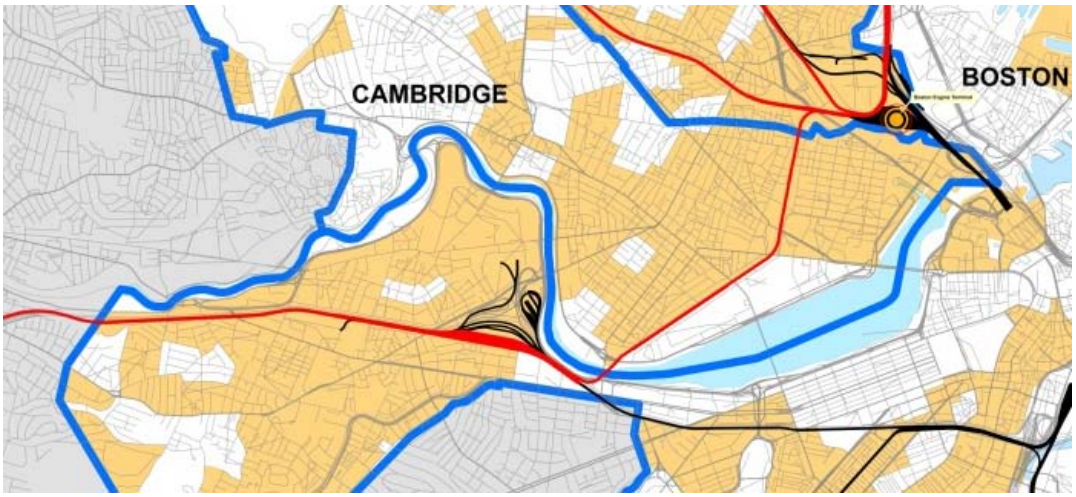


Route 1, shown in Figure 2-4, consists primarily of two railroad tracks from the Cambridge city line through to the Boston Engine Terminal. The widest track cross section is located in West Cambridge, west of the Alewife Brook Parkway, where there are five track sidings primarily used for maintenance of way equipment for the MBTA. There are two at-grade crossings along this segment as can be seen in the following table. The table additionally shows the number of tracks at each crossing.

Table 2-2: Route 1 Roadway/Rail crossings, locations and type

Street Crossing	Tracks	Type of Crossing	Warning Type- passive/ active	Type of Signals	Pedestrian Crossing
Switch-Grand Junction Section Track					
McGrath Highway	5	bridge	-	-	-
Medford Street	3	bridge	-	-	-
Prospect Street	2	bridge	-	-	-
Webster Street	2	bridge	-	-	-
Washington Street	2	bridge	-	-	-
Dane Street	2	bridge	-	-	-
Park Street	3	at-grade	active	street marking and gates	gates
Sacramento Street	2	bridge	-	-	-
Beacon Street	2	bridge	-	-	-
Porter Sq	2	bridge	-	-	-
Massachusetts Avenue	2	bridge	-	-	-
Signal Bridge	2	bridge	-	-	-
Walden Street	2	bridge	-	-	-
Yerxa Street	2	bridge	-	-	-
Sherman Street	2	at-grade	active	no street markings, gate only	gate
Alewife Brook Parkway	4	bridge	-	-	-
Culvert	7	bridge	-	-	-

Figure 2-5: Route 2 – Framingham/Worcester Line to the Boston Engine Terminal (BET)



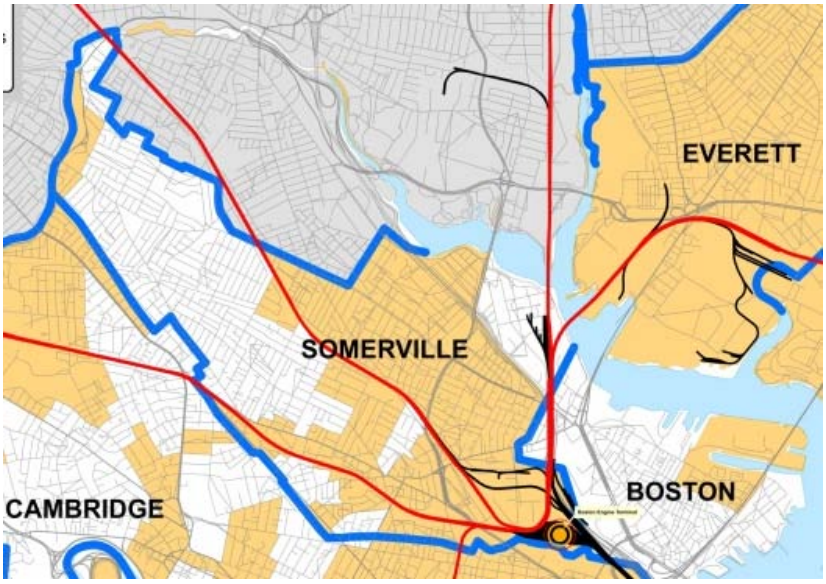
Route2, shown in Figure 2-5, consists primarily of two tracks from the Boston city line to the Beacon Park Yard in Allston and one railroad track from the Beacon Park Yard to the Boston Engine Terminal. The widest track cross section is located at the Beacon Park Yard, where there is a former CSX freight offloading operation. In addition to the sidings in the Beacon Park Yard facility, there is another siding ("the long siding") between the Fort Washington Pedestrian Way and Massachusetts Avenue. This route crosses the Charles River on a bridge in the vicinity of the BU Bridge. The route also passes through two buildings on the campus of the Massachusetts Institute of Technology (MIT). There are two major

switching moves along this route located just east of the Beacon Park Yard in Boston and at the BET. There are seven public and two private at-grade crossings along this segment as can be seen in the following table. The table additionally shows the number of tracks at each crossing.

Table 2-3: Route 2 Roadway/Rail crossings, locations and type

Street Crossing	Tracks	Type of Crossing	Warning Type- passive/ active	Type of Signals	Pedestrian Crossing
Grand Junction					
McGrath Highway	5	bridge	-	-	-
Medford Street	1	at-grade	active	gates	gates
Cambridge Street	1	at-grade	active	street markings & gate	gates
Binney Street	1	at-grade	passive	street markings	-
Broadway Street	1	at-grade	active	street markings & gates	gates
Main Street	1	at-grade	passive	street markings	-
University Pedestrian Way	1	at-grade	active	-	gates
Massachusetts Ave	2	at-grade	active	street markings & gates	gates
Private Street	2	bridge	-	-	-
University Pedestrian Way	2	at-grade	active	-	gates
Memorial Drive	2	bridge	-	-	-
Charles River	1	bridge	-	-	-
Soldiers Field Road	1	bridge	-	-	-
Switch - Beacon Park Yard					
Switch - Framingham Line					
Framingham-Worcester Line					
Switch - Grand Junction					
Cambridge Street	2	bridge	-	-	-
Underpass	2	bridge	-	-	-
Cambridge Street	2	bridge	-	-	-
Franklin Road	2	bridge	-	-	-
Everett Street/Frontage Road	2	bridge	-	-	-
Switch - Brighton Yard					
Market Street	2	bridge	-	-	-
North Beacon Street	2	bridge	-	-	-
Parsons Street	2	bridge	-	-	-
Brooks Street	2	bridge	-	-	-
Massachusetts Turnpike	2	bridge	-	-	-

Figure 2-6: Route 3 – Lowell Line to the Boston Engine Terminal (BET)

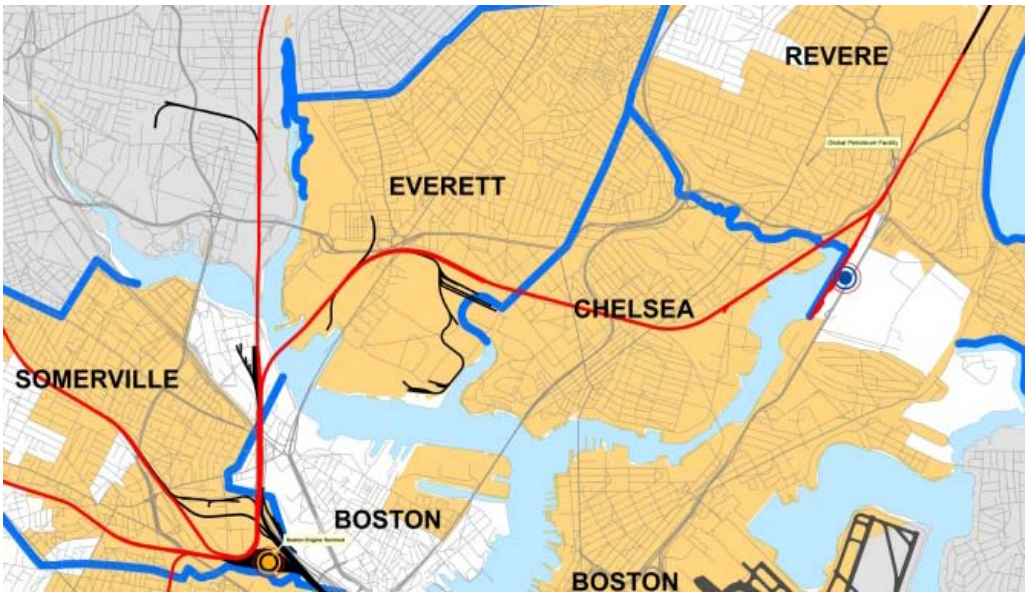


Route 3, shown in Figure 2-6, consists primarily of two railroad tracks from the Somerville city limits to the Boston Engine Terminal. This route passes through the campus of Tufts University. The widest track cross section is located just prior to the Boston Engine Terminal where there are four tracks. This route crosses the Mystic River as it enters the City of Somerville. There are no at-grade crossings along this segment, as noted in the following table.

Table 2-4: Route 3 Roadway/Rail Crossings, locations and type

Street Crossing	Tracks	Type of Crossing	Warning Type- passive/ active	Type of Signals	Pedestrian Crossing
Pipe Tunnel	2	bridge	-	-	-
B & A Tracks	2	bridge	-	-	-
Inner Belt Road	2	bridge	-	-	-
Switch - Yard 8 and 10 Lead					
Washington Street	5	bridge	-	-	-
Cross Street	3	bridge	-	-	-
Northern Artery	3	bridge	-	-	-
Wanut Street	3	bridge	-	-	-
Medford Street	3	bridge	-	-	-
School Street	3	bridge	-	-	-
Sycamore Street	3	bridge	-	-	-
Central Street	3	bridge	-	-	-
Switch - No. Cambridge					
Lowell Street	3	bridge	-	-	-
Mystic Valley Parkway	2	bridge	-	-	-

Figure 2-7: Shared Route - Boston Engine Terminal to the Global Partners Facility



The **Shared Route**, shown in Figure 2-7, consists primarily of two railroad tracks from the Boston Engine Terminal through to the East Boston spur line to the Global Partners facility. The widest track cross section is located at Assembly Square in Somerville, where the Newburyport/Rockport Commuter Rail Line parallels the Haverhill Commuter Rail Line and an industrial spur line for a total of six railroad tracks. There are also a significant number of siding tracks that serve the industrial properties along this route, including the Mobil facility in Everett and the New England Produce Center in Chelsea. The shared route passes over the Mystic River on a causeway. The East Boston spur line currently consists of 2 railroad tracks that are partially buried. As part of the proposal to transport ethanol to the Global facility, Pan Am Railways is planning to upgrade the line to a single railroad track with sidings for the ethanol trains located adjacent to the Global facility. There are three major switching moves along this route located at the BET, in Assembly Square, and at the East Boston branch in Revere near the intersection of Route 1A and Route 16. There are seven at-grade crossings along this segment, as shown in Table 2-5. The table also shows the number of tracks at each crossing.

Table 2-5: Shared Route, Roadway/Rail crossings, locations and type

Street Crossing	Tracks	Type of Crossing	Warning Type- passive/ active	Type of Signals	Pedestrian Crossing
Switch - Mystic Junction Yard					
Cambridge Street	2	bridge	-	-	-
Sullivan Square Station	1	bridge	-	-	-
Broadway/Maffa Way	5	bridge	-	-	-
Mystic Avenue	5	bridge	-	-	-
Pedestrian Path	2	bridge	-	-	-
Mystic River	2	bridge	-	-	-
Monsanto Private 1	2	bridge	-	-	-
Monsanto Private 2	2	bridge	-	-	-
Switch - Saugus Branch					
Broadway	3	bridge	-	-	-
Culvert	4	bridge	-	-	-
2nd Street	2	at-grade	active	gates	-
3rd Street	2	at-grade	active	gates	-
Everett Street	2	at-grade	active	street markings & gates	gates
Spruce Street	2	at-grade	active	gates	-
NE Expressway	2	bridge	-	-	-
Arlington Street	2	at-grade	active	street markings & gates	
6th Street	2	at-grade	active	street markings & gates	
Washington Avenue	2	bridge	-	-	-
Broadway	2	bridge	-	-	-
Switch - Chelsea Yard					
Eastern Avenue	2	at-grade	active	street markings & gates	gates
Forbes Street	2	bridge	-	-	-
Mill Creek	2	bridge	-	-	-
Railroad Street	2	bridge	-	-	-
Switch - East Boston Branch					
Culvert	3	bridge	-	-	-
Winthrop Avenue	3	bridge	-	-	-
Lee Burbank Highway	2	bridge	-	-	-
Beach Street	2	bridge	-	-	-
Wonderland	2	bridge	-	-	-
Revere Street	2	bridge	-	-	-

2.3 Operational Conditions Along Each Route

The three routes selected for a full analysis are used each day by MBTA passenger trains. Passenger train movements include scheduled MBTA commuter rail trains, scheduled Amtrak passenger trains, and movement of empty passenger rail equipment for maintenance or scheduling purposes (referred to as "deadhead movements"). The number of passenger train movements is shown in Table 2-6. The deadhead movements are primarily between North Station and the Boston Engine Terminal, which is used for mid-day train storage and maintenance of equipment. It should be noted that the numbers of trains moving across each line can vary depending on operating conditions.

Table 2-6: 2012 Average Daily Passenger Train Movements within the Study Area Routes

	Study Area Route			
Passenger Movements	1 - Fitchburg	2 - Worcester/GJ	3 - Lowell	Shared
MBTA Commuter Rail	34	41	58	62
Amtrak	0	2	0	0
Deadheads	10	0	19	11
Total	**44**	**43**	**77**	**73**

The MBTA and the freight companies have operating agreements that dictate how the freight and passenger trains interact along the three routes. Under these agreements, the MBTA controls the dispatching of all trains within the study area; as a result, passenger trains are given priority over the freight trains. Because of this priority for passenger movements, freight can move more freely at night when there are no passenger trains running. As a result, the freight railroads choose to make most, but not all, freight movements outside of the MBTA's standard operating times. Freight that must be moved during the day can move more freely outside of peak hours, when the passenger train traffic is highest. Any freight movements made within the operating times for the MBTA system would, therefore, most likely move during mid-day. Table 2-7 shows the span of passenger service along each of the study routes.

Table 2-7: Standard Hours of Weekday Passenger Train Operations

	Study Area Route			
	1 - Fitchburg	2 - Worcester/GJ	3 - Lowell	Shared
Start Time	6:36 AM	4:05 AM	5:45 AM	6:03 AM
End Time	12:20 AM	1:30 AM	12:22 AM	11:56 PM
Span of Service	17 h 44 m	21 h 25 m	18 h 37 m	17 h 53 m

The existing freight operations along the three routes are less consistent than the passenger operations because they are dependent on the needs of the rail customers along the routes. However, there are three freight trains that move along the study area routes on a regular basis. The first is a delivery of sand and/or gravel to Boston Sand & Gravel, which utilizes Route 3. The second is a mixed commodity train including hazardous materials that travels from Lawrence to Chelsea and Salem, which utilizes Route 3 and the Shared Route. The final freight train that operates on a regular basis is the "Fruit Train," which travels to the New England Produce Market in Chelsea via Route 2 and the Shared Route. Table 2-8 provides a summary of the freight rail movements along the study area routes.

Table 2-8: 2012 Average Daily Freight Train Movements within the Study Area Routes

Freight Movements	Study Area Route			
	1 - Fitchburg	2 - Worcester/GJ	3 - Lowell	Shared
Boston S&G	0	0	2	0
Lawrence to Salem	0	0	2	2
Produce Market	0	2	0	2
Total	**0**	**2**	**4**	**4**

Chapter 3: Evaluation of Impact on Public Safety

3.1 Rail Safety Record and Potential Safety Risks

In order to identify potential risks to public safety that could be caused by the transport of ethanol by rail in the Commonwealth, the following section provides a review of available information on rail accidents in the United States and Massachusetts for the past five years. On the national level, the analysis only includes train accidents that have resulted in the release of ethanol or another (unidentified) hazardous material. Focusing on these accidents provides a picture of the scale of ethanol accidents, the factors that contributed to the accident, the factors that contributed to the ethanol release, and the emergency response techniques employed. These aspects are crucial to understanding the risks of an accident involving an ethanol train.

The analysis of rail accidents in Massachusetts is split into two separate categories, rail accidents and highway-rail crossing accidents. Rail accidents represent events where a train collided with another train or derailed, while highway-rail crossing accidents represent events where a train and motor vehicle collide at an at-grade crossing. Both accident types are important for understanding the overall safety risks involved in transporting ethanol through the study area. Due to their very small chance of leading to an ethanol spill, this safety analysis does not include an evaluation of trespassing incidents on the railroad lines. The materials reviewed were those made publicly available by the Federal Railroad Administration (FRA), the Association of American Railroads (AAR), and the National Railroad Transportation Board (NTSB).

Nationwide Ethanol Rail Accidents

National freight carriers transport roughly 29.4 million carloads of freight every year across more than 140,000 miles of rail in the United States, according to the American Association of Railroads (AAR). Just under 1.8 million (or 6.1 percent) of the carloads moved each year contain hazardous materials. Of that, more than 200,000 of the carloads contain ethanol, making it the top hazardous material moved by train. Table 3-1 lists the top hazardous materials moved by train.

Table 3-1: Top Ten Hazardous Materials (by Volume) shipped by rail

Rank	Material	DOT Class #	DOT Class Name
1	Ethanol & Ethanol-Gasoline Mix	3	Flammable Liquid
2	Sodium Hydroxide	8	Corrosive
3	Liquefied Propane Gas	2.1	Flammable Gas
4	Molten Sulfur	9	Misc. Hazmat ORM-D
5	Sulfuric Acid	8	Corrosive
6	Anhydrous Ammonia	2.2	Non Flammable/Non Toxic Gas
7	Chlorine	2.3	Toxic Gas and/or Corrosive - Oxidizing
8	Asphalt	9	Misc. Hazmat ORM-D
9	Ammonium Nitrate Fertilizer	5.1	Flammable Liquid
10	Ethylene Glycol	9	Flammable Liquid

Source: Massachusetts Department of Environmental Protection and CSX

In the five years reviewed, approximately one percent of total accidents released hazmat, and 0.32 percent released ethanol. Table 3-2 details the summary statistics for accidents in the United States from 2008 to 2012.

Table 3-2: Summary Statistics for Rail Accidents, 2008-2012

	2008	2009	2010	2011	2012
Accidents Involving Hazmat					
Train Only (Not Highway-Rail)	2,481	1,910	1,902	2,010	1,678
Trains Carrying Hazmat	754	617	580	579	484
Involving the Release of Hazmat	22	22	21	20	23
% Involving Release of Hazmat	0.89%	1.15%	1.10%	1.00%	1.49%
Accidents Involving Ethanol, or Not Otherwise Specified Hazardous Material (NOS)					
Involving Release of Ethanol or NOS	4	8	4	7	8
% Involving Release of Ethanol or NOS	0.16%	0.42%	0.21%	0.35%	0.48%

Source: The Federal Railroad Administration

Table 3-3 lists all accidents involving ethanol or unknown hazardous materials, as catalogued by the FRA, in the United States from 2008 to 2012. The FRA identifies the following information for each: date of accident, state, county, type of track, primary cause of the accident, rail road property damage, people killed and/or injured, area evacuated, reported speed of accident, and number of locomotives and/or cars derailed. From 2008 to 2012 there were 31 accidents, 21 of which included the release of ethanol and 10 others that resulted in the release of an undefined hazardous material. Those 10 accidents have been included in the statistical analysis as if they were ethanol in order to provide the most conservative analysis.

Table 3-3: National Rail Accidents Involving Ethanol or Unknown Hazardous Material (2008-2012)

Date	State	County	Type Track	Primary Cause	Property Damage $	Killed	Injured	Evac-uated	Speed Mph	Derailed	
										Loco	Car
7/29/2008	MN	Houston	Main	Equipment	2,294,052	0	0	0	25	0	28
8/16/2008	NC	Columbus	Main	Equipment	358,839	0	2	0	17	0	10
8/22/2008	OK	Oklahoma	Main	Track	852,915	0	0	35	19	0	14
3/8/2009	IA	Buchanan	Siding	Track	148,926	0	0	31	8	0	7
4/9/2009	CA	Los Angeles	Yard	Track	400,924	0	0	0	10	0	6
5/18/2009	IL	Cook	Yard	Equipment	13,919	0	0	0	9	0	1
6/19/2009	IL	Winnebago	Main	Track	1,816,653	1	11	600	34	0	19
7/23/2009	ND	Mclean	Main	Track	610,000	0	0	0	11	0	7
8/15/2009	ME	Oxford	Main	Track	1,106,830	0	0	2	27	0	20
9/15/2009	TN	Knox	Main	Human Factor	462,073	0	0	25	10	0	8
11/27/2009	MN	Hennepin	Yard	Human Factor	124,506	0	0	0	7	0	5
4/19/2010	OH	Williams	Main	Equipment	2,431,870	0	0	28	44	0	39
8/3/2010	NE	Boone	Main	Human Factor	334,774	0	0	0	2	0	16
2/6/2011	OH	Hancock	Main	Track	1,917,500	0	0	20	46	0	33
5/4/2011	OR	Multnomah	Main	Equipment	785,677	0	0	0	24	0	11
7/15/2011	IL	Iroquois	Main	Track	106,510	0	0	0	22	0	1
7/19/2011	SD	Brookings	Yard	Track	89,842	0	0	0	8	0	5
10/7/2011	IL	Bureau	Main	Track	1,847,619	0	0	500	37	0	26
6/1/2012	IN	Pike	Main	Track	876,000	0	0	0	25	0	8
7/11/2012	OH	Franklin	Main	Miscellaneous	681,866	0	2	100	23	0	17
10/12/2012	TN	Knox	Yard	Track	250,000	0	0	0	5	0	6
Type of Hazmat Not Otherwise Specified (NOS)											
8/28/2008	NM	Curry	Yard	Equipment	23,117	0	0	0	3	0	1
2/20/2010	CA	Kern	Main	Track	2,222,672	0	0	35	20	0	6
9/13/2010	WI	Pierce	Main	Equipment	2,091,287	0	0	14	54	0	9
9/13/2011	TX	Galveston	Yard	Track	69,600	0	0	14	8	0	8
9/16/2011	TX	Potter	Yard	Human Factor	946,211	0	3	200	5	0	1
3/27/2012	IN	Nobel	Main	Track	1,311,523	0	0	54	47	0	25
8/5/2012	MT	Fallon	Main	Track	1,400,085	0	0	0	23	0	18
8/10/2012	NV	Clark	Siding	Human Factor	16,205	0	0	3	8	0	6
11/1/2012	AZ	Graham	Main	Track	66,335	0	0	0	22	0	7
11/30/2012	NJ	Gloucester	Main	Miscellaneous	413,388	0	121	0	8	0	7

The major causes of the accidents were inspection errors, maintenance problems, or lack of communication between train crews. The train speed and railcar design were the primary contributing factors to the release of ethanol. Although actual damage in most accidents was to the immediate area surrounding the tracks, the required minimum distance of a half mile was evacuated for each of the relevant accidents. In some situations, a greater distance was evacuated based on the specific circumstances. The average number of people evacuated per accident was 54, and the average cost of damages to railroad property was $841,000.

Of the 31 accidents, only the accident in Cherry Valley, Illinois resulted in a fatality. This accident occurred in a small rural community. The derailment was caused by a wash-out of a portion of the track, which was discovered about one hour before the train was scheduled to pass that section. The Canadian National Railway Company (CN) did not notify the train crew of the known wash-out in time to stop the train due to the inadequacy of CN's emergency communications procedures. Contributing to the accident was CN's failure to work with the local county government to develop a comprehensive storm water management plan in order to address previous wash-outs of track in 2006 and 2007. Contributing to the severity of the accident was CN's failure to issue a flash flood warning to the train crew and the design of the tank cars, which were subject to damage and catastrophic loss of hazardous materials during a derailment.

The DOT-111 is the primary model of tank car that transports liquid non-pressurized hazmat commodities throughout the United States. According to the National Transportation Safety Board (NTSB), 69 percent of all tank cars are DOT-111, and an estimated 40,000 DOT-111 cars are used to transport ethanol. The National Transportation Safety Board (NTSB) Office of Railroad, Pipeline and Hazardous Materials Safety has recently completed a report on the DOT-111 model tank cars. The report cites several accidents where the DOT-111 tank car design is the primary cause for the release of a hazardous material. The main concern with the cars is that upon impact, the tanks can puncture and valves can break open.

These design issues resulted in a collaborative effort between the AAR and the NTSB, where the AAR has suggested design modifications for all new DOT-111 tank cars made after October 1, 2011. However, the AAR actions do not address the existing fleet of DOT-111 railcars. The full safety benefits of the new design will only be realized once the existing fleet has been retired at the end of each car's useful life, which may be as much as 40 years. NTSB reports that ultimately the safety benefits suggested will not be fully realized if old and new tank cars are commingled in trainsets.

The potential for a breakdown in communication is increased at locations along rail lines that may require additional surveillance and maintenance, as the necessary information needs to be relayed to all pertinent members of the train crews. These locations include, but are not limited to: sidings, yards, switches, bridges, and tunnels; areas that are subject to impacts of severe weather; and areas that are more remote. A critical issue is the condition of a railroad mainline in a more remote area; trains travel at much higher speeds on rail mainlines and in more remote areas, where it is less likely that a problem will be detected. The railroad lines in the study are all in dense urban areas, and they are used many times daily for passenger trains, which should result in rapid detection of a problem.

The available information showed that five of the 31 accidents resulted in a fire. In each case the responding fire departments did not attempt to extinguish the fire, but let it burn out. It is important to note that employing this strategy at any accident within the study area would carry additional risks due to the high population density and the presence of structures adjacent to the rail routes.

Rail Accidents in Massachusetts

A review of all railroad accidents in Massachusetts provides a better understanding of the potential safety issues locally. Like the nationwide accident results analyzed above, five years worth of accidents were reviewed (2008 through 2012). However, all accidents, not just those involving hazardous materials, were included in the Massachusetts analysis. During this time period, 68 accidents were reported in Massachusetts, including five collisions, 39 derailments, and 24 other accidents. Thirty-eight accidents occurred on main lines, while 30 accidents occurred in yards and sidings. There were 28 accidents with passenger cars, 21 accidents involved freight traffic, and 19 with other types of train cars. Of the 68 accidents identified, none involved the release of ethanol and none resulted in a fatality.

Of all the accidents reported in Massachusetts, five resulted in personal injury and no evacuations were ordered. A record for each of these 68 accidents can be found in Appendix 2, along with the accident report data.

Highway-Rail Accidents in Massachusetts

From 2008-2012 there were 37 reported highway-rail accidents at grade crossings in Massachusetts. Of the 37, four accidents resulted in a fatality; two were deaths of automobile occupants, one death was a suicide, and one death was a child on a bicycle. Only eight of the remaining 33 accidents resulted in a personal injury. The detailed reports of these accidents are included in Appendix 2.

In all of the accidents reported, the FRA has recorded what type of crossing protection was at each accident location. Out of the 37 accidents, three did not have any protection because they occurred inside private facilities; only one of them resulted in an injury. Most of the accidents, 31 of the 37, were with a personal vehicle, four rail accidents were with commercial vehicles; and two accidents were with pedestrians. In its reports, the FRA attributed the cause for all of the accidents to errors made by the motor vehicle operator or the person walking or bicycling across the tracks.

Table 3-4: Highway-Rail Accidents in Massachusetts (2008-2012)

Date	Railroad Company	City	Highway Name	Rail Equipment	Highway User	Crossing	Killed/ Injured
2/6/2008	CSX	West Springfield	Bridge St	Freight Train	Car	Gates	.
4/17/2008	MBTA	Canton	Washington St	Commuter Train	Car	Gates	.
5/8/2008	CSX	Bellingham	Hardford Ave	Freight Train	Car	Cross bucks	.
5/25/2008	MBTA	Revere	Oak Island	Commuter Train	Pedestrian	Gates	1/0
7/16/2008	CSX	Framingham	Concord St	Freight Train	Car	Gates	.
9/22/2008	CSX	Foxboro	North St	Freight Train	Car	Flashing lights	0/1
9/26/2008	ATK	Amherst	Bridge St	Passenger Train	Van	Flashing lights	0/1
11/14/2008	MBTA	Abington	North Ave	Commuter Train	Car	Gates	0/1
2/27/2009	MBTA	Belmont	Brighton St	Commuter Train	Pedestrian	Gates	1/0
7/17/2009	NECR	Monson	Chestnut St	MOW equip.	Car	Flashing lights	0/1
9/29/2009	ATK	Not Listed	Private	Passenger Train	Car	Stop signs	.
9/29/2009	GRS	Springfield	Railroad Yard	Passenger Train	Car	Stop signs	.
12/21/2009	MBTA	Chelsea	Spruce St	Commuter Train	Car	Gates	.
1/13/2010	MBTA	Shirley	Patterson Rd	Commuter Train	Car	Gates	0/2
2/6/2010	NECR	Not Listed	Cranberry Pond Rd	Freight Train	Car	Cross bucks	.
2/15/2010	CSX	Taunton	Freemont St	Freight Train	Truck & Trailer	Flashing lights	.
3/14/2010	CSX	Berlin	West St	Maintenance	Car	Flashing lights	0/2
3/30/2010	CSX	Marlborough	Private Rd	Freight Train	Van	Cross bucks	.
4/22/2010	MBTA	Cambridge	Broadway	Light loco(s)	Car	Flashing lights	.
12/6/2010	MBTA	Braintree	Grove St	Commuter Train	Car	Gates	1/0
12/12/2010	NECR	Not Listed	Bay Rd	Freight Train	Car	Flashing lights	.
1/12/2011	MBTA	Waltham	South St	Passenger Train	Maintenance	Gates	.
1/18/2011	PW	Worcester	McKeon Rd	Freight Train	Car	Gates	.
1/27/2011	CSX	Foxboro	Mechanic St	Light loco(s)	Truck	Flashing lights	.
1/28/2011	MBTA	Rockport	Poole's Lane	Commuter Train	Car	Stop signs	.
3/4/2011	MBTA	Stoughton	Porter St	Passenger Train	Car	Flashing lights	.
3/17/2011	MBTA	Holbrook	EastHigh St	Commuter Train	Car	Gates	1/0
10/26/2011	ATK	Not Listed	StrathmoreMills Rd	Passenger Train	Car	None	.
11/10/2011	ATK	NORTHFIELD	Upper Farms Rd	Passenger Train	Truck & Trailer	Stop signs	.
1/13/2012	MBTA	Kingston	Route 3A	Commuter Train	Car	Gates	.
4/17/2012	CSX	West Springfield	Bridge St	Freight Train	Car	Gates	.
8/16/2012	ATK	Medford	High St	Passenger Train	Car	Gates	0/1
9/27/2012	CSX	Cambridge	Pedestrian Crossing	Freight Train	Car	Gates	.
11/8/2012	CSX	West Springfield	Yard Track Xing	Light loco(s)	Pickup Truck	None	.
11/9/2012	PW	Gardner	Whitney Rd	Light loco(s)	Car	Flashing lights	.
12/3/2012	CSX	Foxboro	Private Rd	Freight Train	Car	None	0/1
12/12/2012	PW	Worcester	Thomas St	Freight Train	Car	Gates	.

3.2 Potentially Exposed Populations

A major part of understanding the potential impact on public safety of transporting ethanol by rail is identifying the potentially exposed populations along the routes. The following section provides information on the populations and facilities potentially exposed in the event of an ethanol train accident.

Identifying the populations and facilities requires the definition of the potential reach of any ethanol incident. The U.S. DOT Emergency Response Guidebook recommends that an ethanol tanker or railcar be initially isolated for ½ mile in all directions, with evacuations of the same distance. The guide is an initial recommendation until the incident commander can assess the situation. The length of the train also factors into the definition of potentially exposed populations. The theoretical maximum length of a train within the study area, based on the state regulation that no grade crossing can be blocked for more than five minutes, is 100 railcars. Although an incident involving a whole train is very unlikely, this train length was used to provide a conservative estimate of the potential exposure. No plans have been discussed to bring in a train of that length to the Global Facility by any freight railroad.

These two conditions were then applied as a buffer around the routes identified in Section 2.1. These buffer zones were overlaid with the available data from the Massachusetts Geographic Information System (MassGIS) on Assisted Living Facilities, Nursing Homes, Rest Homes, Private/Public Colleges/Universities, Public/Private Schools, Hospitals, Fire Stations, and Commuter Rail/Transit Stations. These categories were selected based on the requirements set forth in Section 24 in Chapter 242 of the Acts of 2012. The potentially exposed facilities are listed in Tables 3-5, 3-6, 3-7, 3-8, 3-9, and 3-10.

Table 3-5: Assisted Living Facilities, Nursing and Rest Homes within ½-mile buffer zone

CODE	FACILITY NAME	ADDRESS	CITY
A5	WINGATE AT BRIGHTON REHAB & SN RESI	100 N BEACON ST	Boston
A6	PRESENTATION NURSING & REHAB CENTER	10 BELLAMY ST	BRIGHTON
A9	YOUVILLE HOUSE	1573 Cambridge ST	Cambridge
A11	Somerville HOME	117 SUMMER ST	Somerville
A12	CADBURY COMMONS	66 SHERMAN ST	Cambridge
A14	EASTPOINTE NURSING CARE CENTER	255 CENTRAL AVE	Chelsea
A15	NEVILLE PLACE	650 CONCORD AVE	Cambridge
A16	JEANNE JUGAN RESIDENCE	186 HIGHLAND AVE	Somerville
A17	NEVILLE CENTER AT FRESH POND FOR NU	640 CONCORD AVE	Cambridge
A18	HUTCHINS TRANSITIONAL CARE UNIT	230 HIGHLAND AVE	Somerville
A19	SANCTA MARIA NURSING FACILITY	799 CONCORD AVE	Cambridge
A20	DON ORIONE NURSING HOME	111 ORIENT AVE	East Boston
A21	FLORENCE & CHAFETZ HOME FOR SPECIALIZED CARE	175 CAPTAINS ROW	Chelsea
A22	COHEN FLORENCE LEVINE ESTATES	201 CAPTAINS ROW	Chelsea
A23	VISITING NURSE ASSISTED LIVING	259 LOWELL ST	Somerville
A24	Chelsea JEWISH NURSING HOME	17 LAFAYETTE AVE	Chelsea
A25	SOLDIERS' HOME IN MASS	91 CREST AVE	Chelsea
A26	HAVEN HEALTH CENTER OF Chelsea	932 BROADWAY	Chelsea
A27	MARGOLIS APARTMENTS HOUSING (FOR ELDERS)	260 CLARK AVENUE	Chelsea
A28	Chelsea SENIOR CENTER	10 RILEY WAY	Chelsea
A29	SENIOR LIVING BUILDING	5 ADMIRALS WAY	Chelsea
A30	SENIOR LIVING BUILDING	150 CAPTAINS ROW	Chelsea

Table 3-6: College or Universities within ½-mile buffer zone

CODE	FACILITY NAME	ADDRESS	CITY
C2	Boston University	121 Bay State Road	Boston
C3	Rets Technical Center	965 Commonwealth Ave	Boston
C4	Massachusetts Institute of Technology	77 Massachusetts Avenue	Cambridge
C5	Lesley University	29 Everett Street,	Cambridge
C7	Computer-ed Institute-Somerville	5 Middlesex Ave	Somerville
C8	Muscular Therapy Institute	122 Rindge Ave	Cambridge

Table3-7: Transit Stations within ½-mile buffer zone

CODE	FACILITY NAME	ROUTE	CITY
T3	Boston University East	GREEN: B - Boston College	Boston
T4	Boston University Central	GREEN: B - Boston College	Boston
T5	Harvard Avenue	GREEN: B - Boston College	Boston
T6	Boston University West	GREEN: B - Boston College	Boston
T7	Saint Paul Street	GREEN: B - Boston College	Boston
T8	Pleasant Street	GREEN: B - Boston College	Boston
T9	Packards Corner	GREEN: B - Boston College	Boston
T10	Babcock Street	GREEN: B - Boston College	Boston
T11	Kendall/MIT	RED: A - Ashmont B - Braintree C - Alewife	Cambridge
T12	Lechmere	GREEN: E - Lechmere	Cambridge
T13	Sullivan Square	ORANGE: Forest Hills to Oak Grove	Boston
T14	Porter	RED: A - Ashmont B - Braintree C - Alewife	Cambridge
T15	Alewife	RED: A - Ashmont B - Braintree C - Alewife	Cambridge
T39	PORTER SQUARE	Commuter Rail Station	Cambridge
T70	YAWKEY	Commuter Rail Station	Boston
T17	Chelsea	Commuter Rail Station	Chelsea

Table 3-8: Hospitals and Medical Facilities within 0.5 mile buffer zone in study area

CODE	FACILITY NAME	ADDRESS	CITY
H2	Cambridge Health Alliance - Cambridge Campus	1493 Cambridge Street	Cambridge
H3	Chelsea Soldier Home-Quigley Memorial Hospital	91 Crest Avenue	Chelsea
H4	Beth Israel Hospital	1000 Broadway Street	Chelsea
H1	Spaulding Cambridge Outpatient Center	1575 Cambridge Street	Cambridge
H2	Cambridge Health Alliance - Cambridge Campus	1493 Cambridge Street	Cambridge
H3	Chelsea Soldier Home-Quigley Memorial Hospital	91 Crest Avenue	Chelsea
H4	Beth Israel Hospital	1000 Broadway Street	Chelsea
M0	Brighton/Allston Afterschool Enrichment Program (BASE)	5 Saint Luke's Road	Allston
M1	Joseph M. Smith Community Health Center	287 Western Avenue	Allston
M2	Windsor Street Health Center	119 Windsor Street	Cambridge
M3	East Cambridge Health Center	163 Gore Street	Cambridge
M4	Cambridge Health Alliance	1493 Cambridge Street	Cambridge
M6	Primary Care Center	1493 Cambridge Street	Cambridge
M7	Zinberg Clinic	1493 Cambridge Street	Cambridge
M8	Cambridge Health Alliance Birth Center	1493 Cambridge Street	Cambridge
M9	Cambridge Pediatrics	1493 Cambridge Street	Cambridge
M10	Union Square Health Center	337 Somerville Ave	Somerville
M11	Central Street Health Center	26 Central Street	Somerville
M12	East Somerville Health Center	42 Cross Street	Somerville
M13	Somerville Teen Connection at Somerville High School	81 Highland Ave	Somerville
M14	Cambridge Health Alliance - Somerville Campus	230 Highland Avenue	Somerville
M15	Cambridge Health Alliance - Somerville Campus	230 Highland Avenue	Somerville
M16	Cambridge Health Alliance - Somerville Campus	230 Highland Avenue	Somerville
M17	Internal Medicine Associates	236 Highland Ave	Somerville
M18	Cambridge Family Health North	2067 Massachusetts Ave	Cambridge
M19	Broadway Health Center	300 Broadway	Somerville
M20	North Cambridge Health Center	266B Rindge Avenue	Cambridge
M21	MGH Chelsea HealthCare Center	151 Everett Avenue	Chelsea
M22	Chelsea High School	299 Everett Ave	Chelsea
M27	MGH Everett Family Care	19-21 Norwood Street	Everett
M28	MGH Revere HealthCare Center	300 Ocean Avenue	Revere
M29	MGH Community Health Associates	300 Ocean Avenue	Revere
M30	MGH Revere HealthCare Center	300 Broadway	Somerville
M31	MGH/Revere High School	101 School Street	Revere

Table 3-9: Public and Private Schools within ½-mile buffer zone

CODE	SCHOOL NAME	ADDRESS	CITY
S01	CAPIC HEAD START	67 CRESCENT AVENUE	Chelsea
S8	William McKinley School	90 Warren Avenue	Boston
S12	Lyon K-8 School	50 Beechcroft Street	Boston
S13	Boston University Academy	1 University Road	Boston
S14	Mesivta High School	34 Sparhawk Street	Boston
S16	Conservatory Lab Charter School	25 Arlington Street	Boston
S17	Lyon Upper 9-12 School	95 Beechcroft Street	Boston
S18	Jackson Mann School	40 Armington Street	Boston
S19	Horace Mann School for the Deaf	40 Armington Street	Boston
S20	Baldwin Early Learning Center	121 Corey Road	Boston
S21	Another Course To College	20 Warren Street	Boston
S22	St Columbkille Partnership School	25 Arlington	Boston
S23	Mt St Joseph Academy	617 Cambridge	Boston
S24	MATCH Charter Public High School	1001 Commonwealth Avenue	Boston
S25	Crittenton Inc School	10 Perthshire Rd	Boston
S32	Morse School	40 Granite Street	Cambridge
S37	German International School Boston	57 Holton Street	Boston
S38	Cambridgeport School	89 Elm Street	Cambridge
S39	Gardner Pilot Academy	30 Athol Street	Boston
S41	Farr Academy School	71 Pearl St.	Cambridge
S42	Fletcher/Maynard Academy	225 Windsor Street	Cambridge
S43	Community Charter School of Cambridge	245 Bent Street	Cambridge
S45	Albert F. Argenziano School at Lincoln Park	290 Washington Street	Somerville
S48	Maria L. Baldwin School	28 Sacramento Street	Cambridge
S50	Peabody School	70 Rindge Avenue	Cambridge
S52	John M Tobin School	197 Vassal Lane	Cambridge
S53	E Somerville Community School	42 Prescott Street	Somerville
S54	Cambridge Montessori School	161 Garden Street	Cambridge
S57	St Catherine Of Genoa School	192 Summer Street	Somerville
S58	Somerville High School	81 Highland Avenue	Somerville
S60	Full Circle High School	8 Bonair Street	Somerville
S61	Capuano Early Childhood Center	150 Glen Street	Somerville
S62	Cambridge Friends School	5 Cadbury Rd	Cambridge
S63	Next Wave Junior High School	8 Bonair Street	Somerville
S64	John F Kennedy School	5 Cherry Street	Somerville
S65	Shurtleff Early Childhood School	99 Hawthorn Street	Chelsea
S66	Winter Hill Community School	115 Sycamore Street	Somerville
S67	Manassah E Bradley School	110 Beachview Road	Boston
S69	Benjamin Banneker Charter Public School	21 Notre Dame Avenue	Cambridge

Table 3-9: Schools: Public and Private within 0.5 mile buffer zone in study area (continued)

CODE	SCHOOL NAME	ADDRESS	CITY
S70	Excel Academy Charter School	180 Second Street	Chelsea
S71	Joseph A. Browne School	180 Walnut Street	Chelsea
S72	Eugene Wright Science and Technology Academy	180 Walnut Street	Chelsea
S74	St Rose Elementary School	580 Broadway	Chelsea
S78	Clark Avenue School	8 Clark Avenue	Chelsea
S80	Benjamin G Brown School	201 Willow Avenue	Somerville
S81	Edgar A Hooks Elementary School	300 Crescent Avenue	Chelsea
S82	Frank M Sokolowski Elementary School	300 Crescent Avenue	Chelsea
S83	George F. Kelly Elementary School	300 Crescent Avenue	Chelsea
S84	William A Berkowitz Elementary School	300 Crescent Avenue	Chelsea
S85	Chelsea High School	299 Everett Avenue	Chelsea
S90	Sumner G. Whittier School	337 Broadway	Everett
S92	St Anthony Elementary School	54 Oakes Street	Everett
S93	West Somerville Neighborhood School	177 Powderhouse Blvd	Somerville
S94	Immaculate Conception Elementary School	127 Winthrop Avenue	Revere
S95	Revere High School	101 School Street	Revere
S96	Rumney Marsh Academy	140 American Legion Highway	Revere
S97	Paul Revere School	395 Revere Street	Revere

Table 3-10: Fire Stations within ½-mile buffer zone

CODE	FACILITY NAME	ADDRESS	CITY
F2	Boston FIRE DEPARTMENT	425 Faneul Street	Boston
F3	Boston FIRE DEPARTMENT	460 Cambridge Street	Boston
F6	Cambridge FIRE DEPARTMENT	378 Massachusetts Avenue	Cambridge
F7	Cambridge FIRE DEPARTMENT	175 Cambridge Street	Cambridge
F8	Cambridge FIRE DEPARTMENT	1384 Cambridge Street	Cambridge
F10	Somerville FIRE DEPARTMENT	255 Somerville Avenue	Somerville
F11	Boston FIRE DEPARTMENT	525 Main Street	Boston
F12	Cambridge FIRE DEPARTMENT	113 Garden Street	Cambridge
F13	Somerville FIRE DEPARTMENT	651 Somerville Avenue	Somerville
F14	Cambridge FIRE DEPARTMENT	2029 Massachusetts Avenue	Cambridge
F15	Somerville FIRE DEPARTMENT	266 Broadway	Somerville
F16	Somerville FIRE DEPARTMENT	265 Highland Avenue	Somerville
F17	Chelsea FIRE DEPARTMENT	307 Chestnut Street	Chelsea
F19	Chelsea FIRE DEPARTMENT	883 Broadway	Chelsea
F21	Everett FIRE DEPARTMENT	384 Broadway	Everett
F22	Revere FIRE DEPARTMENT	13 Walden Street	Revere
F23	Revere FIRE DEPARTMENT	4 Freeman Street	Revere
F25	Revere FIRE DEPARTMENT	140 Lynnway	Revere

MassDOT also identified the total number of people within the buffer areas based on the data from the 2010 Census. One notable aspect of the population within the study area is the high proportion of areas with identified environmental justice populations. "Environmental Justice" populations are defined by the Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," which directs federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of programs, policies, and activities on minority populations and low-income populations. This evaluation identifies the environmental justice populations as defined by the Executive Office of Energy and Environmental Affairs.

From the MassGIS layer based on the 2010 Census data, the number of people living within this buffer zone for each of the cities was determined. Because the routes overlap within communities, Table 3-12 shows the total population for each city within the buffer zone for all routes. The table also shows the affected Environmental Justice population for each city.

Table 3-11: Population within ½-mile of the Potential Ethanol Rail Routes

City	Outside of EJ Area	Within EJ Area	Total Population in 0.5 mile buffer around all routes in Study Area
Total Boston	**18,065**	**45,262**	**63,327**
Allston/Brighton/Back Bay	**15,621**	**39,744**	**55,365**
Charlestown	**2,444**	**-**	**2,444**
East Boston	**-**	**5,518**	**5,518**
Cambridge	**24,737**	**54,379**	**79,116**
Chelsea	**-**	**31,792**	**31,792**
Everett	**-**	**20,288**	**20,288**
Revere	**1,143**	**29,121**	**30,264**
Somerville	**32,344**	**38,136**	**70,480**
Totals	**76,289**	**218,978**	**295,267**

Figure 3-1 shows the potentially exposed populations and facilities for Route1; Figure 3-2 shows the potentially exposed populations and facilities for Route2; Figure 3-3 shows the potentially exposed populations and facilities for Route3; and Figure 3-4 shows the potentially exposed populations and facilities for the Shared Route.

Figure 3-1: Potentially Exposed Populations in Route 1

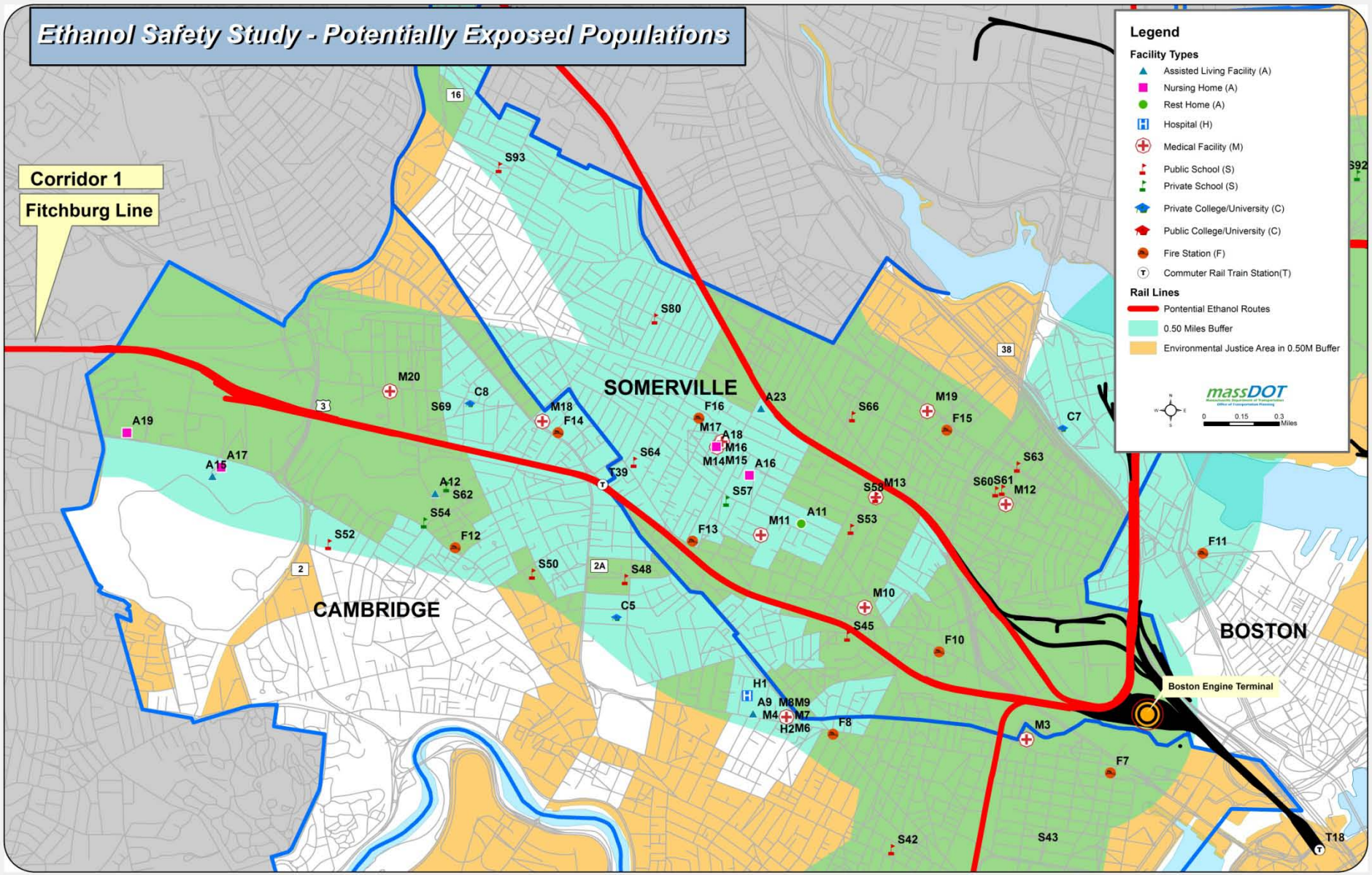


Figure 3-2: Potentially Exposed Populations in Route 2

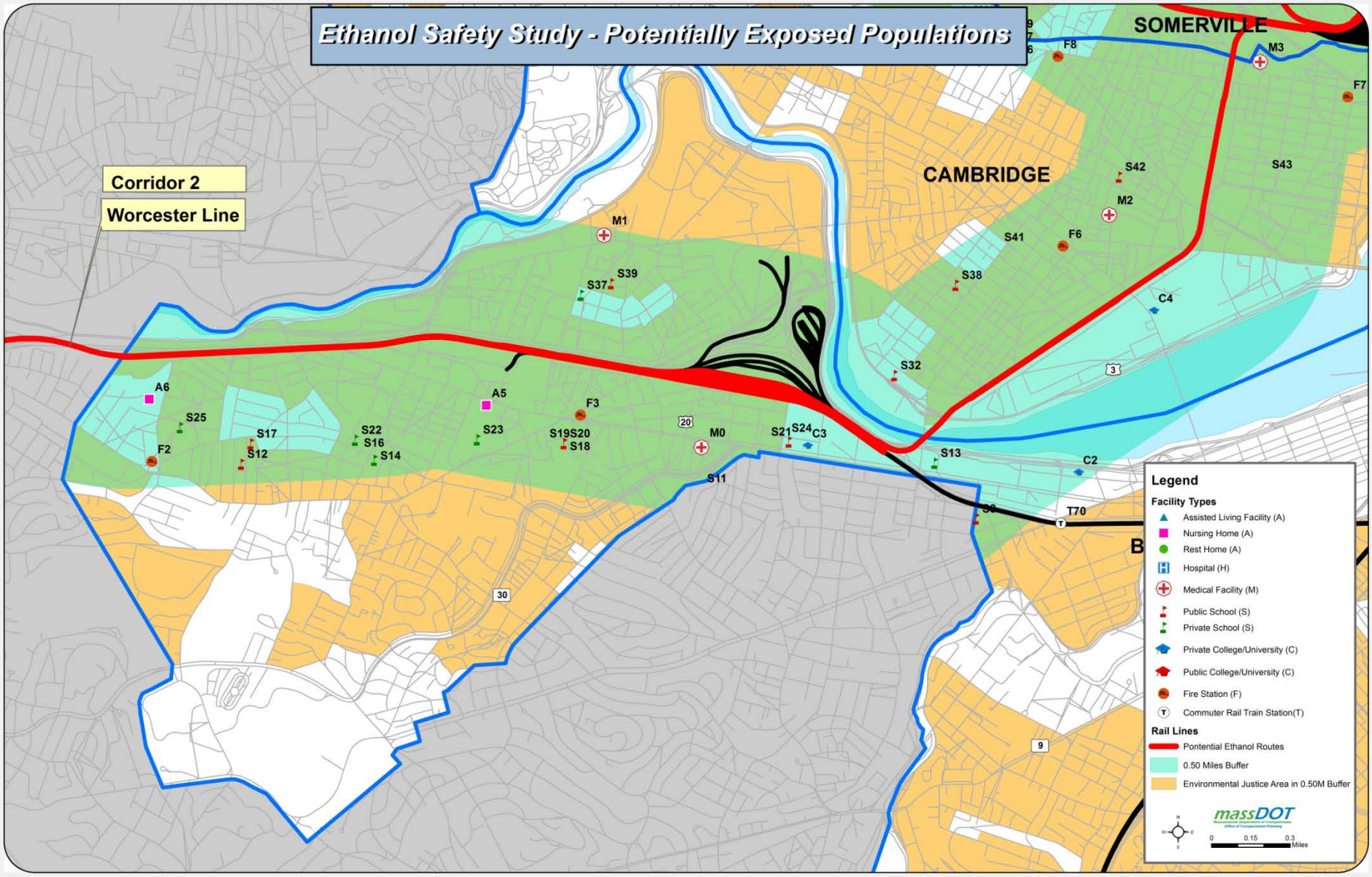


Figure 3-3: Potentially Exposed Populations in Route 3

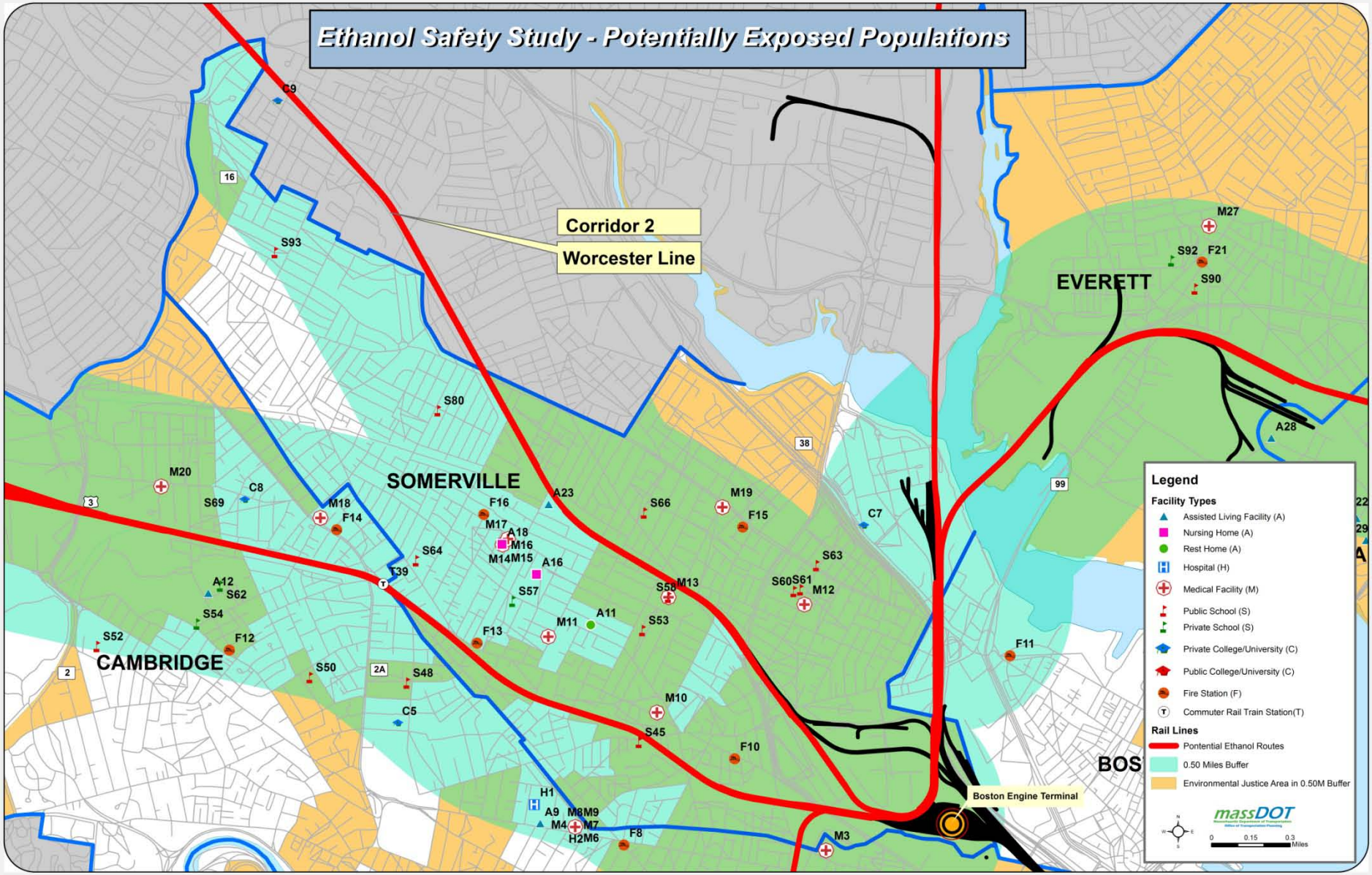
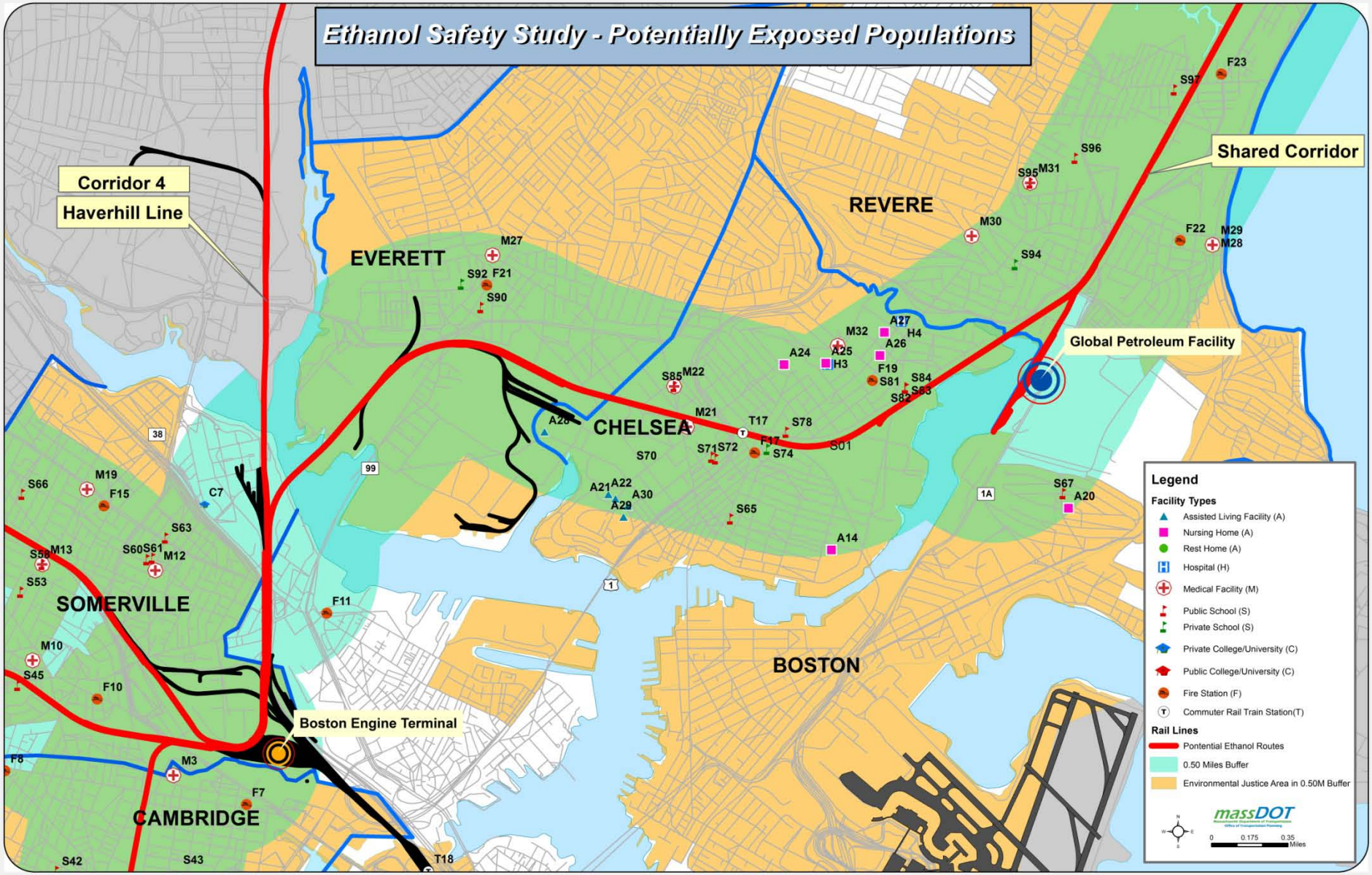


Figure 3-4: Potentially Exposed Populations in the Shared Route



3.3 Existing Safety and Security Policies and Procedures for Handling Ethanol

The following section provides an overview of the safety and security regulations that govern the transportation of ethanol. Transporting ethanol and other hazardous materials is regulated by the federal government. There are a number of federal agencies responsible for oversight of hazardous material shipments and oversight of the businesses that deal with hazardous materials. The regulations discussed within this section are intended to ensure the safety and security of both people working with hazardous materials and the populations located in close proximity to railroad lines where hazardous materials are present.

Overview of Federal Agency Authority

Multiple federal agencies are tasked with regulating and authorizing the use and transport of hazardous materials. While the majority of rail-specific regulations are handled by the Federal Railroad Administration (FRA), other agencies have oversight of various aspects of hazardous materials transportation. The specific roles of each federal agency were outlined comprehensively in a 2010 Department of Homeland Security (DHS) plan: "Chemical Sector-Specific Plan, An Annex to the National Infrastructure Protection Plan." A section of this plan can be found in Appendix 1, and the full report is available on the DHS website.

Department of Homeland Security

The Department of Homeland Security is granted authority over hazardous materials through the Homeland Security Presidential Directive 7 (HSPD-7), Chemical Facility Anti-Terrorism Standards mandate (CFATS), the Maritime Transportation Security Act (MTSA), Hazardous Materials Transportation Act (HMTA) and other laws and regulations. DHS is responsible for managing the security of the entire chemical sector, with a specific focus on high-risk facilities and water-adjacent facilities.

HSPD-7 gives DHS responsibility for coordinating protection activities for the entire chemical sector. This includes development of risk management frameworks and sector-specific plans, such as the one for ethanol. It is through these plans and management tools that DHS coordinates with partners in the private sector to regulate high-risk materials. Executive Order 13416 improves upon HSPD-7. Titled "Strengthening Surface Transportation Security," the order facilitates the implementation of a comprehensive, coordinated and efficient security program. It set new deadlines for key security related activities, such as the development of security assessments.

CFATS gives DHS the authority to require high-risk facilities to develop vulnerability assessments, develop site security plans, and create security performance standards. These performance standards are used by DHS to evaluate facilities, and DHS is able to mandate that protective measures be implemented based on those evaluations. CFATS also requires DHS to inspect and audit chemical facilities.

The Maritime Transportation Security Act gives DHS the authority, via the US Coast Guard, to protect the transportation of hazardous materials over water, and to secure chemical facilities that are adjacent to navigable waterways. Much like CFATS, MTSA requires the development of security plans, the use of performance standards and the implementation of protective measures. MTSA also has provisions to ensure security within the workforce of ports and vessels.

The Transportation Worker Identification Credential program provides for biometric identification badges to allow access to secure areas of selected ports. All workers who require secure access for their jobs were required to submit biometric information and pass a security threat assessment by April 2009.

The Hazardous Materials Transportation Act (HMTA) regulates the 3.5 million commercial vehicle drivers that transport hazardous materials via truck. These drivers are required to submit to periodic background checks and security assessments in order to maintain the hazmat endorsement on their driver's license.

In addition, DHS tasks the TSA is permitted to inspect property, facilities, and records relevant to rail security. Freight carriers must also report the location and shipping information of various substances to TSA upon request, and maintain chain-of-custody documents to ensure the safe exchange of materials.

U.S. Environmental Protection Agency

The U.S. EPA has authority over hazardous materials through three federal laws: the Clean Air Act, The Emergency Planning and Community Right-to-Know Act (EPCRA), and Superfund. The Clean Air Act requires that any facility that stores or handles hazardous materials over a certain amount must develop and implement a risk management program that is submitted for review by EPA. These plans must be updated every five years for each facility, and include assessments of potential chemical release scenarios, information on accident prevention and emergency response, and a five year history of incidents at the facility. These program reports are also submitted to DHS, which uses them to determine which facilities to classify as "high risk" or "high consequence."

The Emergency Planning and Community Right-to-Know Act (EPCRA) requires states and municipalities to develop state and local emergency response commissions. The commissions are then responsible for developing emergency response plans for the potential release of chemical substances. Local facilities are required to assist the commissions in developing these plans, and to provide any information necessary. Commissions collect material safety data sheets on the substances stored at local facilities, and ensure that they are distributed to the appropriate local authorities. Finally, facilities must submit annual inventories of hazardous materials to the commissions.

The Superfund Amendments and Reauthorization Act of 1986 gave the Centers for Disease Control and Prevention (CDC) the responsibility for public health logistical support in the event of a chemical release event. The CDC has responsibility in the areas of public health assessments, establishment and maintenance of material databases, information dissemination, and medical education. In addition, the CDC has developed a plan for a laboratory response network in the event of a chemical event in order to allow for immediate testing and communication to benefit public health. This involves rapid material screenings to benefit the public and first responders.

U.S. Department of Justice

The U.S. Department of Justice, through the Drug Enforcement Administration (DEA), has authority under the Controlled Substances Act and the Controlled Substances Import and Export Act to regulate

the security of certain chemicals. DEA guards against theft or diversion of these materials, and evaluates the physical security of various facilities

U.S. Department of Labor
The U.S. Department of Labor has authority through the Occupational Safety and Health Act (OSHA) to regulate the handling of hazardous materials. OSHA requires facilities to conduct a hazard analysis, develop operational procedures, develop emergency action plans, report on incidents and conduct regular compliance audits.

U.S. Department of Transportation
The U.S. DOT has authority to regulate hazardous materials under a number of laws, including the Hazardous Materials Transportation Act (HMTA), the Federal Rail Safety Act, and multiple rulemaking responsibilities. HMTA gives US DOT wide authority to ensure safe and secure shipments of hazardous materials. General requirements are developed by the Pipeline and Hazardous Materials Safety Administration (PHMSA) within US DOT. PHMSA's regulations cover classification, packaging, emergency communication, training, and modal-specific requirements for materials. Much like other regulations, PHMSA also requires security plans, risk assessments and employee training.

The Federal Rail Safety Act gives authority to the FRA to ensure secure movement of hazardous freight via railroads. This includes regulations on the design, manufacture, and repair of the equipment, freight cars, locomotives, and track used to carry hazardous materials, and information on the movement of these materials.

The "Hazardous Materials: Enhancing Rail Transportation Safety and Security for Hazardous Materials Shipments" rule requires railroads to use routes with the fewest overall safety and security risks to transport hazardous materials. The "Hazardous Materials: Risk-Based Adjustment of Transportation Security Plan Requirements" rule narrowed the list of materials subject to security plan requirements. This allows a greater focus on materials with the most potential for concern. One of the hazardous materials regulated under this rule is ethanol.

Overview of Federal Railroad Administration Programs
As discussed above, the Federal Railroad Administration, under the umbrella of U.S. DOT, is authorized to carry out a number of safety and security programs. At FRA, this is delegated to the Office of Safety, which has a number of divisions with programs aimed at addressing safety concerns.

Hazardous Materials Division
The Hazardous Materials Division administers a safety program that oversees the movement of hazardous materials. This program focuses on tank car safety and movement approvals. The tank car safety program ensures that vehicles that carry hazardous materials are secure and properly maintained. The program also includes procedures for loading and unloading railcars. The Division also regulates movement approvals and has developed a tiered process for shippers. The regulations supported by this division are found in 49 CFR 171 to 180.

Highway-Rail Grade Crossing and Trespass Prevention Division
This Division focuses on trespassing prevention and grade crossing security. FRA's program has reduced the number grade crossing deaths by 50 percent over 20 years. Information on train horns and quiet zones is also controlled by this Division. FRA works with the railroad industry and state and local governments, to sponsor, plan and conduct educational outreach efforts at schools, workplaces, and other venues, in order to raise awareness about the dangers and consequences of railroad trespassing. The regulations supported by this division are found in 49 CFR 222 and 229.

Rail and Infrastructure Integrity Division
The Rail and Infrastructure Integrity Division promotes an understanding of and compliance with standards concerning rail and bridge maintenance. The purpose of the Division is to prevent accidents that result from rail and structure degradation. In addition, the Division provides technical expertise to ensure maximum safety in railroad operations. Specific focuses are in the areas of maintenance and development of continuous welded rail, and bridge and structure worker safety. The regulations supported by this division are found in 49 CFR 213 and 214.

Motive Power and Equipment Division
This Division provides technical expertise and direction relevant to motive power and freight, passenger, and commuter equipment. It promotes an understanding of and compliance with Federal standards for locomotives, passenger and freight cars, and its safety appliances such as air brakes. The regulations supported by this division are found in 49 CFR 215, 218, 221, 223, 224, 229, 230, 231 and 232.

Operating Practices Division
The Operating Practices Division examines railroad carrier operating rules, employee qualification guidelines, and carrier training and testing programs to determine compliance with the Railroad Safety Act of 1970, railroad occupational safety and health standards, the Hours of Service Act, and accident and personal injury reporting requirements. The regulations supported by this division are found in 49 CFR 217 through 222, 225, 228, 239, 240 and 242.

Risk Reduction Program Division
The Risk Reduction Program Division evaluates safety risks and helps to manage those risks in order to reduce the numbers and rates of accidents. This includes collecting data on accidents, developing programs to mitigate risk, developing best practices and providing support. Some programs developed by this division include the Confidential Close Call Reporting System, the Peer-to-Peer Safety Program, Fatigue Management Plans, and programs to eliminate in-cab distractions.

Signal and Train Control Division
The Signal and Train Control Division promotes an understanding of and compliance with the various federal regulations related to signal and train control systems; highway-rail grade crossing warning systems; and the hours of service laws applicable to signal employees. The applicable regulations primarily address the design, installation, maintenance, inspection and testing of these signal systems, and the necessary system components adjustment, repair, or replacement, as well as the associated recordkeeping and reporting requirements. The regulations supported by this division are found in 49 CFR 214, 228 and 233 through 236.

Track Division
The Track Division's mission is to provide technical expertise and direction relevant to railroad track. This includes reports and guidance on track maintenance and conditions, standards development and compliance manuals.

Overview of Safety and Security Plans
As noted, facilities and shippers of hazardous materials are required to submit safety and security plans to reduce the risk and mitigate impacts of an incident with a hazardous material. The safety and security plans are also meant to address the potential threats from terrorism. For railroads, these regulations are codified in 49 CFR 172. Ethanol is classified as a Class 3 material under this regulation, meaning it qualifies for packaging in Group I or II type containers. In addition, the Maritime Transportation Security Act (MTSA) also enumerates components necessary in safety plans, specifically for ports and vessels.

The safety plans outlined under these two regulations are remarkably similar. Specific components of a security plan are listed in the regulation. These include measures to provide personnel security and authorized access; security en route to a destination; identification of key contacts; training received by employees; and background checks. The regulations also call for specific hazard drills, and screening of potential employees.

This railroad regulation also states that states or municipalities are not permitted to prohibit the use of a rail line for transporting hazardous materials.

Safety and security plans are typically required to remain confidential, due to the sensitive nature and risk of incident. This results in a limitation of available information on the subject. DHS classifies most information contained within safety and security plans to be either classified, sensitive security information, or information relating to a chemical terrorism vulnerability. The information on critical infrastructure and key resources is shared only with the specific agencies and private partners who need it. Protected information includes:

- Security Vulnerability Assessments;
- Site Security Plans;
- Documents related to the Department's review and approval of SVAs and Site Security Plans, including Letters of Authorization, Letters of Approval, and responses to them;
- Alternative Security Programs;
- Documents related to inspections and audits;
- Records required to be created and maintained by regulated facilities;
- Sensitive portions of orders, notices, or letters;
- Information developed pursuant to the Top-Screen process; and
- Other information designated as CVI by the Secretary of Homeland Security.

As a member of the Technical Advisory Group, Global Petroleum shared some information on their security plan. Their plan, which has been approved by the Department of Homeland Security, includes:

- Monitored camera surveillance at the facility,
- Recorded inspection rounds of the facility at specified intervals,

- A minimum number of terminal personnel at the facility,
- Gated facility with restricted access,
- The facility conducts security drills and training,
- Employees at the facility have TSA Transportation Worker Identification Credential cards,
- The facility is subject to unannounced security inspections by the U.S. Coast Guard,
- Contracts for spill response with local and national spill responders, and
- Protocols for reporting any security breach.

Various entities and laws govern the use and protection of this information, including the Critical Infrastructure Information Act of 2002 and the Critical Infrastructure Partnership Advisory Council. Within the Boston metropolitan area, the Metro-Boston Homeland Security Region (encompassing Boston, Brookline, Cambridge, Chelsea, Everett, Revere, Somerville, Quincy and Winthrop) and the Urban Area Security Initiative work with the federal government on the release and use of this information. Critical infrastructure and key resources are further protected by the Critical Infrastructure Monitoring System (a central hub of targeted cameras and sensors), target hardening, and work on enhancing the prevention tools of local bomb squads.

3.4 Existing Emergency Response Capabilities

While the safety and security of ethanol transportation and storage are regulated at the federal level, the response to any ethanol accident is the responsibility of the local fire departments and other local emergency responders. The following section provides an overview of the emergency response capabilities within the study area and the resources available for emergency planning and preparation.

Local Response

In the event of an ethanol train accident, the local fire departments and emergency personnel would be the first to respond. Table 3-12 identifies the fire stations within the study area that are located within ½ mile of the potential ethanol rail routes. The staff and apparatus from these stations would likely be the first on-site during an ethanol train incident.

Table 3-12: Fire Stations within ½ mile of the Potential Ethanol Rail Routes

City	Facility Name	Address
Boston	Engine 51	425 Faneuil Street
Boston	Engine 41, Ladder 14	460 Cambridge Street
Boston	Engine 32, Ladder 9	525 Main Street
Cambridge	Engine 8, Ladder Co. 4	113 Garden Street
Cambridge	Engine 5	1384 Cambridge Street
Cambridge	Engine 4	2029 Massachusetts Avenue
Cambridge	Engine 3, Ladder Co. 2	175 Cambridge Street
Cambridge	Engine 2, Ladder Co. 3	378 Massachusetts Avenue
Chelsea	Headquarters	307 Chestnut Street
Chelsea	Engine 3 Ladder 2	883 Broadway
Everett	Headquarters	384 Broadway
Revere	Engine 5	4 Freeman Street
Revere	Engine 1	13 Walden Street
Somerville	Headquarters	266 Broadway
Somerville	Engine 7	265 Highland Avenue
Somerville	Engine 4 & Tower 1	651 Somerville Avenue
Somerville	Engine 3	255 Somerville Avenue

Depending upon the scale and nature of the incident, responding fire departments will likely rely on mutual aid agreements to respond to the incident. Mutual aid agreements in the Boston metro area are coordinated through Metrofire, which is an association of 34 municipal fire departments in and around Boston.

Responding to an ethanol fire requires the use of alcohol resistant foam which is classified as AR-AFFF foam. Table 3-13 shows a listing of the mobile foam resources across the Commonwealth. Foam supplies within the study area response district (District 13) are highlighted. The table shows that there are approximately 5,500 gallons of alcohol-resistant foam available. The petroleum terminals also have additional foam resources that can be made available during an emergency. Despite these resources, several members of the technical advisory group, including representatives of local fire departments, voiced concerns that there is insufficient AR-AFFF foam to respond to an ethanol train fire.

Table 3-13: Mobile Alcohol-Resistant Foam Resources in Massachusetts

Foam trailers - Location	**Type** AFT = Attack Foam Tanker FT= resupply only	**Type of concentrate** UC = unconfirmed	**District**	**Amount of concentrate (gallons)**
Mashpee	AFT	AR-AFFF 1-3%	1	500
Nantucket	AFT	AR-AFFF 1-3%	1	500
Tisbury	AFT	AR-AFFF 1-3%	1	500
Sandwich	AFT	AR-AFFF 3-6% UC	1	1000
Kingston	AFT	AR-AFFF 1-3%	2	500
Raynham	AFT	AR-AFFF 1-3%	3	500
New Bedford	AFT	AR-AFFF 1-3%	3	600
Somerset	AFT	AR-AFFF 1-3%	3	600
Plainville	AFT	AR-AFFF 1-3%	4	500
Needham	AFT	AR-AFFF 1-3%	4	500
Randolph	AFT	AR-AFFF 1-3%	4	500
Danvers	AFT	AR-AFFF 3-6%	5	500
Worcester	AFT	AR-AFFF 1-3%	7 and 8	500
Ashburnham	AFT	AR-AFFF 1-3%	8	500
Holden	AFT	AR-AFFF 1-3%	8	500
Orange	AFT	AR-AFFF 1-3%	9	500
Westover AFB	AFT	AR-AFFF 1-3%	11	500
Longmeadow	AFT	AR-AFFF 1-3%	11	500
Palmer (Monsanto)	AFT	AR-AFFF 3-6% UC	11	1000
Pittsfield	AFT	AR-AFFF 1-3%	12	500
Chelsea	FT	AR-AFFF 3-6% UC	13	500
Revere	FT	AR-AFFF 3-6% UC	13	500
Everett	FT	AR-AFFF 3-6% UC	13	500
Braintree (Citgo) 1	FT	AR-AFFF 3-6%	13	2000
Braintree (Citgo) 2	FT	AR-AFFF 3-6%	13	2000
North Andover.	AFT	AR-AFFF 3-6%	15	500

Source: The Massachusetts Department of Fire Services

Local Emergency Planning

Each city is responsible for creating a comprehensive emergency management plan. As required by MEMA, the local government must accomplish the following through these plans:

1. Establish and maintain an emergency management framework at the local level involving all government, private, and volunteer organizations that have a role in the success of comprehensive emergency management within the jurisdiction.
2. Provide for development of a broad-based public awareness, education, and information program designed to reach all local citizens, including those needing alternative media formats such as Braille or non-English languages.

3. Participate actively in discussions and negotiations with the Commonwealth regarding policies and priorities to ensure that the work being done contributes to the improvement of emergency capabilities for the town or city.
4. Perform work for Federal and state emergency management programs within the negotiated scope and in a responsible manner.
5. Provide direction and control of a local response and recovery approach that involves broad participation from local organizations and is compatible with the state response and recovery organization and concept of operations.
6. Participate in programs and initiatives designed to avoid, reduce, and mitigate the effects of hazards through development and enforcement of policies, standards, and regulations.
7. Establish and maintain mutual aid agreements with other towns and cities.

MassDOT engaged representatives of the study area communities' fire departments in this study, and invited them to participate in the technical advisory group. On behalf of the fire departments, Boston Fire Commissioner Roderick J. Fraser submitted the following observations and proposed recommendations for addressing ethanol safety issues in the study area. These are quoted directly below, and have been substantially incorporated into the study recommendations in Chapter 4.

Fire Service Recommendations to the Department of Transportation Technical Advisory Group for the study of the Safety Impacts of Ethanol Transportation by Rail through Boston, Cambridge, Chelsea, Everett, Somerville & Revere

1. The leaders of the Fire Departments that are affected by the proposed transportation of ethanol by rail to the Global Petroleum facility in Revere have met to review the potential impacts of an accident and release of ethanol along the transit route.
2. On February 26, 2013 a meeting was held of the Fire Service leaders of Boston, Cambridge, Chelsea, Everett, Somerville and Revere at the BFD Holton St. Training facility to review the regional response capabilities and determine which, if any, additional response capability would be needed. The following attended the meeting:
    a. Roderick J Fraser Jr., Boston Fire Commissioner
    b. Steve Abraira, Boston Fire Department
    c. Eugene Doherty, Revere Fire Department
    d. David Butler, Everett Fire Department
    e. Gerald Reardon, Cambridge Fire Department
    f. Kevin Kelleher, Somerville Fire Department
    g. Gerard Mahoney, Cambridge Fire Department
    h. Robert Better, Chelsea Fire Chief
    i. Robert Donahue, MASSPORT Fire Department

Although not a community directly affected by the rail transportation of ethanol, Chief Donahue has a great deal of knowledge in combating flammable liquid fires and training for flammable liquid response incidents.

3. If faced with a large ethanol spill, large quantities of alcohol resistant foam will be needed to contain the spill and/or combat a fire that may result from an accident.
4. A review of the number of foam capable response units in the affected region and their capacity was conducted. Currently, the foam capabilities for the region are not sufficient to contain an ethanol fueled fire incident (one or more ruptured rail cars).
5. The Boston Fire Commissioner met with the Chief of the Providence, RI Fire Department to review the preparations that have been made in the communities affected by ethanol transportation by rail to the port of Providence and was briefed on the RI Foam Task Force concept that was put in place.
6. Other communities and Fire Service leaders that have similar threats were contacted to determine best practices for equipment and response training.
7. The Fire Service regional leadership recommends the following:
    a. Development of a regional Foam Response Task Force made up of Foam Tenders combined with existing Fire Engines that respond as a unit to emergencies where large quantities of alcohol resistant fire fighting foam is required.
    b. The DOT and/or shipping company and product owner fund the purchase of four (4) pieces of apparatus, commonly called “Foam Tenders” built on a commercial chassis with the following general specification:
        i. Foam Transfer pump
        ii. Balanced pressure foam proportioning system rated at 6,000 GPM
        iii. 3,000 gallon foam poly tank
        iv. 2,000 GPM deck gun with remote control capability
        v. Infrared camera mounted in the cab
    c. Once funded, the above listed Fire Service Chiefs will meet as a committee to develop one set of specifications to apply to the purchase of all 4 Foam Tenders.
    d. The DOT and/or shipping company and product owner fund the purchase of alcohol resistant class “B” aqueous film forming foam for each Foam Tender.
    e. The DOT and/or shipping company and product owner fund the training of twelve (12) regional training instructors in flammable liquid fire fighting tactics and procedures for 5 years.
    f. The DOT conduct an annual Tabletop and functional exercise to assist the region in preparation and training for potential emergencies. As part of the functional exercise, we recommend budgeting to expend 50 gallons of foam concentrate per unit per year for training.

Cost estimate for recommended actions:

1. Foam Tender ($380,000.00) X 4	$1,520,000.00
2. Foam ($20 per gallon) X 12,000 gallons	$240,000.00
3. Instructor training	$35,000.00
4. Foam for annual training	$4,000.00
Total cost (estimated)	**$1,799,000.00**

State-Level Initiatives

There are a number of resources available to the study area communities to assist in preparing and responding to an ethanol accident.

Massachusetts Emergency Management Agency

The Massachusetts Emergency Management Agency (MEMA) is the central state agency responsible for coordinating the deployment and coordination of local, regional, and statewide assets during an emergency. The primary emergency planning document produced by MEMA is the State Comprehensive Emergency Management Plan. The sixth revision of this document was published in September 2007. The State Comprehensive Emergency Management Plan includes a series of Massachusetts Emergency Support Functions (MAESFs), which are meant to lay out the framework for responding to an emergency that has overwhelmed a community's capabilities and resources. The framework under the MAESFs includes initial response actions, continuing response actions, and recovery actions for all potential emergencies, including fire fighting and environmental protection and hazardous materials. The Comprehensive Emergency Management Plan includes a Hazardous Materials Annex and a Large Volume Ethanol Annex which is included in Appendix 2.

Department of Fire Services

The Massachusetts Department of Fire Services (DFS) includes two special response groups that are available to assist local fire departments in their response to an emergency (such as an ethanol incident). The DFS Special Operations team is meant to provide the local command structure with specialized resources necessary to coordinate the response of multiple agencies to significant events within the Commonwealth of Massachusetts. This is accomplished through the deployment of their specialized mobile incident support unit. The DFS Hazmat Response group is made up of six regional response teams that are strategically located for a maximum of 1-hour response to anywhere in the Commonwealth. The teams are supported by specialized equipment, including the Operational Response Units (ORUs), which contain specialized personal protective equipment and decontamination equipment, and the Technical Operations Mobile Unit (TOM), which is a state-of-the-art support vehicle containing chemical information databases and a sophisticated communications network of radios and telephones. In addition to the emergency response teams outlined above, DFS is also a major planning and training resource for local fire departments.

DFS offers a number of training courses to local fire departments on ethanol-related issues. The courses are provided free to Massachusetts fire departments although attendance at the courses generally requires the firefighter to find a replacement who is paid at overtime rates, resulting in a cost to the communities. A list of the courses and their descriptions are provided below:

> **Course #266 – Ethanol for First Responders:** This 6-hour program introduces the local response community to the risks and challenges for first responders when dealing with small and large volume gasoline/ethanol blended fuels and denatured ethanol. Topics covered: what is ethanol, how is ethanol made, what are its transportation modes, what are its primary and secondary hazards, what public protective actions are required, and what firefighting methods are required. The program stresses the use of alcohol resistant foams and dry chemical extinguishing agents, since

ethanol is a polar solvent. Program includes a live demonstration of AR-AFFF foam and dry chemical on an ethanol fire.

Course #267 – Ethanol Risk and Challenges for Community Leaders: Increased transportation and storage of ethanol within the Commonwealth is creating new challenges for fire service, emergency management, public health and the environment. In response to these challenges, the Department of Fire Services has developed a course specifically geared toward elected and appointed officials. The goal of this 3-hour course is to provide community decision makers with the information they need to support the new public safety challenges posed by ethanol. Topics include: transportation modes and routes, primary and secondary hazards, public protective actions, and firefighting considerations.

Course #401 – Flammable Gas Firefighter Training, Classroom: This course is designed to provide students with knowledge of the general properties of flammable gases to include a working knowledge of the effects of temperature and pressure as they relate to firefighting efforts. Classroom theory and practical application of firefighting evolutions on actual gas equipment and situations are included. Students applying must successfully complete the classroom portion of the course prior to acceptance into the practical session.

Course #402 – Flammable Gas Firefighter Training, Practical: Practical session for Flammable Gas Firefighting: See course #401 for description. This is day two (practical session) of the 2-day flammable gas program that must be attended during the same semester. As part of the 2-day program, the practical portion is designed to provide students with hands on experience and a working knowledge of the effects of temperature and pressure as they relate to firefighting evolutions on actual gas equipment. Safety considerations require that a minimum of 18 students be enrolled in this 12-hour course.

Department of Environmental Protection

Like DFS, the Massachusetts Department of Environmental Protection (MassDEP) is a statewide agency charged with protecting public health, safety, welfare and the environment. Within MassDEP, the emergency response program is a 24/7 operation with trained responders and multiple cleanup contractors. Under Chapter 21E/Massachusetts Contingency Plan, MassDEP participates from initial response, through cleanup and recovery to final release closure. MassDEP identifies potentially responsible parties, jointly and severally, and holds them responsible for conducting cleanup actions.

MassDEP is also mandated to undertake planning and prevention activities for potential oil and hazmat releases to the environment. They work with U.S. EPA and the U.S. Coast Guard on spill prevention control and countermeasures (SPCC) and facility response plans (FRP). MassDEP also provides technical research and training, such as the Large Volume Ethanol Spills – Environmental Impacts & Response Options document (included in Appendix 2).

Department of Public Health

The Massachusetts Department of Public Health (DPH) provides support to hospitals and other public health agencies to ensure their overall emergency preparedness. These programs include preparations for the treatment and transportation of patients during a mass casualty incident and the development of hospital evacuation plans. Hospitals are required to update their comprehensive plans for partial or full evacuation annually.

Chapter 4: Report Findings & Recommendations

Transporting ethanol by rail through the cities of Boston, Cambridge, Chelsea, Everett, Revere, and Somerville will be a change to the status quo for each of these communities. While the railroad lines that will be used to transport ethanol through these communities have existed for over 100 years, they have not recently been used on a regular basis to move ethanol or other hazardous materials in the quantities that are expected to be shipped to the Global Petroleum Facility in Revere. However, the movement of such materials is regulated at a federal level, and cannot be regulated in any manner at the state or local level.

The findings and recommendations outlined below are meant to provide a better understanding of the impacts on public safety of this change to the transportation system.

4.1 Report Findings

As with all hazardous materials there are inherent risks in transporting, storing, and transferring ethanol. There are a number of factors identified in the body of this report that mitigate the potential impact on public safety of ethanol transportation by rail through the Study Area.

The first is the existing regulatory environment. Businesses such as Global Petroleum and the railroads must comply with a comprehensive set of federal regulations that address both safety and security in order to transport or store ethanol. These regulations govern the training of their personnel, the operating procedures they employ, and the design of their facilities.

The second is the existing safety record of rail transportation. Looking specifically at the railroad industry, the regulations in place have helped keep the number of railroad accidents low. Between 2008 and 2012 there was an average of 5.66 accidents per million train miles nationwide. Thirty one train accidents that resulted in the release of ethanol were identified between 2008 and 2012. That represents only 0.32% of the accidents that occurred during that period while ethanol represented approximately 1.1% of all rail carloads during that same time. Additionally only five of the thirty one accidents resulted in a death or injury. Statewide, there were sixty eight railroad accidents between 2008 and 2012 and none of them involved the release of ethanol. The rail routes within the study area have added safety improvements such as block signaling systems, maintenance of the track at FRA Class 3 standards, and the use of welded rail which further helps reduce the risks of an accident.

The third is the added level of investment by the MBTA in the study area railroad tracks. At a minimum, the MBTA maintains its tracks to meet Class 3 railroad standards. As a safeguard of the track condition, the MBTA has stipulated in its contract with the Massachusetts Bay Commuter Railroad (MBCR) that it must maintain all tracks to meet the Class 4 railroad standards. Additionally, the MBTA utilizes continuously welded track which provides added safety for rail operations by removing the rail joints, which can be a source of derailments if they are allowed to deteriorate significantly. The MBTA's signaling systems rely upon the ability of continuously welded track to carry signals along the circuit that they form. These signal systems help control train movements and also allow for detection of missing rail segments and open switches which can also lead to accidents.

The fourth is the emergency response planning that occurs at the state and local level. Planning and preparing for such an incident is primarily the responsibility of city emergency management in cooperation with fire and other emergency response staff. Communities are closely supported by training and assistance from the Massachusetts Emergency Management Agency (MEMA), the Massachusetts Department of Fire Services (DFS), the Massachusetts Department of Environmental Protection (MassDEP), and the Massachusetts Department of Public Health (MassDPH). The railroad and fuel industries also have a responsibility to plan and prepare for emergencies and to fulfill their obligations to local emergency planning committees. These plans help identify the procedures for regional collaboration in the event of an emergency including training resources, on-site command, and mutual aid agreements.

Nonetheless, the rail routes in the study area are unusual in terms of their density of residents, joint public/private use of the rail assets, and adjacent industrial businesses that may also house hazardous materials on-site.

The report has identified a number of public safety factors that need to be addressed, including:

- That train speed and the old DOT-111 railcar design contribute to the release of ethanol in an accident,
- That the Grand Junction and East Boston Spur are not maintained to the same standards as the remainder of the MBTA/MassDOT system, and
- Additional alcohol-resistant foam resources are needed to battle an ethanol train fire.

4.2 Recommendations

Based on the report findings, MassDOT makes the following recommendations to ensure the safe and secure transportation of ethanol by rail.

1. The railroad tracks along any possible ethanol transportation routes should be maintained to a Class 3 standard (consistent with the current MBTA standards for passenger service). This recommendation includes the East Boston branch, which is currently planned for rehabilitation to provide access to the Global facility.
2. Despite the Class 3 rail, the ethanol train speeds should be as slow as possible to reduce the energy of any accident.
3. The railroads should work with shippers to maximize the use of DOT-111 railcars for ethanol delivery that were constructed after October 1, 2011 to be compliant with the new American Association of Railroads (AAR) design guidelines, which will limit the likelihood that the railcar would be pierced in the event of a derailment.
4. Ethanol trains should be scheduled to avoid conflicts with any other trains (passenger or freight) that may cause them to be delayed or stored on sidings during transit to the Global facility.
5. Ethanol train schedules should be reported to community and state fire officials and first responders with sufficient notice.
6. At-grade crossing safety and security equipment on the affected routes should be maintained and/or upgraded to prevent collisions with motor vehicles. One possible source of funding for these improvements is the Section 130 program overseen by the MassDOT Rail & Transit Division.

7. The railroads should utilize Department of Homeland Security (DHS) resources to update their security plans regularly to reflect changes in the safety and security conditions.

MassDOT makes the following additional recommendations for the safe and secure offloading of ethanol:

1. The railroads and Global Petroleum should secure the railroad tracks and sidings where the ethanol trains will be stored adjacent to the Global facility.
2. On-site fire suppression systems should be kept in working condition and tested regularly.
3. Global Petroleum should update its facility security plan to address the added risks of storing and offloading ethanol from railcars on their site. This revised plan should identify procedures to isolate any ethanol spill or fire to prevent spreading to the other stored railcars within the confined tracks along the facility. The revised plan should also identify facility upgrades necessary to adequately protect the storage of ethanol and ethanol-petroleum blends on its property.
4. Global Petroleum should utilize the Voluntary Chemical Assessment Tool (VCAT) in updating their facility security plans and work collaboratively with local, state, and federal security, emergency, and first responders to plan for and respond to an ethanol-related incident. The VCAT is a voluntary assessment tool available to chemical sector industries from the Department of Homeland Security.

MassDOT makes the following additional recommendations to ensure that the communities, railroad companies, first responders, and emergency managers are prepared to respond to any derailment or emergency:

1. City fire departments and other emergency personnel should take advantage of the training courses currently offered by the Massachusetts Department of Fire Services related to ethanol and flammable gases and by the Massachusetts Department of Environmental Protection on the latest methods for responding to an ethanol spill, including containment strategies. These courses include classroom and practical training sessions.
2. Hospitals and other healthcare facilities that may be exposed during an ethanol emergency should take full advantage of the programs offered by the Massachusetts Department of Public Health in planning for mass casualty incidents and hospital evacuations that may result.
3. City fire departments and other emergency personnel should utilize the informational materials and training resources provided by the Massachusetts Department of Fire Services, the Massachusetts Department of Environmental Protection, and the Massachusetts Department of Public Health, including the Large Volume Ethanol Annex of the Massachusetts Comprehensive Emergency Management Plan, in future revisions to their comprehensive emergency management plans in order to address any unusual issues that may result from an ethanol train fire within the study area, including protection of structures adjacent to the incident and methods for accessing the rail right-of-way.
4. City fire departments and other emergency personnel should identify critical facilities along the potential ethanol transportation routes and develop detailed emergency response plans as necessary using consequence modeling of the worst case scenario of a derailment, release and fire involving multiple ethanol railcars. The emergency response plans should include an analysis of the response time to get the appropriate amount of alcohol-resistant foam and water

flow deployed, taking into account the possibility that multiple at-grade crossings may be blocked. Additionally, the plans should include an analysis of whether an evacuation would be appropriate or whether the public should be advised to shelter in place.

5. City fire departments should ensure that risk communication and notification in the event of an incident is made in multiple languages to ensure communication with limited English language speakers.
6. The Massachusetts Department of Fire Services should work with the city fire departments and other emergency personnel to analyze the regional capabilities needed to battle an ethanol train fire, including the amount of alcohol resistant foam that would be required. This study should, at a minimum, include the following items, which address the recommendations of the study area fire department representatives:
    a. Development of a regional Foam Response Task Force made up of Foam Tenders combined with existing Fire Engines that respond as a unit to emergencies where large quantities of alcohol resistant fire fighting foam is required.
    b. The purchase of four (4) pieces of apparatus, commonly called "Foam Tenders" built on a commercial chassis and having the following general specification:
        i. Foam transfer pump
        ii. Balanced pressure foam proportioning system rated at 6,000 GPM
        iii. 3,000 gallon foam poly tank
        iv. 2,000 GPM deck gun with remote control capability
        v. Infrared camera mounted in the cab
    c. The Study Area Fire Service Chiefs should meet as a committee to develop one set of specifications to apply to the purchase of all four Foam Tenders.
    d. The purchase of alcohol resistant class "B" aqueous film forming foam for each Foam Tender.
    e. Train twelve (12) regional training instructors in flammable liquid fire fighting tactics and procedures for five years.
    f. Conduct an annual tabletop and functional exercise to assist the region in preparation and training for potential emergencies.

4.3 Next Steps & Implementation

As outlined in Section 24 in Chapter 242 of the Acts of 2012, completion of this report will permit the Massachusetts Department of Environmental Protection (MassDEP) to issue a written determination of either approval or denial of the Chapter 91 license for Global's proposed plan to upgrade the track and sidings along its property to accommodate storage and unloading of ethanol trains. MassDEP's written determination on the Chapter 91 license will be based on the information presented by Global in their original application, the public comment received through their public outreach process, and the findings and recommendations of this report which incorporates additional public feedback. Upon issuance of the Chapter 91 written determination, any party that provided comments to MassDEP will be able to request an appeal of that decision within 21 days. If an appeal is received, MassDEP will then work with the two parties to work out a settlement. If a settlement is not possible, the appeal will be brought before a MassDEP administrative law judge who will then issue a recommendation for the Commissioner's approval.

This report has also identified a number of ways that MassDOT can help reduce the impact on public safety of the transportation of ethanol by rail through the study area. The first is the recommendation that the railroad tracks along any possible ethanol transportation routes should be maintained to a Class 3 standard (consistent with the current MBTA standards for passenger service). MassDOT, working with the MBTA, will identify improvements necessary to improve any sections of railroad that may carry ethanol within the study area to meet Class 3 standards. MassDOT will then work to identify the appropriate funding for these improvement projects and develop a timeline for their implementation.

The second way that MassDOT can help reduce the impact on public safety of the transportation of ethanol by rail through the study area is the recommendation that at-grade crossing safety and security equipment on the affected routes should be maintained and/or upgraded to prevent collisions with motor vehicles. MassDOT will identify improvements necessary to improve the at-grade crossing safety and security equipment along the routes that may carry ethanol within the study area. MassDOT will also work to identify the appropriate funding for these improvement projects and develop a timeline for their implementation. One possible source of funding for these improvements is the Section 130 program overseen by the MassDOT Rail & Transit Division.

Addressing the remaining recommendations will require the cooperation of the federal agencies, state agencies, cities, community groups, and businesses that have an interest in the safe transportation of ethanol by rail. The federal preemption of state and local laws on railroad operations means that the Commonwealth and the communities within it do not have the power to require additional security and safety measures of either Global or the railroads. Therefore, it should be the responsibility of the federal agencies that oversee ethanol transportation by rail to provide a forum for the communities' safety and security concerns to be discussed. We hope that this would then lead to actions that will help augment the existing safety and security regulations on the transportation of ethanol by rail that do not force undue hardships on the railroads and other companies that provide ethanol and other fuels that are a vital part of the region's economy.

The state agencies, which include the Massachusetts Emergency Management Agency, the Massachusetts Department of Fire Services, the Massachusetts Department of Environmental Protection, and the Massachusetts Department of Public Health should continue to act as a resource for the cities and towns of the Commonwealth as they prepare for the potential large-volume ethanol incidents that may result from an ethanol train accident. The most important of these efforts is the analysis of the regional capabilities needed to battle an ethanol train fire, including the amount of alcohol resistant foam that would be required. The Department of Fire Services has agreed to coordinate this crucial effort.

The cities will continue to be the primary entities responsible for emergency planning and response. The comprehensive emergency management plans for each city should be updated to reflect the added risks associated with ethanol transportation by rail in the quantities proposed. Through the submission of their Fire Service Recommendations, the city fire departments have shown a great interest in coordination and cooperation. This should continue as they prepare plans to identify critical facilities along the potential ethanol transportation routes and develop detailed emergency response plans as

necessary using consequence modeling of the worst case scenario of a derailment, release and fire involving multiple ethanol railcars.

The businesses involved in the transportation and distribution of ethanol also have a vested interest in safe operations. Both Global and the railroads currently prepare and enforce safety and security plans in compliance with the federal regulations. We recognize that preparing these plans and ensuring compliance with these regulations does add to the cost of their operations. The report has identified several actions that these businesses can take to further ensure safe and secure operations. Many of the recommendations would not carry a significant additional cost beyond the existing plans and procedures they have in place.

Finally, it must be noted that the largest question raised during this study process was how the added costs of preparing for safe transportation of ethanol by rail will be covered when funding is being cut at all levels of government. The only way to address this issue is through a collaborative effort that involves all of the parties involved. Each has its own resources, either manpower or funding, to contribute to the safe transportation of ethanol by rail.