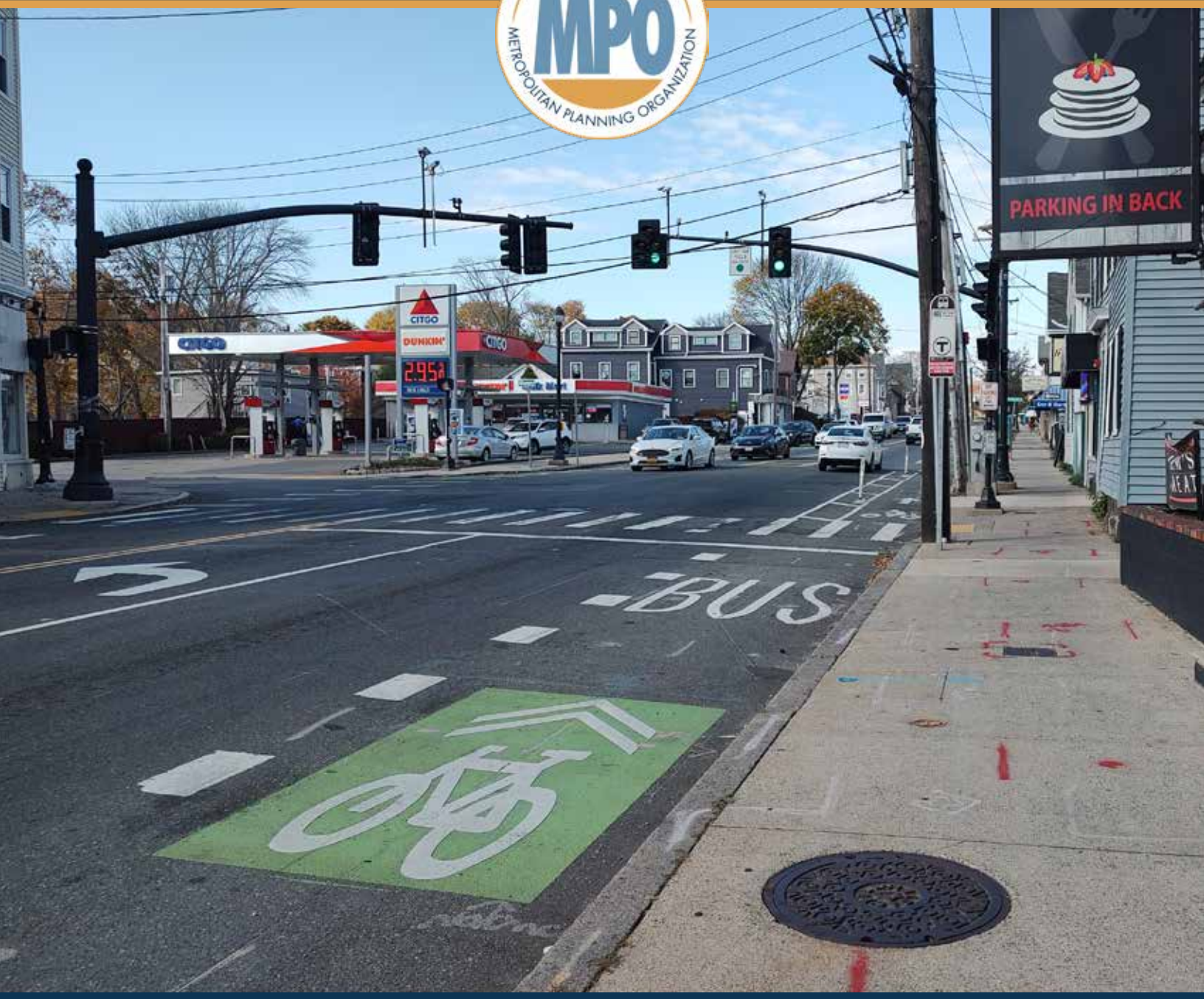
Route 114 Corridor Study
City of Salem



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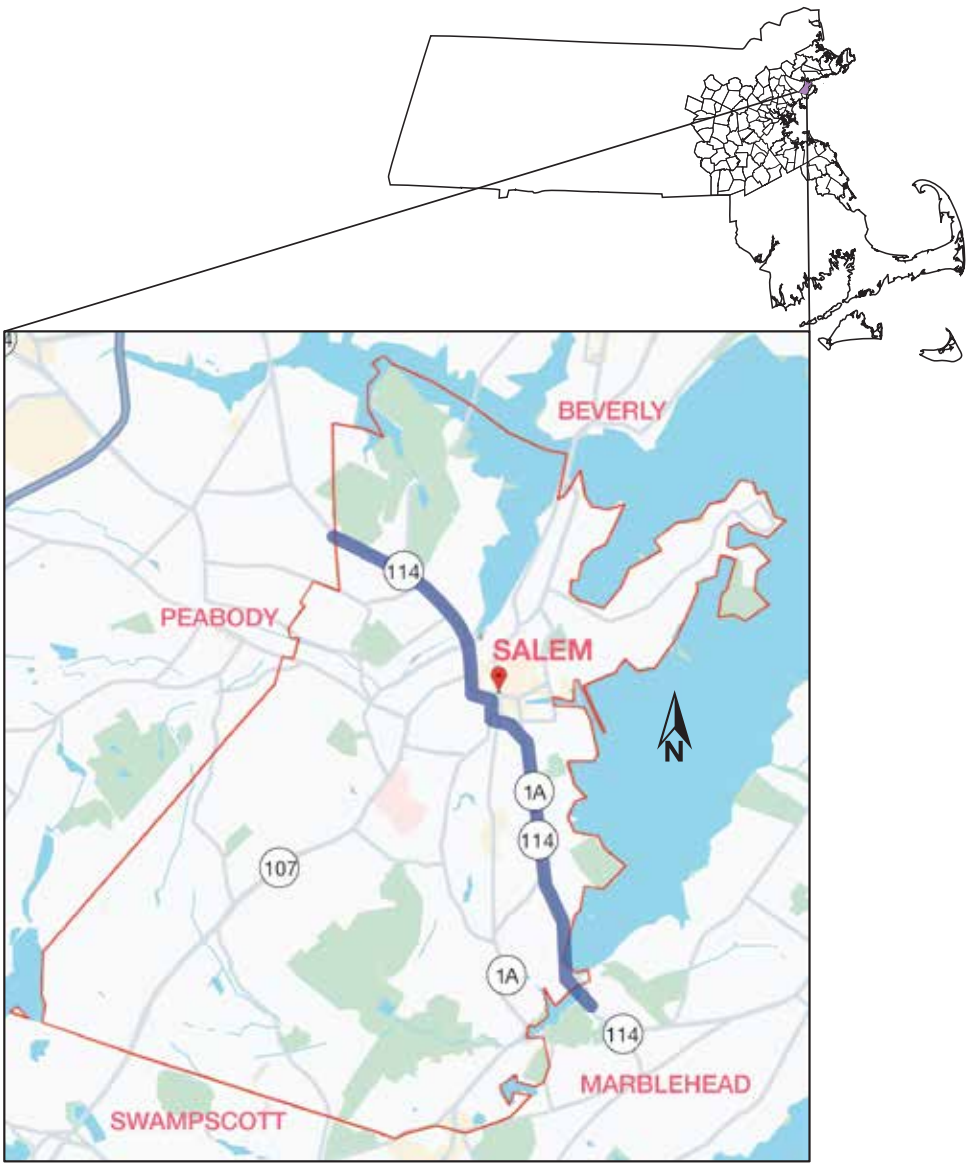

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Abstract

The Boston Region Metropolitan Planning Organization's (MPO) corridor studies are conducted through the Multimodal Mobility Infrastructure Program. The program aims to support a safe, accessible, and multimodal regional transportation system by addressing issues of safety, congestion, and multimodal mobility and accessibility. Staff to the MPO prioritized Route 114 in the City of Salem for study after considering several factors, including the need to address poor safety conditions and the desire to enhance multimodal transportation in that location. This report outlines the existing conditions, assesses safety and operational issues, proposes improvements, and identifies funding programs for implementing projects. The potential improvements, if implemented, would enhance safety, multimodal transportation service, and traffic operations, thereby supporting the residents, local businesses, and schools along the corridor.

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Executive Summary

ES.1 BACKGROUND

This study was conducted through the Boston Region Metropolitan Planning Organization's (MPO) Multimodal Mobility Infrastructure Program (MMIP). The program aims to support a safe, accessible, and multimodal regional transportation system by addressing issues of safety, congestion, and multimodal mobility and accessibility. The program has three focus areas:

- Site-specific studies that are designed for communities to address transportation needs in corridors, intersections, and curbs
- Regional studies that explore ways to shift more people from driving to taking transit, walking, or biking
- Capacity-building studies that develop tools for communities to carry out small-scale studies, such as guides and best practices

The MPO has committed to funding corridor studies over the past decade, demonstrating its long-term dedication to improving safety and multimodal transportation. Many of the recommendations from the corridor studies have been implemented, as they provide municipalities, the Massachusetts Department of Transportation (MassDOT), and stakeholders with the necessary information to address deficiencies in the corridors before committing to the design and engineering of projects.

The MPO staff selected Route 114 in the City of Salem as the subject of a corridor study in the federal fiscal year 2025. When evaluating locations for study, the Route 114 corridor scored highly among several corridors due to the high incidence of crashes involving vehicles and vulnerable road users (such as pedestrians, bicyclists, and people using mobility devices), operational problems such as speeding and congestion, and transportation modes along the corridor that require infrastructure upgrades.

ES.2 COMMUNITY ENGAGEMENT

Stakeholder participation was a crucial part of the study. MPO staff employed several methods to engage stakeholders, to gather local community perceptions regarding safety, operations, and infrastructure conditions, and to explore ideas for improvements. The engagement strategies included participatory mapping and a community survey that received 684 responses, gathering information about transportation concerns and ideas for improvement. Staff also attended several staff meetings at the City of Salem and three advisory committee meetings.

ES.3 EXISTING CONDITIONS AND NEEDS ASSESSMENT

With the assistance of the City of Salem and MassDOT, MPO staff collected and assembled a wide range of data to assess existing conditions, launched a community survey to identify transportation concerns, and considered the results of safety analyses conducted through the MPO's and the City of Salem's Vision Zero programs. This process ensured that the recommendations were well-informed and that all relevant perspectives were considered.

Key concerns focus on safety and the high number of crashes involving vehicles and vulnerable road users that have occurred on the corridor, roadway segments where speeding has been an issue, poor infrastructure conditions, and infrastructure that is not compliant with the Americans with Disabilities Act (ADA). Other concerns include operational issues, such as congestion and queuing, and a lack of protection for users in bike lanes.

ES.4 RECOMMENDED IMPROVEMENTS

MPO staff developed short-, mid-, and long-term improvements to address the needs in the corridor. The short-term improvements are generally low-cost and relatively uncomplicated to implement. They would require minimal design efforts and typically take fewer than three years to complete. The mid-term improvements are medium cost, requiring minimal design efforts, and would take about three to five years to implement. The long-term improvements are generally costly, requiring more design and engineering efforts, and would typically take more than five years to implement.

The short-term improvements include implementing repairs to comply with ADA standards, enhancing intersection and crosswalk visibility, and improving signage and pavement markings. The mid-term improvements include adding retroreflective backplates to enhance the visibility of signals, upgrading signal equipment and features, and improving sidewalks. The long-term improvements include modernizing intersections and roadway segments to enhance safety and multimodal transportation, typically within a Complete Streets framework.

ES.5 CONCLUSION

The recommendations developed in this study provide the City of Salem and stakeholders with an opportunity to review the potential improvements for addressing deficiencies before committing design and engineering funds to improvement projects in the corridor. The City of Salem could package recommendations included in this report into projects and then coordinate with the Boston Region MPO and MassDOT to identify funding sources for the

projects. If implemented, the suggested improvements would enhance traffic safety and operations for all users.

Chapter 1—Introduction

1.1 STUDY ORIGIN

The Boston Region Metropolitan Planning Organization (MPO) has been conducting studies of roadway corridors identified through the Multimodal Mobility Infrastructure Program as needing improvements to address issues of safety, congestion, and multimodal mobility and accessibility The studies aim to build consensus among stakeholders and engage them in planning for a safe, multimodal transportation system.

Study recommendations are sent to implementing agencies, which may fund projects through various federal, state, and local sources, either separately or in combination. Municipalities and the Massachusetts Department of Transportation (MassDOT) have been receptive to these studies, which offer an opportunity to review options for improving a specific corridor before allocating design and engineering funds. The study documentation can help project proponents complete MassDOT's project initiation forms, justify the need for improvements, and facilitate the design and engineering process.

Many MPO-studied corridors have advanced into projects, are currently under construction, or have already been implemented. The map in Figure 1 shows the communities where corridor studies have occurred.

1.2 REPORT ORGANIZATION

This report is organized into four chapters. Chapter 1 provides an overview of the Boston Region MPO's corridor studies, including the selection process for choosing locations to study, goals and objectives, and community engagement efforts. Chapter 2 outlines the characteristics of Route 114 and the context of the study area, describes the data collection and existing condition assessments that informed the study, and discusses the need for improvements to infrastructure and operations. Chapter 3 outlines short-, mid-, and long-term improvements aligned with the corridor's transportation needs, along with their safety and operational advantages. Chapter 4 explains the project development and implementation process, including how to incorporate potential improvements into projects and secure funding to implement them.

1.3 CORRIDOR SELECTION PROCESS

The approach to MPO corridor studies starts with defining a universe of corridors. The MPO staff reach out to municipalities, subregional committees, and other stakeholders to identify corridors of concern. Staff also review the MPO's Long-Range Transportation Planning (LRTP) Needs Assessment and the Congestion

Source: Central Transportation Planning Staff

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Figure 1
Corridor Study Locations

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Management Process, and consult the MassDOT Impact Portal and other tools to pinpoint corridors of interest. Once the universe of corridors is defined, staff screen the study locations using established criteria, such as the Transportation Improvement Program (TIP) scoring process. Corridors are then prioritized based on safety conditions, congestion levels, multimodal importance, regional significance, transportation equity, geographical distribution, and potential for implementation of projects. A corridor is then selected for study, considering feedback from agencies, municipalities, and stakeholders. After selecting a study location, an advisory committee is formed to guide the study, consisting of representatives from the municipality, MassDOT, business chambers of commerce, major employers, and educational institutions.

Following the above selection process, Route 114 in Salem was chosen for study in federal fiscal year 2025. The study location was selected from a list of 43 arterial segments across 33 municipalities in the Boston Region MPO area. The City of Salem, MassDOT, and Salem State University (SSU) supported the study by gathering the necessary data for the analyses and reviewing the study documents.

1.4 GOALS AND OBJECTIVES

The MPO committed to studying Route 114 in Salem to address safety and operational concerns. The high rate of crashes involving vehicles, pedestrians, and bicyclists, operational problems such as speeding, congestion, and poor infrastructure have been impacting users. Therefore, the goals and objectives of the study focused on improving conditions for users by increasing safety and upgrading infrastructure for walking, biking, driving, and transit.

1.5 COMMUNITY ENGAGEMENT

Stakeholder participation is a crucial element of any MPO-sponsored study. An advisory committee comprising staff from the City of Salem, MassDOT, the Massachusetts Bay Transportation Authority (MBTA), the Saltonstall School, and SSU was formed to guide the project. MPO staff convened the advisory committee to launch the study. During the kickoff meeting, staff outlined the purpose and needs, scope of work, tasks, deliverables, and timeline. In subsequent meetings, staff presented the existing conditions and survey results, highlighted corridor needs and potential improvements, and collected feedback. Staff also launched an interactive mapping survey to assess public opinions on transportation issues and gather ideas for solutions. This report incorporates the advisory committee's feedback. Appendix A provides a list of advisory committee members and their review comments.

Chapter 2—Existing Conditions

2.1 STUDY AREA

Salem is a well-established suburban community located 16 miles north of Boston with approximately 45,000 residents and a diverse business sector. Salem's multimodal transportation system offers public transit options connecting to nearby communities and Boston. Commuter rail service is available at the MBTA's Salem Station on the Newburyport/Rockport Line, and there are five local and express bus routes, as well as a seasonal ferry service to Boston. For transportation planning purposes, the City of Salem is a member of the Metropolitan Area Planning Council's North Shore Task Force.

Figure 2 illustrates the study area along with nearby communities and streets. The study corridor is a three-mile segment of Route 114, stretching from the Peabody city line to the Marblehead town line. This two-lane, two-way roadway widens to include turn lanes at signalized intersections and is open to all traffic, including trucks, serving both regional and local travelers. In the northern part, the roadway is called North Street and Summer Street; in the middle, Norman Street and Washington Street; and in the south, Lafayette Street. Figure 3 illustrates these segments.

The character and context of the roadway change along these segments of the corridor, as it accommodates multiple modes of transportation (walking, biking, driving, and transit) and provides access to areas with diverse land uses (residential, educational, recreational, and commercial). It is bordered by dense residential and commercial development. Residents in the area include a significant low-income and minority population, including people with limited English proficiency. The roadway directly connects to SSU, Saltonstall School, Salem Station, and downtown Salem.

This section of Route 114 is primarily a city-owned principal arterial that is part of the National Highway System, thus highway projects on it are eligible for federal and state funding. The Massachusetts Department of Transportation (MassDOT) owns the section with the North Street Bridge overpass and the section of North Street that goes over the North River culvert.

2.2 NORTH STREET SEGMENT

The northern part of the corridor is surrounded by dense residential areas and a mix of commercial and recreational spaces near the downtown area. This segment has the highest traffic volume in the corridor. Approximately 28,000 vehicles travel the corridor daily between Federal and Mason Streets, making

direct connections to Route 107, the MBTA station, downtown, and Peabody. There are continuous sidewalks and bike lanes on both sides of the corridor.

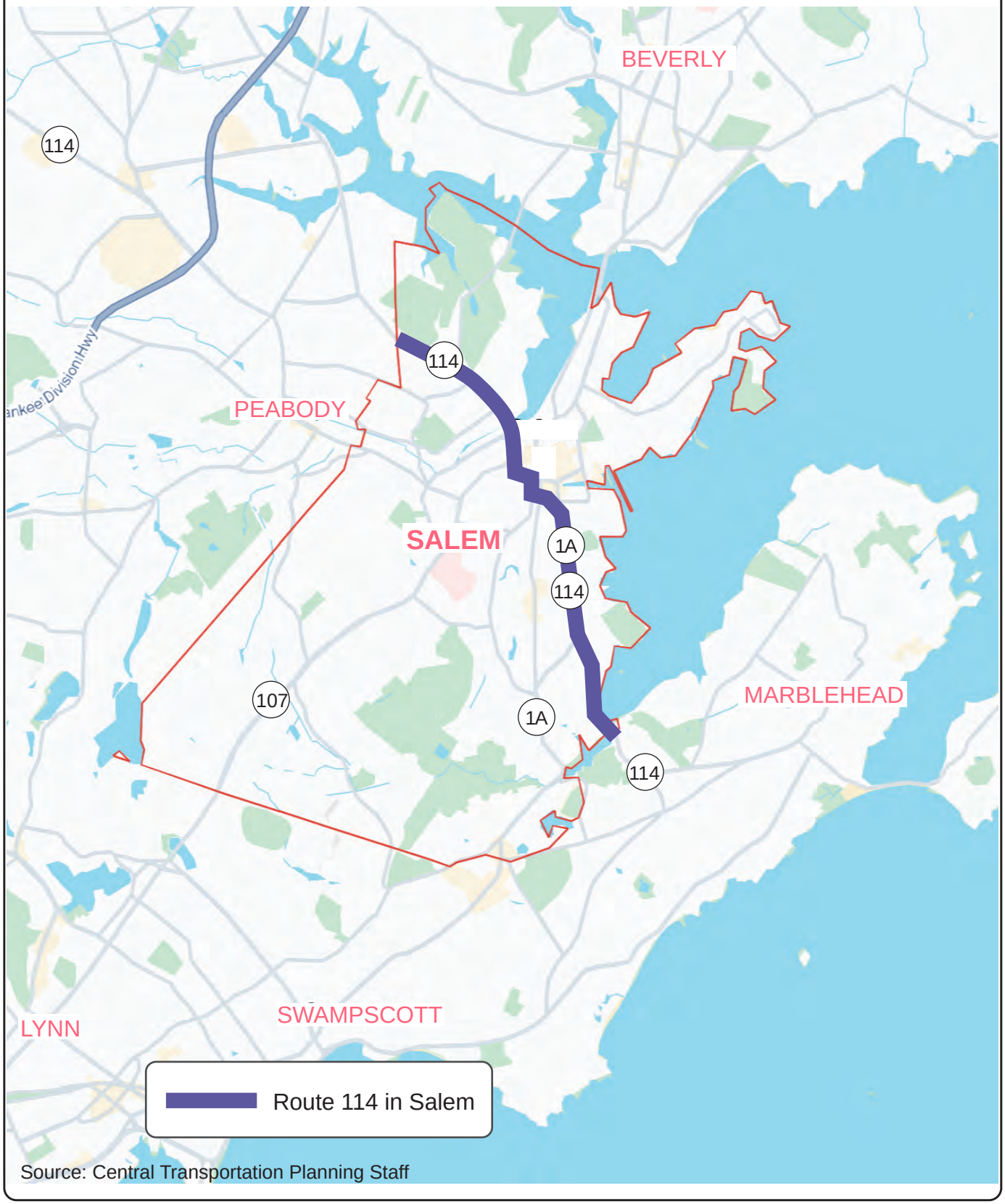

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Figure 2
Study Area

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Figure 3
Route 114 Segments

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This segment has four signalized intersections at School Street, Mason Street, Federal Street, and Essex Street. An emergency traffic signal has been installed at the fire station near Dearborn Street. All crosswalks across North Street are marked, and pedestrian-activated signals control those with traffic signals. Dedicated pedestrian signals are present at the crosswalks near the intersections of Liberty Hill Avenue and Oakland Street, and rectangular rapid flashing beacons (RRFBs) are installed for the crosswalks near the intersections of Dearborn Street and Cressy Avenue.

MBTA bus Route 435 operates along this segment.

2.3 NORMAN AND WASHINGTON STREETS SEGMENT

The middle section of the corridor is surrounded by a mix of residential, commercial, and institutional buildings and developments in the downtown area. Approximately 15,000 vehicles travel daily on Norman Street, while approximately 30,000 vehicles use the busiest part of Washington Street, primarily due to its proximity to the MBTA station and downtown area.

Both sides of the roadway in this segment have continuous sidewalks and bike lanes, along with crosswalks marked and managed by pedestrian-activated signals, RRFBs, or pedestrian signs. There are two signalized intersections—at New Derby Street and Mill Street/Canal Street—and a mini roundabout at Norman and Summer Streets.

MBTA bus Routes 451 and 455 run along a portion of this segment.

2.4 LAFAYETTE STREET SEGMENT

A mix of residential and educational buildings surround the southern part of the corridor. This segment carries approximately 14,000 to 18,000 vehicles daily. Sidewalks and bike lanes are on both sides of the roadway.

This segment has two signalized intersections, located at Dow Street and Loring Avenue, as well as two pedestrian signals, one at Leach Street and another at Ocean Avenue. All crosswalks across Lafayette Street are marked and controlled by pedestrian-activated signals, RRFBs, or pedestrian crossing signs.

MBTA bus Route 455 runs through part of this segment.

2.5 DATA COLLECTION

A comprehensive data collection plan was developed, encompassing the gathering of data from existing databases maintained by the City of Salem,

MassDOT, MBTA, and the MPO for analysis. The data included relevant information about roadway users (people walking, biking, driving, and using transit), infrastructure conditions (sidewalks, crosswalks, traffic signals, streetlights, and parking), and operations (crashes, speeds, delays, and queues).

MassDOT collected data on traffic volumes, vehicle speeds, and the mix of vehicles, pedestrians, and bicyclists using the corridor. Daily traffic volumes were measured continuously at 24 sites over three consecutive days, from Tuesday, March 25 to Friday, March 28, 2025. Intersection turning movement counts (TMCs) were recorded at 16 intersections on Tuesday, March 25, 2025, including counts of pedestrians, bicycles, and trucks. The TMC counts were conducted during the weekday morning peak (6:00 AM to 9:00 AM) and afternoon peak (3:00 PM to 6:00 PM). The traffic and speed data are included in Appendix B.

2.5.1 Walking and Biking Volumes

Figures 4 and 5 display pedestrian and bicycle volumes at selected intersections during peak travel times. Pedestrian volumes at the intersections ranged from 93 to 672, with the highest numbers near downtown on North Street, Washington Street, and Lafayette Street. Bicycle volumes during the same period ranged from 14 to 43, with the highest recorded on Washington Street. These volumes could be higher at other times of the year, as the counts were taken during a period of cold weather in March.

2.5.2 Vehicle Volumes

Figure 6 displays the average daily traffic volumes on segments of Route 114 and on selected side streets. The average daily traffic on the corridor ranged from 14,000 to 28,000 vehicles per day. The highest traffic volumes were recorded on the four-lane stretch of North Street between Federal and Mason Streets. The lowest volumes were recorded on the segment near the town line of Marblehead. Figure 7 shows the turning-movement volumes at the 16 intersections during weekday morning and afternoon peak travel hours. The volumes of pedestrians observed at each intersection during the peak periods are also shown.

2.5.3 Bus and Commuter Rail Ridership

Information from 2023 on transit ridership and operating service performance was obtained from the MBTA. The average number of weekday boardings at all bus stops in Salem for the five MBTA bus routes (Routes 435, 450, 451, 455, and 456) that run along portions of Route 114, is 1,242 riders. For the commuter rail, the average is 2,326 riders.

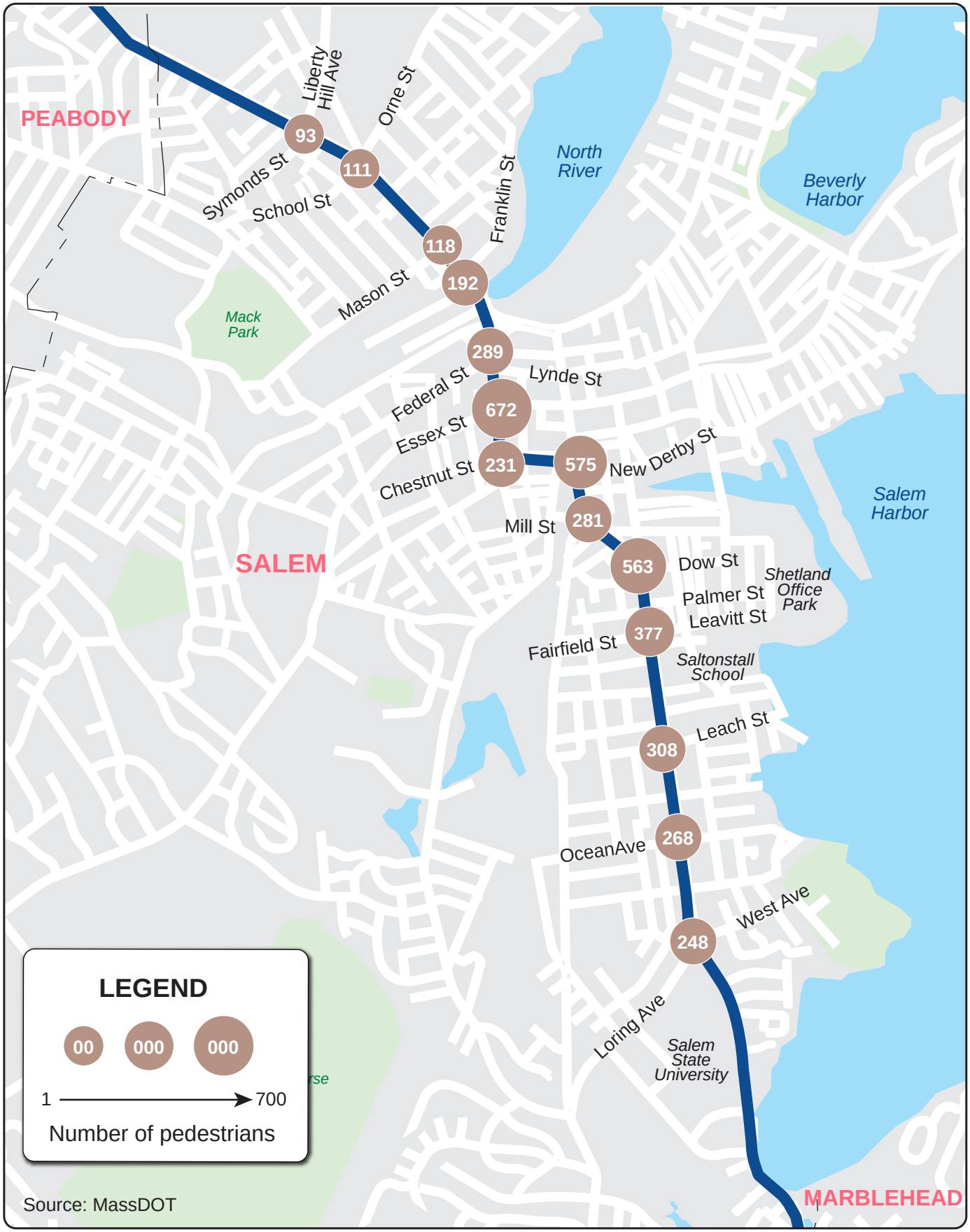

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Figure 4
Peak Period Pedestrian Volumes
(Weekday: 6:00 - 9:00 AM and 3:00 - 6:00 PM)

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Figure 5
Peak Period Bicycle Volumes
(Weekday: 6:00 - 9:00 AM and 3:00 - 6:00 PM)

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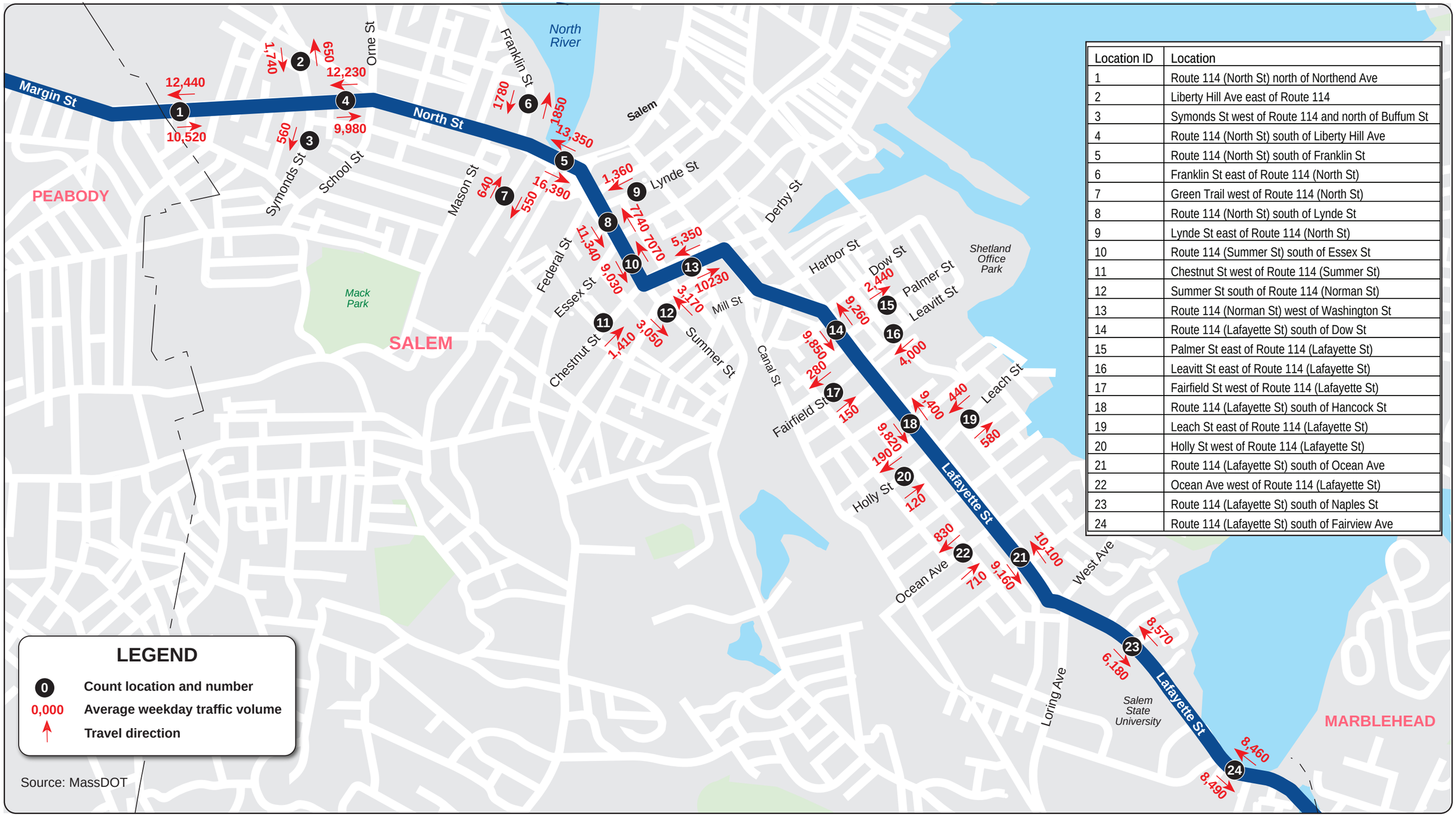

Location ID	Location
1	Route 114 (North St) north of Northend Ave
2	Liberty Hill Ave east of Route 114
3	Symonds St west of Route 114 and north of Buffum St
4	Route 114 (North St) south of Liberty Hill Ave
5	Route 114 (North St) south of Franklin St
6	Franklin St east of Route 114 (North St)
7	Green Trail west of Route 114 (North St)
8	Route 114 (North St) south of Lynde St
9	Lynde St east of Route 114 (North St)
10	Route 114 (Summer St) south of Essex St
11	Chestnut St west of Route 114 (Summer St)
12	Summer St south of Route 114 (Norman St)
13	Route 114 (Norman St) west of Washington St
14	Route 114 (Lafayette St) south of Dow St
15	Palmer St east of Route 114 (Lafayette St)
16	Leavitt St east of Route 114 (Lafayette St)
17	Fairfield St west of Route 114 (Lafayette St)
18	Route 114 (Lafayette St) south of Hancock St
19	Leach St east of Route 114 (Lafayette St)
20	Holly St west of Route 114 (Lafayette St)
21	Route 114 (Lafayette St) south of Ocean Ave
22	Ocean Ave west of Route 114 (Lafayette St)
23	Route 114 (Lafayette St) south of Naples St
24	Route 114 (Lafayette St) south of Fairview Ave

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Figure 6
Average Weekday Traffic Volumes

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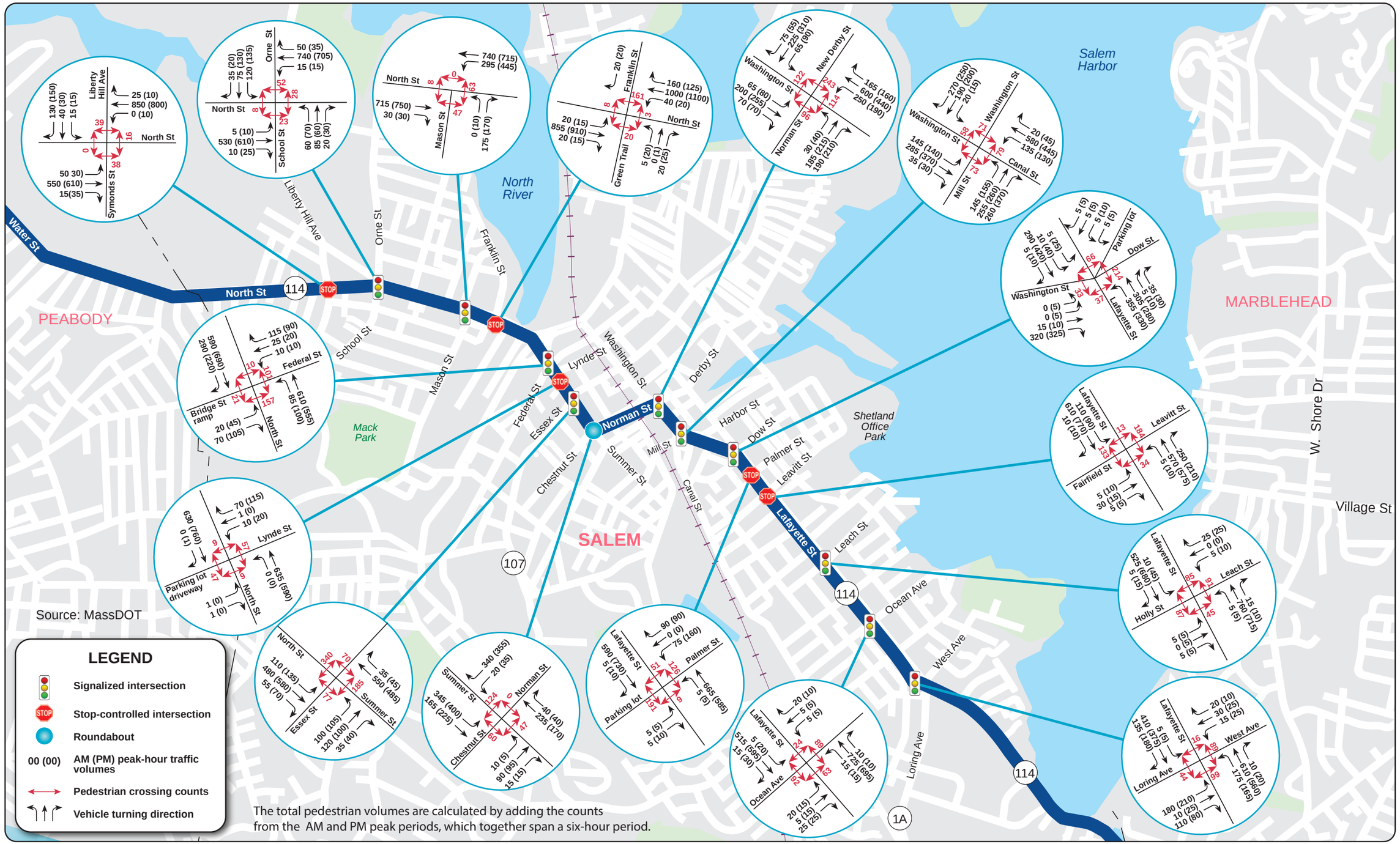

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Figure 7
Peak-Hour Turning Movement Volumes

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2.6 INFRASTRUCTURE CONDITIONS

2.6.1 Crosswalks

Pedestrians can safely cross Route 114 at several locations in the study area. Figure 8 displays the locations and types of crosswalks along the roadway. There are 30 marked crosswalks across Route 114, averaging one every 550 feet. Most of these locations are accessible and meet ADA standards, though some on Lafayette Street do not comply.

The following signals and signage exist at the crossing locations:

- Twelve crosswalks have traffic or pedestrian signal controls.
- Five feature RRFB controls.
- Eight are equipped with pedestrian crossing signs.
- Five have crosswalk markings but no pedestrian crossing signs.

2.6.2 Sidewalks

Figure 9 shows the locations and conditions of the sidewalks. More than 95 percent of the roadway has sidewalks on both sides, and most are in good or fair condition. They require repairs to meet the ADA standards.

The sections in poor condition are on Lafayette Street near the Marblehead town line. The poor sidewalk conditions create challenges for people walking and those using mobility devices.

2.6.3 Bike Lanes

The corridor features bike lanes that are approximately five feet wide for approximately 90 percent of its length. Figure 10 shows the types of bike lanes in the corridor: parking-protected, buffered, unbuffered (unprotected), and shared-use. Approximately 60 percent of the bike lanes lack buffer protection, and there are several short segments where people biking share the roadway with vehicles. These conditions create high stress and safety concerns for people biking due to the high speeds and volumes of vehicles.

2.6.4 Bus Shelters and Benches

Figure 11 displays the bus routes in Salem, along with the locations of the stops on Route 114. Analysis of 2023 ridership data showed that three bus stops on Route 114 are suitable for installing a shelter and a bench:

- Bus stop 4453, North Street opposite Lynde Street, has 87 boardings.
- Bus stop 6104, Lafayette at Harbor Street, has 66 boardings.
- Bus stop 6106, Lafayette at Cedar Street, has 59 boardings.

Two of the eligible stops already have shelters, and one has only a bench because it did not pass the site suitability test.

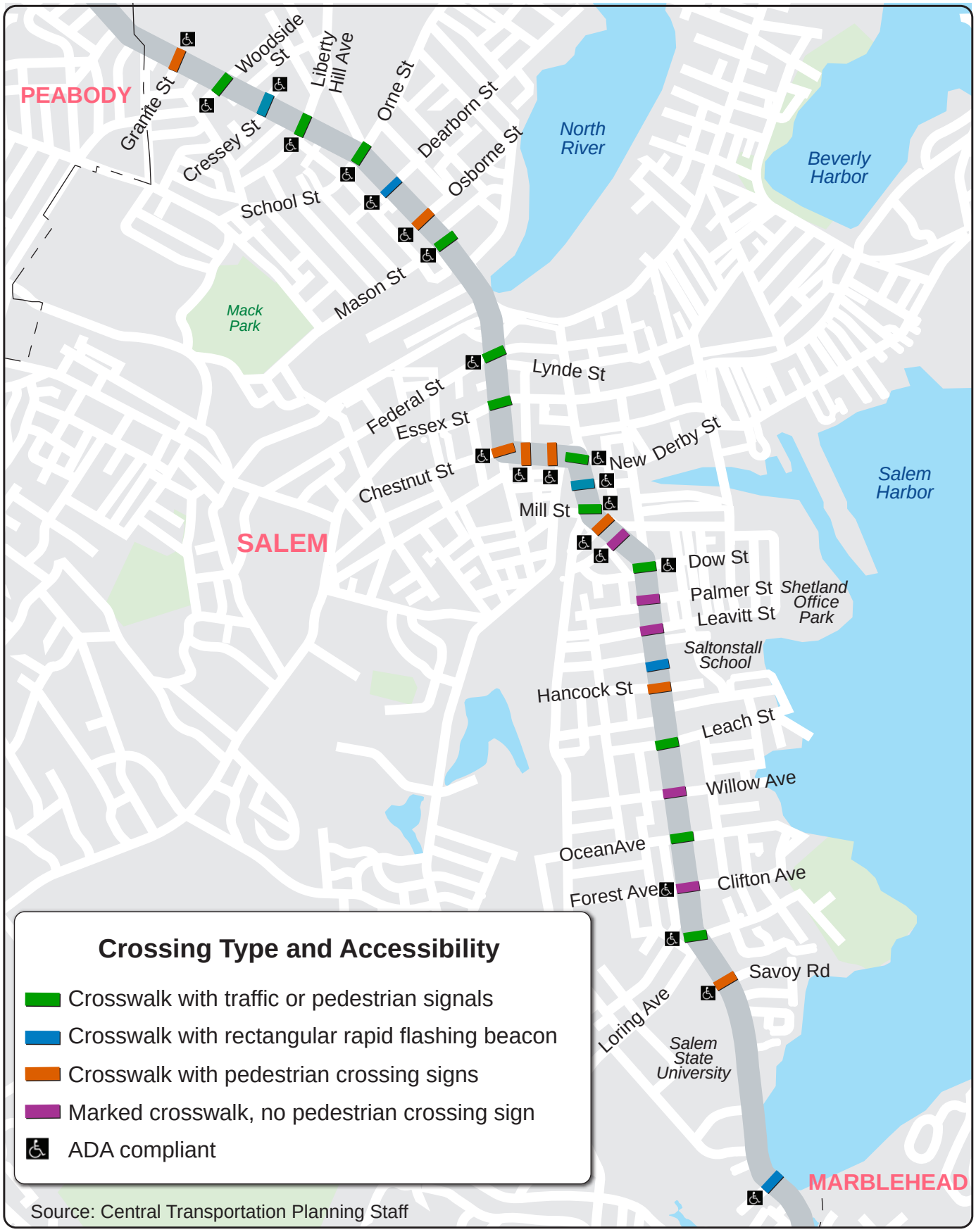

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Figure 8
Route 114 Crossing Locations and Types

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Figure 9
Sidewalk Condition

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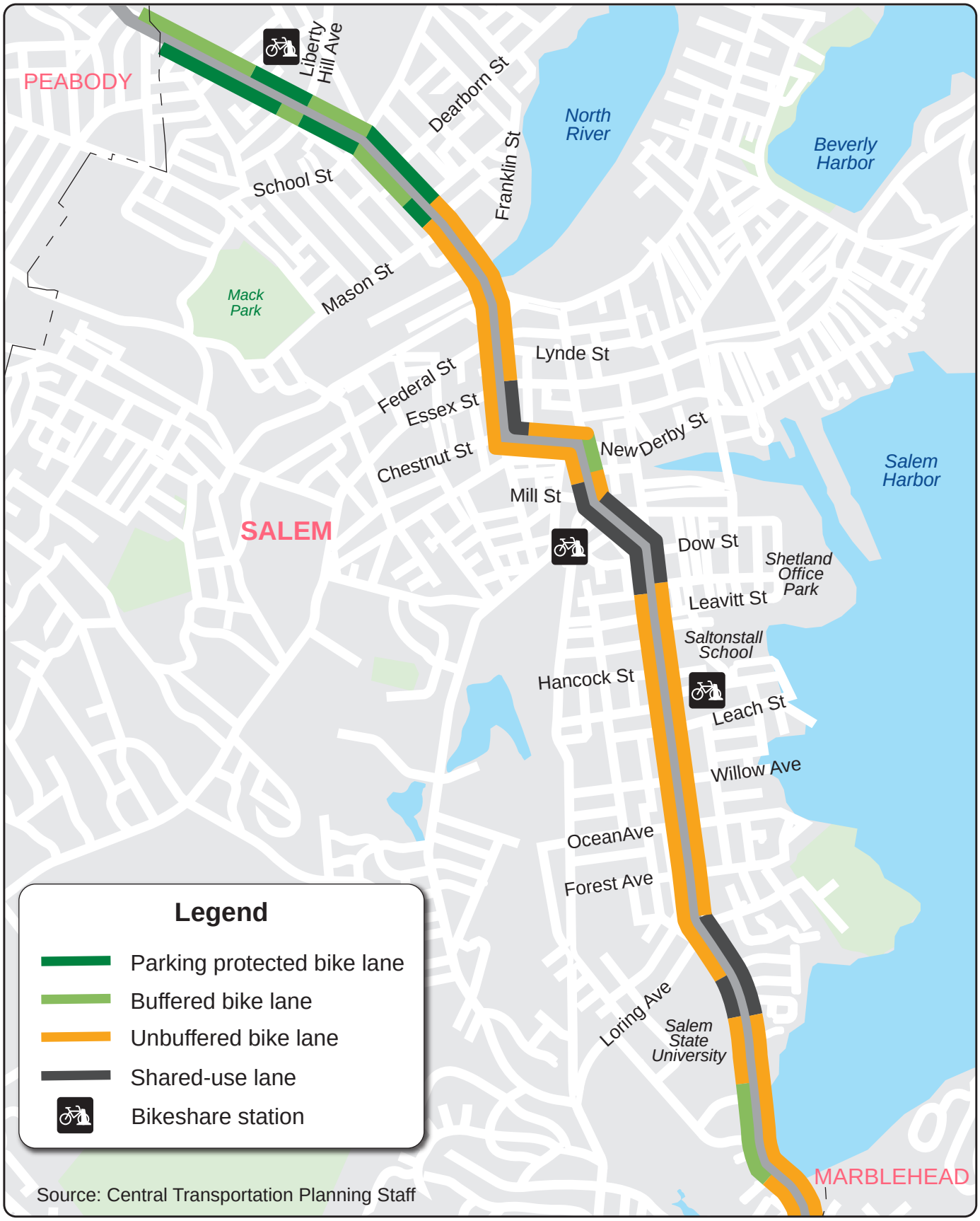

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Figure 10
Route 114 Bike Infrastructure

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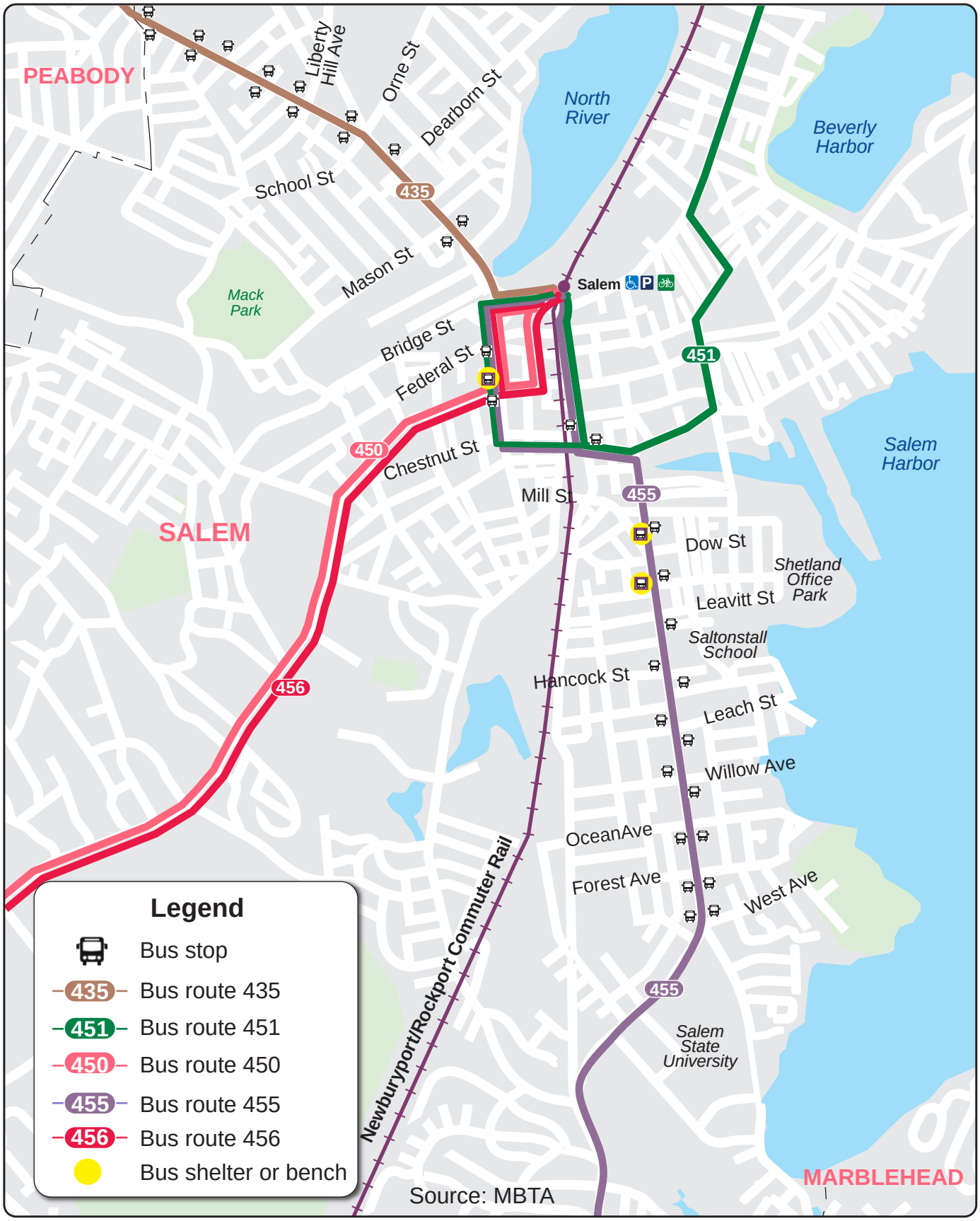

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Figure 11
MBTA Transit Map, Salem

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2.6.5 Traffic Signals

Most of the traffic signals on Route 114 are in good condition. However, several require upgrades, such as backplates, yellow retroreflective borders, larger lenses (12 inches), and accessible features to enhance safety and visibility. Traffic signal equipment at these intersections is outdated and needs to be upgraded:

- North Street at Federal Street
- North Street at Essex Street
- Lafayette Street at Leach Street
- Lafayette Street at Ocean Avenue

A comprehensive assessment of the traffic signals on Route 114 is necessary to determine if they can adapt and respond dynamically to changing conditions and be interconnected to coordinate multiple signals.

2.6.6 Streetlights

There are two types of streetlights in the corridor: those mounted on utility poles and standalone lights. Examples are shown in Figure 12. The streetlights are in good condition, spaced approximately 90 to 120 feet apart, and mounted at heights from 20 to 30 feet. However, nearly 30 percent of the crashes in the corridor happen in dark conditions, during nighttime, dusk, or dawn.

Mounted on Utility Pole

Standalone

Source: Google

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Figure 12
Streetlights

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2.7 OPERATIONAL CONDITIONS

2.7.1 Historical Crash Summaries

Crash data from January 2019 through September 2024 was analyzed for trends. The analysis, which is summarized in Table 1, shows the following:

- Crashes resulting in injuries accounted for nearly 23 percent of the crashes.
- Crashes at intersections accounted for approximately 66 percent of the crashes.
- Rear-end (36 percent) and angle (34 percent) crashes were the most common types, together representing 70 percent of the crashes.
- Crashes that occurred during nighttime, dusk, and dawn accounted for nearly 30 percent of the crashes. These crashes occurred in places where the roadway had lighting and places that were unlit.
- Pedestrians and bicyclists were involved in 7.5 percent of crashes.

Table 1
Corridor Crash Summaries (2019–24)

Crash Variable	Number of Crashes	Percent
Total number of crashes	933	100
Severity	--	--
Property damage only	675	72
Nonfatal injury	217	23
Fatality	0	0
Not reported/unknown	41	5
Crash Type	--	--
Single vehicle	57	6
Rear-end	338	36
Angle	320	34
Head-on	84	9
Sideswipe, same direction	105	11
Sideswipe, opposite direction	18	2
Not reported/unknown	11	2
Ambient Light Conditions	--	--
Daylight	662	71
Dark—lighted roadway	228	24
Dark—roadway not lighted	8	1
Dark—unknown	2	0
Dawn	7	1
Dusk	25	3
Unknown/other	1	0
Involved pedestrian(s)	46	5
Involved bicyclist(s)	23	2.5
Wet or icy pavement conditions	148	16
Dark conditions (lighted or not lighted)	236	29

Source: Central Transportation Planning Staff.

2.7.2 High-Injury Network (HIN)

The Route 114 safety assessment references Salem and MPO Vision Zero initiatives. Route 114 is part of Salem's high-injury network (HIN), making it a key corridor for safety improvements. The HIN highlights corridors with fatal and serious injury crashes, as shown in Figure 13.

2.7.3 Intersection Crash Risk

Figure 14 shows the key intersections along the corridor where crashes and the risk of crashes is highest. These locations were identified by using both a crash-based and risk-based analysis. The reactive crash-based method focuses on historical crash severity-weighted frequency as a leading safety indicator. In contrast, the proactive risk-based method considers roadway and community features as primary factors that contribute to increased risk of injury. Both methods are essential for developing effective and proactive safety strategies.

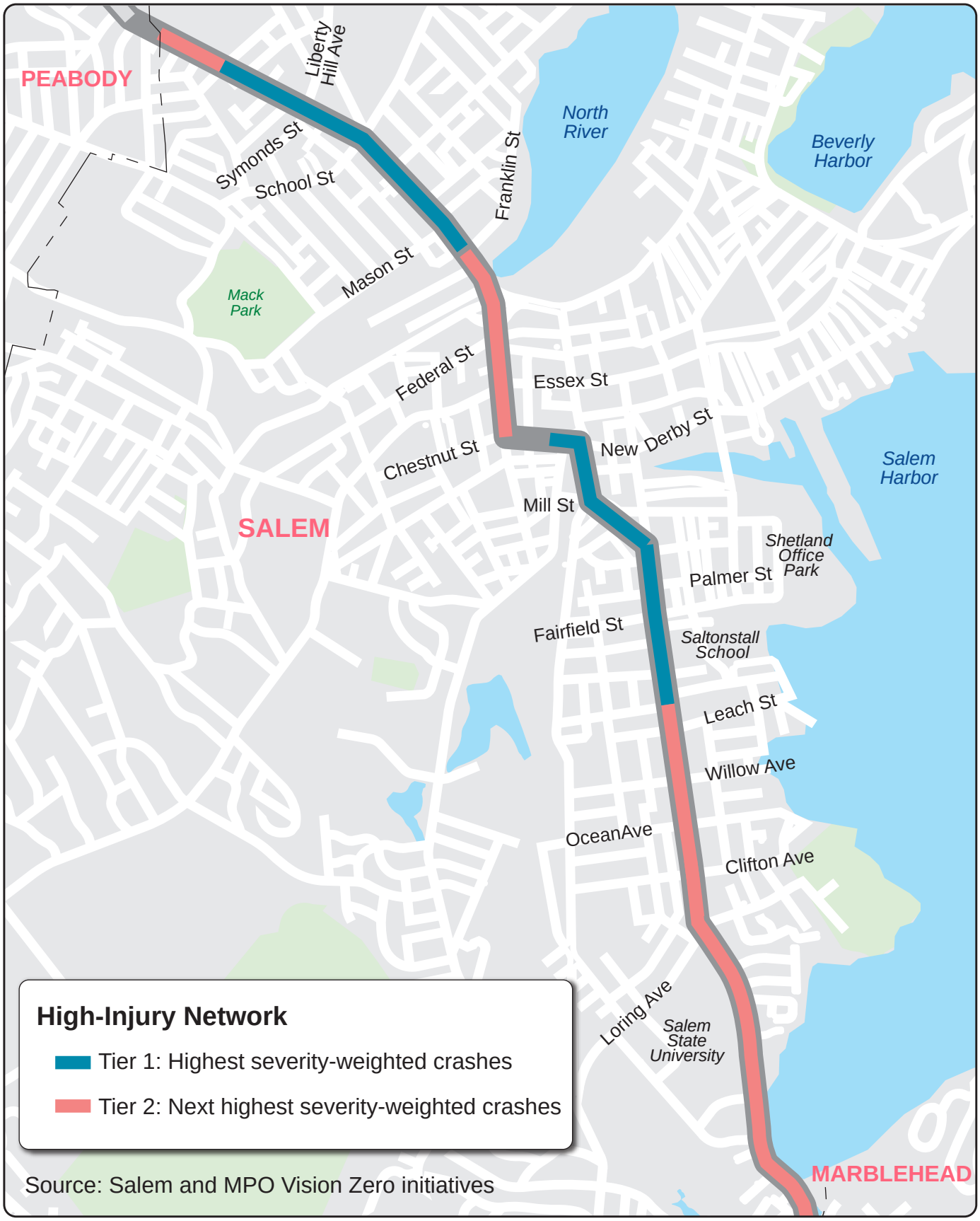

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Figure 13
High-Injury Network

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Figure 14
Intersection Crash Risk

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2.7.4 Vulnerable Road User (VRU) Crash Risk

Figure 15 shows the locations along the corridor where crashes and the risk of crashes is highest for vulnerable road users (such as pedestrians, bicyclists, and people using mobility devices). These locations also were identified by using both a crash-based and risk-based analysis. Shown are sites where actual crashes occurred involving pedestrians and bicyclists, and areas of high risk for these users.

2.7.5 Collision Diagrams

MPO staff prepared collision diagrams for most of the roadway segments, including major intersections, using crash data from 2019 to 2024. These diagrams enable the identification of patterns and factors contributing to crashes, as well as the identification of effective safety strategies. The diagrams and reference tables presenting the characteristics of the crashes are included in Appendix C.

The following findings are consistent with the summaries in collision diagrams:

- There is a high frequency of angle crashes within the intersections and rear-end crashes on the approaches to the intersections. The likely causes are distracted and impaired driving, speeding, inadequate signal timing, and vehicles following too closely.
- There is a high frequency of nighttime crashes. Possible causes are poor visibility or lighting.
- Crashes involving vulnerable road users are likely caused by restricted sight distance at the intersections due to parking, inadequate signal phasing, and inadequate protections for these users.

2.7.6 Speed Studies

MassDOT conducted speed studies at four locations along Route 114, and the findings are summarized in Figure 16. The sections of Route 114 with speeding issues are North Street, west of Federal Street, and Lafayette Street, south of Loring Avenue. In these areas, the 85th percentile speeds are 7 to 10 miles per hour (mph) above the speed limit. The speed data are included in Appendix B.

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Figure 15
Vulnerable Road User Crash Risk

Route 114 Corridor Study
City of Salem

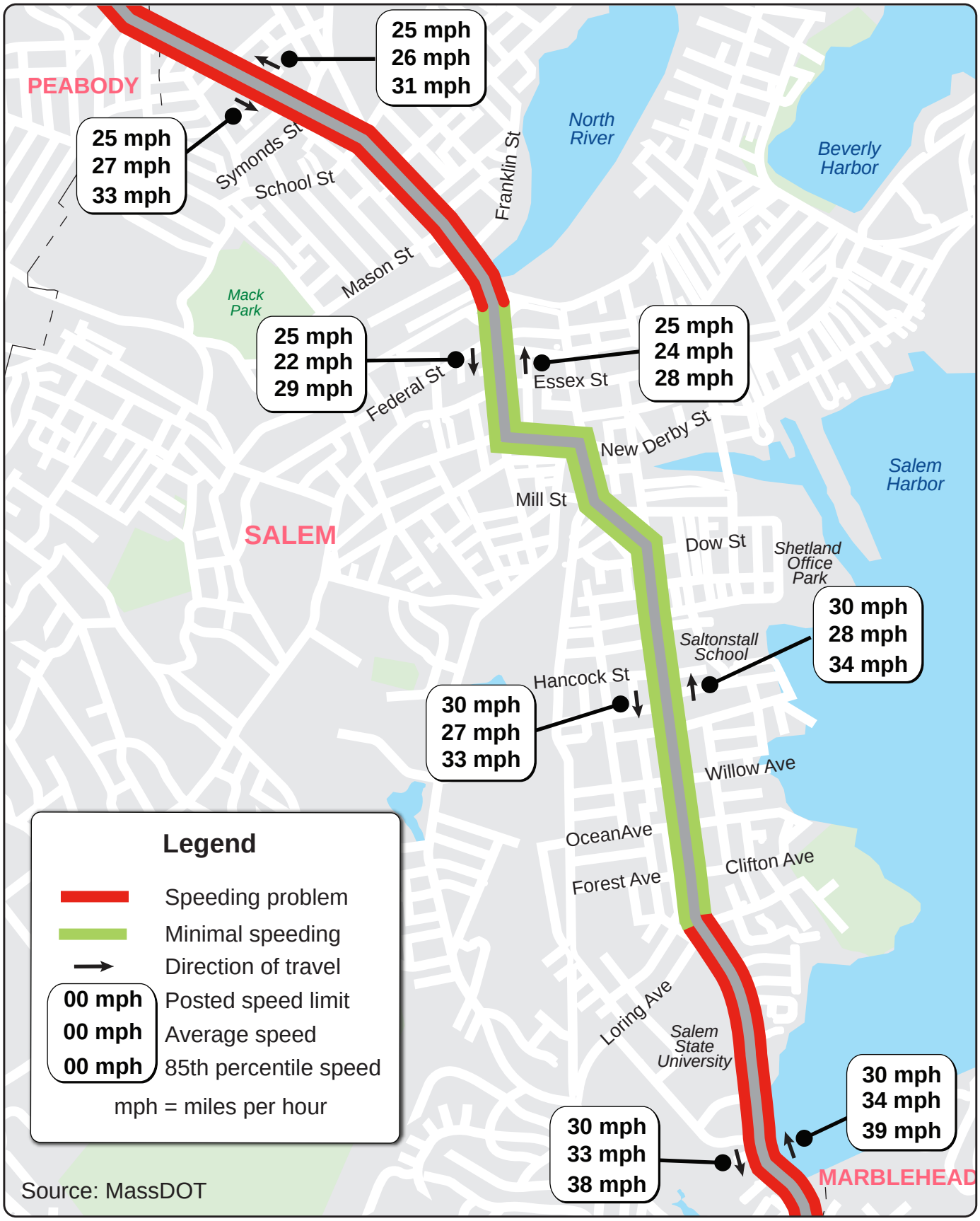

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Figure 16
Speeding on Route 114

Route 114 Corridor Study
City of Salem

2.7.7 Congestion, Delays, and Queues

MPO staff conducted traffic-operations analyses using Synchro 12 to assess traffic conditions at signalized and unsignalized intersections.[1] Table 2 presents the delays and levels of service (LOS) for signalized and unsignalized intersections. LOS A represents the best operating conditions (little to no delay). In contrast, LOS F represents the worst operating conditions (long delay). LOS E represents operating conditions at capacity (the limit of acceptable delay). The intersection LOS analyses are included in Appendix D.

Table 2
Intersection Level of Service Criteria

Level of Service	Signalized Intersection Control Delay (seconds per vehicle)	Unsignalized Intersection Control Delay (seconds per vehicle)
A	<10	<10
B	10–20	10–15
C	20–35	15–25
D	35–55	25–35
E	55–80	35–50
F	>80	>50

Source: Transportation Research Board, Highway Capacity Manual, Seventh Edition, 2022.

Figures 17 and 18 show the LOS and delays at the signalized and unsignalized intersections during weekday morning and afternoon peak hours. Eight signalized intersections were found to operate under congested conditions with LOS E or F, resulting in queuing at multiple locations during peak travel hours. Several unsignalized intersections also were found to experience significant delays on side streets during peak travel periods. Traffic on the side streets at these intersections also were operating at LOS E or F, with queuing on their approaches.

2.8 TRANSIT SERVICE

Figure 11 shows the MBTA service in or near the study area, including commuter rail and five bus routes. Commuter rail service to Boston runs every 30 minutes on weekdays and every 60 minutes on weekends. All five bus routes serving Salem start at the commuter rail station. The MBTA's Bus Network Redesign plan, approved in 2022 for implementation over five years, proposes the following changes:

[1] CUBIC Transportation Systems, 9233 Balboa Avenue, San Diego, CA 92123.

- Operate bus Route 450 via Bridge Street to Washington to Essex Street instead of via North Street.
- Operate bus Route 451 along Route 107, which would remove bus Route 451 from Route 114.
- Operate bus Route 455 in both directions along Washington Street, which would remove bus Route 455 from Summer Street and Norman Street. The remaining part of the route to Loring Avenue would stay the same.
- Eliminate bus Route 456, which duplicates bus Route 450.

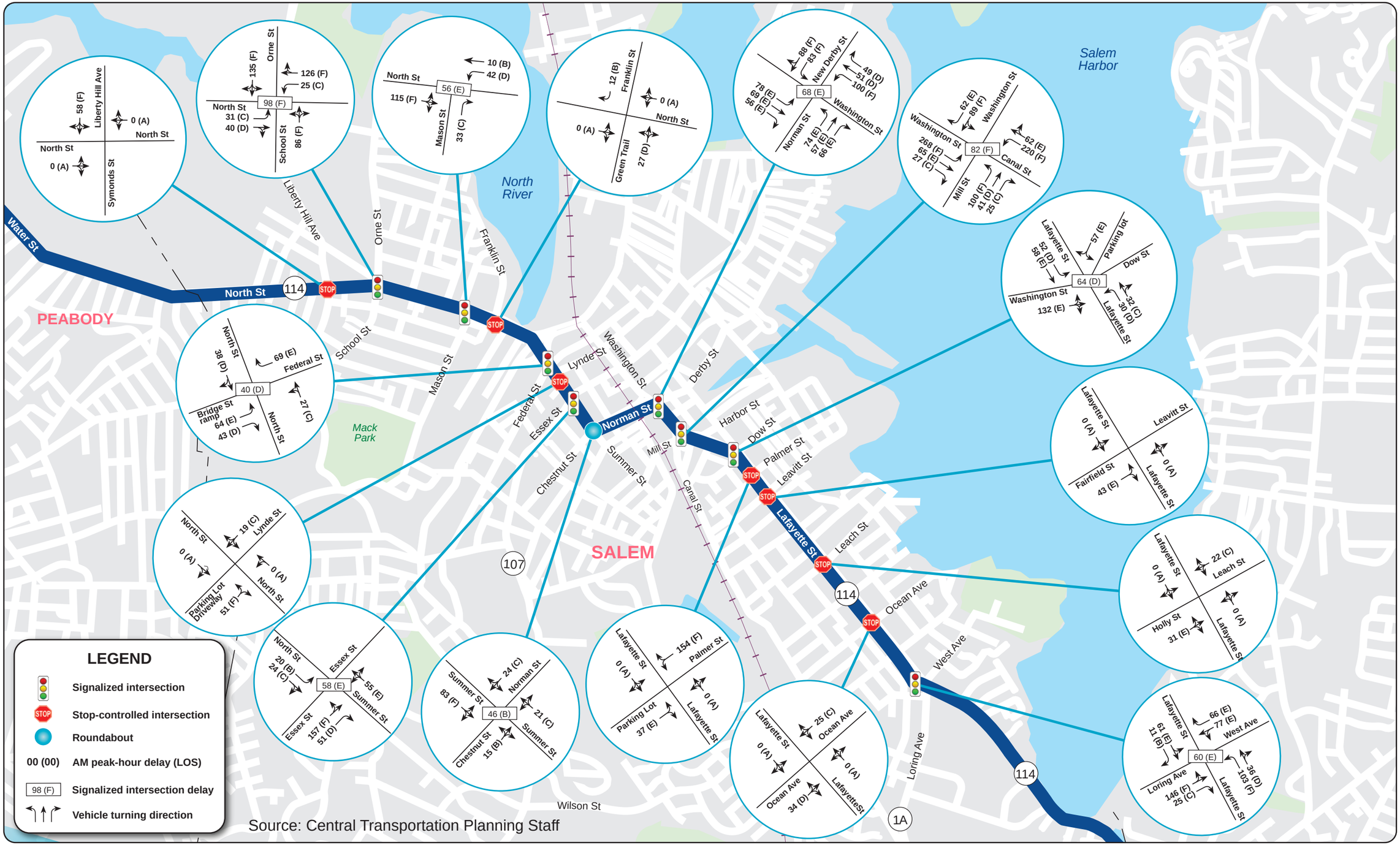

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Figure 17
2025 Weekday AM Peak Hour Delays and Level of Service

Route 114 Corridor Study
City of Salem

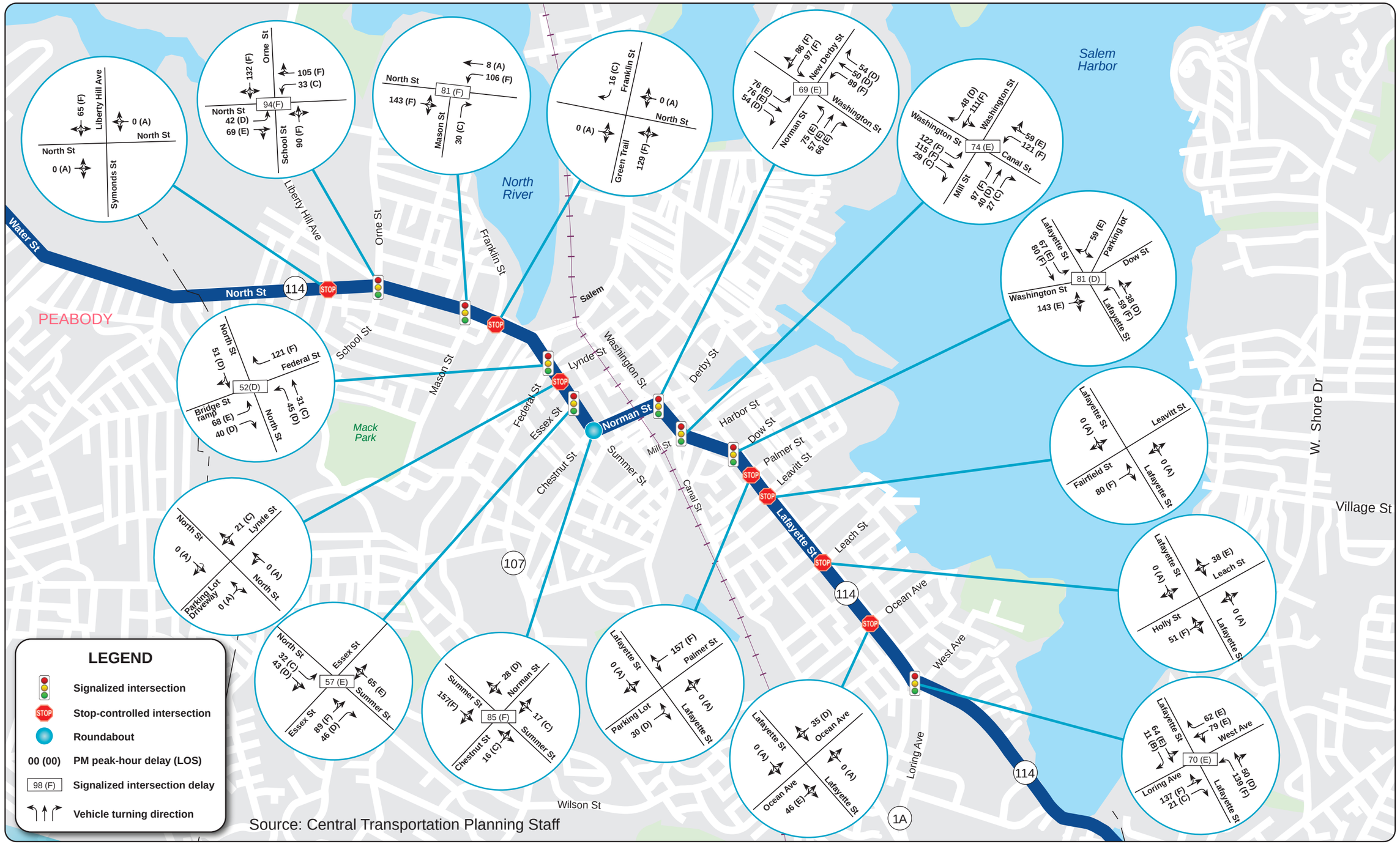

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Figure 18
2025 Weekday PM Peak Hour Delays and Level of Service

Route 114 Corridor Study
City of Salem

2.9 TRAFFIC SIGNAL WARRANTS ANALYSIS

Justifying the need for a traffic control signal at an unsignalized intersection involves analyzing factors related to current traffic flow and safety conditions, as well as the potential for improvement. The Manual on Uniform Traffic Control Devices (MUTCD) lists nine traffic signal warrants that support installing a signal. Table 3 displays these nine warrants and the analysis results for intersections with significant side street delays. Installing signals may be justified at some of these locations, and this should be investigated further. Detailed traffic signal warrant analysis worksheets are included in Appendix D.

Table 3
Results of the Traffic Signal Warrant Analysis

Warrant	Liberty Hill Avenue	Franklin Street	Lynde Street	Norman Street Circle	Palmer Street
Warrant 1, Eight-Hour Vehicular Volume	Satisfied	Satisfied	Satisfied	Satisfied	Satisfied
Warrant 2, Four-Hour Vehicular Volume	Satisfied	Satisfied	Satisfied	Satisfied	Satisfied
Warrant 3, Peak Hour	Satisfied	Satisfied	Satisfied	Satisfied	Satisfied
Warrant 4, Pedestrian Volume	Not satisfied	Not satisfied	Not satisfied	Not satisfied	Not satisfied
Warrant 5, School Crossing	Not satisfied	Not satisfied	Not satisfied	Not satisfied	Not satisfied
Warrant 6, Coordinated Signal System	Satisfied	Not satisfied	Not satisfied	Not satisfied	Not satisfied
Warrant 7, Crash Experience	Not satisfied	Not satisfied	Not satisfied	Not satisfied	Not satisfied
Warrant 8, Roadway Network	Satisfied	Satisfied	Satisfied	Satisfied	Satisfied
Warrant 9, Intersection Near a Grade Crossing	Not satisfied	Not satisfied	Not satisfied	Not satisfied	Not satisfied

Source: Central Transportation Planning Staff.

2.10 COMMUNITY SURVEY

Staff created an interactive mapping survey to gather the community's opinions on transportation issues related to walking, biking, transit, driving, parking, and other concerns along the corridor, as well as potential solutions. The survey questionnaire, responses, and specific comments are included in Appendix E. Respondents had the option to participate in the survey in English, Spanish, Portuguese, and Haitian Kreyol. The survey was shared with the City of Salem for promotion on city websites and social media platforms and for distribution to residents and stakeholders. The survey was launched in mid-June and closed on July 30, 2025, after gathering 684 responses.

The following information was gleaned from the survey:

- Most respondents (more than 90 percent) travel daily or several times a week in the corridor, providing them with familiar experiences regarding transportation issues along the corridor.
- Most respondents (72 percent) expressed concerns about driving, while nearly 28 percent commented on walking, biking, or transit, indicating thoughtful consideration of feedback from the underrepresented vulnerable road users.
- Nearly 75 percent of respondents were residents of Salem, while 25 percent either travel through, work in, or commute to Salem, demonstrating a strong local presence.
- Drivers mainly reported concerns about traffic congestion, long waits at intersections, or difficulty turning into or out of side streets.
- Those walking, biking, taking transit, or using assistive mobility devices were primarily concerned about inattentive or aggressive drivers, high vehicle speeds, or the lack of bike lanes or surfaces meeting ADA standards.

2.11 NEEDS ASSESSMENT

The corridor, in its current state, has deficiencies that impact user safety, mobility, quality of life, and access to businesses and other sites for residents. The challenges, which relate to the corridor's role in providing safe and efficient multimodal transportation, emphasize the urgent need to improve safety and operations, promote multimodal transportation, and upgrade the infrastructure, including the following:

- Safety enhancements at intersections to improve visibility for vulnerable road users
- Safety improvements along the corridor to slow down vehicle speeds
- Safety upgrades to bike lanes to protect bicyclists
- Infrastructure improvements to enhance pedestrian safety, such as high-quality sidewalks and safe crossing points
- Infrastructure maintenance, including resurfacing roads
- Infrastructure upgrades to boost operations and efficiency, such as advanced traffic signal equipment and technology
- Intersection redesigns to improve safety and operations for users
- Traffic signal modernization to retime and optimize traffic signal systems to reduce congestion, pedestrian wait times, and red light running

Chapter 3—Proposed Improvements

3.1 PROJECTS AND STUDIES

Recently completed, ongoing, and planned projects for the corridor include the following:

- City of Salem, Pedestrian and Bicycle Improvements, North Street Protected Bike Lanes (completed)
- MassDOT Project #605332 Bridge Replacement, North Street over North River (in design)
- MassDOT Project #612990 Reconstruction of Bridge Street (Route 107), from Flint Street to Commuter Rail Station Entrance/Exit (in design)
- City of Salem, Pedestrian and Bicycle Improvements, Lafayette Street Protected Bike Lanes (in design)
- City of Salem, Shared Streets grant awarded to the City on Lafayette Street from Loring Avenue to Harborview Terrace.

3.2 POTENTIAL IMPROVEMENTS

The corridor was divided into three segments based on context: North Street, Norman and Washington Streets, and Lafayette Street. For each segment, staff developed recommendations for improvements for both the segment and specific intersections along it. The improvements were categorized by time frame and cost. The time frames are defined as follows: short-term improvements are typically expected to be completed within three years, mid-term improvements within three to five years, and long-term improvements in more than five years. In terms of cost, low-cost improvements are those under $10,000, medium-cost improvements are between $10,000 and $50,000, and high-cost improvements exceed $50,000.

Most short-term improvements usually do not require design and engineering efforts. These improvements include installing new signs, upgrading old signs, marking pavement, painting high-visibility crosswalks, and upgrading curb ramps to ADA standards. Some mid-term improvements may require some design and engineering efforts. These improvements include protecting existing bike lanes, installing rectangular rapid flashing beacons (RRFBs) and pedestrian signals, and repairing substandard sidewalks. The long-term improvements require significant design and engineering efforts, as well as larger funding sources. They include safety, multimodal, and operational improvements, such as intersection and roadway reconstruction in a Complete Streets framework.

Tables 4 through 6 present the proposed improvements, including the time and cost categories and jurisdictional responsibilities. Figures 19 through 21 illustrate

graphically some of the improvements in the segment. Figure 22 gives examples of successful strategies to enhance safety for vulnerable road users.

Table 4
Potential Improvements on North Street

Issue/ Concern	Safety Category	Suggested Improvement	Time Frame	Cost	Responsibility
1—North Street Segment					
The segment is part of a high-injury network, and several intersections along the segment are primary angle crash sites.	Traffic Signal Operations and Visibility	Consider enhancing safety through traffic calming, signal optimization, lighting, and intersection improvements, such as making the recent traffic-calming and speed management improvements on North Street permanent.	Long	High	City of Salem
Drivers fail to yield to pedestrians crossing streets.	Pedestrian and Bicycle Accommodation	Evaluate and implement leading pedestrian intervals for the signalized intersections with concurrent pedestrian and vehicle phases.	Short	Medium	City of Salem
Drivers fail to yield to pedestrians crossing streets.	Pedestrian and Bicycle Accommodation	Consider installing rectangular rapid flashing beacons at the uncontrolled marked crosswalks on North Street.	Short	Medium	City of Salem
Pedestrians have to wait too long for the Walk signal.	Pedestrian and Bicycle Accommodation	Optimize signal timings, including pedestrian timing and clearance intervals, to minimize pedestrian delay and prevent illegal crossings.	Short	Low	City of Salem
Crashes are more likely to occur in dark conditions.	Intersection Visibility	Evaluate and improve street and pedestrian-scale lighting to reduce crashes in dark and low-light conditions.	Short	Low	City of Salem
Crashes are more likely to occur in dark conditions.	Traffic Signal Operations and Visibility	Consider installing backplates with retroreflective borders on all signal heads to improve signal visibility.	Short	Medium	City of Salem
Drivers tend to speed on North Street.	Roadway Features	Install speed limit signs and speed feedback signs at regular intervals to inform drivers of speed limits.	Short	Low	City of Salem
Drivers tend to speed on North Street.	Roadway Features	Consider making the recent traffic-calming and speed management improvements on North Street permanent.	Long	High	City of Salem
Drivers run red lights, risking pedestrian safety.	Traffic Signal Operations and Visibility	Assess clearance intervals and update them to current standards as needed to enhance safety and operational efficiency.	Short	Low	City of Salem
Drivers encounter congestion, delays, and long queues in the segment.	Traffic Signal Operations and Visibility	Upgrade the signal equipment to incorporate technologies that can adapt and respond dynamically to changing conditions.	Long	High	City of Salem
Drivers encounter congestion, delays, and long queues in the segment.	Traffic Signal Operations and Visibility	Optimize signal timings and phasing, and coordinate signals within a 1,500-foot distance to enhance traffic flow.	Short	Medium	City of Salem
Bike lanes between Franklin Street and Essex Street have gaps and lack protection.	Pedestrian and Bicycle Accommodation	Assess the feasibility of installing flex posts or curbing to prevent drivers from encroaching on or raising the bike lanes and integrating them with the sidewalks.	Middle	Medium	City of Salem
2—Liberty Hill Avenue at North Street					
Intersection is a primary angle crash site.	Traffic Operations and Visibility	Consider installing a traffic signal to improve safety.	Long	High	City of Salem
Crashes occur more often in dark conditions.	Intersection Visibility	Evaluate and improve street and pedestrian-level lighting.	Short	Low	City of Salem
Drivers have to wait too long to turn out of Liberty Hill Avenue.	Pavement Markings and Signage	Consider installing pavement markings and signage to improve traffic operations.	Short	Low	City of Salem
Drivers have to wait too long to turn out of Liberty Hill Avenue.	Traffic Signal Operations and Visibility	Consider installing a traffic signal to reduce delays.	Long	High	City of Salem
3—School Street/Orne Street at North Street					
Drivers often fail to yield to pedestrians crossing streets.	Pedestrian and Bike Accommodation	Consider implementing leading pedestrian intervals (LPI) during concurrent vehicle and pedestrian phases.	Short	Medium	City of Salem
Drivers often fail to yield to pedestrians crossing streets.	Pedestrian and Bike Accommodation	Evaluate and update No Right Turn on Red signage placement to ensure it is MUTCD compliant.	Short	Low	City of Salem
Drivers encounter congestion, delays, and long queues.	Traffic Signal Operations and Visibility	Optimize signal timings and phasing and coordinate signals within 1,500 feet of each other to enhance traffic flow. Coordinate signals at School Street and Mason Street as a subsystem.	Short	Medium	City of Salem
Drivers encounter congestion, delays, and long queues.	Traffic Signal Operations and Visibility	Consider implementing a protected or permissive phase for eastbound and westbound left turns on North Street during peak hours.	Short	Medium	City of Salem

Issue/ Concern	Safety Category	Suggested Improvement	Time Frame	Cost	Responsibility
Drivers encounter congestion, delays, and long queues.	Traffic Signal Operations and Visibility	Upgrade the signal equipment to incorporate technologies that can adapt and respond dynamically to changing conditions.	Long	High	City of Salem
Drivers run red lights, risking pedestrian safety.	Traffic Signal Operations and Visibility	Evaluate clearance intervals and update them to meet current safety and operational standards.	Short	Low	City of Salem
4—Mason Street at North Street					
Vulnerable road users face high risks at intersections, especially where the crosswalk is missing on the west side of North Street.	Pedestrian and Bike Accommodation	Consider adding a crosswalk on the west side of North Street.	Short	Low	City of Salem
Drivers encounter congestion, delays, and long queues.	Traffic Signal Operations and Visibility	Optimize signal timings and phasing and coordinate signals within 1,500 feet of each other to enhance traffic flow. Coordinate signals at Mason Street and School Street as a subsystem.	Short	Medium	City of Salem
Drivers encounter congestion, delays, and long queues.	Traffic Signal Operations and Visibility	Upgrade the signal equipment to integrate technologies that can adapt and respond dynamically to changing conditions, thereby optimizing flow and reducing congestion.	Long	High	City of Salem
Drivers are using the Citgo driveways to turn left onto North Street, which is not permitted on Mason Street, creating safety concerns.	Traffic Signal Operations and Visibility	Consider adding signs to reinforce the prohibition or enforcement to prevent such maneuvers.	Short	Low	City of Salem
Drivers are using the Citgo driveways to turn left onto North Street, which is not permitted on Mason Street, creating safety concerns.	Traffic Signal Operations and Visibility	Assess the feasibility of allowing left turns on Mason Street.	Short	Low	City of Salem
Drivers run red lights, risking pedestrian safety.	Traffic Signal Operations and Visibility	Review clearance intervals and revise them to current standards as necessary to enhance safety and operational efficiency.	Short	Low	City of Salem
5—Franklin Street at North Street					
There is no crosswalk on North Street at the intersection.	Pedestrian and Bike Accommodation	Consider adding a crosswalk with pedestrian-activated signals on North Street.	Middle	High	City of Salem
Drivers exiting the Speedway gas station are involved in many crashes.	Intersection Geometry and Operations	Assess the feasibility of signalizing the intersection to enable left turns and pedestrian crossing.	Long	High	City of Salem
Drivers have to wait too long to turn out of Franklin Street.	Traffic Signal Operations and Safety	Assess the feasibility of signalizing the intersection to enable left turns and pedestrian crossing.	Long	High	City of Salem
6—On-ramp at North Street Bridge over Route 107					
Drivers tend to speed on the ramp.	Pavement Markings and Signage	Install speed limit signs, speed feedback signs, and pavement markings to raise awareness.	Short	Low	MassDOT and City of Salem
Crashes occur more often in dark conditions.	Intersection Visibility	Evaluate and improve street and pedestrian-scale lighting to reduce crashes in dark and low-light conditions.	Short	Low	MassDOT and City of Salem
Drivers treat the ramp like a highway on-ramp and fail to yield to pedestrians.	Pedestrian and Bike Accommodation	Consider installing a rectangular rapid flashing beacon at the crosswalk on the on-ramp to enhance pedestrian safety.	Short	Medium	MassDOT and City of Salem
Drivers treat the ramp like a highway on-ramp and fail to yield to pedestrians.	Pedestrian and Bike Accommodation	Alternatively, consider replacing the yield sign with a stop sign and adding pedestrian crossing signs.	Short	Low	MassDOT and City of Salem
7—Federal Street/Ramp at North Street					
Drivers often do not yield to pedestrians crossing the street.	Pedestrian and Bike Accommodation	Evaluate and update No Right Turn on Red signage placement to ensure it is MUTCD compliant and improve pedestrian safety.	Short	Low	MassDOT and City of Salem
Drivers often do not yield to pedestrians crossing the street.	Pedestrian and Bike Accommodation	Assess the feasibility of eliminating the eastbound right-turn slip lane from the ramp onto southbound North Street due to low volumes on the on-ramp. Will shorten a proposed crosswalk on the west side of North Street described below.	Short	Medium	MassDOT and City of Salem
Drivers often do not yield to pedestrians crossing the street.	Pedestrian and Bike Accommodation	Consider installing a crosswalk on the west side (southbound) of North Street across the ramp to improve pedestrian safety.	Short	Medium	MassDOT and City of Salem
Pedestrians are trying to access the MBTA station.	Pedestrian and Bike Accommodation	Install wayfinding signs to direct pedestrians and bicyclists on safe routes to the MBTA station.	Short	Low	MassDOT and City of Salem
Drivers run red lights and yield signs, risking pedestrian safety.	Traffic Signal Operations and Visibility	Assess clearance intervals and revise them to meet current standards and operational requirements.	Short	Low	MassDOT and City of Salem
Drivers are not given advance notice of lane assignments and often become confused, resulting in them ending up in the wrong lane.	Pavement Markings and Signage	Consider installing signs and pavement markings in advance to guide drivers into the correct lanes on North Street between Federal Street and Essex Street.	Short	Low	MassDOT and City of Salem

Issue/ Concern	Safety Category	Suggested Improvement	Time Frame	Cost	Responsibility
Drivers face congestion, delays, and long queues, and pedestrians have to wait too long for the Walk signal.	Traffic Signal Operations and Visibility	Optimize signal timings and phasing and coordinate signals within 1,500 feet of each other to enhance traffic flow. Coordinate signals at Federal Street and Essex Street as a subsystem.	Short	Medium	MassDOT and City of Salem
Signal equipment is outdated.	Traffic Signal Operations and Visibility	Upgrade the signal equipment to incorporate technologies that can adapt and respond dynamically to changing conditions, thereby optimizing flow and reducing congestion	Long	High	MassDOT and City of Salem
8—Lynde Street at North Street					
Drivers turning left out of Lynde Street are often involved in crashes.	Traffic Signal Operations and Visibility	Consider prohibiting left turns from Lynde Street (and allowing right turns only).	Short	Low	City of Salem
Drivers turning left out of Lynde Street are often involved in crashes.	Traffic Signal Operations and Visibility	Assess the practicality of reversing traffic flow on Lynde Street.	Middle	Medium	City of Salem
Drivers turning left out of Lynde Street are often involved in crashes.	Intersection Geometry and Operations	Evaluate the feasibility of reconstructing the intersection to improve safety.	Long	High	City of Salem
Drivers have to wait too long to turn out of Lynde Street.	Traffic Signal Operations and Visibility	Evaluate the feasibility of installing a signal at the intersection to decrease delays on Lynde Street.	Long	High	City of Salem
9—Essex Street at North Street					
Vulnerable road users are at high risk, as drivers often fail to yield to pedestrians.	Pedestrian and Bicycle Accommodation	Remove the right-turn slip lane from Essex Street to Summer Street to enhance pedestrian safety.	Short	Medium	City of Salem
Crashes often occur under dark conditions.	Intersection Visibility	Evaluate and enhance street and pedestrian-scale lighting to reduce crashes during dark and low-light conditions.	Short	Low	City of Salem
Sidewalks are narrow and need improvement.	Pedestrian and Bicycle Accommodation	Assess and improve sidewalks.	Middle	Medium	City of Salem
Drivers run red lights, risking pedestrian safety.	Traffic Signal Operations and Visibility	Assess clearance intervals and update them to current standards as necessary to enhance safety and operational efficiency.	Short	Low	City of Salem
Drivers encounter congestion, delays, and long queues, and pedestrians have to wait too long for the Walk signal.	Traffic Signal Operations and Visibility	Optimize signal timings and phasing and coordinate signals within 1,500 feet of each other to enhance traffic flow. Coordinate signals at Federal Street and Essex Street as a subsystem.	Short	Medium	City of Salem
Drivers encounter congestion, delays, and long queues.	Traffic Signal Operations and Visibility	Upgrade the signal equipment to incorporate technologies that can adapt and respond dynamically to changing conditions, thereby optimizing flow and reducing congestion.	Long	High	City of Salem
Drivers often become confused about lane assignments on the southbound approach to North Street and end up in the wrong lane.	Pavement Markings and Signage	Consider installing signs and pavement markings in advance to guide drivers into the correct lanes.	Short	Low	City of Salem
10—Chestnut Street/Norman Street at Summer Street					
Drivers often do not yield to pedestrians crossing streets.	Pedestrian and Bike Accommodation	Consider adding a rectangular rapid flashing beacon to the crosswalks to increase driver yield rates.	Short	Medium	City of Salem
The roundabout is malfunctioning during the peak travel period, resulting in congestion, delays, and lengthy queues for drivers.	Intersection Geometry	Evaluate the feasibility of replacing the roundabout with a traffic signal or two-way stop sign control to enhance safety and traffic flow.	Long	High`	City of Salem

MUTCD = Manual on Uniform Traffic Control Devices.

Table 5
Potential Improvements on Norman and Washington Streets

Issue/ Concern	Safety Category	Suggested Improvement	Time Frame	Cost	Responsibility
11—Norman and Washington Streets Segment					
The segment is part of a high-injury network, and two intersections on the segment are primary angle crash sites.	Traffic Signal Operations and Visibility	Consider enhancing safety with traffic calming, signal optimization, lighting, and intersection improvements.	Long	High	City of Salem
Bike lanes are absent on Washington Street from Mill Street to Lafayette Street.	Pedestrian and Bicycle Accommodation	Consider adding shared-lane markings or signs to alert drivers of the presence of bicyclists.	Short	Low	City of Salem
Drivers often become confused about lane assignments and end up in the wrong lane.	Traffic Signal Operations and Visibility	Consider installing signs and pavement markings (including white dotted lines at intersections) in advance to guide drivers into the correct lanes at intersections.	Short	Low	City of Salem
Crashes are more likely to occur in dark conditions.	Intersection Visibility	Evaluate and improve street and pedestrian-scale lighting to increase visibility and reduce crashes during dark and low-light conditions.	Short	Low	City of Salem
Crashes are more likely to occur in dark conditions.	Traffic Signal Operations and Visibility	Consider installing backplates with retroreflective borders on all signal heads to improve signal visibility.	Short	Medium	City of Salem
Drivers tend to speed on Washington Street.	Roadway Features	Install speed limit and speed feedback signs at regular intervals to raise awareness.	Short	Low	City of Salem
12—Norman Street/New Derby Street at Washington Street					
Intersection is a primary angle crash site.	Traffic Signal Operations and Visibility	Review clearance intervals and update them to current standards as needed to enhance safety and operational efficiency.	Short	Low	City of Salem
Intersection is a primary angle crash site.	Traffic Signal Operations and Visibility	Consider a Road Safety Audit for the intersection.	Short	Low	City of Salem
Drivers often fail to yield to pedestrians crossing streets.	Pedestrian and Bicycle Accommodation	Consider prohibiting right turns on red after stopping on Norman Street to increase pedestrian safety.	Short	Low	City of Salem
Drivers often fail to yield to pedestrians crossing streets.	Pedestrian and Bicycle Accommodation	Evaluate and update the placement of No Right Turn on Red signage to ensure it is MUTCD compliant.	Short	Low	City of Salem
Pedestrians have to cross too many lanes.	Pedestrian and Bicycle Accommodation	Assess the feasibility of incorporating curb extensions to decrease crossing distance and tightening curb radii to prevent speeding.	Short	Medium	City of Salem
Crashes are more likely to occur in dark conditions.	Traffic Signal Operations and Visibility	Evaluate and enhance street and pedestrian-scale lighting to improve visibility and decrease crashes in dark and low-light conditions.	Short	Low	City of Salem
Crashes are more likely to occur in dark conditions.	Traffic Signal Operations and Visibility	Consider installing backplates with retroreflective borders on all signal heads to improve signal visibility.	Short	Medium	City of Salem
Drivers often run red lights, risking the safety of pedestrians.	Traffic Signal Operations and Visibility	Evaluate clearance intervals and update them to current standards as needed to enhance safety and operational efficiency.	Short	Low	City of Salem
Drivers encounter congestion and pedestrians wait too long for the Walk signal to change.	Traffic Signal Operations and Visibility	Optimize signal timings and phasing and coordinate signals within 1,500 feet of each other to enhance traffic flow and pedestrian safety.	Short	Medium	City of Salem
Drivers encounter congestion, delays, and long queues.	Traffic Signal Operations and Visibility	Upgrade the signal equipment to incorporate technologies that can adapt and respond dynamically to changing conditions, thereby optimizing traffic flow and reducing congestion.	Long	High	City of Salem
Drivers often become confused about lane assignments on the North Street southbound approach and end up in the wrong lane.	Pavement Markings and Signage	Consider installing signs and pavement markings (including dotted white lines in the intersection) in advance to guide drivers into the correct lanes.	Short	Low	City of Salem
Drivers get into crashes due to the lane drop and merge on Washington Street just north of New Derby Street.	Pavement Markings and Signage	Consider installing pavement markings in addition to existing signage to enhance safety at the merge area.	Short	Low	City of Salem
13—Mill Street/Canal Street at Washington Street					
Intersection is a primary angle crash site.	Traffic Signal Operations and Visibility	Review clearance intervals and update them to current standards as needed to enhance safety and operational efficiency.	Short	Low	City of Salem
Intersection is a primary angle crash site.	Traffic Signal Operations and Visibility	Consider a Road Safety Audit for the intersection.	Short	Low	City of Salem
Drivers often fail to yield to pedestrians crossing streets.	Pedestrian and Bicycle Accommodation	Evaluate and update the placement of No Turn on Red signage to ensure it is MUTCD compliant.	Short	Low	City of Salem

Issue/ Concern	Safety Category	Suggested Improvement	Time Frame	Cost	Responsibility
The bike lane on the west side (southbound) of Washington Street ends before reaching Mill Street.	Pedestrian and Bicycle Accommodation	Assess whether removing the exclusive right-turn lane on southbound Washington Street is feasible, due to the low volume of right turns, and consider implementing a shared through/right turn lane.	Short	Medium	City of Salem
The bike lane on the west side of Washington Street ends before reaching Mill Street.	Pedestrian and Bicycle Accommodation	If a shared through/right-turn lane is installed, consider extending the bike lane on the west side of Washington Street to Mill Street.	Short	Medium	City of Salem
The bike lane ends on the west side of Washington Street before the approach at Mill Street.	Pedestrian and Bicycle Accommodation	An alternative to the above recommendation is to consider narrowing lanes on the southbound approach of Washington Street at Mill Street to accommodate a bike lane.	Middle	Medium	City of Salem
Pedestrians have to cross too many lanes.	Pedestrian and Bicycle Accommodation	Assess the feasibility of incorporating curb extensions to shorten crossing distances and tightening curb radii to slow down vehicles.	Short	Medium	City of Salem
Crashes are more likely to occur in dark conditions.	Traffic Signal Operations and Visibility	Assess street and pedestrian-scale lighting to increase visibility and reduce crashes during dark and low-light conditions.	Short	Low	City of Salem
Drivers encounter congestion and pedestrians wait too long for the walk signal to change.	Traffic Signal Operations and Visibility	Optimize signal timings and phasing and coordinate signals within 1,500 feet of each other to enhance traffic flow and pedestrian safety.	Short	Medium	City of Salem
Drivers encounter congestion, delays, and long queues.	Traffic Signal Operations and Visibility	Review and upgrade the signal equipment to incorporate technologies that can adapt and respond flexibly to changing conditions, thereby optimizing flow and reducing congestion.	Long	High	City of Salem
Drivers often run red lights, risking the safety of pedestrians.	Traffic Signal Operations and Visibility	Review clearance intervals and revise them to meet current standards, enhancing safety and traffic flow.	Short	Low	City of Salem
Drivers frequently get confused about lane assignments on the approaches and often end up in the wrong lane.	Pavement Markings and Signage	Consider installing signs and pavement markings (including dotted white lines in the intersection) in advance to guide drivers into the correct lanes.	Short	Low	City of Salem
14—Ropes Street at Washington Street					
Drivers often fail to yield to pedestrians.	Pedestrian and Bicycle Accommodation	Consider installing pedestrian crossing signs for the crosswalk on Washington Street near Ropes Street.	Short	Low	City of Salem

MUTCD = Manual on Uniform Traffic Control Devices.

Table 6
Potential Improvements on Lafayette Street

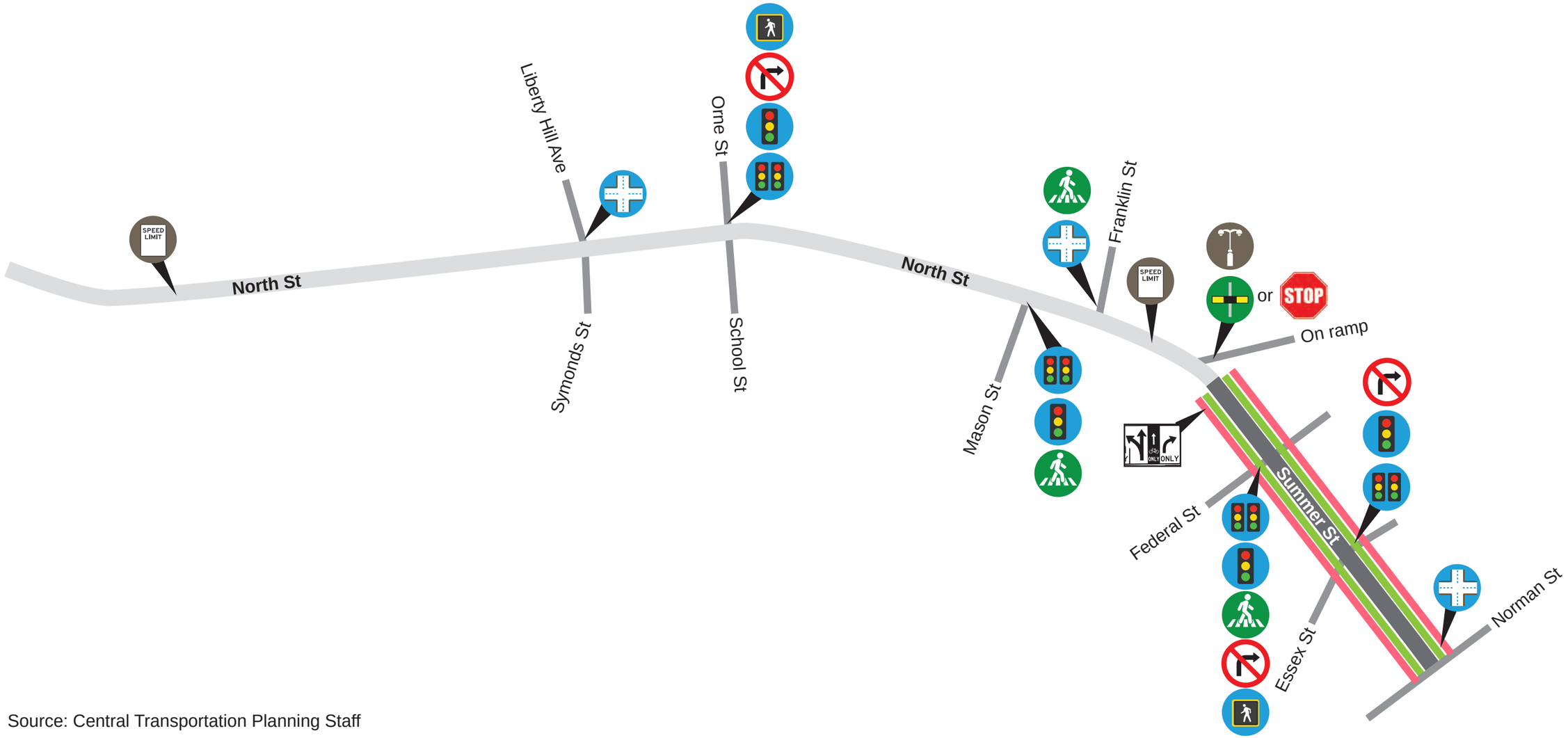
Issue/ Concern	Safety Category	Suggested Improvement	Time Frame	Cost	Responsibility
15—Lafayette Street Segment					
The segment is part of a high-injury network, and several intersections along the segment are primary angle crash sites.	Traffic Signal Operations and Visibility	Consider enhancing safety with traffic calming, signal optimization, lighting, and intersection improvements.	Long	High	City of Salem
Drivers often fail to yield to pedestrians crossing streets.	Pedestrian and Bike Accommodation	Consider daylighting intersections, installing curb extensions, or adding a rectangular rapid flashing beacon to enhance visibility and signal to drivers to yield.	Short	Medium	City of Salem
Drivers park too close to intersections, which limits sight distance.	Pedestrian and Bike Accommodation	Consider removing parking near crosswalks to enhance visibility by installing curb extensions or daylighting intersections.	Middle	Medium	City of Salem
Bike lane markings are fading and becoming hard to see.	Pedestrian and Bike Accommodation	Repaint bike lane markings and extend the markings through intersections to improve visibility.	Short	Low	City of Salem
Bike lanes are unprotected, and drivers frequently use them to pass other vehicles.	Pedestrian and Bike Accommodation	Consider establishing parking-protected bike lanes on Lafayette Street.	Middle	High	City of Salem
Bike lanes are unprotected, and drivers frequently use them to pass other vehicles.	Pedestrian and Bike Accommodation	Consider raising the bike lanes and connecting them to the sidewalk to enhance safety.	Long	High	City of Salem
Sidewalks are in poor condition or need repairs.	Pedestrian and Bike Accommodation	Repair or reconstruct sidewalks and curb ramps to comply with ADA standards.	Middle	Medium	City of Salem
Crashes are more likely to occur in dark conditions.	Intersection Visibility	Evaluate and adjust street and pedestrian-scale lighting to increase visibility.	Short	Low	City of Salem
Drivers often speed on Lafayette Street, especially south of Loring Avenue.	Roadway Features	Install speed limit signs and speed feedback signs at regular intervals.	Short	Low	City of Salem
Drivers often speed on Lafayette Street, especially south of Loring Avenue.	Roadway Features	Consider implementing the traffic calming and speed management improvements on Lafayette Street.	Long	High	City of Salem
Drivers run red lights, risking pedestrian safety.	Traffic Signal Operations and Visibility	Assess clearance intervals and update to current standards as necessary to enhance safety.	Short	Low	City of Salem
Drivers encounter congestion, delays, and long queues in the segment.	Traffic Signal Operations and Visibility	Optimize signal timings and phasing to enhance traffic flow.	Short	Medium	City of Salem
Drivers encounter congestion, delays, and long queues in the segment.	Traffic Signal Operations and Visibility	Upgrade the signal equipment to incorporate technologies that can adapt and respond dynamically to changing conditions.	Long	High	City of Salem
Drivers encounter delays on the side streets.	Pavement Marking and Signage	Add pavement markings and signage to help traffic turning out of the side streets or consider installing traffic signals at intersections that meet signal warrants.	Short	Low	City of Salem
The surface of the road is in poor condition and not well maintained.	Maintenance	Assess and provide routine maintenance or resurface Lafayette Street.	Middle	Medium	City of Salem
Transit service is infrequent.	Transit	Coordinate with the MBTA to ensure that frequent and express bus service is available on Lafayette Street.	Short	Medium	City of Salem
16—Washington Street, Dow Street at Lafayette Street					
The intersection is a primary site for angle crashes.	Traffic Signal Operations and Visibility	Assess clearance intervals and update them to current standards as needed to enhance safety and operations.	Short	Low	City of Salem
The intersection is a primary site for angle crashes.	Traffic Signal Operations and Visibility	Consider a Road Safety Audit for this intersection and the intersections of Palmer and Leavitt Streets.	Short	Low	City of Salem
Drivers park too close to the intersection, which limits sight distance.	Pedestrian and Bike Accommodation	Consider daylighting intersections by removing parking near crosswalks or installing curb extensions to enhance visibility.	Short	Medium	City of Salem
Vulnerable road users are at high risk. (Drivers make right turns on red after stopping on Washington Street, which is unsafe.)	Pedestrian and Bike Accommodation	Consider prohibiting right turns on red after stopping on Washington Street to Lafayette Street southbound.	Short	Low	City of Salem
Vulnerable road users are at high risk, especially when drivers make illegal left turns onto Dow Street from Washington Street.	Pedestrian and Bike Accommodation	Consider installing No Left Turn signs (both overhead and post-mounted) to alert drivers on Washington Street not to turn left onto Dow Street.	Short	Low	City of Salem

Issue/ Concern	Safety Category	Suggested Improvement	Time Frame	Cost	Responsibility
Drivers often fail to yield to pedestrians in crosswalks.	Pedestrian and Bike Accommodation	Evaluate and update the placement of No Turn On Red signage to ensure it complies with the MUTCD.	Short	Low	City of Salem
Pavement markings are fading and becoming difficult to see, especially at the intersections.	Pedestrian and Bike Accommodation	Repaint bike lane markings through the intersection to improve visibility and enhance safety for bicyclists.	Short	Low	City of Salem
Drivers run red lights, risking pedestrian safety.	Traffic Signal Operations and Visibility	Assess clearance intervals and revise them to meet current safety and efficiency standards.	Short	Low	City of Salem
Crashes are more likely to occur in dark conditions.	Intersection Visibility	Evaluate and adjust street and pedestrian-scale lighting to increase visibility.	Short	Low	City of Salem
Crashes are more likely to occur in dark conditions.	Intersection Visibility	Consider installing backplates with retroreflective borders on all signal heads to improve signal visibility.	Short	Low	City of Salem
Drivers encounter congestion and delays, and pedestrians have to wait too long for the Walk signal to appear.	Traffic Signal Operations and Visibility	Evaluate signal phasing and timing, and consider making improvements to reduce queues and congestion.	Short	Medium	City of Salem
Drivers encounter congestion, delays, and long queues.	Traffic Signal Operations and Visibility	Assess and upgrade the signal equipment to incorporate technologies that can adapt and respond dynamically to changing conditions.	Long	High	City of Salem
Drivers encounter congestion, delays, and long queues.	Traffic Signal Operations and Visibility	Evaluate whether implementing a one-way flow around Lafayette Park and reversing some existing one-way directions could help improve safety and traffic flow, or enhance bike safety.	Long	High	City of Salem
17—Palmer Street at Lafayette Street					
The intersection is a primary site for angle crashes.	Traffic Signal Operations and Visibility	Install a traffic signal at the intersection to enhance pedestrian safety and traffic flow.	Long	High	City of Salem
Drivers often fail to yield to pedestrians in crosswalks.	Pedestrian and Bike Accommodation	Consider installing rectangular rapid flashing beacons on the uncontrolled marked crosswalk on Lafayette Street to improve pedestrian safety.	Short	Medium	City of Salem
Crashes are more likely to occur in dark conditions.	Intersection Visibility	Evaluate and adjust street and pedestrian-scale lighting to enhance visibility.	Short	Low	City of Salem
Drivers have to wait too long to turn out of Palmer Street.	Traffic Signal Operations and Visibility	Consider installing a traffic signal to improve traffic flow.	Long	High	City of Salem
Drivers have to wait too long to turn out of Palmer Street.	Traffic Signal Operations and Visibility	Consider reversing traffic directions on Leavitt Street and installing a traffic signal at the Leavitt Street intersection to improve traffic flow. This option provides more space between the signal at the intersection of Dow and Washington Streets for queue build-up.	Long	High	City of Salem
18—Leavitt Street at Lafayette Street					
Drivers often fail to yield to pedestrians in crosswalks.	Pedestrian and Bicycle Accommodation	Consider installing rectangular rapid flashing beacon at the uncontrolled marked crosswalk on Lafayette Street to improve pedestrian safety.	Middle	Medium	City of Salem
Drivers often fail to yield to pedestrians in crosswalks.	Traffic Signal Operations and Visibility	Consider reversing traffic directions on Palmer Street and installing a traffic signal at the Leavitt Street intersection to improve traffic flow. This option provides more space between the signal at the intersection of Dow and Washington Streets for queue build-up.	Long	High	City of Salem
Vulnerable road users are at high risk as drivers park close to intersections, which limits sight distance.	Pedestrian and Bike Accommodation	Consider daylighting the intersection or installing curb extensions by removing parking near crosswalks.	Short	Medium	City of Salem
19—Saltonstall/Hancock Street at Lafayette Street					
Drivers often fail to yield to pedestrians in crosswalks.	Pedestrian and Bicycle Accommodation	Consider installing rectangular rapid flashing beacons at the uncontrolled marked crosswalks on Lafayette Street near Hancock Street/Saltonstall Parkway.	Middle	Medium	City of Salem
Drivers park too close to the intersection, which limits sight distance.	Pedestrian and Bike Accommodation	Consider daylighting the intersection by removing parking near crosswalks or installing curb extensions to improve visibility.	Short	Medium	City of Salem
Crashes occur more often in dark conditions.	Intersection Visibility	Assess and enhance street and pedestrian-level lighting to improve visibility and reduce crashes in dark and low-light conditions.	Short	Low	City of Salem
There is congestion during school drop-off and pick-up times.	Pavement Markings and Signage	Consider using pavement markings and signage to prevent double parking, parking in bike lanes, and parking near crosswalks.	Short	Low	City of Salem
20—Leach Street/Holly Street at Lafayette Street					

Issue/ Concern	Safety Category	Suggested Improvement	Time Frame	Cost	Responsibility
Drivers often fail to yield to pedestrians crossing streets.	Pedestrian and Bike Accommodation	Consider upgrading the pedestrian signal equipment to comply with current MassDOT standards.	Long	High	City of Salem
Drivers become confused by the blinking green light and the simultaneous yellow and red lights.	Pedestrian and Bike Accommodation	Consider updating the flashing green, simultaneous yellow, and red signal indications as needed to comply with MassDOT standards.	Middle	Medium	City of Salem
The pedestrian signal equipment is outdated.	Traffic Signal Operations and Visibility	Upgrade the pedestrian signal equipment as necessary to comply with current MassDOT standards.	Long	High	City of Salem
Drivers have to wait too long to turn out of the side streets.	Traffic Signal Operations and Visibility	Assess and upgrade the pedestrian signal to full traffic signals to manage traffic on side streets, speeding, and system coordination. Ocean Avenue has more traffic than Leach Street; however, Leach Street is in a more central position.	Long	High	City of Salem
Drivers often park too close to intersections, which reduces sight distance and endangers pedestrian safety.	Pedestrian and Bike Accommodation	Consider daylighting the intersection or installing curb extensions to increase pedestrian visibility.	Middle	Medium	City of Salem
Pavement markings are fading and becoming increasingly difficult to see, especially at intersections.	Pedestrian and Bike Accommodation	Repaint bike lane and crosswalk markings to improve safety for bicyclists.	Short	Low	City of Salem
Crashes are more likely to occur in dark conditions.	Intersection Visibility	Evaluate and improve street and pedestrian-level lighting to increase visibility.	Short	Low	City of Salem
21—Laurel Street/Willow Avenue at Lafayette Street					
Drivers often fail to yield to pedestrians crossing streets.	Pedestrian and Bike Accommodation	Consider installing pedestrian crossing signs at the uncontrolled marked crosswalk on Lafayette Street to enhance pedestrian safety.	Middle	Medium	City of Salem
Drivers park too close to the intersection, which limits sight distance.	Pedestrian and Bike Accommodation	Consider daylighting the intersection by removing parking near the crosswalk or installing curb extensions to enhance visibility.	Short	Medium	City of Salem
Drivers have to wait too long to turn out of the side streets.	Pavement Marking and Signage	Assess and install pavement markings and signage to assist traffic turning onto the side streets.	Short	Low	City of Salem
22 Ocean Avenue at Lafayette Street					
Intersection is a primary angle crash site.	Traffic Signal Operations and Visibility	Assess and upgrade the pedestrian signal to full traffic signals to manage traffic on side streets, speeding, and system coordination.	Long	High	City of Salem
Drivers often fail to yield to pedestrians crossing streets.	Pedestrian and Bike Accommodation	Consider upgrading the pedestrian signal equipment to meet current MassDOT standards.	Long	High	City of Salem
Drivers become confused by the blinking green light and the simultaneous yellow and red lights.	Pedestrian and Bike Accommodation	Consider updating the flashing green, simultaneous yellow, and red signal indications as necessary to comply with current MassDOT standards.	Middle	Medium	City of Salem
Drivers park close to the intersection, which limits sight distance.	Pedestrian and Bike Accommodation	Consider installing curb extensions or daylighting the intersection to enhance pedestrian visibility.	Middle	Medium	City of Salem
Crashes are more likely to occur in dark conditions.	Intersection Visibility	Evaluate and improve street and pedestrian-level lighting to increase visibility.	Short	Low	City of Salem
Drivers have to wait too long to turn out of the side streets.	Traffic Signal Operations and Visibility	Upgrade the pedestrian signal to a full traffic signal to better control traffic on side streets, speeding, and system coordination. Ocean Avenue has more traffic than Leach Street; however, Leach Street is in a more central position.	Long	High	City of Salem
The pedestrian signal equipment is outdated.	Traffic Signal Operations and Visibility	Upgrade the pedestrian signal equipment as necessary to comply with current MassDOT standards.	Long	High	City of Salem
23—Forest Avenue/Clifton Avenue at Lafayette Street					
The intersection is a primary angle crash site.	Intersection Visibility	Consider installing curb extensions or daylighting the intersection by removing parking to enhance visibility and increase safety for pedestrians and drivers.	Short	Medium	City of Salem
Drivers often fail to yield to pedestrians crossing streets.	Pedestrian and Bike Accommodation	Consider adding pedestrian crossing signs to the uncontrolled marked crosswalk on Lafayette Street.	Middle	Medium	City of Salem
Drivers have to wait too long to turn out of the side streets.	Pavement Marking and Signage	Evaluate and install pavement markings and signage to assist traffic in turning out of the side streets.	Short	Low	City of Salem
Traffic queues frequently extend into the intersection, creating safety problems for pedestrians and drivers.	Traffic Signal Operations and Visibility	Assess and optimize signal timing and phasing sequence at the intersection of Lafayette Street and Loring Avenue to decrease queues.	Short	Medium	City of Salem

Issue/ Concern	Safety Category	Suggested Improvement	Time Frame	Cost	Responsibility
24—Loring Avenue/West Avenue at Lafayette Street					
Drivers run red lights, risking pedestrian safety.	Traffic Signal Operations and Visibility	Assess clearance intervals and update them to comply with current standards.	Short	Low	City of Salem
The right-turn lane on Lafayette Street is too short for the amount of traffic it carries.	Intersection Geometry	Assess and consider lengthening the southbound right-turn lane on Lafayette Street to accommodate current traffic demands.	Short	Low	City of Salem
Vulnerable road users are at high risk at intersections.	Pedestrian and Bike Accommodation	Evaluate and update No Turn On Red signs to improve pedestrian safety at the intersection.	Short	Low	City of Salem
Drivers encounter congestion and delays, and pedestrians have to wait too long for the Walk signal.	Traffic Signal Operations and Visibility	Optimize signal timings and phasing to enhance pedestrian crossing experience and traffic flow.	Short	Medium	City of Salem
Drivers encounter congestion, delays, and long queues.	Traffic Signal Operations and Visibility	Assess and upgrade the signal equipment to incorporate technologies that can adapt and respond dynamically to changing conditions, thereby optimizing flow and reducing congestion.	Long	High	City of Salem
25—Marblehead Trail Crossing at Lafayette Street					
Drivers often fail to yield to pedestrians crossing Lafayette Street.	Pedestrian and Bike Accommodation	Consider adding pavement marking yield lines and Yield Here to Pedestrians signs (R1-5) to the existing rectangular rapid flashing beacon to enhance pedestrian safety.	Short	Low	City of Salem
Drivers often fail to yield to pedestrians crossing streets.	Pedestrian and Bike Accommodation	Consider installing rumble strips before the crosswalk to alert drivers to their approach.	Short	Low	City of Salem
Drivers often fail to yield to pedestrians crossing streets.	Pedestrian and Bike Accommodation	Consider installing a pedestrian refuge island or median island to shorten the crosswalk and provide space for pedestrians to pause.	Short	Low	City of Salem
The existing rectangular rapid flashing beacon is not working well.	Pedestrian and Bike Accommodation	Evaluate and upgrade the existing rectangular rapid flashing beacon to a traditional pedestrian crossing signal.	Middle	High	City of Salem
Sidewalks are missing or in need of repair.	Pedestrian and Bike Accommodation	Evaluate and repair sidewalks and/or reconstruct sidewalks to close gaps	Short	Medium	City of Salem
Bike lanes are unprotected, and drivers frequently use them to pass.	Pedestrian and Bike Accommodation	Consider installing parking-protected or buffered bike lanes, or raising the bike lanes and connecting them to the sidewalks.	Middle	Medium	City of Salem
Drivers often speed, particularly in this segment.	Roadway Features	Install speed limit signs and speed feedback signs at regular intervals to inform drivers of speed limits.	Short	Low	City of Salem

ADA = Americans with Disabilities Act. MUTCD = Manual on Uniform Traffic Control Devices.



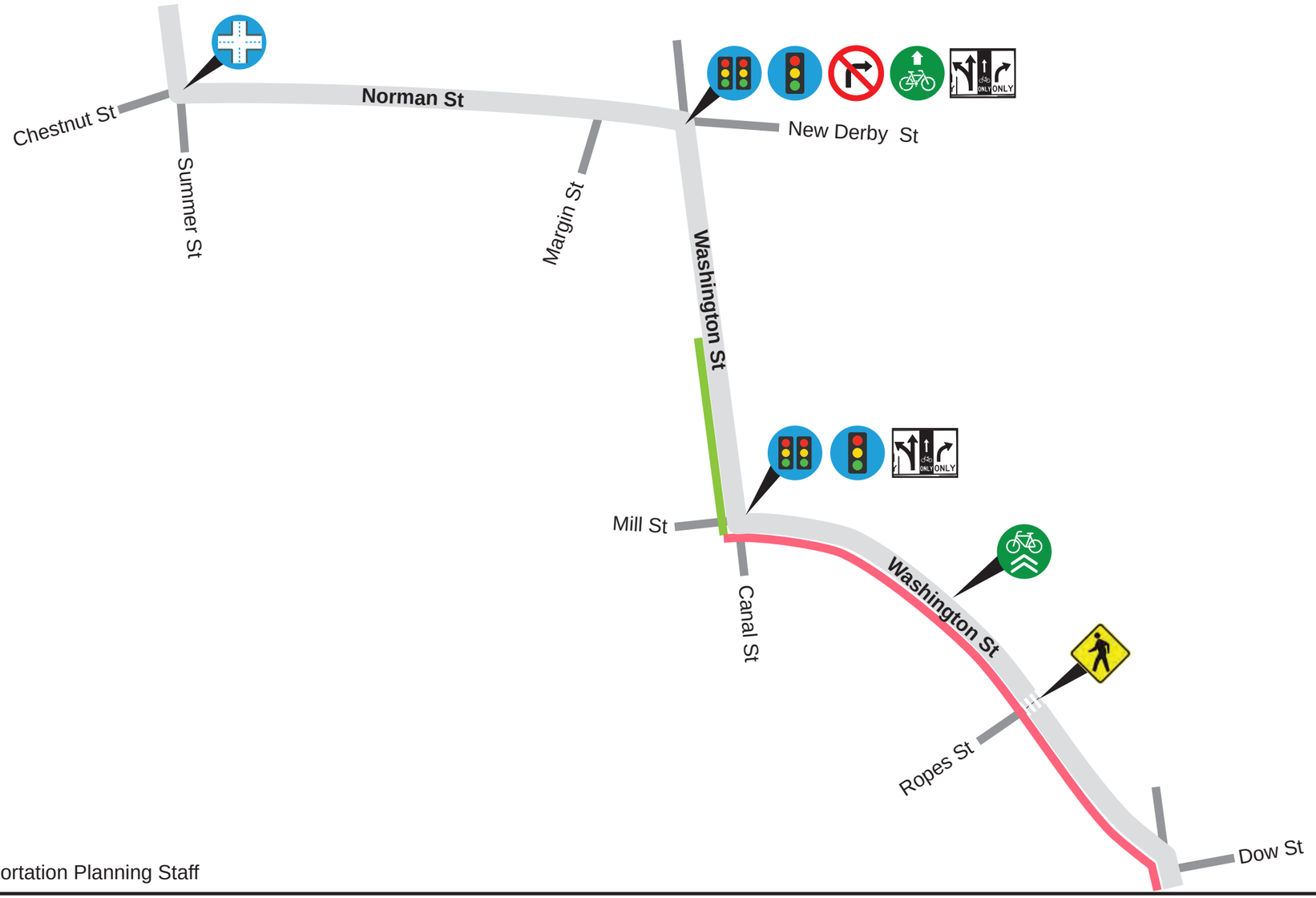
Source: Central Transportation Planning Staff

- Retime and coordinate traffic signals
- Upgrade traffic signal equipment
- Signalization and intersection improvements
- Evaluate and install leading pedestrian intervals
- Add crosswalk(s)
- Install rectangular rapid flashing beacon
- Install speed limit and feedback signs at regular intervals
- Evaluate and adjust No Right Turn on Red signage placement
- Improve lighting
- Install a stop sign
- Install signs and pavement markings in advance to guide drivers into correct lanes
- Evaluate and resurface road
- Protect bike lanes
- Repair or reconstruct sidewalks

BOSTON REGION MPO

Figure 19
Potential Improvements for North Street

Route 114 Corridor Study
City of Salem



Source: Central Transportation Planning Staff

- Retime and coordinate traffic signals
- Upgrade traffic signal equipment and features
- Signalization and intersection improvements
- Evaluate Right Turn on Red signage placement
- Add pedestrian crossing signs
- Install signs and pavement markings in advance to guide drivers into correct lanes
- Paint bike lane markings through intersections
- Add shared lane markings
- Repair or reconstruct sidewalk
- Protect bike lanes

BOSTON REGION MPO

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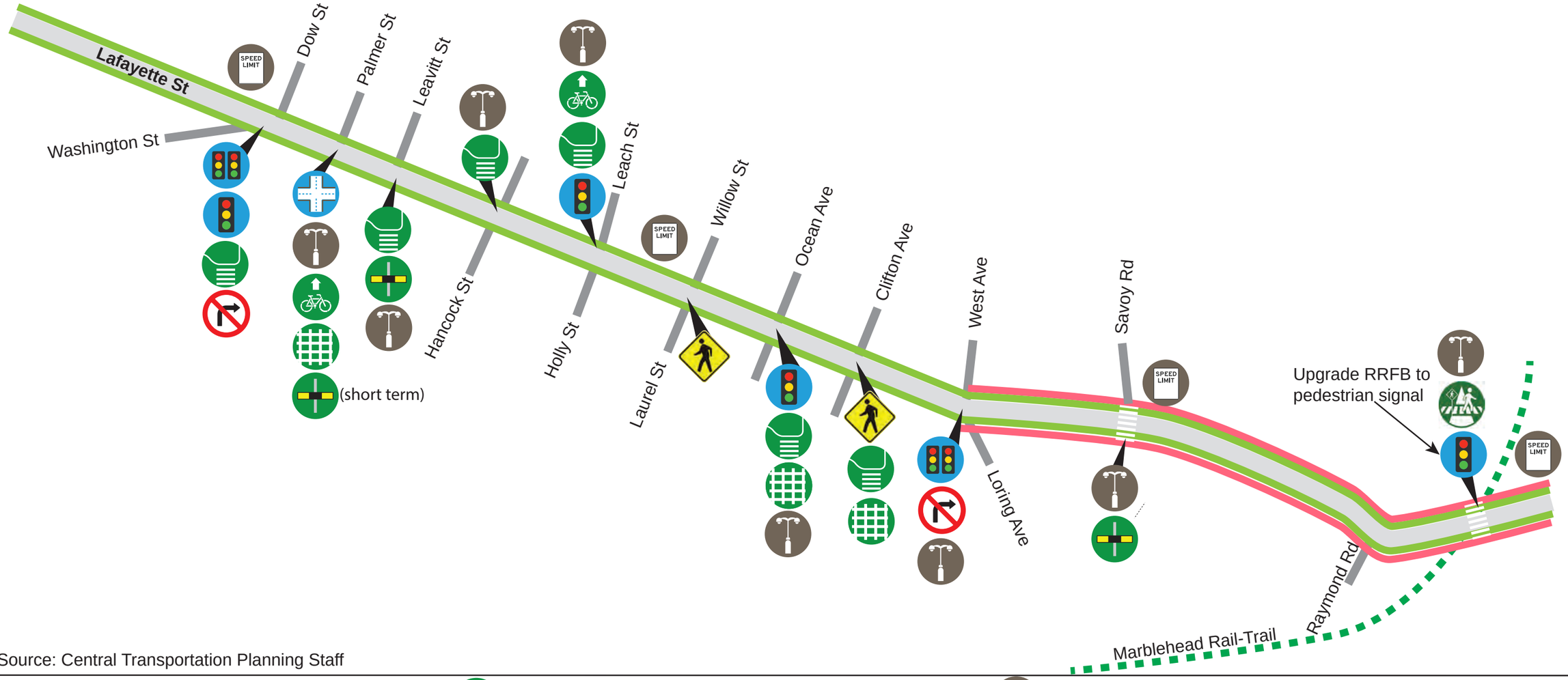
Figure 20
Potential Improvements for Washington Street

Route 114 Corridor Study
City of Salem



Source: Central Transportation Planning Staff

- Retime and coordinate traffic signals
- Upgrade traffic or pedestrian signal equipment
- Signalization and intersection improvements
- Evaluate and adjust No Right Turn on Red signage placement
- Paint do not block intersection markings and/or add signs
- Install rectangular rapid flashing beacon
- Paint bike lane markings through intersections
- Install curb extensions or daylight intersection
- Install pedestrian refuge or median island
- Improve street and pedestrian-level lighting
- Install speed limit and feedback signs at regular intervals
- Add pedestrian crossing signs
- Evaluate and resurface road
- Protect bike lanes and paint bike lane markings through intersections
- Evaluate and reconstruct sidewalks

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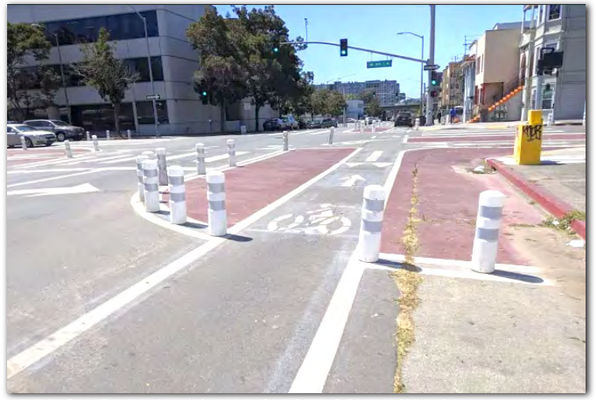
Figure 21
Potential Improvements for Lafayette Street

Route 114 Corridor Study
City of Salem

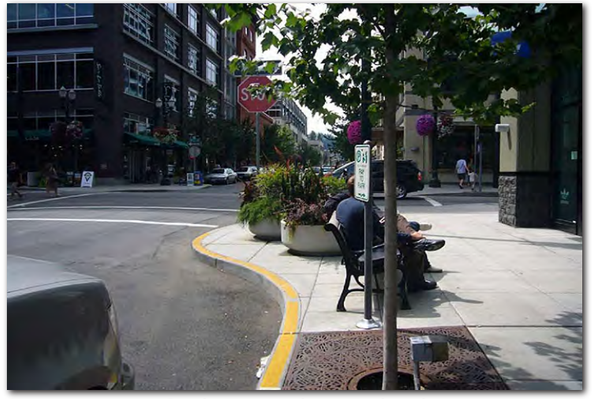
Bike Lane Protection: Cycle Track

Bike Lane Protection: Parking-Protected

Pedestrian-Scale Lighting: Sidewalk



Curb Extension: Flush with Bollards



Curb Extension: Raised

Pedestrian-Scale Lighting: Intersection

Pedestrian Refuge Island: Midblock Crossing

Pedestrian Signal

Speed Limit and Feedback Sign

3.3 OPERATIONAL IMPACTS OF SUGGESTED IMPROVEMENTS

The Boston Region MPO's transportation planning model (TDM23 2.0) was used to forecast traffic for this study to the target year of 2040. The model results projected that between 2019 and 2040 traffic volumes on Route 114 in Salem would increase by approximately 0.019 percent annually. The results also indicate that there would be minimal increases in traffic volumes in the vicinity of the study area in the future.

If the potential improvements are implemented, travel conditions in 2040, measured by total travel time, are expected to decrease by as much as 17 percent compared to 2025 levels, while delays at intersections are expected to decline by as much as 22 percent. Figures 23 and 24 show the delays and LOS projected for 2040 with the proposed improvements.

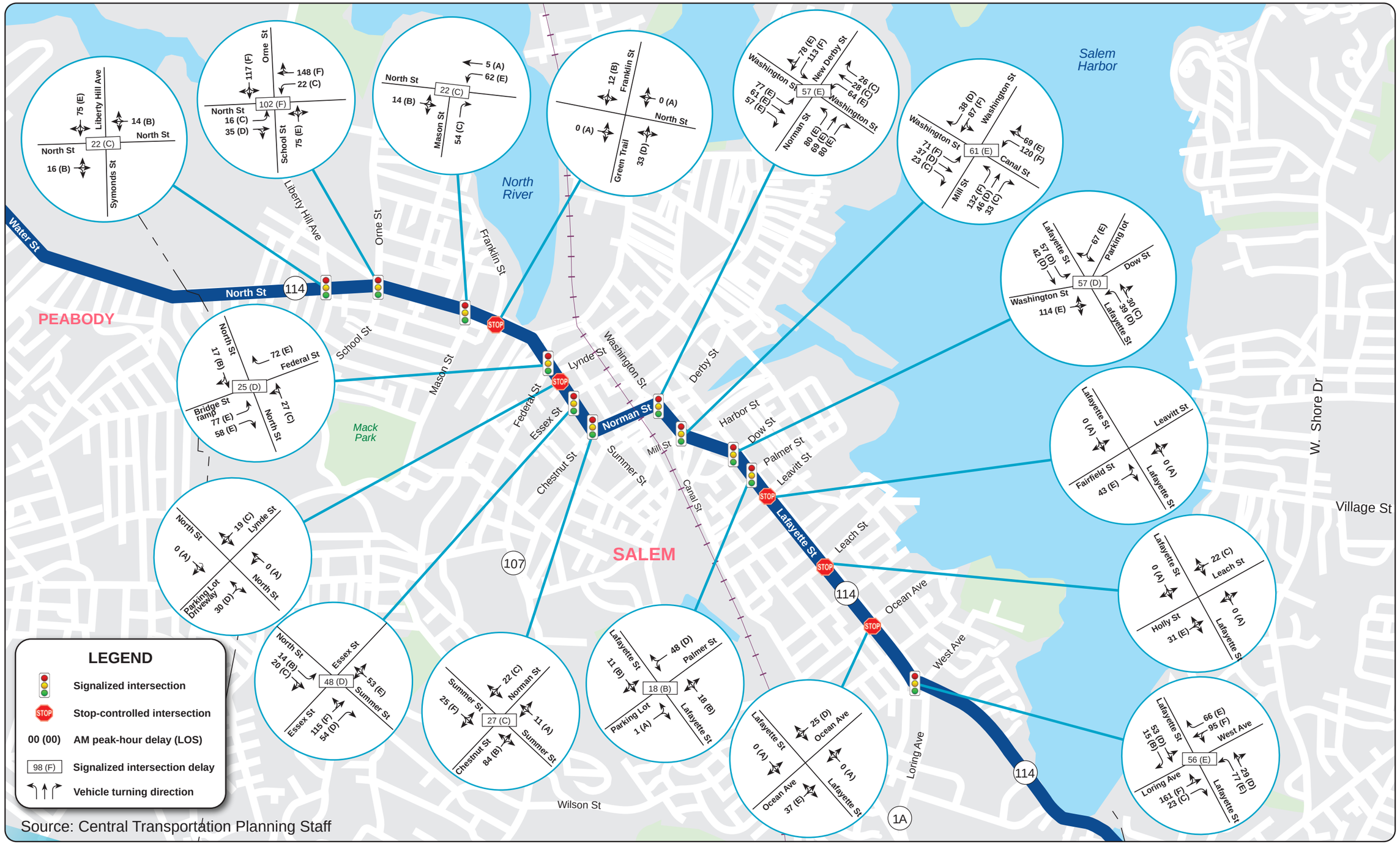


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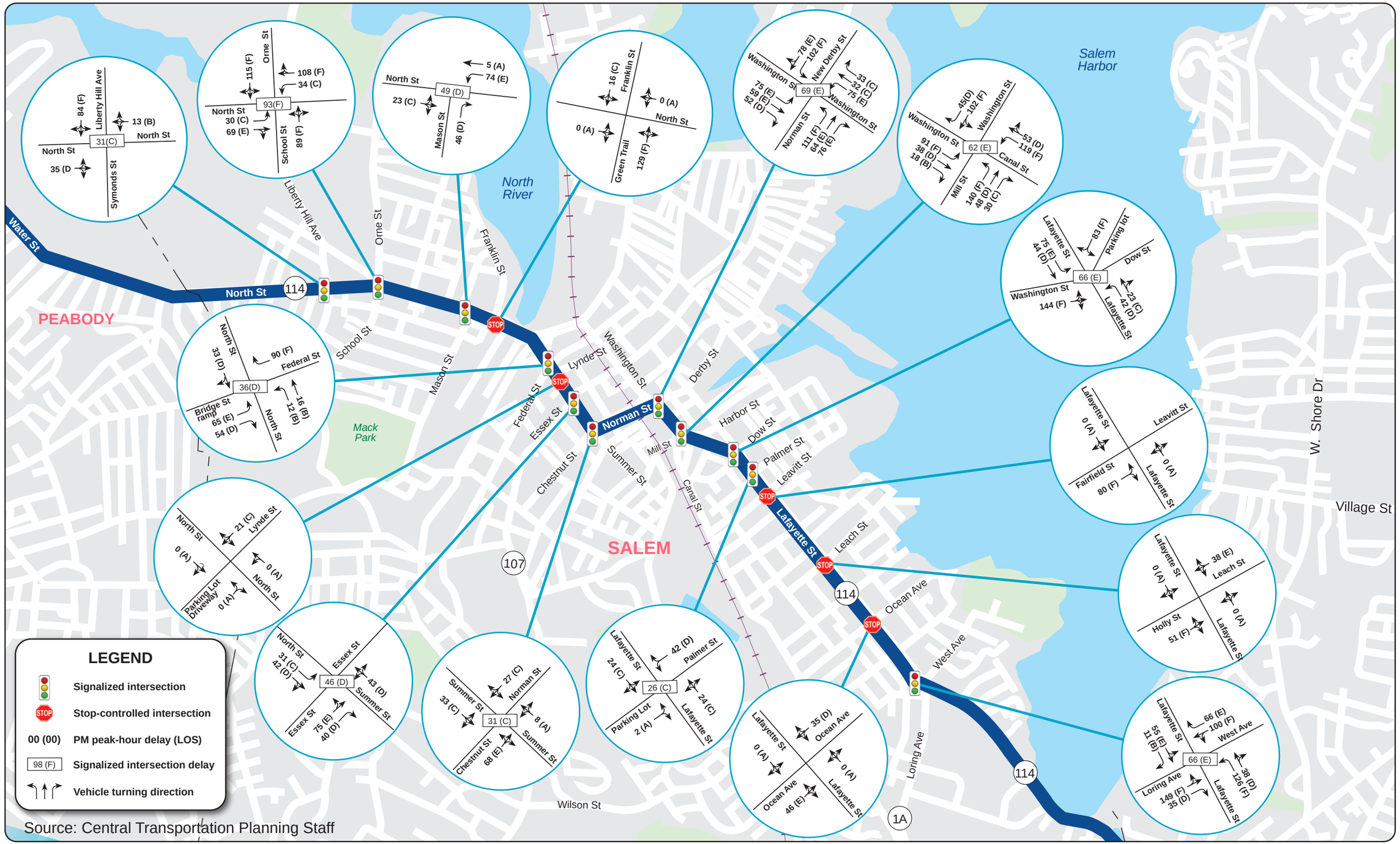
Figure 23
2040 Build: Weekday AM Peak Hour Delays and Level of Service

Route 114 Corridor Study
City of Salem



Source: Central Transportation Planning Staff

BOSTON REGION MPO

Figure 24
2040 Build: Weekday PM Peak Hour Delays and Level of Service

Route 114 Corridor Study
City of Salem

3.4 SAFETY IMPACTS OF SUGGESTED IMPROVEMENTS

Each proposed safety improvement was selected to address specific safety deficiencies. Considering the limited funding for projects, improvements that reduce injurious and fatal crashes should be prioritized. Therefore, stakeholders must understand the extent to which a particular safety improvement, or a set of enhancements, can reduce the number of crashes. Table 7 illustrates some of the safety benefits of the proposed improvements.

Table 7
Safety Benefits of Proposed Improvements

Improvements	Safety Benefit
Install a rectangular rapid flashing beacon.	Up to 47 percent reduction in pedestrian crashes
Install a high-visibility crosswalk.	Up to 40 percent reduction in pedestrian injuries
Improve street lighting.	Up to 28 percent reduction in nighttime injury crashes
Improve intersection lighting.	Up to 42 percent reduction in pedestrian crashes Up to 38 percent reduction in nighttime crashes
Install advance yield or stop marking.	Up to 25 percent reduction in pedestrian crashes
Provide sidewalks.	Up to 40 percent reduction in pedestrian crashes
Implement road diets.	Between 19 percent and 47 percent reduction in total crashes
Install leading pedestrian intervals.	Up to 13 percent reduction in pedestrian-vehicle crashes at intersections
Install separated bike lanes.	Converting traditional or flush-buffered bicycle lanes into separated bicycle lanes can reduce bicycle/vehicle crashes by up to 53 percent
Add stop signs or stop lines.	Up to 10 percent reduction in total crashes Up to 37 percent reduction in injury and fatal crashes
Modify clearance or change times to standards.	Up to 50 percent reduction in red light running Up to 14 percent reduction in all crashes
Add yellow retroreflective borders to signal heads.	Up to 15 percent reduction in nighttime crashes

Source: Federal Highway Administration, Crash Modification Factors Clearinghouse.

Chapter 4—Conclusion and Next Steps

4.1 PROJECT DEVELOPMENT

Addressing deficiencies in the Route 114 corridor in Salem will involve converting the planning stage improvements into projects and identifying the necessary funding to implement them. The City of Salem is encouraged to start collaborating with MassDOT and the Boston Region MPO to initiate projects and secure funding for their design, engineering, and construction. The types of projects that can be started include the following:

- Complete Streets projects to modernize and enhance multimodal transportation in the corridor, especially for Lafayette Street near Salem State University
- Traffic signal modernization projects that aim to reduce congestion, especially on North Street and Lafayette Street
- Intersection improvement projects focused on enhancing safety, including signalization and geometry modifications at the intersections of Liberty Hill Avenue or Franklin Street on North Street, Summer Street at Norman Street, and Palmer Street or Leavitt Street on Lafayette Street
- Pavement rehabilitation directed at resurfacing and preserving pavement conditions on North Street and Lafayette Street
- Pedestrian and bicycle projects centered on safety, such as adding curb extensions, creating pedestrian refuge islands, protecting bike lanes, and installing rectangular rapid flashing beacons (RRFBs).
- Lighting upgrade projects at intersections and crossings to reduce crashes under dark conditions

4.2 PROJECT FUNDING

There are various types of funding available through MassDOT[2] and the Boston Region MPO[3] for implementing projects, and Salem staff are encouraged to explore these funding options for projects on Route 114:

- MassDOT's Complete Streets Funding Program provides funding to promote Complete Streets, which offers safe and accessible options for all travel modes for all users.
- MassDOT's Local Bottleneck Reduction Program seeks to fund innovative solutions to modernize traffic signals and address congestion, including coordinating multiple traffic signals, retiming traffic signals, and upgrading traffic signal controllers and cabinets.

[2] See MassDOT's Grant Central website: https://madothway.my.site.com/GrantCentral/s/.
[3] See the Boston Region MPO's summary of investment programs: https://www.bostonmpo.org/data/pdf/plans/TIP/TIP-Flyer-2024-03-23.pdf.

- MassDOT's Municipal Pavement Program aims to improve pavement conditions of municipally owned, state-numbered routes, especially those on the National Highway System (NHS), such as Route 114.
- MassDOT's Shared Streets and Spaces Program provides funding to municipalities to quickly enhance public spaces such as plazas, sidewalks, curbs, streets, bus stops, and parking areas to support health, safe mobility, and stronger commerce.
- MassDOT's Safe Route to Schools Program provides funding to municipalities to increase safe walking, biking, and rolling among public elementary, middle, and high school students.
- MassDOT's Local Early and Actionable Planning (LEAP) Program provides planning and design support for municipally prioritized transportation infrastructure projects.
- The MPO's Intersection Improvements investment program funds projects to update intersection layouts and signals, enhancing safety for all users.
- The MPO's Complete Streets investment program funds projects to modernize roadways to improve safety and mobility for all users. This program is independent of the MassDOT Complete Streets program.
- The MPO's Bicycle Network and Pedestrian Connections investment program funds projects to expand bicycle and pedestrian networks to improve safe access to transit, schools, employment centers, and shopping destinations.
- MassWorks' Infrastructure Program provides funding to municipalities for public infrastructure projects that support housing production, economic development, and job creation.

4.3 CONCLUSION

The improvements proposed in this report, if implemented, would significantly improve safety, mobility, and operations in the Route 114 corridor by supporting walking, biking, transit, and other transportation modes that connect Salem's downtown, schools, residential areas, and recreational spaces. The improvements would also provide stakeholders with the opportunity to review options for addressing deficiencies in the corridor before committing funds to a roadway improvement project. The next steps are to begin project development and seek funding. The City of Salem is encouraged to start collaborating with MassDOT and the Boston Region MPO to initiate projects and secure funding for their design, engineering, and construction.