CENTRAL MASSACHUSETTS

METROPOLITAN PLANNING ORGANIZATION

West Boylston - Boylston - Shrewsbury Route 140 Corridor Profile

December 2018

Document Prepared by:
Staff of the Central Massachusetts Metropolitan Planning Organization
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Central Massachusetts Regional Planning Commission
1 Mercantile Street
Suite 520
Worcester, MA 01608
(508) 756-7717

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One Ashburton Place, 6th floor
Boston, MA 02109
(617) 994-6000
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Table of Contents

List of Figures

List of Tables

1.0 Introduction

1.1 Transportation Management Systems Integration: "Corridor Profile"

A Corridor Profile combines the information produced by the transportation Management Systems along a particular highway corridor, often in multiple host communities, and analyzes performance-based data, suggests both operational and physical improvements, and may identify candidate projects for further study.

Utilizing the range of data and analyses produced by the ongoing transportation Management Systems maintained by the staff of the Central Massachusetts Regional Planning Commission (CMRPC) and overseen by the Central Massachusetts Metropolitan Planning Organization (CMMPO), Corridor Profile efforts allow for comprehensive integration through the consideration of a broad range of key transportation planning factors.

Ultimately, a range of suggested improvement options are compiled for the consideration of the host communities and the Massachusetts Department of Transportation (MassDOT), Highway Division. When local consensus is reached, proposed improvement projects accepted by the community eligible for federal-aid funding have the potential to be selected by the CMMPO for programming in the annual Transportation Improvement Program (TIP) document. At this time, the highly competitive TIP is essentially fully proscribed for the fiscal years 2019 to 2023.

As the Corridor Profile study series has evolved, it has become increasingly multi-modal and intermodal. The Management Systems have also served as the basis for the transition to performance-based planning. Performance-based planning seeks to measure the value of investments made in the nation's transportation infrastructure. Focus areas include reducing congestion, improving pavement, reducing vehicle crashes and, in the spirit of the state's Complete Streets Program, increasing the use of other modes such as transit, bicycling, and walking. The Route 140 Corridor Profile includes the analysis and interpretation of Management System data, including the following:

Traffic Counting: Daily Automatic Traffic Recorder (ATR) counts and MassDOT Highway Division count data.

Congestion Management Process (CMP): Current Travel Time & Delay studies along Route 140; current and future projected peak-hour Turning Movement Counts (TMC) at focus intersections and associated Level of Service (LOS) analyses.

Freight Planning: Peak hour percentages of heavy vehicles utilizing Route 140 focus intersections.

Transportation Safety Planning Program: In-depth vehicle crash research using crash data received from the MassDOT, utilizing a three-year history of reported crashes and subsequent analysis.

Pavement Management System (PMS): Observation of pavement surface distress and extent in the field along with subsequent analysis and calculated Overall Condition Index (OCI).

Bridge Management System (BMS): Bridge condition data available through MassDOT Highway Division; GIS-based inventory of major roadway drainage structures, if any, as well as staff observations in the field.

Depending on local sentiment and available funding, the technical work necessary to compile a Corridor Profile is supplemented by customized public outreach efforts. This can range from basic meetings with local officials to the formation of a Technical Advisory Group to guide the effort. As determined necessary, special meetings can also be held with various stakeholder groups.

1.2 Performance Management

Reaffirmed by the Fixing America's Infrastructure (FAST) Act, the CMMPO is continuing the evolution of the development of performance-driven, multimodal TIP projects. Performance Based Planning & Programming (PBP&P) is intended to improve public transparency, fiscal accountability, and investment decisions affecting the condition and performance of the transportation system.

The CMMPO's evolving Performance Management program includes 18 goals and objectives across ten federal transportation planning emphasis areas. The ten federal emphasis areas are safety, security, state of good repair, congestion, multimodality, GHG/sustainability, equity, economic vitality, stormwater management & resiliency, and travel & tourism. Each goal and objective has corresponding performance metrics that are monitored and progress towards these established goals is reported annually. A Performance Measures Scoresheet was created to assess current and candidate future year TIP projects to determine to what extent they address regional goals. TIP projects that rank high are often projects that can provide substantive measurable outcomes for each goal, thus having increased regional impact.

The findings from this Corridor Profile Report include a list of suggested improvements. Ideally, these suggested improvements will encourage a TIP project that can influence regional

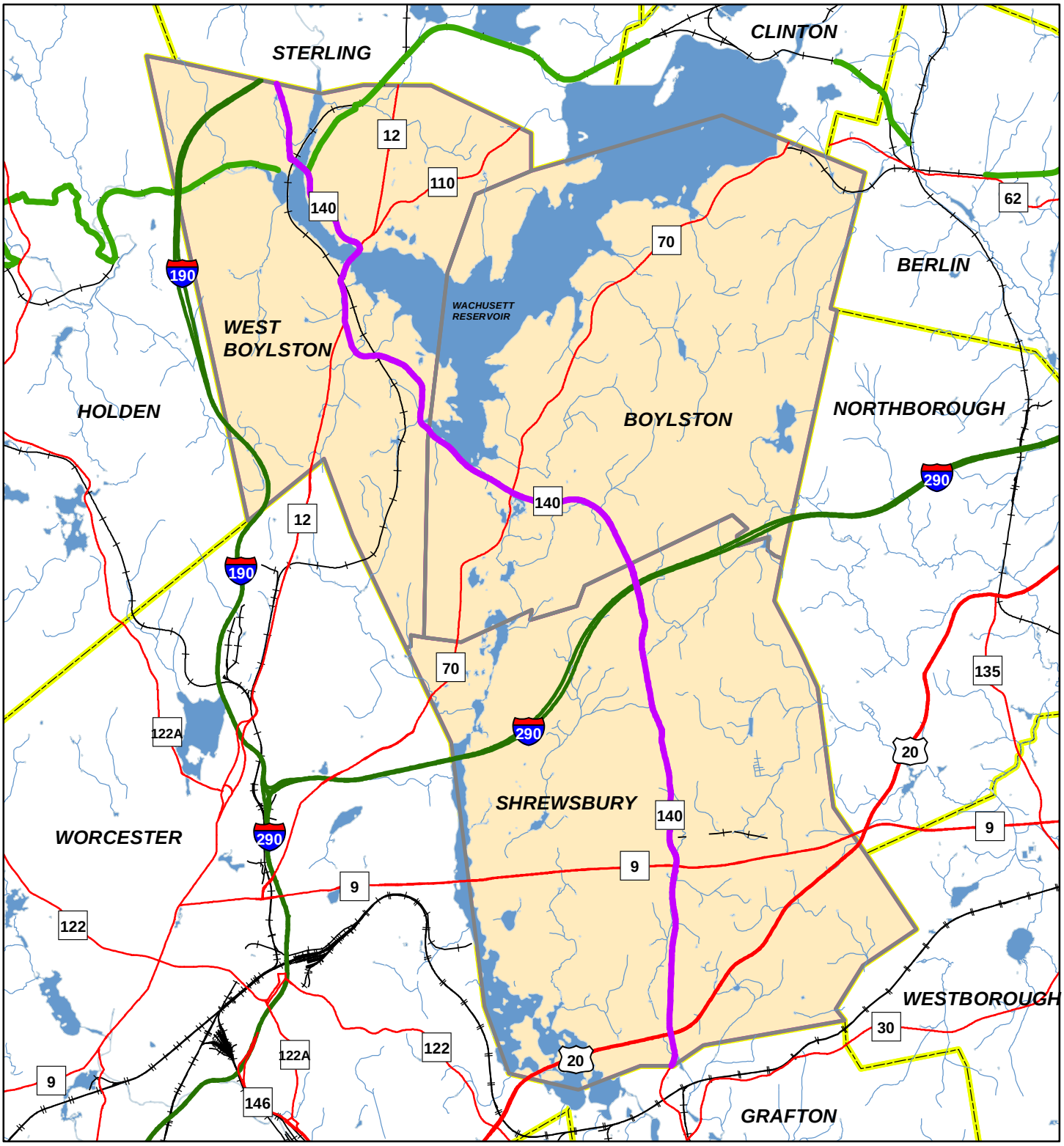
performance. A table integrating the suggested improvements and how they can support the goals and objectives for each federal emphasis area is included in the Overall Findings chapter of this report.

1.3 Route 140 Corridor Profile: West Boylston, Boylston, and Shrewsbury

The Route 140 Corridor Profile was competitively selected by the CMMPO as a worthy candidate to analyze and study. Route 140 is a federal-aid roadway that is eligible for US DOT funding for improvements. Since the corridor is heavily traveled, the goals of this Corridor Profile include improving roadway safety, reducing congestion, preserving and improving roadway pavement, maintaining major bridge and drainage structures as well as determining how to improve the roadway for bicycle and pedestrian accommodations. The Route 140 study corridor is shown in **Figure 1** along with other major aspects of the region's multi-modal transportation network including railroads and long distance trails.

Throughout the Corridor Profile effort, staff communicated and met with various officials from the three host communities involved. In West Boylston, the roadway has a mixture of businesses and residential homes. The Wachusett Reservoir is located in the center of town and the I-190 Interchange (#5) is located at the northern end of the study area, in the town of Sterling. In Boylston, the Wachusett Reservoir is along the western part of town. Between Route 70 and the Shrewsbury town line it is mostly commercial uses with only a few residential houses. A new FedEx distribution facility was built along Route 140 near the Shrewsbury town line. Similar to West Boylston, Shrewsbury also has a mixture of businesses and residential homes. In the northern part of town there is the I-290 Interchange (#23). Routes 9 & 20 travel through the town and intersect with Route 140. Near the Route 20 Interchange area there is a major United Parcel Service (UPS) distribution facility.

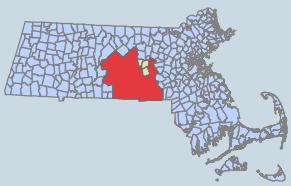
The roadway segments of Route 140 in West Boylston (4.9 miles), Boylston (2.6 miles), and Shrewsbury (5.5 miles) combine for a total length of 13 miles. Route 140 in West Boylston and Shrewsbury is a mix of town and state maintained highway while Boylston is entirely maintained by the town. The MassDOT Roadway Inventory File (RIF) indicates that the right-of-way for Route 140 varies between 40 - 70 feet in width within West Boylston and Shrewsbury and 50 feet in the town of Boylston.

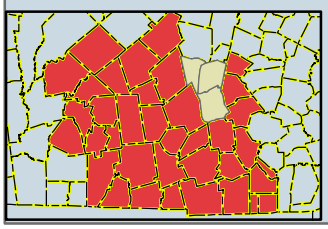


ROUTE 140 CORRIDOR PROFILE

Host Communities of West Boylston, Boylston & Shrewsbury

Figure 1





Legend

- Route 140 Corridor Profile
- Interstate
- U.S. Route
- State Route
- Water
- Railroad
- Mass Central Rail Trail

Miles

0 0.5 1 2 3 4

CMRPC

Central Massachusetts Regional Planning Commission

Source: Data provided by the US Census Bureau, Central Massachsuetts Regional Planning Commission (CMRPC), massDOT Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information MassGIS), Commonwealth of Massachusetts, Information Technology Division.

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1.4 Corridor Profile Work Activities Defined in UPWP

This Corridor Profile effort has been completed as part of a previously CMMPO Endorsed Unified Planning Work Program (UPWP). The following provides an overview of the major tasks that were included within the defined scope of the Route 140 Corridor Profile effort:

- CMRPC coordination on an entire range of Corridor Profile aspects including data collection and analysis.
- Vehicle crash analyses completed using MassDOT-maintained vehicle crash data.
- Completion of an "Environmental Profile" for the entire Route 140 study corridor in West Boylston, Boylston, and Shrewsbury. Consists of GIS-based maps highlighting overlays developed by Department of Conservation & Recreation (DCR), Department of Environmental Protection (DEP), and National Heritage & Endangered Species Program (NHESP).
- Range of suggested improvement options compiled for host community consideration.
- Preparation of report document, complete with color graphics and maps, along with accompanying Technical Appendix.
- Hosting of meetings with host communities involved in study.

1.5 Corridor-Wide Observations & Existing Deficiencies

The following corridor-wide existing deficiencies, also shown in **Figure 2**, were observed along the entire length of the Route 140 study area:

West Boylston

- Signage issues – lack of consistency of warning, speed limit, and regulatory signs. Signs missing at some locations. Areas of sign clutter.
- Pavement maintenance – markings faded or worn out in some areas. Near the Boylston town line the existing pavement condition is below average. Edge drop off and erosion also an observed issue.
- Road geometry – Route 140 is a fairly curvy road is some areas. There are also some fairly steep grades in some locations. Weather and the road geometry are likely factors is some crashes.
- Roadway cross section fairly narrow in West Boylston, especially south of railroad tracks. Boylston has 12' lanes, 8' shoulders compared to fairly narrow widths in West Boylston, which provide minimal bicycle accommodation.
- Bicycle & Pedestrian accommodations – there are biking & walking activities near Old Stone Church and Wachusett Reservoir causeway area. Poor sidewalk conditions at various locations.

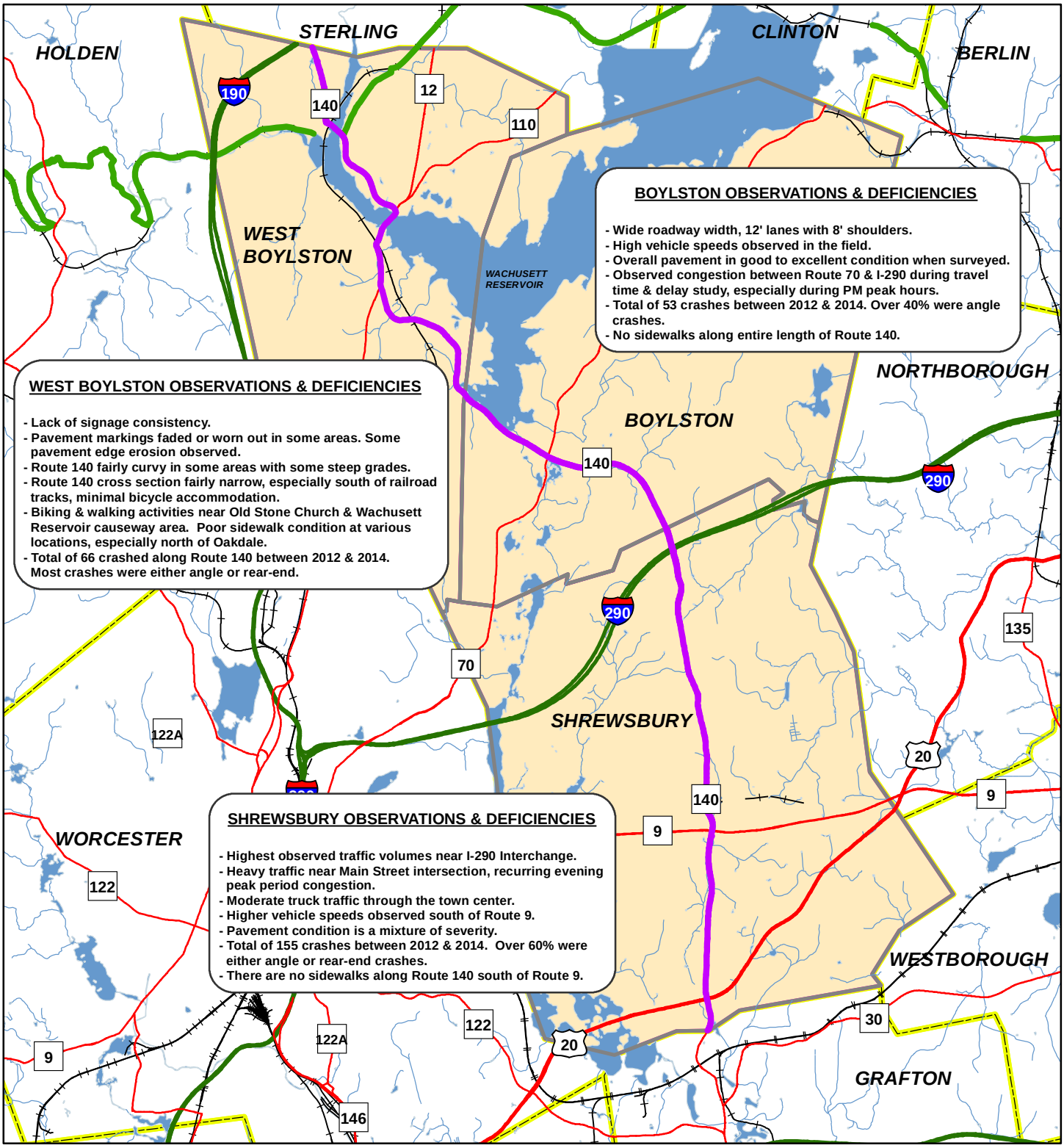
- There were a total of 66 crashes along Route 140 between 2012 and 2014. Most vehicle crashes were either angle or rear-end (over 60%).

Boylston

- Wide roadway width, 12' lanes with 8' shoulders.
- High vehicle speeds observed in the field.
- Overall pavement in good to excellent condition when surveyed.
- During the travel time & delay study, traffic congestion was observed between Route 70 and I-290, especially during PM peak hours.
- There were 53 total crashes between 2012 and 2014. Over 40% were angle crashes.
- There are no sidewalks for the entire length of Route 140 through the town of Boylston.

Shrewsbury

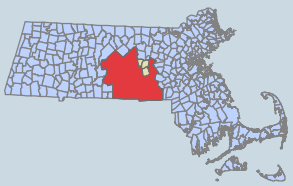
- Highest observed traffic volumes near I-290 Interchange.
- Heavy traffic near Main Street intersection, recurring evening peak period congestion.
- Moderate truck traffic through the town connecting to other major routes.
- Higher vehicle speeds observed in the field south of Route 9.
- Half of the pavement is in either good or excellent condition while the remaining pavement was observed to be in fair or poor condition.
- There were 155 (most of the three corridor host communities) total crashes between 2012 and 2014. Over 60% were either angle or rear-end crashes.
- There are no sidewalks along Route 140 south of Route 9 all the way to the Grafton town line.

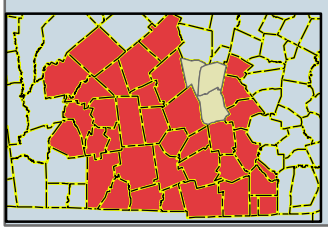


ROUTE 140 CORRIDOR PROFILE

Corridor-Wide Observations & Deficiencies

Figure 2





Legend

- Route 140 Corridor Profile
- Interstate
- U.S. Route
- State Route
- Water
- Railroad
- Mass Central Rail Trail

0 0.5 1 2 3 4 Miles

CMRPC Central Massachusetts Regional Planning Commission

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1.6 Town of West Boylston Site-Specific Observations & Existing Deficiencies

The following site-specific existing deficiencies, also shown in **Figures 3 and 4**, were observed along the West Boylston segment of the Route 140 study corridor:

Route 140/Laurel Street Intersection

- Obstructed sight lines exiting Laurel Street, especially looking north.
- Minimal delays for Laurel Street approach.
- Sidewalks narrow, no ADA ramps.
- Awkward positioning of Stop sign and bar.

Route 140/Route 12 Intersection

- Recently resurfaced as part of a Transportation Improvement Project (TIP) that addressed roadway drainage into Wachusett Reservoir. DCR was the project proponent.
- Poor level-of-service for the Route 140 approach to the Stop sign during the PM peak hour.

Route 140/Route 12/Central Street Intersection

- Second highest crash total for a study intersection in West Boylston. Also Highway Safety Improvement Program (HSIP) eligible.
- Travel & turning lanes are overall somewhat narrow, most >11' in width.
- The opposing Route 12 NB & SB left turn lanes are not optimally aligned.
- Existing pedestrian phase signal equipment appears to be corroded and could be a candidate for replacement and upgrades.
- Wheelchair ramps exist; connectivity with sidewalks is limited. Existing sidewalks are fairly narrow and need to be reconstructed & widened.
- The intersection has marked shoulders of insufficient width (~1') for bicycle accommodation.
- Right turns into Church Street, which bisects this location, are permissible on each side of the intersection. Vehicles are prohibited from entering the Route 12/Route 140 intersection from each Church Street approach.
- Route 12 northbound approach recently paved, no more rutting or wheel path deterioration is evident.
- The Route 12/Route 140 southbound left turn to the Route 140 southbound departure lane is somewhat narrow, just under 11' in width. Further, vehicles from Route 12 northbound making a right turn to Route 140 southbound using the curved, channelized turn lane, need to be cautious of Route 140 flows.

- Route 140 northbound vehicle queues have been observed to measure approximately one-half mile during the evening peak travel period at 4:00 PM.
- Route 140 northbound left turning maneuver to Route 12 southbound is difficult, due to sharp turn angle; requires large trucks to cross opposing travel lanes.
- Route 140 northbound transition of this approach to the alignment of the Route 12/140 northbound departure lane has a somewhat poor transition area; observed to be potentially confusing for those unfamiliar with location.
- The Central Street transition of the right turn lane approach to the alignment of the Route 12 southbound departure lane has a poor transition area. Further, the Central Street exclusive right turn lane is fairly narrow 10'-5".
- The Central Street right turn movement from the southbound Route 12/140 approach to Central Street southbound is prohibited. Avoiding this turning restriction, traffic uses the private driveway of the church as a cut-through route. As the church accommodates a nursery school parking lot, this unauthorized usage need to be curtailed.
- Traffic signals – because of the substandard geometry of this intersection, the traffic signal heads are at odd angles and can potentially confuse drivers as to which signals are for which intersection approach.
- Lane use is somewhat confusing because of acute roadway geometry. Frequent "near misses" of Route 140 SB and Route 12 NB traffic observed in field.
- Pedestrian accommodations – Limited; crosswalk by Honey Farms not signal controlled. Observations showed pedestrians cross when they want or are simply able to.
- Intersection recently resurfaced and restriped (June 2018). Other minor improvements also implemented, including ADA ramp upgrades.

Route 12/Franklin Street Intersection

- Prior, town officials considered making Franklin Street one-way from Route 12 to Route 140. This is meant to address crash issues involving vehicles from Franklin Street attempting to cross or turn onto Route 12.
- Slight grade on the westbound Franklin Street approach.
- Poor level-of-service for "Stop" sign controlled Franklin Street approaches, especially during the evening peak travel period.
- Highest number of crashes (18) at an intersection in West Boylston. Also Highway Safety Improvement Program (HSIP) eligible.

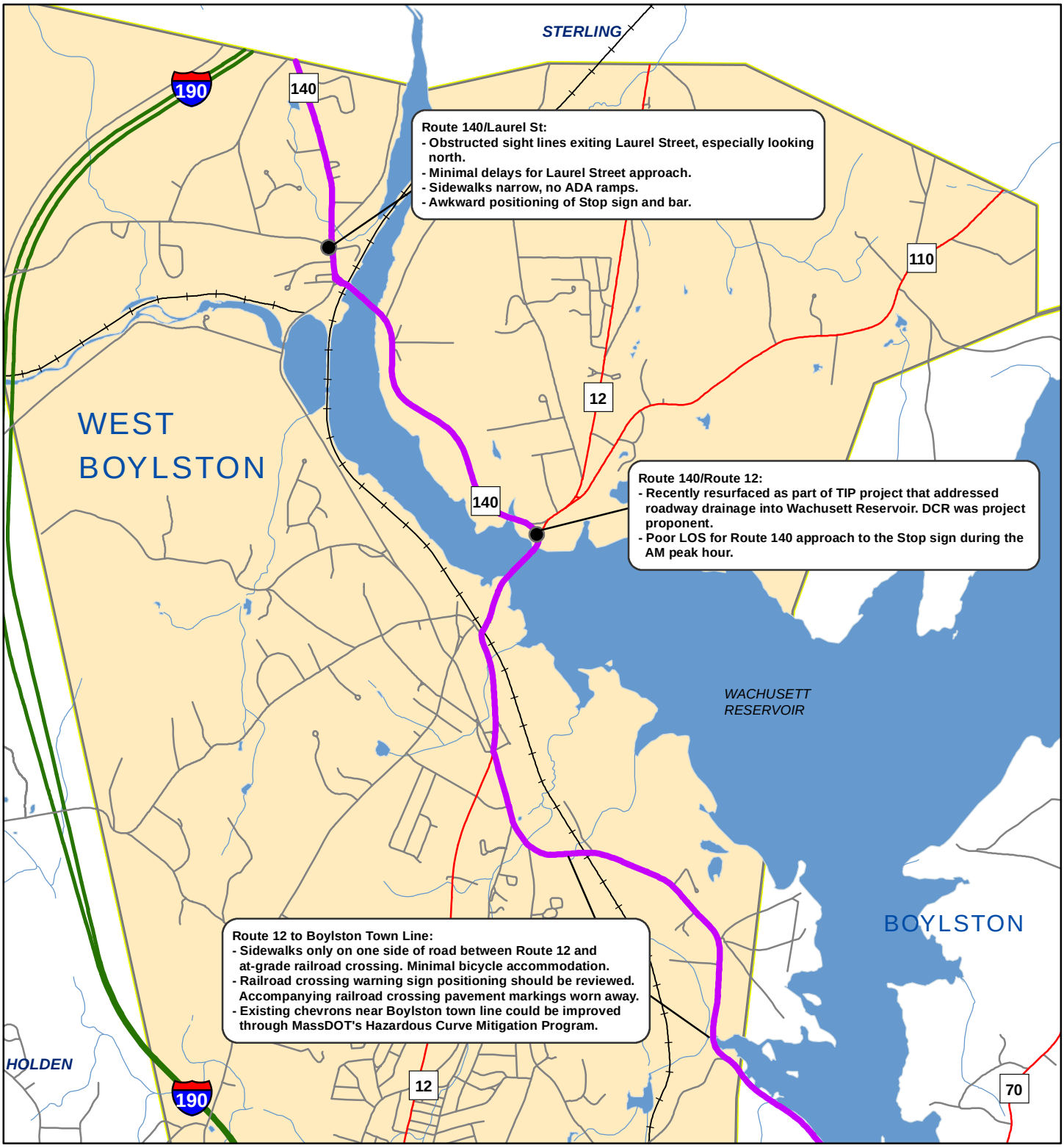
Route 140/Franklin Street Intersection

- Increased volume of traffic observed turning at this intersection.

- Franklin Street used as a cut-through to Route 12 to avoid left turn at signalized Route 12/Route 140 intersection.
- Only one reported crash at this location between 2012 and 2014.
- Minimal delays for the Franklin Street approach.
- Franklin Street approach fairly narrow, minimal shoulders for bicycle accommodation. Sidewalks provided along entirety of northern side of Franklin Street. On southern side, sidewalk provided between Freedom Village apartments and Route 140.

Other Route 140 Locations

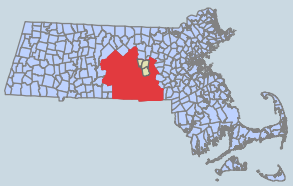
- Sidewalks provided on one side of road from Route 12 to just north of at-grade railroad crossing. Narrow shoulder provides minimal bicycle accommodations.
- Railroad crossing yellow circle warning sign positioning should be reviewed. Accompanying railroad crossing pavement markings worn away.
- Existing chevrons near the Boylston town line could be supplemented through installation of new improved warning signage, part of MassDOT's Hazardous Curve Mitigation program.

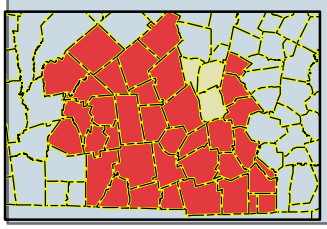


ROUTE 140 CORRIDOR PROFILE

West Boylston Site-Specific Observations & Deficiencies

Figure 3





Legend

- Route 140 CP
- Interstate
- State Route
- Roads
- Streams
- Water Bodies
- Railroad

0 0.2 0.4 0.8 1.2 1.6 Miles

CMRPC
Central Massachusetts Regional Planning Commission

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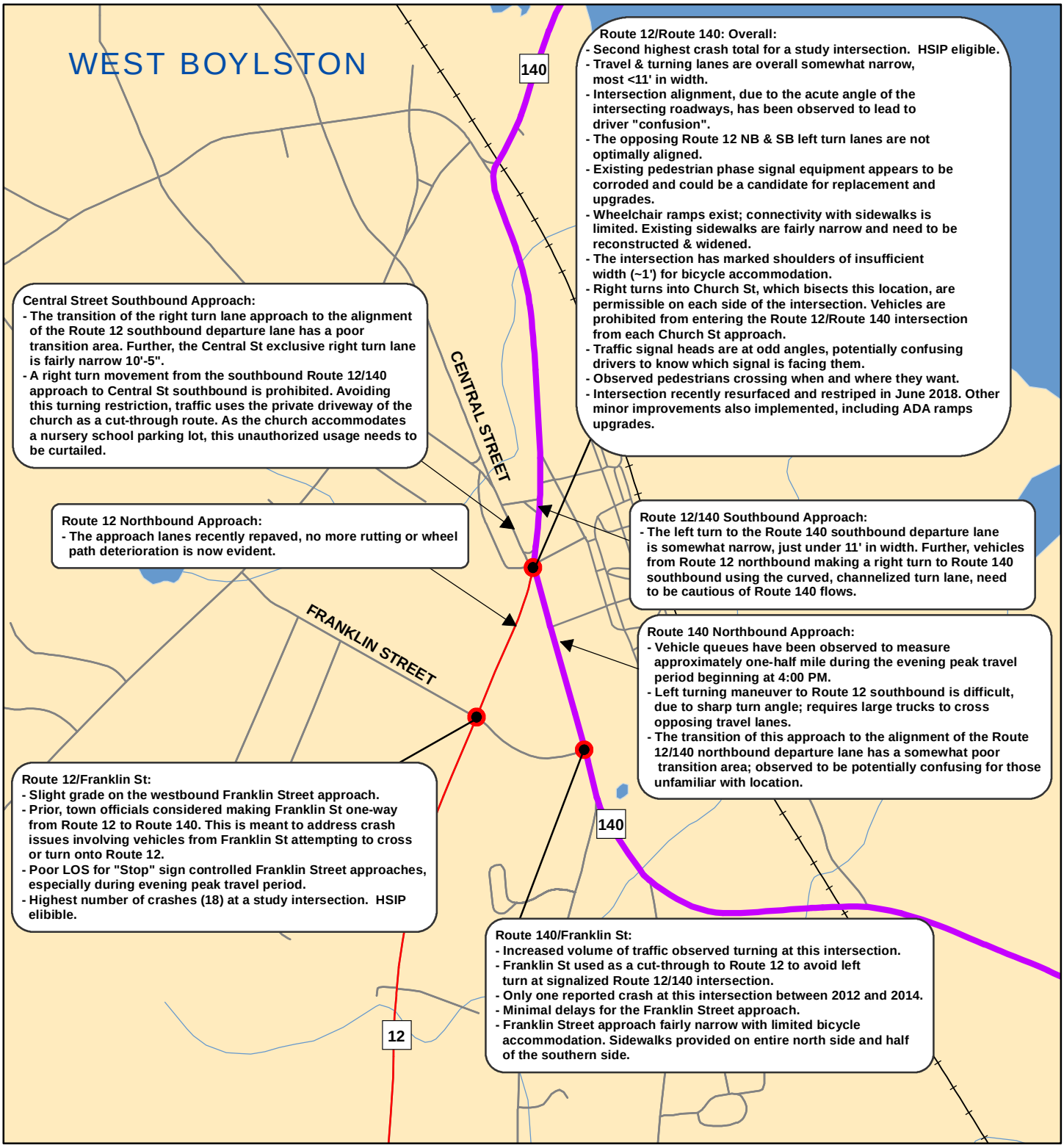
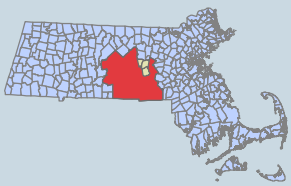
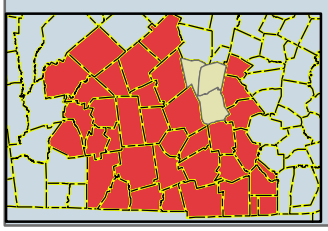


ROUTE 140 CORRIDOR PROFILE

West Boylston Observations & Deficiencies
Route 12/Route 140/Central Street
Figure 4





Legend

- Route 140 CP
- State Route
- Streams
- Roads
- Railroad
- Water Bodies

0 0.05 0.1 0.2 0.3 0.4 Miles

CMRPC
Central Massachusetts Regional Planning Commission

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1.7 Town of Boylston Site-Specific Observations & Existing Deficiencies

The following site-specific deficiencies, also shown in **Figure 5**, were observed along the Boylston segment of the Route 140 study corridor:

Route 140/Route 70 Intersection

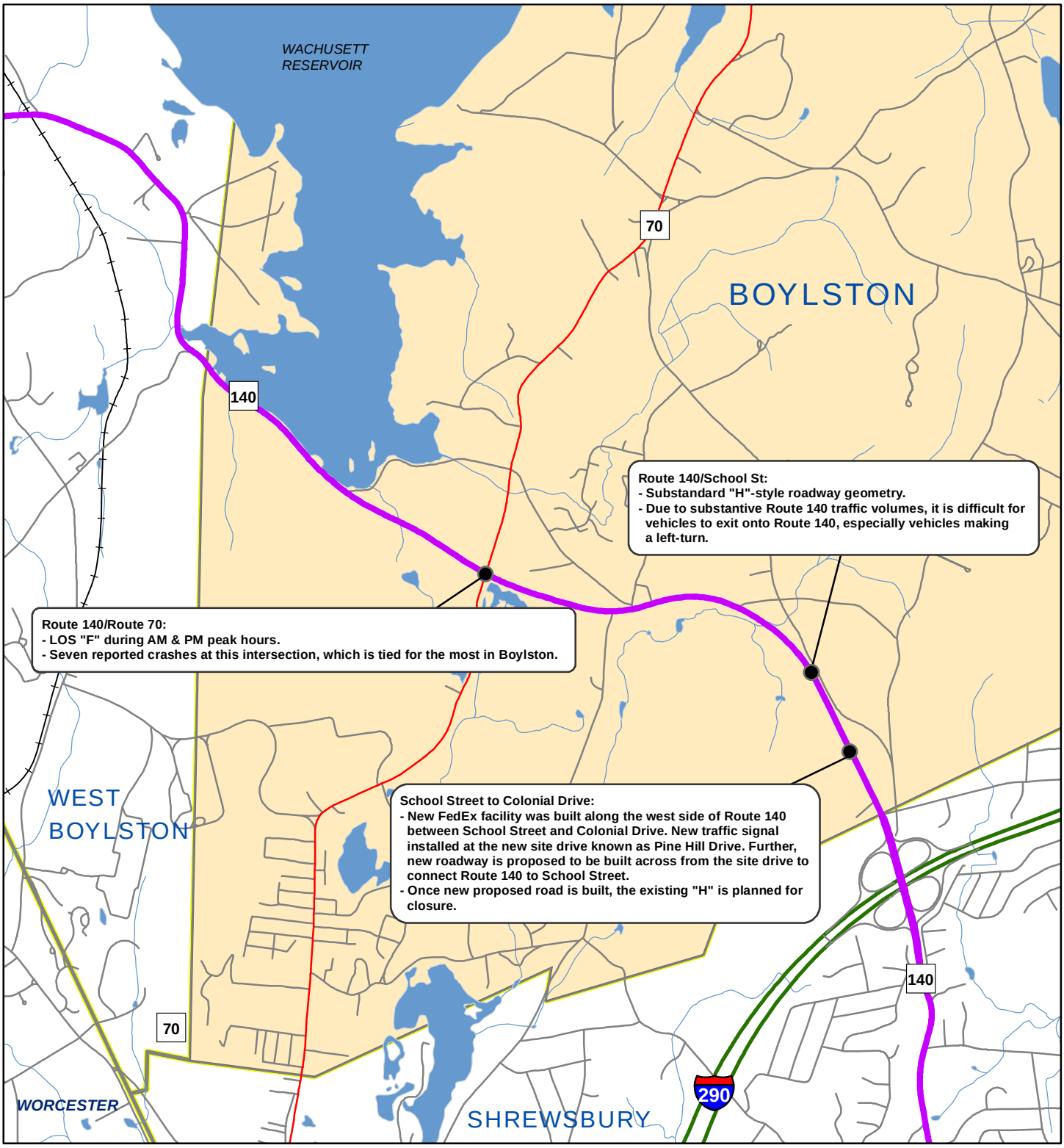
- Level-of-service "F" during AM & PM peak hours.
- Seven reported crashes at this location, which is tied for the most at an intersection in the town of Boylston.

Route 140/School Street Intersection

- Substandard "H"-style roadway geometry.
- Due to substantive Route 140 traffic volumes, it is difficult for vehicles to exit onto Route 140, especially for vehicles making a left-turn.

Other Route 140 Locations

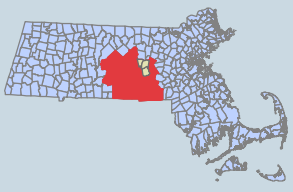
- There is a new FedEx facility that has been built along the west side of Route 140 between School Street and Colonial Drive. There is a new traffic signal at the FedEx site drive known as Pine Hill Drive. Further, a new roadway is proposed to be built across from the FedEx site drive to connect Route 140 to School Street.
- With construction of Pine Hill Drive, between Route 140 and School Street, the existing "H" is proposed for closure.

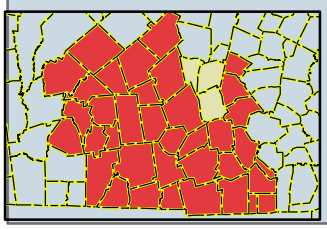


ROUTE 140 CORRIDOR PROFILE

Boylston Site-Specific Observations & Deficiencies

Figure 5





Legend

- Route 140 CP
- Interstate
- State Route
- Roads
- Streams
- Water Bodies
- Railroad

0 0.15 0.3 0.6 0.9 1.2 Miles

CMRPC
Central Massachusetts Regional Planning Commission

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1.8 Town of Shrewsbury Site-Specific Observations & Existing Deficiencies

The following site-specific deficiencies, also shown in **Figure 6**, were observed along the Shrewsbury segment of the Route 140 study corridor:

Route 140/Prospect Street Intersection

- Difficult for Prospect Street exiting vehicles to turn left on Route 140 southbound during both morning and evening peak periods.

Route 140/Main Street Intersection

- Heavy observed traffic volumes.
- Poor level-of-service for AM & PM peak periods.
- Highest number of crashes (27) along Route 140 segment in host community of Shrewsbury. Considered a crash cluster, this location is eligible for Highway Safety Improvement Program (HSIP) funding.

Route 140/Lake Street Intersection

- Fairly recent installation of signalized control. Minimal delays observed for Route 140 peak hour traffic volumes.

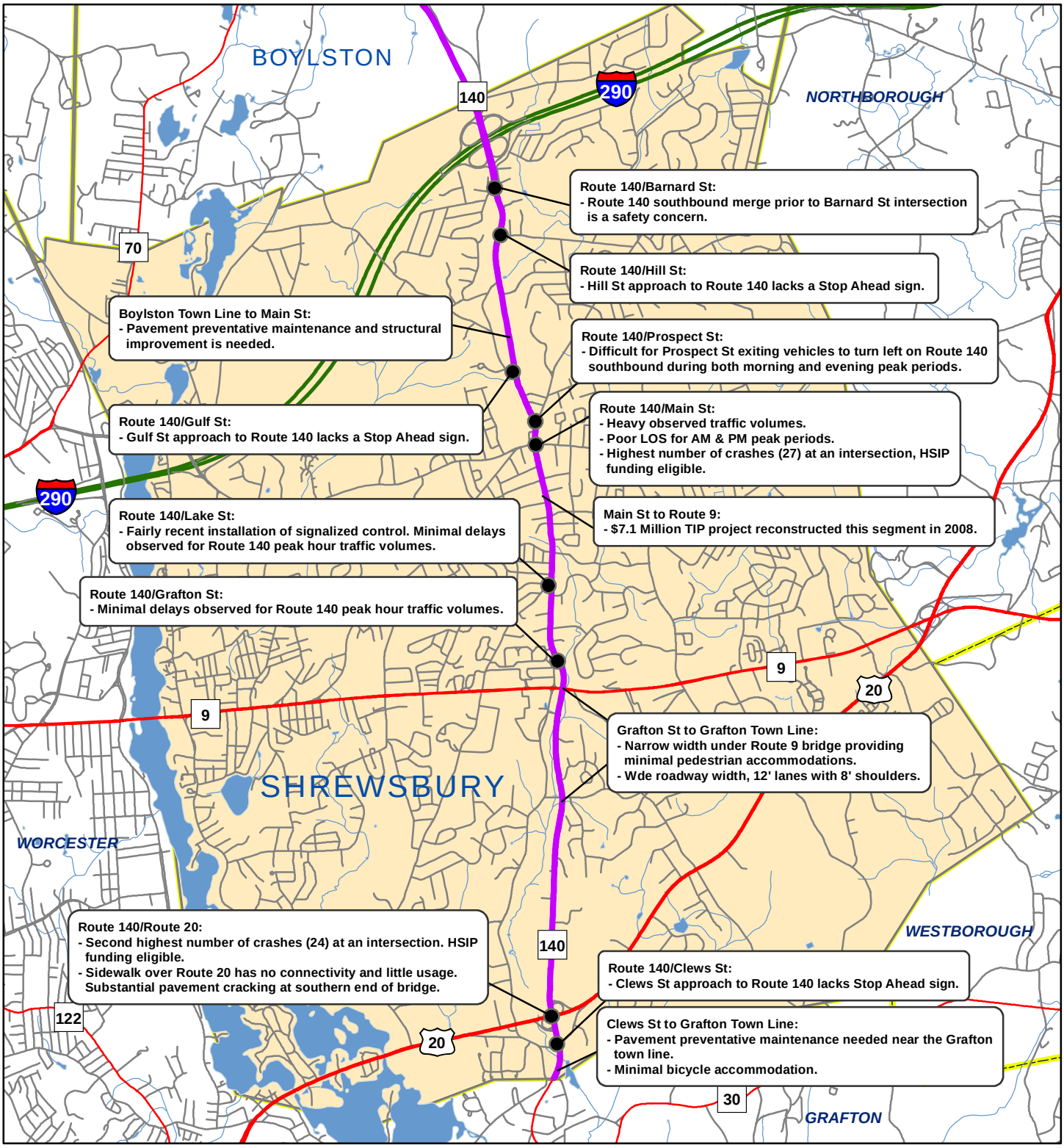
Route 140/Grafton Street Intersection

- Minimal delays observed for Route 140 peak hour traffic volumes.

Other Route 140 Locations

- The Route 20/Route 140 intersection has the second highest number of crashes (24) in the town of Shrewsbury. This intersection is also eligible for Highway Safety Improvement Program (HSIP) funding.
- $7.1 Million TIP projected reconstructed the segment of Route 140 between Main Street and Route 9 in 2008.
- Wide roadway width, 12' lanes with 8' shoulders south of Route 9.
- Narrow width under Route 9 bridge providing minimal pedestrian accommodations.
- Based on observations in the field, pavement preventative maintenance is needed near the Grafton town line.
- Sidewalk on Route 140 bridge over Route 20 has no connectivity (little usage). Substantial pavement cracking on Route 140 at southern end of bridge.
- Clews Street approach to Route 140 lacks a Stop Ahead sign.
- Minimal bicycle accommodation on Route 140 south of Route 20 to Clews Street.

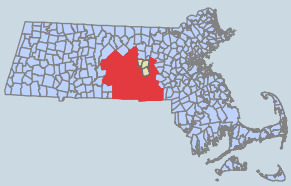
- Based on observations in the field, pavement preventative maintenance and structural improvement is needed between Main Street and the Boylston town line.
- Gulf Street approach to Route 140 lacks a Stop Ahead sign.
- Hill Street approach to Route 140 lacks a Stop Ahead sign.
- Route 140 southbound merge prior to Barnard Street intersection is a safety concern.

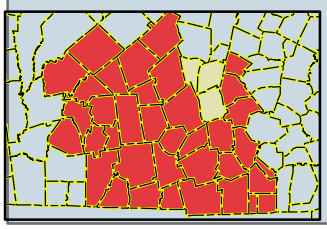


ROUTE 140 CORRIDOR PROFILE

Shrewsbury Site-Specific Observations & Deficiencies

Figure 6





Legend

- Route 140 CP
- Interstate
- U.S. Route
- State Route
- Streams
- Water Bodies
- Roads

Miles

0 0.25 0.5 1 1.5 2

CMRPC
Central Massachusetts Regional Planning Commission

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2.0 Route 140 Environs

2.1 Natural Environment

Major features of the natural environment were also identified as part of the Route 140 Corridor Profile effort and were used to create Environmental Profile maps for this study area. Such maps are included in many Corridor Profile Reports and allows the user to view major environmental systems beyond the corridor study area that have impacts on such things as drainage, water quality and wildlife migration.

The following Environmental Profile Maps for the Route 140 Corridor study include environmental features such as vernal pools, wetlands, impaired waters and wellhead protection areas. Vernal pools are small, shallow ponds characterized by lack of fish and by periods of dryness. Wetlands are areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods of time during the year. Under the Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waterways. These are waters that are too polluted or otherwise degraded to meet the water quality standards set by states, territories, or authorized tribes. The law requires that these jurisdictions establish priority rankings for waters on the lists and develop a Total Maximum Daily Load (TMDL) for these waters. A TMDL is a calculation of the maximum amount of pollutant that a waterbody can receive and still safely meet water quality standards. A wellhead protection area is that area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated. These maps of the study area showing major environmental features were compiled from the following key resources.

Department of Conservation and Recreation (DCR)

The mission of DCR is to protect, promote and enhance our common wealth of natural, cultural and recreational resources. Geographic Data layers are managed by divisions within DCR.

- **Division of State Parks and Recreation -**This division protects land and resources on privately and municipally held land through technical assistance, grant and planning programs, policy development, and other services.
- **Forest Stewardship Program -** This non-regulatory program is designed to help landowners protect the inherent ecosystem values of their forest.
- **Division of Water Supply Protection -** Manages and protects the drinking water supply watersheds for Greater Boston.

Department of Environmental Protection (DEP)

MassDEP is responsible for ensuring clean air and water, safe management and recycling of solid and hazardous wastes, timely cleanup of hazardous waste sites and spills, and the preservation of wetlands and coastal resources. It includes:

- **Division of Watershed Management (DWM)**
- **Watershed Planning Program (WPP) -** Contaminated water eliminates drinking water supplies, degrades our recreational water resources and destroys wildlife habitat. Water that does not soak into the ground is called runoff. Proper manure management and runoff management will protect or improve water quality in any community and watershed. Geographic data layers are from an integrated list from DWM and WPP and include:

  - ***Impaired Waterways (typically due to phosphorous, metals, and pathogens from sewage and farming's use of manure as well as other contaminants)***
  - ***Impaired Waterbodies***
  - ***Monitored Waterways***
  - ***Zone II (Wellhead Protection Areas)***

- **Bureau of Resource Protection (BRP) -** The Wetlands Protection Act protects wetlands and the public interests they serve, including flood control, prevention of pollution and storm damage, and protection of public and private water supplies, groundwater supply, fisheries, land containing shellfish, and wildlife habitat. These public interests are protected by requiring a careful review of proposed work that may alter wetlands or buffer zones.

National Heritage & Endangered Species Program (NHESP)

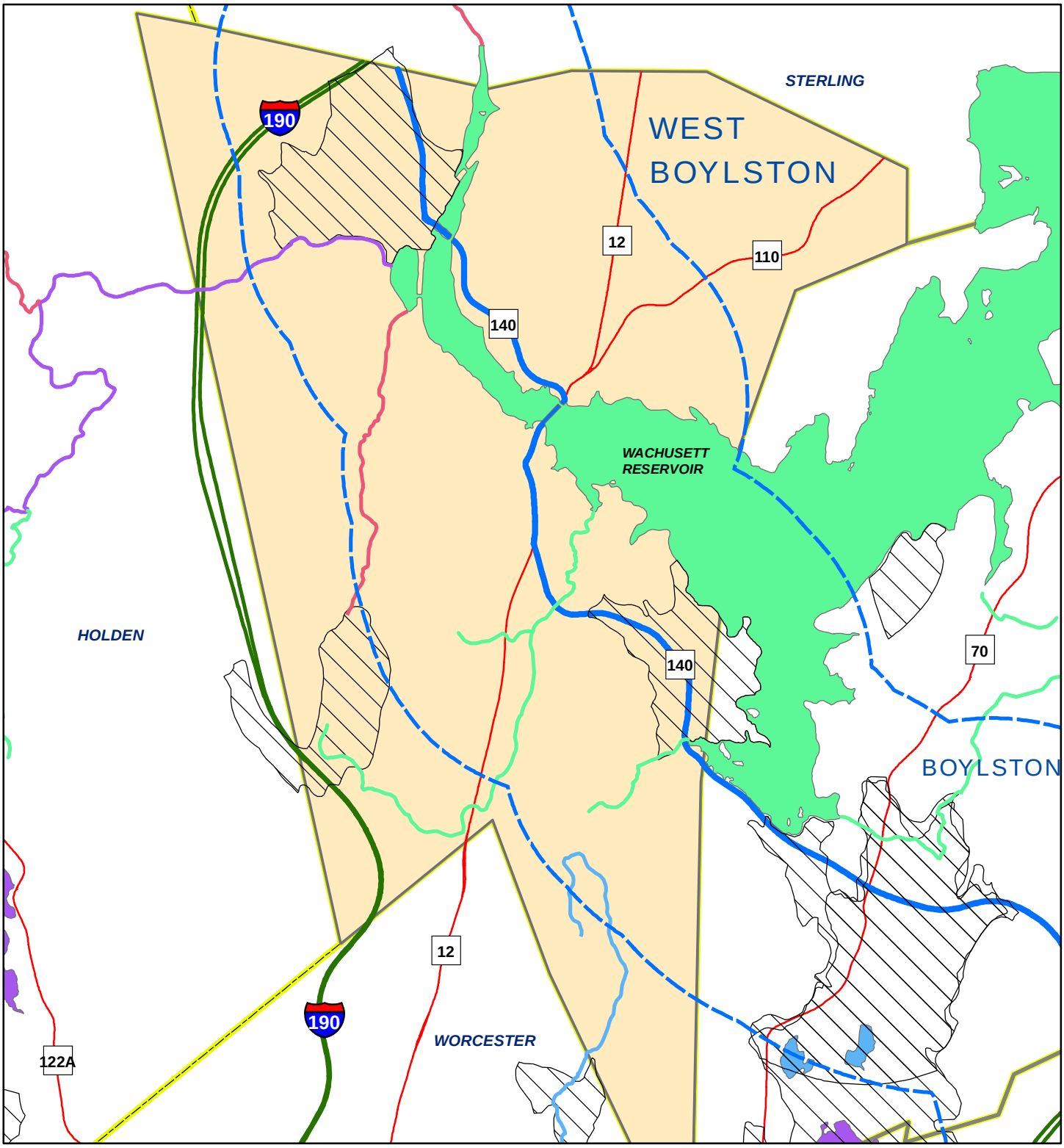
The overall goal of the NHESP is the protection of the state's wide range of native biological diversity. NHESP is responsible for the conservation and protection of hundreds of species that are not hunted, fished, trapped, or commercially harvested in the state. Available geographic data layers include:

- **Certified Vernal Pools**
- **Potential Vernal Pools**
- **BioMap Core Habitat** - This depicts the most viable habitats for rare species in Massachusetts.

- **BioMap Supporting Natural Landscape**
- **Priority Habitats of Rare Species** – These are the geographical extents of habitat for all state-listed rare species, both plants and animals. They are officially used under the Massachusetts Endangered Species Act (MESA).

Impaired Waterways and Wellhead Protection Areas

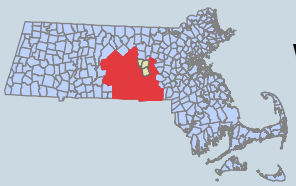
Figures 7 through 9 show impaired waterways and wellhead protection areas in the study area. In West Boylston, the Wachusett Reservoir requires a TMDL. There are also two wellhead protections areas in the vicinity of Route 140, one near the Sterling town line and the other at the Boylston town line. The Wachusett Reservoir is also the major water body in the town of Boylston. Besides the wellhead protection area near the West Boylston town line there is a large wellhead protection area around Route 70 that continues south into Shrewsbury. In Shrewsbury, there is only a small portion of Lake Quinsigamond that is close to Route 140 near the Grafton town line. There are no wellhead protection areas along Route 140, but a large area just to the west near Route 70.

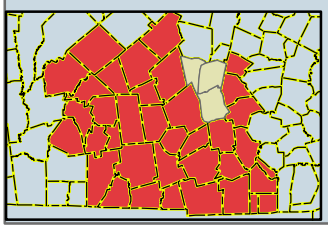


ROUTE 140 CORRIDOR PROFILE

West Boylston Impaired Waters & Wellhead Protection Areas

Figure 7





Legend

- Route 140 CP
- Interstate
- State Route
- Route 140 1-Mi Buffer Zone
- DEP Aproved Zone II's

Water Body (Rivers, Lakes and Ponds) Category

- 2 Attaining Some Uses
- 3 No Uses Assessed
- 4A TMDL is Completed
- 4C Impairment not Caused by a Pollutant
- 5 Waters Requiring a TMDL

0 0.275 0.55 1.1 1.65 2.2 Miles

CMRPC

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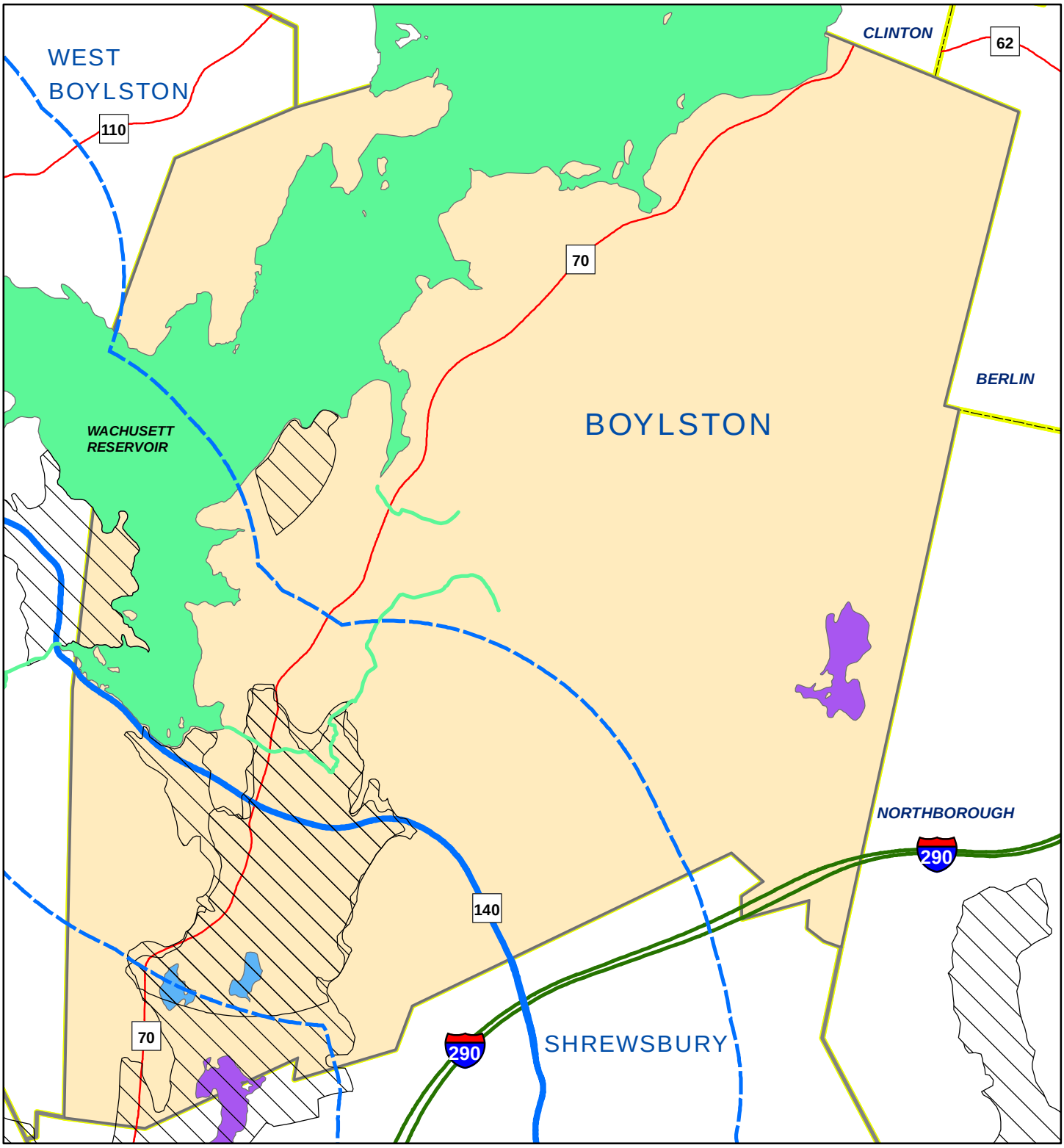
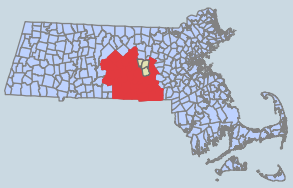
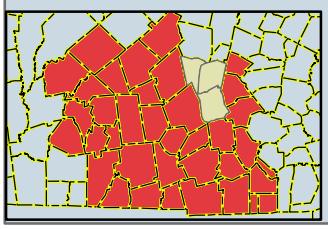


ROUTE 140 CORRIDOR PROFILE

Boylston Impaired Waters & Wellhead Protection Areas

Figure 8





Legend

- Route 140 CP
- Interstate
- State Route
- Route 140 1-Mi Buffer Zone
- DEP Aproved Zone II's

Water Body (Rivers, Lakes and Ponds) Category

- 2 Attaining Some Uses
- 3 No Uses Assessed
- 4A TMDL is Completed
- 4C Impairment not Caused by a Pollutant
- 5 Waters Requiring a TMDL

0 0.25 0.5 1 1.5 2 Miles

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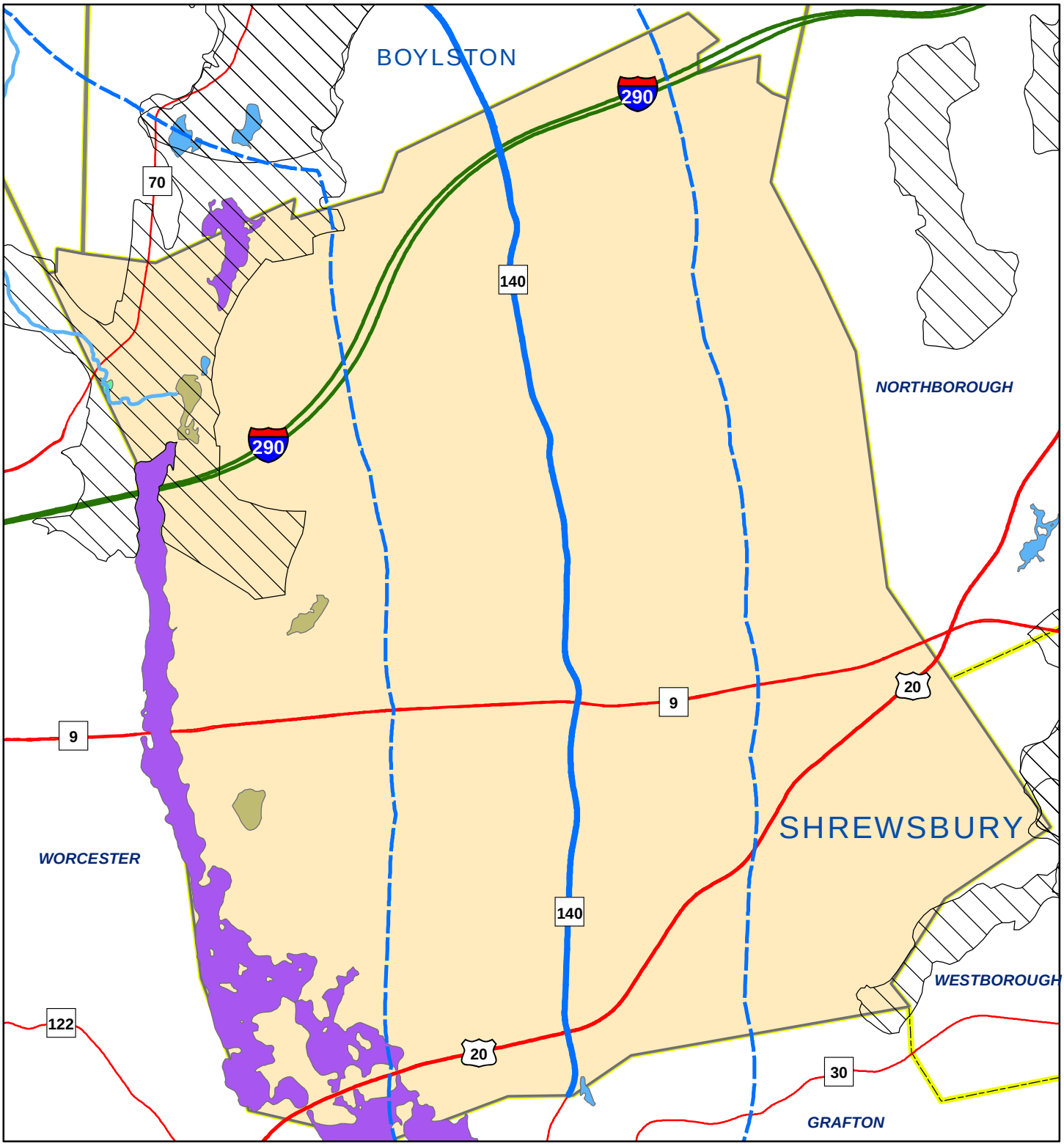
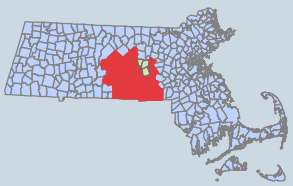
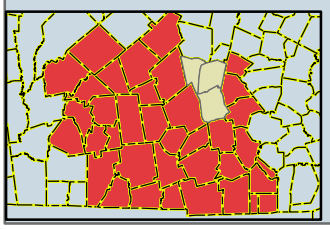


ROUTE 140 CORRIDOR PROFILE

Shrewsbury Impaired Waters & Wellhead Protection Areas

Figure 9





Legend

- Route 140 CP
- Interstate
- U.S. Route
- State Route
- Route 140 1-Mi Buffer Zone
- DEP Aproved Zone II's

Water Body (Rivers, Lakes and Ponds) Category

- 2 Attaining Some Uses
- 3 No Uses Assessed
- 4A TMDL is Completed
- 4C Impairment not Caused by a Pollutant
- 5 Waters Requiring a TMDL

0 0.25 0.5 1 1.5 2 Miles

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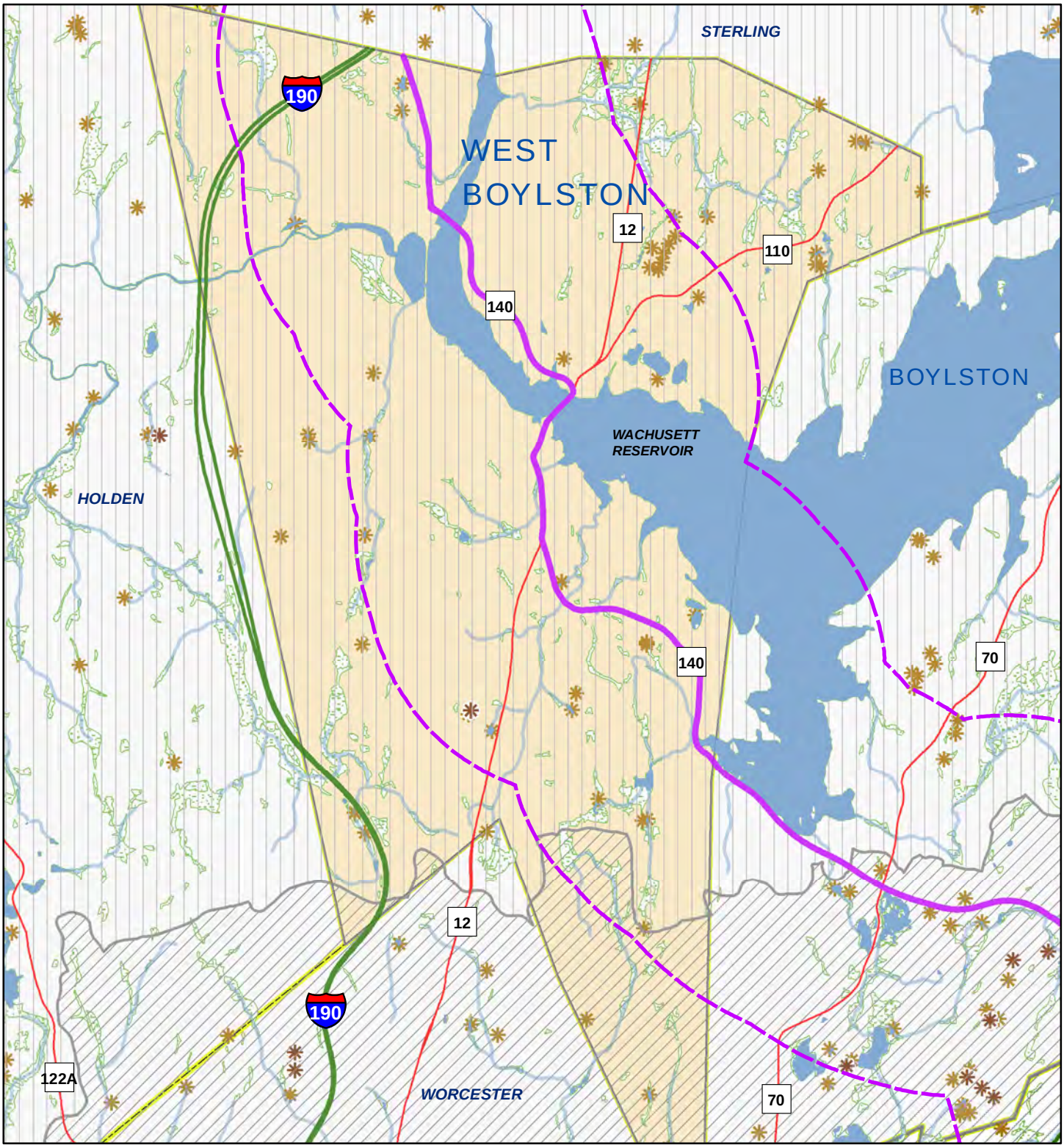
Major Watershed Areas, Vernal Pools, and Wetlands

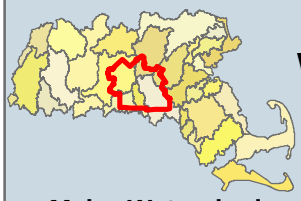
Next, **Figures 10 through 12** show major watershed areas, vernal pools, and wetlands within the Route 140 study area. In West Boylston, the entire length of Route 140 is within the Nashua River Watershed. There are a few wetlands around the southern intersection of Route 12 and also a few near the Sterling town line. There are a few potential vernal pools near Route 140, but there are no certified vernal pools. In Boylston, half of Route 140 is within the Nashua River Watershed and the other half is within the Blackstone River Watershed. There are some wetlands around Spruce Pond and Sewall Brook and there are also a few certified and potential vernal pools, mainly to the east of Route 70. Route 140 in Shrewsbury is mainly within the Blackstone River Watershed, but a small section is within the Concord River Watershed. There are some small wetlands scattered throughout the Route 140 corridor and also a few potential and certified vernal pools. Further study would be needed to investigate the types of species that inhabit the wetlands and vernal pools in this study, and if any of the proposed improvements would be detrimental to their existence.



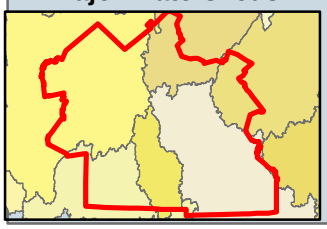
ROUTE 140 CORRIDOR PROFILE

West Boylston Major Watersheds, Vernal Pools & Wetlands

Figure 10



Major Watersheds



Legend

- Route 140 CP
- Route 140 1-Mi Buffer Zone
- NHESP Certified Vernal Pools
- Potential Vernal Pools
- DEP Wetlands (Jan. 2009)
- Blackstone River Watershed
- Nashua River Watershed
- Streams
- Water Bodies

0 0.275 0.55 1.1 1.65 2.2 Miles

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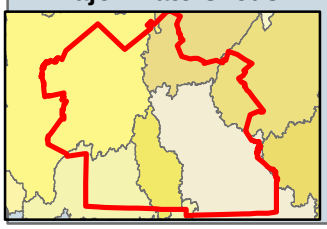
ROUTE 140 CORRIDOR PROFILE

Boylston Major Watersheds, Vernal Pools & Wetlands

Figure 11

Major Watersheds



Legend

- Route 140 CP
- Route 140 1-Mi Buffer Zone
- Streams
- Water Bodies
- NHESP Certified Vernal Pools
- Potential Vernal Pools
- DEP Wetlands (Jan. 2009)
- Blackstone River Watershed
- Nashua River Watershed
- Concord River Watershed

0 0.25 0.5 1 1.5 2 Miles

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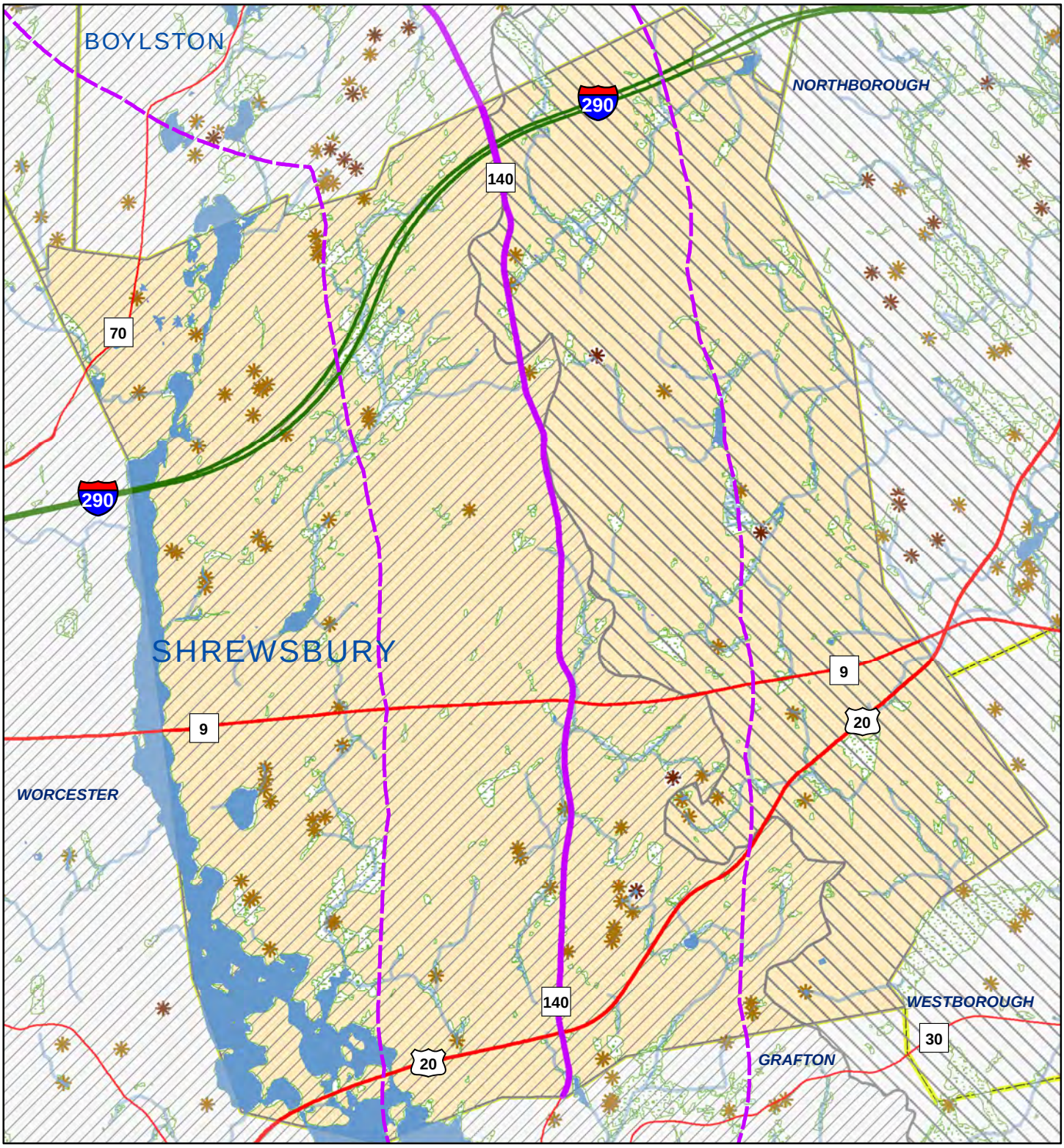
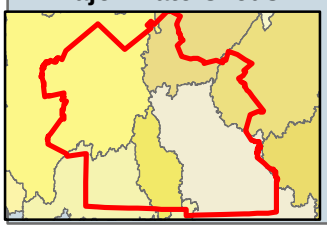


ROUTE 140 CORRIDOR PROFILE

Shrewsbury Major Watersheds, Vernal Pools & Wetlands

Figure 12

Major Watersheds



Legend

- Route 140 CP
- Route 140 1-Mi Buffer Zone
- Streams
- Water Bodies
- NHESP Certified Vernal Pools
- DEP Wetlands (Jan. 2009)
- Blackstone River Watershed
- Concord River Watershed
- Potential Vernal Pools

Miles

0 0.25 0.5 1 1.5 2

C M R P C
Central Massachusetts Regional Planning Commission

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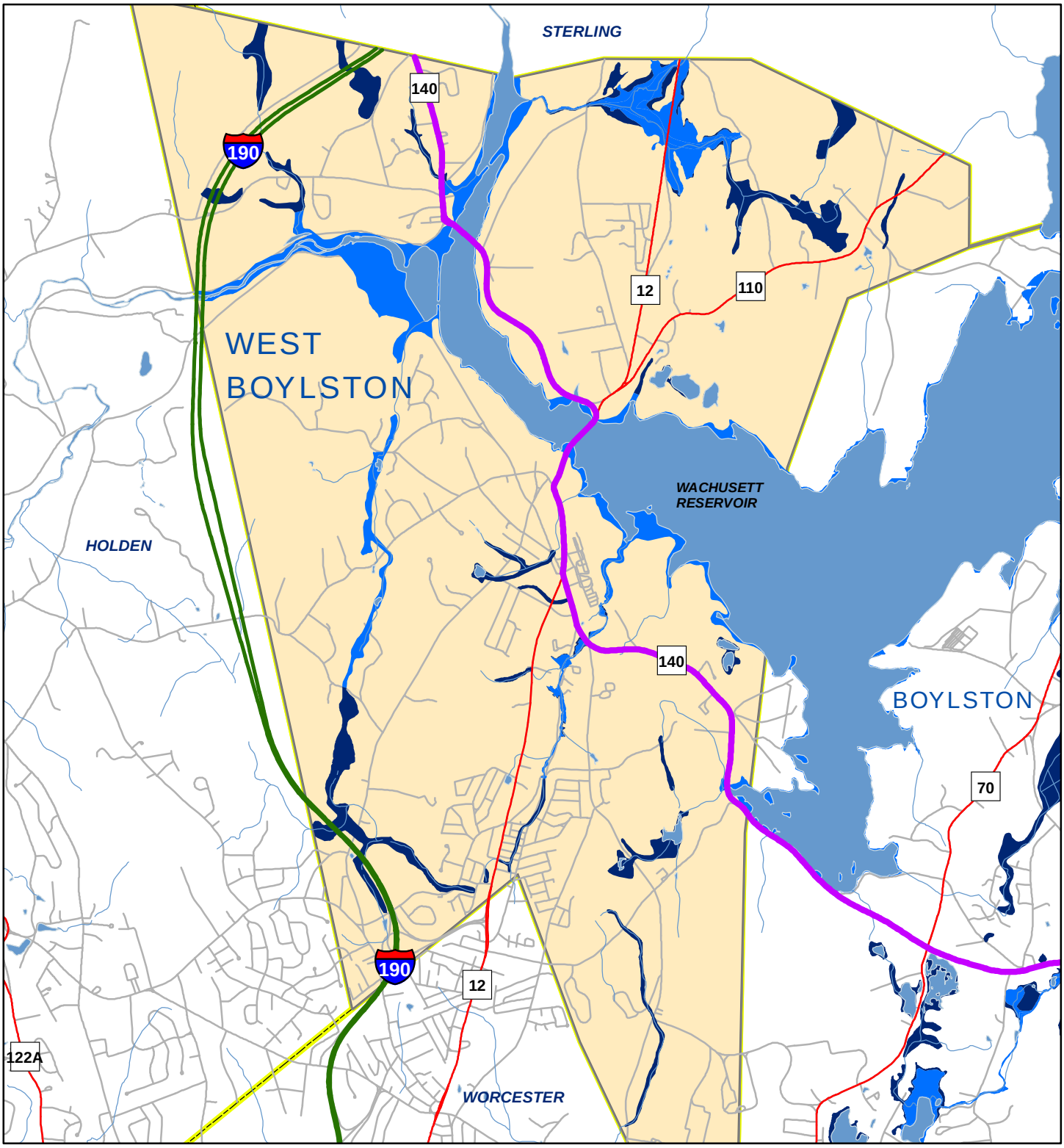
2.2 Flood Zones

Figures 13 through 15 show the 100 and 500 year flood zone near the study area. The 100 year flood zone means that there is a one percent annual chance of a flood within that defined area. The 500 year flood zone means that there is a 0.2 percent annual chance for a flood. The closer something is to the flooding source (e.g. river, stream, pond, etc.) the greater the risk of flooding. Flood zones can also be used to calculate flood insurance rates for homes and businesses.

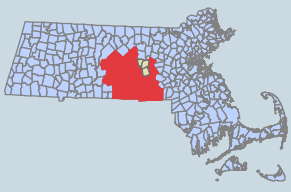
In West Boylston, the area around the Wachusett Reservoir is within a 100 year flood zone. There is another 100 year flood zone near the Quinapoxet River, just to the west of Route 140 near River Road. Also, there are a few small 500 year flood zones near the Sterling town line and Central Street and Franklin Street. In Boylston, there are 100 year flood zones around the Wachusett Reservoir and also Spruce Pond. Further, there are 500 year flood zones near Sewall Brook. In Shrewsbury, there are 100 year flood zones along West Brook, Rawson Hill Brook, and Big Bummet Brook. The 500 year flood zones are also around Big Bummet Brook, located just to the east of Route 140, in the vicinity of Route 9.

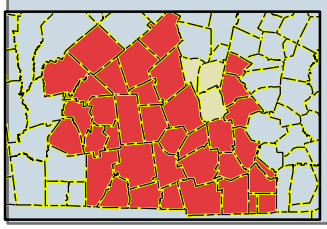


ROUTE 140 CORRIDOR PROFILE

West Boylston Flood Zones

Figure 13





Legend

- Route 140 CP
- Interstate
- State Route
- Roads
- Streams
- Water Bodies
- 100 Year Flood Zone
- 500 Year Flood Zone

Miles

0 0.225 0.45 0.9 1.35 1.8

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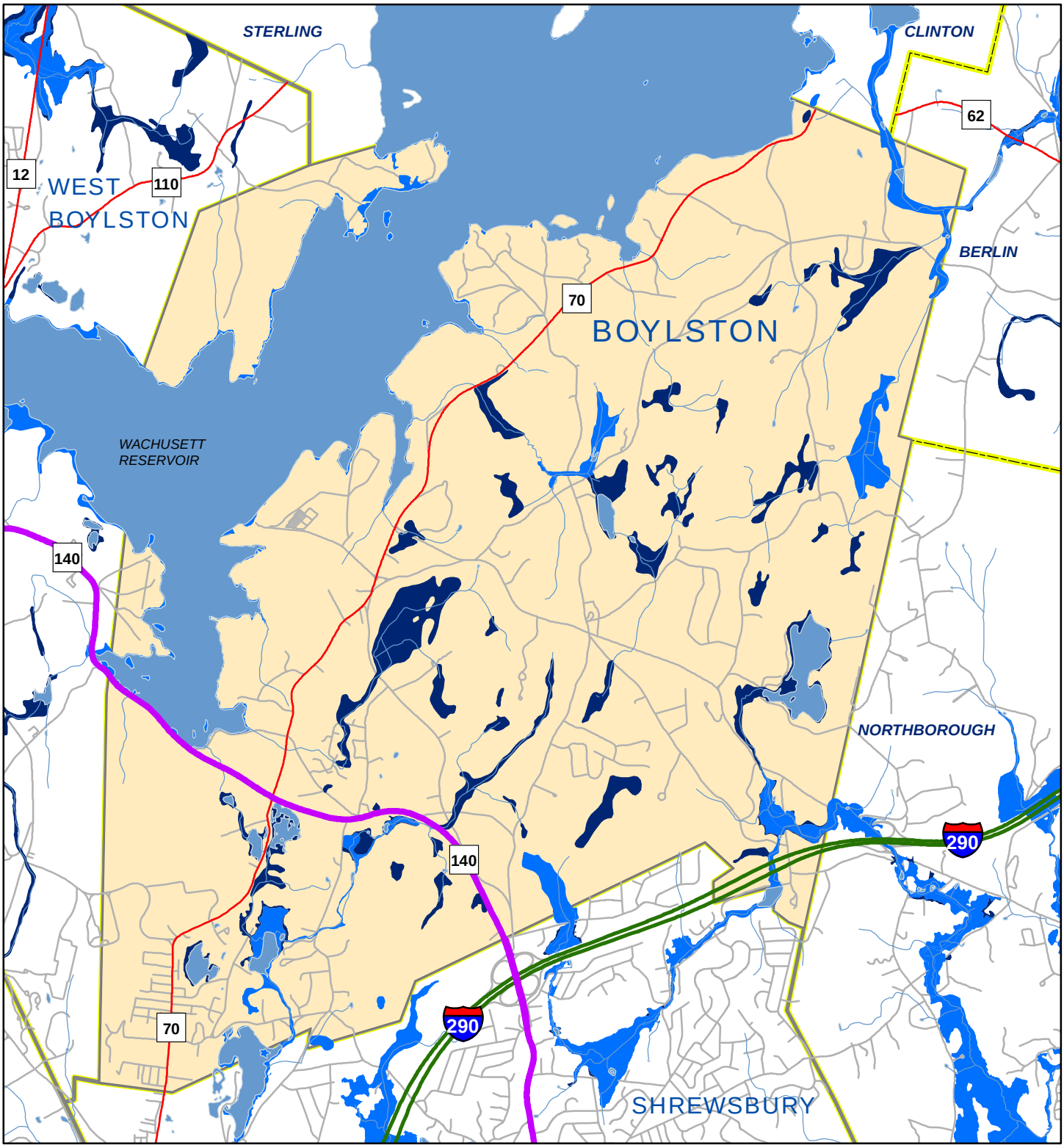
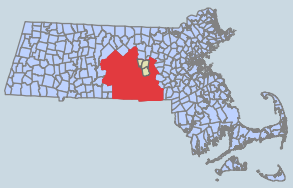
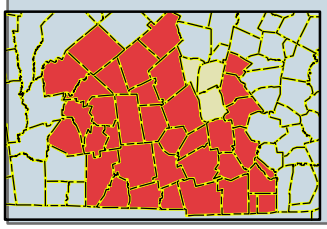


ROUTE 140 CORRIDOR PROFILE

Boylston Flood Zones

Figure 14





Legend

- Route 140 CP
- Interstate
- State Route
- Roads
- Streams
- Water Bodies
- 100 Year Flood Zone
- 500 Year Flood Zone

Miles

0 0.25 0.5 1 1.5 2

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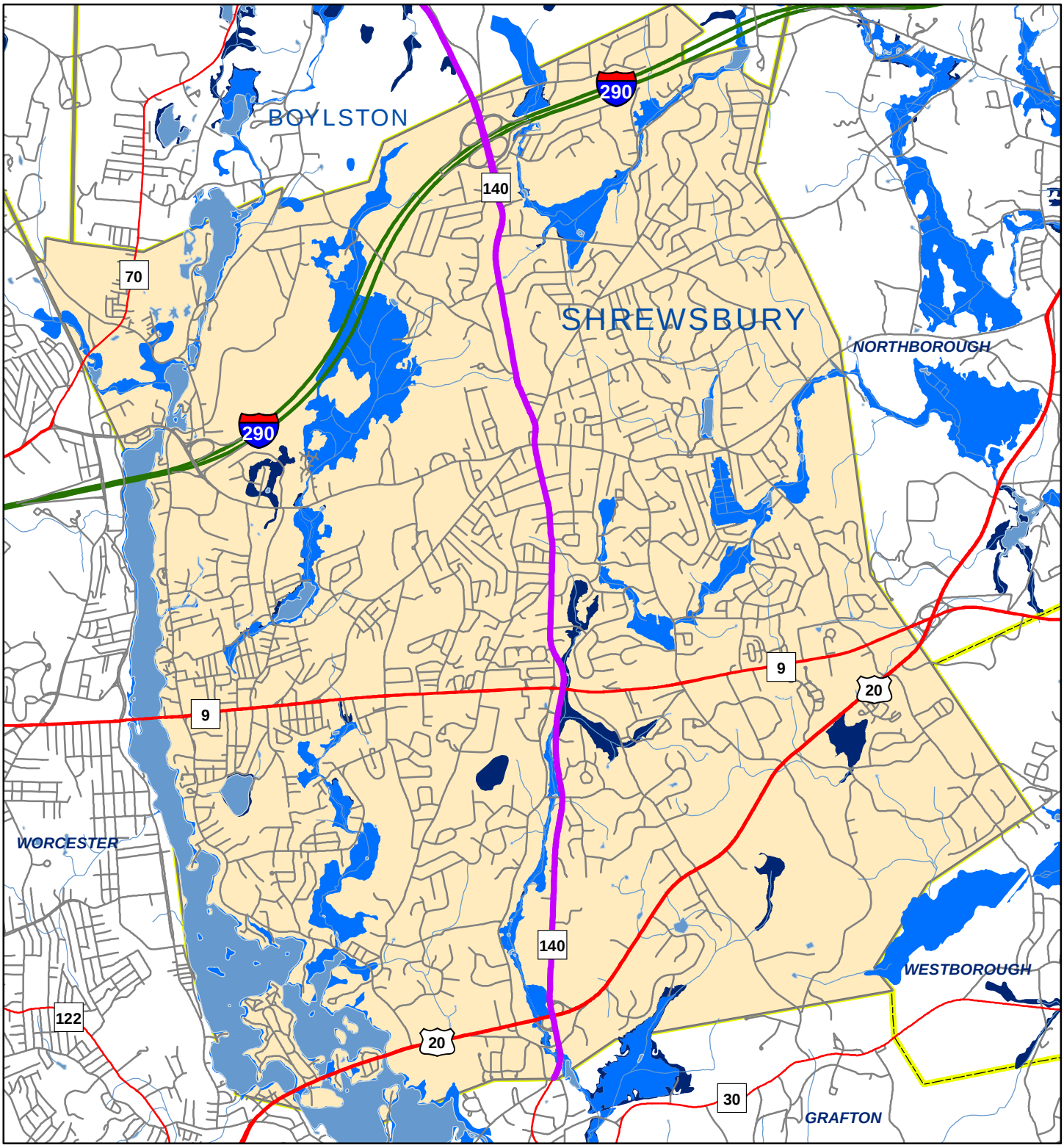
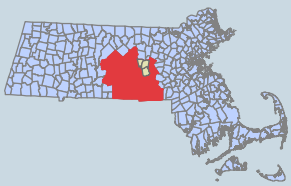
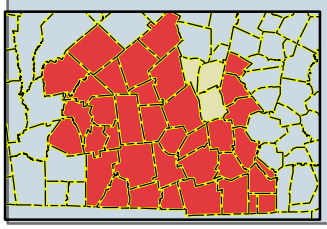


ROUTE 140 CORRIDOR PROFILE

Shrewsbury Flood Zones

Figure 15





Legend

- Route 140 CP
- Interstate
- U.S. Route
- State Route
- Roads
- Streams
- Water Bodies
- 100 Year Flood Zone
- 500 Year Flood Zone

Miles

0 0.25 0.5 1 1.5 2

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2.3 Route 140 Major Drainage Structures

Using the previously described Environmental Profile maps compiled for this study using DCR, DEP and NHESP data, the major water features intersecting the roadway were identified through a GIS analysis. This mapping exercise allowed for the identification of major stream crossings along Route 140 through each town. **Figures 16, 17 and 18** show the location of each identified major water crossing, denoted by a red pentagon symbol. Inside each pentagon is a number corresponding to the major drainage structures observed in each Route 140 host community.

Staff then conducted a field visit to locate and observe the various drainage structures along Route 140. In total, 12 distinct structures were reviewed: 5 in West Boylston, 3 in Boylston and 4 in Shrewsbury. Accompanying the graphics, **Table 1** summarizes key information about each of the major drainage structures surveyed in the field. This information includes: pipe material and diameter, general condition, estimated pipe length, field observations, and any additional notes.

A majority of the observed structures are either in fair or good condition, along with a couple in excellent condition and one in poor condition. Most structures observed were made of concrete and square is shape. The culvert sizes are mainly two to four feet wide, although there is one major culvert in the town of Shrewsbury that is nine feet wide. Other noted field observation include: overgrown vegetation, some culvert blockage, erosion around structures, and noted wildlife activity.

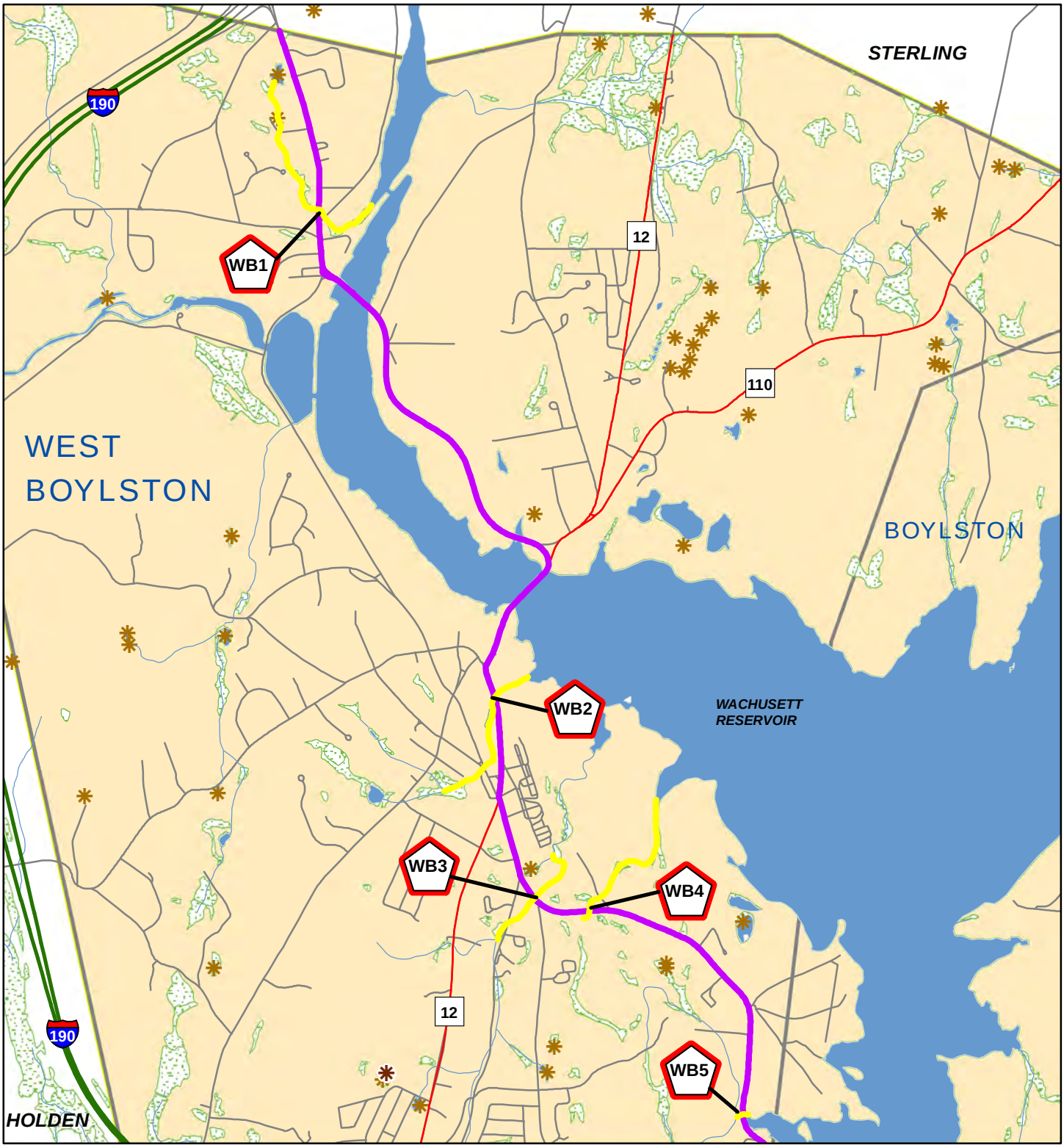
Following **Table 1** are **Figures 19, 20 and 21** which show photos taken in the field of various major drainage structures in each host community. As can be seen from the photos, many unique drainage structures exist along Route 140. There is no standard design in each of the towns and some are aged and in need of eventual modernization/replacement.

Based on the observations made in the field, the following provides a brief listing of specific maintenance and improvement options that target the Route 140 drainage structures observed in the field:

- Prohibit dumping of yard waste, leaves, grass clippings, etc. in flow areas.
- Regularly inspect & clean.
- Clear trash, vegetation, branches and other blockages.
- Inspect for adverse wildlife activity, ex. animal nests, beaver dams.
- As appropriate, maintain passage for aquatic & land animals.

- Install safety fencing where needed.
- Institute a planned, prioritized reconstruction program for improved or replaced structures.
- Consider participation in UMass-Amherst “River and Stream Continuity Project”. This project surveys, assesses, and prioritizes road-stream crossing structures for replacement.

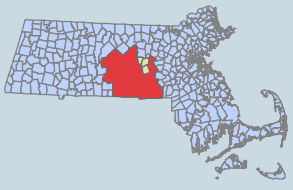
In addition, MassDEP has a Culvert Replacement Municipal Assistance Grant Program for communities. Information about this program can be found on the MassDEP Website. Currently, this year’s deadline for project submittal has past, as the deadline was April 2018. Through this program a community can only apply for one culvert project as there are limited funds available. The total anticipated funding for this year was $750,000. Awarded funds may range from $25,000 to $200,000, depending on phase and work proposed.

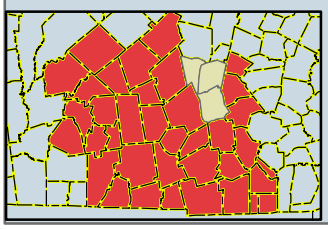


ROUTE 140 CORRIDOR PROFILE

West Boylston Major Drainage Structures

Figure 16





Legend

- Route 140 Corridor Profile
- Interstate
- State Route
- Streams
- Streams Intersecting Rt 140
- Drainage structures
- NHESP Certified Vernal Pools
- Potential Vernal Pools
- Water Bodies
- DEP Wetlands (Jan. 2009)

Miles

0 0.15 0.3 0.6 0.9 1.2

CMRPC

Source: Data provided by the US Census Bureau, Central Massachsuetts Regional Planning Commission (CMRPC), massDOT Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information MassGIS), Commonwealth of Massachusetts, Information Technology Division.

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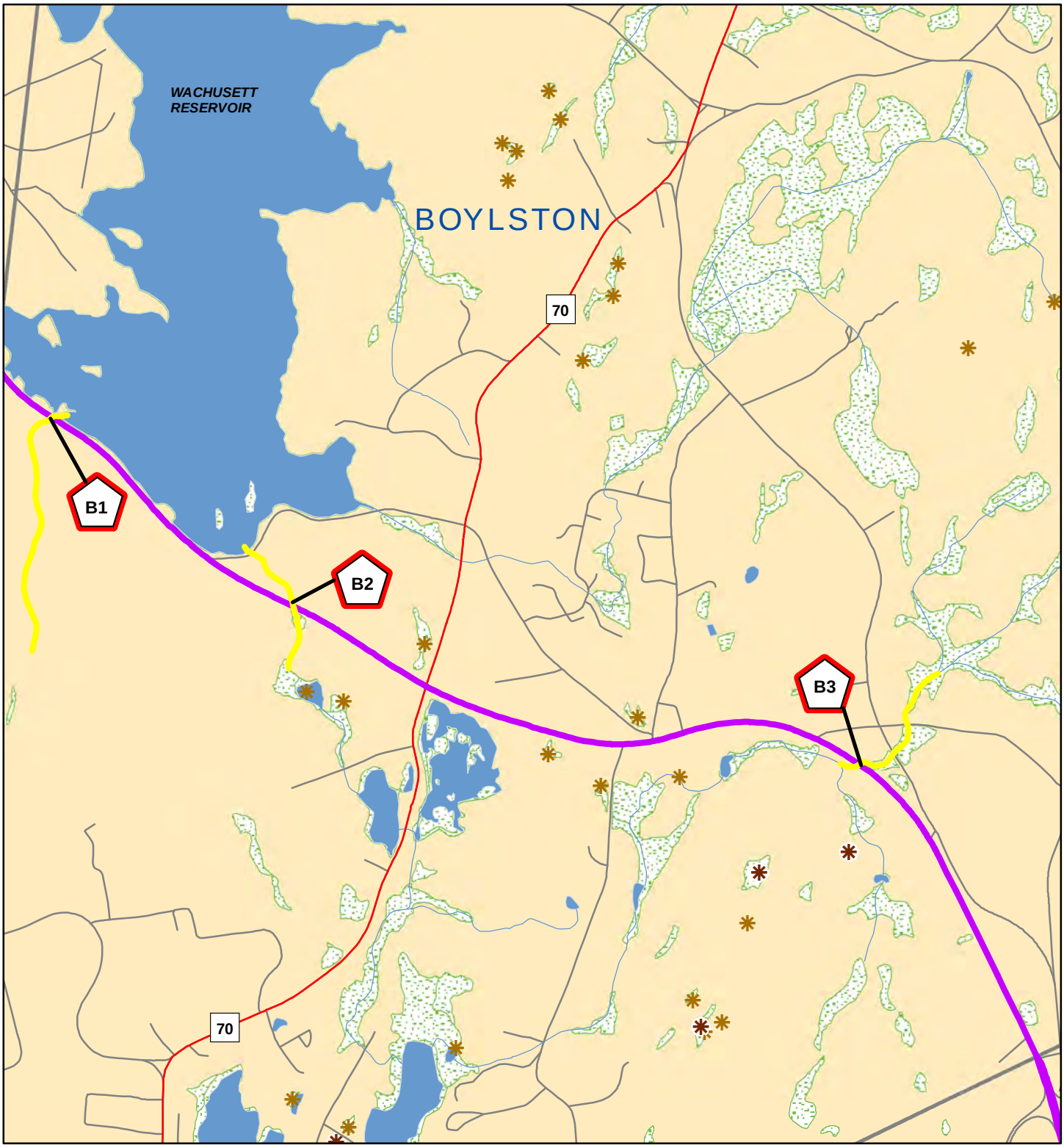
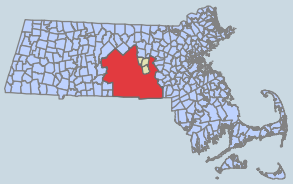
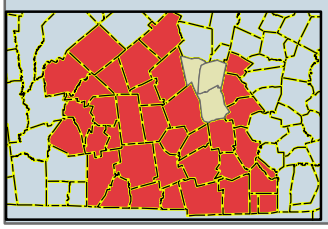


ROUTE 140 CORRIDOR PROFILE

Boylston Major Drainage Structures

Figure 17





Legend

- Route 140 Corridor Profile
- Interstate
- State Route
- Streams
- Streams Intersecting Rt 140
- Drainage structures
- NHESP Certified Vernal Pools
- Potential Vernal Pools
- Water Bodies
- DEP Wetlands (Jan. 2009)

Miles

0 0.1 0.2 0.4 0.6 0.8

CMRPC

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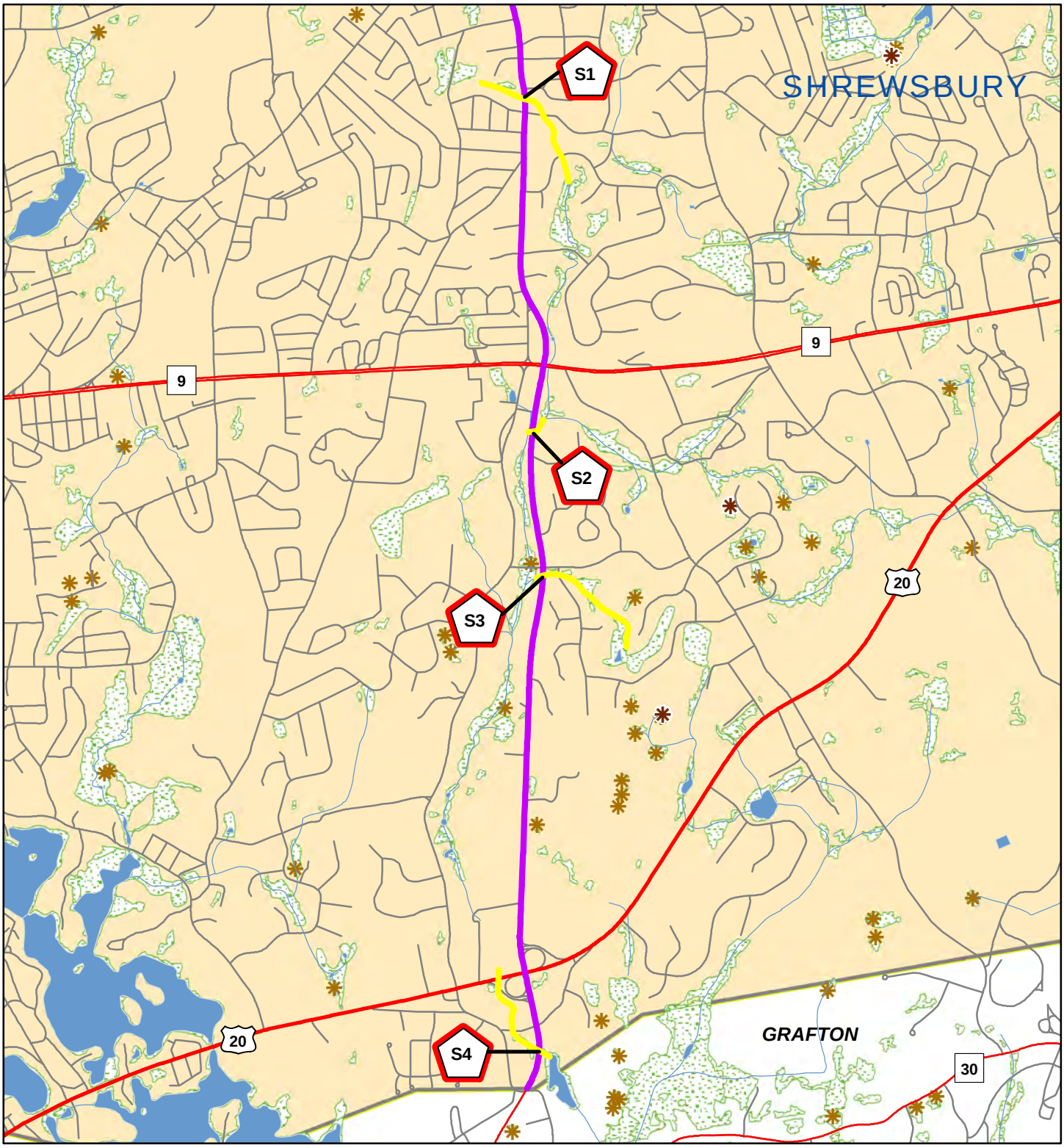
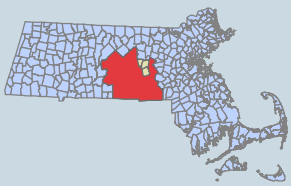
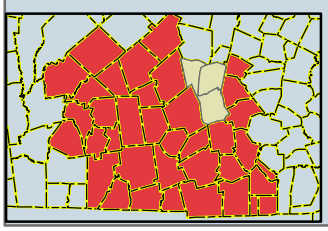


ROUTE 140 CORRIDOR PROFILE

Shrewsbury Major Drainage Structures

Figure 18





Legend

- Route 140 Corridor Profile
- Interstate
- State Route
- Streams
- Streams Intersecting Rt 140
- Drainage structures
- NHESP Certified Vernal Pools
- Potential Vernal Pools
- Water Bodies
- DEP Wetlands (Jan. 2009)

CMRPC

Central Massachusetts Regional Planning Commission

Source: Data provided by the US Census Bureau, Central Massachsuetts Regional Planning Commission (CMRPC), massDOT Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information MassGIS), Commonwealth of Massachusetts, Information Technology Division.

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0 0.125 0.25 0.5 0.75 1 Miles

Table 1
Route 140
Inventory of Major Drainage Structures

Assigned Map #	Host Community	Primary Materials	General Condition	Approx. Pipe Size	Approx. Length	Field Observations	Additional Notes
WEST BOYLSTON							
WB1		Concrete pipe Stone & mortar head wall	Good	3'	50'	Free flowing water, some sedimant on bottom of culvert.	Unable to reach west side culvert due to heavy overgrown vegetation. Stream flows from Wachusett Reservoir.
WB2		Stone blocks and some concrete culvert & head wall	Fair/Good	Square culvert 3'	150'	Lots of sediment and stones around culvert.	Unable to reach east side culvert due to heavy overgrown vegetation. Stream flows from Wachusett Reservoir.
WB3		Concrete culvert & head wall	Excellent	Square culvert 4'	35'	East & west side of culvert in good condtion. Some vegetation on both sides.	On the west side there is a log at the bottom of the opening creating a little waterfall. Prevents fish from swimming through. Stream flows from Wachusett Reservoir.
WB4		Concrete pipe	Fair	1'	34'	No water near culvert. Lot's of vegetation.	Unable to reach east side culvert due to heavy overgrown vegetation.
WB5		Granite/Stone blocks culvert & head wall	Good	Square culvert 4'	68'	Stagnent water on east side, lots of pond scum near opening. Flowing water on west side, some large rocks in water.	Some overgrown vegetation on both sides. Steep slopes above culvert. At Wachusett Reservoir.

Table 1
Route 140
Inventory of Major Drainage Structures

Assigned Map #	Host Community	Primary Materials	General Condition	Approx. Pipe Size	Approx. Length	Field Observations	Additional Notes
BOYLSTON							
B1		Concrete pipe	Fair	1-2'	73'	No water on either side of culvert. Lots of leaves and sediment in and around pipe.	Moderate vegetation nearby. Culvert is near Wachusettt Reservoir.
B2		Concrete pipe	East side is Fair West side is Poor	There are two pipes on the east side, 1-2'. Only one pipe on west side, 2'.	75'	Some standing water near east & west side culvert.	Some vegetation on both sides, but west side has much more.
B3		Concrete culvert & head wall	Good	Square culvert 4'	76'	Mostly clear water on the west side, just a few branches in water.	Unable to reach east side culvert due to heavy overgrown vegetation.

Table 1
Route 140
Inventory of Major Drainage Structures

Assigned Map #	Host Community	Primary Materials	General Condition	Approx. Pipe Size	Approx. Length	Field Observations	Additional Notes
SHREWSBURY							
S1		Stone, cement & granite on west side culvert. Cement culvert on east side.	Excellent	Square culvert 3'	70'	Some rocks in water on west side. Also, rocks and some vegetation on the east side.	There is a safety fence blocking the west side culvert on the sidewalk.
S2		Unable to locate the culvert on either side of the roadway at this location.					
S3		Cement	Good	2'	66'	Some vegetation and rocks near culvert on the east side. Very little water near the culvert.	Unable to reach west side culvert due to heavy overgrown vegetation.
S4		Cement	Excellent	9'	60'	Both sides of the culvert are clear of rocks and branches.	Water does not seem to be moving or it is moving very slow. Noticed wildlife activity in the area.

Figure 19
West Boylston
Route 140 Major Drainage Structures Photos

Culvert #WB1 eastbound side

Culvert #WB2 westbound side

Culvert #WB3 eastbound side

Culvert #WB3 westbound side

Culvert #WB4 westbound side

Culvert #WB5 eastbound side

Figure 20

Boylston

Route 140 Major Drainage Structures Photos

Culvert #B1 eastbound side

Culvert #B1 westbound side

Culvert #B2 eastbound side

Culvert #B2 westbound side

Culvert #B3 westbound side

Figure 21
Shrewsbury
Route 140 Major Drainage Structures Photos

Culvert #S1 eastbound side

Culvert #S1 westbound side

Culvert #S3 eastbound side

Culvert #S4 eastbound side

Culvert #S4 westbound side

2.4 Performance Management

In regards to Performance Measures there are two that pertain to this chapter. The first measure is sustainability and the goal is to combat sprawl and its effects by avoiding, minimizing, and mitigating environmental effects in a Priority Preservations Area (PPA) or a Priority Development Area (PDA). In West Boylston there is a PDA around the intersection of Route 12/Route 140/Central Street. Any potential economic development or roadway projects should consider possible environmental effects in the designing of the project. There is another PDA along the railroad, just south of Route 140, near the Boylston Town Line. There are no PPAs or PDAs along Route 140 in the towns of Boylston or Shrewsbury.

The second Performance Measure is stormwater management & resiliency. This goal is to create a transportation network that is resilient to the impacts of stormwater. For any new TIP projects it is important to consider the use of Green Infrastructure or Nature Based Solutions to help manage stormwater. Also, older culverts should be upgraded to new modern structures that can handle the heavy water flows from the stronger and the increasing frequency of storms in the region. A higher priority should be given to areas that are within a 100 or 500 year flood zone. By using these approaches the goal of a stormwater resilient transportation network can be obtained.

3.0 Congestion Management Process (CMP)

3.1 Overview of the Central Massachusetts CMP

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) required urban areas across the country to assess traffic congestion using a management system approach. Briefly, a management system approach is one where issues are identified through a systematic process of data collection and analysis, recommendations are developed to address the issues, solutions are implemented, and their effectiveness is monitored. For the Central Massachusetts Metropolitan Planning Organization (CMMPO), staff at CMRPC began developing the region's Congestion Management System (CMS) in 1994.

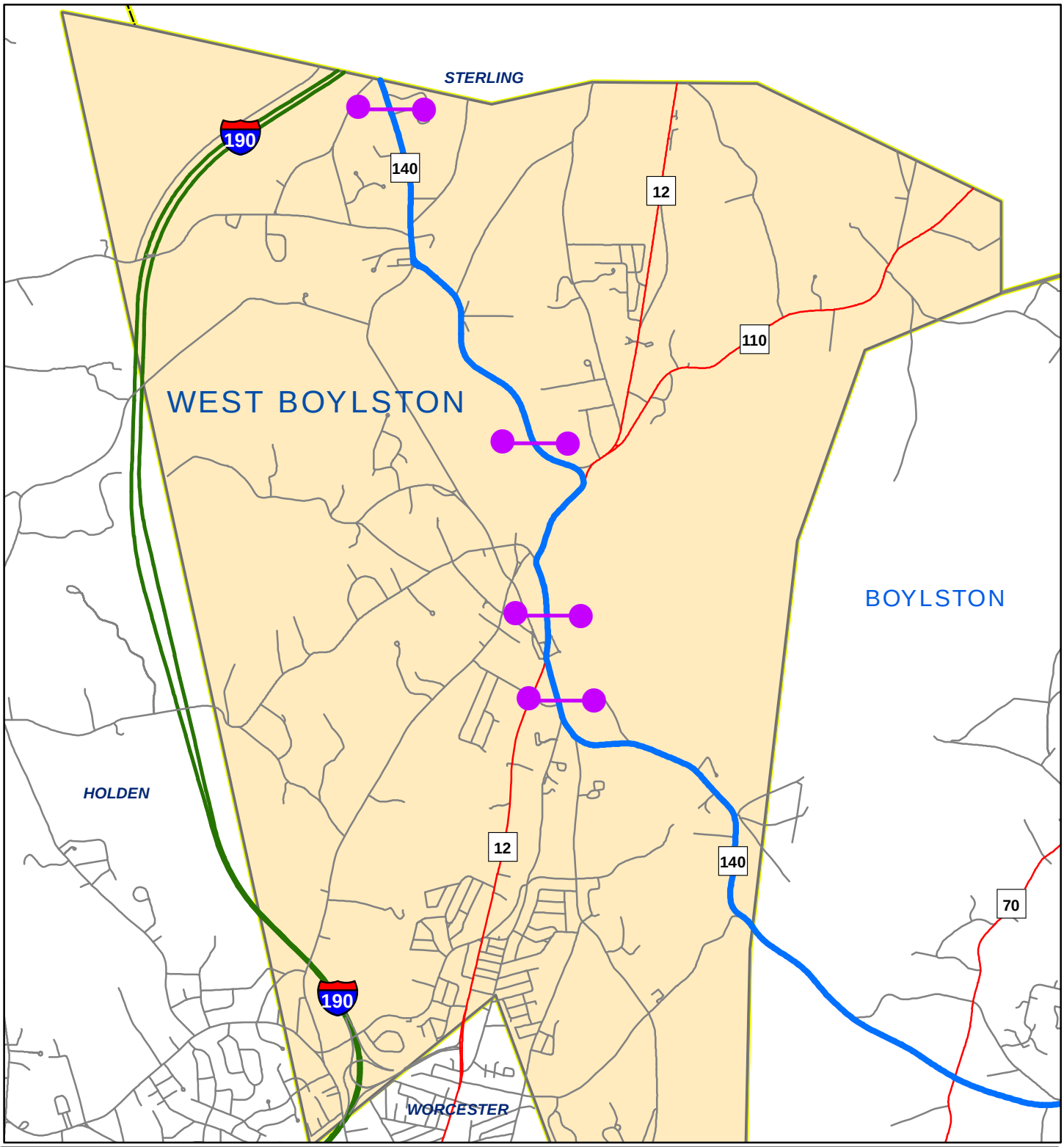
The first step was to identify "focus segments," roadways where the traffic volume on the roadway was exceeding the operational capacity. According to the Highway Capacity Manual, a roadway's capacity is defined as "the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under prevailing roadway, traffic and control conditions." Beginning in 1995, CMRPC staff proceeded to verify and monitor the congested conditions in the field by conducting a series of travel time and delay studies along roadways and turning movement counts at intersections. The location of these data collection activities could be indicated by CMRPC's Traffic Demand Model software or as suggested by one of the communities in the CMRPC region.

The 2006 Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) called for the CMS to be evolved into a Congestion Management *Process* (CMP), with a greater focus on implementation of operational improvements to the highway system to mitigate congestion. In 2012, the Moving Ahead for Progress in the 21st Century Act (MAP-21) called for the continuation of the CMP program while also requiring a transition to performance based planning, as does 2015's successor legislation Fixing America's Surface Transportation (FAST) Act. Staff will continue to follow the evolution of applicable CMP performance measures by U.S. DOT. This Corridor Profile provides the baseline data needed to coordinate such improvements with the MassDOT District #3 office as well as the Route 140 host communities.

3.2 Daily Traffic Volumes

Figures 22 to 24 show locations along Route 140 in the towns of West Boylston, Boylston, and Shrewsbury where CMRPC set Automatic Traffic Recorders (ATRs) to gather the volume of traffic. All locations were completed in September and October of 2016. The ATRs were

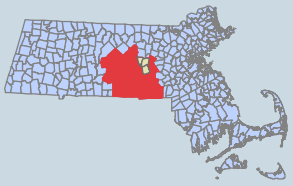
installed along the roadway and left in place for at least 48 hours. There were 13 locations completed for this Corridor Profile. **Table 2** shows the volume results from the Route 140 ATR locations. As the data shows, the highest traffic volumes are at the Boylston/Shrewsbury town line and the lowest volumes are north of Route 12 in West Boylston. The majority of Route 140 carries over 10,000 vehicles per day.

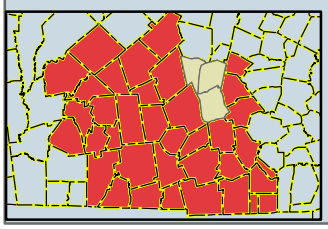


ROUTE 140 CORRIDOR PROFILE

West BoystonTraffic Count Locations

Figure 22





Legend

- Route 140 Corridor Profile
- Interstate
- State Route
- State Route
- Local Roads
- ATR Locations

Miles

0 0.2 0.4 0.8 1.2 1.6

C M R P C
Central Massachusetts Regional Planning Commission

Source: Data provided by the US Census Bureau, Central Massachsuetts Regional Planning Commission (CMRPC), massDOT Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information MassGIS), Commonwealth of Massachusetts, Information Technology Division.

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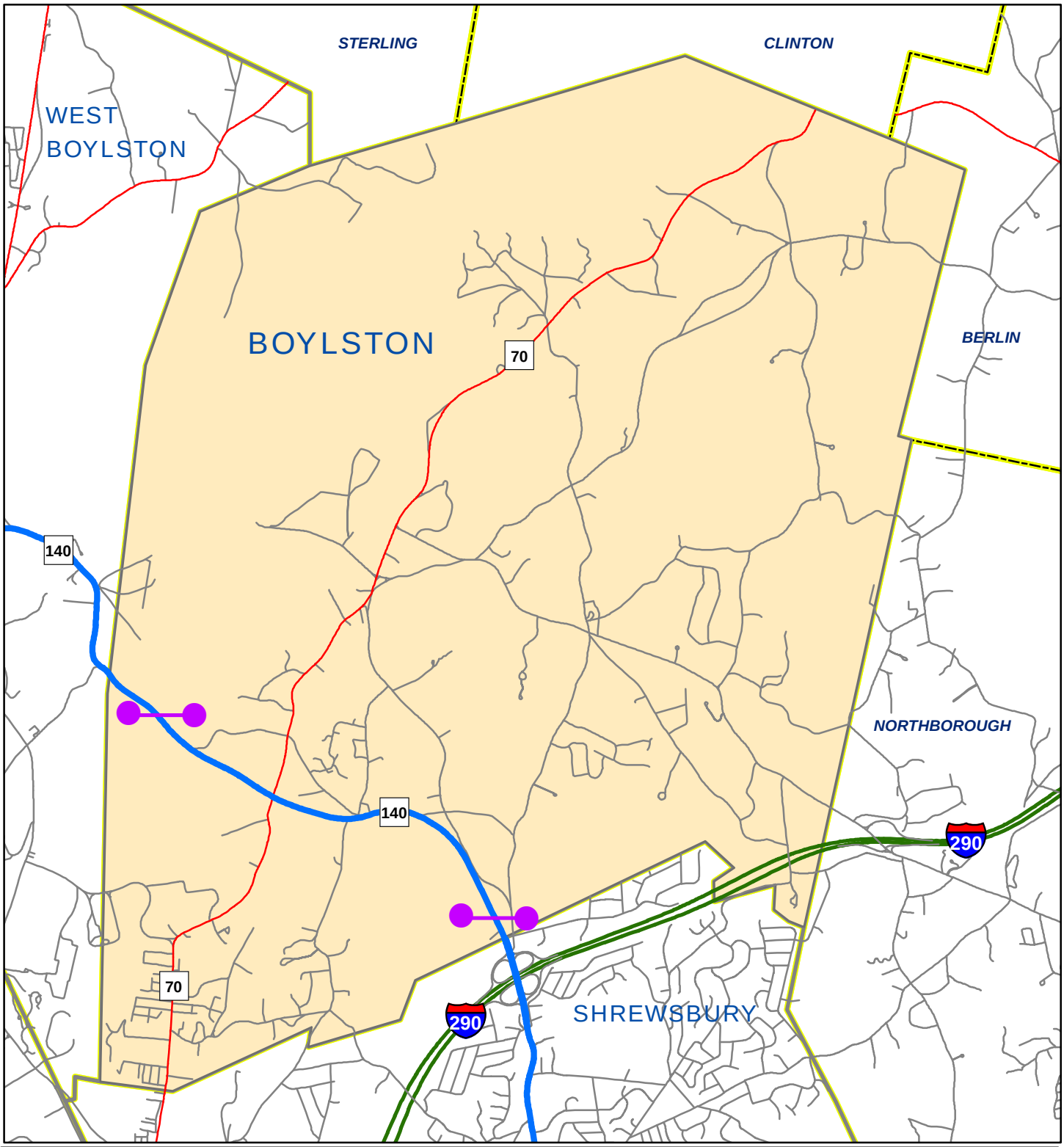
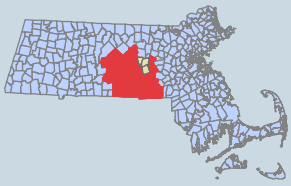
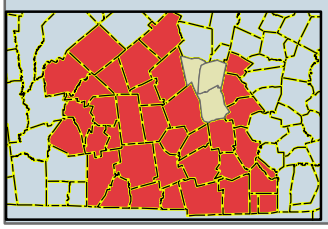


ROUTE 140 CORRIDOR PROFILE

Boylston Traffic Count Locations

Figure 23





Legend

- Route 140 Corridor Profile
- Interstate
- State Route
- State Route
- Local Roads
- ATR Locations

0 0.275 0.55 1.1 1.65 2.2 Miles

CMRPC Central Massachusetts Regional Planning Commission

Source: Data provided by the US Census Bureau, Central Massachsuetts Regional Planning Commission (CMRPC), massDOT Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information MassGIS), Commonwealth of Massachusetts, Information Technology Division.

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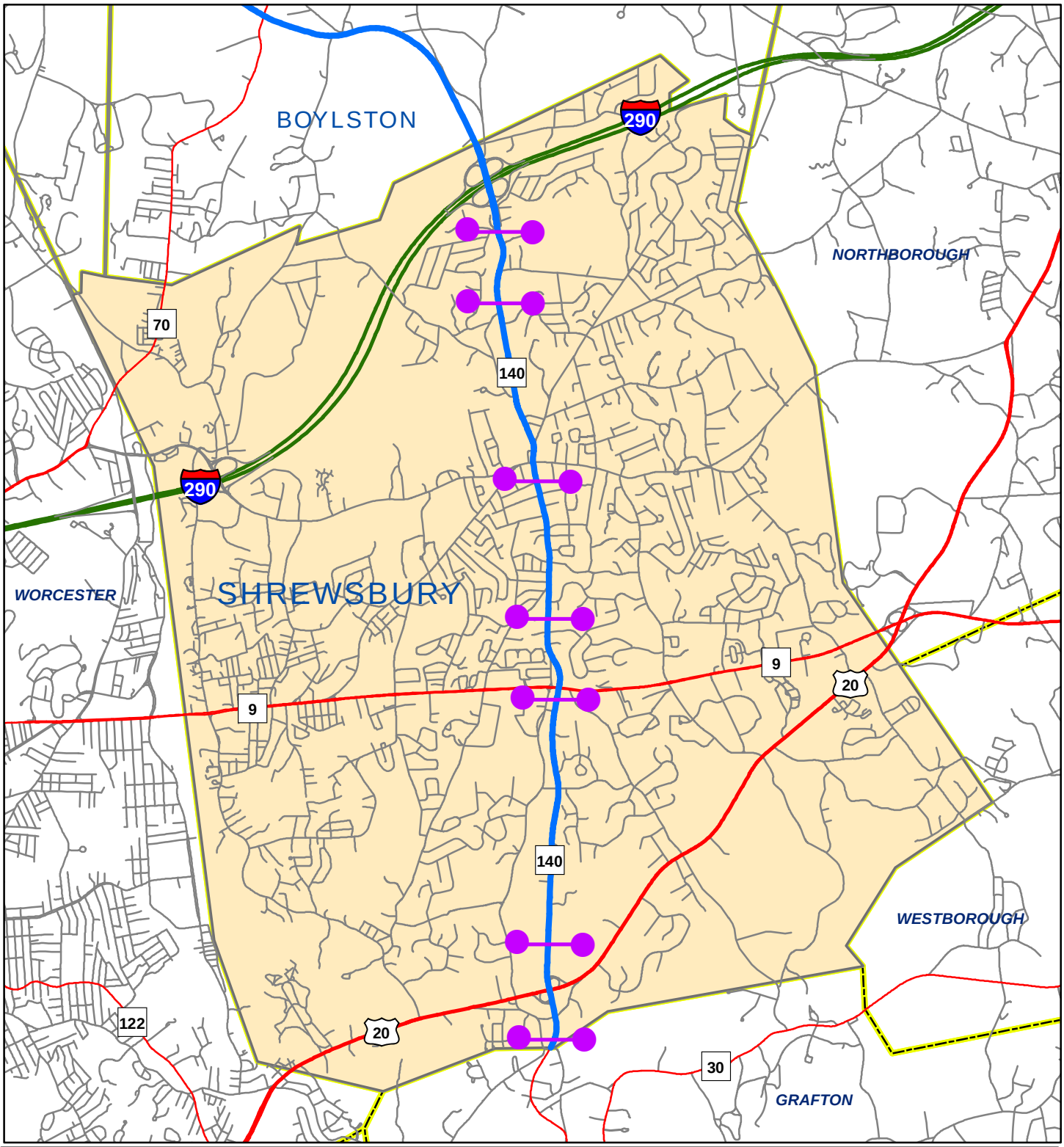
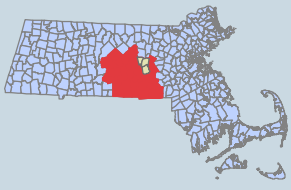
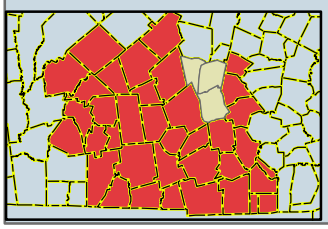


ROUTE 140 CORRIDOR PROFILE

Shrewsbury Traffic Count Locations

Figure 24





Legend

- Route 140 Corridor Profile
- Interstate
- State Route
- State Route
- Local Roads
- ATR Locations

0 0.275 0.55 1.1 1.65 2.2 Miles

CMRPC
Central Massachusetts Regional Planning Commission

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Table 2
Route 140 Daily Traffic Volumes

Town	ATR Location	Date	Volume*
West Boylston	Route 140 at Sterlin Town Line	9/13/2016	5,725
	Route 140 north of Route 12	9/13/2016	3,325
	Route 140/12 north of Central Street	10/19/2016	11,650
	Route 140 south of Route 12	9/13/2016	10,175
Boylston	Route 140 at West Boylston Town Line	10/19/2016	11,700
	Route 140 at Shrewsbury Town Line	9/15/2016	18,400
Shrewsbury	Route 140 south of I-290	10/4/2016	16,500
	Route 140 south of Hill Street	9/15/2016	14,450
	Route 140 south of Main Street	9/15/2016	13,025
	Route 140 south of Lake Street	10/4/2016	13,200
	Route 140 south of Route 9	10/4/2016	14,400
	Route 140 north of Route 20	10/4/2016	11,250
	Route 140 at Grafton Town Line	10/12/2016	11,100

*Vehicles Per Day (VPD)

3.3 Route 140 Travel Time and Delay Studies

CMRPC staff conducted three travel time and delay studies for this Corridor Profile. Two were completed in 2015 and the third was completed in 2017. The northern section of Route 140 in West Boylston was under construction so staff needed to wait for it to finish before the final travel time study was conducted. The travel time data was collected by CMRPC using a Global Positioning System (GPS) unit. The studies occurred between 7am – 9am and 4pm – 6pm. After the field data was collected, it was downloaded into "TravTime" software (developed by Geo Stats) in order to analyze the data. As indicated in **Table 3**, it takes about five minutes to travel from Central Street to the Sterling town line. Further, traveling through Boylston and part of West Boylston took between seven and ten minutes and it took between nine and eleven minutes through the town of Shrewsbury. So, to travel the entire study corridor takes about 25 minutes on a typical day.

Table 3

Route 140 Travel Time and Delay Study Results

Peak Period	Direction	Study Year	Distance	Travel Time (average minutes)
AM-West Boylston	Northbound	2017	3.0 miles	5.2
AM-West Boylston	Southbound	2017	3.0 miles	5.1
PM-West Boylston	Northbound	2017	3.0 miles	5.3
PM-West Boylston	Southbound	2017	3.0 miles	5.2
AM-WBoylston/Boylston	Northbound	2015	4.5 miles	9.3
AM-WBoylston/Boylston	Southbound	2015	4.5 miles	8.2
PM-WBoylston/Boylston	Northbound	2015	4.5 miles	9.1
PM-WBoylston/Boylston	Southbound	2015	4.5 miles	7.0
AM-Shrewsbury	Northbound	2015	5.5 miles	10.4
AM-Shrewsbury	Southbound	2015	5.5 miles	9.9
PM-Shrewsbury	Northbound	2015	5.5 miles	9.2
PM-Shrewsbury	Southbound	2015	5.5 miles	10.7

Figures 25 through 28 show vehicle speeds for each run during the West Boylston travel time and delay study that was completed in 2017. Average travel speeds were consistently around 35 mph for both the AM and PM time periods. There was minimal delay on Route 140 in the northern part of West Boylston. There was heavier traffic in the PM, but still little observed stopped delay except for the traffic signal and a couple of stop signs. In the AM, there was a school bus that affected one of the runs on Route 140, north of Thomas Street.

Figures 29 through 32 illustrate the vehicle speeds for each separate northbound and southbound trip along Route 140 observed in 2015 through West Boylston and Boylston. The average vehicle speeds observed for the northbound direction was 29 mph in the AM and 30 mph during the PM. The slowest speeds were located between the Shrewsbury town line and Route 70, especially in the PM. The study vehicle stopped numerous times during two of the study runs before crossing Route 70. The approach to the Route 12 traffic signal in West Boylston was also congested. For the southbound direction, the average vehicle speeds were 33 mph in the AM and 39 mph in the PM. In the AM vehicle speeds were the slowest near Route 70. During the PM peak hours vehicle speeds were slowest between Route 12 and the West Boylston town line.

Further, **Figures 33 through 36** show vehicle speeds for each separate northbound and southbound trip along Route 140 observed in 2015 through the town of Shrewsbury. The average vehicle speed observed for the northbound direction was 32 mph in the AM and 36 mph during the PM. The slowest speeds were located between Lake Street and Main Street in both the AM and PM. For the southbound direction, the average vehicle speeds were 34 mph in the AM and 31 mph during the PM. The slowest speeds were on the approaches to the Main Street intersection. During a couple of the study runs, traffic was backed up over a half-mile from the Main Street intersection and the study vehicle needed to stop numerous times.

Figure 25

Speed Profile - Route 140 NB

2017 - AM

ScaleX: 1 in = 0.5 Miles
ScaleY: 1 in = 25 mph

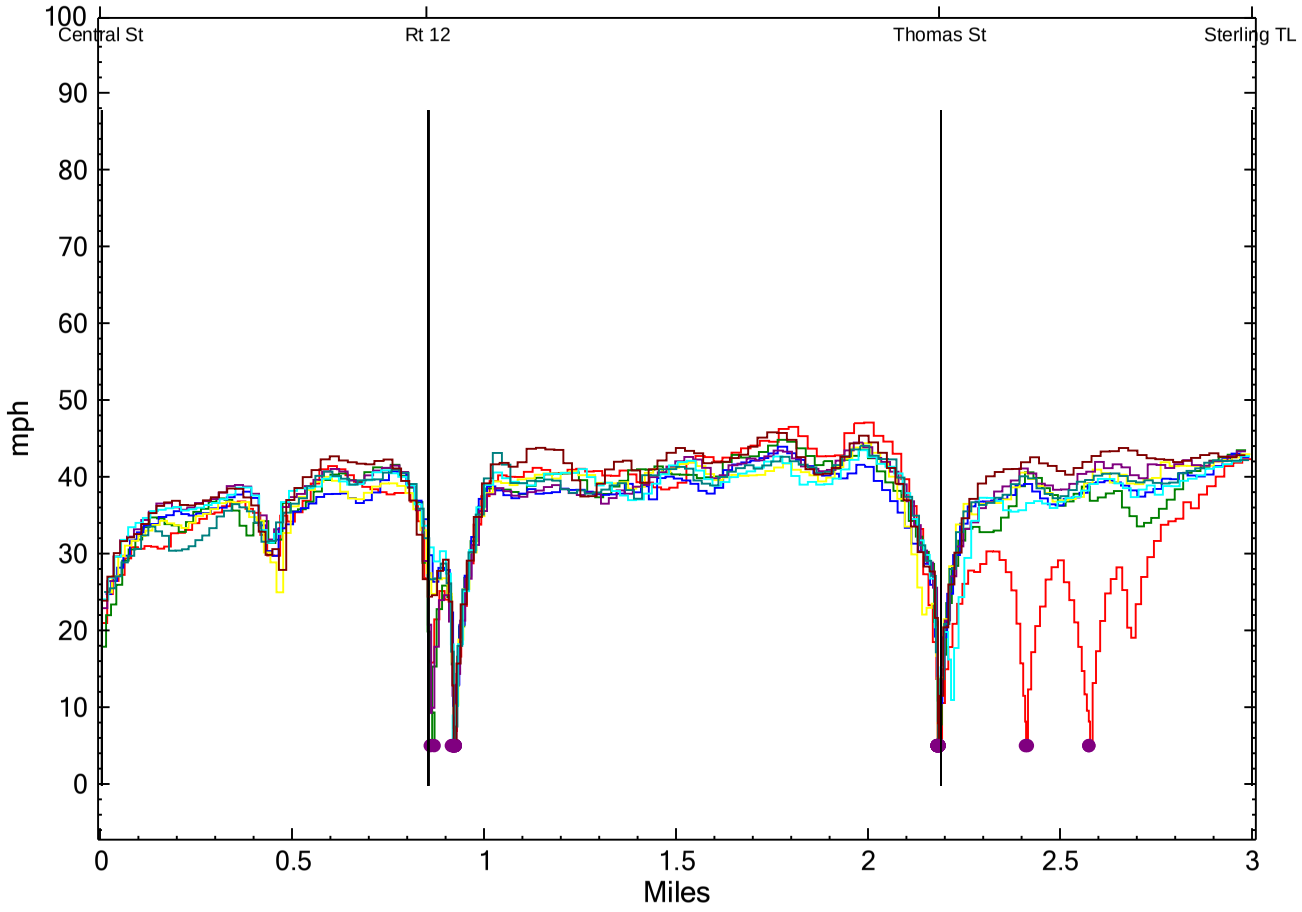

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Figure 26

Speed Profile - Route 140 SB

2017 - AM

ScaleX: 1 in = 0.5 Miles
ScaleY: 1 in = 25 mph

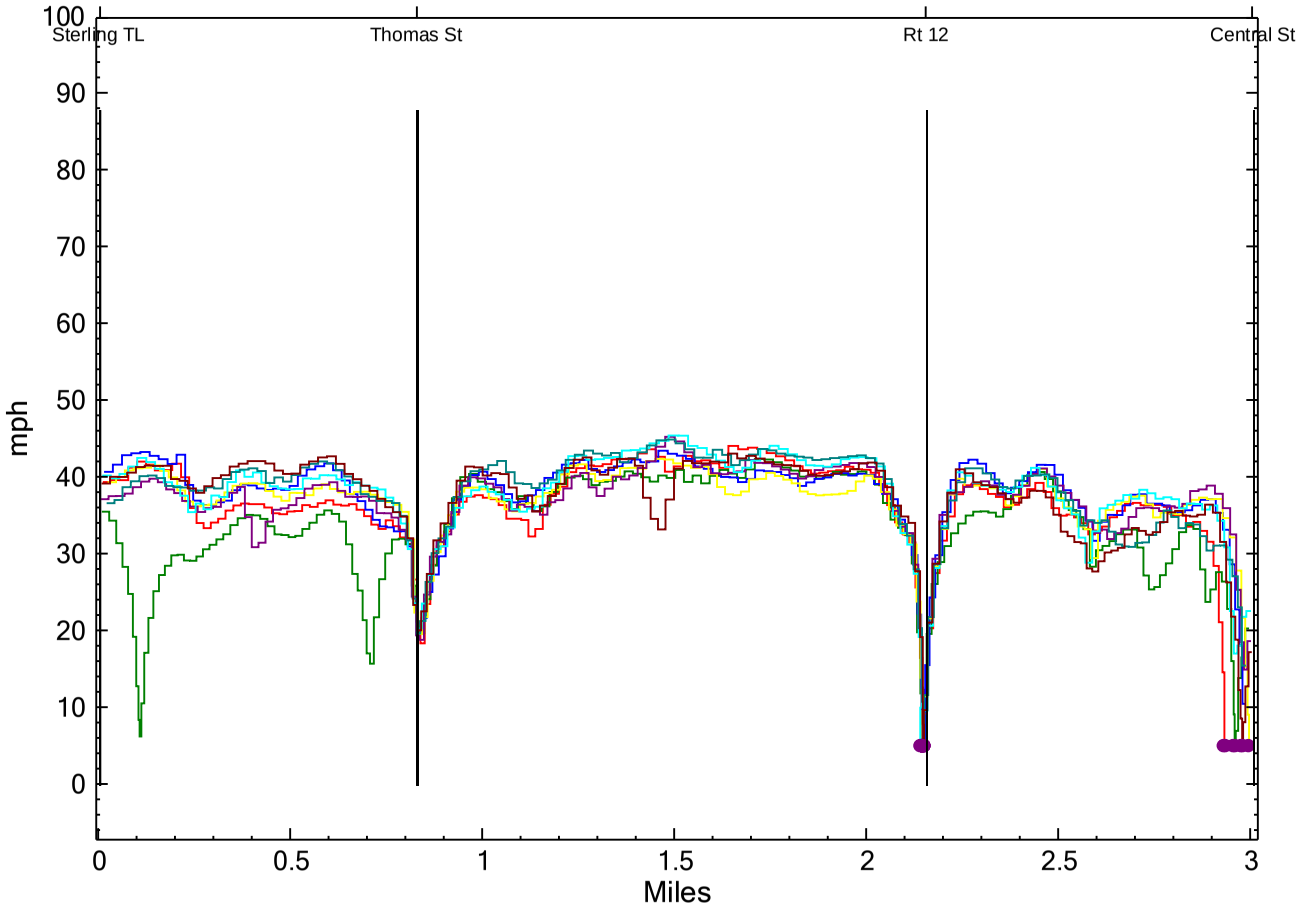

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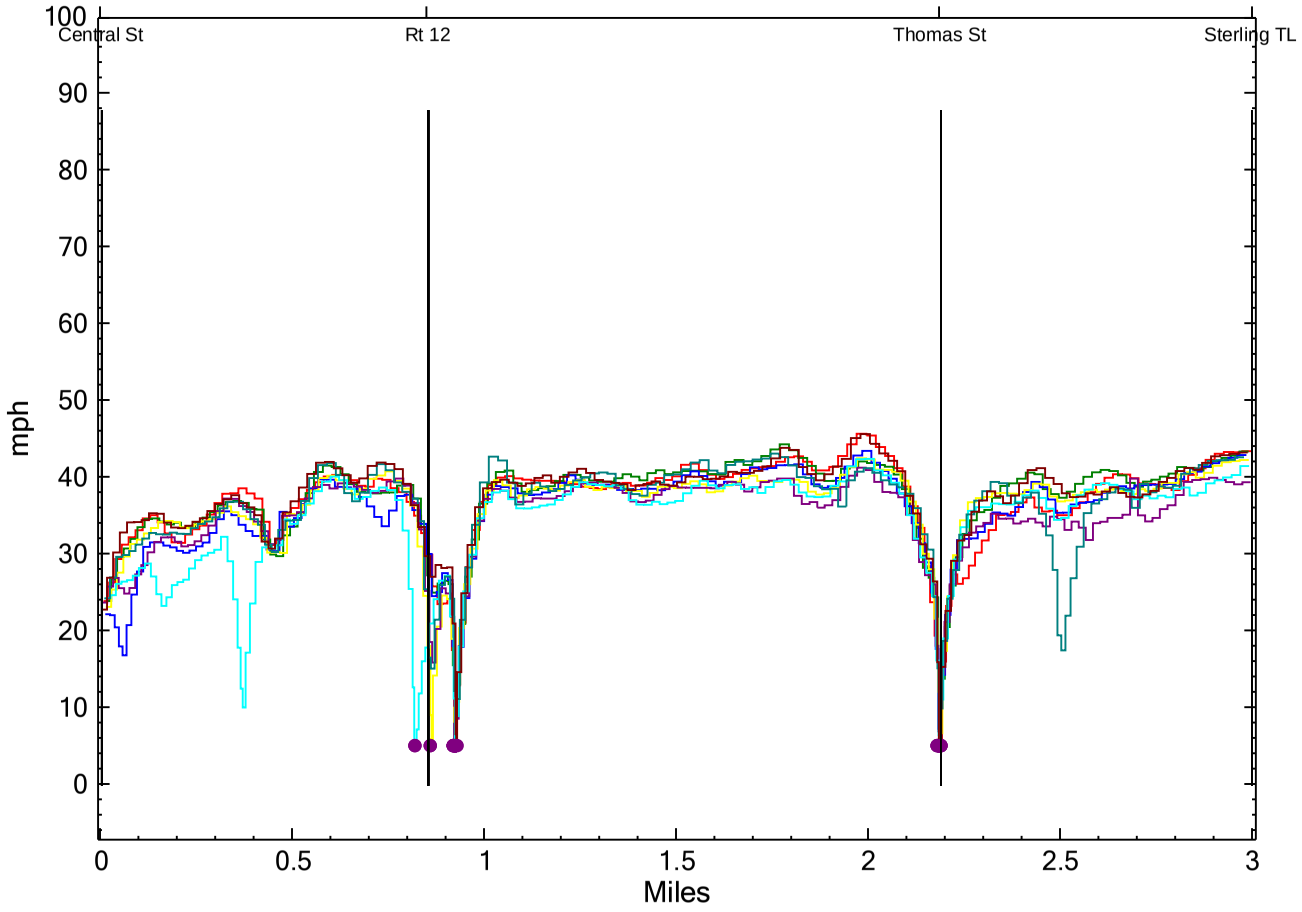
Figure 27

Speed Profile - Route 140 NB

2017 - PM

ScaleX: 1 in = 0.5 Miles
ScaleY: 1 in = 25 mph



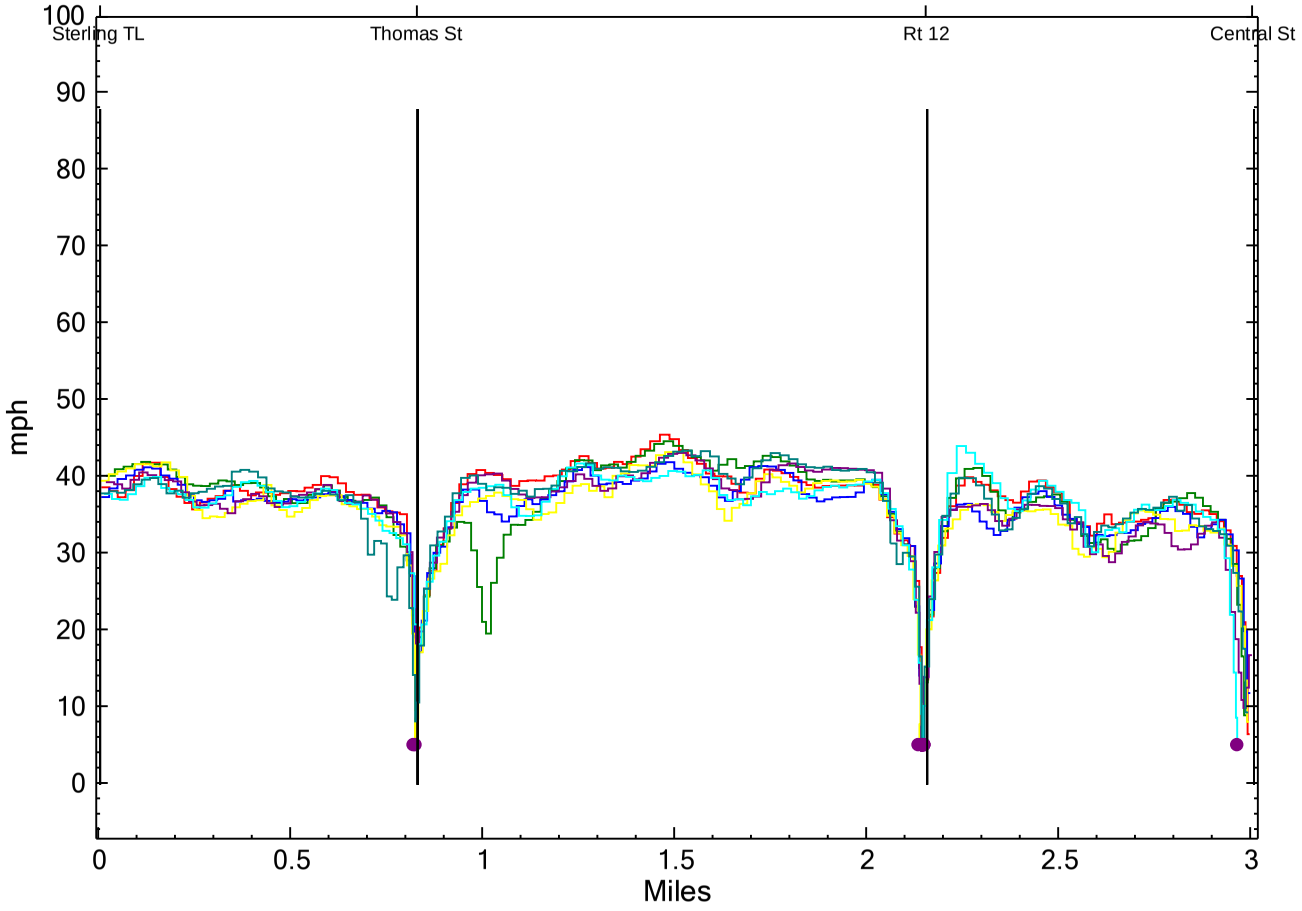
Generated 12/8/2017 9:49 AM

Figure 28

Speed Profile - Route 140 SB

2017 - PM

ScaleX: 1 in = 0.5 Miles
ScaleY: 1 in = 25 mph



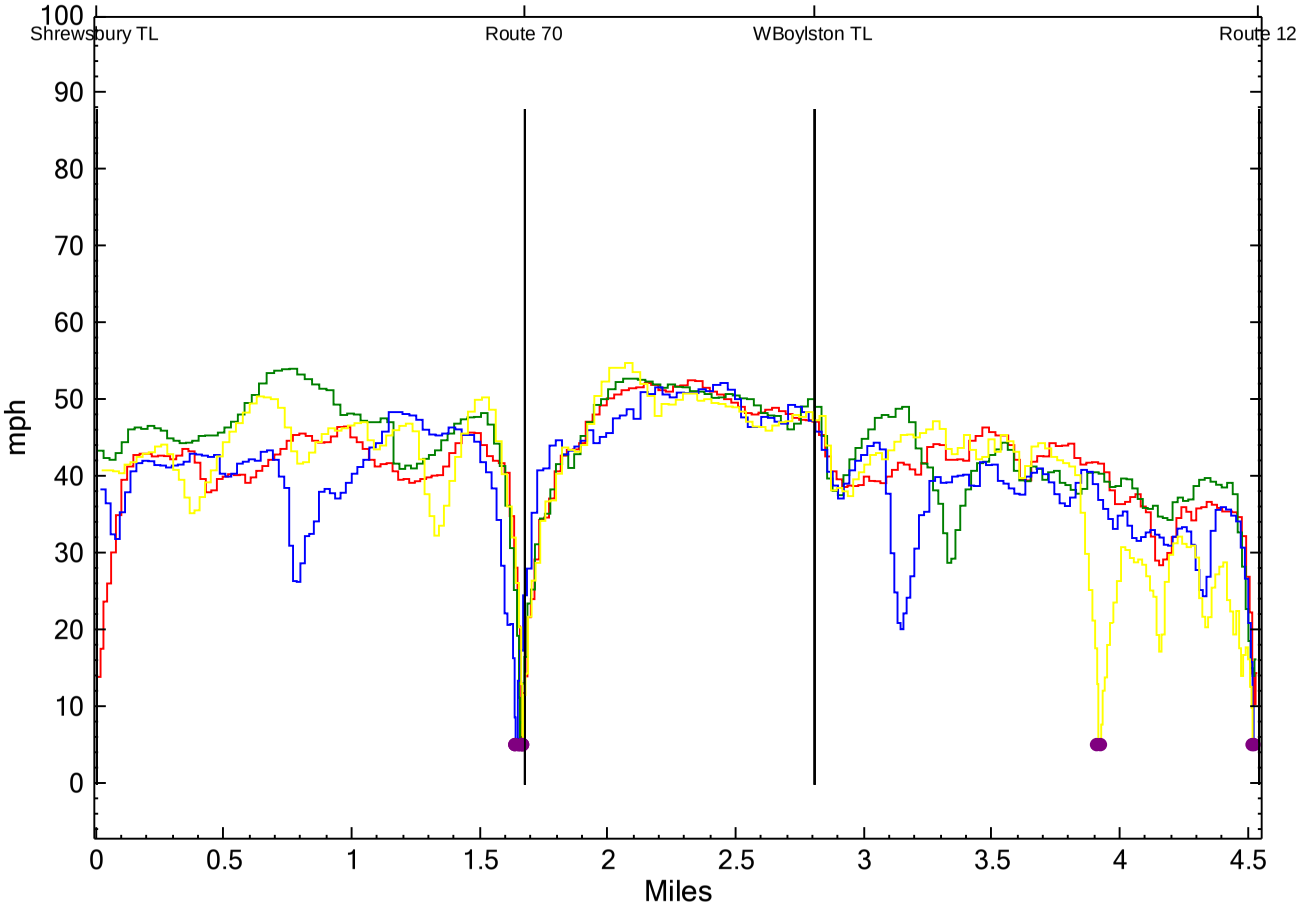
Generated 12/8/2017 9:50 AM

Figure 29

Speed Profile - Route 140 NB

2015 - AM

ScaleX: 1 in = 0.75 Miles
ScaleY: 1 in = 25 mph



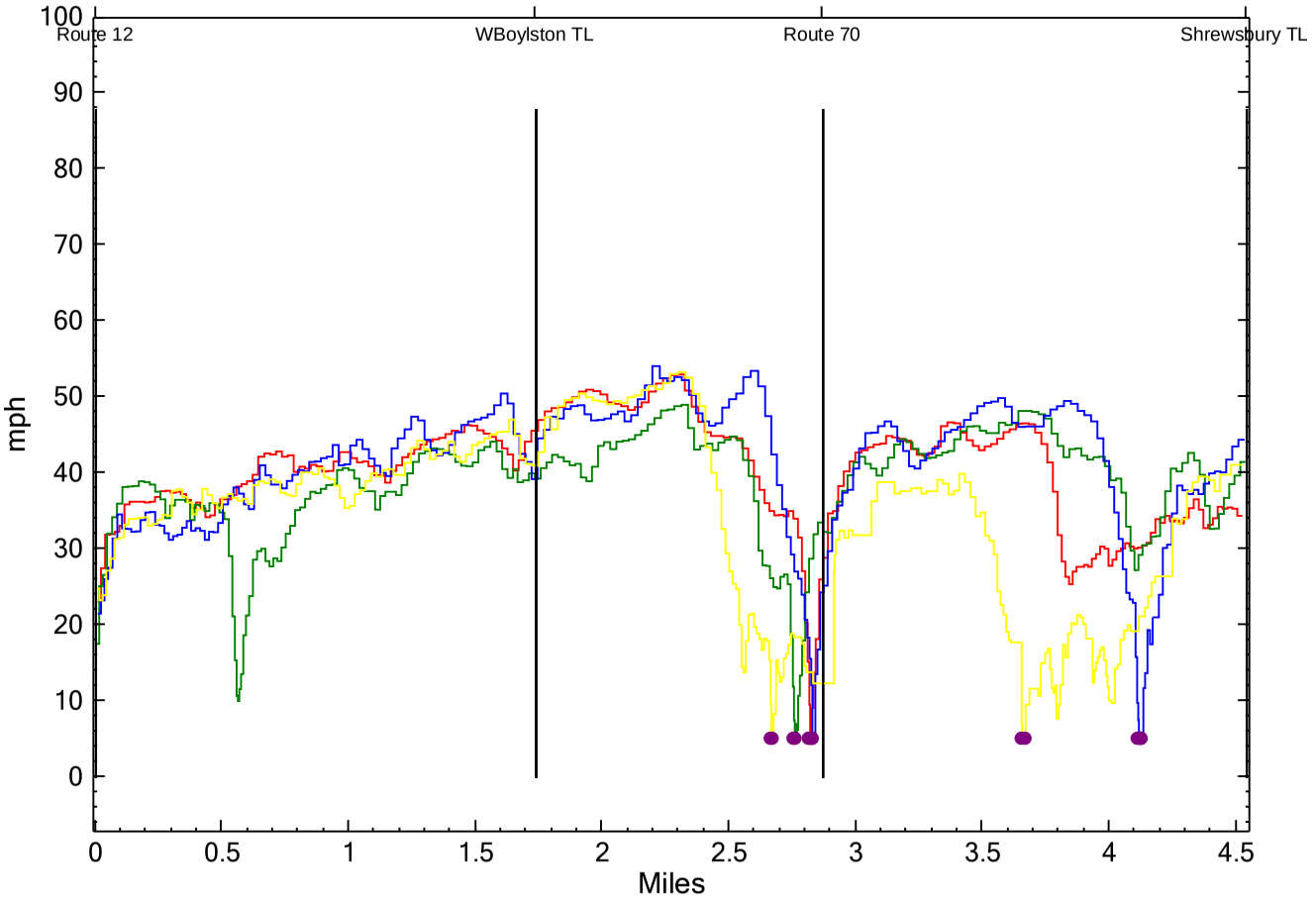
Generated 6/9/2015 2:42 PM

Figure 30

Speed Profile - Route 140 SB

2015 - AM

ScaleX: 1 in = 0.75 Miles
ScaleY: 1 in = 25 mph



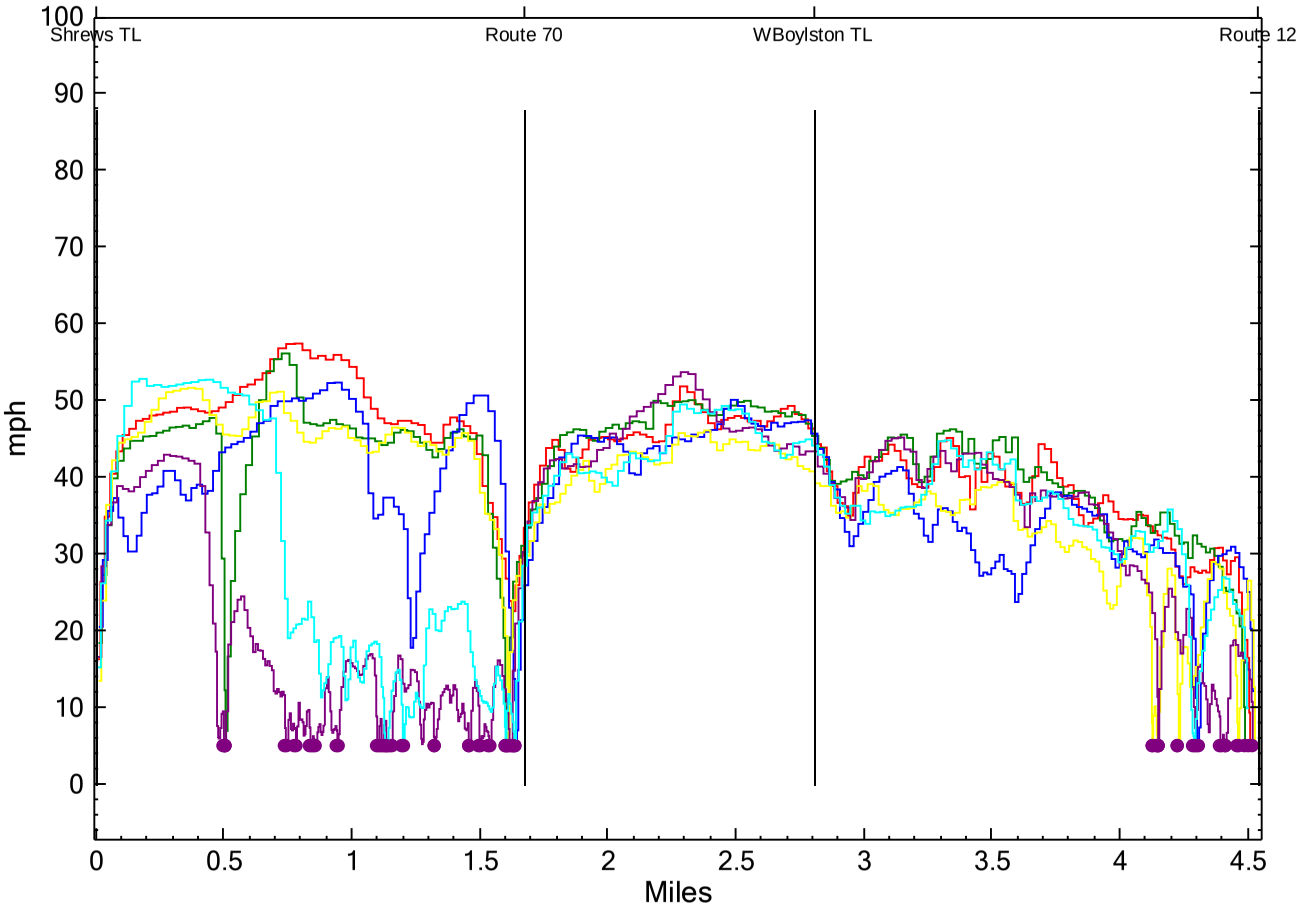
Generated 6/9/2015 2:42 PM

Figure 31

Speed Profile - Route 140 NB

2015 - PM

ScaleX: 1 in = 0.75 Miles
ScaleY: 1 in = 25 mph



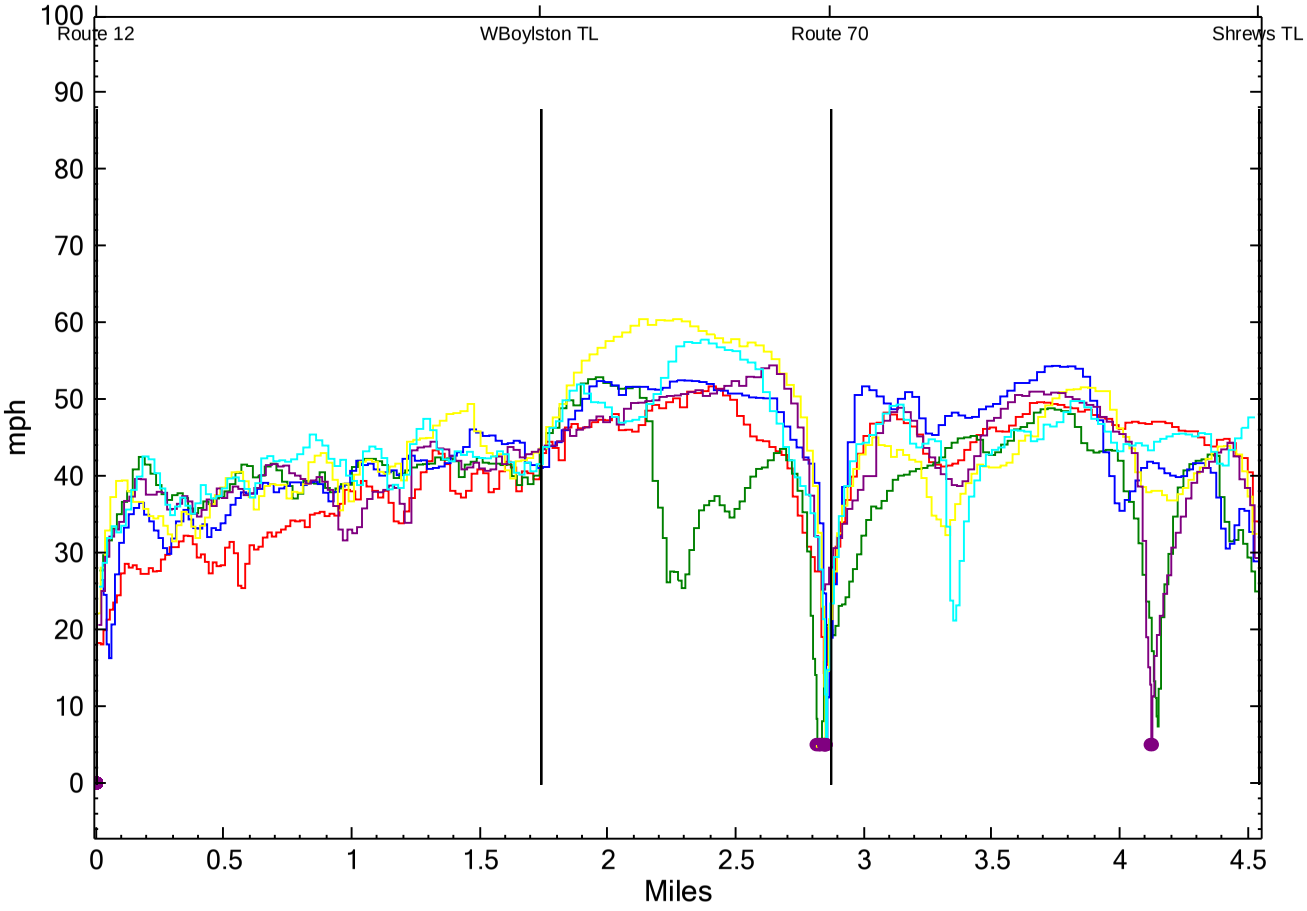
Generated 10/13/2015 1:03 PM

Figure 32

Speed Profile - Route 140 SB

2015 - PM

ScaleX: 1 in = 0.75 Miles
ScaleY: 1 in = 25 mph



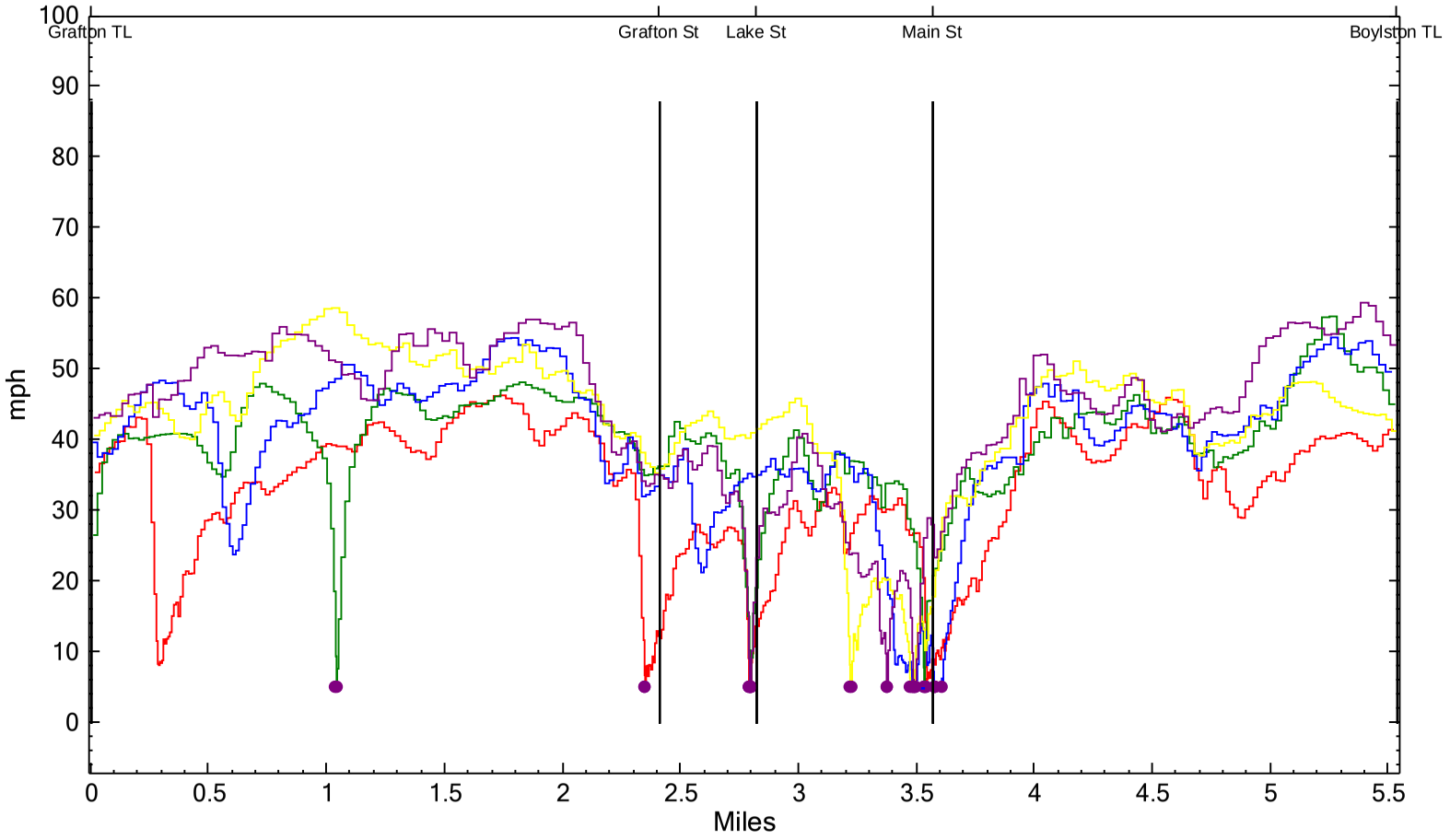
Generated 10/13/2015 1:03 PM

Figure 33

Speed Profile - Route 140 NB

2015 - AM

ScaleX: 1 in = 0.75 Miles
ScaleY: 1 in = 25 mph



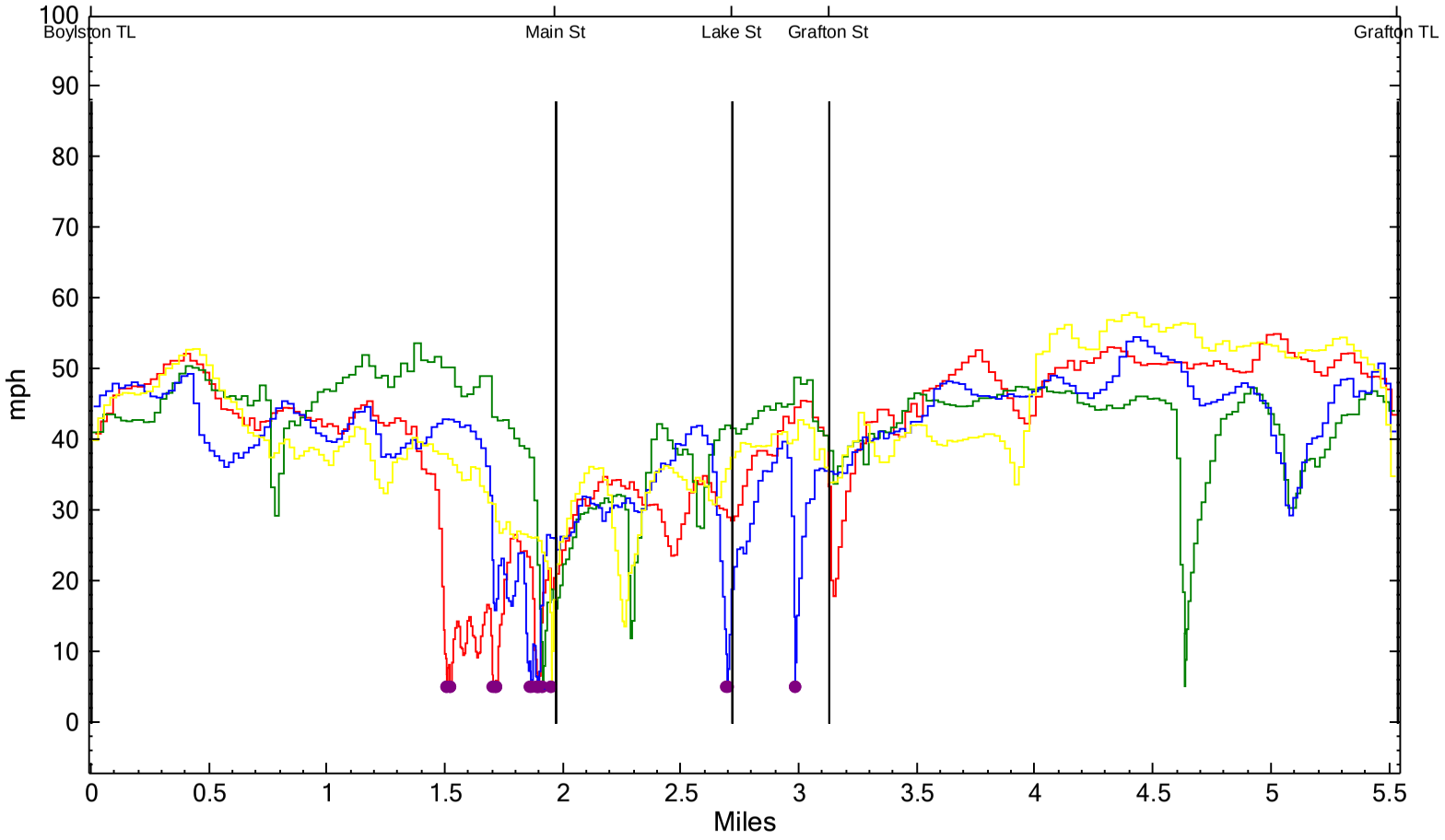
Generated 6/17/2015 10:01 AM

Figure 34

Speed Profile - Route 140 SB

2015 - AM

ScaleX: 1 in = 0.75 Miles
ScaleY: 1 in = 25 mph



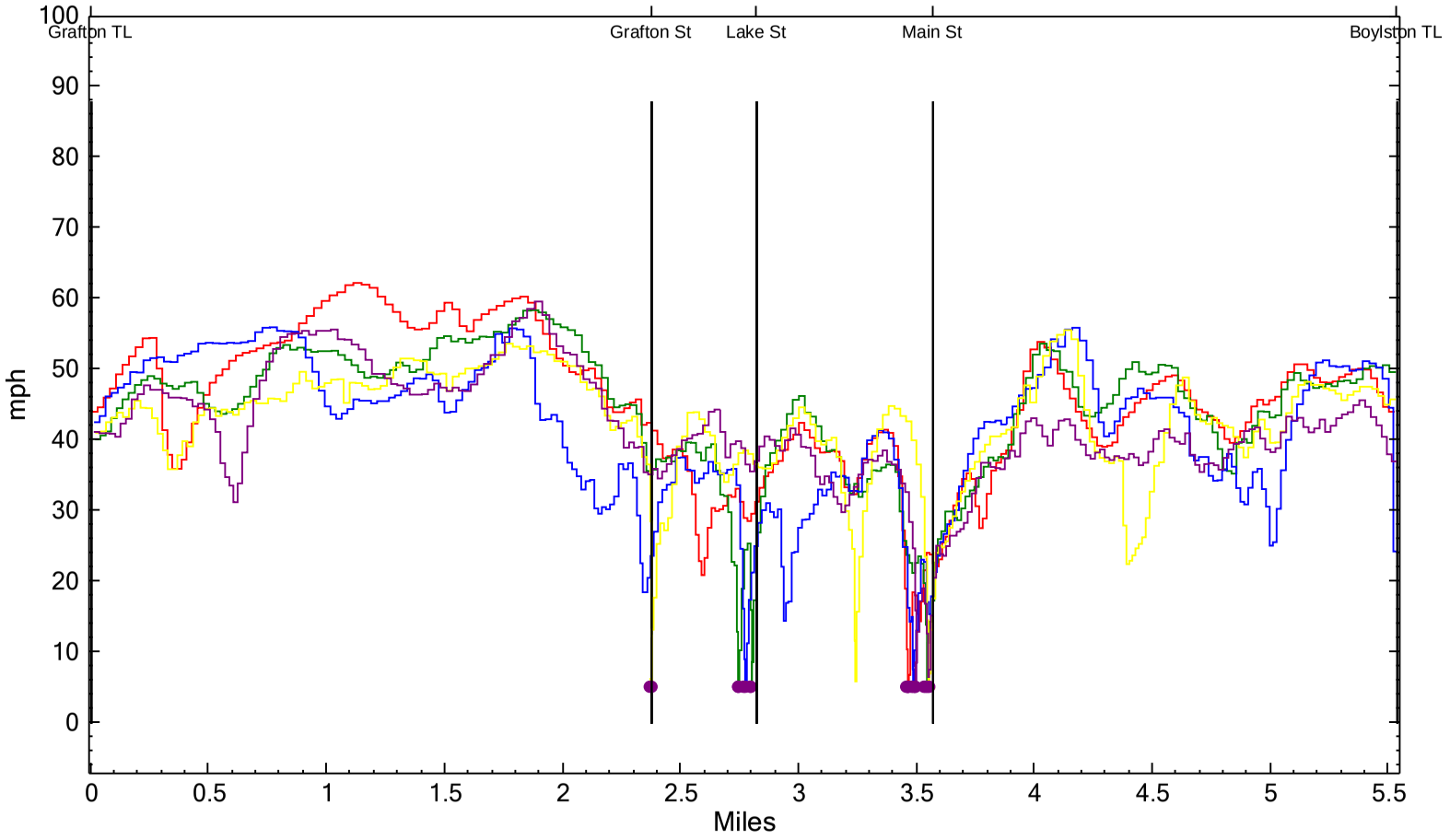
Generated 6/17/2015 10:01 AM

Figure 35

Speed Profile - Route 140 NB

2015 - PM

ScaleX: 1 in = 0.75 Miles
ScaleY: 1 in = 25 mph



1

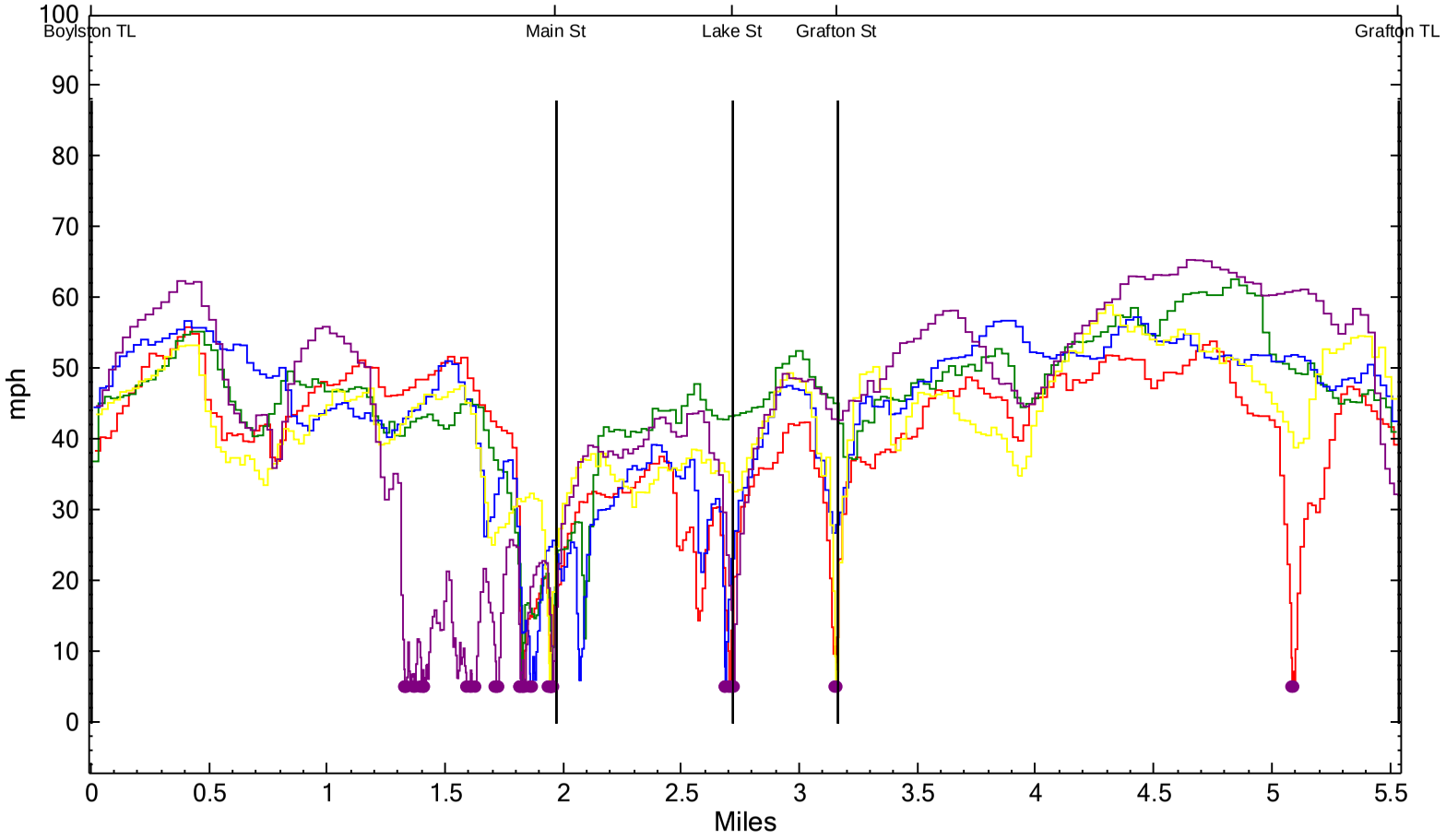
Generated 10/14/2015 1:45 PM

Figure 36

Speed Profile - Route 140 SB

2015 - PM

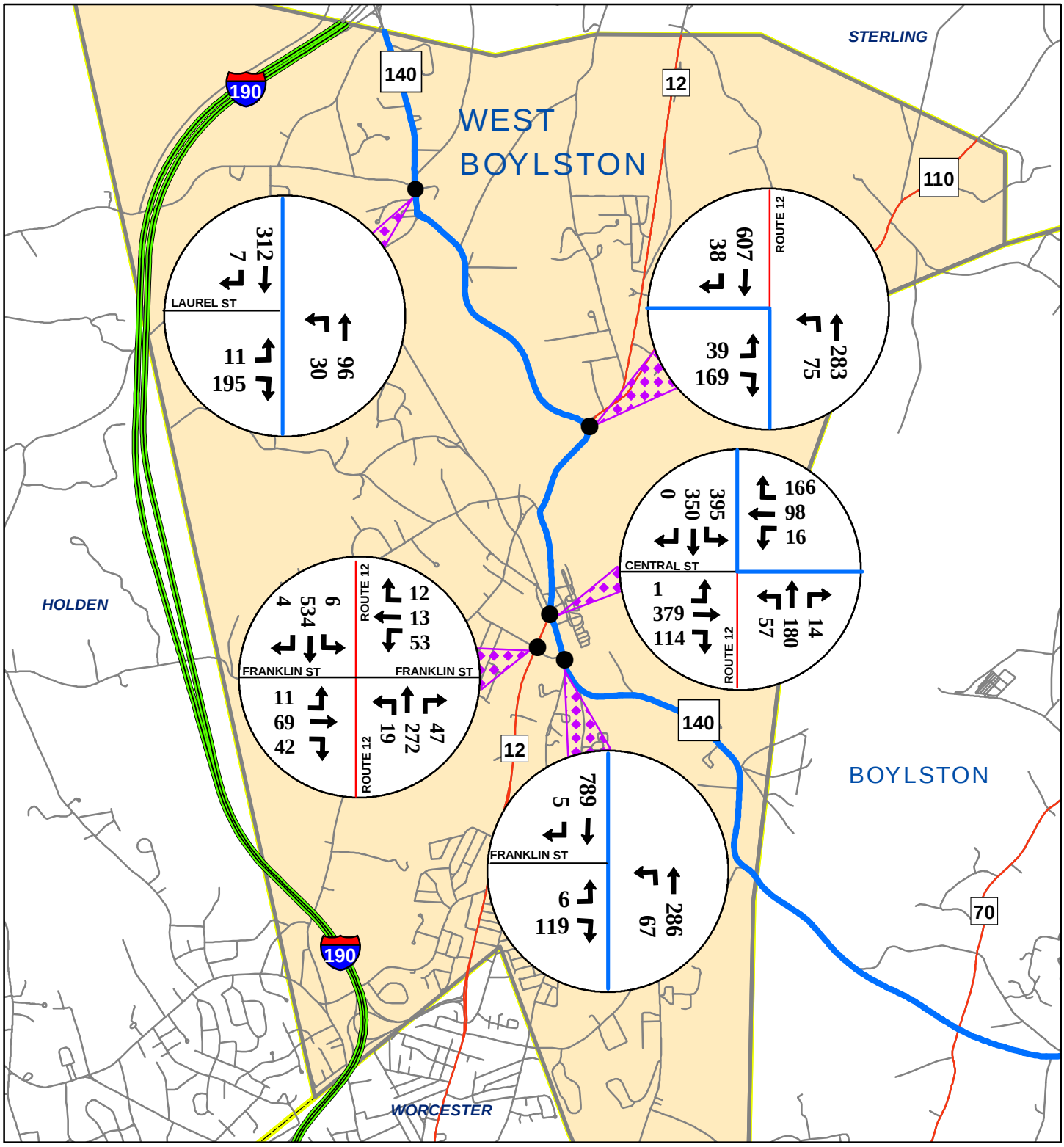
ScaleX: 1 in = 0.75 Miles
ScaleY: 1 in = 25 mph



Generated 10/14/2015 1:45 PM

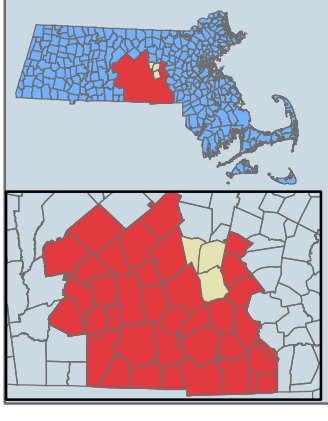
3.4 Route 140 Intersections Existing Peak Hour Traffic Volumes

CMRPC conducted Turning Movement Counts (TMCs) at eleven focus intersections for this Corridor Study. Most counts were completed between 2012 and 2015. Every effort was made to complete these TMCs during peak flow months while school was in session. In addition, all volumes at the focus intersections were adjusted, using a growth rate percentage, to 2016 volumes. In displaying these counts as a network, a "balancing" exercise was conducted to account for the typical addition and loss of traffic between adjacent study intersections (due to local streets, site drives serving major land uses, and other private driveways) and natural statistical variation encountered when turning movement counts are conducted on different days. These adjusted volumes are shown in **Figures 37 through 42** as existing AM and PM peak hour traffic flows. The complete TMC datasheets have been provided in the document's Technical Appendix.



ROUTE 140 CORRIDOR PROFILE

West Boylston Existing Traffic Flows
AM Peak Hour Period
Figure 37



Legend

- Route 140 Corridor Profile
- Interstate
- State Numbered Routes
- Local Roads

Miles
0 0.2 0.4 0.8 1.2 1.6

CMRPC
Central Massachusetts Regional Planning Commission

Source: Data provided by the US Census Bureau, Central Massachsuetts Regional Planning Commission (CMRPC), massDOT Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information MassGIS), Commonwealth of Massachusetts, Information Technology Division.

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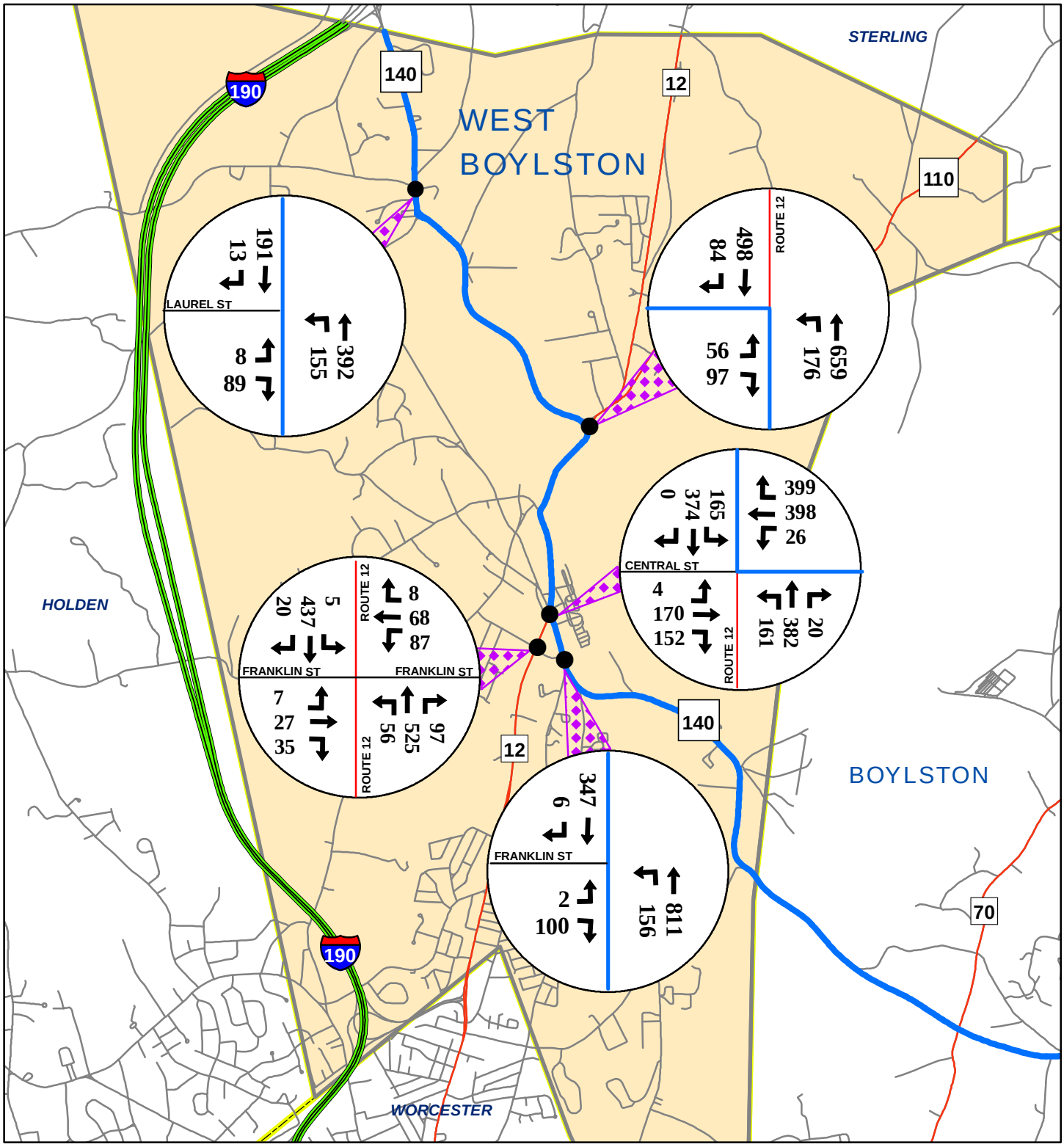
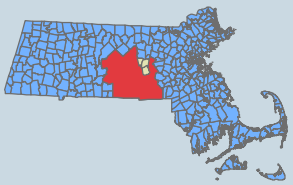
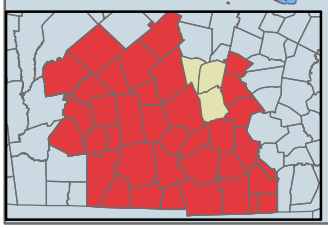


ROUTE 140 CORRIDOR PROFILE

West Boylston Existing Traffic Flows
PM Peak Hour Period
Figure 38





Legend

- Route 140 Corridor Profile
- Interstate
- State Numbered Routes
- Local Roads

0 0.2 0.4 0.8 1.2 1.6 Miles

CMRPC
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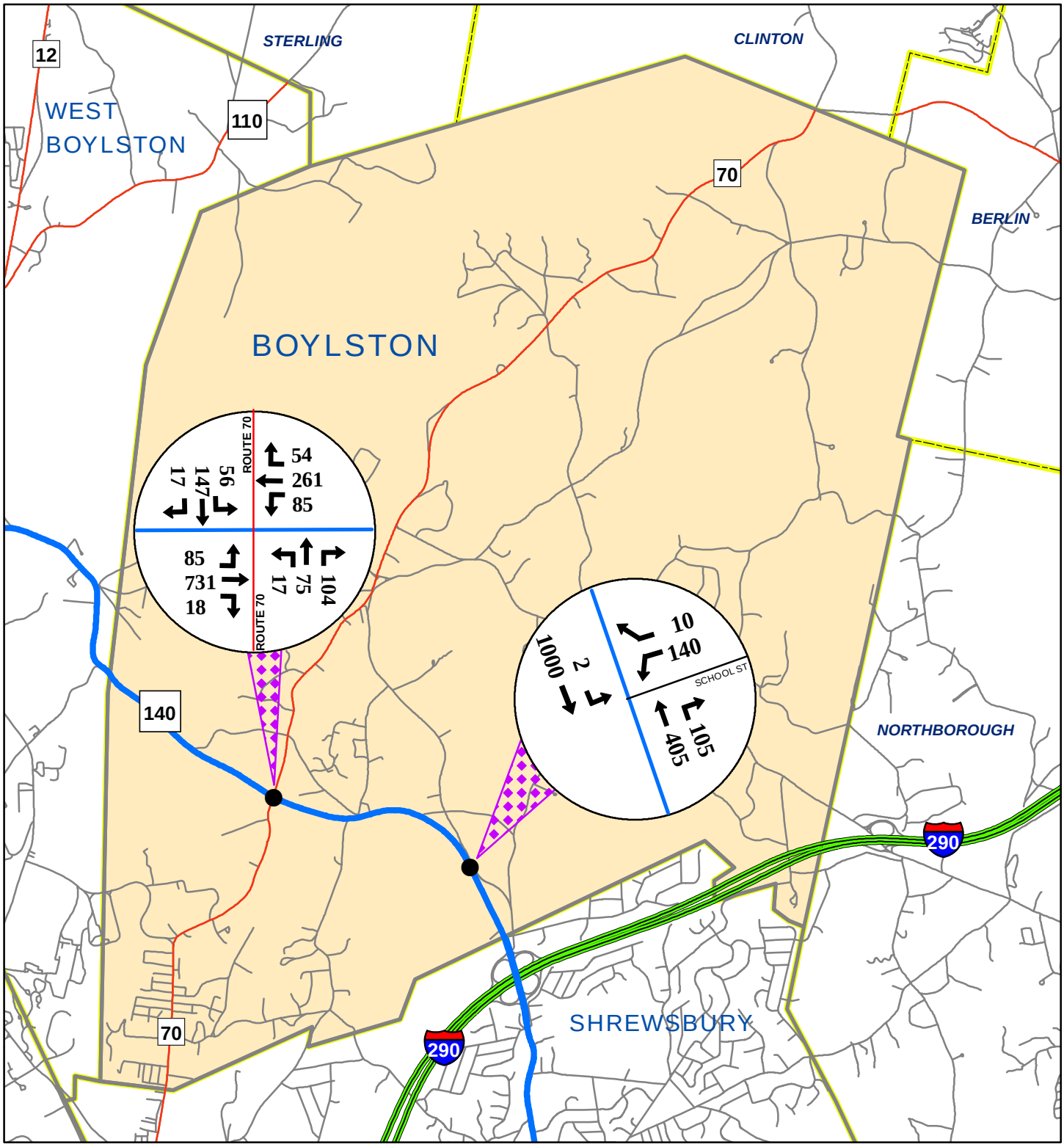
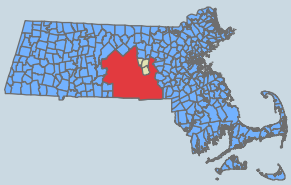
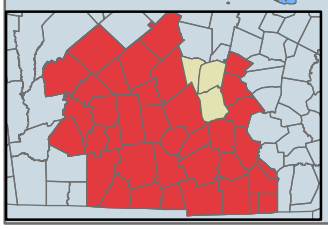


ROUTE 140 CORRIDOR PROFILE

Boylston Existing Traffic Flows
AM Peak Hour Period
Figure 39





Legend

- Route 140 Corridor Profile
- Interstate
- State Numbered Routes
- Local Roads

0 0.25 0.5 1 1.5 2 Miles

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Central Massachusetts Regional Planning Commission

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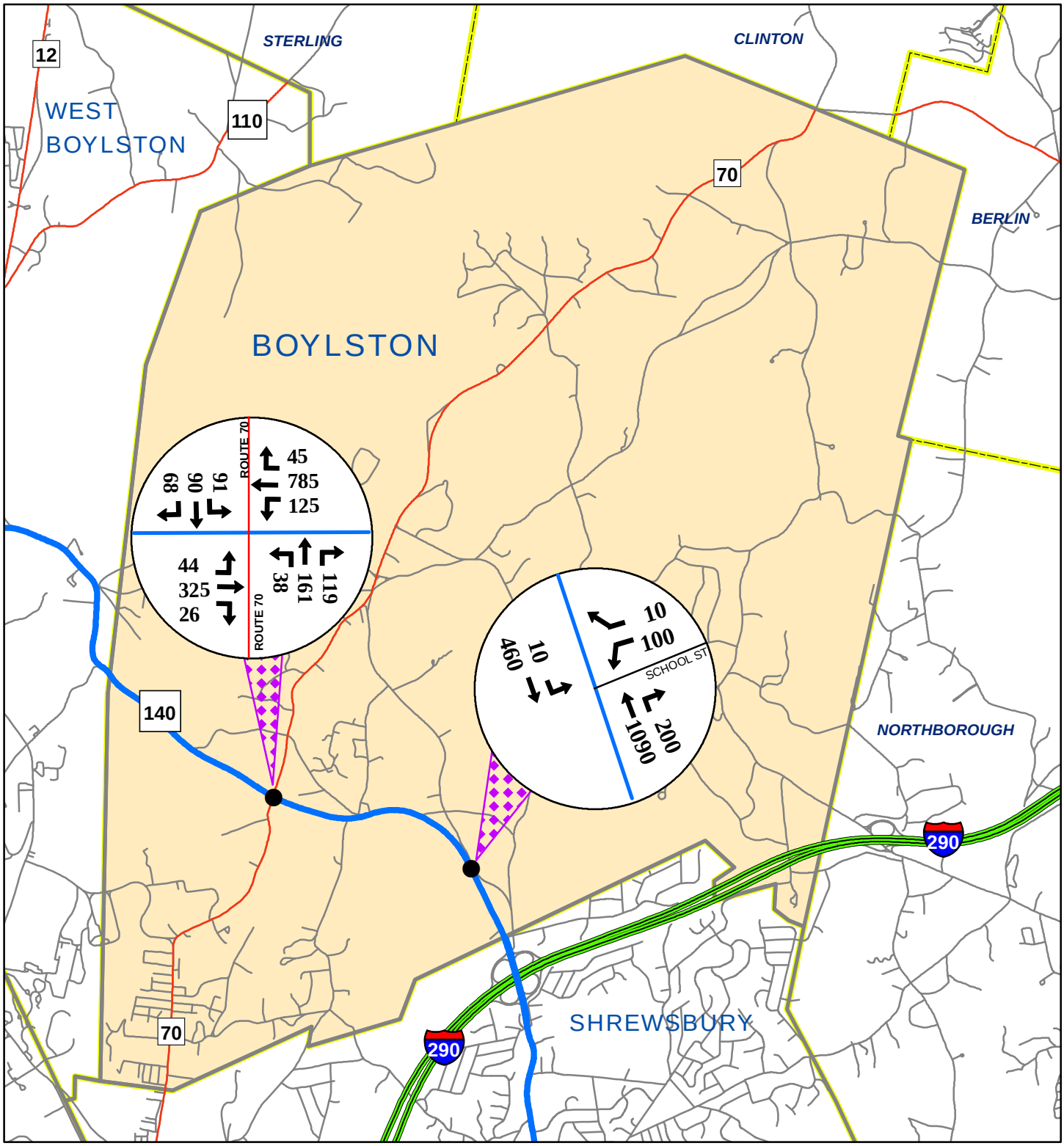
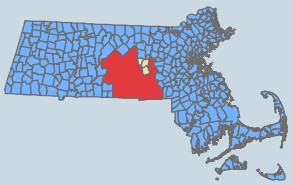
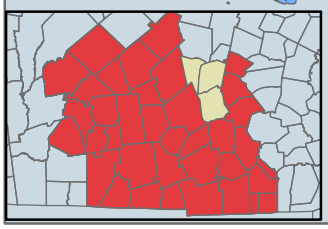


ROUTE 140 CORRIDOR PROFILE

Boylston Existing Traffic Flows
PM Peak Hour Period
Figure 40





Legend

- Route 140 Corridor Profile
- Interstate
- State Numbered Routes
- Local Roads

0 0.25 0.5 1 1.5 2 Miles

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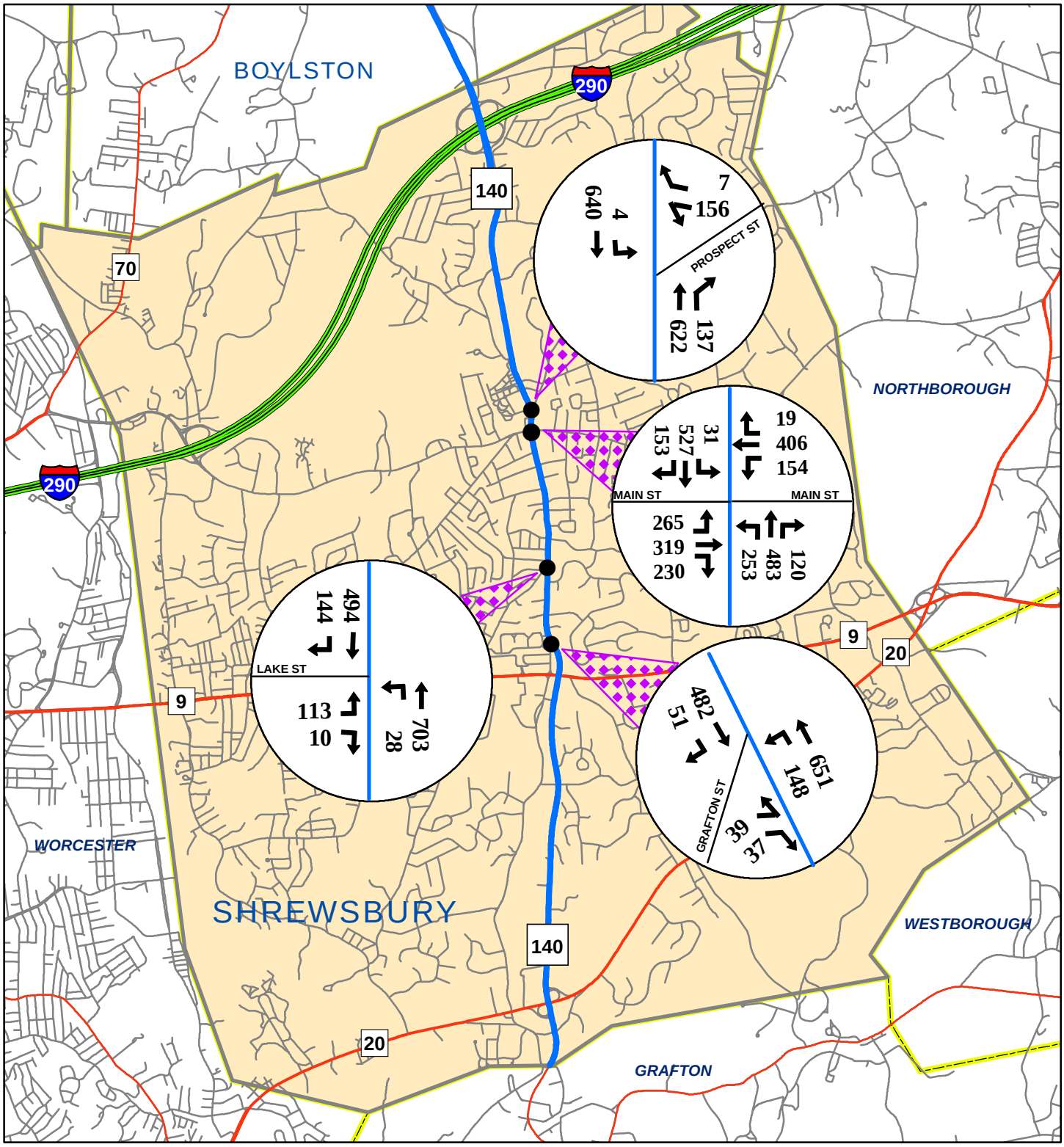
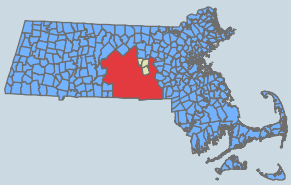
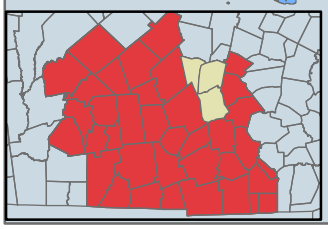


ROUTE 140 CORRIDOR PROFILE

Shrewsbury Existing Traffic Flows
AM Peak Hour Period
Figure 41





Legend

- Route 140 Corridor Profile
- Interstate
- State Numbered Routes
- Local Roads

0 0.25 0.5 1 1.5 2 Miles

C M R P C
Central Massachusetts Regional Planning Commission

Source: Data provided by the US Census Bureau, Central Massachsuetts Regional Planning Commission (CMRPC), massDOT Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information MassGIS), Commonwealth of Massachusetts, Information Technology Division.

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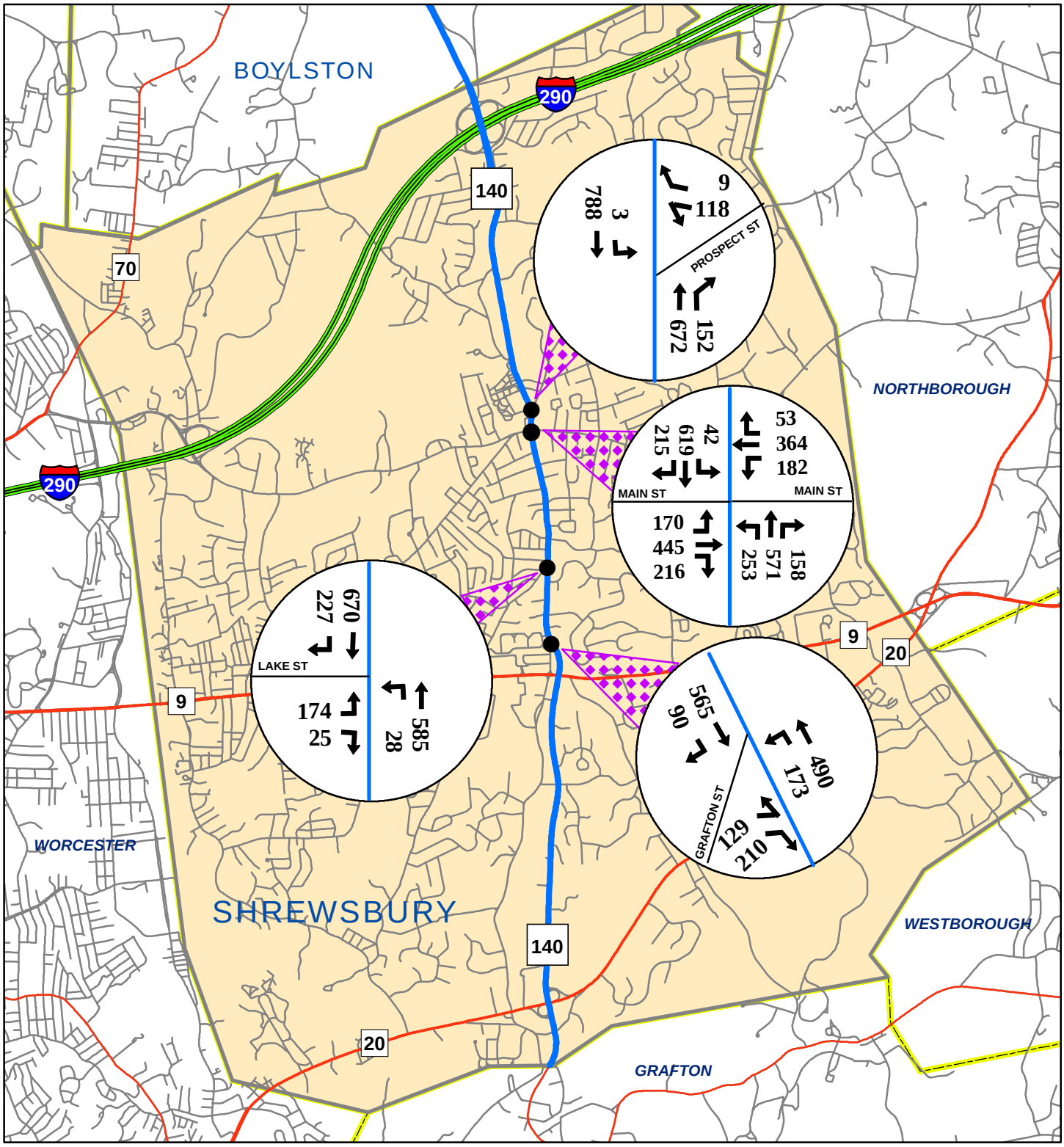
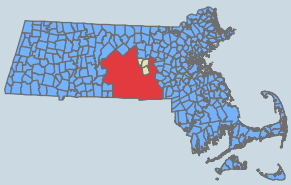
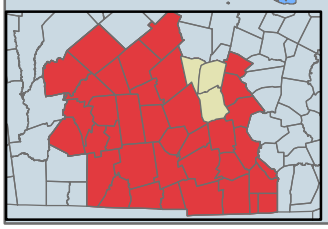


ROUTE 140 CORRIDOR PROFILE

Shrewsbury Existing Traffic Flows
PM Peak Hour Period
Figure 42





Legend

- Route 140 Corridor Profile
- Interstate
- State Numbered Routes
- Local Roads

0 0.25 0.5 1 1.5 2 Miles

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Central Massachusetts Regional Planning Commission

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3.5 Percentage of Heavy Vehicles Utilizing Route 140 Focus Intersections

According to the Highway Capacity Manual (HCM), heavy vehicles are vehicles that have more than four tires touching the pavement. Trucks, buses, and recreational vehicles (RVs) are the three primary groups of heavy vehicles. Heavy vehicles often adversely affect traffic flows in two ways: 1) they are larger than passenger cars and occupy more roadway space and 2) they have inferior operating capabilities than passenger cars, particularly with respect to acceleration, deceleration, and the ability to maintain speed on upgrades.

Table 4 lists the percentage of heavy vehicles that was observed at each of the focus intersections. The town of West Boylston had the lowest averages with 3.6% in the AM and 1.6% in the PM. The next highest was the town of Boylston with 6.3% in the AM and 2.1% in the PM. Boylston and Shrewsbury averaged almost twice as much heavy vehicles as West Boylston for both the AM and PM peak periods. Shrewsbury had the highest averages with almost 7% in the AM and just over 3% in the PM. Notably, a UPS distribution facility is located at the southern end of the study corridor near Route 20. The main entrance is actually located on Route 20 just west of Route 140. Route 20 is a major east/west trucking route and the trucks will also utilize Route 140 north to get to I-290. Observers in the field noted that school buses accounted for some of the heavy vehicle traffic as well.

It should be noted that the heavy vehicle percentages shown in the table were observed on one random weekday. The numbers are, by nature, subject to variation due to sample size and temporary or permanent local conditions as well as other factors, such as prevailing weather. As such, the figures in the table should be used as a general indicator of trends and conditions only, as opposed to absolute statements of prevailing circumstance.

TABLE 4
Percentage of Heavy Vehicles
Utilizing Route 140 Focus Intersections

	Study Intersection	Date of Count	Morning Peak Hour %	Evening Peak Hour %
West Boylston	Route 140 / Laurel St	May '16	2.2%	1.1%
	Route 140 / Route 12	September '11	5.0%	2.2%
	Route 140 / Route 12 / Central St	August '14	3.1%	0.9%
	Route 140 / Franklin St	September '12	5.0%	2.9%
	Route 12 / Franklin St	September '12	2.7%	1.2%
	West Boylston Peak Hour Averages		**3.6%**	**1.6%**
Boylston	Route 140 / Route 70	July '14	6.3%	2.1%
	Route 140 / School St	June '16	6.0%	2.0%
	Boylston Peak Hour Averages		**6.2%**	**2.1%**
Shrewsbury	Route 140 / Prospect St	June '15	7.9%	3.6%
	Route 140 / Main St	October '15	5.6%	2.1%
	Route 140 / Lake St	September '15	6.4%	4.0%
	Route 140 / Grafton St	September '15	7.8%	3.5%
	West Boylston Peak Hour Averages		**6.9%**	**3.3%**

3.6 Route 140 Intersections Projected 2026 Peak Hour Traffic Volumes

As this is a planning document, meant to be used to suggest and help design improvements that may not be built or implemented for several years, it is typical to estimate or "project" future traffic conditions in the study area. Transportation changes and solutions are rarely made instantly, and pertinent area circumstances can change. More specifically, here is an attempt to modify current levels of traffic volume to reflect what might be anticipated in ten years – reasonable lead time for planning purposes.

Regional Travel Demand Model

The Regional Travel Demand Model is an advanced computer simulation of the region's network of major highways that is maintained by the CMRPC transportation staff. It considers the greater region's population, housing stock, and employment. For this Corridor Profile effort, anticipated overall growth in subregional traffic volumes was examined.

This study looks to the future with estimated year 2026 projected traffic increases. This allows for an assessment of potential future year operational conditions and, if necessary, the suggestion of potential improvements options.

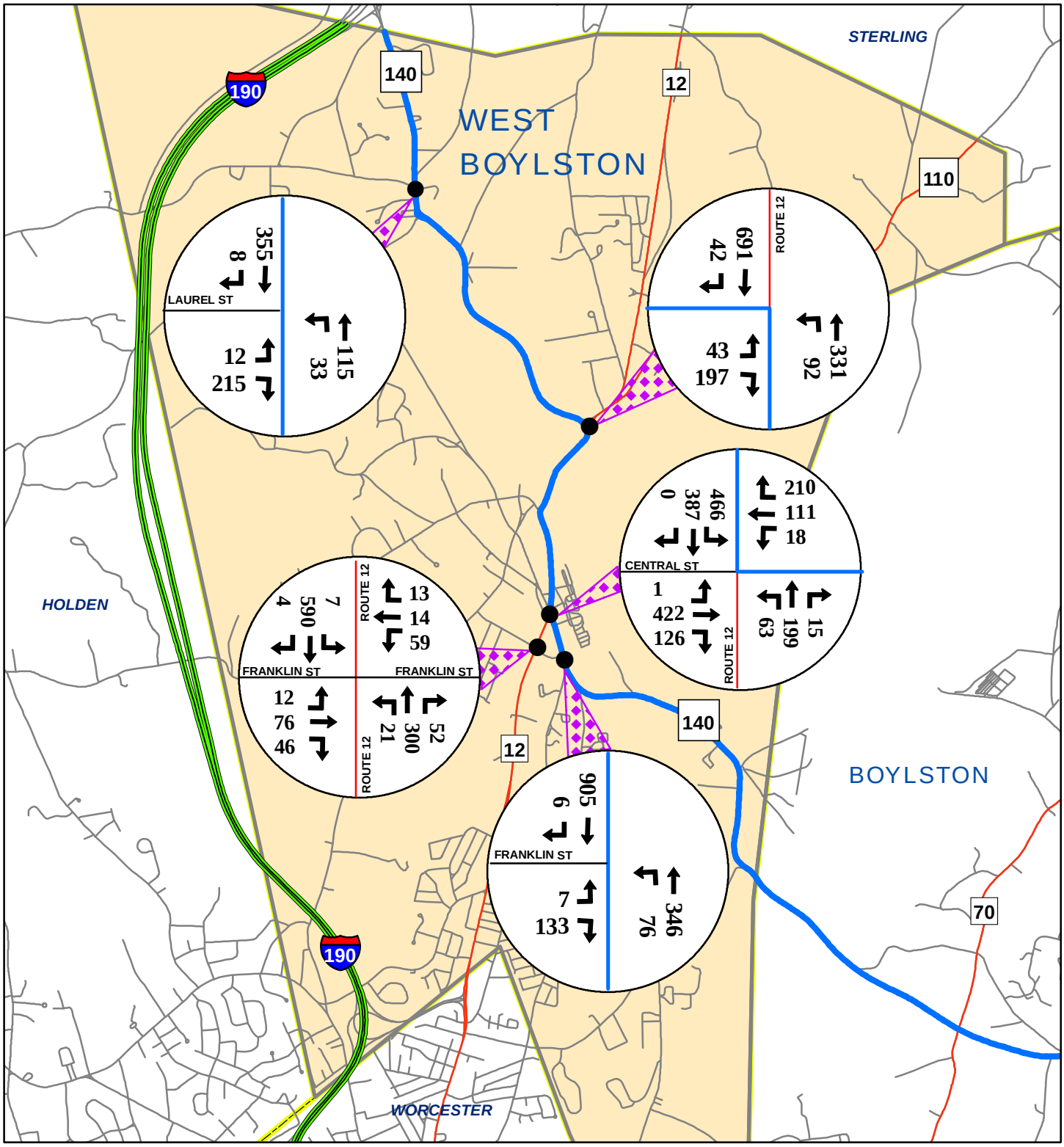
The model currently projects approximately 1% per year growth over the next decade in the general Corridor Profile study area, resulting in about an overall +10% increase in Route 140 traffic volumes in the 10 year period between 2016 and 2026. This percentage increase was applied in order to assess potential future year conditions.

The resulting 2026 traffic flow networks for the AM and PM peak hours were then analyzed to characterize likely future operating conditions. **Figures 43 through 48** illustrate 10-year projections of the existing volumes, assuming an annual growth rate of 1% for the entire length of Route 140.

Additional Site-Specific Volumes

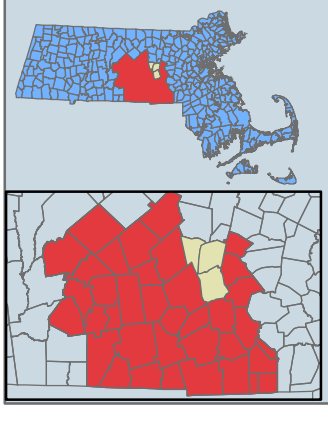
In the town of Boylston, there is a new FedEx Ground Distribution Facility that has been constructed at 160 Shrewsbury Street, as of July 2018, with the primary site drive located between School Street and Colonial Drive. In preparation for this new facility, there were two traffic impact studies completed by two different consultants. One was for the town of Boylston and the other was for the town of Shrewsbury. Each report shows the traffic distribution analysis for the FedEx project within their towns. Both reports had about 500

vehicles entering/exiting the new FedEx facility during the AM & PM peak hours. Using a combination of both studies, the additional traffic was added to the projected 2026 volumes that were calculated using the results of the Travel Demand Model and are also included in the following figures.



ROUTE 140 CORRIDOR PROFILE

West Boylston Projected 2026 Traffic Flows
AM Peak Hour Period
Figure 43



Legend

- Route 140 Corridor Profile
- Interstate
- State Numbered Routes
- Local Roads

0 0.2 0.4 0.8 1.2 1.6 Miles

CMRPC
Central Massachusetts Regional Planning Commission

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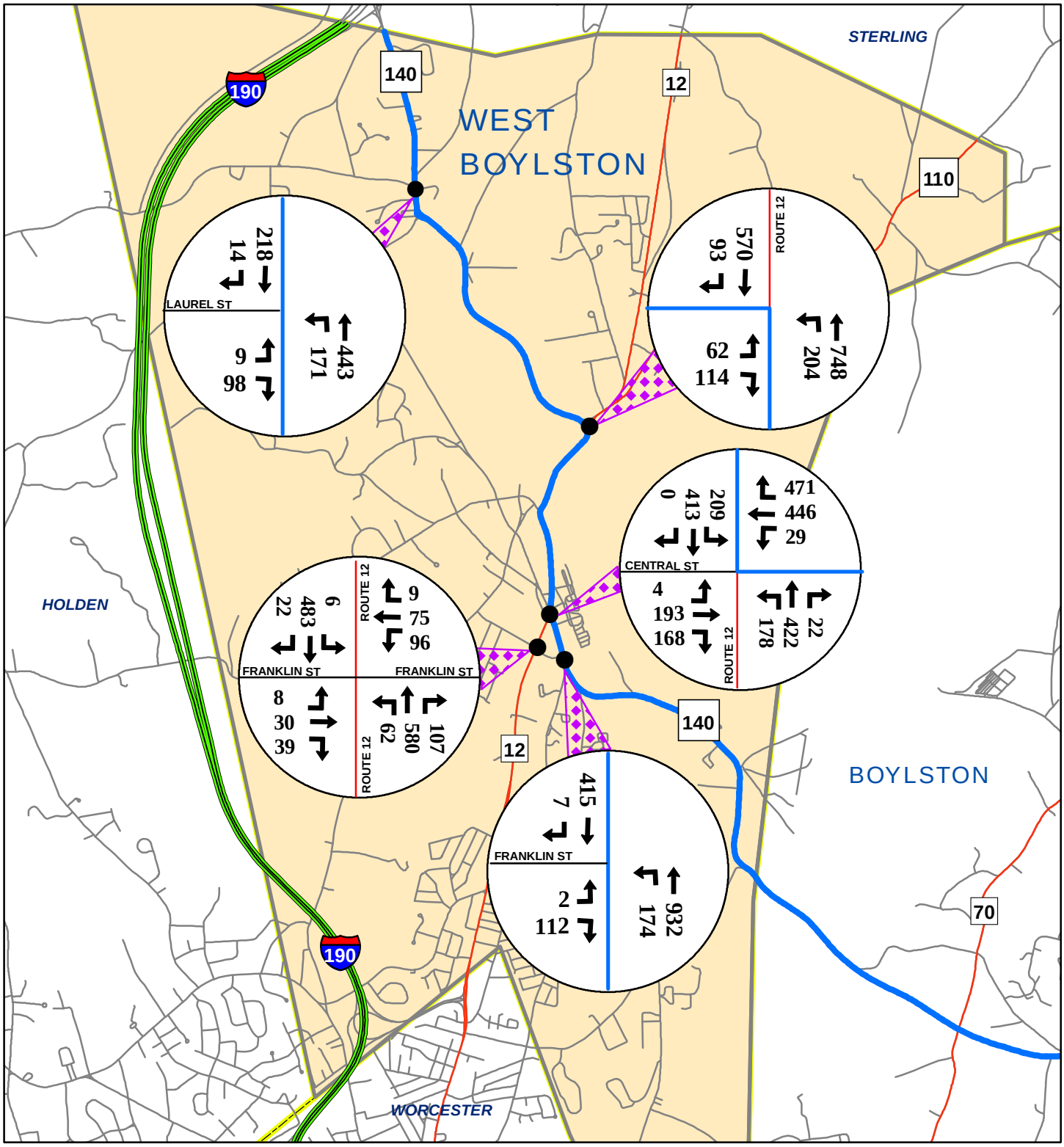
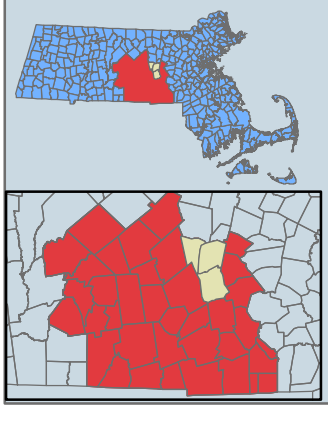


ROUTE 140 CORRIDOR PROFILE

West Boylston Projected 2026 Traffic Flows
PM Peak Hour Period
Figure 44



Legend

- Route 140 Corridor Profile
- Interstate
- State Numbered Routes
- Local Roads

0 0.2 0.4 0.8 1.2 1.6 Miles

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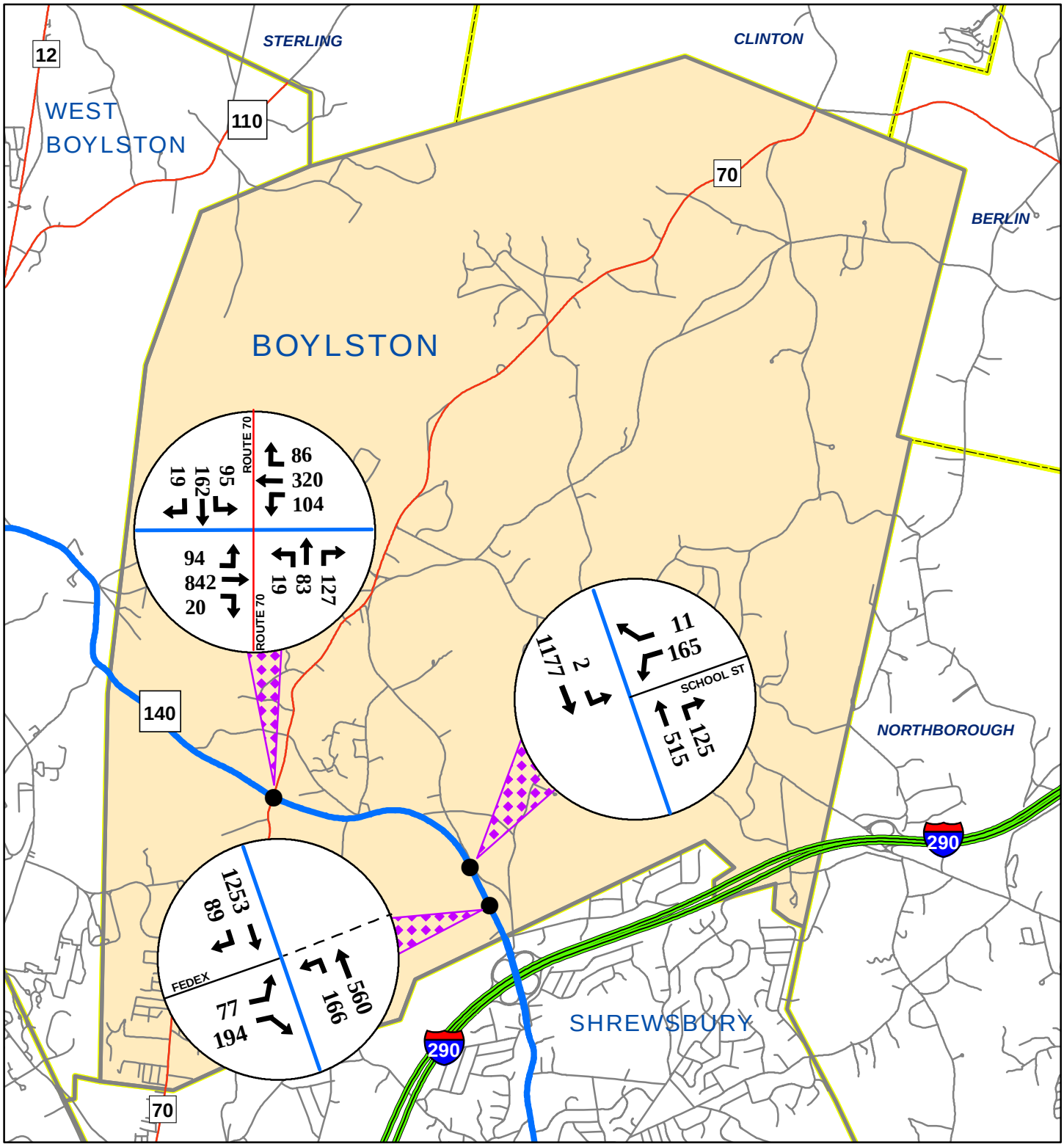
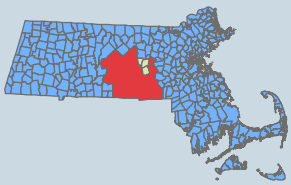
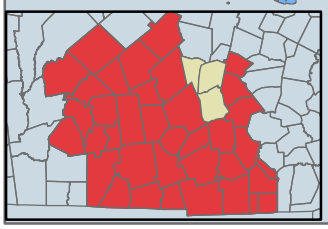


ROUTE 140 CORRIDOR PROFILE

Boylston Projected 2026 Traffic Flows
AM Peak Hour Period
Figure 45





Legend

- Route 140 Corridor Profile
- Interstate
- State Numbered Routes
- Local Roads

0 0.25 0.5 1 1.5 2 Miles

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Central Massachusetts Regional Planning Commission

Source: Data provided by the US Census Bureau, Central Massachsuetts Regional Planning Commission (CMRPC), massDOT Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information MassGIS), Commonwealth of Massachusetts, Information Technology Division.

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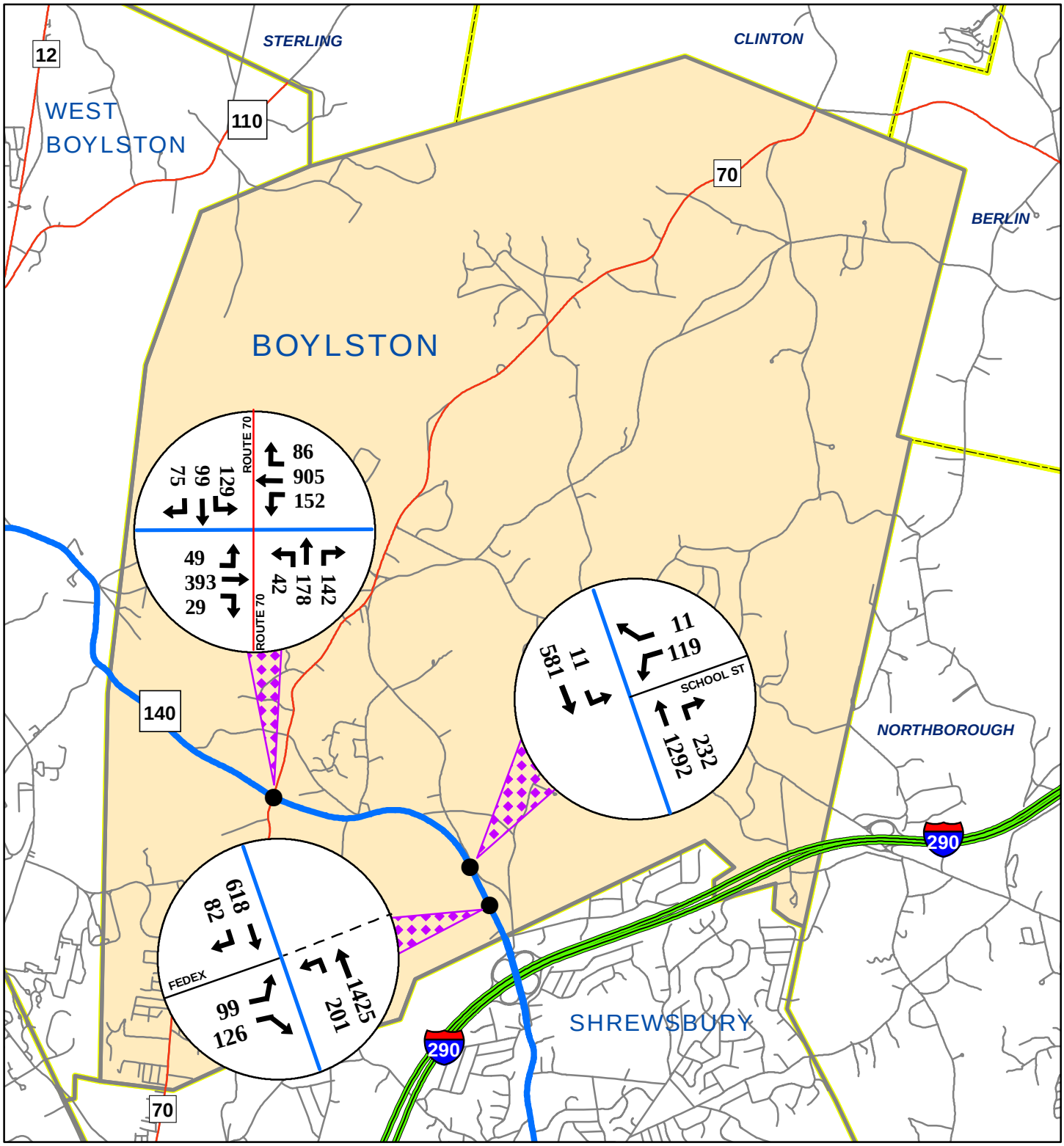
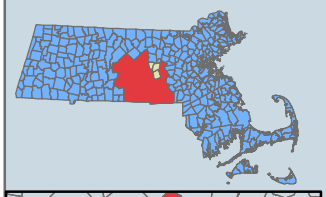
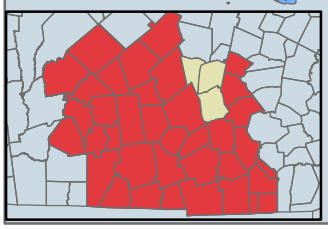


ROUTE 140 CORRIDOR PROFILE

Boylston Projected 2026 Traffic Flows
PM Peak Hour Period
Figure 46





Legend

- Route 140 Corridor Profile
- Interstate
- State Numbered Routes
- Local Roads

0 0.25 0.5 1 1.5 2 Miles

CMRPC
Central Massachusetts Regional Planning Commission

Source: Data provided by the US Census Bureau, Central Massachsuetts Regional Planning Commission (CMRPC), massDOT Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information MassGIS), Commonwealth of Massachusetts, Information Technology Division.

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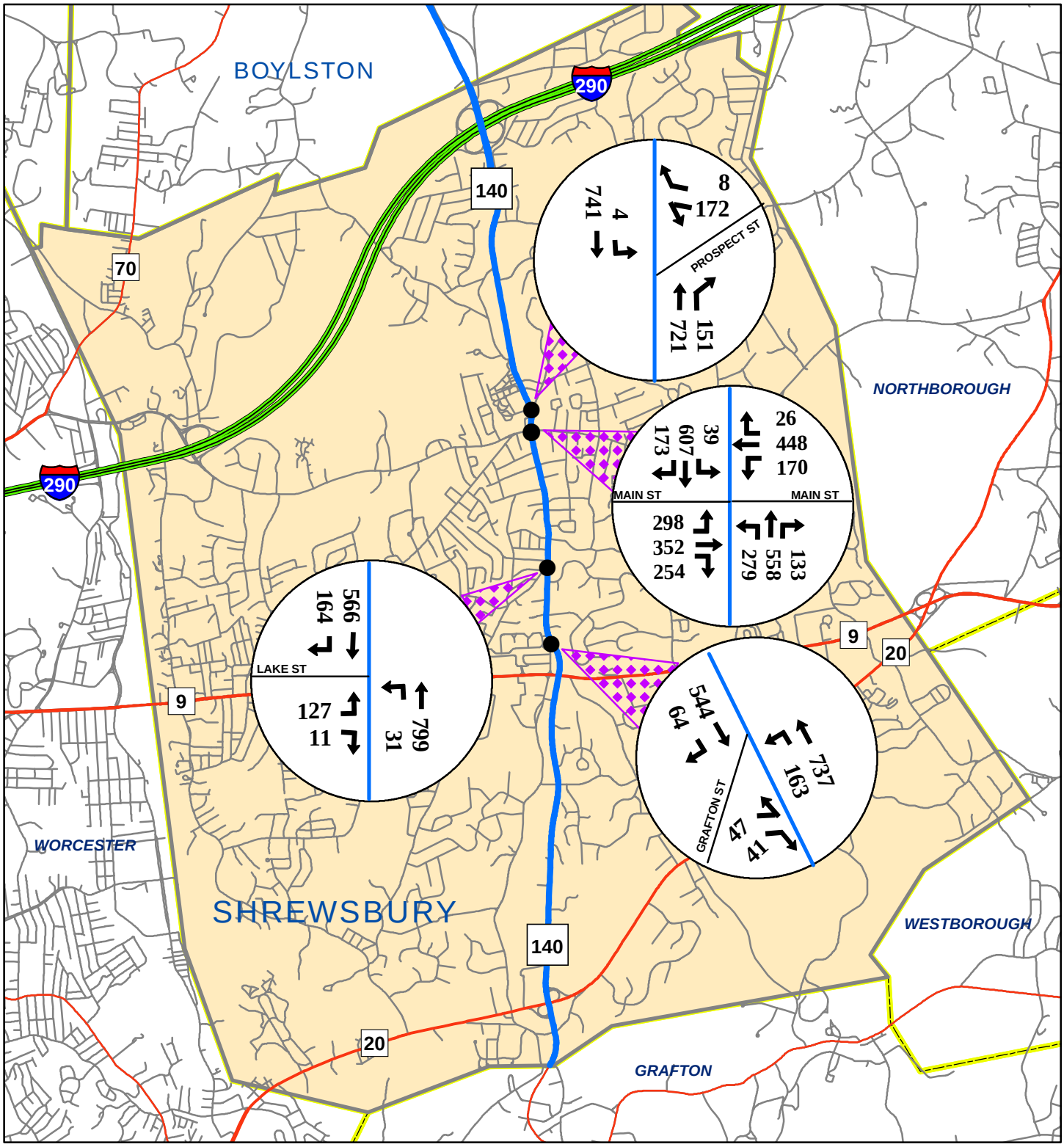
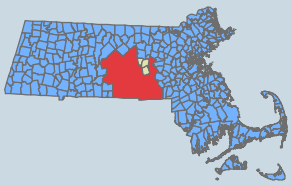
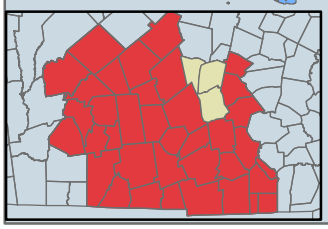


ROUTE 140 CORRIDOR PROFILE

Shrewsbury Projected 2026 Traffic Flows
AM Peak Hour Period
Figure 47





Legend

- Route 140 Corridor Profile
- Interstate
- State Numbered Routes
- Local Roads

0 0.25 0.5 1 1.5 2 Miles

CMRPC
Central Massachusetts Regional Planning Commission

Source: Data provided by the US Census Bureau, Central Massachsuetts Regional Planning Commission (CMRPC), massDOT Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information MassGIS), Commonwealth of Massachusetts, Information Technology Division.

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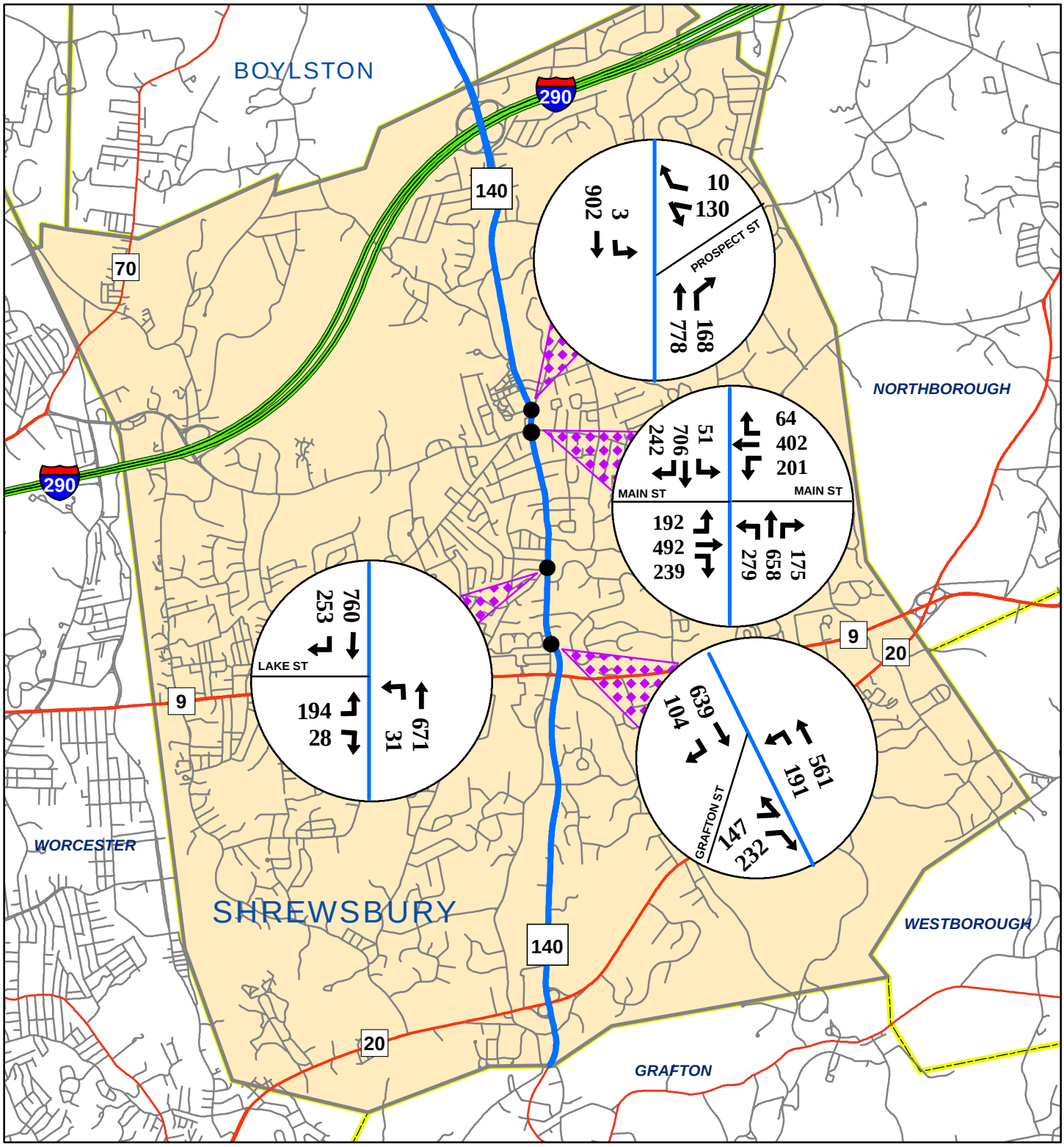
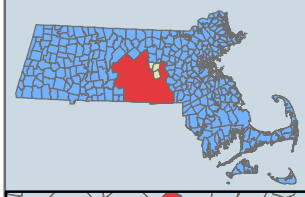
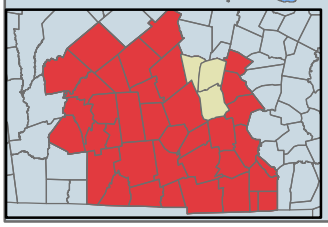


ROUTE 140 CORRIDOR PROFILE

Shrewsbury Projected 2026 Traffic Flows
PM Peak Hour Period
Figure 48





Legend

- Route 140 Corridor Profile
- Interstate
- State Numbered Routes
- Local Roads

0 0.25 0.5 1 1.5 2 Miles

C M R P C
Central Massachusetts Regional Planning Commission

Source: Data provided by the US Census Bureau, Central Massachsuetts Regional Planning Commission (CMRPC), massDOT Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information MassGIS), Commonwealth of Massachusetts, Information Technology Division.

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3.7 Route 140 Intersections Peak Hour Level of Service (LOS) Analyses

Using the existing and projected 2026 traffic increases for Route 140 a Level of Service (LOS) grade was calculated for the intersections. The LOS is calculated by using a Highway Capacity Software (HCS). The software calculates the amount of delay (in seconds) for each approach and the intersection as a whole. Using the estimated length of delay in seconds, a LOS grade between "A" and "F" is assigned. **Table 5** lists both the existing and projected LOS for the focus intersections in each host community. The complete LOS worksheets are provided in the document's Technical Appendix. The following notable trends were observed:

- There are five study intersections in West Boylston. One is signalized and the other four are Stop sign controlled. The worst operating intersections, in terms of delay, are Route 12/Central Street, Route 12 (by reservoir), and Route 12/Franklin Street. All three of these intersections have an LOS "C" or worse for existing and projected conditions. The two other study intersections of Laurel Street and Route 140/Franklin Street operate at LOS "B" in the AM & PM for both existing and projected conditions.

- In Boylston, staff counted and analyzed the Route 70 intersection, and also used data from other traffic studies for the School Street intersection and the new FedEx site drive. The Route 70 and School Street intersections operate at a LOS "F" with over 100 seconds of delay for both AM & PM. The FedEx site drive is projected to have a LOS "C" in the AM and LOS "B" in the PM.

- Four study intersections are located in the town of Shrewsbury. The lone Stop sign controlled Route 140/Prospect Street intersection has a LOS "F" during the AM & PM for both existing and projected conditions. Under projected conditions, the amount of delay is over 300 seconds. It should be pointed out that the LOS represents the delay for the minor street approach, Prospect Street, for a Stop sign controlled intersection. The Main Street intersection is just south of Prospect Street and also has an LOS "F" for both the AM & PM periods. The remaining two intersections are Lake Street and Grafton Street. Both operate very well with a LOS "A" or "B" for existing and projected conditions.

TABLE 5
Intersection Level Of Service (LOS) Analyses Results:
Existing Conditions & Projected 2026 Conditions

COMMUNITY	ROUTE 140 INTERSECTION	NETWORK Existing Balanced AM V/C[1]	AM Delay[2]	AM LOS	PM V/C[1]	PM Delay[2]	PM LOS	NETWORK 2026 Projected AM V/C[1]	AM Delay[2]	AM LOS	PM V/C[1]	PM Delay[2]	PM LOS
	SIGNALIZED	**Overall Intersection Operations**											
West Boylston	Route 140/Route 12/Central St	1.35	64	E	0.90	32	C	1.59	94	F	1.06	44	D
Boylston	Route 140/Route 70	1.48	130	F	1.31	89	F	1.70	172	F	1.57	143	F
	Route 140/FedEx Site Drive**	-	-	-	-	-	-	0.97	32	C	0.80	18	B
Shrewsbury	Route 140/Main St	1.30	100	F	1.41	124	F	1.61	147	F	2.76	194	F
	Route 140/Lake St	0.63	6	A	0.76	9	A	0.74	8	A	0.85	13	B
	Route 140/Grafton St	0.24	6	A	0.77	11	B	0.66	7	A	0.84	13	B
	UNSIGNALIZED[3]	**Minor Street Approaches under "Stop" Sign Control**											
West Boylston	Route 140/Laurel St	0.30	12	B	0.14	11	B	0.35	13	B	0.17	12	B
	Route 140/Route 12	0.41	20	C	0.88	71	F	0.54	27	D	1.49	167	F
	Route 140/Franklin St	0.37	21	C	0.18	12	B	0.50	29	D	0.23	14	B
	Route 12/Franklin St	0.47	42	E	1.05	144	F	0.67	73	F	1.47	300	F
Boylston	Route 140/School St*	1.20	120	F	1.20	120	F	1.20	120	F	1.20	120	F
Shrewsbury	Route 140/Prospect St	0.98	119	F	1.03	151	F	1.46	300	F	1.58	300	F

1) V(volume)/C(capacity) is for worst lane group; C is maximum flow under prevailing conditions
2) Delay in seconds
3) Delay and LOS are for minor street approach

*Data used from the Boylston Traffic Impact Study for the Proposed Fed Ex Facility by VHB (September 2016)
**Data used from the Shrewsbury Corridor Study of Route 140 South for the Proposed Fed Ex Facility by MDM (November 2017)

3.8 Performance Management

There are number of performance measures related to the Congestion Management Process (CMP). The first measure is Congestion. The objective is to reduce travel delay and increase connectivity along identified roadway corridors while also improving level of service at identified intersections. By studying the Route 140 corridor, the observations, data collection, and discussions with the three host communities included in the study helped determine what some of the existing deficiencies were and what suggested improvement options might alleviate the congestion. One option would be to check the timing and phasing of all the traffic signals along Route 140 to be certain all are working correctly. If needed, the timing could be adjusted for improved traffic flow. By making these signalized intersections more efficient it will potentially reduce travel delays and improve level of service at the key intersections.

The second measure is related to Greenhous Gases (GHG). The objective for this performance measure is to reduce automobile and transit vehicle emissions. This measure is somewhat related to the Congestion performance measure described above. With the reduction of travel delays and fewer idling vehicles, GHG's could potentially be reduced. Another way to reduce GHG's would be to encourage the use of other modes such as walking, bicycling, or public transit. Since there are no fixed-route buses currently traveling along Route 140 within these host communities, one suggestion would be to examine the feasibility of transit service along Route 140. In addition, by improving Route 140 to be more pedestrian and bicycle friendly would give the public other options by increasing modal choice. The bicycle and pedestrian infrastructure would need to be added where it doesn't already exist, as observed along some segments of Route 140. As for transit emissions, the use of electric or lower emission hybrid buses would help the goal of reducing GHG's.

The last measure is under the Economic category. The objective is to speed shipping in the region by reducing delay along established primary freight routes. This measure is similar to the first measure, except it is for a primary freight route. Since Route 140 is considered a primary freight route, improvements made for the initial Congestion measure will also help this measure, reducing delays for trucking activities.

4.0 Safety Management System (SMS)

For this Corridor Profile, CMRPC staff obtained crash data from the Massachusetts Department of Transportation (MassDOT). On a yearly basis MassDOT receives crash data from the Registry of Motor Vehicles (RMV). Before the data is released to the public a quality control analysis is conducted on the crash records. MassDOT then releases the three most recent years of data. The crash information used for this Corridor Profile is from the three-year period from 2012 to 2014. This chapter will discuss the results of the data gathered for the towns of West Boylston, Boylston, and Shrewsbury.

Figures 49 through 51 show the location of the crashes that occurred in West Boylston, Boylston, and Shrewsbury between 2012 and 2014. The colored dots on the maps indicate whether an incident was a fatal injury, non-fatal injury, or property damage-only type crash. Also included are bicycle and pedestrian incidents. The total count of each crash type is shown in the legend. In addition, the locations of Highway Safety Improvement Program (HSIP) eligible crash clusters are shown on the maps. These clusters are defined based on the number of crashes adjacent to one another within a defined radius that has a high incidence of crash severity. MassDOT has developed an automated procedure for processing, standardizing, matching and aggregating the crash data collected from the RMV by geographical location using Geographic information System (GIS) tools and procedures resulting in crash clusters, bicycle clusters and pedestrian clusters.

There are a total of four HSIP* locations included in this study area, two in West Boylston and two in Shrewsbury. **Table 6** shows these four HSIP eligible locations. The cluster with the most crashes was at Main Street in Shrewsbury with a total of 27. There was one fatality at the Route 140/Route 20 location, but the crash actually happened on Route 20. The Equivalent Property Damage Only (EPDO) number included in the table is based on a scoring method in which each crash is assigned a value based on the severity of the crash. The higher the EPDO number the worse the crash impact. Based on EPDO score, nearby Route 12 @ Franklin Street included in the study scope is the most severe crash area with a score of 54.

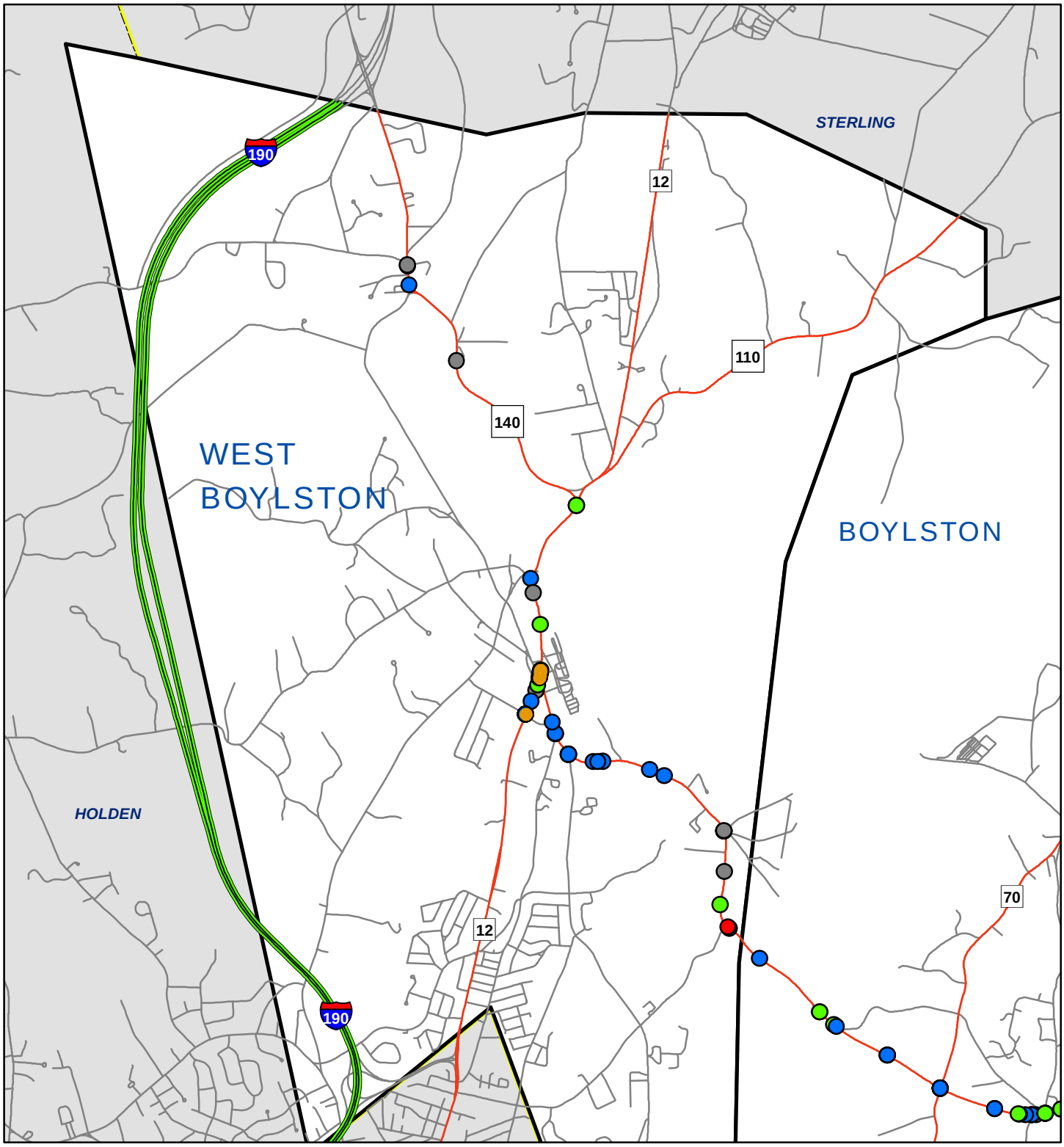
**Note: Recently released 2013-2015 crash data, not available for this report, shows only Route 12 / Franklin Street and Route 140 / Route 20 intersections as HSIP eligible.*

TABLE 6

Route 140 HSIP Locations, 2012-2014

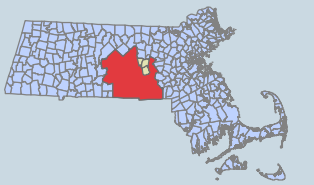
Location	Number of Crashes	Number of Fatal Injuries	Number of Non-Fatal Injuries	EPDO*
Route 12 / Franklin Street	18	0	9	54
Route 140 / Church Street	15	0	7	44
Route 140 / Main Street	27	0	3	49
Route 140 / Route 20	24	1	5	53

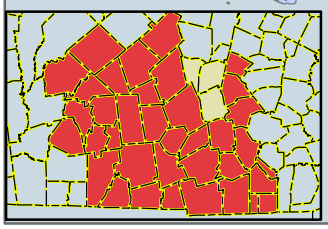
** EPDO refers to the "Equivalent Property Damage Only" scoring method that considers frequency and severity of crashes at a given location over three to five year period.*



ROUTE 140 CORRIDOR PROFILE

West Boylston Crash Data
Figure 49





Legend

- HSIP Eligible Crash Clusters (Auto)
- Fatal Injury (1)
- Non-Fatal Injury (22)
- Property Damage (35)
- Unknown (8)

0 0.2 0.4 0.8 1.2 1.6 Miles

CMRPC
Central Massachusetts Regional Planning Commission

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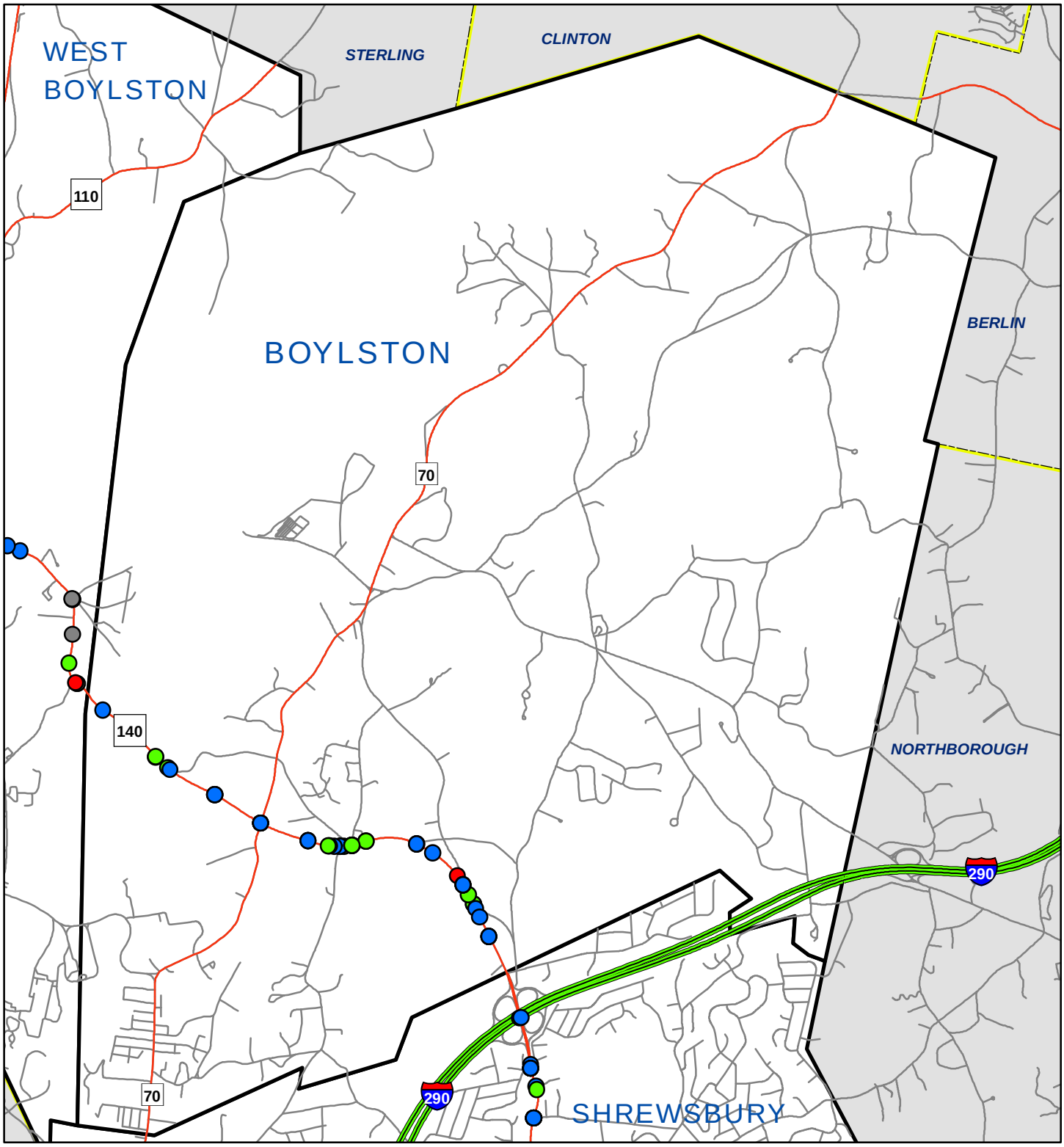
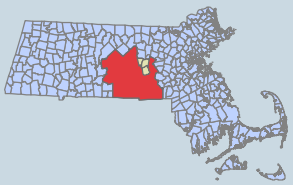
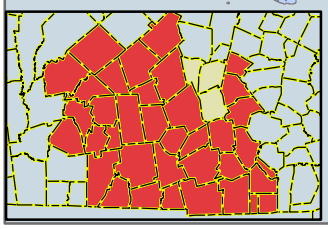


ROUTE 140 CORRIDOR PROFILE

Boylston Crash Data
Figure 50





Legend

- Fatal Injury (1)
- Non-Fatal Injury (17)
- Property Damage (30)
- Unknown (5)

0 0.225 0.45 0.9 1.35 1.8 Miles

CMRPC
Central Massachusetts Regional Planning Commission

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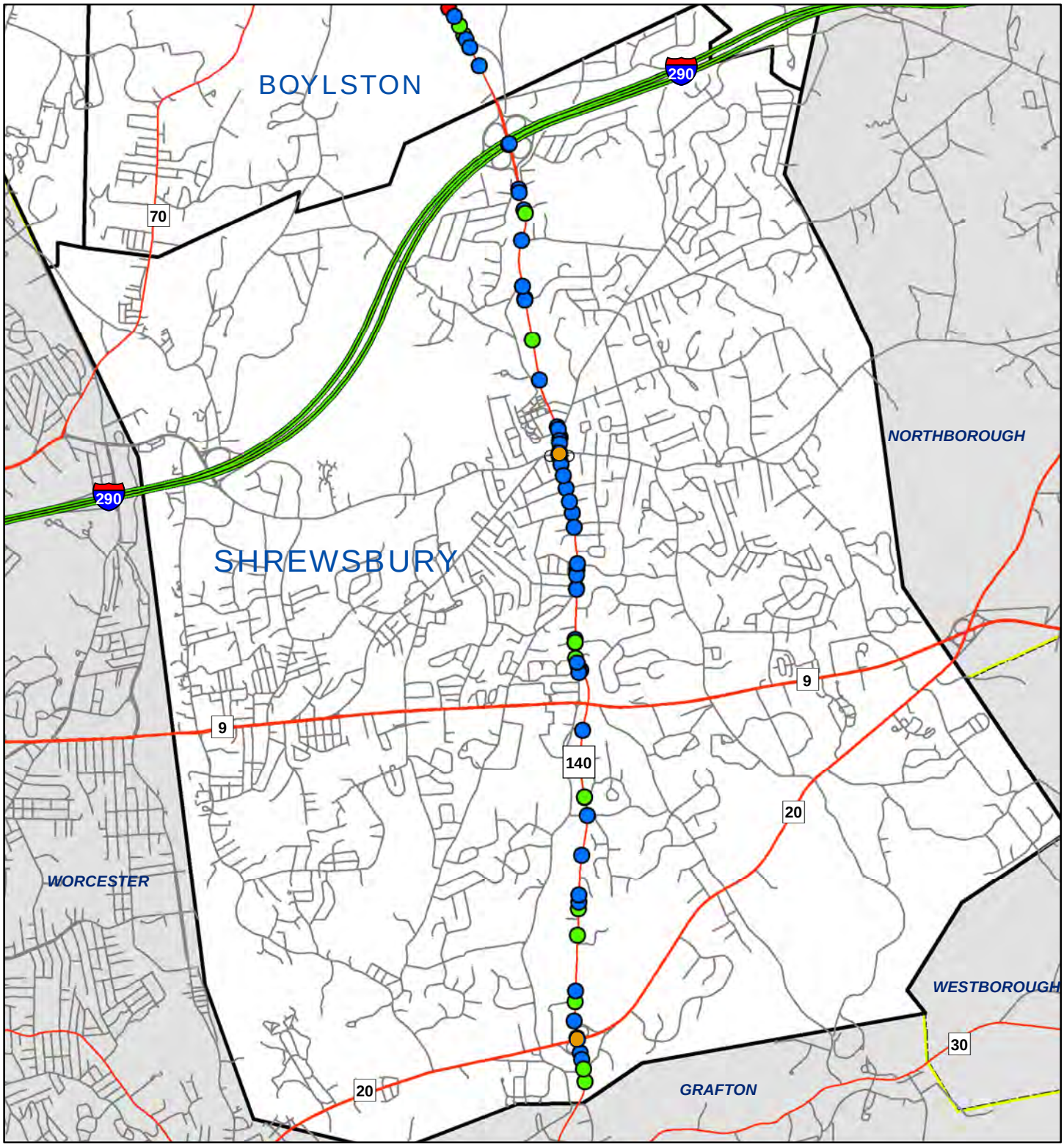
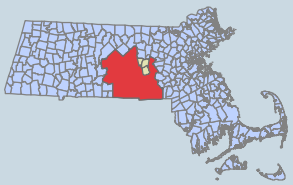
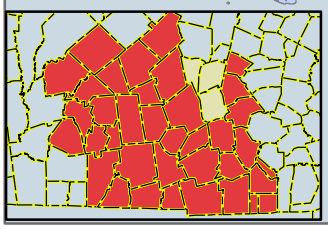


ROUTE 140 CORRIDOR PROFILE





Shrewsbury Crash Data
Figure 51

Legend

- Bicycle Crashes (1)
- HSIP Eligible Crash Clusters (Auto)
- Non-Fatal Injury (32)
- Property Damage (120)
- Unknown (3)

0 0.25 0.5 1 1.5 2 Miles

C M R P C
Central Massachusetts Regional Planning Commission

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4.1 Town of West Boylston Crash Analysis

For the town of West Boylston, MassDOT vehicle crash records were analyzed for a three-year period, 2012 - 2014. All crashes along Route 140 from the Sterling town line to the Boylston town line were tabulated. Also, incidents on minor streets that were close to or at Route 140 were also included. Additionally, the nearby intersection of Route 12 @ Franklin Street was also included in the analyses. All important information from the crash reports was organized and included in the various tables that follow.

There were a total of 66 reported study area crashes in the town of West Boylston for the three-year analysis period. **Table 7** shows a summary of the crashes. Details are shown in a variety of ways. Property damage only crashes accounted for 53% of the total, while non-fatal injuries accounted for over 33%. There was also one recorded fatality during the three years. Rear-end crashes were the most prevalent with a total of 23. Angle crashes were second with 21. The two intersections with the most crashes were at nearby Route 12 @ Franklin Street and Route 140 @ Church Street/Central Street. Often the case, most crashes occurred on dry road conditions, in daylight, and in clear weather. Over 30% of the crashes occurred between 12 PM and 4 PM. The most crashes occurred during the month of August, with the months of January and March close behind.

Table 7
Summary of Reported Crashes
On Route 140 Corridor (also part of Route 12) in the Town of West Boylston
January 1, 2012 - December 31, 2014

Crash Severity

	Number	Percent
Property Damage Only	35	53.0%
Non-Fatal Injury	22	33.3%
Fatal Injury	1	1.5%
Not Reported	8	12.1%
Total	**66**	**100.0%**

Manner of Collision

	Number	Percent
Angle	21	31.8%
Rear-end	23	34.8%
Head-on	2	3.0%
Sideswipe, opposite direction	1	1.5%
Sideswipe, same direction	3	4.5%
Single vehicle crash	11	16.7%
Unknown/not reported	5	7.6%
Total	**66**	**100.0%**

Type of Collision

	Number	Percent
Collision with a motor vehicle in traffic	52	78.8%
Collision with animal	1	1.5%
Collision with curb, embankment or guardrail	5	7.6%
Collision with tree or other fixed object	4	6.1%
Overturn or rollover	1	1.5%
Other / Unknown	3	4.5%
Total	**66**	**100.0%**

Locations with the highest number of crashes

	Number
ROUTE 12 / FRANKLIN STREET	18
ROUTE 140 / CHURCH STREET / CENTRAL STREET	15
ROUTE 140 / MAPLE STREET	4
ROUTE 140 / ROUTE 12 (NORTH)	2

Road Surface Condition

	Number	Percent
Dry	43	65.2%
Wet	12	18.2%
Snow	6	9.1%
Icy	1	1.5%
Unknown	4	6.1%
Total	**66**	**100.0%**

Time of Day

	Number	Percent
Before 7 AM	6	9.1%
7 AM - 10 AM	8	12.1%
10 AM - 12 PM	4	6.1%
12 PM - 4 PM	21	31.8%
4 PM - 6 PM	14	21.2%
6 PM - 9 PM	10	15.2%
After 9 PM	3	4.5%
Total	**66**	**100.0%**

Light Conditions

	Number	Percent
Daylight	42	63.6%
Dark	15	22.7%
Dusk	4	6.1%
Not Reported	5	7.6%
Total	**66**	**100.0%**

Weather Conditions

	Number	Percent
Clear	34	51.5%
Snow	7	10.6%
Rain	6	9.1%
Cloudy	15	22.7%
Fog		0.0%
Not Reported	4	6.1%
Total	**66**	**100.0%**

Month of the Year

	Number	Percent
January	7	10.6%
February	6	9.1%
March	7	10.6%
April	4	6.1%
May	4	6.1%
June	6	9.1%
July	6	9.1%
August	8	12.1%
September	2	3.0%
October	5	7.6%
November	5	7.6%
December	6	9.1%
Total	**66**	**100.0%**

Table 8 shows the collision type by study area location in the town of West Boylston. The table lists the total crashes at each intersection and at other Route 140 locations (non-intersection crashes) and what type of crash occurred. There were 24 non-intersection crashes and 42 intersection crashes. There were 21 angle crashes along the study corridor, but most of them occurred at nearby Route 12 @ Franklin Street. One reason for so many angle crashes along Route 140 is the high volume of left turning vehicles, whether turning in/out of a business at the intersection or turning in/out of a minor street or driveway. Drivers often underestimate the speed and distance of oncoming vehicles (or become impatient when insufficient safe gaps occur) and turn in front of the oncoming vehicles, leaving them very little time to stop. Rear ends were the highest type of crash with ten of them occurring at non-intersection locations. One of these rear end crashes resulted in a fatality. There were also six such rear end crashes at the Church Street/Central Street intersection. Rear ends often occur during congested roadway conditions and from driver inattention. Roadway surface conditions can also be a factor. Single vehicle crashes are also prevalent along the corridor. Most of them occurred on roadway segments between the intersections where vehicles were reported to run off the road.

TABLE 8
Collision Type by Location in West Boylston, 2012-2014

Location	Total	Type							
		Angle	Rear-End	Rear-to-rear	Head-on	Sideswipe, opposite direction	Sideswipe, same direction	Single vehicle crash	Other (Unknown, Not reported)
ROUTE 140 / FRANKLIN STREET	**1**		1						
ROUTE 140 / GOODALE STREET	**1**	1							
ROUTE 140 / LAUREL STREET	**1**							1	
ROUTE 140 / MAPLE STREET	**4**	1	1					2	
ROUTE 140 /ROUTE 12 (NORTH)	**2**		2						
ROUTE 140 / CHURCH STREET / CENTRAL STREET	**15**	3	6		1		2	1	2
ROUTE 12 / FRANKLIN STREET	**18**	13	3		1		1		
OTHER ROUTE 140 LOCATIONS	**24**	3	10			1		7	3
TOTAL	**66**	**21**	**23**	**0**	**2**	**1**	**3**	**11**	**5**

Table 9 below shows the types of collisions that occurred and the severity. Over half of the crashes caused property damage only. Angle and rear-end crashes caused the most property damage with a total of 25. Of the 22 crashes that caused a non-fatal injury, angle and rear-end crashes were again the most prevalent with a total of 16. There was also one fatality from a single vehicle crash.

TABLE 9

West Boylston Crashes by Severity and Type of Collision, 2012-2014

	Severity			
Type of Collision	***Fatal Injury***	***Non-fatal Injury***	***Property Damage Only***	***Other (not reported, unknown, etc.)***
Angle	0	8	12	1
Head-on	0	1	1	0
Rear-end	0	8	13	2
Sideswipe, opposite direction	0	1	0	0
Sideswipe, same direction	0	0	3	0
Single vehicle crash	1	3	4	3
Other (not reported, unknown, etc	0	1	2	2
Total number of crashes	**1**	**22**	**35**	**8**

4.2 Town of Boylston Crash Analysis

For the town of Boylston, vehicle crash records were analyzed for a three-year period, 2012-2014. All reported crashes along Route 140 from the West Boylston town line to the Shrewsbury town line were tabulated. Also, crashes on minor streets that were close to or at Route 140 were included. Pertinent information from the crash reports was organized and included in the various tables that follow.

As shown in **Table 10**, there were a total of 53 crashes reported during the three-year analysis period. According to the results, the most common types were angle and single vehicle crashes. The majority of the crashes in Boylston caused property damage, but there were also a high number of non-fatal injuries. The location with the highest number of crashes was the Route 70 intersection with a total of 8. Further, most crashes occurred during clear weather, on a dry roadway surface, and during daylight hours. The hours between 4 PM and 6 PM were when most of the crashes happened. The three highest months for crashes were July, August, and October with each containing over 10% of the total crashes.

Table 10
Summary of Reported Crashes
On Route 140 Corridor in the Town of Boylston
January 1, 2012 - December 31, 2014

Crash Severity

	Number	Percent
Property Damage Only	30	56.6%
Non-Fatal Injury	17	32.1%
Fatal Injury	1	1.9%
Unknown	5	9.4%
Total	**53**	**100.0%**

Manner of Collision

	Number	Percent
Angle	22	41.5%
Rear-end	9	17.0%
Head-on	3	5.7%
Sideswipe, opposite direction	3	5.7%
Sideswipe, same direction	3	5.7%
Single vehicle crash	12	22.6%
Unknown / Not Reported	1	1.9%
Total	**53**	**100.0%**

Type of Collision

	Number	Percent
Collision with a motor vehicle in traffic	40	75.5%
Collision with other movable object	1	1.9%
Collision with animal	4	7.5%
Collision with guardrail	2	3.8%
Collision with utility pole or tree	3	5.7%
Other / Unknown / Not Reported	3	5.7%
Total	**53**	**100.0%**

Locations with the highest number of crashes

	Number
Route 140 / Route 70	7
Route 140 / School Street Connector	7
Route 140 / Sewall Street North	6
Route 140 / Sewall Street South	3
Route 140 / East Temple Street	3

Road Surface Condition

	Number	Percent
Dry	40	75.5%
Wet	4	7.5%
Snow	7	13.2%
Slush	1	1.9%
Other	1	1.9%
Total	**53**	**100.0%**

Time of Day

	Number	Percent
Before 7 AM	5	9.4%
7 AM - 10 AM	10	18.9%
10 AM - 12 PM	1	1.9%
12 PM - 4 PM	10	18.9%
4 PM - 6 PM	15	28.3%
6 PM - 9 PM	9	17.0%
9 PM - 12 AM	3	5.7%
Total	**53**	**100.0%**

Light Conditions

	Number	Percent
Daylight	37	69.8%
Dark	13	24.5%
Dawn	3	5.7%
Total	**53**	**100.0%**

Weather Conditions

	Number	Percent
Clear	35	66.0%
Snow	8	15.1%
Rain	3	5.7%
Cloudy	6	11.3%
Unknown	1	1.9%
Total	**53**	**100.0%**

Month of the Year

	Number	Percent
January	5	9.4%
February	5	9.4%
March	3	5.7%
April	4	7.5%
May	4	7.5%
June	2	3.8%
July	9	17.0%
August	6	11.3%
September	3	5.7%
October	6	11.3%
November	4	7.5%
December	2	3.8%
Total	**53**	**100.0%**

Table 11 shows the collision type by location in the town of Boylston. The table lists the total crashes and the type of crashes at each intersection and at other Route 140 non-intersection locations. There were 27 non-intersection crashes and 26 intersection crashes. The Route 70 & School Street locations had the most crashes with a total of 7. Besides angle and rear end crashes there were one head-on collision, one sideswipe, and two single vehicle crashes. The single vehicle crash at School Street resulted in a fatality. There were also two other head-on crashes along the corridor. Head-on collisions tend to happen when a vehicle crosses over the yellow center lines, usually due to driver error/distraction or road conditions. With these types of crashes there is a higher chance for injury to occur and in some cases a fatality. There were also a high percentage of single vehicle crashes along the corridor, with the majority of them occurring at non-intersection locations where vehicles run off the road or strike fixed objects.

TABLE 11
Collision Type by Location in Boylston, 2012-2014

Location	Total	Type						
		Angle	Rear-End	Head-on	Sideswipe, opposite direction	Sideswipe, same direction	Single vehicle crash	Other (Unknown, Not reported)
ROUTE 140 / EAST TEMPLE STREET	3						2	1
ROUTE 140 / ROUTE 70	7	3	2	1			1	
ROUTE 140 / SCHOOL STREET CONNECTOR	7	4	1		1		1*	
ROUTE 140 / SEWALL STREET NORTH	6	3	2		1			
ROUTE 140 / SEWALL STREET SOUTH	3	3						
OTHER ROUTE 140 LOCATIONS	27	9	4	2	1	3	8	
TOTAL	**53**	**22**	**9**	**3**	**3**	**3**	**12**	**1**

* The single vehicle crash at this location ended with a fatality.

The following **Table 12** shows the crash severity by the type of collision. There was one fatality along Route 140 between 2012 and 2014. There were a total of 17 non-fatal injuries, 30 property damage only, and five crashes in which the severity was not reported or unknown. Most of the injuries were from angle crashes and the majority of property damage only crashes were caused by both angle and single vehicle crashes.

TABLE 12

Boylston Crashes by Severity and Type of Collision, 2012-2014

	Severity			
Manner of Collision	***Fatal Injury***	***Non-fatal Injury***	***Property Damage Only***	***Other (not reported, unknown, etc.)***
Angle	0	11	9	2
Head-on	0	2	1	0
Rear-end	0	3	5	1
Sideswipe, opposite direction	0	1	2	0
Sideswipe, same direction	0	0	3	0
Single vehicle crash	1	0	9	2
Other (not reported, unknown, etc	0	0	1	0
Total number of crashes	**1**	**17**	**30**	**5**

4.3 Town of Shrewsbury Crash Analysis

For the town of Shrewsbury, vehicle crash records were analyzed for a three-year period, 2012-2014. All reported crashes along Route 140 from the Boylston town line to the Grafton town line were tabulated. Also, crashes on minor streets that were close to or at Route 140 were included. Pertinent information from the crash reports was organized and included in the various tables that follow.

As shown in **Table 13**, there were a total of 155 crashes reported for the three-year analysis period. Similar to the other two towns, the most common types were angle and rear end crashes. There were also more than 30 single vehicle crashes. The majority of the crashes in Shrewsbury caused property damage. The locations with the highest number of crashes were the Main Street and Route 20 intersections with totals of 27 and 24, respectively. Most crashes occurred during clear weather, on a dry roadway surface, and during daylight hours. The hours between 12 PM and 4 PM were when most of the crashes happened. The three highest months for crashes were October, November and December, with all three containing over 11% of the total crashes.

Table 13
Summary of Reported Crashes
On Route 140 Corridor in the Town of Shrewsbury
January 1, 2012 - December 31, 2014

Crash Severity

	Number	Percent
Property Damage Only	120	77.4%
Non-Fatal Injury	32	20.6%
Unkown	3	1.9%
Total	**155**	**100.0%**

Manner of Collision

	Number	Percent
Angle	43	27.7%
Rear-end	53	34.2%
Head-on	5	3.2%
Sideswipe, opposite direction	5	3.2%
Sideswipe, same direction	14	9.0%
Single vehicle crash	33	21.3%
Unknown / Not Reported	2	1.3%
Total	**155**	**100.0%**

Type of Collision

	Number	Percent
Collision with a motor vehicle in traffic	115	74.2%
Collision with cyclist	1	0.6%
Collision with animal	2	1.3%
Collision with ditch / fence/ guardrail	8	5.2%
Collision with other or unknown object	3	1.9%
Collision with pole, sign or tree	11	7.1%
Other / Unknown / Not Reported	15	9.7%
Total	**155**	**100.0%**

Locations with the highest number of crashes

	Number
ROUTE 140 / MAIN STREET	27
ROUTE 140 / ROUTE 20	24
ROUTE 140 / GOLD STREET	13
ROUTE 140 / BARNARD STREET	7
ROUTE 140 / HILL STREET	7

Road Surface Condition

	Number	Percent
Dry	115	74.2%
Wet	21	13.5%
Snow	13	8.4%
Icy	2	1.3%
Unknown / Not Reported	4	2.6%
Total	**155**	**100.0%**

Time of Day

	Number	Percent
Before 7 AM	8	5.2%
7 AM - 10 AM	23	14.8%
10 AM - 12 PM	22	14.2%
12 PM - 4 PM	57	36.8%
4 PM - 6 PM	24	15.5%
6 PM - 9 PM	12	7.7%
9 PM - 12 AM	9	5.8%
Total	**155**	**100.0%**

Light Conditions

	Number	Percent
Daylight	111	71.6%
Dark	36	23.2%
Dusk	4	2.6%
Dawn	2	1.3%
Unknown	2	1.3%
Total	**155**	**100.0%**

Weather Conditions

	Number	Percent
Clear	100	64.5%
Snow	12	7.7%
Rain	19	12.3%
Cloudy	22	14.2%
Unkown	2	1.3%
Total	**155**	**100.0%**

Month of the Year

	Number	Percent
January	15	9.7%
February	11	7.1%
March	9	5.8%
April	4	2.6%
May	11	7.1%
June	16	10.3%
July	10	6.5%
August	13	8.4%
September	10	6.5%
October	18	11.6%
November	19	12.3%
December	19	12.3%
Total	**155**	**100.0%**

Table 14 shows the collision type by location in the town of Shrewsbury. The table lists the total and the type of crashes at each intersection and at other Route 140 non-intersection locations. There were 32 non-intersection crashes and 123 intersection crashes. The Main Street location had the most crashes with a total of 27. Besides angle and rear end crashes it had five sideswipes and four single vehicle crashes. Beyond the top three crash types there were also a number of sideswipe crashes along Route 140. Sideswipes generally occur on multi-lane roadways. Drivers attempt to make quick lane changes or upcoming travel lanes quickly merge. According to Shrewsbury town officials, there have been crashes that have occurred at the Colonial Drive intersection, but MassDOT records do not include any crashes at that location for undetermined reasons.

TABLE 14
Collision Type by Location in Shrewsbury, 2012-2014

Location	Total	Type						
		Angle	Rear-End	Head-on	Sideswipe, opposite direction	Sideswipe, same direction	Single vehicle crash	Other (Unknown, Not reported)
ROUTE 140 / ADAMS FARM ROAD	**2**						2	
ROUTE 140 / BARNARD STREET	**7**	2				1	4	
ROUTE 140 / BOYLSTON CIRCLE	**1**	1						
ROUTE 140 / CHURCH ROAD	**2**		2					
ROUTE 140 / CLEWS STREET	**3**	1	1			1		
ROUTE 140 / ESTABROOK ROAD	**1**		1					
ROUTE 140 / GOLD STREET	**13**	4	3		1	3	2	
ROUTE 140 / GRAFTON CIRCLE	**4**	1	1	1			1	
ROUTE 140 / HARRINGTON FARMS	**2**	1		1				
ROUTE 140 / HILL STREET	**7**		5	1		1		
ROUTE 140 / I-290	**2**		1			1		
ROUTE 140 / LAKE STREET	**1**		1					
ROUTE 140 / MAIN STREET	**27**	8	10		1	4	4	
ROUTE 140 / MELODY LANE	**3**	1	2					
ROUTE 140 / MUNICIPAL DRIVE	**1**		1					
ROUTE 140 / NEPTUNE DRIVE	**3**		3					
ROUTE 140 / OLD BROOK ROAD	**5**	2	3					
ROUTE 140 / PATON ROAD	**3**	2		1				
ROUTE 140 / PROSPECT STREET	**4**	2	1		1			
ROUTE 140 / RAYMOND AVENUE	**2**	1	1					
ROUTE 140 / ROUTE 20	**24**	7	7			1	7	2
ROUTE 140 / WACHUSETT AVENUE	**3**	2	1					
ROUTE 140 / WESLEYAN STREET	**2**	1			1			
ROUTE 140 / WOODLAND ROAD	**1**		1					
OTHER ROUTE 140 STREET LOCATIONS	**32**	7	8	1	1	2	13	
TOTAL	**155**	**43**	**53**	**5**	**5**	**14**	**33**	**2**

The following **Table 15** shows the crash severity by the type of collision. There were a total of 31 non-fatal injuries, 121 property damage only, and three crashes in which the severity was not reported or unknown. Most of the injuries were from either angle, rear-end or single vehicle crashes and the majority of property damage only crashes were caused by angle and rear-end crashes.

TABLE 15

Shrewsbury Crashes by Severity and Type of Collision, 2012-2014

	Severity			
Manner of Collision	***Fatal Injury***	***Non-fatal Injury***	***Property Damage Only***	***Other (not reported, unknown, etc.)***
Angle	0	9	32	2
Head-on	0	1	4	0
Rear-end	0	8	44	1
Sideswipe, opposite direction	0	0	5	0
Sideswipe, same direction	0	3	11	0
Single vehicle crash	0	10	23	0
Other (not reported, unknown, etc	0	0	2	0
Total number of crashes	**0**	**31**	**121**	**3**

4.4 Performance Management

The first performance measure to consider is Safety. In 2018, the CMMPO chose to adopt the statewide safety performance measure targets set by MassDOT for calendar year 2018. The objectives of the safety performance measures are to reduce the total number of fatalities, rate of fatalities per 100 million vehicles miles traveled (VMT), total number of serious injuries, rate of serious injuries per 100 million VMT, and the total number of combined serious injuries and fatalities for non-motorized modes. Currently, the first four listed safety measures are showing a decrease in statewide trends. Unfortunately, the last safety measure is showing an increase in the statewide data. In all safety categories, MassDOT has established a long-term target towards "Zero Deaths" and will establish safety targets for the MPO to consider for adoption each calendar year. In regards to the Route 140 study corridor, any suggested safety improvements would potentially help reach the safety targets set forth by MassDOT.

In addition to the Safety performance measures above, two other objectives are to reduce heavy truck crashes and all crashes on freight routes and reduce the rate of fatalities and serious injuries per 100 million VMT along freight routes. To complete these objectives the

number and rate of injuries and fatalities along roadways and freight routes need to be reduced. Since Route 140 is considered a primary freight route, suggested safety improvements along the study corridor would potentially help both of these objectives.

Another performance measure is Security. The objective of this measure is to enhance security preparedness and coordination. One way to measure this is to establish evacuation routes in the region. In a previous joint effort between the CMRPC and the MRPC, a Central Region Homeland Security Evacuation Plan was completed in 2013. In this evacuation plan, numerous roadways within the central region were designated as either primary or secondary evacuation routes. Route 140 was designated a primary evacuation route so it is important for this roadway to be both safe and secure.

5.0 Pavement Management System (PMS)

5.1 Pavement Management Concepts

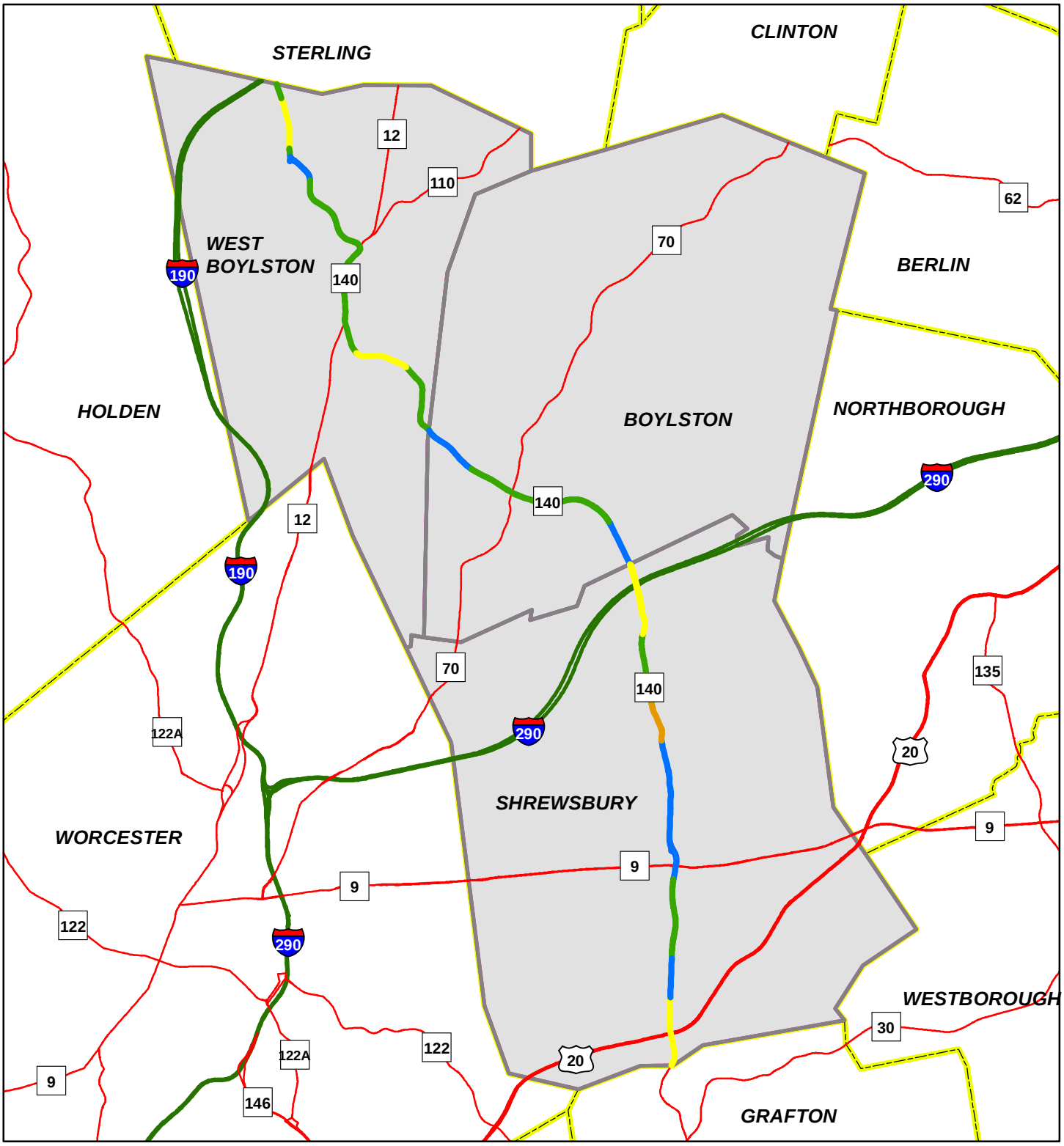
Pavement management is an asset management system designed to assist decision-makers in determining the most cost-effective strategies to address poor or failing roadway conditions. In general, a successful Pavement Management System (PMS) defines a roadway network, identifies the condition of each segment of the network, develops a list of needed improvements, and balances those needs with the available resources of the party responsible for maintaining the defined roadway network. Cartegraph, a software package developed and supported by Cartegraph Systems Incorporated, is used by CMRPC in its pavement management program to assess overall pavement condition and to assist in developing a cost effective strategy for addressing any observed pavement distress.

For this Corridor Profile, pavement distress information was collected for Route 140 in the towns of West Boylston, Boylston, and Shrewsbury. The pavement data was collected by conducting "windshield surveys." A team of two CMRPC representatives inspected Route 140, taking note of the severity and extent of the following pavement distresses:

- Potholes
- Distortions
- Alligator Cracking
- Transverse and Longitudinal Cracking
- Block Cracking
- Rutting
- Bleeding/Polished Aggregate
- Surface Wear and Raveling
- Corrugations, Shoving, and Slippage

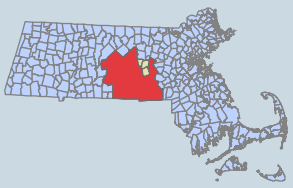
Based on the observed distresses, an Overall Condition Index (OCI) was calculated for each surveyed roadway segment. The OCI is used to rate each segment on a scale of 0 to 100. An OCI of 100 indicates optimal pavement conditions, usually a newly paved roadway segment. Conversely, a score of 0 indicates a roadway that has failed entirely and is likely impassable for an average passenger vehicle. Starting at a top index rating of 100, the OCI is calculated by subtracting a series of deduct values, each associated with the severity and extent of the various pavement distresses described above. *Cartegraph's* deduct values are determined through a series of deduct curves, which were developed by pavement engineers using years of research on pavement performance. The resulting OCI is a quantified rating of pavement condition.

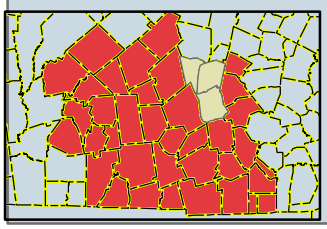
Figure 52 displays the current pavement conditions for Route 140 represented by Overall Condition Index (OCI) Recommended Action. *Cartegraph* produced OCI Recommended Action categories that suggest the type of action necessary to bring a road segment to "Excellent" condition. **Table 16** shows the OCI and Recommended Action for each roadway segment.



ROUTE 140 CORRIDOR PROFILE

Pavement Condition
Figure 52





Legend

- Excellent
- Good
- Fair
- Poor
- Very Poor

Miles
0 0.5 1 2 3 4

C M R P C
Central Massachusetts Regional Planning Commission

Source: Data provided by the US Census Bureau, Central Massachsuetts Regional Planning Commission (CMRPC), massDOT Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information MassGIS), Commonwealth of Massachusetts, Information Technology Division.

Information depicted on this map is for planning purposes only. This information is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analysis. Use caution intrepreting positional accuracy.

Table 16
Route 140 Pavement Analysis Recommendations

City/Town	Street	From	To	Length	Plan Activity	OCI
WEST BOYLSTON	ROUTE 140(N MAIN ST)	STERLING TOWN LINE	STILLWATER HEIGHTS	0.16 mi	ROUTINE MAINTENANCE	82.0
WEST BOYLSTON	ROUTE 140(N MAIN ST)	STILLWATER HEIGHTS	LAUREL ST	0.56 mi	PREVENTATIVE MAINTENANCE	65.5
WEST BOYLSTON	ROUTE 140(N MAIN ST)	LAUREL ST	THOMAS ST	0.11 mi	ROUTINE MAINTENANCE	81.6
WEST BOYLSTON	ROUTE 140(BEAMAN ST)	THOMAS ST	CUTTING ST	0.44 mi	DO NOTHING	98.0
WEST BOYLSTON	ROUTE 140(BEAMAN ST)	CUTTING ST	.5 MI EAST OF CUTTING ST	0.50 mi	ROUTINE MAINTENANCE	82.6
WEST BOYLSTON	ROUTE 140(BEAMAN ST)	.5 MI EAST OF CUTTING ST	STERLING ST	0.50 mi	ROUTINE MAINTENANCE	71.2
WEST BOYLSTON	ROUTE 12/140(STERLING ST)	BEAMAN ST	GOODALE ST	0.43 mi	ROUTINE MAINTENANCE	80.3
WEST BOYLSTON	ROUTE 12/140(WORCESTER ST)	GOODALE ST	CHURCH ST	0.43 mi	ROUTINE MAINTENANCE	72.6
WEST BOYLSTON	ROUTE 140(WORCESTER ST)	W BOYLSTON ST	MAPLE ST	0.38 mi	ROUTINE MAINTENANCE	69.8
WEST BOYLSTON	ROUTE 140(TEMPLE ST)	MAPLE ST	PINEWOOD DR	0.58 mi	PREVENTATIVE MAINTENANCE	65.7
WEST BOYLSTON	ROUTE 140(TEMPLE ST)	PINEWOOD DR	BOYLSTON TOWN LINE	0.80 mi	ROUTINE MAINTENANCE	79.6
BOYLSTON	ROUTE 140(W BOYLSTON ST)	W BOYLSTON TOWN LINE	W TEMPLE ST	0.63 mi	DO NOTHING	99.2
BOYLSTON	ROUTE 140(W BOYLSTON ST)	W TEMPLE ST	ROUTE 70	0.51 mi	ROUTINE MAINTENANCE	71.8
BOYLSTON	ROUTE 140(SHREWSBURY ST)	ROUTE 70	E TEMPLE ST	0.85 mi	ROUTINE MAINTENANCE	68.2
BOYLSTON	ROUTE 140(SHREWSBURY ST)	E TEMPLE ST	SCHOOL ST	0.33 mi	ROUTINE MAINTENANCE	87.0
BOYLSTON	ROUTE 140(SHREWSBURY ST)	SCHOOL ST	SHREWSBURY TOWN LINE	0.51 mi	DO NOTHING	99.0
SHREWSBURY	ROUTE 140(BOYLSTON ST)	BOYLSTON TOWN LINE	HILL ST	0.80 mi	PREVENTATIVE MAINTENANCE	65.2
SHREWSBURY	ROUTE 140(BOYLSTON ST)	HILL ST	BOYLSTON CIRCLE	0.77 mi	ROUTINE MAINTENANCE	70.0
SHREWSBURY	ROUTE 140(BOYLSTON ST)	BOYLSTON CIRCLE	MAIN ST	0.42 mi	STRUCTURAL IMPROVEMENT	46.6
SHREWSBURY	ROUTE 140(GRAFTON ST)	MAIN ST	LAKE ST	0.75 mi	DO NOTHING	97.1
SHREWSBURY	ROUTE 140(GRAFTON ST)	LAKE ST	ROUTE 9	0.47 mi	DO NOTHING	92.0
SHREWSBURY	ROUTE 140(GRAFTON ST)	ROUTE 9	GRAFTON CIRCLE	0.41 mi	DO NOTHING	92.9
SHREWSBURY	ROUTE 140(MEMORIAL DR)	GRAFTON CIRCLE	HYDE FARMS RD	0.87 mi	ROUTINE MAINTENANCE	83.6
SHREWSBURY	ROUTE 140(MEMORIAL DR)	HYDE FARMS RD	211 MEMORIAL DR	0.43 mi	DO NOTHING	90.2
SHREWSBURY	ROUTE 140(MEMORIAL DR)	211 MEMORIAL DR	GRAFTON TOWN LINE	0.76 mi	PREVENTATIVE MAINTENANCE	63.0

The Recommended Action category definitions are as follows:

- Do Nothing (OCI 100 – 88) – used when a road is in relatively perfect condition and prescribes no maintenance.
- Routine Maintenance (OCI 88 – 68) – used on roads in reasonably good condition to prevent deterioration from the normal effects of traffic and pavement age. This treatment category would include either crack sealing or local repair (pothole, depression, poorly constructed utility patch, etc.), or minor localized leveling.
- Preventative Maintenance (OCI 68 – 48) – slightly greater response to more pronounced signs of age and wear. This includes crack sealing, full-depth patching, and minor leveling, as well as surface treatments such as chip seals, micro-surfacing, and thin overlays.
- Structural Improvement (OCI 48 – 24) – when the pavement deteriorates beyond the need for surface maintenance applications, but the road base appears to be sound. These include structural overlays, shim and overlay, cold planing and overlay, and hot in-place recycling.
- Base Rehabilitation (OCI 24 – 0) – represents roads that exhibit weakened pavement foundation base layers. Complete reconstruction and full depth reclamation are indicated.

The Recommended Actions found in the previous table each have an associated cost, which includes the design, materials, and labor to complete such action. As a roadway's OCI drops, the associated Recommended Action becomes more demanding, and the cost of repair increases. Therefore, the cost of "Routine Maintenance," which categorically falls right under "Do Nothing," is only a fraction of the cost of "Base Rehabilitation," the most financially demanding Recommended Action category. For a practical example, the cost of applying crack seal to alligator cracking over a half mile segment of road is significantly less than the cost to fully reconstruct a half mile of impassable roadway. Therefore, it is better to do "Routine Maintenance" on a roadway in order to prevent the deterioration of the pavement.

5.2 Town of West Boylston Overall Condition Index (OCI)

The most recent pavement data for Route 140 in West Boylston was collected in 2017. As the map depicts, Route 140 has three different pavement conditions. Most of the segments have an OCI above a 70 and the recommended action is "Routine Maintenance". There was one section of Beaman Street (Rt 140) that was recently paved so that section is within the "Do Nothing" category. The lowest rated segments are between Stillwater Heights and Laurel

Street and from Maple Street to Pinewood Drive. These segments have low distortions for over 25% of the roadway. Further, there are localized areas of high severity alligator cracking and surface wear. Alligator cracking is typically caused by aging pavement combined with weather elements. In the early stages, this distress type can be treated with a crack sealant. If left neglected, these cracks will lead to surface wear and potholes as pavement pieces are pulled out of the cracks from repeated traffic loads and exposure to the freeze-thaw cycle. There are also low severity areas of transverse & longitudinal cracking and rutting. Other distresses found in West Boylston include some severity of distortions, alligator cracking, block or transverse & longitudinal cracking, and rutting.

5.3 Town of Boylston Overall Condition Index (OCI)

The most recent pavement data for the town of Boylston was collected in 2018. As the map shows, from West Temple Street to School Street is in good condition and the segments near the West Boylston and Shrewsbury town lines are in excellent condition. The segment from the West Boylston town line to West Temple Street has only minor alligator cracking and from School Street to the Shrewsbury town line has brand new pavement. The remaining three segments in Boylston have a recommended action of "Routine Maintenance". All three segments have low severity distortions, alligator cracking and transverse & longitudinal cracking. All these distortions and cracks have a low or medium extent within all three segments.

5.4 Town of Shrewsbury Overall Condition Index (OCI)

The most recent pavement data for the town of Shrewsbury was collected in 2018. The map shows the pavement in Shrewsbury ranges from poor to excellent. There are four segments in excellent condition in which just low distortions and alligator cracking exist. Next, there are two roadway segments in good condition that require "Routine Maintenance". These two segments include distortions, alligator cracking, transverse & longitudinal cracking, rutting, and surface wear, but most of these distresses are considered low severity. There are two segments with an OCI in the low 60's and considered in fair condition. One of these segments is at the Boylston town line and the other is at the Grafton town line. These two segments contain distortions, alligator cracking, transverse & longitudinal cracking, and surface wear. The distresses have a low to medium severity and extent. Lastly, there is one poor rated segment with an OCI of 47. This segment is located between Boylston Circle and Main Street. There are distortions, alligator cracking, block cracking, rutting and surface wear. The severity ranges from low to high with a low to medium extent.

5.5 Performance Management

In regards to pavement, the objective is to maintain the condition of the region's roadways. The goal is to reduce poor and very poor pavement lane miles. A roadway in poor or very poor condition means that the OCI is between 0 and 48. Currently, there is only a 0.42 mile segment in Shrewsbury that is rated in poor condition. By repaving this roadway segment in Shrewsbury, it will help to reach the pavement goal.

6.0 Bridges

6.1 Statewide Bridge Management System

MassDOT collects bridge condition data on an ongoing basis using consistent federal standards in various structural categories including bridge deck, superstructures (the physical condition of the bridge), substructures (condition of the piers, abutments, piles, girders, footings, or other related components), retaining walls, deck geometry, and roadway approach alignment. According to MassDOT, in order to be defined as a bridge, the structure must be at least 20 feet or greater in length. The resulting inventory is used to calculate a condition rating, which is used to classify substandard bridges as either Structurally Deficient or Functionally Obsolete. Bridges that do not fall into one of those categories are ineligible for the Highway Bridge Replacement and Rehabilitation Program funded by the Federal Highway Administration (FHWA).

A "Structurally Deficient" (SD) bridge is defined as a bridge whose condition has been rated no better than poor in any of these five areas: bridge deck, superstructures, substructures, culverts, and retaining walls. A "Functionally Obsolete" (FO) bridge is defined as a bridge that is considered in serious condition in any of these three categories: deck geometry, underclearances, or approach roadway alignment. Additionally, if the structural condition or waterway adequacy is in serious condition (but better than that for a structurally deficient bridge), the bridge would be identified as being functionally obsolete. Essentially, a functionally obsolete bridge is one that is not built in accordance with or does not meet currently accepted design standards.

6.2 Route 140 Corridor Profile Bridges

As shown in **Table 17**, there are a total of six bridges along the study corridor. Three bridges are located in West Boylston and three are within the town of Shrewsbury. There are no bridges in the town of Boylston. In West Boylston, two of the bridges are located over water bodies and both were built in 1904. The third bridge is over the Pan Am Railway and was built in 1974. There is some work being proposed for this bridge in coordination with the Department of Conservation & Recreation (DCR), but the details of this project are not yet known. All three bridges have an AASHTO rating of over 77 and bridge W-17-003 is classified as being Functionally Obsolete. In Shrewsbury, one of the bridges crosses over Route 140. The Route 9 bridge (S-14-007) was built in 1934 and is Functionally Obsolete. For the remaining two bridges, one crosses over Route 20 and the other is over Interstate 290. Bridge (S-14-018), which is over Interstate 290, is Structurally Deficient. This bridge actually has the lowest AASHTO rating along the study corridor with a score of 70.3. Using Statewide Bridge funding

this bridge is scheduled for replacement. The cost of this project is over $20 million and it was advertised for construction bids in June 2018. The new cross-section on the bridge will be a single travel lane with an accompanying auxiliary lane in each direction. The auxiliary lane will be used for northbound and southbound bicycle and pedestrian passage as well as maintenance activities.

Table 17
Route 140 Bridges

Host Community	MassDOT Bridge #	Facility Name (Over)	Facility or Waterbody Name (Under)	Year Built/ or Rebuilt	AASHTO Rating	Deficiency*
West Boylston	W17003	Route 140 (Beaman St)	Stillwater River	1904	77.4	FO
West Boylston	W17004	Route 140 (Beaman St)	BMRR (Pan Am)	1974	89.1	
West Boylston	W17005	Route 12/140 (Worcester St)	Wachusett Reservoir	1904	87.4	
Shrewsbury	S14007	Route 9 (Boston Tnpk)	Route 140 (Grafton St)	1932	74.8	FO
Shrewsbury	S14015	Route 140 (Memorial Dr)	Route 20 (Hartford Tnpk)	1966	81.7	
Shrewsbury	S14018	Route 140 (Boylston St)	I-290	1967	70.3	SD

**FO: Functionally Obsolete, SD: Structurally Deficient*

6.3 Performance Management

The Performance Measure related to this chapter is within the State of Good Repair national planning factor. The objective of this factor is to maintain the condition of bridges and to decrease the number of Structurally Deficient bridges. With the near future replacement of S-14-018, the bridge will no longer be Structurally Deficient and therefor will help the objective. There are also potential improvements for bridge W-17-004 over the railroad that could help maintain the condition of that bridge, but the scope of that work is currently unknown.

7.0 Public Transit (Public and Private Transportation)

7.1 Regional and Profile Area Services

Worcester Regional Transit Authority

The Worcester Regional Transit Authority (WRTA) provides transit service for the City of Worcester and 36 additional communities within the Central Massachusetts area. Fixed-route service is provided within thirteen communities, and flexible Community Shuttle service is available in three communities.

Paratransit service is available to eligible individuals, including Americans with Disabilities Act (ADA) complementary paratransit service. ADA paratransit services operate within a 3/4 mile "buffer" surrounding the fixed-route service and is available during the corresponding fixed-route schedule. Non-ADA paratransit service is available for elders and people with disabilities, with service hours varying by community or eligibility. These services are generally provided by local Councils on Aging or other contractors, and are subsidized by the WRTA.

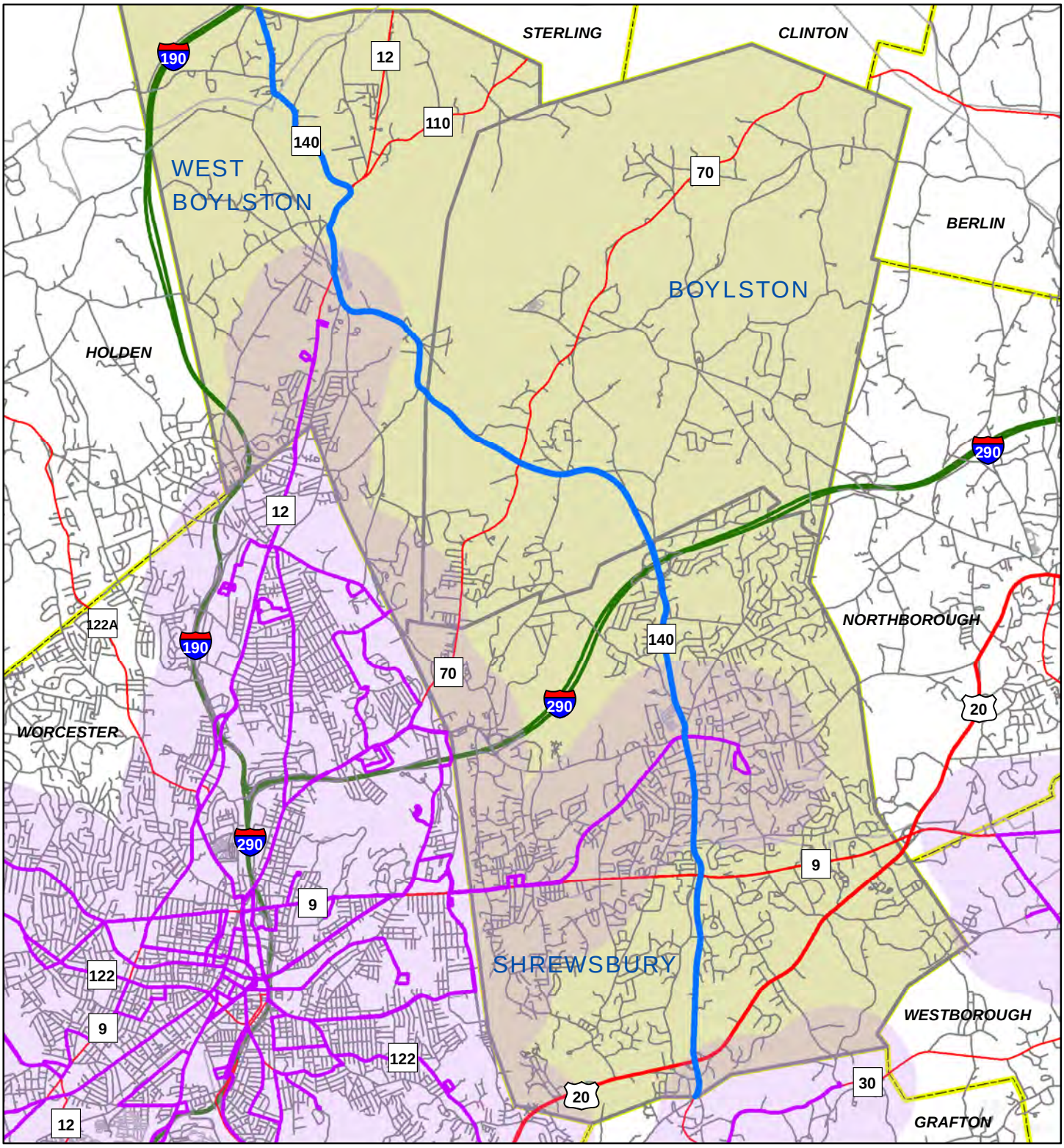
Figure 53 shows WRTA fixed route service and ADA complementary paratransit service areas within the Route 140 host communities.

Ridesharing/Transportation Network Companies (TNCs)

In Massachusetts, rideshare companies such as Uber and Lyft are referred to as Transportation Network Companies (TNCs). The current form of ridesharing is commonly provided as a curb-to-curb on-demand ride service. Customers can order a ride through various providers using either a smartphone application, or other online service, and usually the operator provides the trip in a privately owned vehicle. In Central Massachusetts, TNC services are generally available as Uber or Lyft.

Taxicab and Other Providers

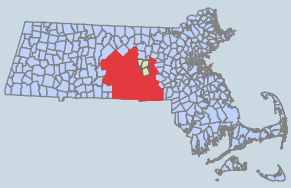
Additionally, Yellow Cab and Red Cab taxicab companies also provide public transportation opportunities within the area. Other specialized transportation services are available to eligible individuals within the area.

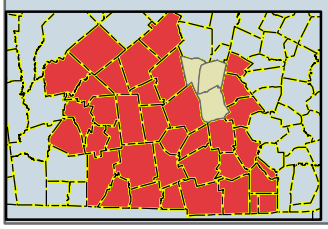


ROUTE 140 CORRIDOR PROFILE

WRTA Fixed-Route System

Figure 53





Legend

- Route 140 Corridor Profile
- Interstate
- U.S. Route
- State Route
- Local Roads
- WRTA Routes
- ADA Buffer

Miles

0 0.45 0.9 1.8 2.7 3.6

CMRPC
Central Massachusetts Regional Planning Commission

Source: Data provided by the US Census Bureau, Central Massachsuetts Regional Planning Commission (CMRPC), massDOT Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information MassGIS), Commonwealth of Massachusetts, Information Technology Division.

Information depicted on this map is for planning purposes only. This information is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analysis. Use caution intrepreting positional accuracy.

7.2 Town of West Boylston

Existing WRTA Services

There is no fixed-route service along the West Boylston portion of Route 140, but fixed-route service is available in town. WRTA Route 30 begins at the WRTA Hub at Union Station in downtown Worcester, and ends at the Walmart on West Boylston Street (Route 12). The weekday route schedule begins at 5:10 AM and ends at 9:30PM, and provides 32 round trips on weekdays. This route also has Saturday and Sunday service, with 17 round trips on Saturdays, and seven round trips on Sundays, all serving West Boylston. Service on Saturdays runs from 5:50 AM to 10:00 PM and Sunday service starts at 11:00 AM and ends at 6:05 PM.

In Fiscal Year 2018, WRTA Route 30 ranked as the fifth-busiest route within the system, out of 23 fixed routes. Nearly one-quarter of the total Route 30 ridership was within West Boylston, about 55,000 passenger trips annually. The bus stops with highest passenger activity in West Boylston are: Walmart, and Wachusett Plaza. The West Boylston Walmart bus stop ranks in the top twenty of average daily passenger boardings within the WRTA entire system, out of over 1,000 active bus stops[1].

ADA complementary paratransit service is available in West Boylston, within the ¾ mile buffer surrounding WRTA Route 30. The service is available to individuals determined eligible under the Americans with Disabilities Act guidelines. The schedule mirrors the existing Route 30 fixed-route schedule. ADA paratransit services are provided by a combination of the WRTA, and the West Boylston Council on Aging.

Additional non-ADA paratransit services are offered to all West Boylston elders (aged 60 and over) and people with disabilities on weekdays between 8:00 AM and 3:00 PM. Non-ADA paratransit services are operated by the West Boylston Council on Aging (CoA), through a contract to the WRTA. The WRTA provides and maintains a handicapped-accessible van, and reimburses the Council on Aging for operating expenses. In Fiscal Year 2018, the West Boylston CoA provided about 2,800 passenger trips[2].

Existing TNC Services

In 2017, the Massachusetts Department of Public Utilities (DPU) released trip count data provided by Uber, Lyft, and other TNC providers. 6,135 TNC trips originated within West Boylston, and 7,140 TNC trips had West Boylston as its destination. Compared to other

[1] Source: Worcester Regional Transit Authority
[2] Source: West Boylston Council on Aging

communities within Massachusetts between 7,000 and 8,000 residents, West Boylston had both the highest number of origin and destination trips, likely due to its location within a densely populated area of Central Massachusetts[3].

Future Outlook

The WRTA underwent a Comprehensive Service Analysis (CSA)/Regional Transit Plan of its entire fixed-route system by consultant URS Corporation/AECOM in 2015. In the CSA, individual route recommendations were proposed with implementation into a three-phase approach based on availability of resources and funding. One of the service recommendations in the report was to short-turn Route 30 to only serve Worcester, and extend Route 14 to provide service to West Boylston[4]. At this time, there are no active plans for additional service changes on the aforementioned routes.

7.3 Town of Boylston

Existing WRTA Services

There is no fixed-route service within Boylston, though ADA complementary paratransit service is available in a small portion of the southwest corner of town. This is due to the ¾ mile buffer surrounding existing fixed-routes in the northeast corner of Worcester, adjacent to the Boylston town line.

Non-ADA paratransit services are offered to all Boylston elders (aged 60 and over) and people with disabilities on Tuesdays and Thursdays between 9:00 AM and 3:00 PM. Non-ADA paratransit services are operated by the Northborough Council on Aging (CoA), through a contract to the WRTA. Trips are provided within Boylston, and from Boylston to the surrounding towns.

The Boylston Council on Aging operates its own van service for residents aged 60 and over, and for those under age 60 with a disability. The service operates Monday through Thursday between 8:30 AM and 1:30 PM. Service is limited to within a fifteen-mile radius of Boylston.[5]

Existing TNC Services

About 2,800 TNC trips originated within Boylston, and nearly 3,000 TNC trips ended in Boylston. Compared to other communities within Massachusetts between 4,000 and 5,000 residents,

[3] Source: 2017 Data Report: Rideshare in Massachusetts, Massachusetts DPU
[4] Worcester Regional Transit Authority: Regional Transit Plan – Final Report, June 2015
[5] Source: Boylston Council on Aging Website

Boylston ranked in the middle in terms of the number of origin and destination trips using TNCs.

Future Outlook

At this time, there are no plans to implement fixed-route service or to expand current paratransit service.

7.4 Town of Shrewsbury

Existing Service

There is no fixed-route service along the Shrewsbury portion of Route 140, but fixed-route service is available in town. WRTA Route 15 begins at the WRTA Hub at Union Station in downtown Worcester, and ends in Shrewsbury Center, approximately one mile east of the intersection of Main Street and Boylston Street (Route 140). The weekday route schedule begins at 5:25 AM and ends at 8:50PM, and provides 16 round trips on weekdays, with 12 round trips serving Shrewsbury center. This route also has Saturday service, with 8 round trips all serving Shrewsbury from 9:50 AM to 5:55 PM.

In Fiscal Year 2018, WRTA Route 15 ranked as the eighteenth-busiest within the system, out of 23 fixed routes. Nearly half of the total Route 15 ridership was within Shrewsbury, about 33,000 passenger trips annually. The bus stops with highest passenger activity in Shrewsbury are: Route 9 at White City Shopping Center/N. Quinsigamond Avenue, and Lakeway Commons[6].

ADA complementary paratransit service is available in Shrewsbury, within the ¾ mile buffer surrounding WRTA Route 15. The service is available to individuals determined eligible under the Americans with Disabilities Act guidelines. The schedule mirrors the existing Route 15 fixed-route schedule. ADA paratransit services are provided by a combination of the WRTA, and the Shrewsbury Council on Aging.

Additional non-ADA paratransit services are offered to all Shrewsbury elders (aged 60 and over) and people with disabilities on weekdays between 8:00 AM and 4:00 PM. Non-ADA paratransit services are operated by the Shrewsbury Council on Aging (CoA), through a contract to the WRTA. The WRTA provides and maintains two handicapped-accessible vans, and reimburses the Council on Aging for operating expenses. In addition to the two WRTA vans, the Shrewsbury

[6] Source: Worcester Regional Transit Authority

COA owns and operates an additional handicapped-accessible van. In Fiscal Year 2018, the Shrewsbury CoA provided nearly 7,000 passenger trips annually[7].

Existing TNC Services

In 2017, the Massachusetts Department of Public Utilities (DPU) released trip count data provided by Uber, Lyft, and other TNC providers. About 65,000 TNC trips originated within Shrewsbury, and had Shrewsbury as its destination. Compared to other communities within Massachusetts between 30,000 and 40,000 residents, Shrewsbury ranked towards the lower end of total origin and destination trips, as many of the comparable communities are located within Interstate 95/Metro Boston[8]. For Central Massachusetts, Shrewsbury ranked second only to Worcester in terms of total origin and destination trips.

Future Outlook

In the WRTA CSA, a service recommendation in the report was to extend Route 15 to provide service to the Northborough Crossing/Wegmans' development, adjacent to the Shrewsbury and Northborough town lines. The WRTA has not pursued this recommendation at this time, due to availability of resources and funding. At this time, there are no future plans for additional service changes on the aforementioned routes, or any expansion of current paratransit service.

7.5 Performance Management

In regards to the Worcester Regional Transit Authority, one transit objective is to maintain transit vehicles in a state of good repair. The targets are set to have the average age of the van fleet under five years and the average age of the fixed route bus fleet less than 12 years. There is very little this Corridor Profile can do with this measure and currently the WRTA is meeting these targets. Further, fixed route buses do not travel along Route 140 within the study corridor.

[7] Source: Shrewsbury Council on Aging
[8] Source: 2017 Data Report: Rideshare in Massachusetts, Massachusetts DPU

8.0 Other Modes

8.1 Introduction

Traffic jams and congestion occur when demand for the highway infrastructure exceeds supply. Because of this, various state initiatives, design criteria revisions, funding opportunities and compacts have guided the design of our region's transportation and physical infrastructure so that alternatives to driving alone are highly encouraged. These other modes include bicycling, public transit (detailed in another chapter of this CP), and walking. This chapter includes examples of the aforementioned statewide initiatives and their applicability for the Route 140 Corridor Profile.

8.2 MassDOT Healthy Transportation Compact

The Transportation Reform Law (2009) established the Healthy Transportation Compact (HTC) which promotes improved public health through active transportation. Active transportation refers to bicycling, transit, and walking. The HTC is an interagency initiative co-chaired by the Secretary of Transportation and the Secretary of Health and Human Services, including the Secretary of Energy and Environmental Affairs, MassDOT Highway Administrator, MassDOT Transit Administrator, the Commissioner of Public Health and the Secretary of Housing and Economic Development. The HTC goals are to facilitate transportation decisions that balance the needs of all users, expand mobility, improve public health, support a cleaner environment and create stronger communities. The intent is to adopt best practices to increase efficiency in achieving positive health outcomes through the coordination of land use, transportation and public health policy.

Some of the programs and/or initiatives promoted by MassDOT and its partners that are currently in place, making the connection between health and transportation, are:

- Mass in Motion
- Safe Routes to School
- Healthy Transportation Policy Directive
- Healthy Transportation Engineering Directive

8.3 Healthy Transportation Policy Directive

MassDOT's Healthy Transportation Policy Directive requires all state transportation projects to increase bicycling, transit and walking options. This Directive is intended to promote multimodal access for all transportation customers. MassDOT has indicated that everyone in

Massachusetts must be provided the opportunity to bike, take transit, or walk instead of driving alone in a motor vehicle.

All MassDOT facilities will consider adjacent land uses and, as applicable, be designed to include sidewalks of sufficient width, landscaping, crossing opportunities and other features to enhance healthy transportation options. Safety audits will be conducted of crash cluster sites where incidents have occurred with healthy-mode transportation users. MassDOT will also develop a guide to assist communities proposing shared use paths on or along rail beds in order to accelerate the path design process.

8.4 Community Health Improvement Plan (CHIP)

The City of Worcester Division of Public Health in collaboration with community partners has in place a Community Health Improvement Plan (CHIP). The CHIP identifies major health priorities for the Greater Worcester region and includes specific objectives and strategies. The towns of West Boylston and Shrewsbury are part of the Central Massachusetts Regional Public Health Alliance; the town of Boylston is not currently a member. One of the topics included in the CHIP is Healthy Eating/Active Living. One of the strategies within this domain is to increase the consideration of pedestrian and bicycle accommodation in routine decision making through the adoption of the Complete Streets transportation policy throughout the region, detailed next.

Goals include an increase in the number of municipalities adopting Complete Streets policies and the number of completed assessments for parks/open spaces, including the development of prioritization criteria. Additionally, the partners seek an increase in miles of bicycle lanes and in the number of schools that have adopted a Safe Routes to School policy. If there is a need for funding, the Transportation Alternatives Program (TAP) could potentially be used to fund projects through the Transportation Improvement Program (TIP).

8.5 Complete Streets

What is widely known as the Complete Streets approach was first included in the 2006 *Project Development and Design Guide*. Multimodal design guidelines are part of MassDOT's current policy for Context Sensitive Design. In a Complete Streets approach, roadway projects accommodate all users, not only auto traffic. All highway projects shall, from the earliest design stages, provide safe access and connectivity for pedestrians and bicyclists. The Healthy Transportation Policy Directive expands on how, when and where these accommodations should be provided, including ADA design compliance. The *Complete Streets Initiative*, which requires roadway designs that accommodate all users, calls for bicycle & pedestrian

accommodation as part of most highway projects, a major exception being limited access highways.

The state's 2014 Transportation Bond Bill authorized a Complete Streets Funding Program. It offers Massachusetts municipalities incentives to adopt complete streets policies and practices. To aid in the program MassDOT launched an interactive web portal to assist municipalities through the policy development, prioritization planning, and project approval steps of the application process. To view the website click on the following link Complete Streets Program

For a community to be eligible for funding from this program it must meet three primary requirements as follows:

1. Attendance of a municipal employee at a Complete Streets training and develop a Complete Streets Policy that scores 80 or above out of a possible 100 points.
2. Development of a Complete Streets Prioritization Plan.
3. Apply for the construction funding available for projects in the communities with a completed Prioritization Plan.

Once these primary requirements are met, the host communities are eligible for up to $35,000 in technical assistance and up to $400,000 in construction funding. MassDOT allocated $12.5M in funding for the first two years of the program. A total of $50 million was allocated to the Complete Streets program over a ten year period. Also, through the Capital Investment Plan (CIP) additional funding could be directed towards the program.

In 2017, the town of West Boylston contracted with CMRPC to develop a prioritization plan and was later approved by MassDOT in August 2017. Shortly after, the town applied for funding for projects included on their prioritization plan. In March 2018, they were awarded $190,374 for one project. This project was for new sidewalks on Crescent Street, between Pine Arden Drive and the School Complex. The town of Boylston has yet to develop a Complete Street policy (but is highly encouraged). As for the town of Shrewsbury, they currently have a policy and have contracted with CMRPC to develop a prioritization plan. The data collection was completed and the plan will be submitted to MassDOT when finished. Once the prioritization plan is approved by MassDOT, the town will be able to apply for funding.

8.6 Bicycling in the Corridor

Paved shoulders reduce passing conflicts between motor vehicles, bicyclists and pedestrians while also making the crossing pedestrian more visible. They also provide for storm water discharge from outside the travel lanes, reducing hydroplaning, along with splash and spray to

following vehicles, bicyclists and pedestrians. In rural areas, they provide space for bicyclists to ride at their own pace.

There are no dedicated bicycle lanes along Route 140 in any of the three host communities. There are, however, wide enough shoulders that are acceptable to safely ride a bicycle. The shoulders through Boylston and Shrewsbury are consistently and sufficiently wide. Through the town of West Boylston, the exiting shoulder width varies. Vehicle speeds are also higher through Boylston and parts of Shrewsbury. As such, there may be safety concerns for bicyclists wanting to ride on Route 140 due to the high vehicle speeds even though there are sufficient shoulder widths.

Further, CMRPC staff will be working on updates to both the regional Bicycle and Pedestrian Plans. The Bicycle Plan mainly consists of on-street facilities and major bikeways, however, some current and potential trails could be discussed. These Bicycle and Pedestrian Plans are expected to be completed by the fall 2018.

8.7 Pedestrian Facilities and Activity in the Corridor

The existence of sidewalks along Route 140 varies among the three communities. In West Boylston, sidewalks are present on at least one side of the roadway for around half the length of Route 140. Most of Beaman Street and Temple Street do not have sidewalks. The sidewalks in the northern part of town rate in fair or poor condition. The northern part of Beaman Street was recently repaved along with the sidewalk located on the northern side of the road. From the Wachusett Reservoir to just east of Maple Street, most of the existing sidewalks are in excellent condition except between Goodale Street and Central Street, which are in poor condition (*this summer the sidewalks and ADA ramps at the Route 12/Route 140/Central Street intersection were reconstructed*). As for the ADA ramps, most that do exist are not ADA compliant. Additionally, there are a few crosswalks along Route 140, mainly at the Route 12/140/Central Street intersection where an on-call dedicated pedestrian phase is incorporated into the traffic signal. In Boylston, there are no sidewalks, ADA ramps, or crosswalks along the entirety of Route 140 in that host community.

As observed in the field, there are existing sidewalks along half the length of Route 140 through the town of Shrewsbury. They are located between the Boylston town line to just north of Route 9 and they are in good to excellent condition. There are no sidewalks south of Route 9. In regards to the ADA ramps, everything south of Main Street is ADA compliant while between Main Street and Hill Street the ramps are considered either non-compliant or historic. Historic means that the ramps were built to past standards, but could be upgraded easily. There are no ADA ramps around the I-290 interchange, but that could potentially change with the future

reconstruction of the bridge. There are also a few crosswalks that cross Route 140, mostly in the vicinity of the Main Street intersection in the town center. There is a dedicated on-call pedestrian phase incorporated into the traffic signal at this location.

8.8 Regional Trails in the Corridor

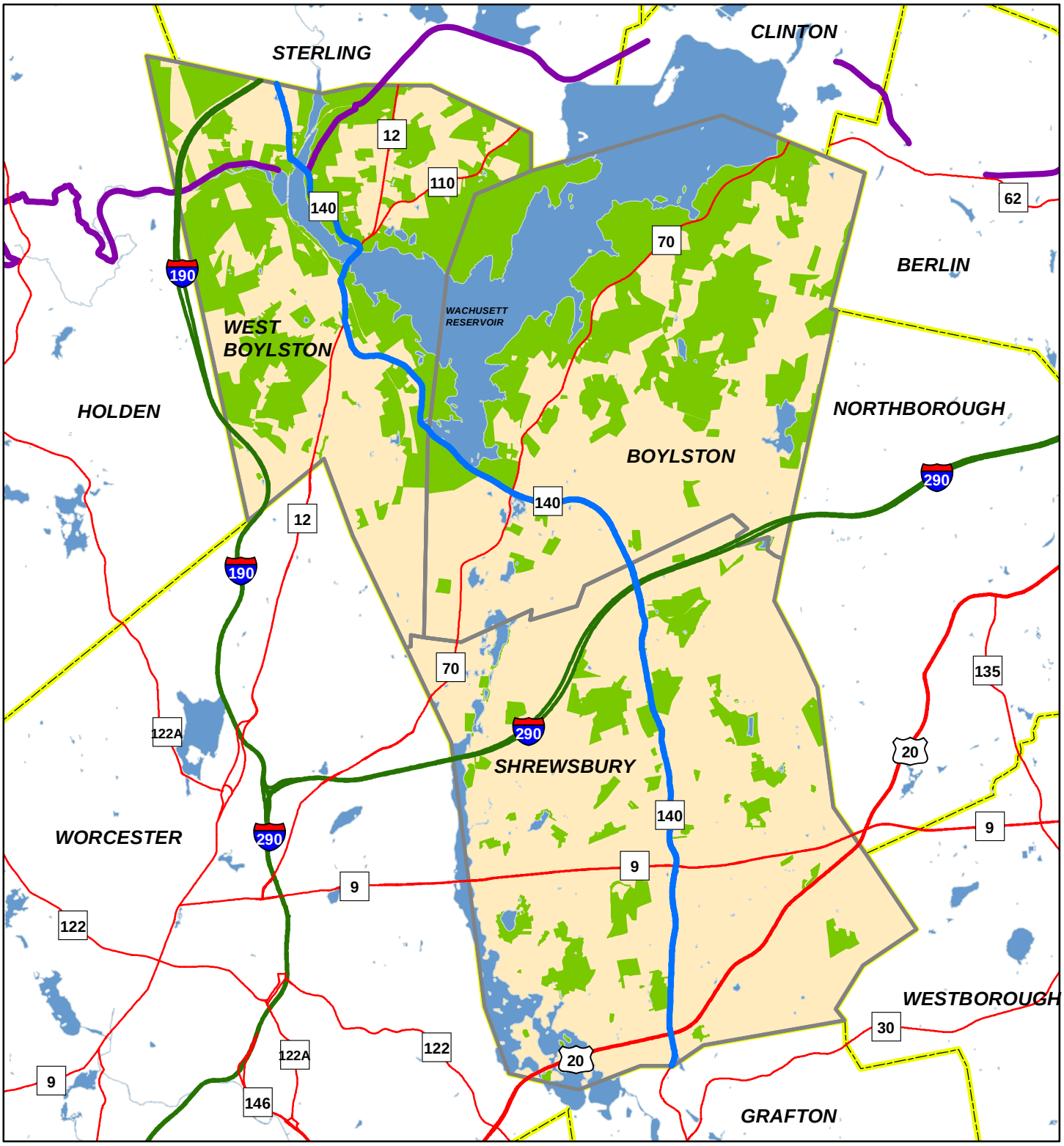
Besides on-road facilities like sidewalks and marked bicycle lanes, regional trails are also used by hikers and bicyclists. In the winter time trails can also be used by cross-country skiers. These trails are often built on old former rail lines as well as through forests, recreational areas, and parks. **Figure 54** features both the Mass Central Rail Trail and open space areas in the three host communities. The open space layer is basically public and private-owned recreational and conservation lands. These lands include, but are not limited to, town parks, commons, playing fields, school fields, golf courses, bike paths, scout camps, cemeteries, and fish & game clubs. There is a significant amount of open space land in the towns of West Boylston and Boylston, largely due to protected watershed areas associated with the Wachusett Reservoir. In Shrewsbury, where land use is more densely developed, far less open space exists.

As shown, the Mass Central Rail Trail crosses through the northern part of West Boylston. This rail trail is envisioned to be 104 miles in length from Boston to Northampton, connecting 24 communities. The rail trail is considered a work in progress. Currently, there are around 25 miles that are open and safe for travel. In Central Massachusetts, the Wachusett Greenways is a volunteer non-profit group that is working to complete 30 miles of the rail trail through the towns of Sterling, West Boylston, Holden, Rutland, Oakham, and Barre. About 19 of the 30 planned miles have been completed. The portions through host community West Boylston have been completed and are fully open to the public.

Located on **Figure 55** are the Department of Conservation and Recreation (DCR) access roads to the Wachusett Reservoir in the towns of West Boylston and Boylston. The locations of the DCR gates for which to access these roads are also shown on the map. The public is allowed to hike, fish on the shore, and cross-country ski on DCR property. Biking is only allowed on the Rail Trail and on designated routes in Holden only.

In the town of Shrewsbury there is a Trails Committee. This committee was formed in 2011 as a recommendation from the town's open space plan. The committee is made up of community volunteers and they provide information to town residents so they can explore and make use of the trails in Shrewsbury. A map of these local trails can be found on the Shrewsbury town website at Shrewsbury Trail Committee. As can be seen on the map, there are a few local trails located near Route 140.

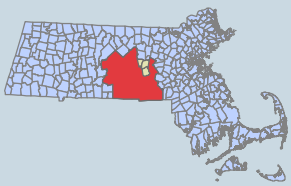
In early 2017, the CMRPC received a grant through the District Local Technical Assistance (DLTA) program to update the existing inventory and maps of the region's trail system. The CMRPC held three public meetings with the host communities, land trusts, and various trail groups to identify what resources, maps, and information are currently available. Through this process it was found that participants wanted a clickable online regional map of the existing trails to use as a resource. To do this work, the CMRPC applied for an Efficiency & Regionalization grant through the Community Compact Program in November 2017, but it was not awarded to the CMRPC. The grant was for $50,000 and would have been used to continue the ongoing trail work. Staff will look to apply for additional funding through the DLTA program at a later date. To assist in this trail system mapping effort, a trails group for Southern Worcester County was established to discuss trails and help make updates to the map. In addition, the CMRPC communities would be responsible for mapping incomplete or missing trails within their communities. The Route 140 Corridor Profile communities were all active participants in the public meetings.

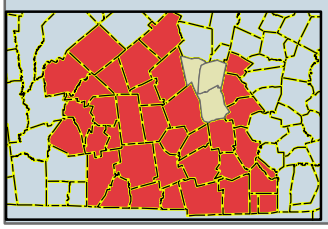


ROUTE 140 CORRIDOR PROFILE

Long Distance Trails & Open Space

Figure 54





Legend

- Route 140 Corridor Profile
- Interstate
- U.S. Route
- State Route
- Mass Central Rail Trail
- Water Bodies
- Open Space

0 0.5 1 2 3 4 Miles

CMRPC
Central Massachusetts Regional Planning Commission

Source: Data provided by the US Census Bureau, Central Massachsuetts Regional Planning Commission (CMRPC), massDOT Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information MassGIS), Commonwealth of Massachusetts, Information Technology Division.

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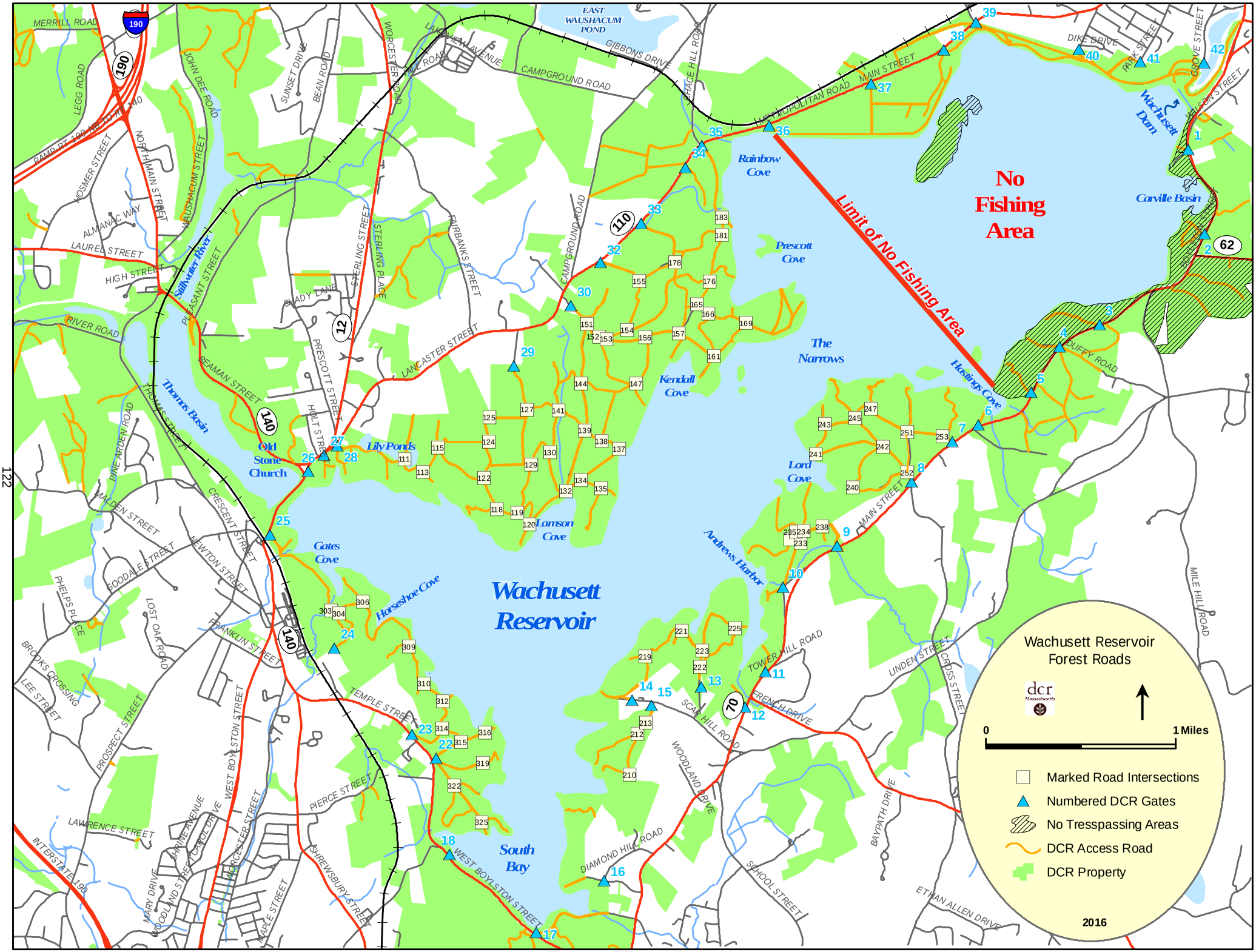

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Figure 55

8.9 Performance Management

There are multiple regional Performance Measures that are related to this chapter. The first objectives are under the State of Good Repair category and they include improving accessibility for all modes by increasing ADA-compliant ramps as well as improving sidewalks in poor condition. To reach the first target, current non ADA-compliant ramps should be upgraded. In West Boylston, most ramps that do exist are not ADA-compliant and in Shrewsbury, about half could use upgrades. These improvements could potentially be completed through the town's yearly roadway maintenance or included within a larger roadway project. Basically, any new ADA-compliant ramps will help reach this performance target. In regards to sidewalks, the community of West Boylston is the only one studied that has sidewalks in poor condition. Accordingly, these identified sidewalks should be improved to help the region meet this target.

The second Performance Measure is in regards to Multimodality. The first objective is to expand bicycle, pedestrian, and transit networks in the region. The second objective is to increase the number of communities with Complete Street policies by working with communities to encourage increased participation. To reach the first objective, sidewalks could be built where needed and the width of Route 140 could be widened to increase accommodations for bicycles. Additionally, dedicated bicycle lanes could be marked along Route 140 to make drivers aware of bicyclists using the roadway. For the second objective, the town of Boylston is the only community included in the Route 140 Corridor Profile that does not currently have a Complete Streets policy. If the town is interested, CMRPC staff would welcome an opportunity to work with the town to develop a policy.

The third Performance Measure is in the Economic category. The objective is to make employment opportunities accessible and available allowing for job expansion by improving bicycle and pedestrian networks near two major employment centers every five years. There are not many major employment centers located along Route 140 through the host communities. There is a UPS facility in Shrewsbury, near Route 20. There is also a new FedEx facility that was built in Boylston, just north of Interchange 290. Any new roadway improvements should consider bicycle and pedestrian modes when being constructed.

The fourth Performance measure is for Travel and Tourism. The objective is to enhance the region's travel and tourism opportunities by encouraging improved mobility to trails and recreation areas. Since all three host communities have local or regional trails near Route 140, installing new wayfinding signage or improving current signs would help to meet the objective. Also, consider roadway improvements at the entrances/exits to these trails or recreation areas as to improve access.

9.0 Overall Corridor Profile Findings

This Corridor Profile effort considers the results of all Management System and environmental analyses and, in conjunction with the public process, selects those improvement options viewed as acceptable to the host community. Based on all the analysis completed and discussed previously, this section of the study summarizes the Corridor Profile findings for both intersections and roadway segments as well Performance Measures related to the Route 140 corridor.

9.1 Route 140 Intersections

Tables 18, 19 and 20 summarize the findings for intersections, which includes study intersection locations, calculated intersection Level of Service (LOS), number of documented vehicle crashes, the availability of public transit, the percentage of heavy vehicles using the intersections during the morning and evening peak hour periods, environmental considerations adjacent to Route 140 and beyond and other considerations such as obstructed lines of sight or the need for bicycle and pedestrian accommodations.

The following are Route 140 observations from the included tables:

- In West Boylston, the stop-sign controlled Route 12 and Franklin Street intersection has the worst LOS currently and in the future. Route 140 and Laurel Street operates the best with an over LOS "B" for existing and projected in the AM & PM. For most of the focus intersections, the AM time period seems to have worse delays than the PM. In Boylston, both of the existing focus intersections operate with a LOS "F" for both the AM & PM. Projected 2026 conditions also operate at a LOS "F" while the new FedEx site drive signalized intersection is projected to operate at a LOS "C" in the AM and a LOS "B" in the PM. In Shrewsbury, the focus intersections south of Main Street operate with an LOS of either "A" or "B" for existing and projected conditions. Conversely, the intersections of Main Street and Prospect Street are the worst with a LOS "F" for existing and projected.

- There were a total of 37 crashes at the five study intersections in the town of West Boylston, 14 crashes at the two intersections in the town of Boylston, and 36 crashes at the four intersections in Shrewsbury. The intersection that had the highest amount of crashes was Main Street in Shrewsbury, with a total of 27. In Boylston, both intersections had less than ten crashes. There were two intersections in West Boylston that had over ten crashes. These intersections were Route 12/Route 140/Central Street

and Route 12 /Franklin Street. Using the 2012-2014 crash data, both of these intersections are eligible for Highway Safety Improvement Program (HSIP) funding.

- There is currently no fixed route public transit service along the Route 140 study corridor. There is fixed route service in West Boylston, but the bus only goes as far as Wal-Mart, which is just south of Route 140. In Shrewsbury, there is a bus that travels across Route 140 along Main Street through the town center east to Julio Drive. Although there is no transit service on Route 140, the WRTA and/or Councils on Aging (COA) provides service the area for the elderly and disabled.

- The percentage of heavy vehicles using the Route 140 study intersections, as is typically the case in the region, was higher during the morning peak hour than in the evening peak. Often trucking activities follow a 7 AM to 3 PM shift, leading to a drop in activity in the evening. Morning percentages were as high as 7.9% (Main Street - Shrewsbury) and evening percentages were as high as 4.0% (Lake Street - Shrewsbury).

- As shown in previous figures, the table summarizes what environmental concerns are near the study intersections. In West Boylston, the northern intersections have nearby waters that require a Total Maximum Daily Load (TMDL) and are within a flood zone. In Boylston, both intersections are near a flood zone and the Route 70 intersection is also near a wellhead protection area and potential vernal pools. Most of the intersections in Shrewsbury have no significant impacts, but Grafton Street is near a flood zone.

- In West Boylston, Laurel Street intersects Route 140 at an angle and the Route 12/Central Street intersection has substandard geometry. The Route 140/Franklin Street intersection does not meet warrants for signalized control, but the Route 12/Franklin Street intersection does meet the required criteria. The Route 12 intersection at the Wachusett Reservoir near the old stone church was just recently resurfaced. In Boylston, the Route 70 intersection is heavily utilized and the School Street “H” intersection is due to close when the new planned roadway is built between Route 140 and School Street across from the new FedEx site drive. In Shrewsbury, Route 140 southbound queues block Prospect Street vehicles. The Main Street intersection is heavily utilized with cars and trucks. The remaining two intersections of Lake Street and Grafton Street have minimal bicycle accommodations. The lines of sight, signs, and pavement markings should be maintained.

Table 18

Town of West Boylston
Route 140 Focus Intersections:
Overall Corridor Profile Findings

Study Intersection Location	CMP Intersection Level-of-Service(LOS)*	Safety Analysis**	Public Transit***	Freight Movement Heavy Vehicle %	Environmental Consultation Analysis	Other Considerations
Route 140/Laurel St	AM = B (B) PM = B (B)	1	No Fixed Route Service COA provides service to the elderly and disabled	AM = 2.2% PM = 1.1%	Nearby waters requiring a TMDL and flood zone	Laurel St intersects Route 140 at an angle. Maintain lines of sight, signs, and markings.
Route 140/Route 12	AM = C (D) PM = F (F)	2	No Fixed Route Service COA provides service to the elderly and disabled	AM = 5.0% PM = 2.2%	Nearby waters requiring a TMDL and flood zone	Recently resurfaced, adjacent drainage improvements.
Route 140/Route 12/ Central St	AM = E (F) PM = C (D)	15	No Fixed Route Service COA & WRTA provides service to the elderly and disabled	AM = 3.1% PM = 0.9%	No identified impacts	Sustandard roadway geometry, design charette suggested.
Route 140 Franklin St	AM = C (D) PM = B (B)	1	No Fixed Route Service COA & WRTA provides service to the elderly and disabled	AM = 5.0% PM = 2.9%	No identified impacts	Does not meet warrants for signal.
Route 12/Franklin St	AM = E (F) PM = F (F)	18	No Fixed Route Service COA & WRTA provides service to the elderly and disabled	AM = 2.7% PM = 1.2%	No identified impacts	Meets warrants for signalized control, consider planning for future installation.

*Intersection Level-of-Service Existing (Projected 2026)
**Total number of crashes
***All WRTA fixed route buses have bicycle racks

Table 19

Town of Boylston
Route 140 Focus Intersections:
Overall Corridor Profile Findings

Study Intersection Location	CMP Intersection Level-of-Service(LOS)*	Safety Analysis**	Public Transit***	Freight Movement Heavy Vehicle %	Environmental Consultation Analysis	Other Considerations
Route 140/Route 70	AM = F (F) PM = F (F)	8	No Fixed Route Service COA provides service to the elderly and disabled	AM = 6.3% PM = 2.1%	Nearby wellhead protection area, wetlands, and potential vernal pools	Heavily utilized.
Route 140/School St	AM = F (F) PM = F (F)	6	No Fixed Route Service COA provides service to the elderly and disabled	AM = Unknown PM = Unknown	Nearby flood zone	Future closure of "H" intersection planned.

*Intersection Level-of-Service Existing (Projected 2026)
**Total number of crashes
***All WRTA fixed route buses have bicycle racks

Table 20

Town of Shrewsbury
Route 140 Focus Intersections:
Overall Corridor Profile Findings

Study Intersection Location	CMP Intersection Level-of-Service(LOS)*	Safety Analysis**	Public Transit***	Freight Movement Heavy Vehicle %	Environmental Consultation Analysis	Other Considerations
Route 140/Prospect St	AM = F (F) PM = F (F)	4	No Fixed Route Service COA & WRTA provides service to the elderly and disabled	AM = 7.9% PM = 3.6%	No identified impacts	Often blocked by Route 140 southbound queues.
Route 140/Main St	AM = F (F) PM = F (F)	27	Route 15 COA & WRTA provides service to the elderly and disabled	AM = 5.6% PM = 2.1%	No identified impacts	Heavily utilized, high truck volumes.
Route 140/Lake St	AM = A (A) PM = A (B)	1	No Fixed Route Service COA & WRTA provides service to the elderly and disabled	AM = 6.4% PM = 4.0%	No identified impacts	Maintain lines of sight, signs, markings. Minimal shoulder width for bicycle accommodation.
Route 140/Grafton St	AM = A (A) PM = B (B)	4	No Fixed Route Service COA provides service to the elderly and disabled	AM = 7.8% PM = 3.5%	Nearby flood zone	Maintain lines of sight, signs, markings. Minimal shoulder width for bicycle accommodation.

*Intersection Level-of-Service Existing (Projected 2026)
**Total number of crashes
***All WRTA fixed route buses have bicycle racks

9.2 Route 140 Roadway Segments

The Corridor Profile findings for Route 140 roadway segments are summarized in **Tables 21, 22 and 23**. Similar to the previous tables, the roadway segment tables list each Route 140 study segment, number of documented vehicle crashes, the field-observed condition of the paved roadway surface, whether there are highway or railroad bridges, the availability of public transit, the daily percentage of heavy vehicles using the Route 140 segments, environmental considerations adjacent to Route 140 and beyond and other considerations including the need to maintain lines of sight and the need to accommodate both bicycles and pedestrians.

As summarized in the tables, the following observations are provided:

- There were 25 roadway segment crashes in West Boylston, 27 crashes in Boylston, and 119 crashes in Shrewsbury. The town of Shrewsbury had the highest number of crashes and between Grafton Street and the Grafton town line had the most with a total of 54. The segment between the Boylston town line and Prospect Street had the second most with a total of 33. Boylston's highest segment was from Route 70 to School Street with a total of 12. In West Boylston, the segment between Franklin Street and the Boylston town line had the most crashes with a total of 19. This section of roadway is fairly narrow with curves and fairly steep grades.

- Roadway pavement condition along Route 140 in West Boylston, Boylston and Shrewsbury is based on a calculated "Overall Condition Index" (OCI) which is derived from the pavement distresses (cracking, distortions, etc) observed in the field. The OCI scale ranges from 100, indicative of a new roadway, down to zero, where total failure of the paved surface is evident. The majority of Route 140 through all three communities is in "good" condition and only requires "Routine Maintenance". There is at least one segment in each town that is in "fair" condition and requires "Preventative Maintenance". The two lowest rated segments are within the town of Shrewsbury. One near the Boylston town line and the other near the Grafton town line.

- West Boylston has three bridges along Route 140. Two are over the Wachusett Reservoir and the third is over the Pan Am Railway. The town of Boylston does not have any bridges along Route 140. Shrewsbury has three bridges. One is over I-290, which will be completed replaced in the near future. The second is the Route 9 bridge over Route 140 and the last bridge is over Route 20, just north of the Grafton town line.

- As indicated in the intersection findings, there is no fixed-route public transit service along the entire length of the Route 140 study corridor. However, the WRTA and/or Councils on Aging (COA) provides service for the elderly and disabled in all three communities.

- Using data through the ongoing traffic count program maintained by CMRPC, staff is able to determine heavy vehicle percentages along Route 140 for a 24-hour period. The data listed in the table is the percentage of heavy vehicles traveling along the focus segments during the time frame previously mentioned. West Boylston truck percentages range between 6% and 11%. Boylston has a range of 8% to 11% and Shrewsbury has the highest percentages ranging from 12% to 15%.

- In West Boylston, most roadway segments have a nearby flood zone and waters requiring a Total Maximum Daily Load (TMDL). Also, there are five culverts along Route 140. In Boylston, all segments have a nearby flood zone and two of the segments are near waters that require a TMDL. In addition, there are three culverts along Route 140. There are minimal environmental impacts in the town of Shrewsbury, but there is a nearby flood zone located in the segment between Grafton Street and the Grafton town line. Further, there are four culverts located along Route 140. As can be realized, the need to protect and preserve sensitive adjacent properties will need to be part of the design process for any of the suggested improvement options.

- In West Boylston, there are minimal shoulder widths for bicycle accommodations north of Laurel Street. Most of the segment between Laurel Street and Route 12 was resurfaced and drainage improvements were also completed. Further, the Wachusett Reservoir viaduct was also recently resurfaced. The southern portion of Route 140 has minimal or no sidewalks along with narrow roadway widths. In Boylston, there are wide shoulders to accommodate bicyclists, but there are no sidewalks. A new traffic signal was installed at the recently constructed FedEx site drive between School Street and the Shrewsbury town line. In Shrewsbury, the section between Prospect Street and Main Street is heavily utilized. Route 140 was reconstructed in 2008 between Main Street and Grafton Street. Wide shoulders, south of Grafton Street, provide adequate bicycle accommodation.

Table 21

Town of West Boylston
Route 140 Roadway Segments:
Overall Corridor Profile Findings

Route 140 Roadway Segments	Safety Analysis*	Pavement Condition**	Bridges	Public Transit***	Freight Movement Daily % of Heavy Vehicles	Environmental Consultation Analysis	Other Considerations
Sterling Town Line to Laurel St	0	OCI = 82.0 *Structural Improvement* OCI = 65.5 *Preventative Maintenance*	None	No Fixed Route Service COA provides service to the elderly and disabled	6.0%	Nearby flood zone. Culvert #WB1. Wellhead protection area.	Minimal shoulder width for bicycle accommodations.
Laurel St to Route 12	3	OCI = 78.5 *Routine Maintenance* *OCI = 98.0* *Do Nothing*	W-17-003 W-17-004	No Fixed Route Service COA provides service to the elderly and disabled	8.0%	Nearby flood zone. Nearby waters requiring a TMDL.	Majority of segment resurfaced with adjacent drainage improvements.
Route 140/12 to Central St	3	OCI = 76.5 *Routine Maintenance*	W-17-005	No Fixed Route Service WRTA & COA provides service to the elderly and disabled	8.0%	Nearby flood zone. Nearby waters requiring a TMDL. Culvert #WB2.	Reservoir viaduct recently resurfaced, DCR drainage projects.
Central St to Franklin St	0	OCI = 69.8 *Routine Maintenance*	None	No Fixed Route Service WRTA & COA provides service to the elderly and disabled	11.0%	No identified impacts	Sidewalk only on one side.
Franklin St to Boylston Town Line	19	OCI = 65.7 *Preventative Maintenance* *OCI = 79.6* Routine Maintenance	None	No Fixed Route Service WRTA & COA provides service to the elderly and disabled	8.0%	Nearby flood zone. Nearby waters requiring a TMDL. Wellhead protection area. Culverts WB3,WB4,WB5	Narrow roadway width and no sidewalks. Roadway has curves and fairly steep grades.

*Total number of crashes (4 crashes occurred on Route 12 between Route 140 & Franklin Street)
**OCI = Overal Condition Index, Ranging From 0 - 100
***All WRTA fixed route buses have bicycle racks

Table 22

Town of Boylston
Route 140 Roadway Segments:
Overall Corridor Profile Findings

Route 140 Roadway Segments	Safety Analysis*	Pavement Condition**	Bridges	Public Transit***	Freight Movement Daily % of Heavy Vehicles	Environmental Consultation Analysis	Other Considerations
West Boyston Town Line to Route 70	7	OCI = 59.0 *Preventative Maintenance*	None	No Fixed Route Service COA provides service to the elderly and disabled	8.0%	Nearby flood zone. Nearby waters requiring a TMDL. Wellhead protection area. Culverts B1 & B2.	Wide shoulders to accommodate bicyclists, no sidewalks.
Route 70 to School St	12	OCI = 74.6 *Routine Maintenance*	None	No Fixed Route Service COA provides service to the elderly and disabled	11.0%	Nearby flood zone. Wellhead protection area. Culvert #B3.	Offset Sewall Street intersection, busy commercial strips.
School St to Shrewsbury Town Line	8	OCI = 75.8 *Routine Maintenance*	None	No Fixed Route Service COA provides service to the elderly and disabled	11.0%	Nearby flood zone.	Recent widening to accommodate new Pine Hill Drive, partially constructed. Connector to School St Planned.

*Total number of crashes
**OCI = Overal Condition Index, Ranging From 0 - 100
***All WRTA fixed route buses have bicycle racks

Table 23

Town of Shrewsbury
Route 140 Roadway Segments:
Overall Corridor Profile Findings

Route 140 Roadway Segments	Safety Analysis*	Pavement Condition**	Bridges	Public Transit***	Freight Movement Daily % of Heavy Vehicles	Environmental Consultation Analysis	Other Considerations
Boylston Town Line to Prospect St	33	OCI = 51.6 *Preventative Maintenance*	S-14-018	No Fixed Route Service WRTA & COA provides service to the elderly and disabled	15.0%	No identified impacts.	Lane drop in southbound travel lane just north of Wachusett Ave/Barnard St interstection.
Prospect St to Main St	2	OCI = 66.1 *Preventative Maintenance*	None	No Fixed Route Service WRTA & COA provides service to the elderly and disabled	13.0%	No identified impacts.	Heavily utilized during peak hour flow periods.
Main St to Lake St	20	OCI = 88.7 *Do Nothing*	None	No Fixed Route Service WRTA & COA provides service to the elderly and disabled	14.0%	Culvert #S1.	Reconstructed under TIP project in 2008
Lake St to Grafton St	10	OCI = 90.7 *Do Nothing*	None	No Fixed Route Service WRTA & COA provides service to the elderly and disabled	12.0%	No identified impacts.	Reconstructed under TIP project in 2008
Grafton St to Grafton Town Line	54	OCI = 74.3 *Routine Maintenance* *OCI = 49.6* *Preventative Maintenance*	S-14-007 S-14-015	No Fixed Route Service COA provides service to the elderly and disabled	15.0%	Nearby flood zone. Culverts S2,S3 & S4.	Wide shoulders provide adequate bicycle accommodation. Highest crash total for a roadway segment.

*Total number of crashes
**OCI = Overal Condition Index, Ranging From 0 - 100
***All WRTA fixed route buses have bicycle racks

9.3 Performance Management

Table 24 shows the integration of the Route 140 Corridor Profile findings as they relate to performance management. This table lists each of the ten federal transportation planning emphasis areas and the associated report chapter in which they are discussed. The performance objectives for each of the emphasis areas are also listed in the table. There are multiple performance areas that are included in more than one chapter while the State of Good Repair category is actually associated with four chapters. The corridor context column describes how the Route 140 corridor relates to each of the performance areas and its objective. Further, the last two columns list the observed deficiencies on Route 140 and what suggested improvements can help obtain the planning region's performance objectives.

Table 24 - Integrating Corridor Profile Findings with Performance Management

Associated Chapter	Performance Area	Performance Objective	Corridor Context	Observed Deficiencies	Suggested Improvement and Regional Impact
Chapter 4	SAFETY	Reduce the number and rate of fatal & injury crashes in the region on all roadways and freight routes.	Route 140 is a primary freight route with four HSIP crash clusters. Safety improvements could reduce vehicle crashes that involve injuries and fatalities along the roadway/freight routes.	A total of 274 crashes occurred in the host communities along Route 140 between 2012 and 2014. Of those crashes, 2 were fatal. There are four HSIP crash clusters.	Improve HSIP intersections and other high crash locations along Route 140. Improve roadway geometry, pavement markings, signage, and add signalized traffic control, if needed, to reduce the number of crashes.
Chapter 4	SECURITY	Enhance security preparedness and coordination.	Route 140 is considered a primary evacuation route and it is important for the roadway to be safe and secure.	See the observed deficiences from the other performance areas.	See the suggested improvement options from the other performance areas.
Chapters 5, 6, 7, 8	STATE OF GOOD REPAIR	**5)** Reduce poor and very poor pavement lane miles. **6)** Decrease the number of bridges that are Structurally Deficient. **7)** Maintain transit vehicles in a state of good repair. **8)** Have ADA compliant ramps and improve the condition of poor sidewalk miles.	**5)** Route 140 is mainly in good condition throughout the three host communities. **6)** There are six total bridges along the Route 140 corridor and only one is Structurally Deficient. **7)** No fixed-route buses and limited paratransit options along Route 140. **8)** Limited ADA compliant ramps along Route 140. Sidewalks mostly in good condition except for the northern part of West Boylston.	**5)** Only one segment of Route 140 is considered in poor or very poor condition. **6)** There is one Structurally Deficient bridge. **7)** Currently, no fixed-route buses travel on Route 140. **8)** Limited ADA compliant ramps. Sidewalks in poor condition in norther part of West Boylston.	**5)** Repave or reconstruct the poor roadway segment and conduct routine maintenance on the other segments of Route 140. **6)** Replace the Structurally Deficient bridge over I-290. **7)** Continue to maintain average age of transit vehicles. **8)** Upgrade existing non-ADA compliant ramps or install new ones. Reconstruct poorly rated sidewalks.
Chapter 3	CONGESTION	Reduce travel delay along roadway corridors while also improving level of service at identified intersections.	Route 140 is a major travel route for the three host communities. Route 140 also connects to I-190, I-290, Route 9 and Route 20.	At times, heavy congestion exists along Route 140 in all three host communities. There are multiple intersections with a LOS of "E" or "F".	Periodically check timing and phasing of all traffic signals in the study corridor to be certain they are working efficiently.
Chapter 8	MULTIMODALITY	Expand the bicycle, pedestrian, and transit network in the region and work with member communities to implement Complete Streets policies.	The current bicycle, pedestrian and transit networks along Route 140 are inconsistant. Working with the host communities through Complete Streets can help lessen this inconsistency.	No pedestrian accommodations in Boylston. No fixed-route transit along Route 140. Boylston does not currently have a Complete Streets policy.	Construct new sidewalks in Boylston and other areas where none currently exist. Potentially study the feasibility of fixed-route transit on Route 140. Assist Boylston in creating a Complete Streets policy.
Chapters 2 & 3	REDUCE GHG / SUSTAINABILITY	**2)** Combat sprawl and its effects by avoiding, minimizing, and mitigating environmental effects in a Priority Preservation Area (PPA) or Priority Development Area (PDA). **3)** Reduce automobile and transit vehicle emissions.	**2)** There are only two PDAs along the Route 140 corridor and both are in West Boylston. Any potential development in these areas should consider environmental effects. **3)** With reduction of vehicle delays GHGs could potentially be reduced.	**2)** There are wetlands and flood zones near both of the PDAs in West Boylston. **3)** Average just under 12,000 vehicle per day traveling Route 140. No fixed-route buses along Route 140. The roadway is not consistently suitable for all roadway users.	**2)** If development occurs make sure to fully consider and study the environmental effects of the potential area. **3)** Encourage use of other modes along Route 140. Consider Complete Streets improvements.
None	EQUITY	Assure that improvements are made throughout the entire region and provide access to essential services to Enviornmental Justice (EJ) populations.	All three towns along Route 140 have vulnerable populations. There is no fixed route bus access along this corridor. Route 140 is eligible for federal-aid monies through the TIP.	See the observed deficiences from the other performance areas.	Ensure that EJ populations have access to transportation services. Proposed projects should consider benefits and burdens of all populations in the project area.
Chapters 3 & 8	ECONOMIC VITALITY	**3)** Speed shipping in the region by reducing delay along established primary freight routes. **8)** Make employment opportunities accessible and available by improving bicycle and pedestrian networks near major employment centers.	**3&8)** Route 140 is a primary freight route. A UPS distribution center and now a FedEx facility exist along the Route 140 study corridor.	**3)** At times, heavy congestion exists along Route 140 in all three host communities. There are multiple intersections with a LOS of "E" or "F". **8)** Currently, limited bicycle or pedestrian facilities near the major employers of UPS or FedEx.	**3)** Periodically check timing and phasing of all traffic signals in the study corridor to be certain they are working efficiently. **8)** Consider bicycle and pedestrian improvements around major employers to create safe and reliable travel for all modes.
Chapter 2	STORMWATER MGMT & RESILIENCY	Create a transportation network that is resilient to the impacts of stormwater.	There are 12 culverts located under Route 140 within the three host communities. Upgrading the older culverts could help reduce the impacts of storms.	About a 1/3 of the culverts are in fair or poor condition.	Upgrade the older and poor condition culverts to more modern structures.
Chapter 8	TRAVEL & TOURISM	Enhance the region's travel and tourism opportunities by encouraging improved mobility to trails and recreation areas as well as locations supported by agritourism.	There are regional and local trails in all three communities. There are also a number of farms, farmers markets in all three towns along Route 140.	See the observed deficiences from the other performance areas.	Improve wayfinding signs to recreation areas and agritourism locations - consider MassDOT general service signs along Route 140 in key locations.

10.0 Suggested Improvement Options

CMRPC discusses many suggested improvement options within each Corridor Profile that is completed. Depending on host community needs, some suggestions can be specific to a certain corridor or can be used in all areas. Staff will typically meet with each community included in the Corridor Profile scope to discuss and incorporate their suggested improvements and ideas into the study report. Some improvements can be implemented on a short-term basis while others are aimed at the future, perhaps 5 to 10 years from the present.

As a reference, below are some of the short-term improvement options that were suggested in previous Corridor Profiles which can be used at specific intersections or along an entire corridor. These suggestions include:

- Check the traffic signal timing & phasing of signalized intersections.
- Maintain all traffic signals, signs, and pavement markings.
- Trim any overgrown vegetation that is hindering sight lines of vehicles, signs, or traffic signals.
- Maintain good pavement surfaces.
- Maintain bridges, culverts, and other roadside drainage facilities and features.
- Consider access management techniques.
- Incorporate additional signage for safety purposes, such as warning signs.
- Consider enhancing pedestrian and bicyclist safety where needed.
- Reconfigure the travel lanes at an intersection where appropriate and feasible.
- Use streetscaping for beautification purposes.

Additionally, the following suggested improvements previously incorporated into other Corridor Profiles were more for mid-term/long-term time frames. These types of improvements will likely cost more and will take longer to implement or construct. They have been mostly suggested on a community-by-community basis, but can generally be used for more than one location. They include:

- Realignment of intersection approaches.
- Consider the use of a modern roundabout instead of a traffic signal where appropriate and feasible.
- Widen roadways where additional travel or turning lanes are needed.
- Incorporate Intelligent Transportation Systems (ITS) components into the roadway network, such as dynamic messaging signs.

- Install overhead highway lighting where necessary.
- Utilize a "Complete Streets" approach, designing for all roadway users.
- Coordinate traffic signals where appropriate and feasible.
- Install new traffic signals where warranted or modernize/update existing signal equipment.
- Utilize traffic calming measures along densely settled sections of a roadway, as appropriate and feasible.

Reaffirmed by the Fixing America's Infrastructure (FAST) Act, the CMMPO is continuing the evolution of the development of performance-driven, multimodal TIP projects. Performance Based Planning & Programming (PBP&P) is intended to improve public transparency, fiscal accountability, and investment decisions affecting the condition and performance of the transportation system.

The CMMPO's Performance Management program includes 18 goals and objectives across ten federal transportation planning emphasis areas. Each goal and objective has corresponding performance metrics that are monitored and progress towards the established goals is reported annually. A Performance Measures Scoresheet was created to assess current and candidate future year TIP projects and to what extent they address regional goals. TIP projects that rank high are often projects that can provide substantive measurable outcomes for each goal, thus having increased regional impact.

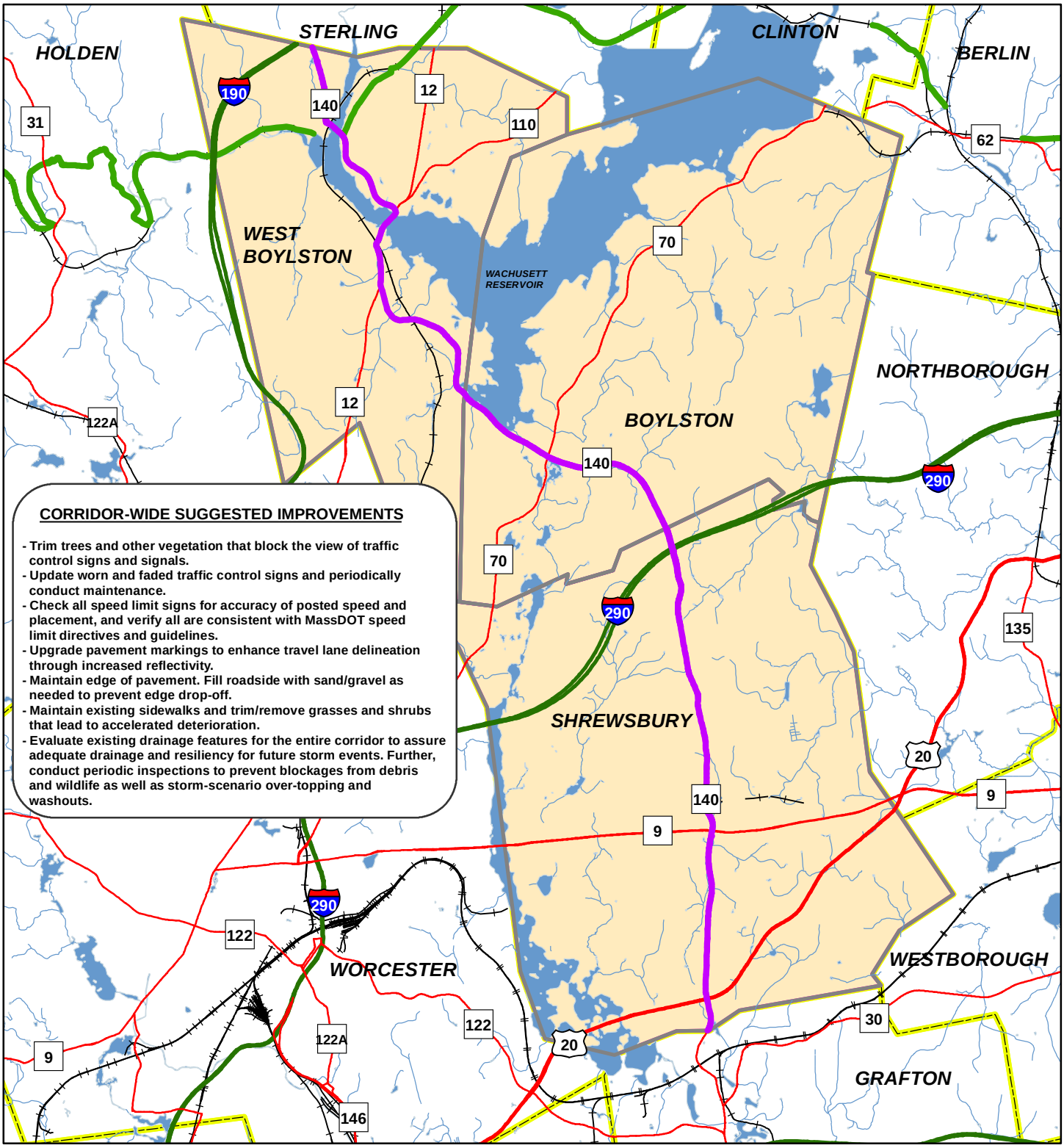
This Corridor Profile report includes a range of suggested improvement options for host community consideration. Many of the suggested improvement options could be included in future candidate TIP projects that could produce higher Performance Management scores. Higher scores increase the likelihood of CMMPO programming.

10.1 Route 140 Corridor-Wide Suggested Improvement Options

The following suggested improvement options, meant to address general overall deficiencies observed along the Route 140 study corridor, have been compiled for the host community's consideration. These improvement options are also shown in **Figure 56**. **Table 25** shows the Level of Service results for the projected 2026 intersections as well as a brief description of potential future year improvements.

- Trim trees and other vegetation that block the view of the traffic control signs and signals.
- Update worn and faded traffic control signs and periodically conduct sign maintenance.

- Check all speed limit signs for accuracy of posted speed and placement and verify all are consistent with MassDOT speed limit directives and guidelines.
- Upgrade pavement markings to enhance travel lane delineation through increased reflectivity.
- Maintain edge of pavement. Fill roadside with sand/gravel as needed to prevent edge drop-off.
- Maintain existing sidewalks and trim/remove grasses and shrubs that grow into the sidewalks and lead to accelerated deterioration.
- Evaluate existing drainage features for the entire corridor to assure adequate drainage and resiliency for future storm events. Further, conduct periodic inspections to prevent blockages from debris and wildlife as well as storm-scenario over-topping and washouts.



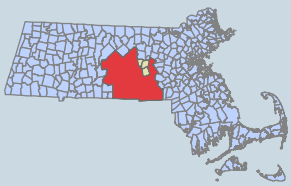
CORRIDOR-WIDE SUGGESTED IMPROVEMENTS

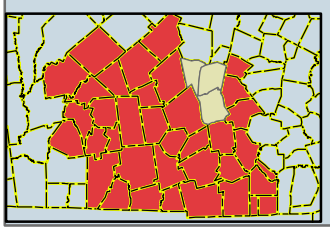
- Trim trees and other vegetation that block the view of traffic control signs and signals.
- Update worn and faded traffic control signs and periodically conduct maintenance.
- Check all speed limit signs for accuracy of posted speed and placement, and verify all are consistent with MassDOT speed limit directives and guidelines.
- Upgrade pavement markings to enhance travel lane delineation through increased reflectivity.
- Maintain edge of pavement. Fill roadside with sand/gravel as needed to prevent edge drop-off.
- Maintain existing sidewalks and trim/remove grasses and shrubs that lead to accelerated deterioration.
- Evaluate existing drainage features for the entire corridor to assure adequate drainage and resiliency for future storm events. Further, conduct periodic inspections to prevent blockages from debris and wildlife as well as storm-scenario over-topping and washouts.

ROUTE 140 CORRIDOR PROFILE

Corridor-Wide Suggested Improvements

Figure 56





Legend

- Route 140 Corridor Profile
- Interstate
- U.S. Route
- State Route
- Water
- Railroad
- Mass Central Rail Trail

0 0.5 1 2 3 4 Miles

CMRPC Central Massachusetts Regional Planning Commission

Source: Data provided by the US Census Bureau, Central Massachsuetts Regional Planning Commission (CMRPC), massDOT Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information MassGIS), Commonwealth of Massachusetts, Information Technology Division.

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TABLE 25

Intersection Level Of Service (LOS) Analyses Results:
Projected 2026 Conditions and Potential Future Year Improvements

COMMUNITY	ROUTE 140 INTERSECTION	NETWORK 2026 Projected AM V/C[1]	AM Delay[2]	AM LOS	PM V/C[1]	PM Delay[2]	PM LOS	Potential Future Year Improvements
	SIGNALIZED	**Overall Intersection Operations**						
West Boylston	Route 140/Route 12/Central St	1.59	94	F	1.06	44	D	Town Center Design Charette Suggested by MassDOT D-3, Consider Future Year Realignment
Boylston	Route 140/Route 70	1.70	172	F	1.57	143	F	Monitor, Adjust Timing Ranges
	Route 140/FedEx Site Drive**	0.97	32	C	0.80	18	B	Monitor, Newly Constructed
Shrewsbury	Route 140/Main St	1.61	147	F	2.76	194	F	Monitor, Adjust Timing Ranges
	Route 140/Lake St	0.74	8	A	0.85	13	B	Monitor and Maintain Equipment
	Route 140/Grafton St	0.66	7	A	0.84	13	B	Monitor and Maintain Equipment
	UNSIGNALIZED[3]	**Minor Street Approaches under "Stop" Sign Control**						
West Boylston	Route 140/Laurel St	0.35	13	B	0.17	12	B	Maintain Lines of Sight, Signs, and Markings
	Route 140/Route 12	0.54	27	D	1.49	167	F	Monitor
	Route 140/Franklin St	0.50	29	D	0.23	14	B	Maintain Lines of Sight, Signs, and Markings
	Route 12/Franklin St	0.67	73	F	1.47	300	F	Consider Future Year Signalized Control
Boylston	Route 140/School St*	1.20	120	F	1.20	120	F	Existing "H" Intersection Closed with Pine Hill Ave Extension
Shrewsbury	Route 140/Prospect St	1.46	300	F	1.58	300	F	Maintain Lines of Sight, Signs, and Markings

1) V(volume)/C(capacity) is for worst lane group; C is maximum flow under prevailing conditions
2) Delay in seconds
3) Delay and LOS are for minor street approach

*Data used from the Boylston Traffic Impact Study for the Proposed FedEx Facility by VHB (September 2016)
**Data used from the Shrewsbury Corridor Study of Route 140 South for the Proposed FedEx Facility by MDM (November 2017)

10.2 West Boylston Site-Specific Suggested Improvement Options

The following suggested improvement options, meant to address existing site-specific deficiencies observed along the West Boylston segment of the Route 140 study corridor, have been compiled for host community consideration. These improvement options are shown in **Figure 57**.

Route 140/Laurel Street Intersection

- Maintain existing lines of sight, especially to the north.
- Maintain "Stop" sign and stop bar marking.
- Consider future year realignment to "T-type" intersection within existing right-of-way, shifting Laurel Street approach slightly south, mindful of adjacent stream.

Route 140/Route 12 Intersection

- Maintain all lines of sight, traffic control signs and markings.
- Monitor location on a periodic basis.

Route 140/Route 12/Central Street Intersection

- As suggested by MassDOT, hold local public information meeting to gain resident ideas and opinions.
- Continue to monitor operations and safety history on a periodic basis. (Safety record appears to show slight improvement w/less reported incidents)

Route 12/Franklin Street Intersection

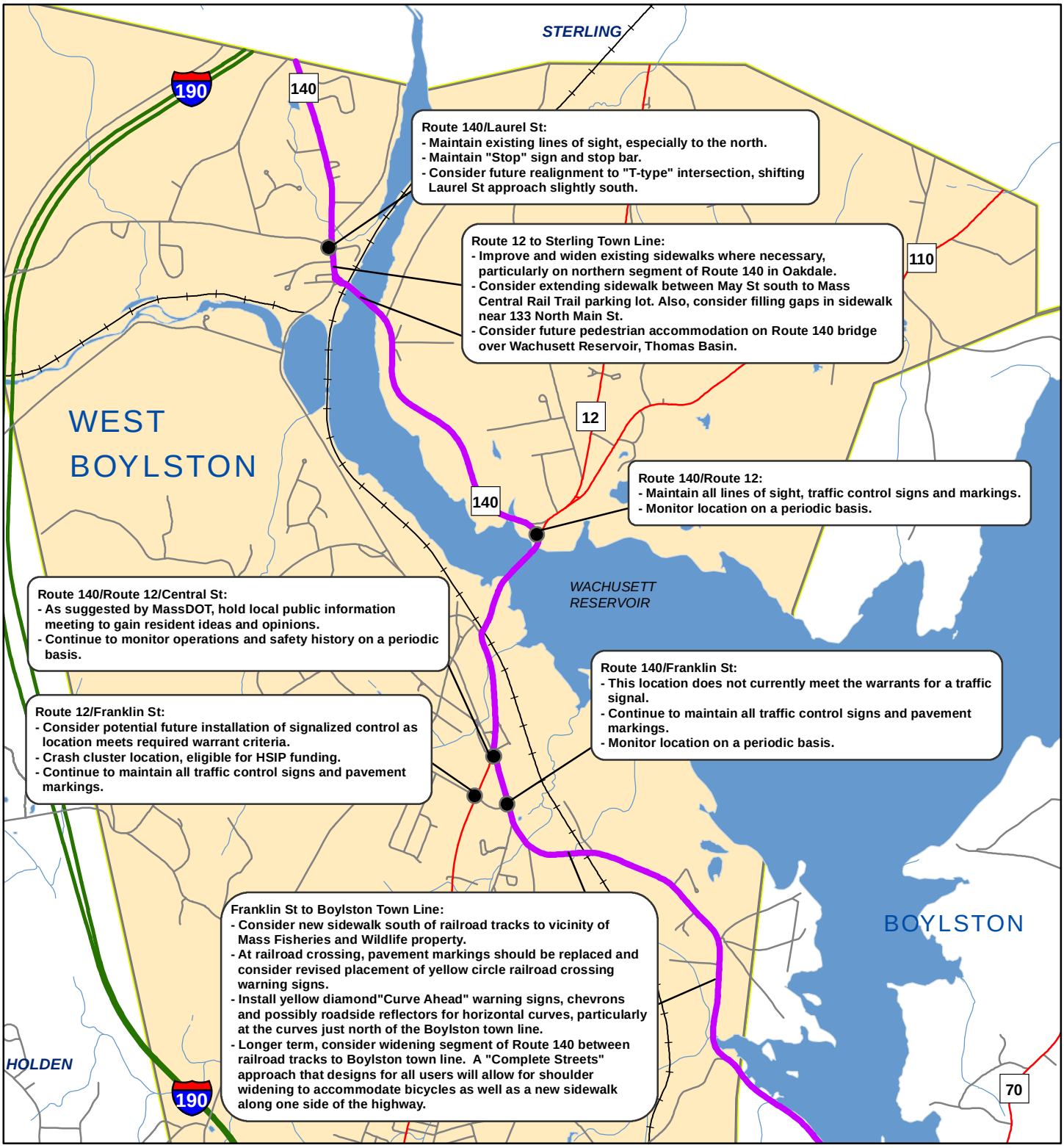
- Consider potential future installation of signalized control as location meets required warrants.
- Crash cluster location, eligible for Highway Safety Improvement Program (HSIP) funding.
- Continue to maintain all traffic control signs and pavement markings

Route 140/Franklin Street Intersection

- This location does not currently meet the MassDOT required warrants for a traffic signal.
- Continue to maintain all traffic control signs and pavement markings.
- Monitor location on a periodic basis.

Other Route 140 Locations

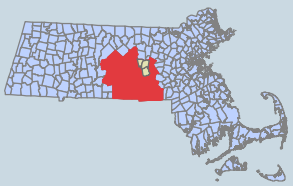
- Consider new sidewalk south of railroad tracks to vicinity of Mass Fisheries and Wildlife property.
- Improve and widen existing sidewalks where necessary, particularly on northern segment of Route 140 in Oakdale.
- Longer term, consider widening segment of Route 140 between railroad tracks to Boylston town line. A "Complete Streets" approach that designs for all users, will allow for shoulder widening to accommodate bicycles (observed to be substantial) as well as a new sidewalk along one side of the highway. This would serve to provide a continuous sidewalk from Route 12 to the Mass Wildlife site.
- In northern part of community, consider extending sidewalk between May Street south to Mass Central rail-trail parking lot. Also, consider filling gaps in sidewalk near 133 North Main Street.
- Consider future pedestrian accommodation on Route 140 bridge over Wachusett Reservoir, Thomas basin.
- At Route 140 railroad crossing, pavement markings should be replaced and consider revising the placement of existing yellow circle railroad crossing warning signs.
- Install yellow-diamond "Curve Ahead" warning signs, chevrons and possibly roadside reflectors for horizontal curves, particularly at the curves just north of the Boylston town line.

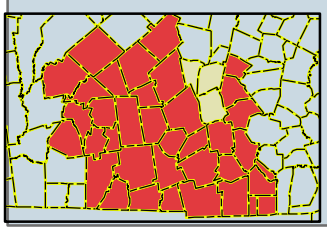


ROUTE 140 CORRIDOR PROFILE

West Boylston Site-Specific Suggested Improvements

Figure 57





Legend

- Route 140 CP
- Interstate
- State Route
- Roads
- Streams
- Water Bodies
- Railroad

0 0.2 0.4 0.8 1.2 1.6 Miles

CMRPC
Central Massachusetts Regional Planning Commission

Source: Data provided by the US Census Bureau, Central Massachsuetts Regional Planning Commission (CMRPC), massDOT Office Of Transportation Planning Geospatial Resources Section and the Office of Geographic Information MassGIS), Commonwealth of Massachusetts, Information Technology Division.

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10.3 Boylston Site-Specific Suggested Improvement Options

The following suggested improvement options, meant to address existing site-specific deficiencies observed along the Boylston segment of the Route 140 study corridor, have been compiled for host community consideration. These improvement options are also shown in **Figure 58**.

Route 140/Route 70 Intersection

- Remove any remaining yellow diamond crossroad signs and replace with "Signal Ahead" signs on all four approaches.
- Continue to periodically monitor intersection operations. With the anticipated growth in traffic volumes along the Route 140 corridor in the host community of Boylston, if improvements to the existing Route 140/Route 70 intersection were determined necessary in the future, MassDOT would consider both upgrading the existing signalized traffic control as well as evaluating the alternative of installing a modern roundabout. This could potentially lead to necessary lane capacity additions on both Route 140 approaches to the intersection with Route 70.

Route 140 Between Route 70 & Sewall Street

- Various future year improvement options could be considered along this segment of the study corridor. Should the future growth in traffic volumes require, consider an "engineered" Route 140 roadway segment in this area. Along the Route 140 segment that fronts the northern commercial strip that includes the US Post Office, a four-lane roadway cross section could be considered in the future (similar to that found in the area of the recently constructed Gulf Gas Station and long-time local roadside business the Dragon 88). The northern commercial segment of Route 140 could potentially operate similarly.
- Alternately, consider preserving a single travel lane on Route 140 southbound while providing two travel lanes on Route 140 northbound. The conceptual roadway cross-section transition would occur in the area of the duel Sewall Street intersections where traffic calming techniques could potentially be implemented, aiding the flow of local school-generated traffic volumes while also processing Route 140 traffic volumes.

Route 140/Sewall Street

- The town is seeking to study this intersection further based on other current development proposals. A modern roundabout is a potential option to be considered.

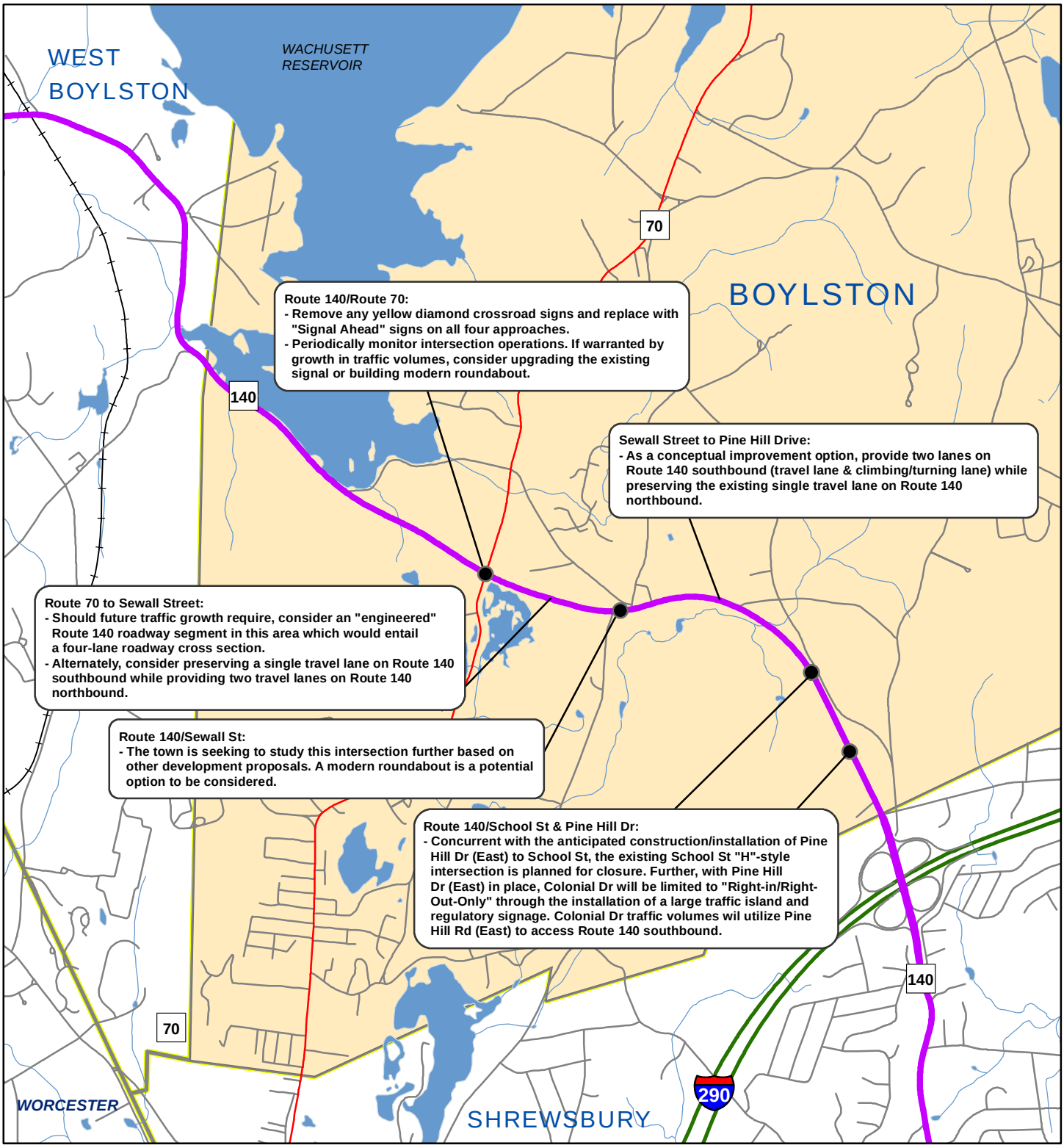
Route 140 Between Sewall Street & Pine Hill Drive

- Similarly, as another conceptual improvement option, between Sewall Street and the newly constructed four-lane Route 140 cross-section that begins at the Dragon 88 prior to the Pine Hill Drive intersection, provide two lanes on Route 140 southbound (travel lane & climbing/turning lane) while preserving the existing single travel lane on Route 140 in the northbound direction.

Route 140/School Street & Pine Hill Drive Intersections

- Concurrent with the anticipated construction/installation of Pine Hill Drive (East) to School Street, the existing School Street "H"-style intersection is planned for closure. A lengthy crash history is associated with this substandard intersection design. Further, with Pine Hill Drive (East) in place, Colonial Drive will be limited to "Right-In/Right-Out-Only" through the installation of a large traffic island and regulatory signage. Colonial Drive traffic volumes will utilize Pine Hill Drive (East) to access Route 140 southbound. Below is a conceptual improvement plan of this planned improvement.

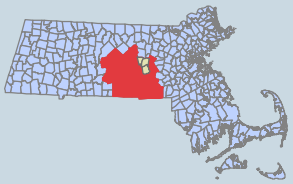
Route 140 Conceptual Roadway Improvement Plan

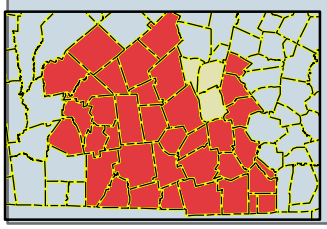


ROUTE 140 CORRIDOR PROFILE

Boylston Site-Specific Suggested Improvements

Figure 58





Legend

- Route 140 CP
- Interstate
- State Route
- Roads
- Streams
- Water Bodies
- Railroad

0 0.15 0.3 0.6 0.9 1.2 Miles

CMRPC Central Massachusetts Regional Planning Commission

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10.3 Town of Shrewsbury

The following suggested improvement options, meant to address both existing site-specific deficiencies observed along the Shrewsbury segment of the Route 140 study corridor, have been compiled for host community consideration. These improvement options are also shown in **Figure 60**.

Route 140/I-290 Interchange Area

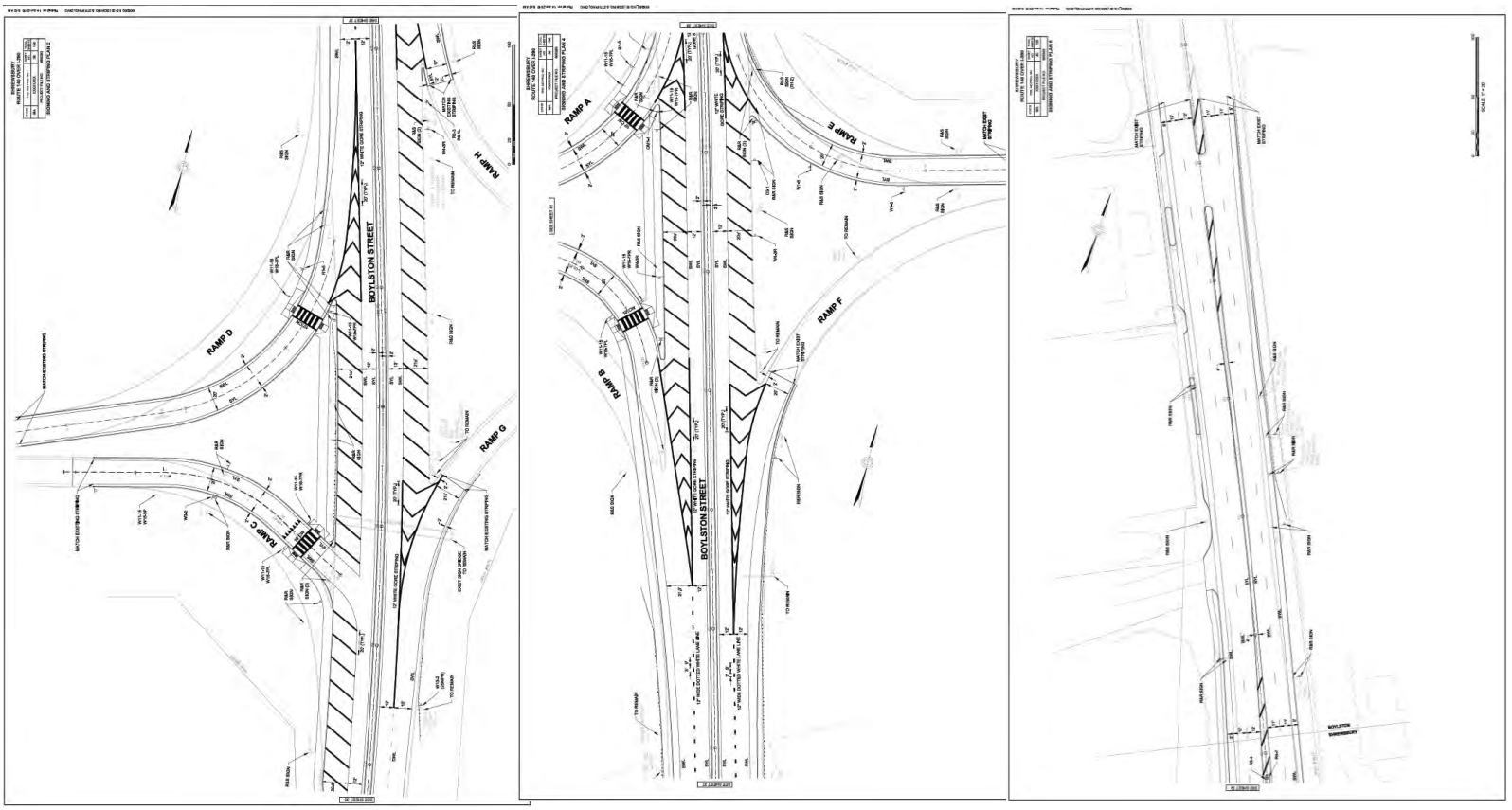
- A project to completely replace the Route 140 bridge over I-290 was advertised for competitive bid to the construction industry in June 2018. Construction bids were opened in September 2018 and the MassDOT District #3 office expects that construction on the new replacement structure will begin in the Spring of 2019.

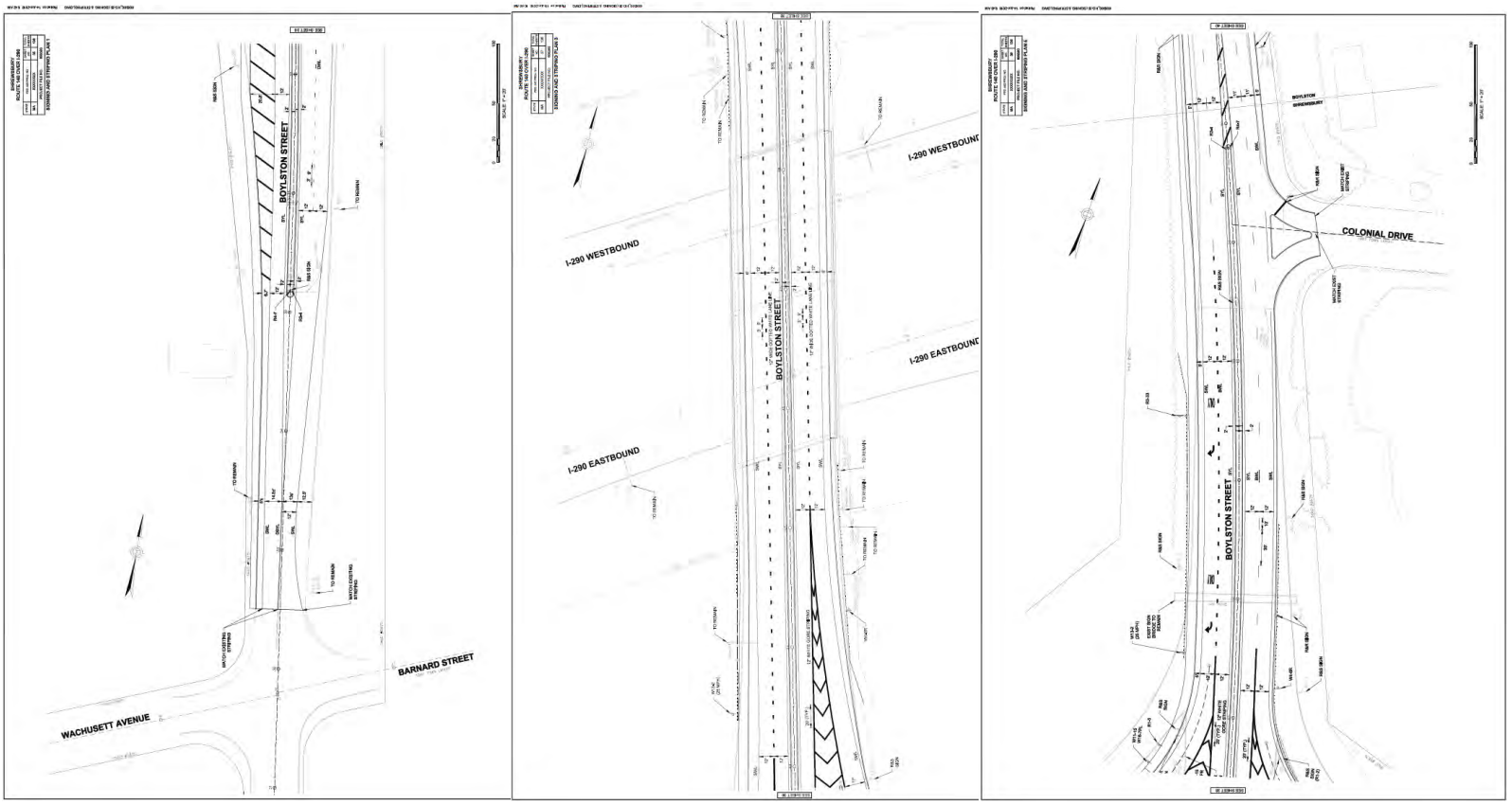
  Shown in **Figure 59** are MassDOT's finalized pavement marking and striping plans for the Route 140 bridge to be replaced over I-290 as well as the associated interchange ramp system. Revised travel and merging/diverging lane arrangements are shown as well as the relocation of a number of ramp approaches, detailed below. Where the outer ramps of the I-290 interchange merge/diverge with Route 140, formal acceleration/deceleration lanes will be provided.

  As noted previously, Colonial Drive will be limited to "Right-In/Right-Out-Only" through the installation of a large traffic island and regulatory signage. Also, the existing median in the Colonial Drive area will be extended northerly to prevent any attempt of potentially hazardous left turns out of Colonial Drive. Route 140's four-lane cross-section south of Pine Hill Drive will match the planned cross-section of the northerly limit of work of the Route 140 bridge over I-290 and associated interchange ramp system.

  Route 140 Southbound: At the I-290 westbound ramps, one lane will continue on Route 140 southbound while the other will be for "Right Turns-Exit Only" to I-290 westbound. Beginning at the off ramp from I-290 westbound to Route 140 southbound, Route 140 accommodates two lanes, one for southbound through travel and the other auxiliary lane for acceleration/deceleration, merging/weaving maneuvers on the bridge, prior to the I-290 eastbound on-ramp. At this point, one lane will continue on Route 140 southbound, and is then joined by the ramp from I-290 eastbound to Route 140 southbound. These two lanes will merge into a single travel lane on Route 140 southbound in order to match the existing single lane geometry at the Wachusett Avenue/Barnard Street intersection.

Route 140 Bridge over I-290 Replacement Design Plan
Figure 59





Route 140 Northbound: When departing the Wachusett Avenue/Barnard Street intersection, one travel lane is provided approaching the interchange area. At the on-ramp for I-290 eastbound, one lane will continue on Route 140 northbound while the other will be for "Right Turns-Exit Only" to I-290 eastbound. Beginning at the off ramp from I-290 eastbound to Route 140 northbound, Route 140 on the bridge accommodates two lanes, one for northbound through travel and the other auxiliary lane for acceleration/deceleration, merging/weaving maneuvers prior to the I-290 westbound on-ramp. At this point, one lane will continue on Route 140 northbound, and is then joined by the ramp from I-290 westbound to Route 140 northbound. A "road diet" concept for Route 140 at this point will serve to reduce the number of northbound lanes where the off-ramp meets Route 140 from three (3) existing to two (2) proposed. These two Route 140 northbound travel lanes will match the existing lane geometry of Route 140 south of Pine Hill Drive. Again, Colonial Drive will be limited to "Right-In/Right-Out-Only" through the installation of a large traffic island and regulatory signage.

The roadway cross-section on the Route 140 bridge includes a widened sidewalk on the west side of the bridge (adjacent to Route 140 southbound). The widened sidewalk is anticipated to provide improved accommodation for both pedestrians and bicyclists. In order to address safety concerns associated with the marked crosswalks planned on the I-290 ramps on the west side of the interchange, MassDOT has designed geometric modifications to the ramps that are intended to improve the visibility of pedestrians and bicyclists to vehicles using the interchange ramps.

<u>Route 140/Prospect Street Intersection</u>

- Keep all nearby vegetation trimmed and close to ground to maintain lines of sight.
- Perhaps consider installing directional guide signage to nearby Prospect Park hiking trails.

<u>Route 140/Main Street Intersection</u>

- Continue to monitor operations for maximum efficiency.
- Maintain all traffic control signs, signals and pavement markings.
- Keep all adjacent sidewalks and pedestrian travel ways clear of any obstructions and debris.

Route 140/Lake Street Intersection

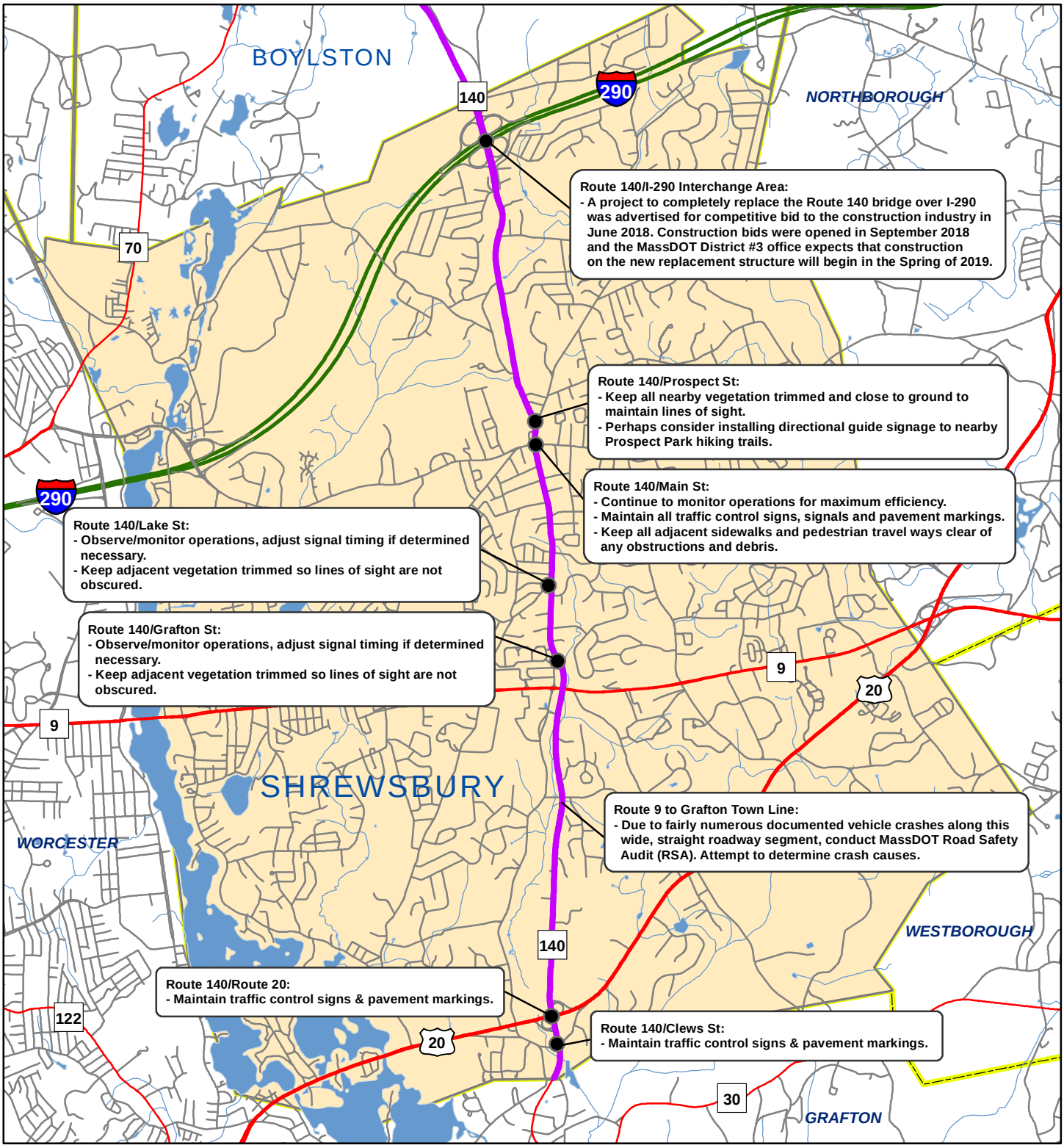
- Observe/monitor operations, adjust signal timing if determined necessary.
- Keep adjacent vegetation trimmed so lines of sight are not obscured.

Route 140/Grafton Street Intersection

- Observe/monitor operations, adjust signal timing if determined necessary.
- Keep adjacent vegetation trimmed so lines of sight are not obscured.

Other Route 140 Locations

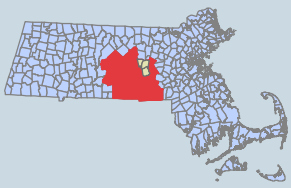
- Maintain traffic control signs and pavement markings at Route 140 ramps and Route 20.
- Maintain traffic control signs and pavement markings at Route 140/Clews Street.
- Due to fairly numerous documented vehicle crashes along this wide, straight roadway segment, plan to conduct a MassDOT Road Safety Audit (RSA) from Route 9 to the Grafton town line. Attempt to determine crash causes on fairly wide roadway with 12' travel lanes, 8' shoulders and essentially unrestricted sight distances. Types of crashes include angle, rear-end, sideswipe and single vehicle crashes.

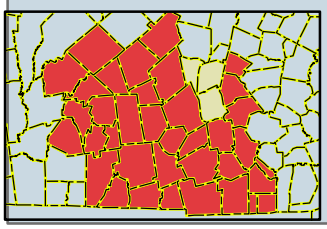


ROUTE 140 CORRIDOR PROFILE

Shrewsbury Site-Specific Suggested Improvements

Figure 60





Legend

- Route 140 CP
- Interstate
- U.S. Route
- State Route
- Streams
- Water Bodies
- Roads

Miles

0 0.25 0.5 1 1.5 2

CMRPC
Central Massachusetts Regional Planning Commission

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Central Massachusetts Regional Planning Commission

Member Communities

Auburn
Barre
Berlin
Blackstone
Boylston
Charlton
Douglas
Dudley
East Brookfield
Grafton
Hardwick
Holden
Hopedale
Leicester
Mendon
Millbury
Millville
New Braintree
North Brookfield
Worcester
Northborough
Northbridge
Oakham
Oxford
Paxton
Princeton
Rutland
Shrewsbury
Southbridge
Spencer
Sturbridge
Sutton
Upton
Uxbridge
Warren
Webster
West Boylston
West Brookfield
Westborough

Central Mass Regional Planning Commission

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