

CENTRAL MASSACHUSETTS METROPOLITAN PLANNING ORGANIZATION (CMMPO)

Holden - Paxton - Spencer Route 31 Corridor Profile



Prepared by the transportation staff of the



September 2014

Prepared in cooperation with the Massachusetts Department of Transportation and the U.S. Department of Transportation – Federal Highway Administration and the Federal Transit Administration. The views and opinions of the Central Massachusetts Regional Planning Commission expressed herein do not necessarily reflect those of the Massachusetts Department of Transportation or the U.S. Department of Transportation.

Table of Contents

1.0	INTRODUCTION	1
1.1	Transportation Management Systems Integration: “Corridor Profile”	1
1.2	Previous Corridor Profile Efforts	2
1.3	Route 31 Corridor Profile: Holden, Paxton, and Spencer	2
1.4	Corridor Profile Work Activities Defined in UPWP	5
1.5	Technical Advisory Group for the Route 31 Corridor Profile.....	6
1.6	Host Community Observations	8
1.7	Town of Holden.....	8
1.8	Town of Paxton	11
1.9	Town of Spencer	13
2.0	ROUTE 31 ENVIRONS.....	19
2.1	Host Community Land Use	19
2.2	Natural Environment	25
3.0	CONGESTION MANAGEMENT PROCESS (CMP)	34
3.1	Overview of the Central Massachusetts CMP	34
3.2	Daily Traffic Volumes	34
3.3	Route 31 Travel Time and Delay Studies	39
3.4	Route 31 Intersections Existing Peak Hour Traffic Volumes.....	48
3.5	Percentage of Heavy Vehicles Utilizing Route 31 Focus Intersections.....	55
3.6	Route 31 Intersections Projected 2023 Peak Hour Traffic Volumes	57
3.7	Route 31 Intersection Peak Hour Level of Service (LOS) Analyses	66
4.0	SAFETY MANAGEMENT SYSTEM (SMS)	68
4.1	Town of Holden Crash Analysis.....	70
4.2	Town of Paxton Crash Analysis	75
4.3	Town of Spencer Crash Analysis	81
4.4	Town of Spencer Additional Study Segment: Meadow Road.....	88
5.0	PAVEMENT MANAGEMENT SYSTEM (PMS)	92
5.1	Pavement Management Concepts	92
5.2	Town of Holden Overall Condition Index (OCI)	95
5.3	Town of Paxton Overall Condition Index (OCI)	96
5.4	Town of Spencer Overall Condition Index (OCI)	96
6.0	BRIDGES & MAJOR DRAINAGE STRUCTURES	98

6.1	Statewide Bridge Management System (BMS).....	98
6.2	Route 31 Corridor Profile Bridges	98
6.3	Town of Holden.....	99
6.4	Town of Spencer	100
6.5	Major Drainage Structures.....	101
7.0	PUBLIC TRANSPORTATION	114
7.1	Regional and Profile Area Services	114
7.2	Town of Holden.....	116
7.3	Town of Paxton	116
7.4	Town of Spencer	116
8.0	ALTERNATIVE MODES	118
8.1	Introduction	118
8.2	GreenDOT	118
8.3	MassDOT Healthy Transportation	118
8.4	Healthy Transportation Policy Directive	119
8.5	Community Health Improvement Plan (CHIP)	119
8.6	Complete Streets	120
8.7	Bicycling in the Corridor.....	120
8.8	Pedestrian Facilities and Activity in the Corridor	120
8.9	Regional Trails in the Corridor	121
9.0	OVERALL CORRIDOR PROFILE FINDINGS	123
9.1	Route 31 Intersections.....	123
9.2	Route 31 Roadway Segments	128
10.0	SUGGESTED IMPROVEMENT OPTIONS.....	133
10.1	Corridor-Wide	133
10.2	Town of Holden.....	137
10.3	Town of Paxton	140
10.4	Town of Spencer	144
11.0	HOST COMMUNITY PROJECT PRIORITIZATION & PRELIMINARY COST ESTIMATES...	149
11.1	Town of Holden.....	149
11.2	Town of Paxton	151
11.3	Town of Spencer	152
11.4	Potential Funding Sources	154

List of Figures

Figure 1	Previous Studies.....	3
Figure 2	Host Communities of Holden, Paxton, and Spencer	4
Figure 3	Town of Holden: Identified Corridor Deficiencies	16
Figure 4	Town of Paxton: Identified Corridor Deficiencies.....	17
Figure 5	Town of Spencer: Identified Corridor Deficiencies.....	18
Figure 6	Town of Holden: Major Employers, Trucking Generators and Other Significant Land Uses	22
Figure 7	Town of Paxton: Major Employers, Trucking Generators and Other Significant Land Uses	23
Figure 8	Town of Spencer: Major Employers, Trucking Generators and Other Significant Land Uses	24
Figure 9	Watersheds and Impaired Waterways	26
Figure 10	Town of Holden: Environmental Profile	29
Figure 11	Town of Paxton: Environmental Profile	30
Figure 12	Town of Spencer: Environmental Profile	31
Figure 13	Town of Holden: Corridor Extension Environmental Profile	32
Figure 14	Town of Spencer: Corridor Extension Environmental Profile.....	33
Figure 15	Holden Traffic Count Locations.....	35
Figure 16	Paxton Traffic Count Locations	36
Figure 17	Spencer Traffic Count Locations	37
Figure 18	Route 31 Speed Profile: Holden/Paxton – Southbound – AM Peak Period	40
Figure 19	Route 31 Speed Profile: Holden/Paxton – Northbound – AM Peak Period	41
Figure 20	Route 31 Speed Profile: Holden/Paxton – Southbound – PM Peak Period.....	42
Figure 21	Route 31 Speed Profile: Holden/Paxton – Northbound – PM Peak Period.....	43
Figure 22	Route 31 Speed Profile: Paxton/Spencer – Southbound – AM Peak Period	44
Figure 23	Route 31 Speed Profile: Paxton/Spencer – Northbound – AM Peak Period	45
Figure 24	Route 31 Speed Profile: Paxton/Spencer – Southbound – PM Peak Period	46
Figure 25	Route 31 Speed Profile: Paxton/Spencer – Northbound – PM Peak Period	47
Figure 26	Town of Holden Route 31 Existing Traffic Flows AM Peak Hour Period.....	49
Figure 27	Town of Holden Route 31 Existing Traffic Flows PM Peak Hour Period	50
Figure 28	Town of Paxton Route 31 Existing Traffic Flows AM Peak Hour Period	51
Figure 29	Town of Paxton Route 31 Existing Traffic Flows PM Peak Hour Period	52
Figure 30	Town of Spencer Route 31 Existing Traffic Flows AM Peak Hour Period	53
Figure 31	Town of Spencer Route 31 Existing Traffic Flows PM Peak Hour Period	54
Figure 32	Town of Holden Route 31 Projected 2023 Traffic Flows AM Peak Hour Period ...	60
Figure 33	Town of Holden Route 31 Projected 2023 Traffic Flows PM Peak Hour Period....	61
Figure 34	Town of Paxton Route 31 Projected 2023 Traffic Flows AM Peak Hour Period....	62
Figure 35	Town of Paxton Route 31 Projected 2023 Traffic Flows PM Peak Hour Period	63
Figure 36	Town of Spencer Route 31 Projected 2023 Traffic Flows AM Peak Hour Period ..	64
Figure 37	Town of Spencer Route 31 Projected 2023 Traffic Flows PM Peak Hour Period ..	65
Figure 38	Vehicle Crash Diagram: Holden - Route 122A/Route 31	72
Figure 39	Vehicle Crash Diagram: Paxton – Route 31/Route 56	77
Figure 40	Vehicle Crash Diagram: Paxton – Route 31/Route 122	78
Figure 41	Vehicle Crash Diagram: Spencer – Route 31/Meadow Rd/Wire Village Rd	83
Figure 42	Vehicle Crash Diagram: Spencer – Route 31/Route 9/Wall St	84

Figure 43	Vehicle Crash Diagram: Spencer – Route 9/Meadow Rd/South Spencer Rd	90
Figure 44	Route 31 Corridor Profile Pavement Condition	93
Figure 45	Town of Holden: Major Drainage Structures	103
Figure 46	Town of Paxton: Major Drainage Structures	104
Figure 47	Town of Spencer: Major Drainage Structures	105
Figure 48	Town of Holden: Route 31 Major Drainage Structures Photos	111
Figure 49	Town of Paxton: Route 31 Major Drainage Structures Photos	112
Figure 50	Town of Spencer: Route 31 Major Drainage Structures Photos.....	113
Figure 51	Worcester Regional Transit Authority Service Area	115
Figure 52	Midstate Trail Alignment	122
Figure 53	Corridor-Wide Suggested Improvement Options.....	135
Figure 54	Town of Holden: Suggested Improvement Options	139
Figure 55	Town of Paxton: Suggested Improvement Options.....	142
Figure 56	Proposed Route 31 (Holden Road) TIP Project #607250.....	143
Figure 57	Town of Spencer: Suggested Improvement Options.....	147
Figure 58	Potential Realignment/Straightening of Route 31 Curve	148

List of Tables

Table 1	Technical Advisory Group Membership Listing & Meeting Dates.....	7
Table 2	Route 31 Existing Daily Traffic Volumes	38
Table 3	Route 31 Travel Time and Delay Study Results	39
Table 4	Percentage of Heavy Vehicles Utilizing Route 31 Focus Intersections.....	56
Table 5	Site Specific Background Development	58
Table 6	Intersection Level of Service (LOS) Analyses Results: Existing Conditions & Projected 2023 Conditions	67
Table 7	Vehicle Crash Rates at Focus Intersections	69
Table 8	Summary of Reported Vehicle Crashes on Route 31 in the Town of Holden.....	71
Table 9	Holden – Route 31 Vehicle Crash Inventory	73
Table 10	Summary of Reported Vehicle Crashes on Route 31 in the Town of Paxton	76
Table 11	Paxton – Route 31 Vehicle Crash Inventory	79
Table 12	Summary of Reported Vehicle Crashes on Route 31 in the Town of Spencer	82
Table 13	Spencer – Route 31 Vehicle Crash Inventory.....	85
Table 14	Summary of Reported Vehicle Crashes on Meadow Road in the Town of Spencer	89
Table 15	Spencer – Meadow Road Vehicle Crash Inventory.....	91
Table 16	Route 31 Pavement Analysis Recommendations	94
Table 17	Route 31 Corridor Profile Bridges	99
Table 18	Route 31 & Meadow Road Inventory of Major Drainage Structures	106
Table 19	Town of Holden Route 31 Focus Intersections: Overall Corridor Profile Findings.....	125
Table 20	Town of Paxton Route 31 Focus Intersections: Overall Corridor Profile Findings.....	126
Table 21	Town of Spencer Route 31 (& Meadow Road) Focus Intersections: Overall Corridor Profile Findings.....	127
Table 22	Town of Holden Route 31 (& Manning Street) Roadway Segments: Overall Corridor Profile Findings.....	130
Table 23	Town of Paxton Route 31 Roadway Segments: Overall Corridor Profile Findings.....	131
Table 24	Town of Spencer Route 31 (& Meadow Road) Roadway Segments: Overall Corridor Profile Findings.....	132
Table 25	Intersection Level of Service (LOS) Analyses Results: Projected 2023 “Do Nothing” and Potential Future Year Improvements	136

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 the comprehensive integration through consideration of a range of key transportation planning factors.

Ultimately, a broad range of suggested improvement options are compiled for the consideration of the host communities and 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 2015 to 2018.

The Route 31 Corridor Profile includes the analysis and interpretation of a range 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 31; current and future projected peak-hour Turning Movement Counts (TMC) at focus intersections and associated Level of Service (LOS) analyses

Freight Planning: Peak hour percentage of heavy vehicles utilizing Route 31 focus intersections

Transportation Safety Planning Program: In-depth vehicle crash research in cooperation with the Holden, Paxton, and Spencer Police Departments utilizing a three-year history of reported crashes and subsequent analysis, including the compilation of collision diagrams and crash rates

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 as well as local 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* or study Task Force to guide the effort. As determined necessary, special meetings can also be held with various stakeholder groups in a range of venues.

1.2 Previous Corridor Profile Efforts

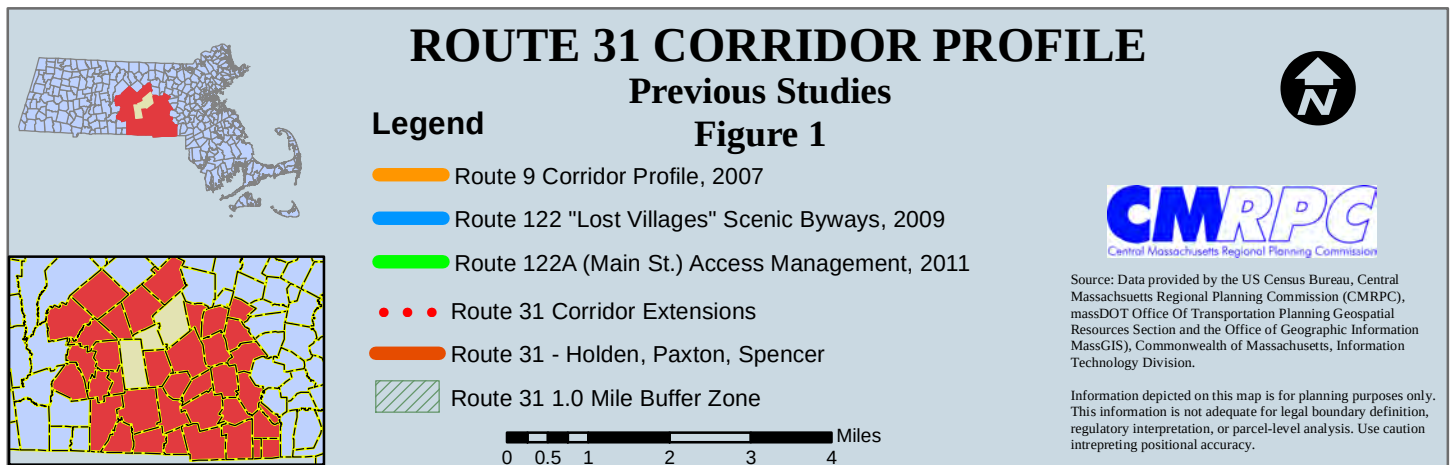
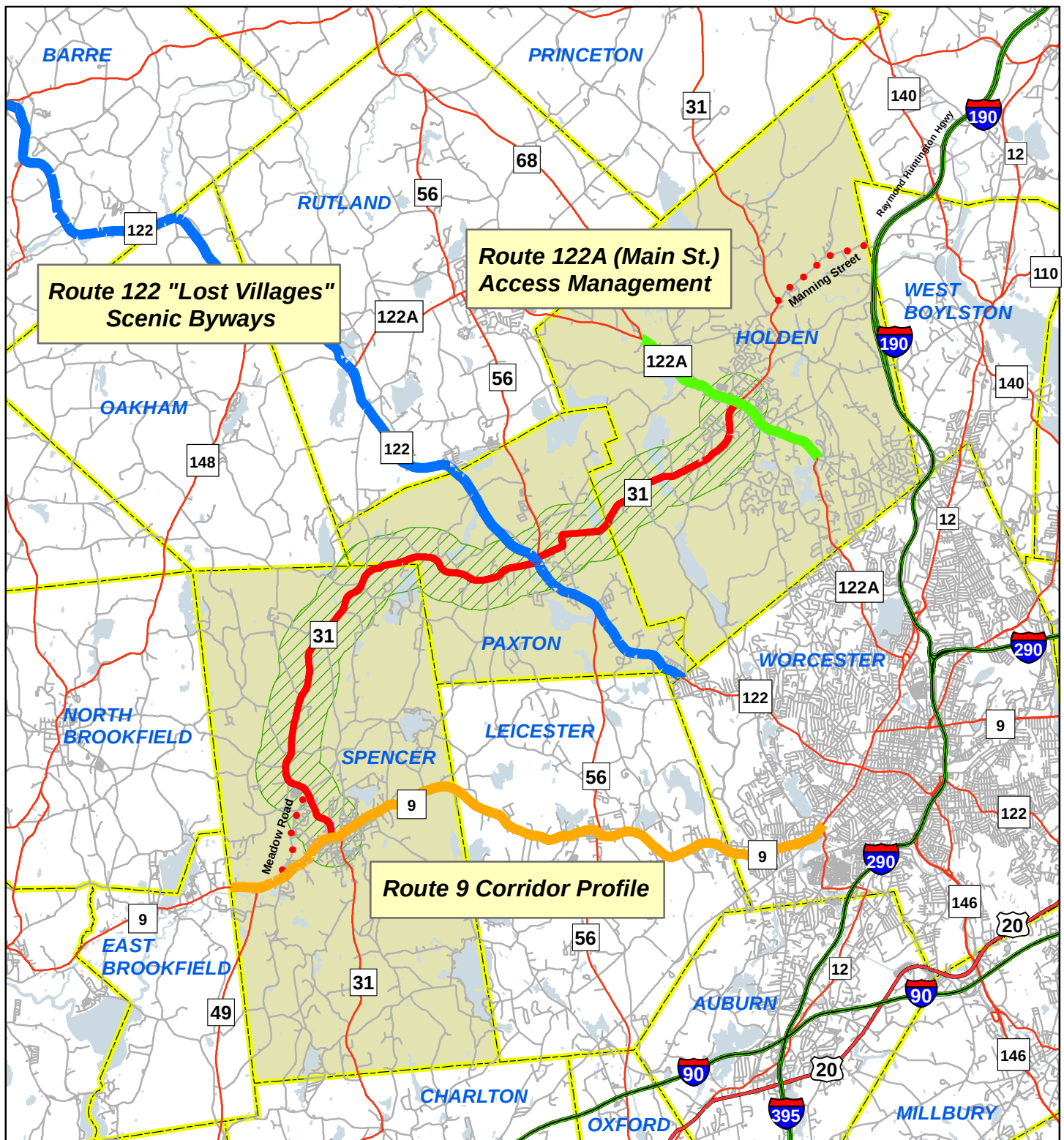
In earlier years, the CMRPC transportation staff has completed several Corridor Profile efforts. As shown in **Figure 1**, three previous studies have been completed in this part of the planning region. The figure indicates how the Route 31 Corridor Profile links with three previously completed transportation planning efforts conducted on Route 122A in Holden, Route 122 Scenic Byway in Paxton and Route 9 in Spencer.

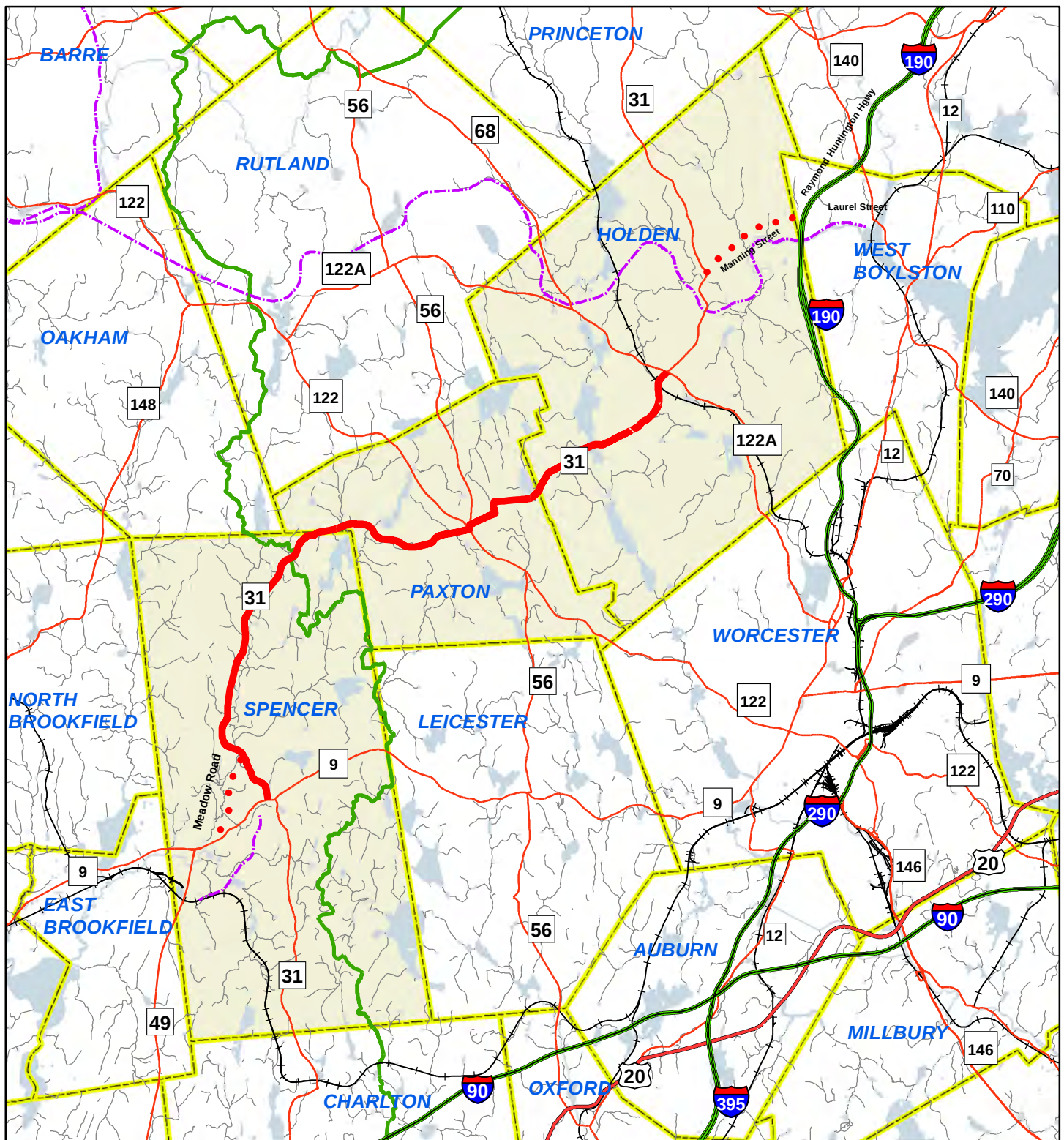
As the Corridor Profile series has evolved, it has become increasingly multi-modal and intermodal. At this time, the Management Systems serve as the basis for the transition to performance-based planning. Performance-based planning seeks to measure the value of investments made in the nation's transportation infrastructure. Presently, focus areas include reducing congestion, improving pavement, reducing vehicle crashes and, in the spirit of the state's Healthy Transportation initiative, increasing the use of the alternative modes of transit, bicycling, and walking.

1.3 Route 31 Corridor Profile: Holden, Paxton, and Spencer

The Route 31 Corridor Profile began as a vision by the town of Spencer for a transportation planning study that would identify potential safety improvements along Route 31. Although having a primary emphasis on improving roadway safety, other goals of the Route 31 Corridor Profile include reducing periodic congestion, preserving and improving roadway pavement, maintaining and reconstructing major bridge and drainage structures as well as determining how to improve the roadway for bicycle and pedestrian accommodations.

Competitively selected by the CMMPO, staff requested the communities of Holden and Paxton to participate in the effort. The participation of Holden and Paxton allowed the Route 31 Corridor Profile to link previous planning studies on Route 122A in Holden, the Route 122 Scenic Byway in Paxton and the earlier Route 9 Corridor Profile in Spencer. Route 31 is a federal-aid highway that is eligible for federal funding for improvements. The Route 31 study corridor is shown in **Figure 2** along with other major aspects of the greater region's multi-modal transportation network including railroads and long distance hiking trails.





ROUTE 31 CORRIDOR PROFILE

Host communities of Holden, Paxton and Spencer

Legend

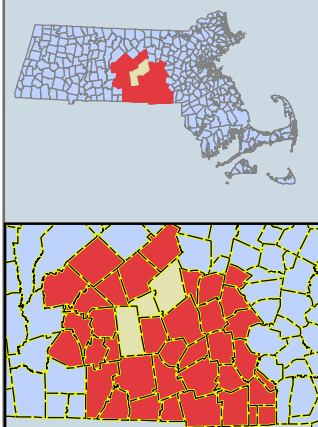
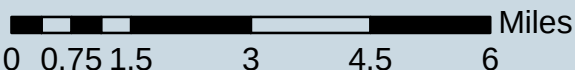
Figure 2

- Route 31 - Holden, Paxton, Spencer
- • • Route 31 Corridor Profile Extensions
- Interstate
- U.S. Route
- State Route
- Midstate Trail
- +— Railroad
- Other Trails



Source: Data provided by the US Census Bureau, Central Massachusetts 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 interpreting positional accuracy.



The roadway segments of Route 31 in Holden (3.3 miles), Paxton (4.4 miles), and Spencer (5.6 miles) combine for a total length of 13.3 miles. Essentially all of Route 31 is locally maintained by the host communities of Holden, Paxton and Spencer.

The MassDOT Roadway Inventory File (RIF) indicates that the right-of-way for Route 31 is mostly 40 feet in width, with some minor exceptions, in the host communities of Holden and Paxton. In Spencer, the RIF indicates an available right-of-way of mostly 50 feet, again with some minor exceptions.

Additionally, Manning Street in Holden and Meadow Road in Spencer (*at the request of the respective communities*) have been included in this study as extensions of Route 31.

1.4 Corridor Profile Work Activities Defined in UPWP

This Corridor Profile effort has been completed as part of the CMMPO Endorsed Unified Planning Work Programs (UPWPs) for federal fiscal years 2013 and 2014. The following provides an overview of the major tasks that were included within the defined scope of the Route 31 Corridor Profile effort:

- CMRPC coordination on an entire range of Corridor Profile aspects including data collection and analysis.
- Vehicle crash analyses completed in cooperation with the Holden, Paxton and Spencer Police Departments.
- Completion of an “Environmental Profile” for the entire Route 31 study corridor in Holden, Paxton and Spencer.
- Range of suggested improvement options compiled for host community consideration.
- Compilation and production of a range of color maps and graphics for the report document as well as for public outreach purposes.
- Completion of detailed Route 31 Corridor Profile report document along with an accompanying Technical Appendix.

Public Outreach:

- Meetings of the Route 31 Technical Advisory Group, alternating between the host communities of Holden, Paxton and Spencer.
- Route 31 Host Community Study Public Outreach and Overview Meetings, autumn 2014.

Additional activity:

- Holden Center & Main Street “Neighborhood SAFE” workshop, summer 2013.

1.5 Technical Advisory Group for the Route 31 Corridor Profile

Public outreach methods are customized for each Corridor Profile study. In the case of Route 31, a Technical Advisory Group was established to oversee and guide the study process. Members were asked to participate from each of the host communities of Holden, Paxton and Spencer. The participants of the Route 31 Technical Advisory Group are listed in **Table 1**.

It was suggested that the group convene every two months throughout the duration of the study process. A listing of the meetings held by the Technical Advisory Group is also shown in the table. As can be seen, the meeting schedule alternated between each Route 31 host community. The first meeting of the Group was held in February 2013 and continued until August 2014.

The CMRPC staff would arrange the meetings with the assistance of the various participants in each host community. Detailed handouts were provided by the staff, most containing a range of color graphics and other visuals. Also, staff from the MassDOT Highway Division District #3 office was consulted periodically during the study process, particularly concerning Route 31 bridge structures.

Following the completion of the study and prior to document finalization, Study Overview Meetings were held with the following host community officials.

Holden: Department of Public Works, Transportation Circulation Committee, and Planning Board

Paxton: Board of Selectmen

Spencer: Town Administrator and Board of Selectmen

The meetings provided an overview to the study process and an opportunity to discuss findings and the range of suggested improvement options while addressing host community concerns.

A detailed Technical Appendix has been compiled to accompany the Route 31 Corridor Profile document and includes meeting agendas from all meetings of the Technical Advisory Group as well as the Study Overview Meetings held with local officials. The Appendix also includes news articles, technical analyses and a broad range of other materials pertinent to the Route 31 Corridor Profile effort.

Table 1
Technical Advisory Group
Membership Listing & Meeting Dates

Town of Holden

Isabel McCauley, Senior Civil Engineer
John Woodsmall, Department of Public Works Director

Town of Paxton

Mike Putnam, Department of Public Works Superintendent
Carol Riches, Town Administrator

Town of Spencer

Steven Tyler, P.E., Utilities & Facilities Superintendent

CMRPC Professional Staff

Kevin Krasnecky, Principal Planner
Rich Rydant, Transportation Project Manager

Meeting Locations & Dates

Spencer - February 5, 2013

Paxton - April 9, 2013

Holden - June 4, 2013

Spencer - August 13, 2013

Paxton - October 8, 2013

Holden - December 10, 2013

Spencer - February 11, 2014

Paxton - April 8, 2014

Holden - June 10, 2014

Spencer - August 12, 2014

1.6 Host Community Observations

At study onset, members of the Technical Advisory Group from each host community were asked to provide a comprehensive listing of Route 31 locations within the defined study area where improvements should be considered. These observations were used to help guide field observation and data collection efforts. Later in the study document, suggested improvement options are provided for host community consideration. These options are based on the below listed community observations, observations made in the field by staff as well as a range of standardized transportation planning calculations. Following the listed community observations, **Figures 3 through 5** show the identified corridor deficiencies and their locations for each of the three towns.

1.7 Town of Holden

Intersection Congestion

- Holden is host community to Wachusett Regional High School (WRHS), a major generator of school bus and personal vehicle traffic. WRHS generated traffic has been observed to contribute to congested conditions at the Route 122A (Main Street)/Route 31 (Reservoir Street/Highland Street) intersection.
- Traffic congestion issues exist at the Route 31 (Highland Street)/Manning Street intersection during peak flow periods. Manning Street along with the Ray Huntington Highway/Legg Road provides access to the I-190 interchange #5 in Sterling. *(This location is outside the CMMPO established Corridor Profile study area.)*

Intersection Safety

- Intersection of Route 31 (Highland Street) with Wachusett Street has a history of vehicle crashes. *HPD records indicated that between 1/1/2010 and 10/16/2013 that three (3) reported vehicle crashed occurred at the Route 31/Wachusett Street location. According to the HPD, all were situations where a vehicle on Route 31 was either slowing to turn or stopped to wait for clear to clear and was rear-ended by another vehicle. It appears that none of the incidents was weather related. (This location is outside the CMMPO established CP study area.)*

Roadway Condition

- Roadway surface settlement issues are evident between 350 & 383 South Road due to a drainage pipe crossing Route 31 that leads to the Kendall Reservoir basin.

Roadway Geometry

- Route 31 provides a minimal shoulder of less than 1 foot in width.

- As observed in the field, there exists limited sight distance due to a notable vertical curve on Route 31 (substandard roadway geometry), adjacent to 50-60 South Road, south of the Mixter Road intersection.
- Route 31 exhibits steep grades on each approach to the Kendall Reservoir basin.

Roadway Drainage

- Route 31 (Paxton Road/South Road) for approximately 0.8 miles, lacks drainage structures. As a result, storm water runs via sheet-flow towards the Kendall Reservoir basin.
- Roadway drainage from South Road flows into the Kendall Reservoir untreated. *There is no provision of any filtering system.*

Bridge

- Bridge Number H-18-002, Route 31 (Reservoir Street) over P&W Railroad: It is suggested that the wearing surface of the Route 31 bridge over the P&W RR be repaved. The bridge was constructed around 1983. *Bridge deemed Functionally Obsolete (FO) by MassDOT, due to general structure deterioration or inadequate strength, MassDOT 77.3 rating.*
- Any repair or improvement plan for this structure should consider the installation of a fully accessible sidewalk along south side of bridge structure.

Roadway Safety

- Route 31 (Paxton Road/South Road/Reservoir Street) presents a potential vehicle crash hazard due to trees and other overgrown vegetation within the roadway right-of-way. Consider selective removal of encroaching vegetation.

Retaining Wall Failure

- Town officials indicate structural and drainage issues associated with the stone retaining wall next to the historic cemetery in the town center, caused by the vertical alignment of the roadway during the redesign of the Route 122A/Route 31 intersection. The town of Holden owns the stone retaining wall; the name of the cemetery is “Old Burial Ground”.

Pedestrian

- It has been suggested that the Route 31 sidewalk be extended from Route 122A (Main Street) to “The Oaks of Holden”, an age 55+ condominium complex, and the Holden Chapel.
- Pedestrian crossing near Colony Homes Senior Housing Project on Route 31 (Reservoir Street) is subject to substantial traffic volumes while providing limited sight distance, through obstructed lines of sight.
- The community seeks sidewalk network connectivity for pedestrian access between the segments of Route 31 both north and south of Route 122A (Main Street). Sidewalk connectivity on Route 31 (Highland Street) north of Route 122A is envisioned to continue north to Nola Drive and south to Joel Scott Drive. *Further, connectivity for bicycles and pedestrians is sought for Davis Hill School, located on Jamieson Street. The potential for off-street bicycle paths also exists in this dense residential area. (This location is outside the CMMPO established CP study area.)*

Active development projects along Route 31 in Holden

- Modification of Route 31 (Highland Street)/Union Street intersection is undergoing the local review process. Improvements are considered mitigation for the Greenwood II subdivision (96 lots) that has access on Union Street. *(This location is outside the CMMPO established CP study area.)*
- Information related to the number of units and occupancy for subdivisions located off Route 31, within the study area:
 - Stoneybrook, total of 76 units, 36 built and occupied to date
 - The Oaks of Holden, designed for 108 with 72 built and occupied.

Manning Street Bridge Status

- In June 2013, a partial lane closure was put into place on the Manning Street bridge due to the discovery of deterioration in the bridge decking and underlying concrete beams (superstructure). On October 7, 2013, Holden’s DPW Highway Division began repair operations to the northbound lane of the bridge which started with the removal of existing pavement and waterproof membrane. During this work, it was noted that the conditions of the concrete beams and other functional elements were such that a replacement of the bridge superstructure was determined to be a more effective long-term solution. Thus, the Highway Division plans to complete the repair of the deteriorated beams, add a spray-applied waterproof membrane under the direction of MassDOT, and repave the northbound lane. The southbound lane will be left intact. MassDOT will re-inspect the bridge after the completion of repairs.

1.8 Town of Paxton

Route 31 (Holden Road), between Holden town line and Grove Street

- The Route 31 (Grove Street)/Route 31 (Holden Road) intersection is considered potentially hazardous due to limited lines of sight. A flashing beacon has long been present at this location, supplementing the STOP sign for Holden Road.
- The town of Paxton is seeking a listing on the CMMPO's TIP for an improvement project for Holden Road reclamation. The proposed project has been approved by MassDOT PRC (#607250). The project has yet to be programmed on the TIP by the MPO. At this time, it is anticipated that funding may be available for FY 2019, at the earliest. The proposed project includes:
 - Addressing deteriorating pavement and berm, mostly country style drainage, some catch basins
 - Drainage improvements/culvert locations
 - Bicycle and pedestrian accommodation
 - Access management, minimal
 - Tree trimming and/or removal within R-O-W
 - Upgrade/improve guard rails along this segment, where necessary
- In addition to Anna Maria College, there may be increased vehicle and pedestrian generation from Paxton's new senior housing development. The site drive is located on Grove Street north of the Holden Road intersection. 50 units with 60 parking spaces are planned.

Route 31 (Grove Street), between Holden Road and Maple Street

- This segment of Route 31 was reconstructed around 2002. Grove Street exhibits "Complete Street" design characteristics, accommodating vehicles, bicycles and pedestrians. Grove Street serves as the primary access to Anna Maria College (AMC), a school with an enrollment of 1,500.

Route 31 (Maple Street), between Grove Street and town center

- Varying roadway width, somewhat narrow in places.
- Identified need to either trim or remove hazardous trees within roadway Right-of-Way
- No sidewalks currently exist on Maple Street. The town is strongly considering the addition of new sidewalks. Maple Street is considered to be an important pedestrian corridor connecting the town center with Grove Street, Anna Maria College and the new senior housing development.

Route 31 in town center

- Traffic generated in nearby communities leads to congestion at the Route 122/Route 31 intersection in the center of town.
- The town seeks upgrades to existing sidewalks. Further, consider the addition of new sidewalks. *Paxton has requested a "Neighborhood SAFE" workshop.*

Route 31 (West Street), between town center and Suomi Street

- The town seeks upgrades to existing sidewalks as well as considering new extensions.
- It has been indicated by town officials that the water main beneath West Street needs to be replaced and upgraded. The new main would also need to be buried deeper under the roadway surface. This necessary utility work must precede any highway improvements suggested for Route 31. (Another option available to the town would be to include the utility upgrades as non-participating work paid for by the host community as part of a potential future year TIP project).
- The Route 31/Paxton Center School access drive serves both school and town recreational facilities. Seek to maintain existing lines of sight at this location.

Route 31 (West Street), between Suomi Street and Spencer town line

- Varying roadway width, somewhat narrow in places.
- Culvert inspection needed (potential repairs/replacement)
 - Large culvert, south of Nanigan Road
 - Large culvert, adjacent to Moore State Park
- Identified need to either trim or remove hazardous trees and other vegetation within roadway right-of-way.
- Upgrade/improve guard rails along this segment, where necessary. Some areas in need of repair noted in field.

Public Transit

- Community begins flex route bus service in cooperation with transit provider Worcester Regional Transit Authority (WRTA). Flex route serving Anna Maria College and the town center initiated in late 2013.

Other concerns

- General heavy vehicle (truck) traffic volumes using Route 31.
- Automotive carrier trucks, many originating in Spencer/East Brookfield. (*Reference NEAG operator observations from earlier meeting.*)

1.9 Town of Spencer

Intersection Congestion

- At the Route 9/Meadow Road/South Spencer Road intersection, northbound vehicle queuing lanes are of insufficient length. It is suggested to expand/lengthen the South Spencer Road northbound approach vehicle queuing lanes. This improvement is necessary to accommodate FLEXcon generated traffic, especially during peak flow periods. Currently, vehicles have been observed to drive over the existing roadway curbing. In addition, the community has requested an access and accident study for Big Y plaza. (*This location is outside the CMMPO established CP study area.*)

Intersection Safety

- The Route 31 (North Spencer Road)/Route 31 (Pleasant Street)/Meadow Road/Wire Village Road study intersection has caused safety concerns due to its recent crash history. In late 2013, this intersection completed FHWA-funded “STOP” sign improvements that feature new signs and advanced warning on all approaches. These improvements were screened and approved by MassDOT. (*A statewide summary of this work has been obtained for the Technical Appendix.*) Supplemental advisory signs noting street names have also been installed on the Route 31 approaches to this study location. One of the new signs is obstructed by S-12-002 bridge posting. This just happens to be the highest speed approach.

Roadway Condition

- Deteriorating pavement conditions worsen on Spencer’s northern most segments of Route 31. Along these northerly segments approaching the Paxton town line, the magnitude and extent of severe alligator cracking and rutting becomes increasingly larger.

Roadway Geometry

- Address the sharp curve in Route 31 just south of the Spencer/Paxton town line. Substandard roadway geometry, can it be *moderated or straightened* in some manner? This site exhibits low travel speeds due to the extremely limited lines of sight.

Vegetation is also encroaching upon the roadway. Potential improvement options include:

- Do nothing
 - Spot improvement
 - Structure relocation
 - Roadway realignment, short and long. *Need to examine parcel map.*
- The Meadow Road vertical approach to Route 31 needs to be raised to improve visibility approaching and at the intersection.

Access Management

- Curb cut consolidation and other Access Management improvements suggested for local roads and abutting private properties along length of Spencer study section.

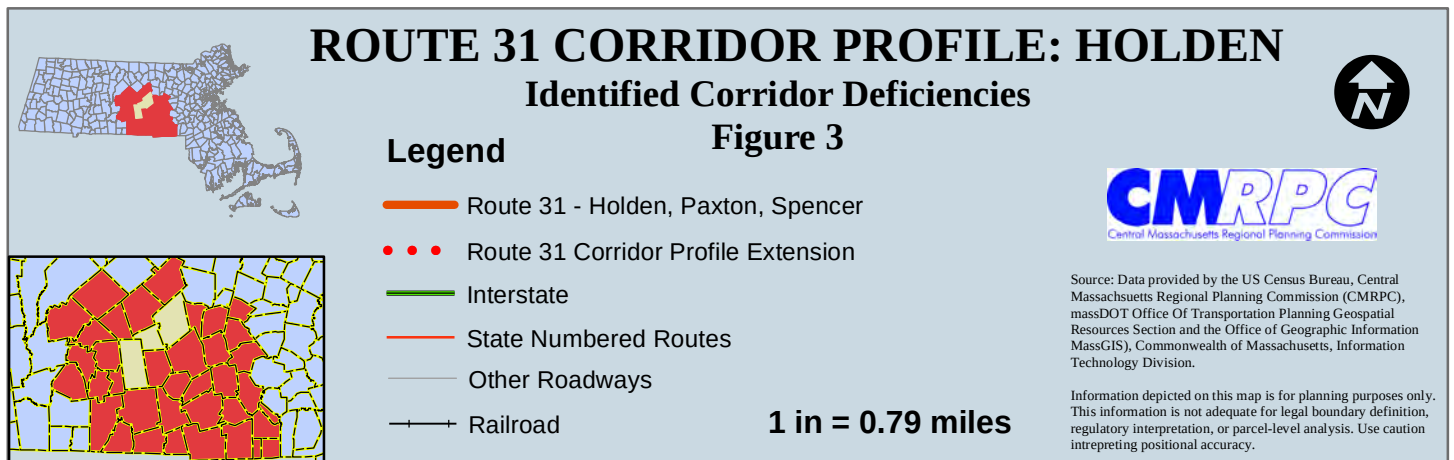
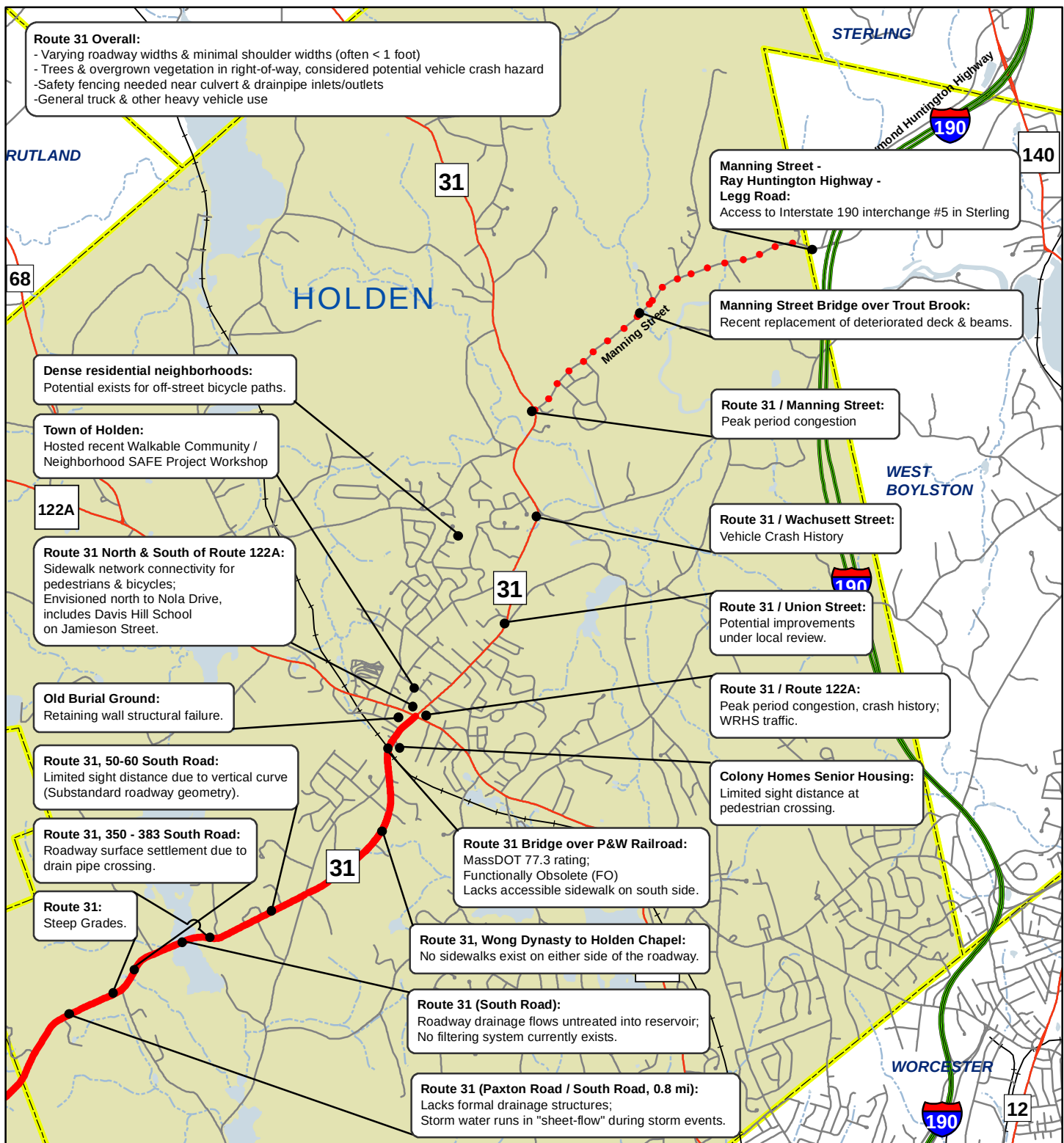
Bridge

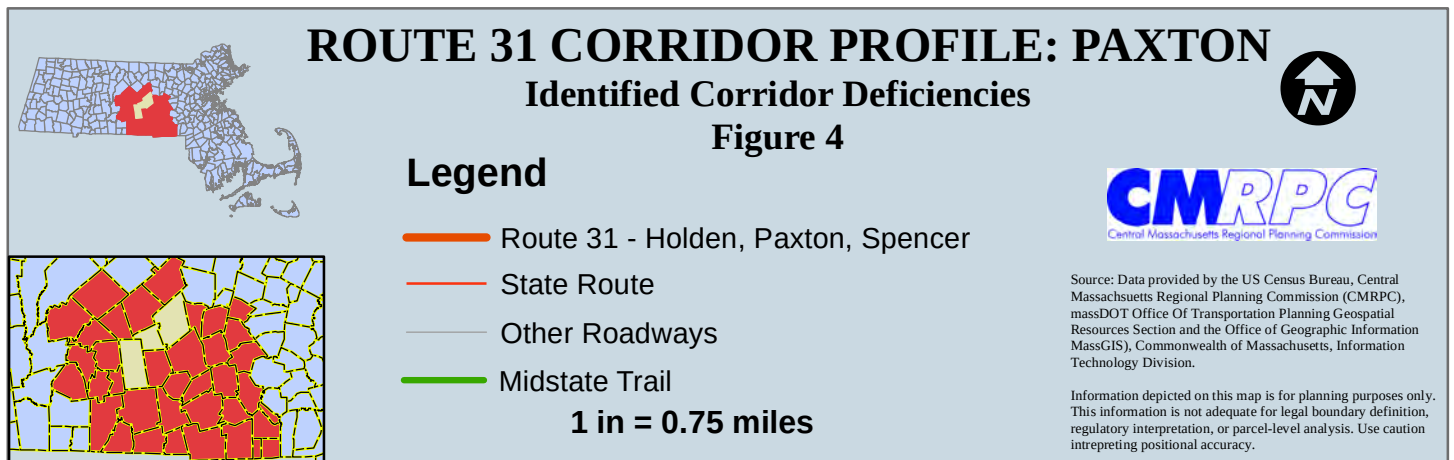
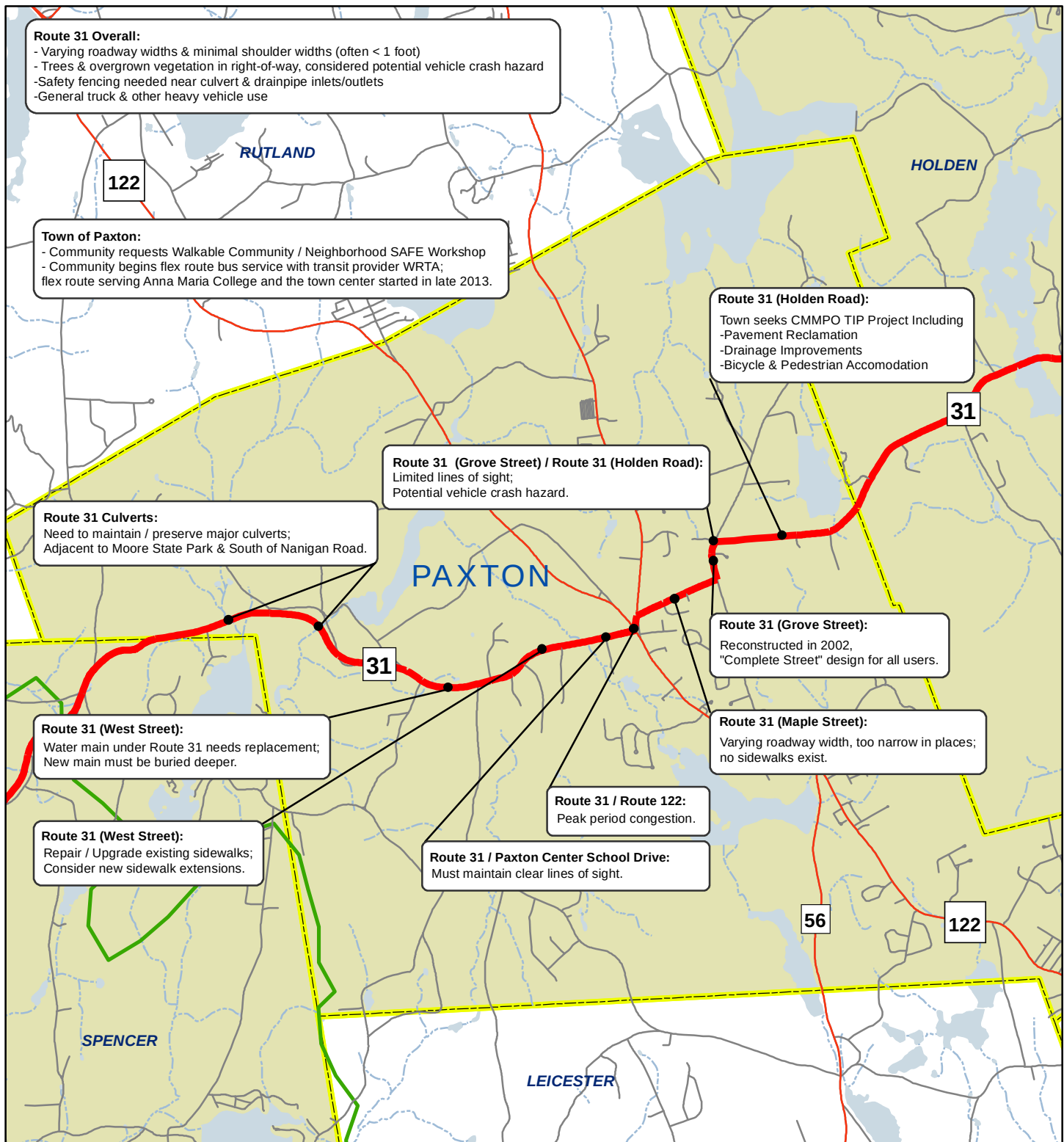
- Bridge Number S-23-002, Route 31 (North Spencer Road) over Seven Mile River: Identified by MassDOT as “Structurally Deficient”, weight limits are posted for this bridge. *(Refer to 4/5/2012 MassDOT bridge inspection report.)*
- Bridge Number S-23-012, Route 31 (North Spencer Road) over Seven Mile River: Continued deterioration of existing structure; will require future year replacement, considered critical by town
- A related topic, the recently damaged Bridge Number S-23-010, Hastings Road over Turkey Hill Brook has caused that crossing to be reduced to a single lane and therefore is now an even worse option for an alternate truck detour (including NEAG generated trucks) when more significant deterioration and loading problems eventually occur on the Route 31 bridges. *The need to use limited town funds to repair this structure further reduces the likelihood that the town could address deterioration on the above summarized Route 31 bridges.*
- Route 31, North Spencer, undersized culvert structures with past flooding issues; there exists potential for future flooding occurrences. At one location, town plans the installation of a new culvert to address recurring flooding issues. *(See plan provided by community.)*

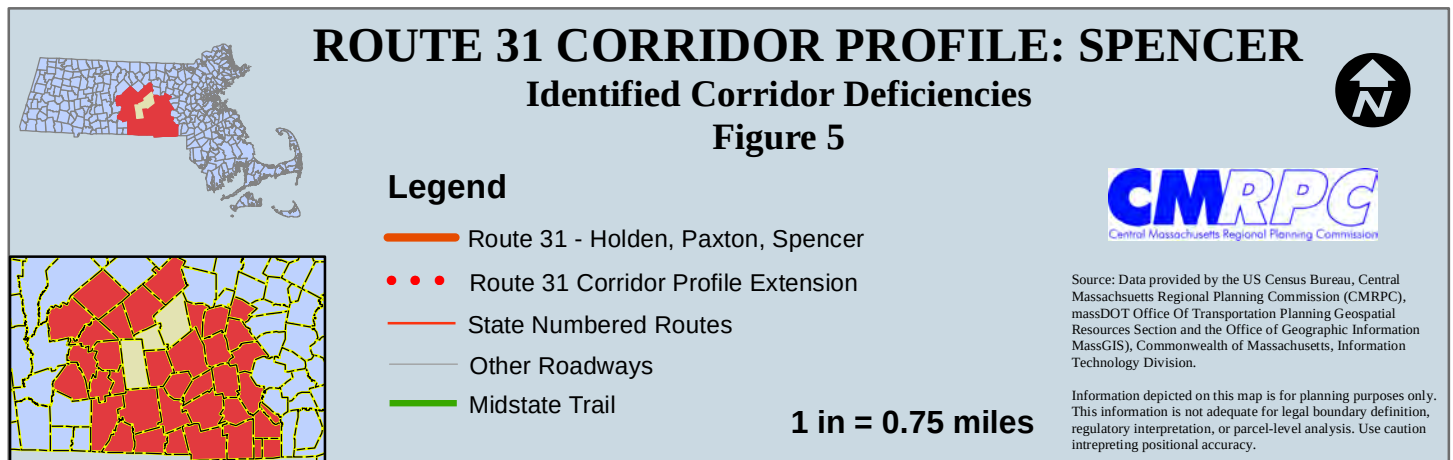
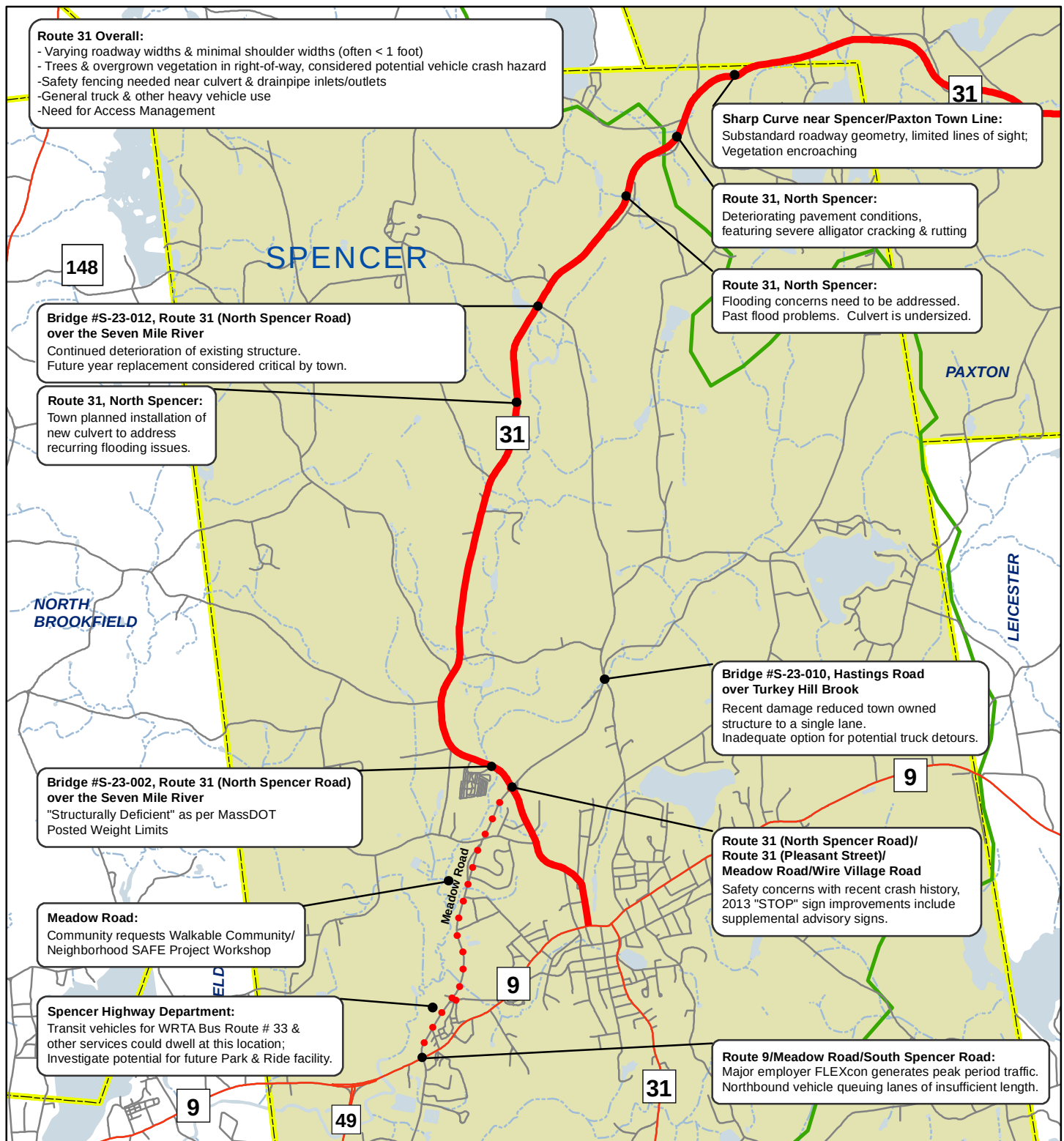
Public Transit

- It has been suggested that Spencer Highway Department property on Meadow Road could be used for a long-term future “Fastcharger” location for electric buses or

potential Park & Ride facility. The Worcester Regional Transit Authority (WRTA) Bus Route #33 could serve such a PNR lot. Further, WRTA buses and other transit vehicles could dwell, or wait between trips, at this location away from residential areas. At a minimum, the Meadow Road improvement project should include revised transit accommodations







2.0 ROUTE 31 ENVIRONS

2.1 Host Community Land Use

Major land uses were identified broadly as part of the Route 31 Corridor Profile effort. The following listings provide a summary of the major employers, trucking generators and other significant land uses in each of the Route 31 host communities of Holden, Paxton and Spencer. The Technical Advisory Committee participated in the compilation of these summaries. Correspondingly, **Figures 6, 7 and 8** show the general location of these land uses for Holden, Paxton and Spencer.

Town of Holden

- A. **Holden Trap Rock:** Massachusetts Broken Stone Company operates Holden Trap Rock, a mining site that has been operating since 1938. The facility has significant reserves, capable of supplying the needs of their customers for decades to come. The company has been an innovator in the production of crushed stone aggregate and Hot Mix Asphalt (HMA).
- B. **Wachusett Regional High School (WRHS):** A major regional high school that serves the towns of Holden, Princeton, Paxton, Rutland and Sterling. Also, other school buildings for the town of Holden are located in vicinity of the town center area, generating school bus and personal vehicle traffic.
- C. **Municipal buildings, including Old Burial Ground:** The town hall, Starbard Building and town library are all located adjacent to the Route 31 intersection with Route 122A. The Old Burial Ground is across the street from the town hall, on the south side of Route 122A.
- D. **Medical Center Central MA:** Long known as Holden Hospital, this medical offices facility has recently been renovated and expanded. The site generates a fair volume of traffic as it continues to serve the greater community.
- E. **Main Street commercial areas:** A range of commercial, retail, restaurant and service-related activities are present along Holden's Main Street (Route 122A). Most of this activity is concentrated between Route 31 southerly to Shrewsbury Street.
- F. **Rustic Plaza:** Popular dining venue Val's is located in this plaza setting as well as a coin-operated laundry mat.
- G. **Holden Commons:** Significant traffic generator featuring a Big Y Supermarket and other shops including a CVS Pharmacy, hardware store, dollar store and an adjacent liquor store. Big Y is the largest family owned retail food company in Southern New England.

- H. **Church structures, including Holden Chapel:** Places of worship exist in the town center area in the vicinity of the Route 31 intersection with Main Street (Route 122A). Located south of the center, the Holden Chapel has access directly off of Route 31 in the vicinity of the new Stonybrook Estates.

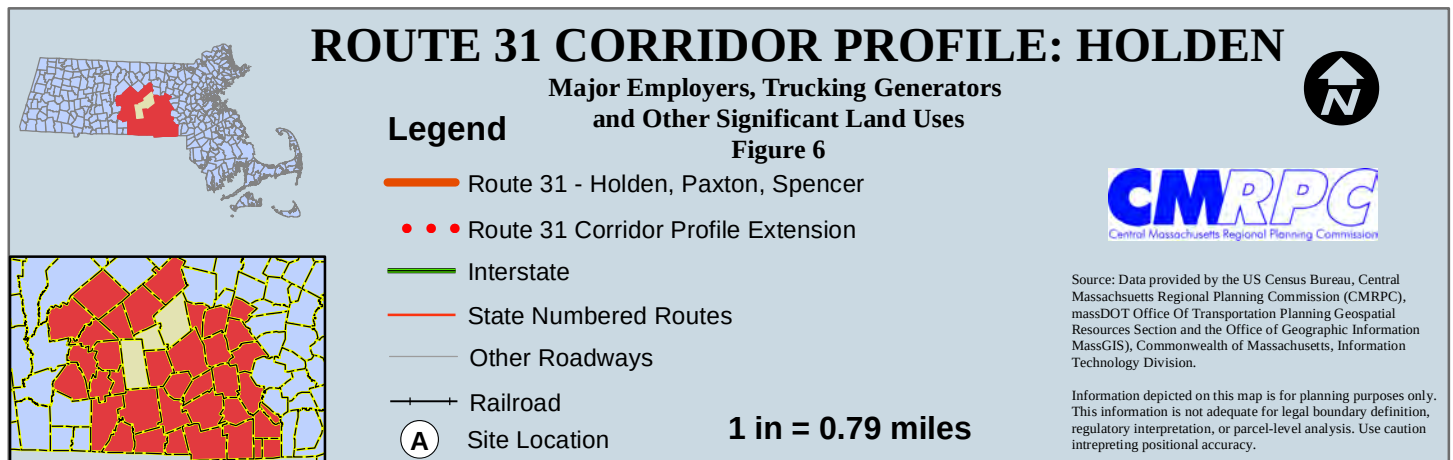
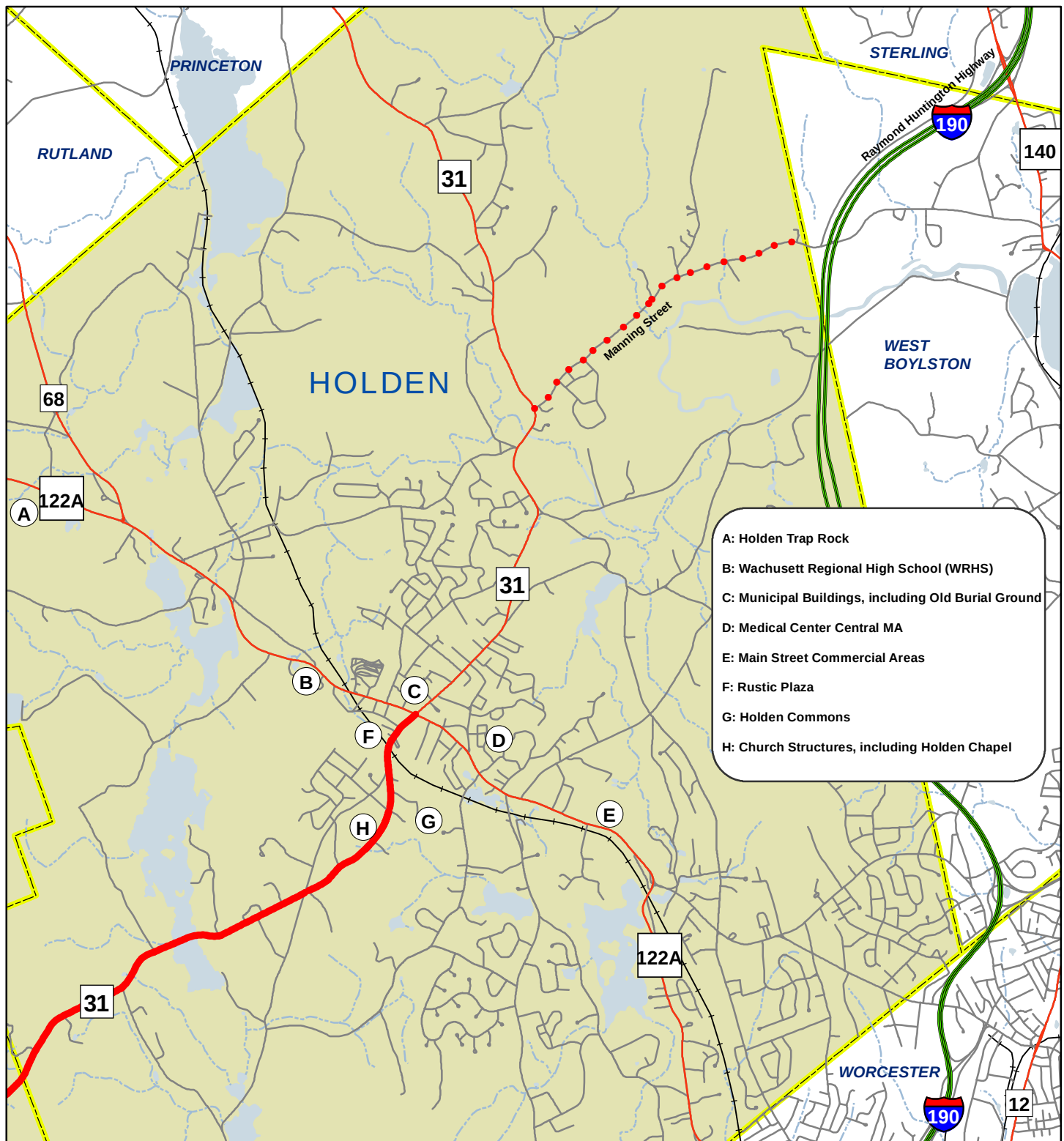
Town of Paxton

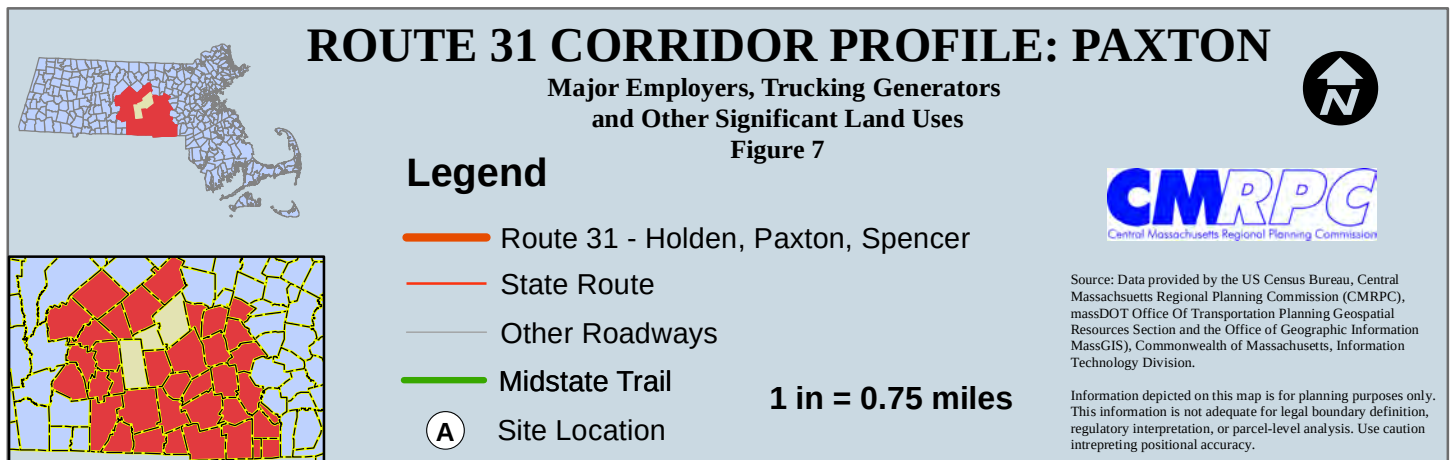
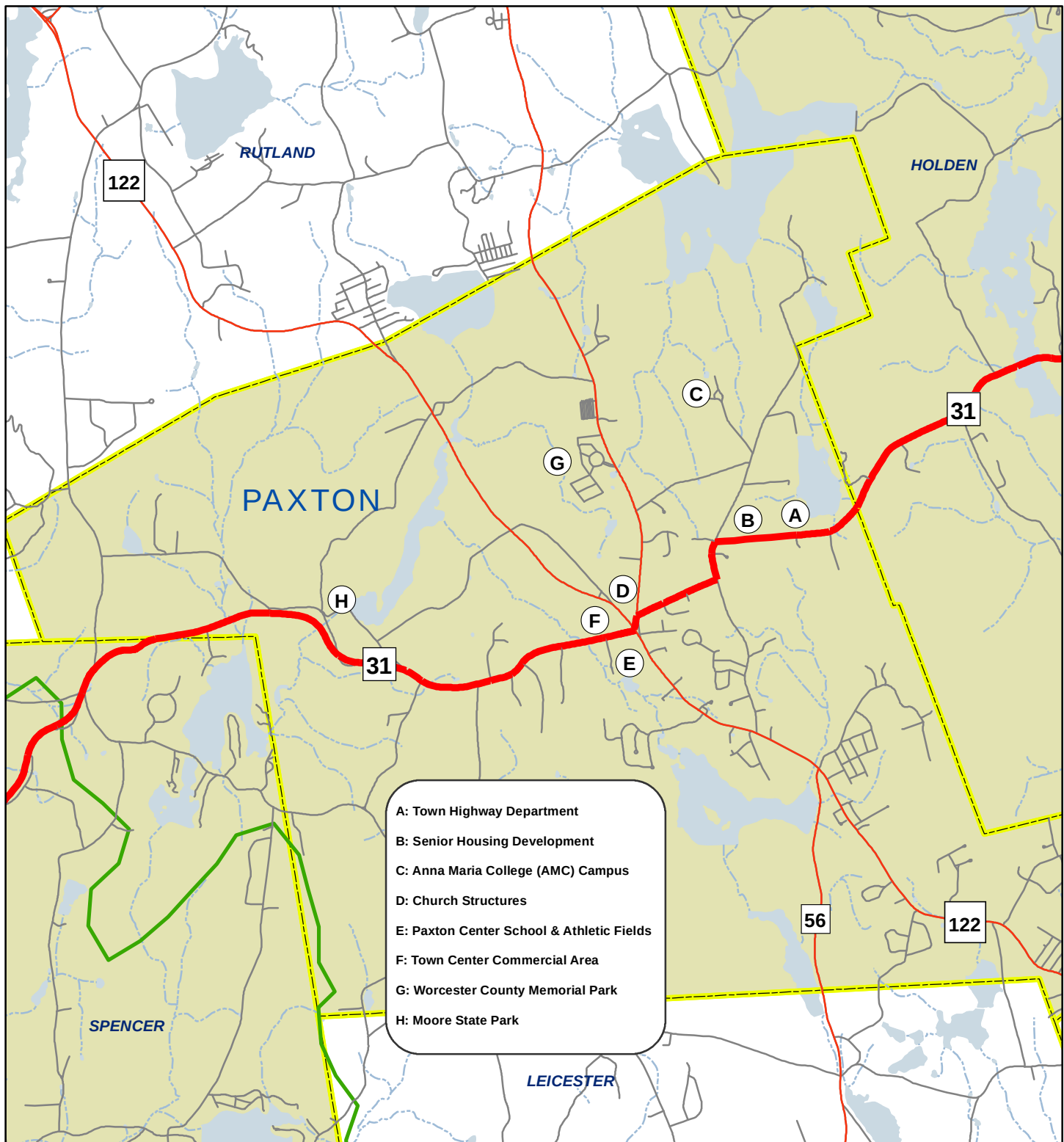
- A. **Town Highway Department:** Large operations and maintenance facility for highway department and other town services.
- B. **Senior Housing development:** A new structure with 50 units and 60 parking spaces, now nearly complete. The site drive is located on Grove Street north of the Route 31 (Holden Road) intersection.
- C. **Anna Maria College (AMC) Campus:** A Catholic, co-educational, Liberal Arts College with an enrollment of 1,500. Founded by the Sisters of Saint Anne in 1946, AMC is located on a 192-acre campus.
- D. **Church structures:** First Congregational Church and St. Columba Parish & rectory.
- E. **Paxton Center School and athletic fields:** K-8 elementary school and adjacent senior center accommodated in the White Building.
- F. **Town center commercial area:** Includes the historic town hall and a number of small businesses, including a bank, package store and hair salon. A small market and other businesses are located in a plaza setting.
- G. **Worcester County Memorial Park:** Large, planned modern cemetery for all faiths located on Route 56 (Richards Avenue). Located adjacent to town operated Mooreland Cemetery.
- H. **Moore State Park:** A beautiful and peaceful 671 acre historic landscape combining archaeological sites, waterfalls, cascades, notable stonework, agricultural fields and forestland, as well as thousands of rhododendrons and azaleas. The park is named in memorial of a Revolutionary War hero *Major Willard Moore* who died at the Battle of Bunker Hill.

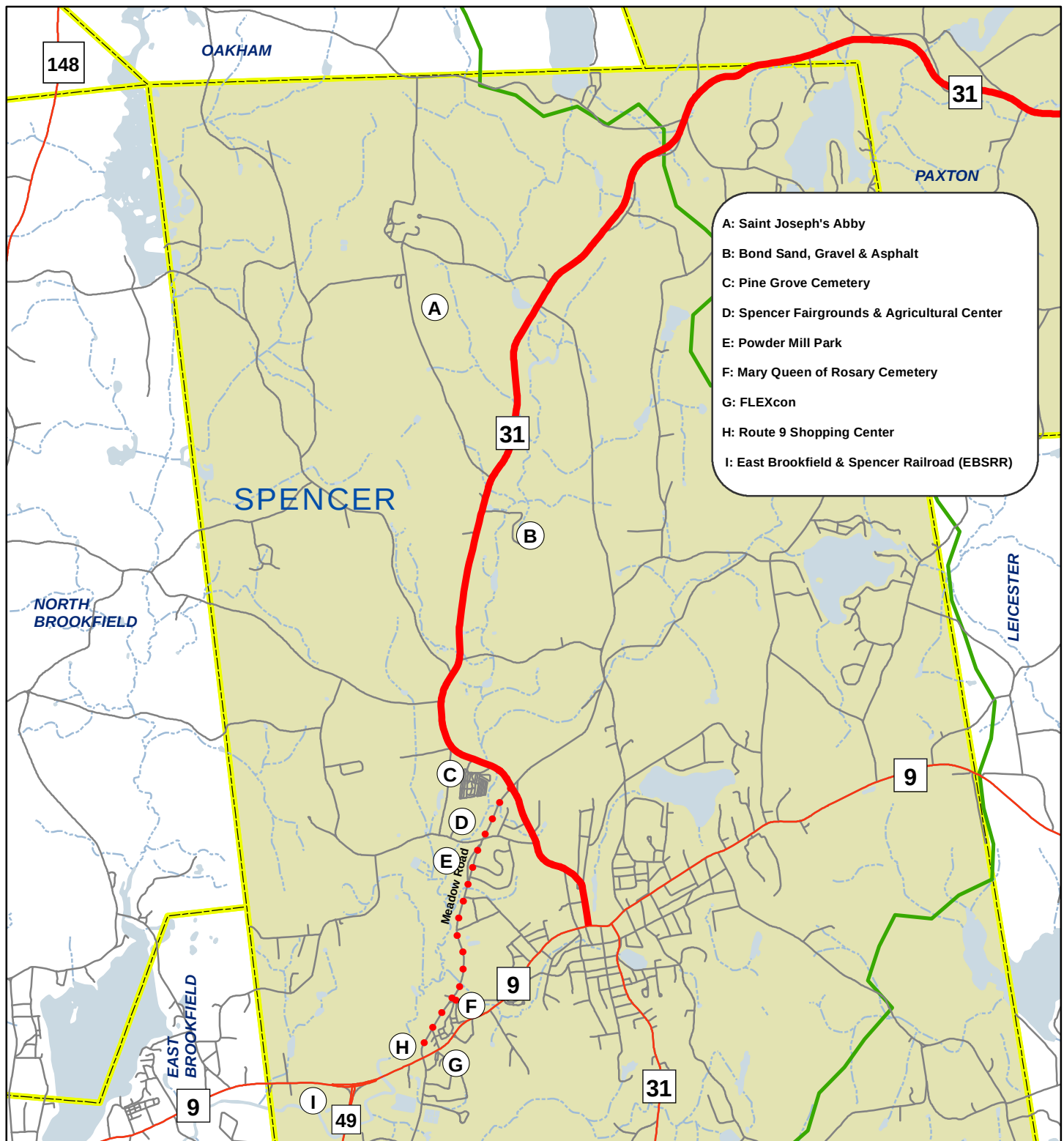
Town of Spencer

- A. **Saint Joseph's Abbey:** The Abbey is a cloistered Roman Catholic monastery of monks of the Cistercian Order of the Strict Observance, known as Trappists. At the Abbey, facilities exist for the production of jellies and jams. These products have been produced on site for more than 50 years. Opened a new brewery for special Trappist-style beers and began retail production for nationwide distribution in 2014.

- B. **Bond Sand, Gravel & Asphalt:** Bond has been at their location on Route 31 since 1972. Bond is open to the general public and caters to both home owners and contractors. They produce a variety of quality aggregate products for construction, building, landscaping and development projects. Delivery service is available; their fleet includes three dump trailers and 7 ten wheeler dump trucks.
- C. **Pine Grove Cemetery:** Historic local cemetery adjacent to Sevenmile River and Spencer Fairgrounds.
- D. **Spencer Fairgrounds and Agricultural Center:** Large events venue that includes hosting a major annual Labor Day agricultural fair.
- E. **Powder Mill Park:** A town-maintained children's playground that is heavily utilized.
- F. **Mary Queen of Rosary Cemetery:** Parish cemetery of the Mary Queen of Rosary parish located in Spencer.
- G. **FLEXcon:** FLEXcon is an [ISO 9001:2008 certified](#) manufacturer of pressure-sensitive films and adhesives, headquartered in Spencer. The company is an innovator in coating, laminating, and finishing of wide-web roll-to-roll polymeric materials, with expertise in graphics and label applications as well as bonding, barrier, optical, and electronics applications. The Spencer facility employs approximately 670 workers.
- H. **Route 9 Shopping Center:** Big Y supermarket and several other businesses. The plaza includes drive-through facilities for both Dunkin Donuts and a bank. Big Y is the largest family owned retail food company in Southern New England. Committed to customer service, Big Y offers world-class selection and quality in a European-market-style layout.
- I. **East Brookfield & Spencer Railroad (EBSRR):** This switching railroad serves the New England Automotive Gateway (NEAG) rail-to-highway intermodal freight transfer facility. The NEAG is in the vicinity of the Route 31 corridor study area. Substantial truck traffic is generated by the NEAG; most uses Route 49, a portion uses Route 31.







ROUTE 31 CORRIDOR PROFILE: SPENCER

Major Employers, Trucking Generators
and Other Significant Land Uses

Figure 8

Legend

- Route 31 - Holden, Paxton, Spencer
- ... Route 31 - Corridor Profile Extension
- State Route
- Other Roadways
- Midstate Trail



Site Location

1 in = 0.75 miles



Source: Data provided by the US Census Bureau, Central Massachusetts 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 interpreting positional accuracy.

2.2 Natural Environment

Major Watersheds

Major features of the natural environment were also identified as part of the Route 31 Corridor Profile effort. **Figure 9** shows the major watershed areas within the Route 31 study area. In addition to major watersheds, the figure also indicates impaired waterways in the study area. 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.

According to the map, the Kendall Reservoir in the town of Holden retains its use, especially as a drinking water supply. In Paxton, the Eames Pond and Turkey Hill Brook require a TMDL. Thompson's Pond, in the town of Spencer, is impaired, but it is not caused by a pollutant while the Sevenmile River also requires a TMDL.

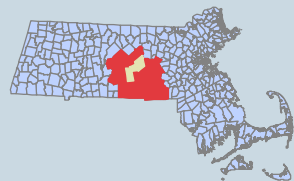
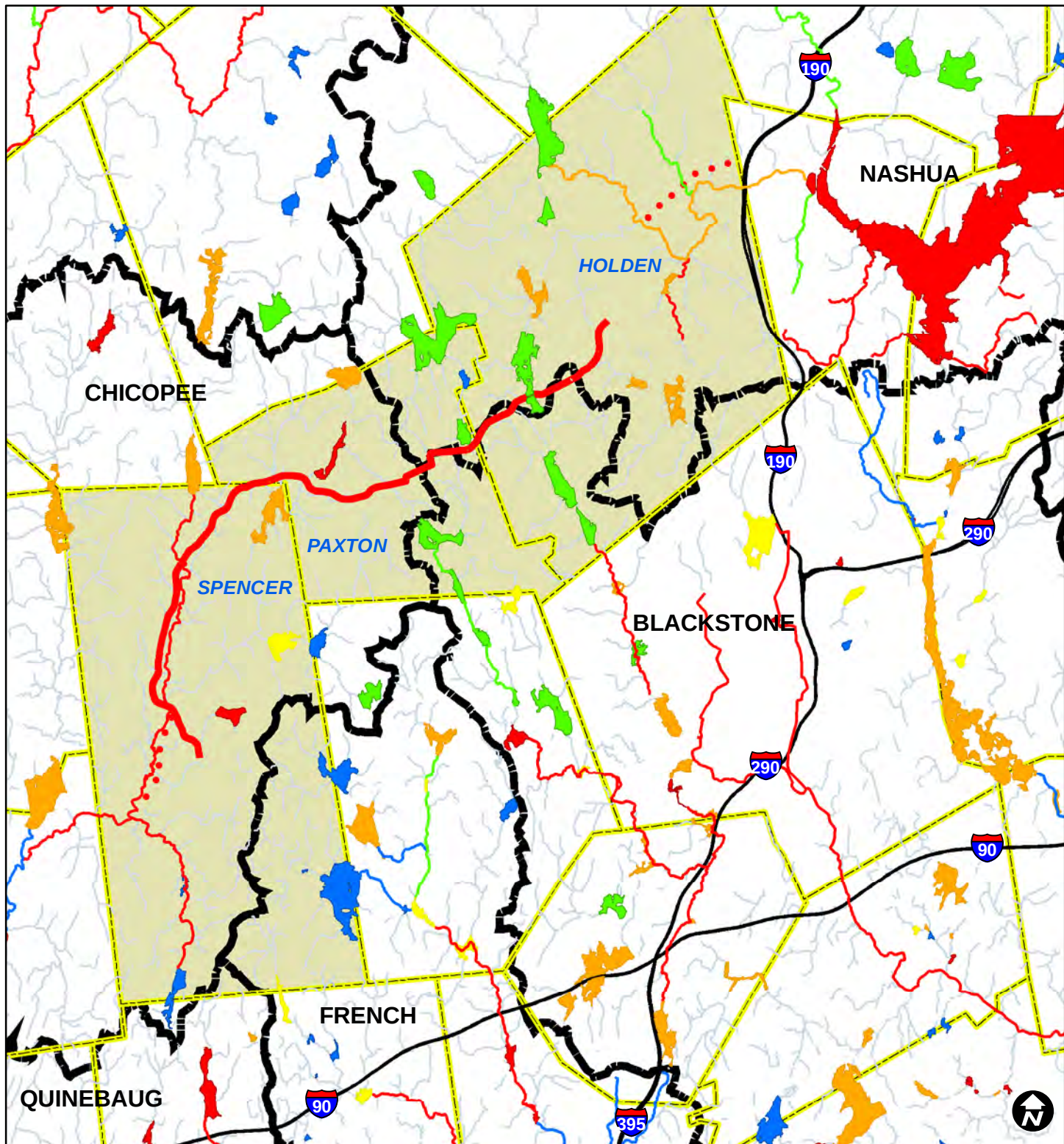
Environmental Profiles

Typically included as part of ongoing Corridor Profile efforts, Environmental Profile maps have been prepared for the Route 31 study. Such maps allow the user to view major environmental systems, beyond the edge of the study corridor, that have impacts on such things as drainage, water quality and wildlife migration. 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.



ROUTE 31 CORRIDOR PROFILE

Watersheds and Impaired Waters

Figure 9



1 in = 2 miles

Legend

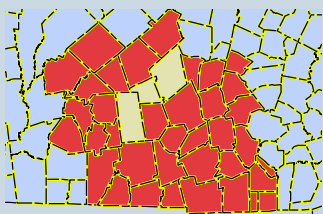
■■■■ - Major Watershed Boundary

Water Body (Rivers) 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

Water Body (Lakes, Estuaries) 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



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).

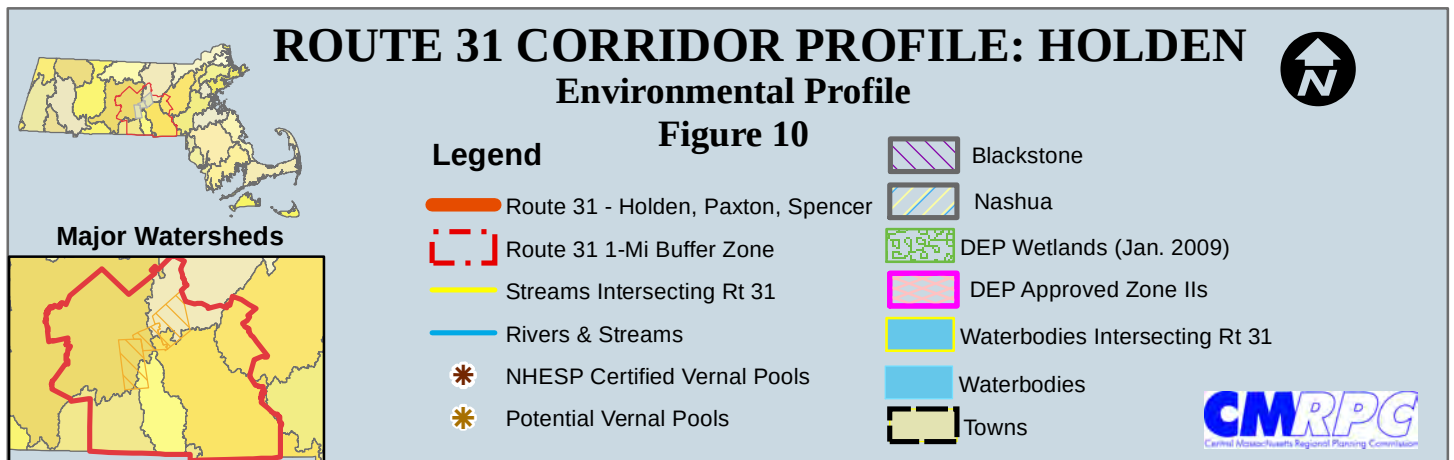
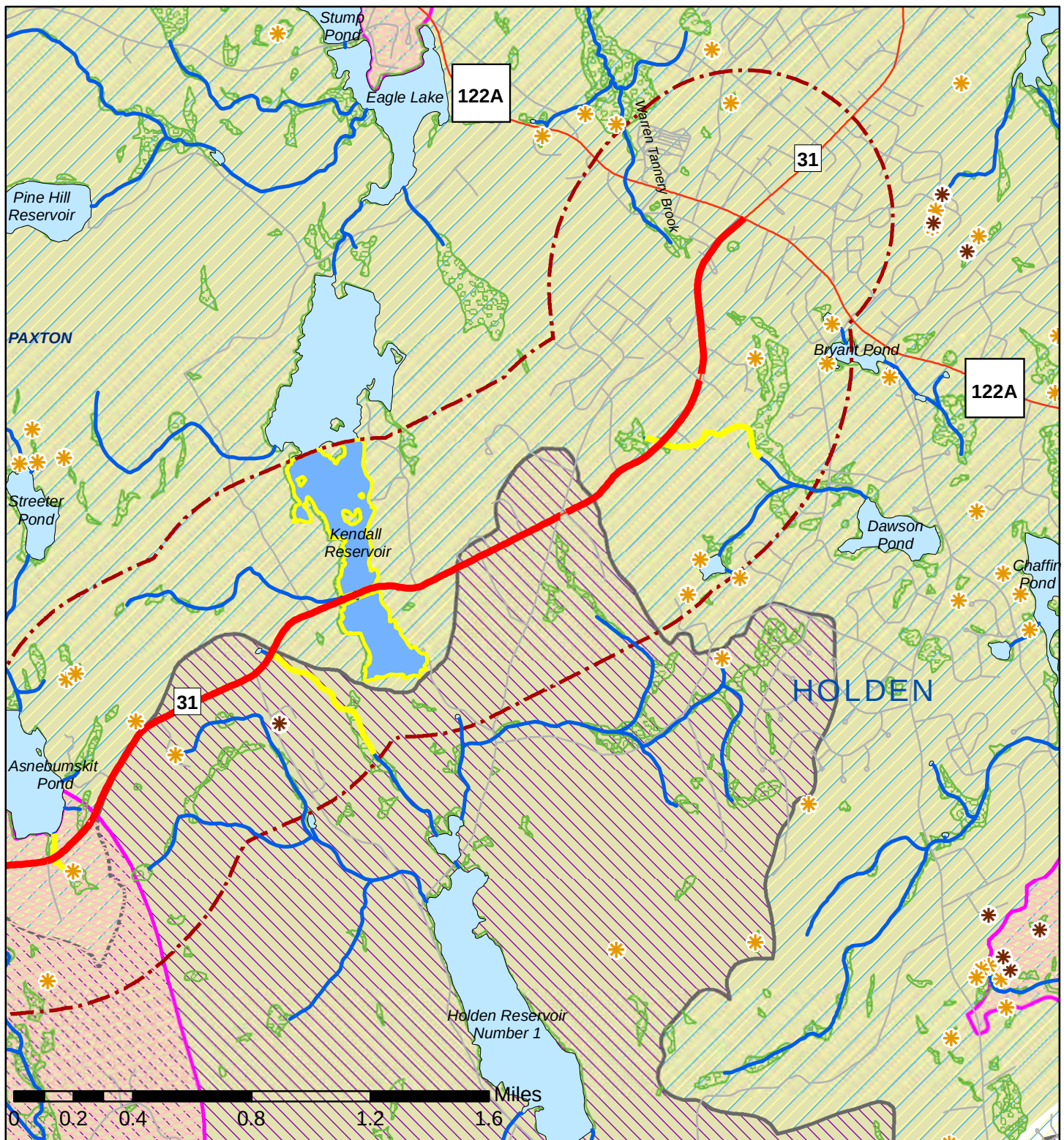
Generated by combining various data layers from the above listed agency contributors, **Figures 10, 11 and 12** were produced. A buffer area of general interest, a mile wide in width centered on Route 31, is indicated.

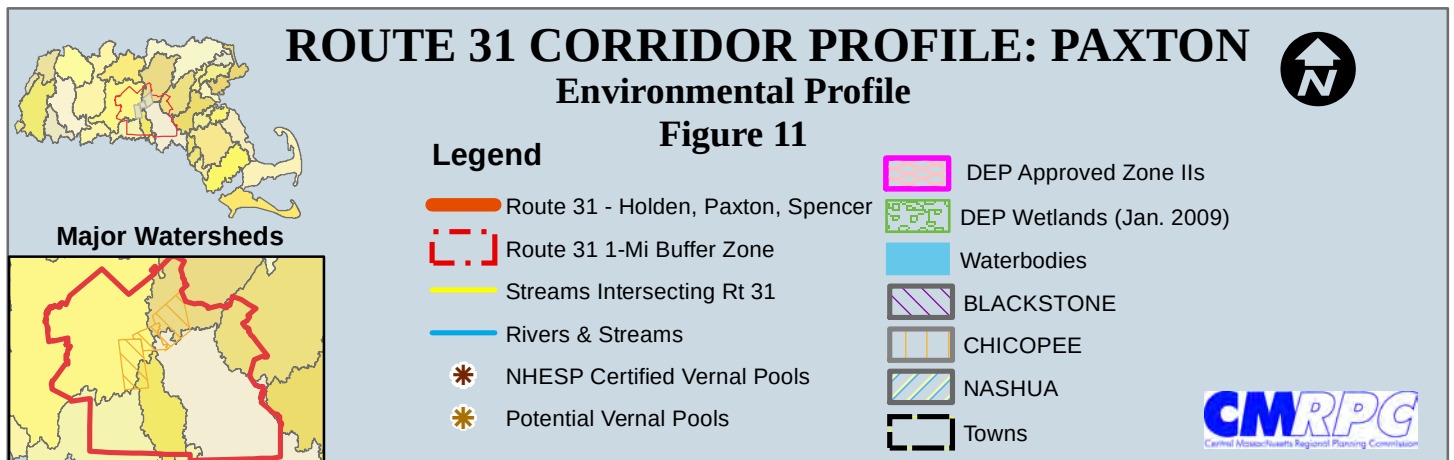
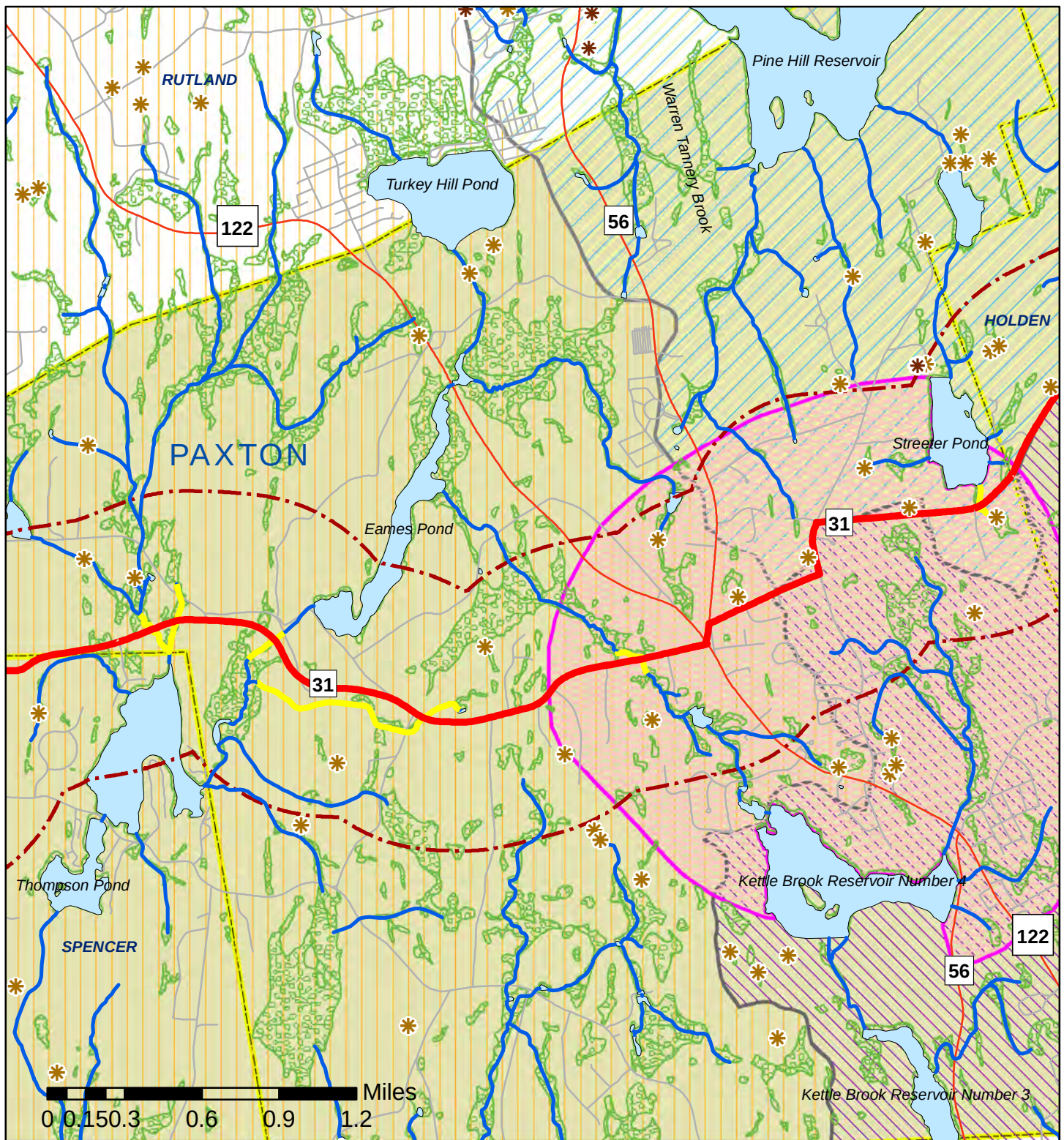
Also produced as part of this study effort, preliminary Environmental Profiles were prepared for two extensions of the CMMPO-defined Route 31 study area. Shown in **Figure 13** is an Environmental Profile prepared for Holden's Manning Street, which is used to gain access to/from I-190 in Sterling. **Figure 14** is the profile for Spencer's Meadow Road, which is similarly used to gain access to/from Route 9 west and nearby Route 49.

Included in the above described maps, all three towns have potential vernal pools, also referred to as Areas of Critical Environmental Concern (ACECs), located near the study corridor that need to be left undisrupted. Many wetlands are included in the mile wide buffer area around Route 31, especially in the towns of Paxton and Spencer. The potential for various rare species living in these wetland areas does exist and further study would be needed to define their extent and what, if any, actions would be overly detrimental to their continued existence. There are also many stream crossings on Route 31 within all three towns. With some of these streams being impaired waterways, there is a need to be sensitive to these environmental concerns when planning future roadway improvements.

The Kendall Reservoir in the town of Holden is a noted water supply protection area where care must be taken to avoid adverse environmental effects. Further, a large portion of the Seven Mile River in the host community of Spencer is designated as a "Zone 2" aquifer protection area for Spencer public water supply (PWS). Drinking water source wells including Bridge S-12-002 and all riparian areas adjoining Meadow Road.

As an overall observation, Route 31 goes through various environmentally sensitive areas. In short, when implementing the suggested improvement options selected by the host communities, care must be taken to prevent adverse impacts to the surrounding environment. Siltation fences, hay bales, other erosion control need to be used, ever mindful of nearby vernal pools and other sensitive habitat.







ROUTE 31 CORRIDOR PROFILE: SPENCER

Environmental Profile

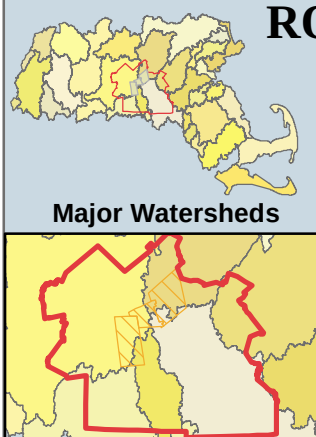
Figure 12

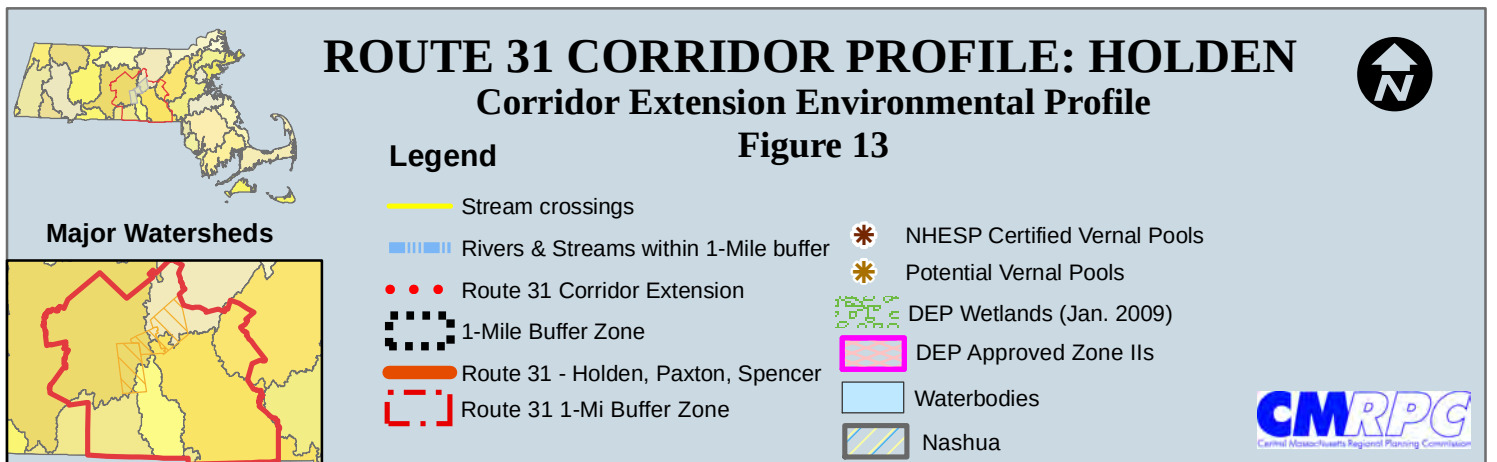
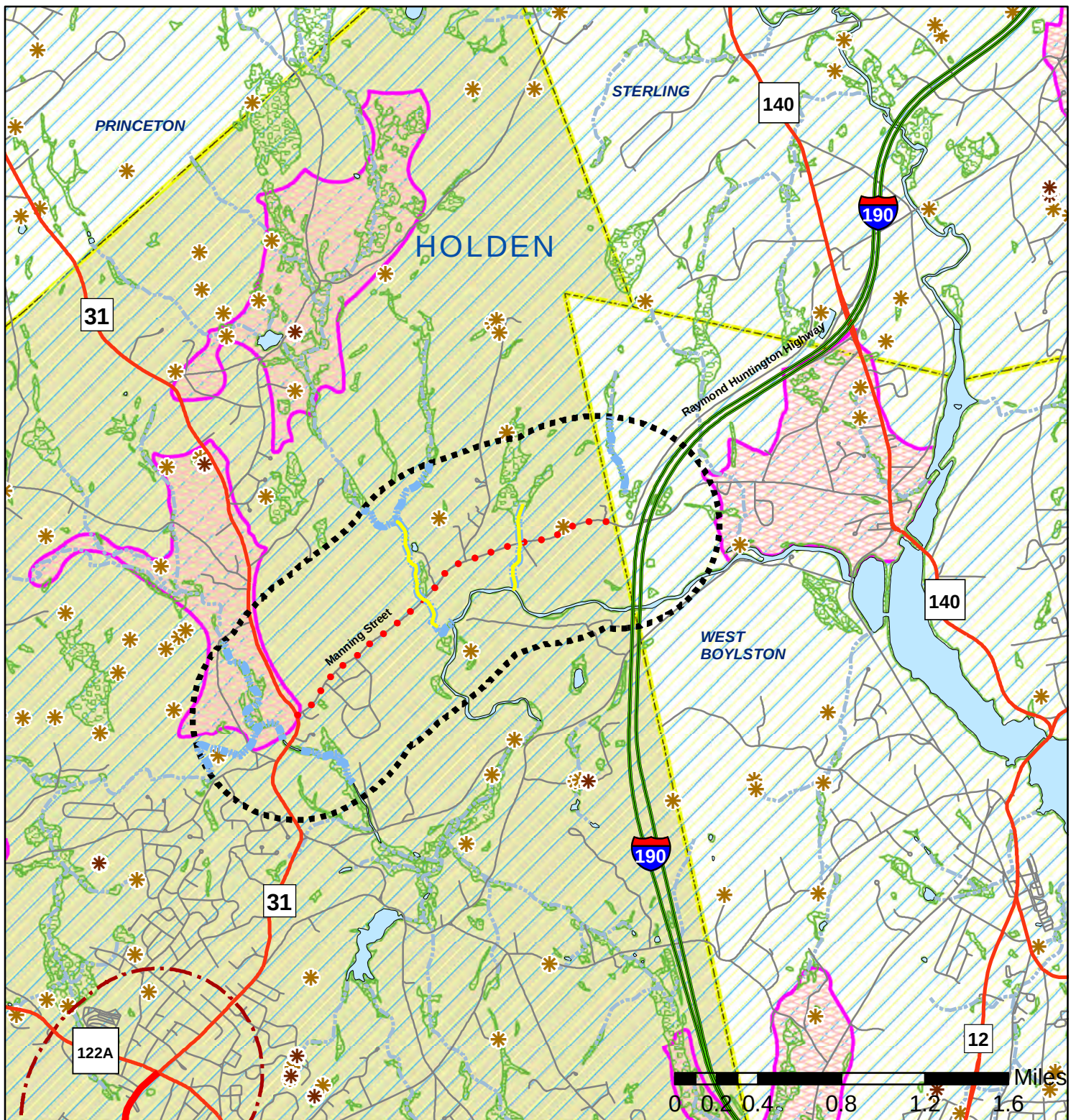


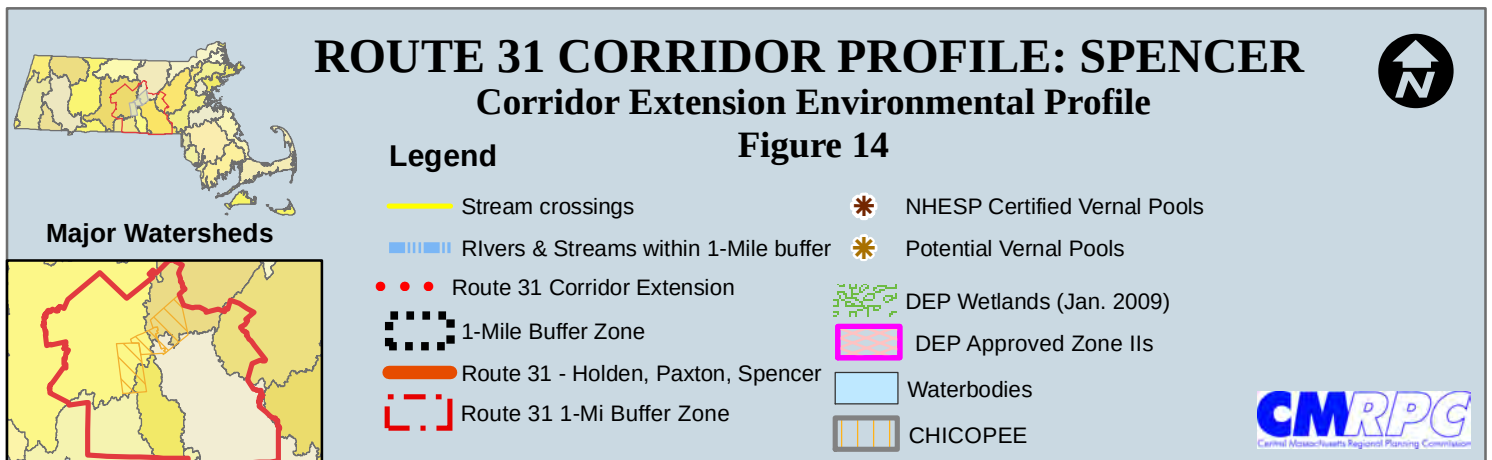
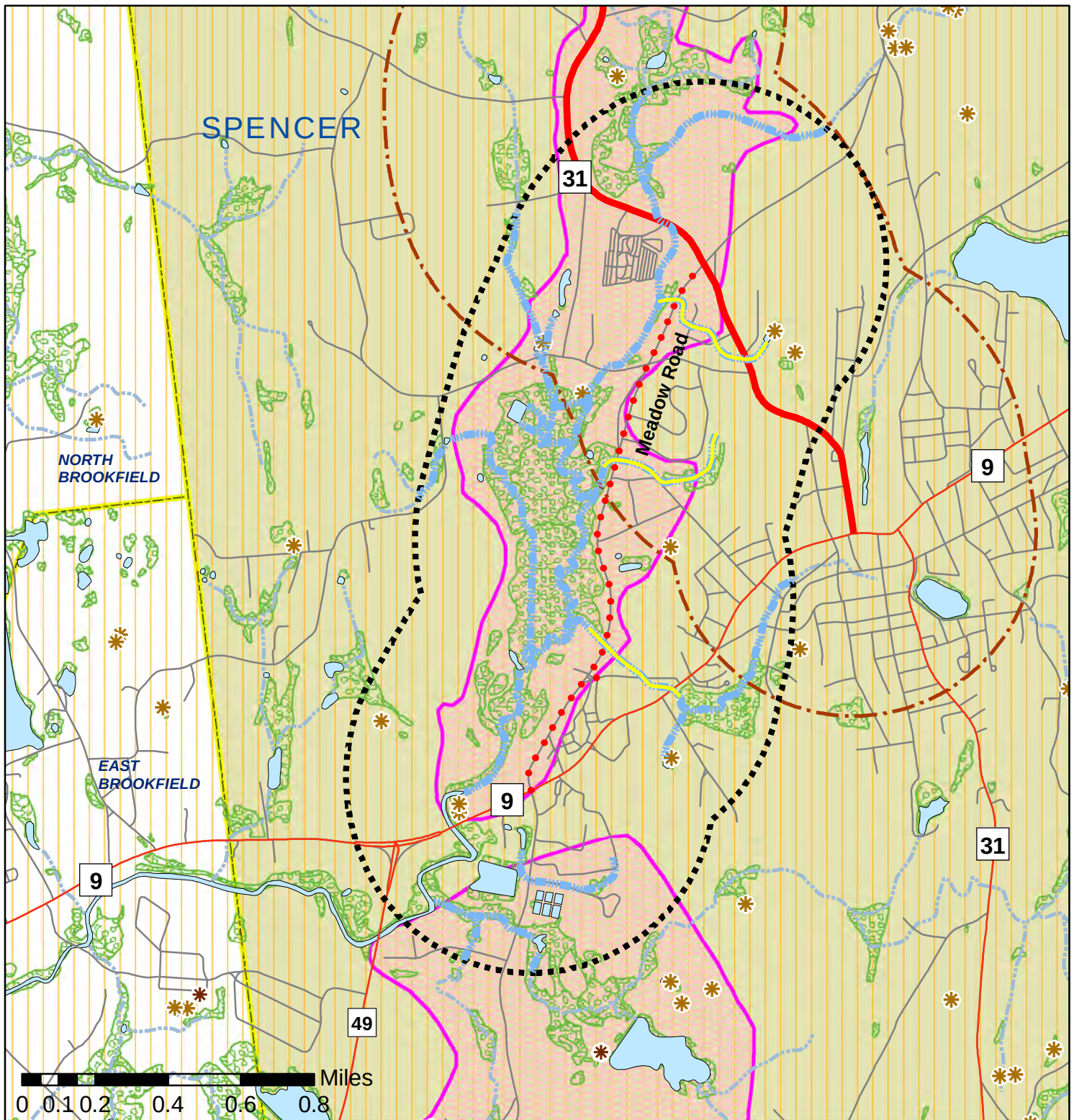
Legend

- Route 31 - Holden, Paxton, Spencer
- - - Route 31 1-Mi Buffer Zone
- Streams Intersecting Rt 31
- Rivers & Streams
- * NHESP Certified Vernal Pools
- * Potential Vernal Pools

- DEP Approved Zone IIs
- DEP Wetlands (Jan. 2009)
- Waterbodies Intersecting Rt 31
- Waterbodies
- CHICOPEE
- FRENCH
- Towns







3.0 CONGESTION MANAGEMENT PROCESS (CMP)

3.1 Overview of the Central Massachusetts CMP

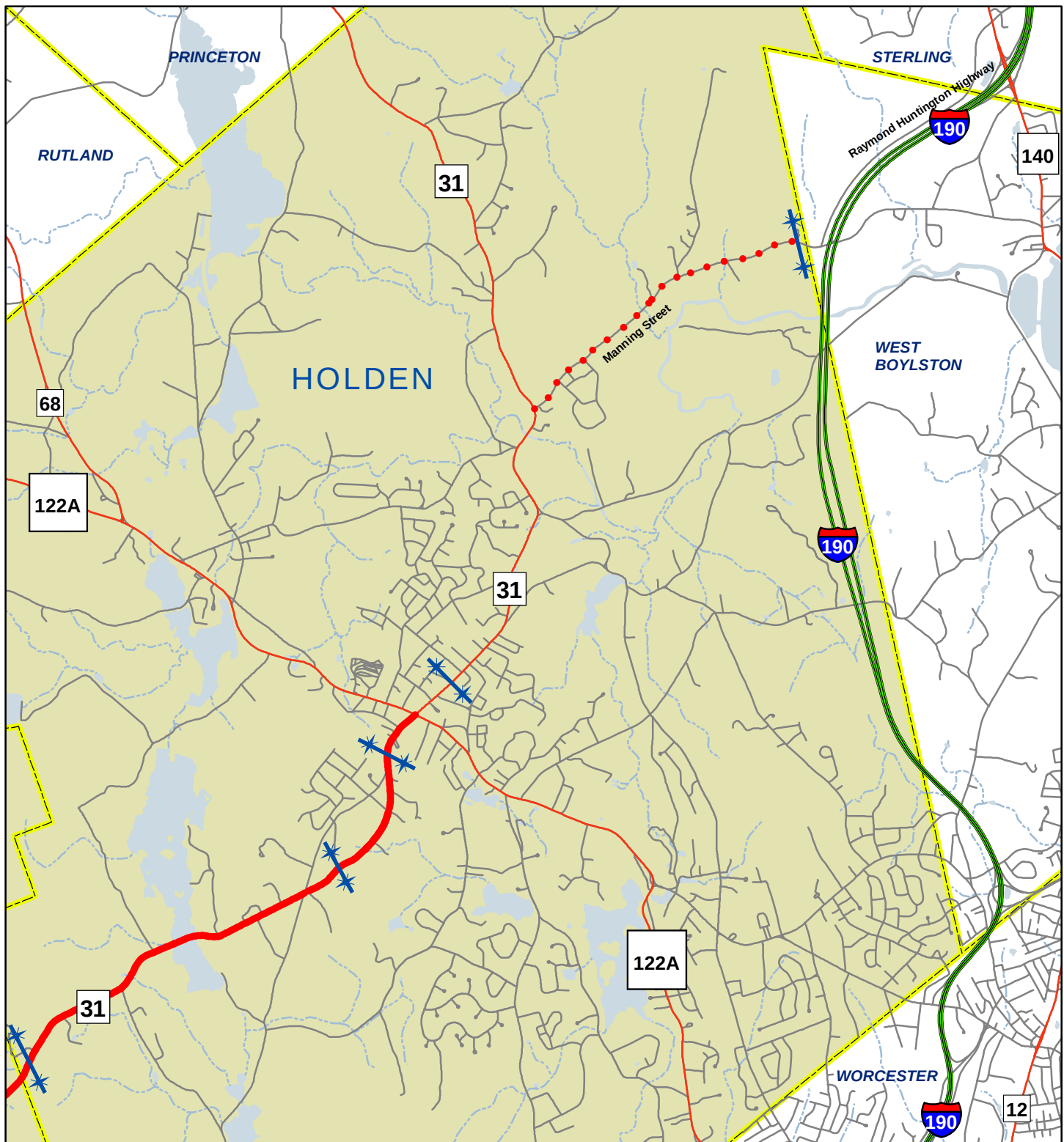
The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) required urban areas across the country to assess traffic congestion using a management system approach. Briefly, a management system approach is one where issues are identified through a systematic process of data collection and analysis, 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 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. This Corridor Profile provides the baseline data needed to coordinate such improvements with the MassDOT District #3 office as well as with the communities through which the highway travels.

3.2 Daily Traffic Volumes

Figures 15 through 17 show locations along Route 31 in the towns of Holden, Paxton, and Spencer where CMRPC set Automatic Traffic Recorders (ATRs) to gather the volume of traffic. The majority of the locations were completed in May of 2013. The ATRs were installed along the roadway and left down for at least 48 hours. There were eleven locations completed for Route 31, one location on Manning Street, and two locations on Meadow Road. **Table 2** shows the volume results from the Route 31 ATR locations. As the data shows, the highest traffic volumes in Holden are near Route 122A, dropping significantly at the Paxton town line. In the town of Paxton, volumes range from a high of 6,000 between Holden Road and Maple Street to a low of 3,500 at the Spencer town line. In Spencer, volumes are the lowest north of Hastings Road and between 6,000 and 7,000 for the rest of Route 31.



ROUTE 31 CORRIDOR PROFILE: HOLDEN

Traffic Count Locations
Figure 15

Legend



Route 31 - Holden, Paxton, Spencer

Route 31 Corridor Profile Extension

Interstate

State Route

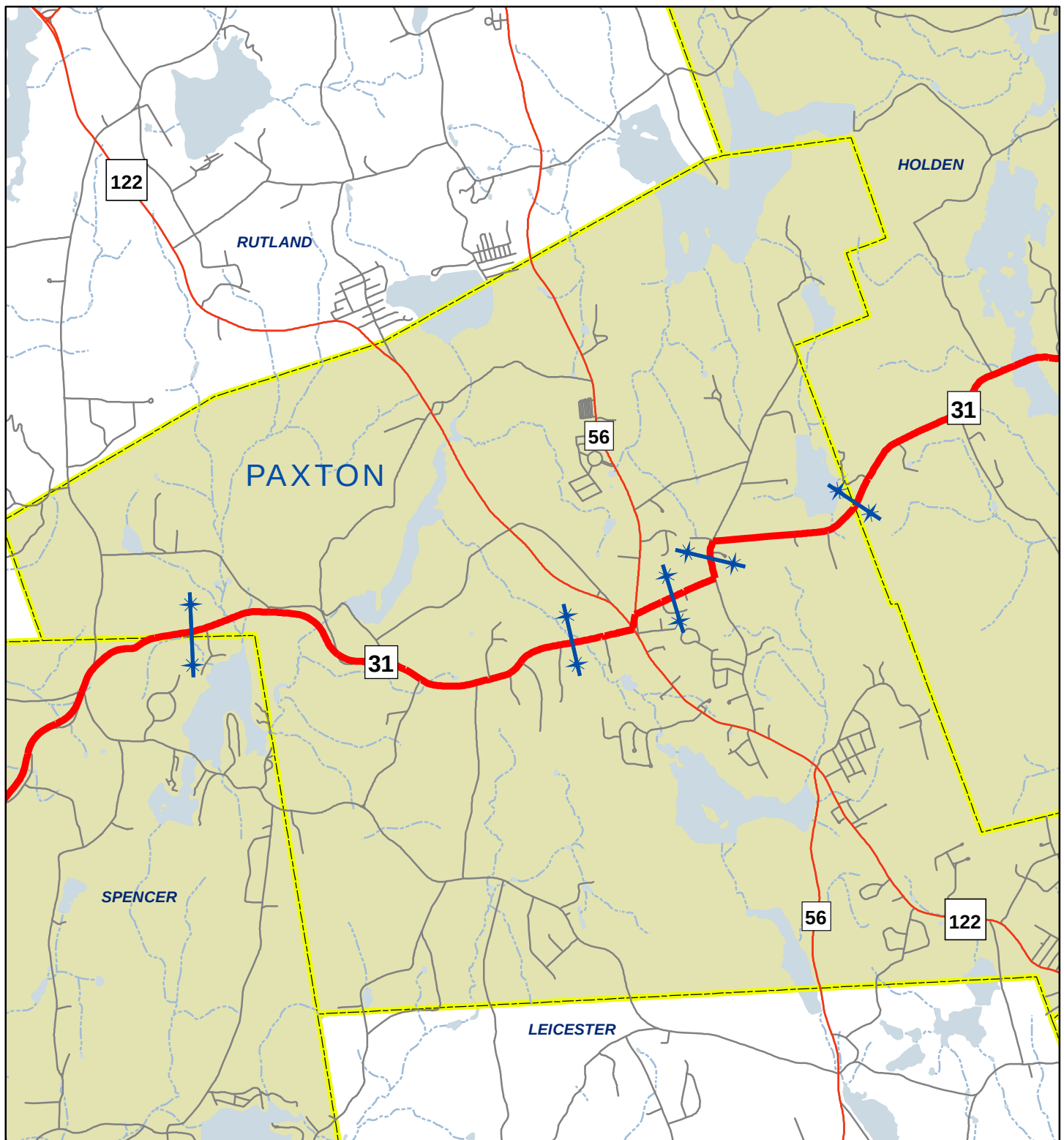
Roads

1 in = 0.79 miles



Source: Data provided by the US Census Bureau, Central Massachusetts 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 interpreting positional accuracy.



ROUTE 31 CORRIDOR PROFILE: PAXTON

Traffic Count Locations

Figure 16

Legend

★—★ ATR

— Route 31 - Holden, Paxton, Spencer

— State Route

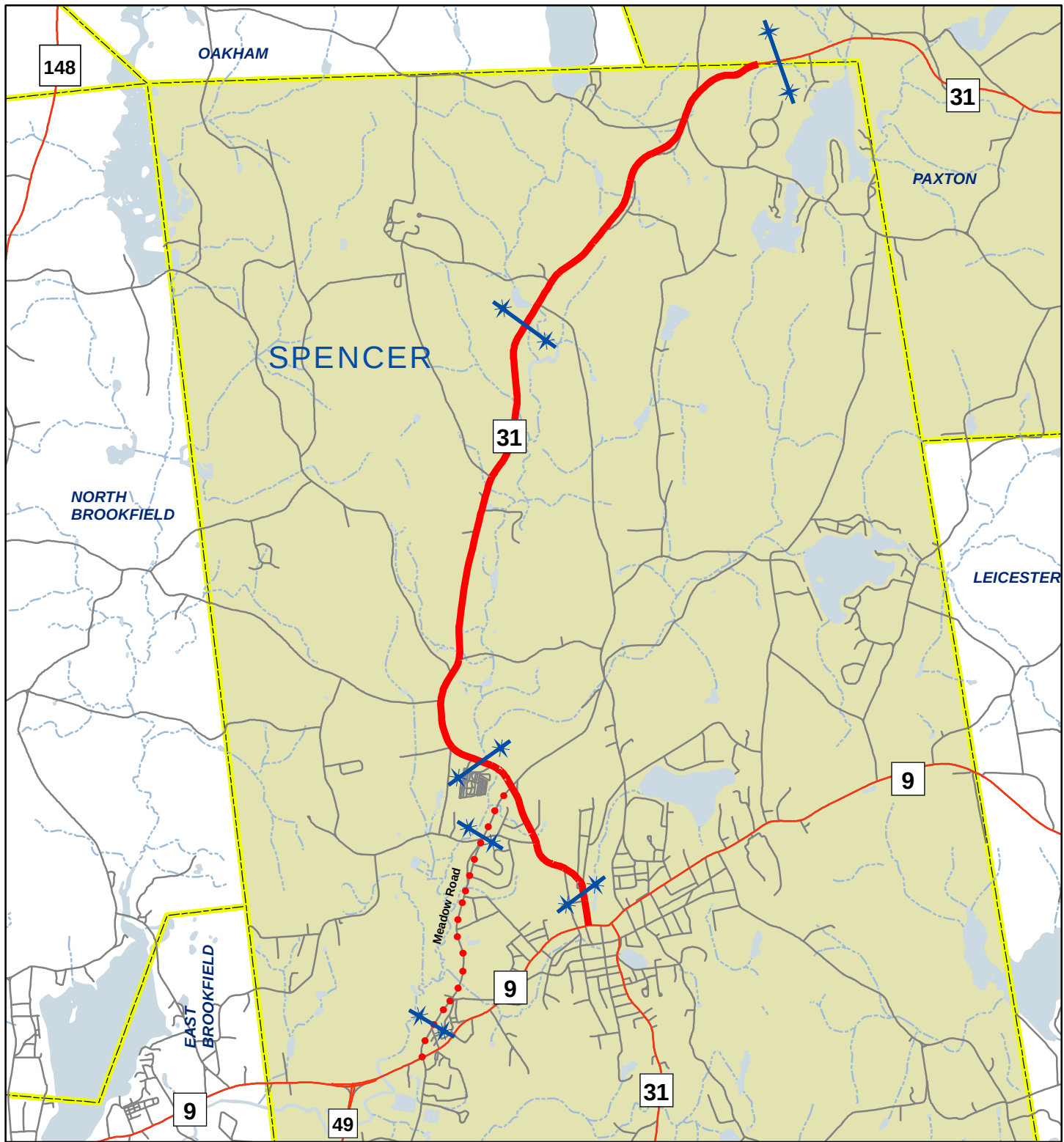
— Roads

1 in = 0.75 miles



Source: Data provided by the US Census Bureau, Central Massachusetts 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 31 CORRIDOR PROFILE: SPENCER

Traffic Count Locations

Figure 17

Legend

★ — ★ ATR

— Route 31 - Holden, Paxton, Spencer

• • • Route 31 Corridor Extensions

— Roads

— State Route

1 in = 0.75 miles



Source: Data provided by the US Census Bureau, Central Massachusetts 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 2
Route 31 Corridor Profile
Existing Daily Traffic Volumes

<u>Town</u>	<u>ATR Location</u>	<u>Date</u>	<u>Volume*</u>
Holden	Manning Street @ West Boylston Town Line**	5/2/2013	7,050
	Route 31 north of Route 122A	5/2/2013	7,950
	Route 31 south of Route 122A	5/2/2013	12,550
	Route 31 north of Reservoir Street	5/7/2013	7,750
	Route 31 @ Paxton Town Line	5/7/2013	5,575
Paxton	Route 31 (Grove Street) between Holden Rd & Maple St	5/7/2013	6,375
	Route 31 east of Route 56	5/7/2013	3,950
	Route 31 west of Route 122	5/7/2013	5,925
	Route 31 west of Route 122***	4/9/2013	5,900
	Route 31 @ Spencer Town Line	5/21/2013	3,525
Spencer	Route 31 south of Hastings Road	6/6/2013	5,450
	Route 31 north of Wire Village Road	5/21/2013	7,000
	Route 31 north of Wire Village Road***	4/9/2013	6,925
	Route 31 north of Route 9	5/23/2013	5,900
	Meadow Road south of Route 31**	5/23/2013	4,600
	Meadow Road north of Route 9**	5/23/2013	5,825

*Vehicles Per Day (VPD)

**Additional ATR Locations Requested By Host Communities

***Recent MassDOT Conducted Counts - Statewide Traffic Monitoring Effort

3.3 Route 31 Travel Time and Delay Studies

CMRPC staff conducted two travel time and delay studies in 2012 for this Corridor Profile. The travel time data was collected by CMRPC using a Global Positioning System (GPS) unit. 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**, traveling from Route 122A in Holden to Route 122 in Paxton took about an average of eight minutes heading northbound or southbound. From Route 122 in Paxton to Route 9 in Spencer, it took about 12 minutes in each direction.

Table 3
Route 31 Travel Time and Delay Study Results

Peak Period	Direction	Study Year	Distance	Travel Time (average minutes)
AM-Holden/Paxton	Southbound	2012	4.7 miles	8.2
AM-Holden/Paxton	Northbound	2012	4.7 miles	8.6
PM-Holden/Paxton	Southbound	2012	4.7 miles	8.6
PM-Holden/Paxton	Northbound	2012	4.7 miles	8.1
AM-Paxton/Spencer	Southbound	2012	8.3 miles	11.9
AM-Paxton/Spencer	Northbound	2012	8.3 miles	12.1
PM-Paxton/Spencer	Southbound	2012	8.3 miles	11.8
PM-Paxton/Spencer	Northbound	2012	8.3 miles	11.8

Figures 18 through 25 illustrate the vehicle speeds for each separate northbound and southbound trip along Route 31 observed in 2012. Route 31 was analyzed in two segments. The first segment starts at Route 122A in Holden and ends at Route 122 in Paxton. The average vehicle speed observed for this segment of Route 31 was about 35 mph in both directions. The slowest vehicle speeds are near the start and end points. The second segment starts at Route 122 in Paxton and ends at Route 9 in Spencer. The average vehicle speed for this segment is near 40 mph in both directions. There is very little delay for this segment heading in either direction. The slowest speeds are between Meadow Road and Route 9 and near the Paxton town line.

Figure 18

Speed Profile - Route 31 SB - Holden/Paxton

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

2012 - AM

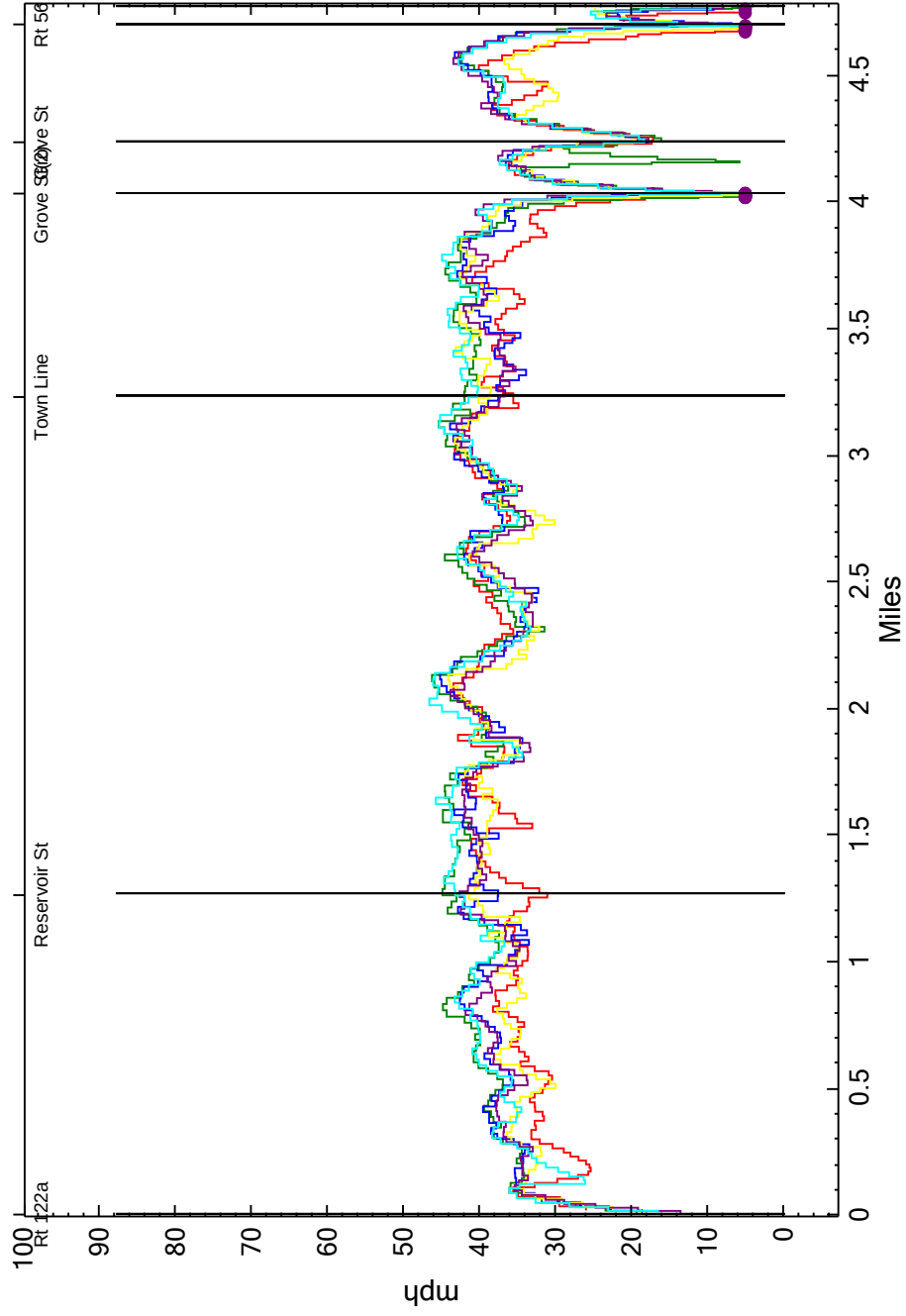


Figure 19

Speed Profile - Route 31 NB - Holden/Paxton

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

2012 - AM

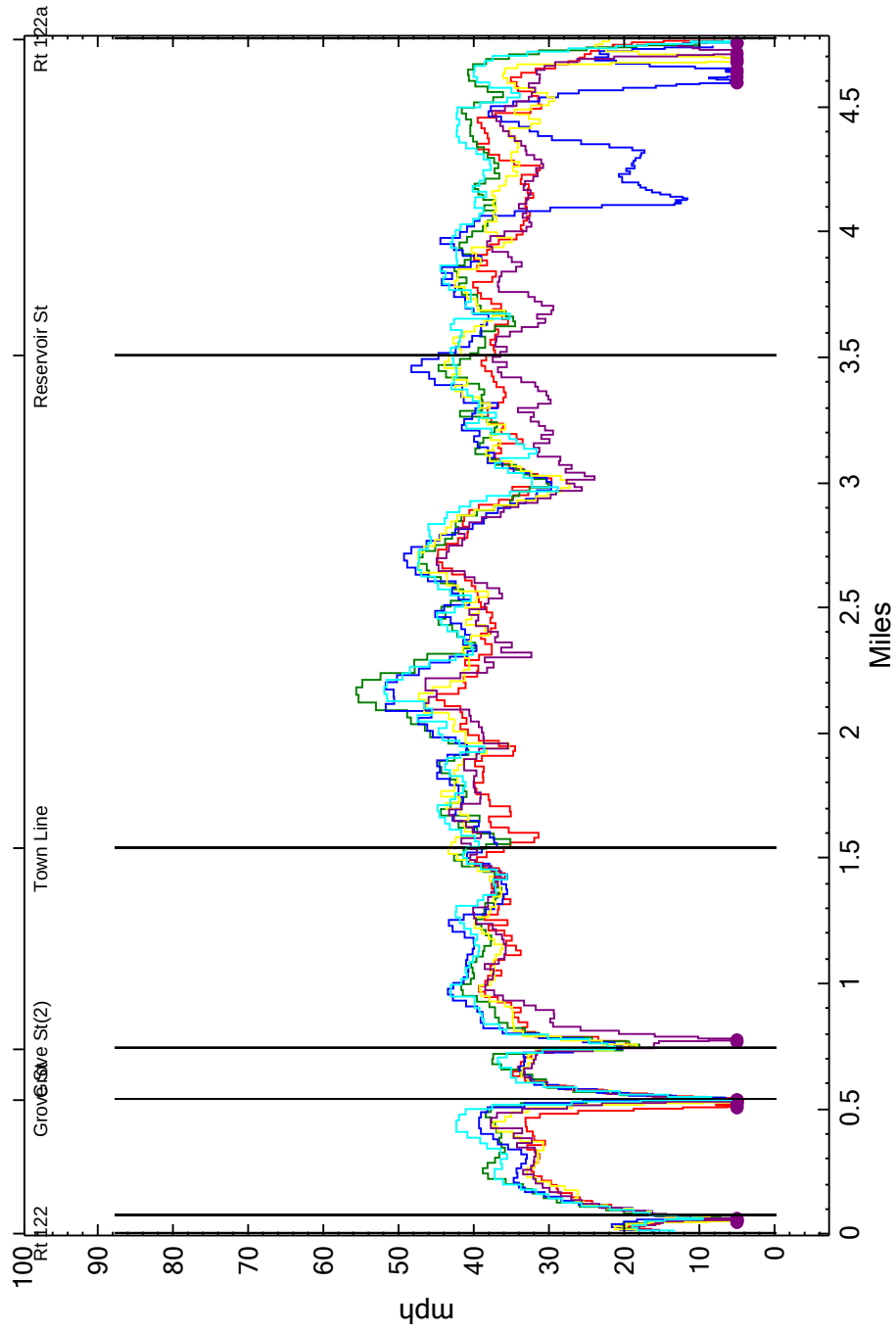


Figure 20

Speed Profile - Route 31 SB - Holden/Paxton

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

2012 - PM

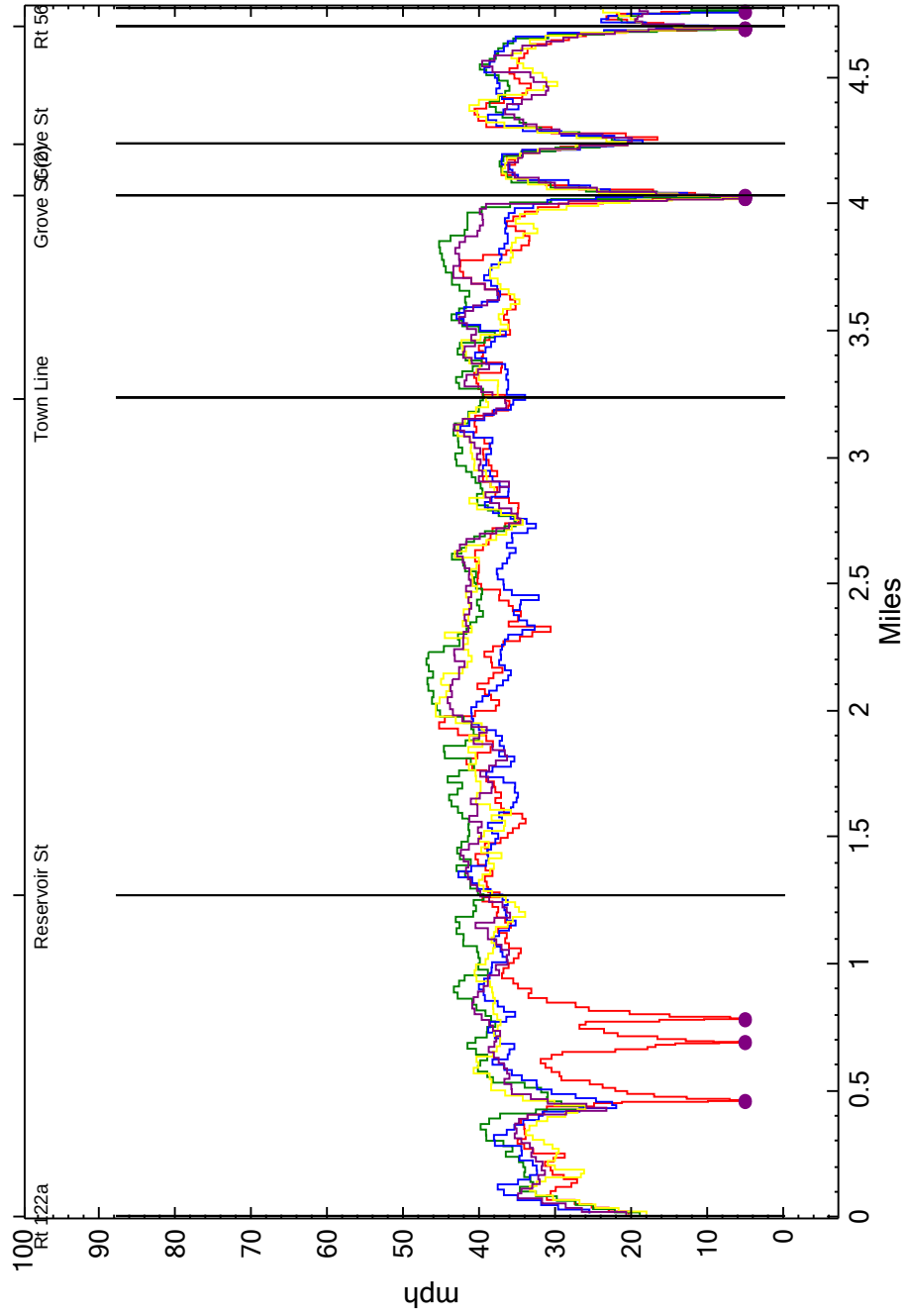


Figure 21

Speed Profile - Route 31 NB - Holden/Paxton

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

2012 - PM

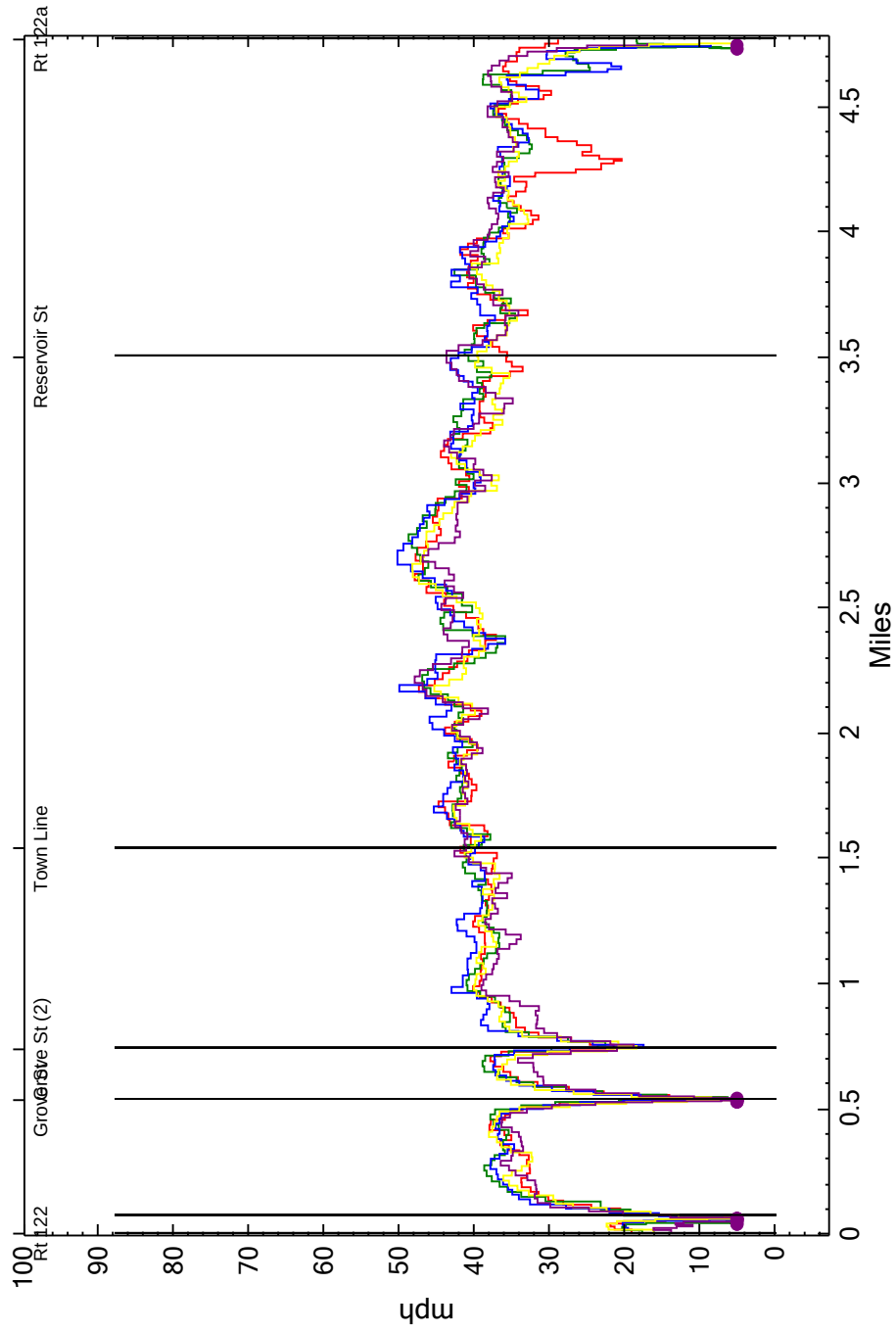


Figure 22

Speed Profile - Route 31 SB - Paxton/Spencer

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

2012 - AM

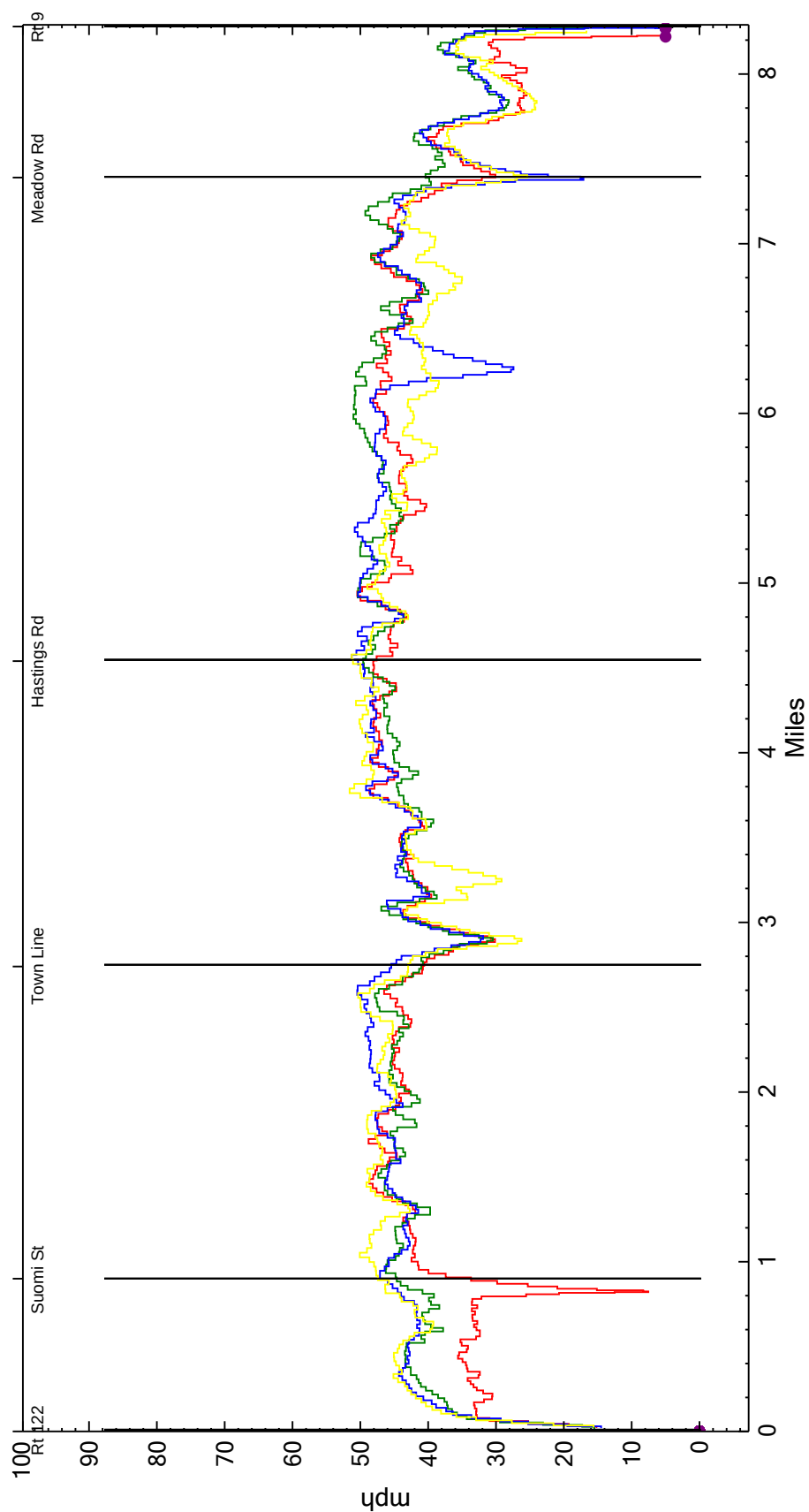


Figure 23

Speed Profile - Route 31 NB - Paxton/Spencer

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

2012 - AM

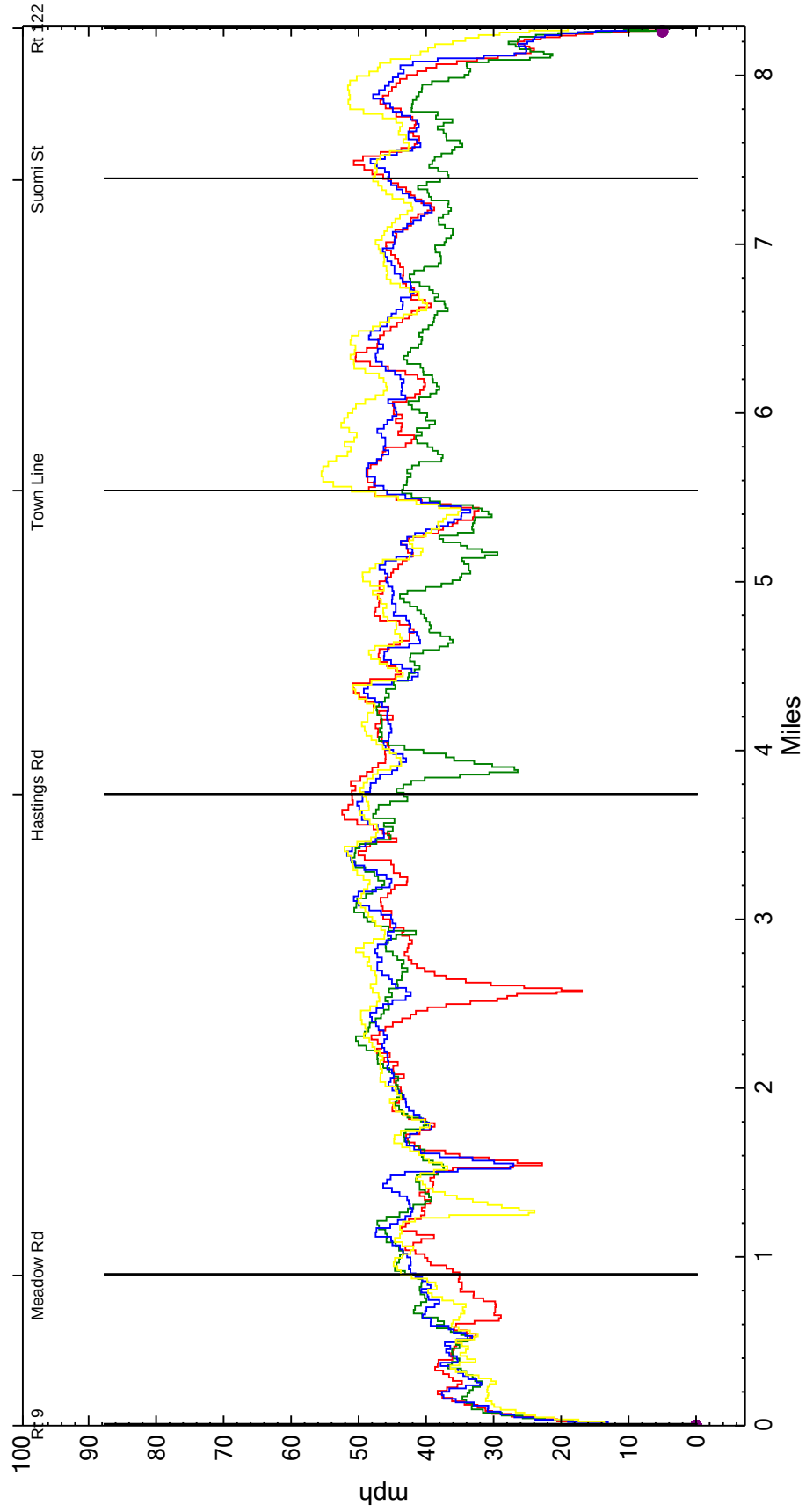


Figure 24

Speed Profile - Route 31 SB - Paxton/Spencer

2012 - PM

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

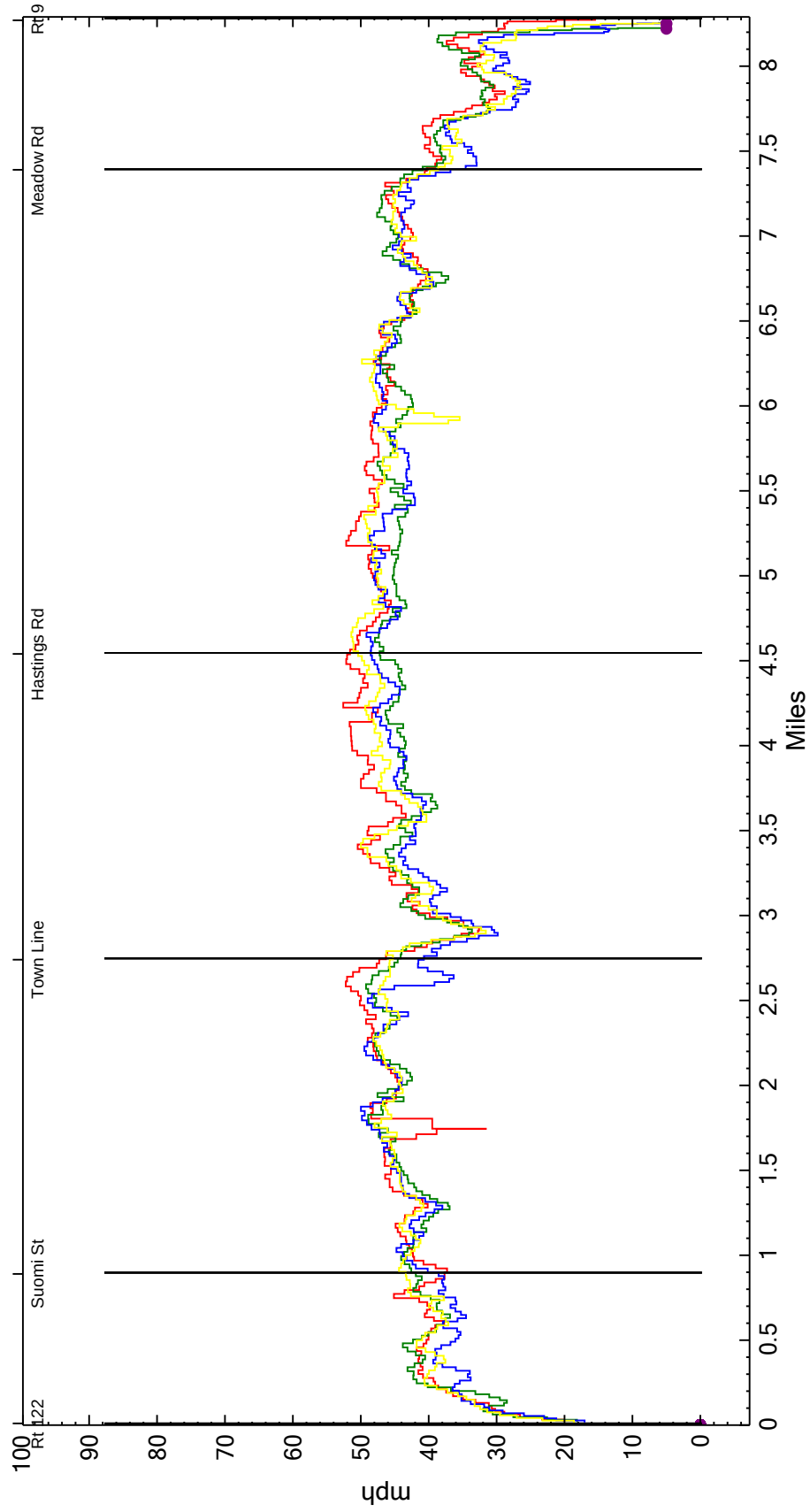
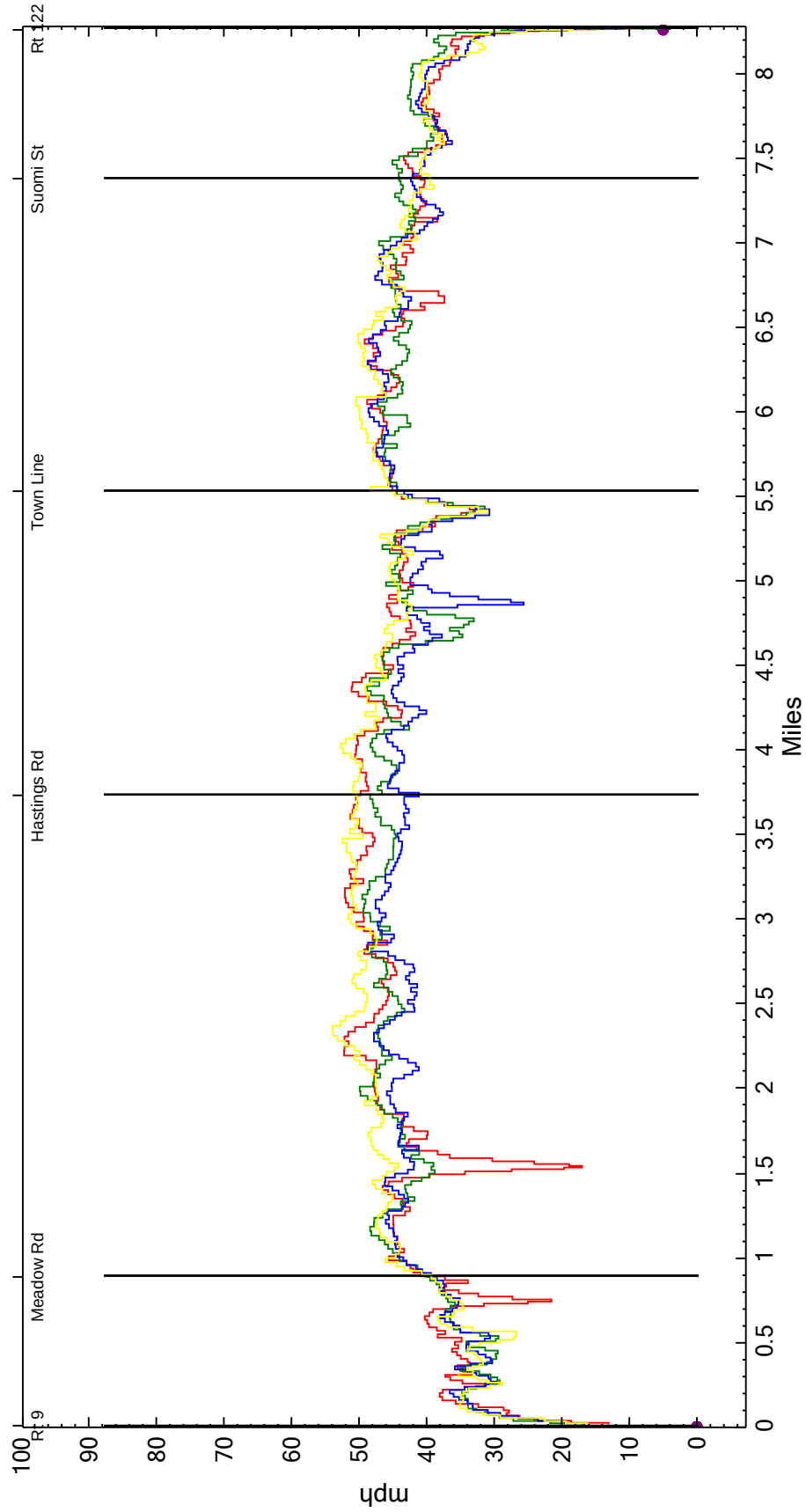


Figure 25

Speed Profile - Route 31 NB - Paxton/Spencer

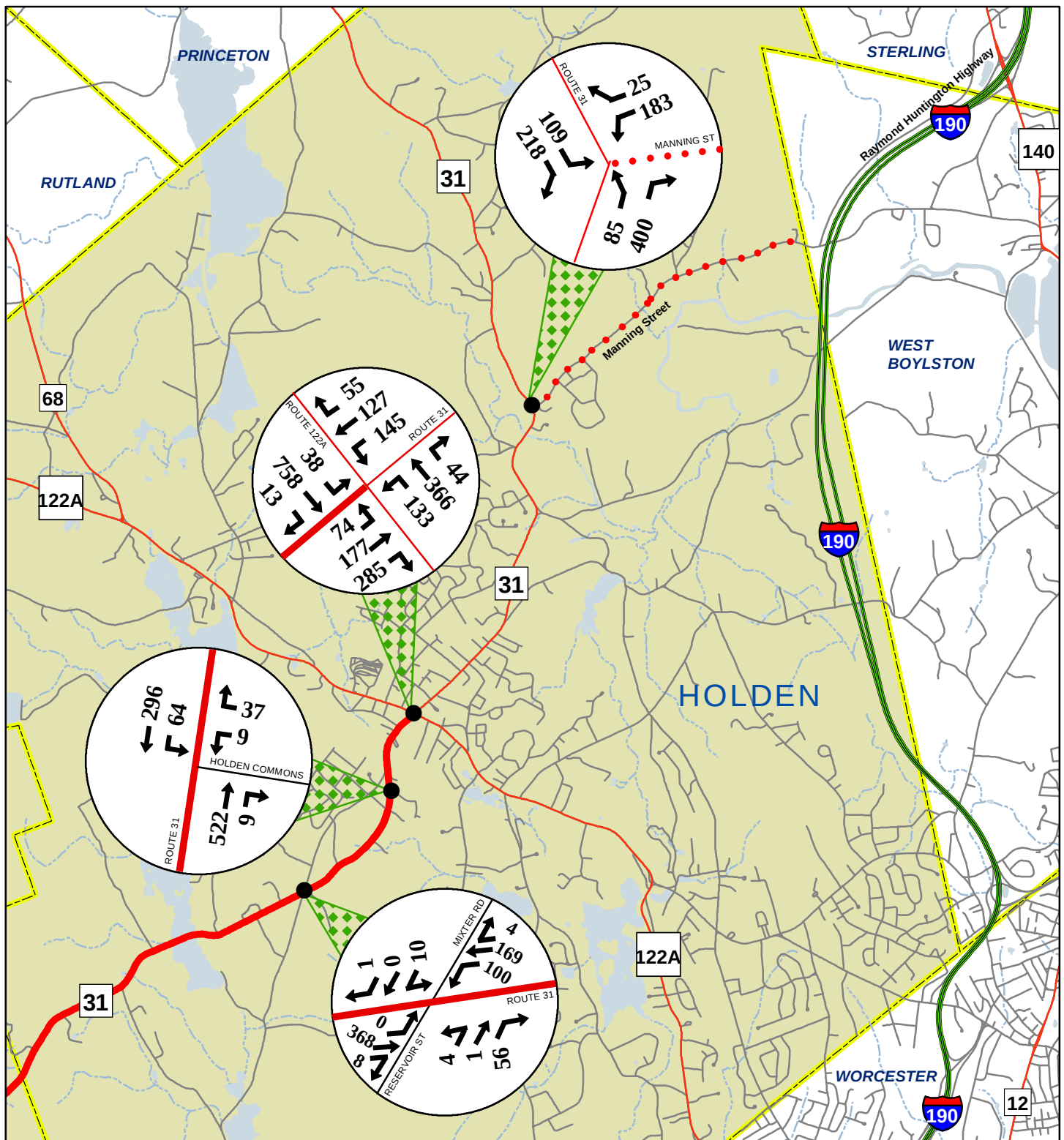
ScaleX: 1 in = 1 Miles
ScaleY: 1 in = 25 mph

2012 - PM



3.4 Route 31 Intersections Existing Peak Hour Traffic Volumes

CMRPC conducted Turning Movement Counts (TMCs) at numerous focus intersections for this Corridor Study. Most counts were done in 2013, but a few were completed in 2011 and 2012. Every effort was made to complete these TMCs during peak flow months while school was in session. In addition, a “balancing” exercise was conducted to account for both the typical addition and loss of traffic volume between adjacent study intersections due to local streets, site drives serving major land uses, and other private driveways, as well as the natural statistical fluctuation encountered when turning movement counts are conducted on different days. These balanced volumes are indicated in **Figures 26 to 31** as existing AM and PM peak hour traffic flows. The complete TMC datasheets have been provided in the document’s Technical Appendix.



ROUTE 31 CORRIDOR PROFILE: HOLDEN

Existing Traffic Flows
AM Peak Hour Period
Figure 26



Legend

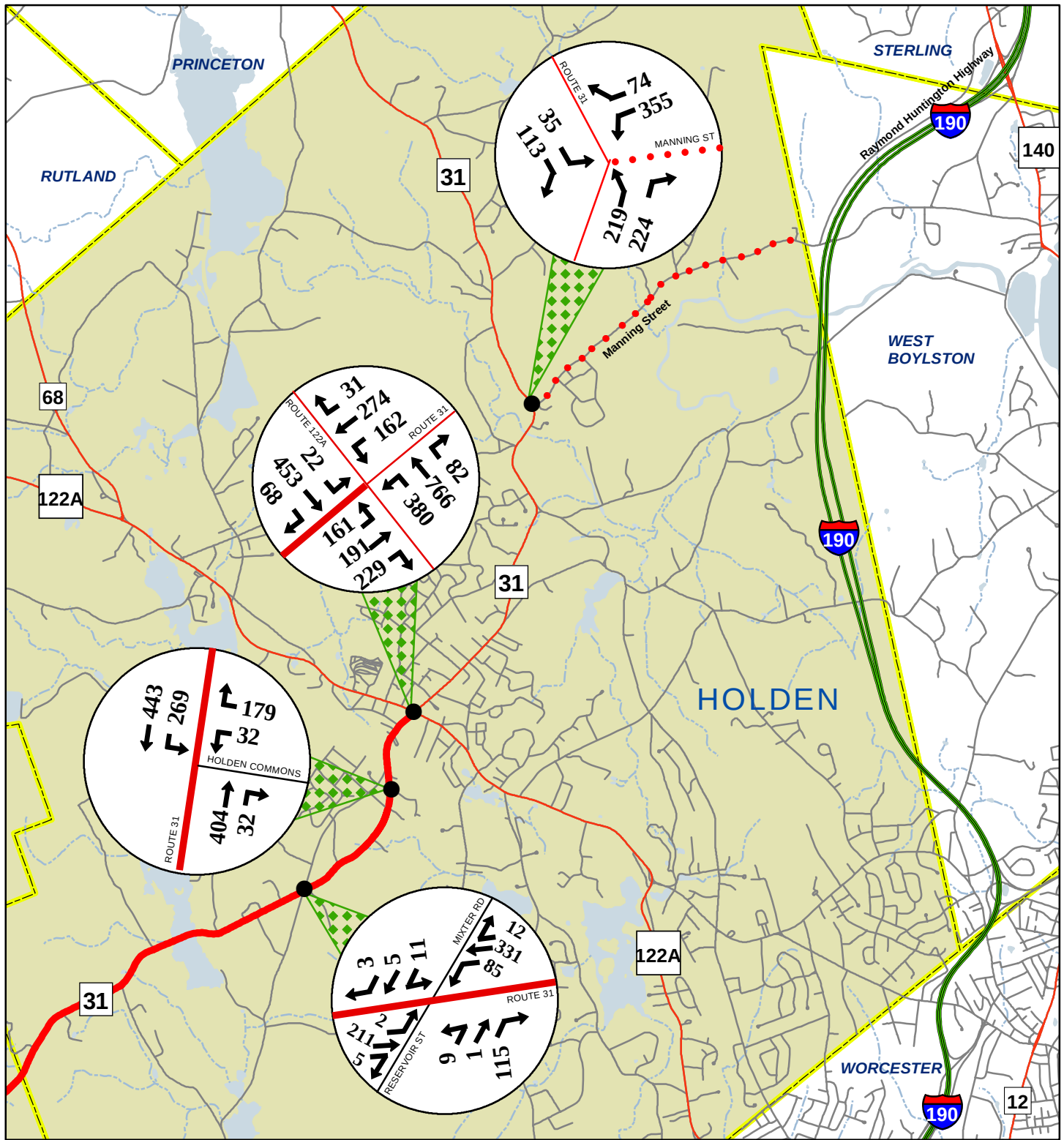
- Route 31 - Holden, Paxton, Spencer
- ... Route 31 Corridor Profile Extension
- Interstate
- State Numbered Routes
- Other Roadways



Source: Data provided by the US Census Bureau, Central Massachusetts 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 in = 0.79 miles



ROUTE 31 CORRIDOR PROFILE: HOLDEN

Existing Traffic Flows
PM Peak Hour Period
Figure 27



Legend

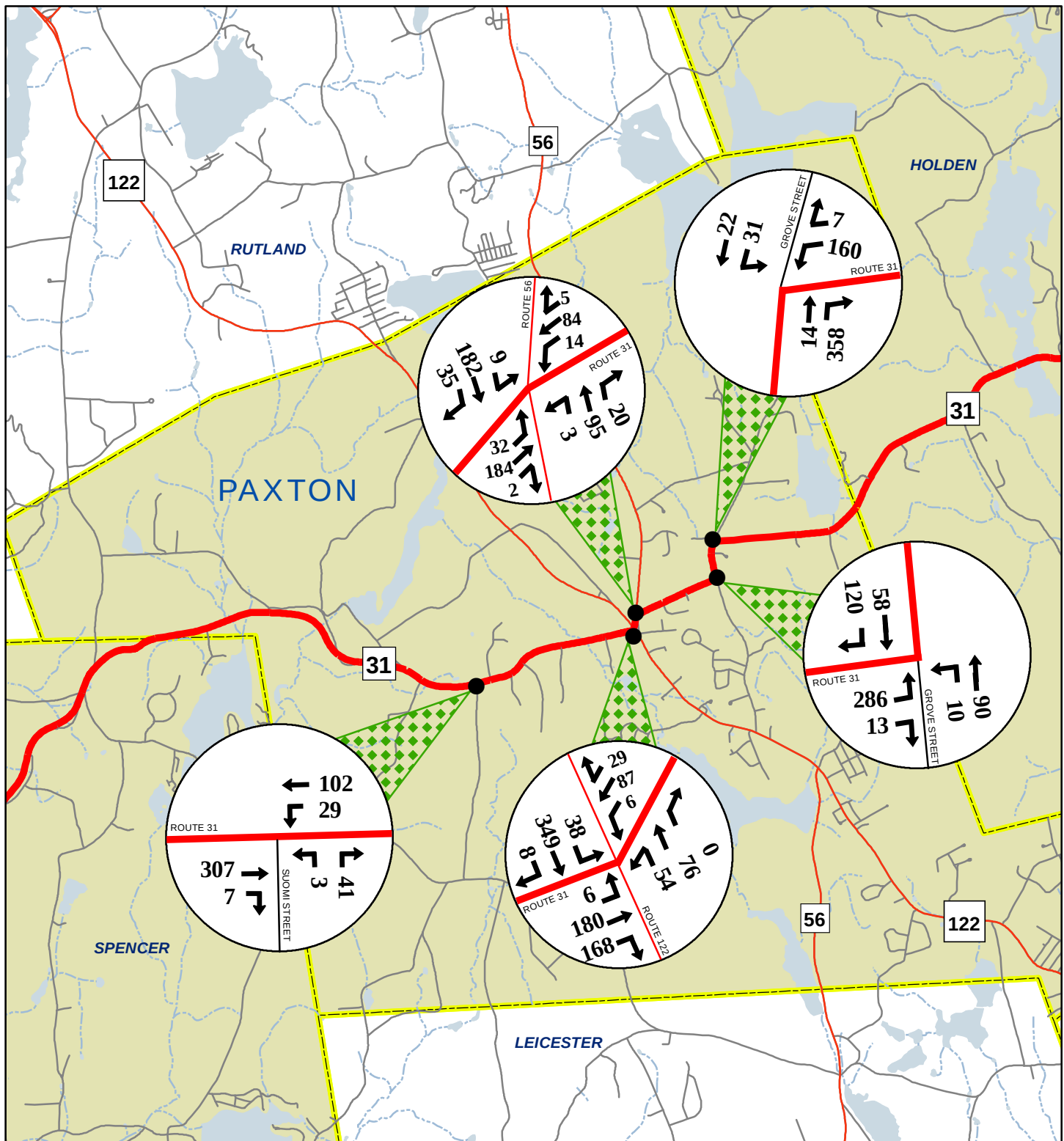
- Route 31 - Holden, Paxton, Spencer
- ... Route 31 Corridor Profile Extension
- Interstate
- State Numbered Routes
- Other Roadways



Source: Data provided by the US Census Bureau, Central Massachusetts 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 in = 0.79 miles



ROUTE 31 CORRIDOR PROFILE: PAXTON

Existing Traffic Flows
AM Peak Hour Period
Figure 28



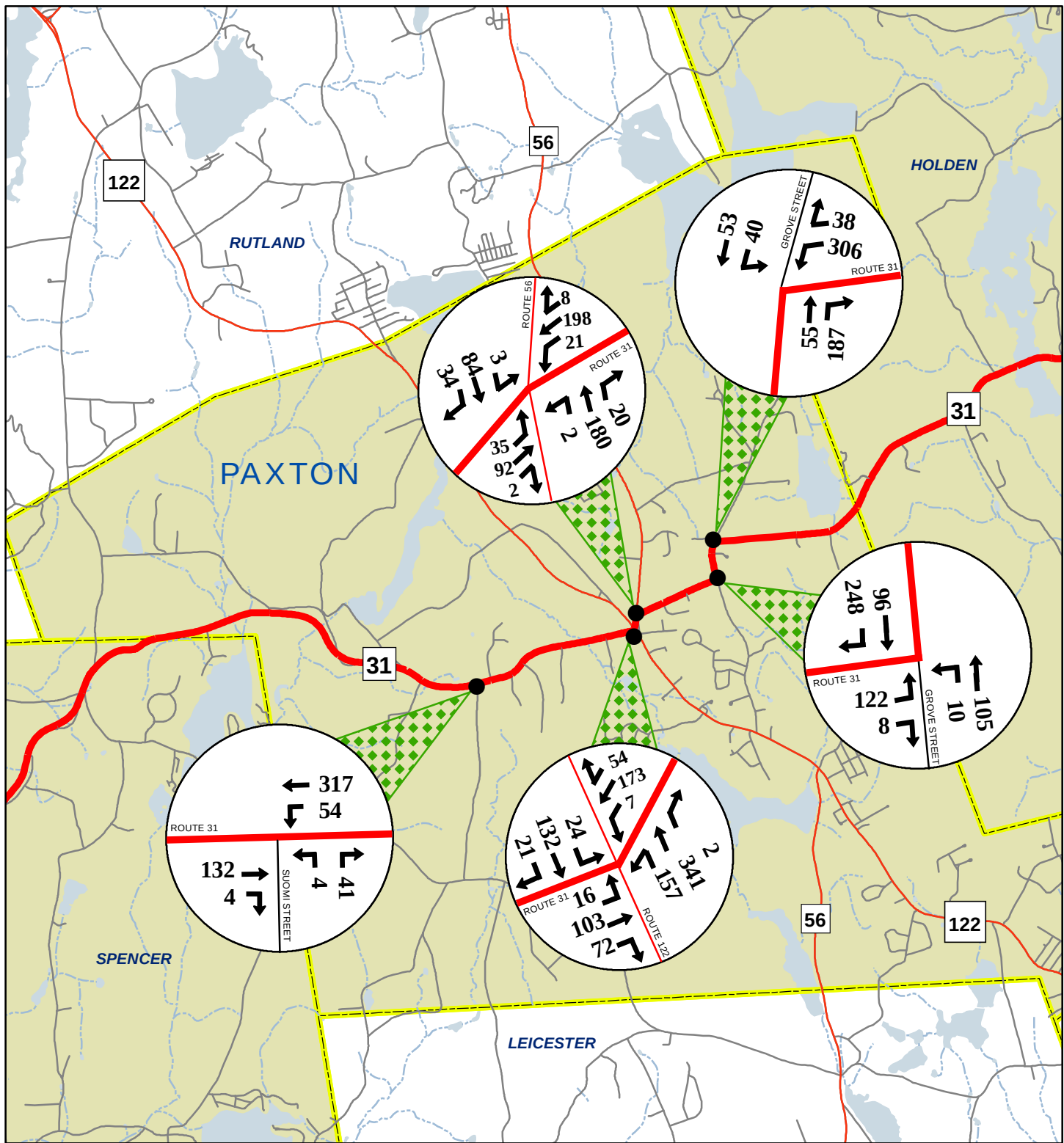
Legend

- Route 31 - Holden, Paxton, Spencer
- State Numbered Routes
- Other Roadways

1 in = 0.75 miles

Source: Data provided by the US Census Bureau, Central Massachusetts 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 31 CORRIDOR PROFILE: PAXTON

Existing Traffic Flows
PM Peak Hour Period
Figure 29



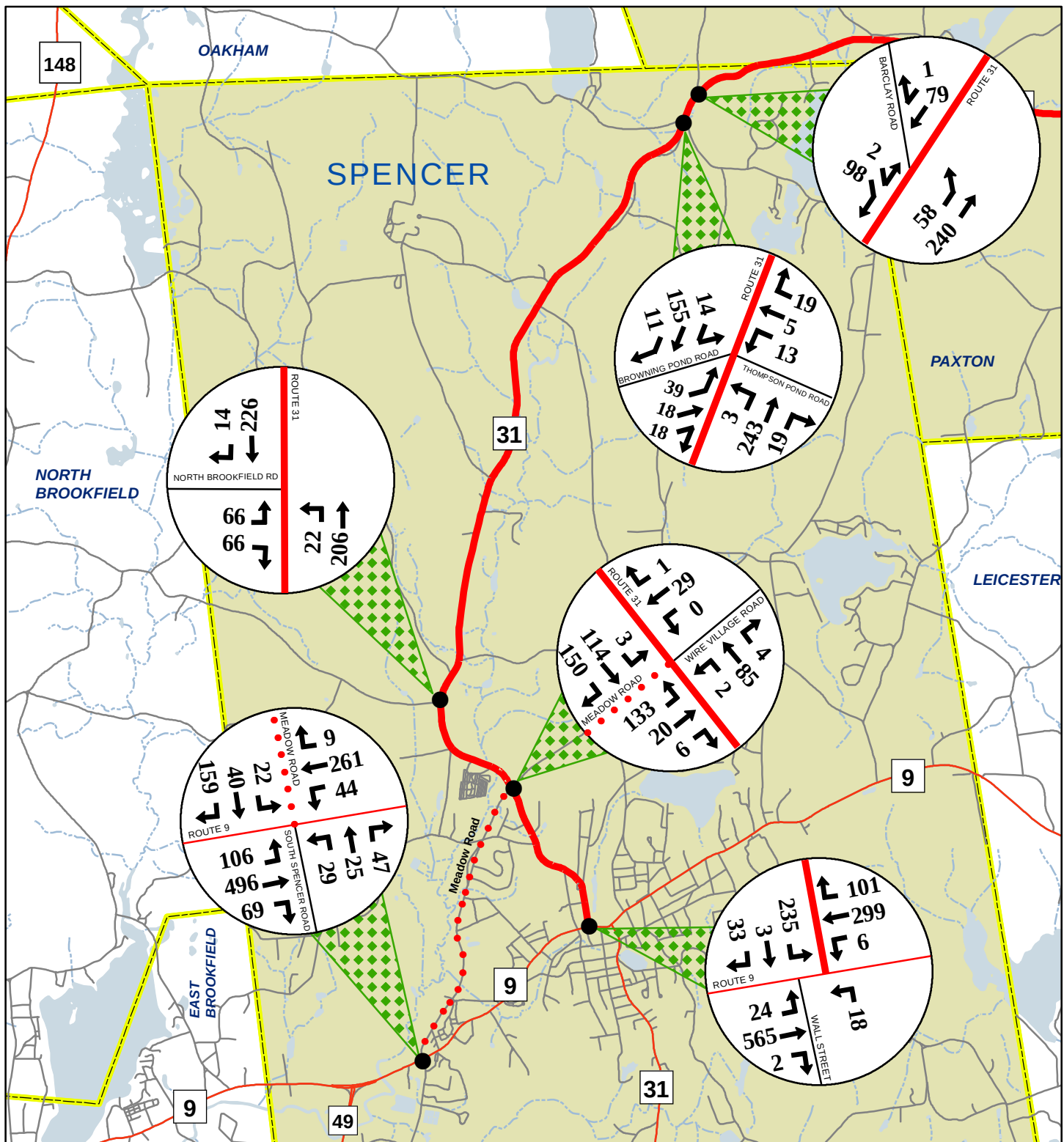
Legend

- Route 31 - Holden, Paxton, Spencer
- State Numbered Routes
- Other Roadways

1 in = 0.75 miles

Source: Data provided by the US Census Bureau, Central Massachusetts 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 31 CORRIDOR PROFILE: SPENCER

Existing Traffic Flows
AM Peak Hour Period
Figure 30



Legend

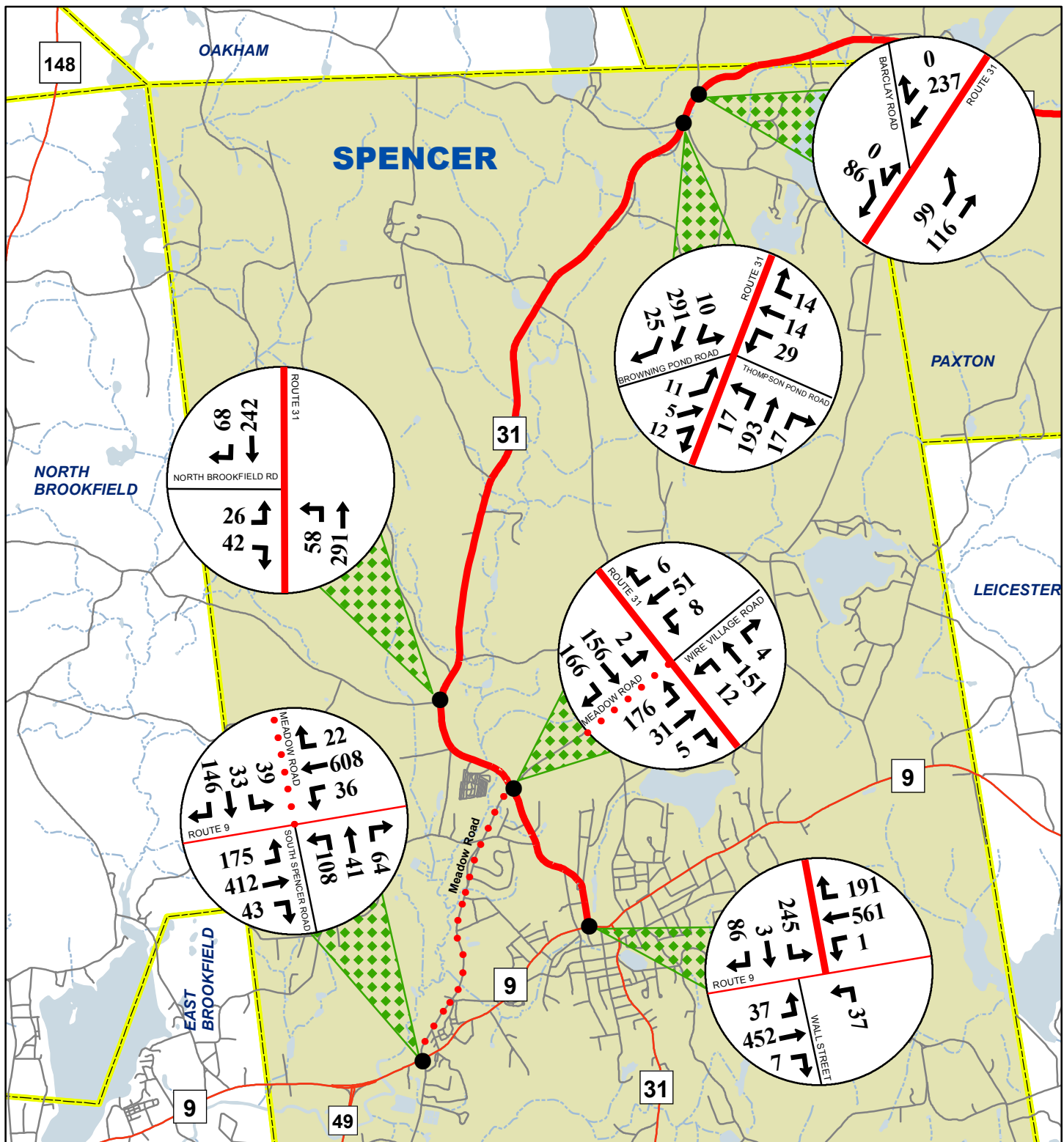
- Route 31 - Holden, Paxton, Spencer
- ... Route 31 Corridor Profile Extension
- State Numbered Routes
- Other Roadways



Source: Data provided by the US Census Bureau, Central Massachusetts 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 in = 0.75 miles



3.5 Percentage of Heavy Vehicles Utilizing Route 31 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 adversely affect traffic in two ways: 1) They are larger than passenger cars and occupy more roadway space and 2) They have poorer 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 percentage of heavy vehicles traveling through the intersections during the morning and afternoon peak fluctuates throughout the corridor, but on the average it is 3.9% in the AM and 1.6% in the PM. The highest recorded heavy vehicle percentage in the AM was 6.8% at the Route 31/Route 9/Wall Street intersection in Spencer. The highest PM location was Route 31(Holden Road)/Grove Street in the town of Paxton, with a total of 2.7%. Observers in the field noted that school buses accounted for some of the heavy vehicle traffic. 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, temporary or permanent local conditions as well as other factors, such as weather conditions. As such, the figures in the table should be used with caution 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 31 Focus Intersections**

	<u>Study Intersection</u>	<u>Date of Count</u>	<u>Morning Peak Hour %</u>	<u>Evening Peak Hour %</u>
Holden	Route 31 / Route 122A	May '13	5.7%	1.1%
	Route 31 / Holden Commons	June '13	2.5%	1.0%
	Route 31 / Mixer Rd / Reservoir St	May '13	4.3%	1.5%
Paxton	Route 31(Holden Rd) / Grove St	May '13	3.4%	2.7%
	Route 31(Maple St) / Grove St	May '13	2.8%	1.7%
	Route 31 / Route 56	August '12	3.9%	1.9%
	Route 31 / Route 122	August '12	1.7%	1.6%
	Route 31 / Suomi St	June '13	2.7%	1.8%
Spencer	Route 31 / Barclay Rd	June '13	3.5%	2.0%
	Route 31 / Browning Pond Rd / Thompson Pond Rd	June '13	4.5%	2.5%
	Route 31 / North Brookfield Rd	July '11	3.5%	0.4%
	Route 31 / Meadow Rd / Wire Village Rd	July '11	3.5%	0.4%
	Route 31 / Route 9 / Wall St	April '11	6.8%	1.5%
<u>Additional Town Requested Locations</u>				
Holden	Route 31 / Manning St	May '13	4.8%	2.6%
Spencer	Route 31 / Route 9 / South Spencer Rd	August '13	5.4%	1.5%
Peak Hour Averages			3.9%	1.6%

3.6 Route 31 Intersections Projected 2023 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 proper to attempt to estimate or “project” future conditions in the study area. Transportation changes and solutions will not be made instantly, and pertinent area circumstances can change. More specifically, here we attempt to modify current levels of traffic to reflect what might be expected to be seen in ten years – reasonable lead time for planning.

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, anticipated overall growth in subregional traffic volumes was examined.

We seek to look ahead 10 years to estimate year 2023 projected traffic increases. We can then assess operational conditions and potential improvements appropriately.

The model currently projects roughly 1% per year growth over the next decade in the general corridor profile study area, resulting in about an overall 10% increase in Route 31 traffic volumes in the 10 year period between 2013 and 2023. We thus applied this increase levels to all traffic levels in the region as a starting point for planning.

Site Specific Background Development

In addition to general overall growth levels, site-specific additional growth sources were considered, where determined appropriate, for their supplemental impact on projected traffic. Identified for each host community, the development growth areas considered are listed in **Table 5**. Local expert sources were contacted for their input on the possible future impact levels of various plans and projects.

In Holden, site-specific trip generation was considered for two major residential subdivisions of single family homes named “Stoneybrook” and “Greenwood II”. Also considered was the “Oaks of Holden”, an age 55+ condominium complex. Paxton’s new senior housing development and the potential for growth in college staff and enrolled students at Anna Maria College were assessed for added growth. In the host community of Spencer, the construction of a small brewery at St. Joseph’s Abby for the production of Trappist Ale was accounted for, as well as the MEPA-approved expansion of the New England Automotive Gateway (NEAG), an established rail-highway transload facility.

Within the **Table** one finds, for each site-specific development, the total number of approved units, current status, future potential units, and projected daily & peak hour trip generation levels. After taking into consideration the relative magnitude of site-specific trip generation,

Table 5
Site Specific Background Development

Community	Development Name	Type	Total		Current Status	Future Potential Units	Projected Daily Trips	Peak Hour Trip Generation		Action
			Approved Units							
Holden	Stoneybrook	Residential Subdivision of Single Family Homes	76		36 built & occupied	40	400, 200 in/200 out	AM: 32/PM: 42		Added to projected 2023 analysis network
Holden	Oaks of Holden	Age 55+ condominium complex	108		72 built & occupied	36	204, 102 in/102 out	AM: 6/PM: 9		Added to projected 2023 analysis network
Holden	Greenwood II	Residential Subdivision of Single Family Homes	96		None yet built	96	920, 460 in/460 out	AM: 24/PM: 41		Added to projected 2023 analysis network
Paxton	Paxton Senior Housing	Condominium complex	50 with 60 parking spaces		All 50 complete, yet to be fully occupied	TBD	282, 141 in/141 out	AM: 9/PM: 13		Captured within 10% projected traffic growth for 2023
Paxton	Anna Maria College	Growth in college staff and/or enrolled students	Current enrollment of 1,500		Future potential	TBD	TBD	TBD		Captured within 10% projected traffic growth for 2023
Spencer	St. Joseph's Abbey	Increase in trucking operations for distribution of locally brewed Trappist Ale	New abbey brewery		Recently opened for operation	Brewery expansion not anticipated	Minimal	AM: 1/PM: 1		Captured within 10% projected traffic growth for 2023, also 1% increases in heavy vehicle percentages at Rte 31 study intersections
Spencer	New England Automotive Gateway (NEAG)	MEPA-approved expansion of existing, established rail-highway transload facility	43 new employees		Construction of expansion currently underway	Vehicle off loading & transfer area, parking	188, 94 in/94 out	AM: 10/PM: 12		Captured within 10% projected traffic growth for 2023, also 1% increases in heavy vehicle percentages at Rte 31 study intersections

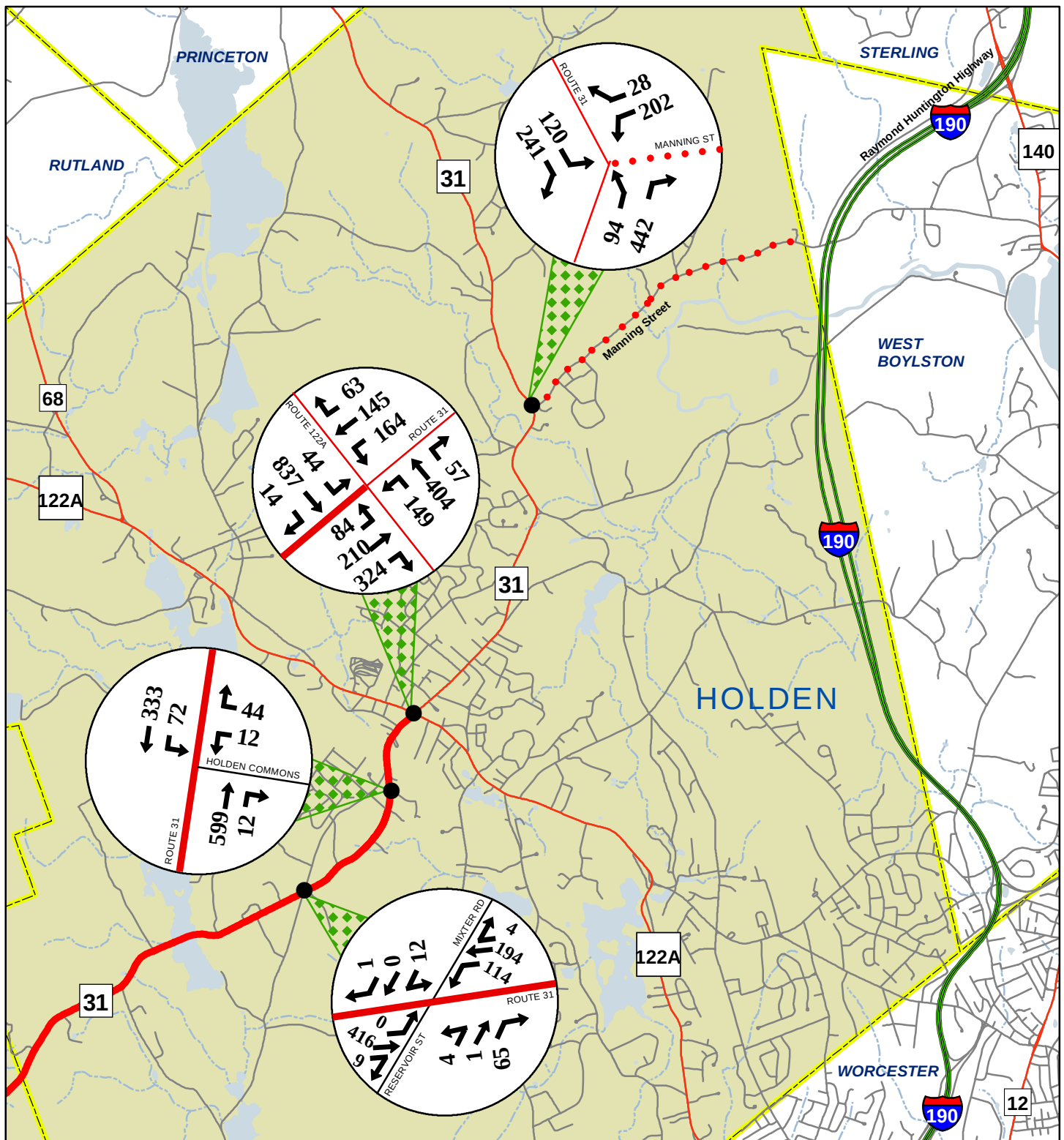
the last column of the table shows whether additional amounts were either “captured” under the general 10% anticipated growth projected by the model or if it was decided to add additional specific traffic volumes from those developments into the general overall year 2023 numbers.

Next, in order to fully account for anticipated future year trucking volumes, a 1% gross increase in heavy vehicle percentages was added along the entire Route 31 corridor to be in effect for future analysis year 2023. Truck percentages affect intersection LOS calculations by adjusting (decreasing) available lane capacity at study intersections.

The resulting 2023 traffic flow networks for the AM and PM peak flow periods were then analyzed to characterize future operating conditions. **Figures 32 to 37** illustrate 10-year projections of the existing volumes, assuming an annual growth rate of 1%. The complete TMC datasheets have been provided in the document’s Technical Appendix.

Trip Generation Section References

- Steven J. Tyler, PE, Spencer Facilities & Utilities Superintendent: Email materials regarding local trip generation
- Isabel McCauley, PE, Holden Senior Civil Engineer: Email materials regarding local trip generation
- NEAG operator George W. Bell, II: Personal observations from a spring 2013 meeting, plus a letter dated May 4, 2012 and provided by the town of Spencer regarding NEAG trucking concerns, specifically, the condition of the Route 31 bridges in Spencer over the Seven Mile River
- CMRPC land use staff : “Rural 11 Compact” study completed in December 2013



ROUTE 31 CORRIDOR PROFILE: HOLDEN

Projected 2023 Traffic Flows

AM Peak Hour Period

Figure 32



Legend

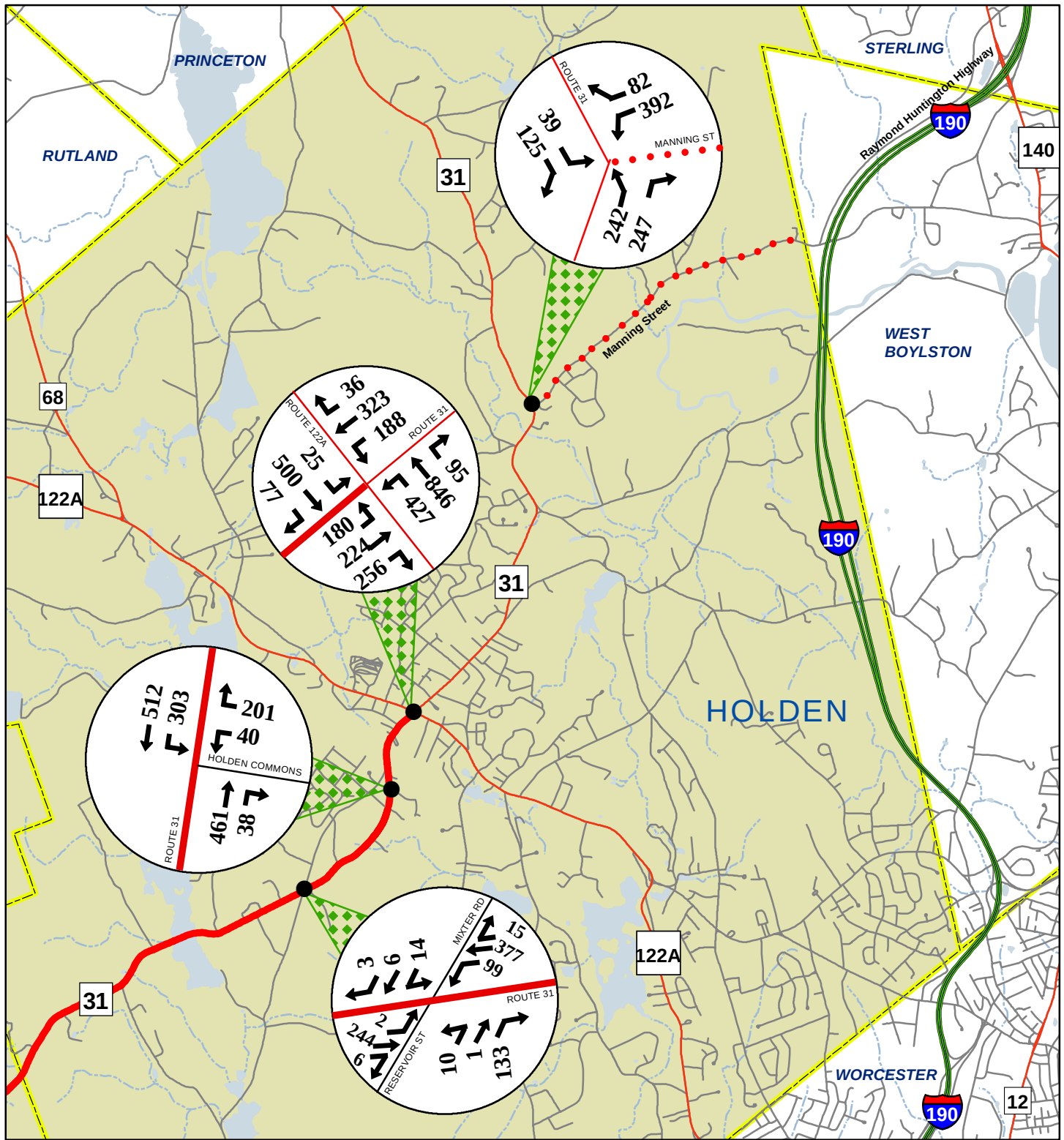
- Route 31 - Holden, Paxton, Spencer
- ... Route 31 Corridor Profile Extension
- Interstate
- State Numbered Routes
- Other Roadways



Source: Data provided by the US Census Bureau, Central Massachusetts 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 in = 0.79 miles



ROUTE 31 CORRIDOR PROFILE: HOLDEN

Projected 2023 Traffic Flows

PM Peak Hour Period

Figure 33



Legend

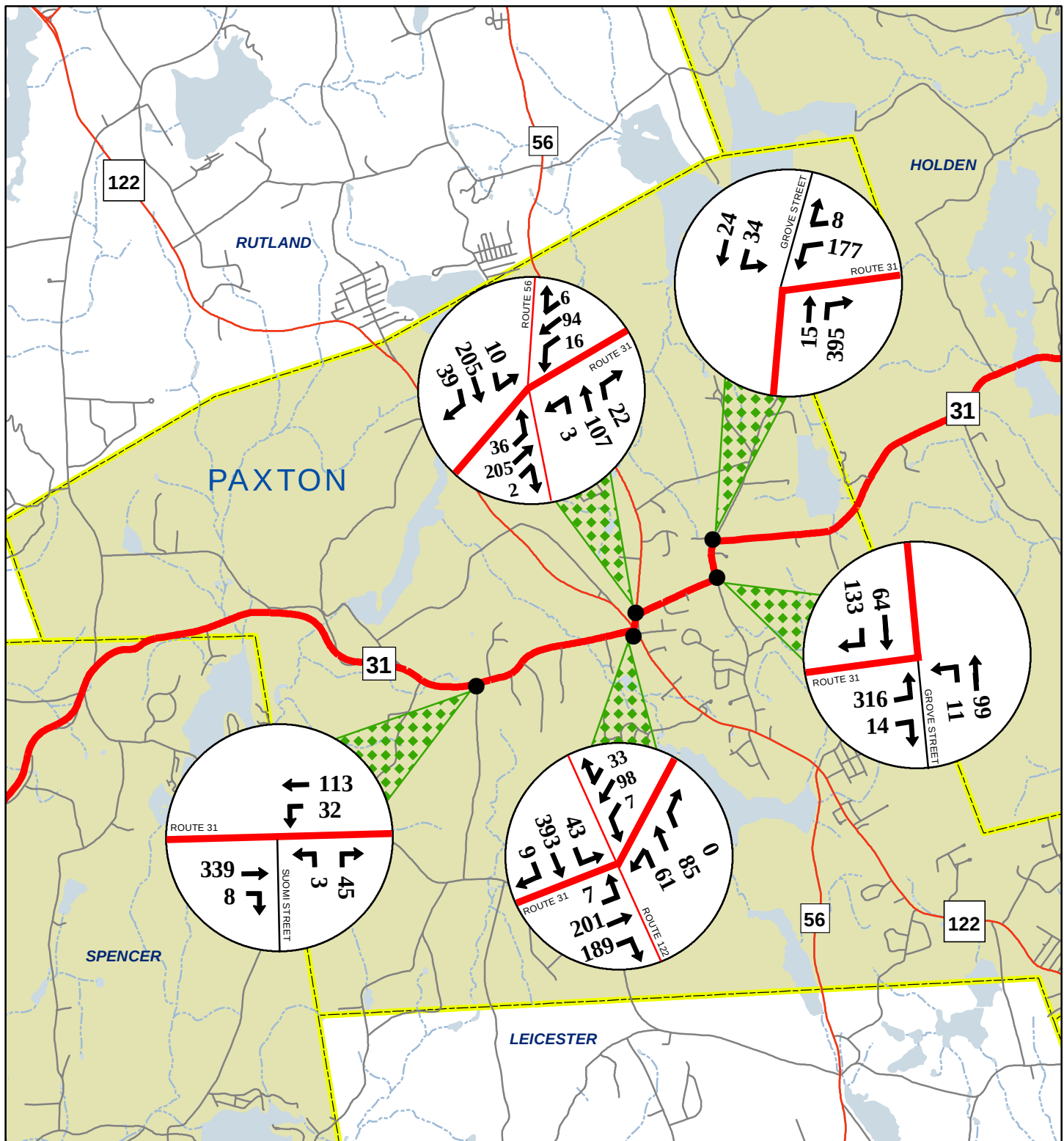
- Route 31 - Holden, Paxton, Spencer
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- Interstate
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ROUTE 31 CORRIDOR PROFILE: PAXTON

Projected 2023 Traffic Flows

AM Peak Hour Period

Figure 34



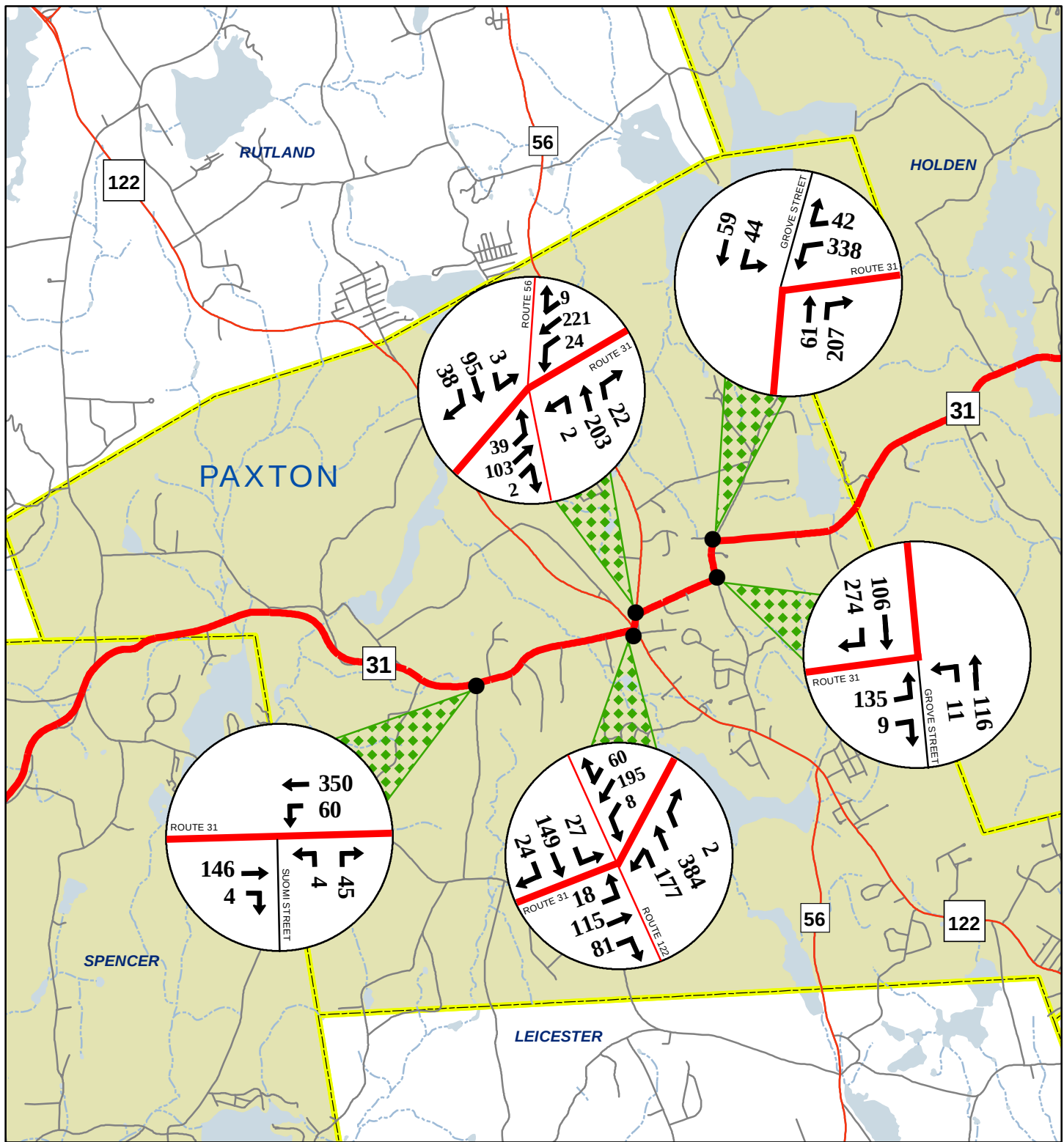
Legend

- Route 31 - Holden, Paxton, Spencer
- State Numbered Routes
- Other Roadways

1 in = 0.75 miles

Source: Data provided by the US Census Bureau, Central Massachusetts 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 31 CORRIDOR PROFILE: PAXTON

Projected 2023 Traffic Flows

PM Peak Hour Period

Figure 35



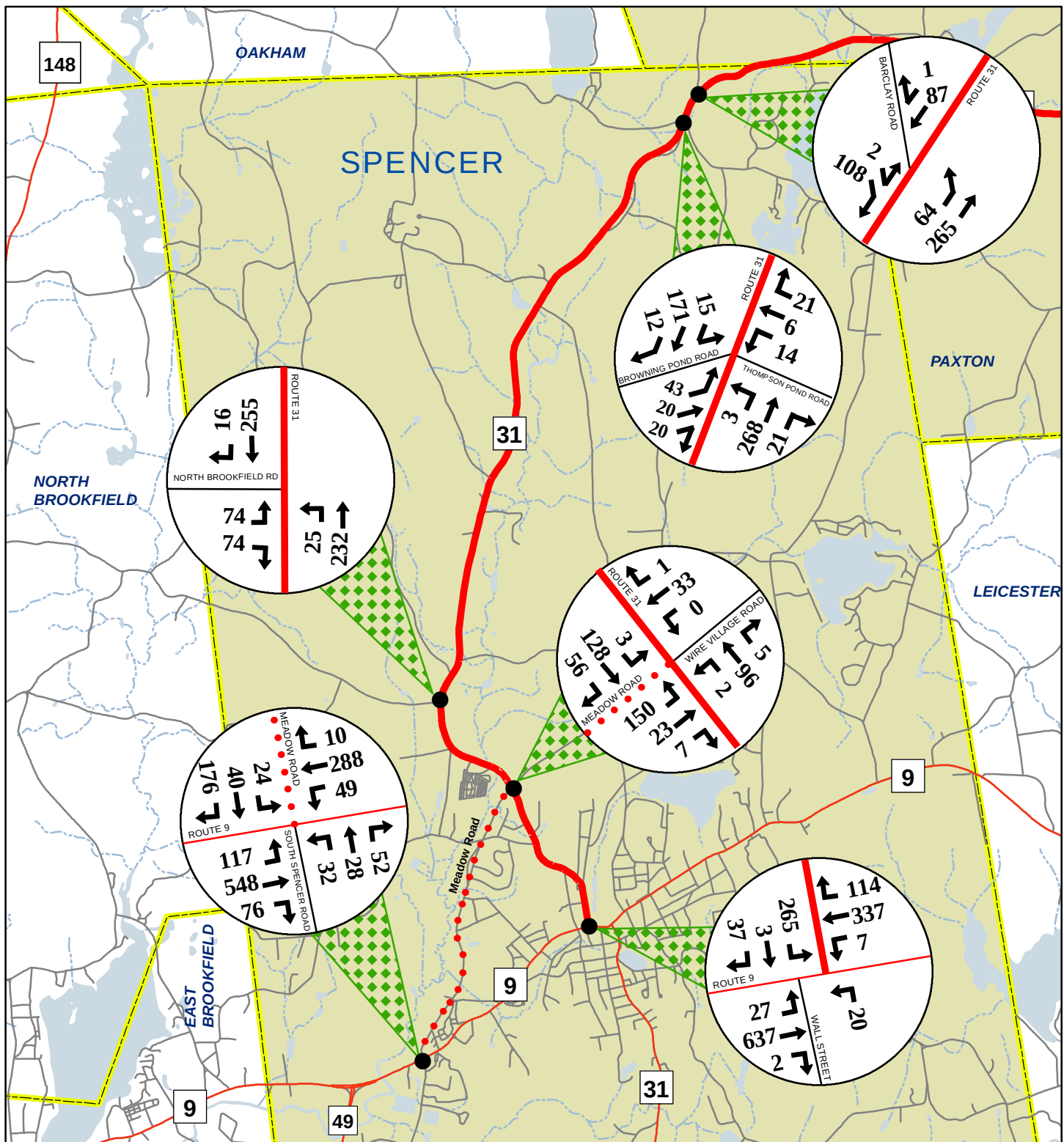
Legend

- Route 31 - Holden, Paxton, Spencer
- State Numbered Routes
- Other Roadways

Source: Data provided by the US Census Bureau, Central Massachusetts 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 in = 0.75 miles



ROUTE 31 CORRIDOR PROFILE: SPENCER

Projected 2023 Traffic Flows

AM Peak Hour Period

Figure 36



Legend

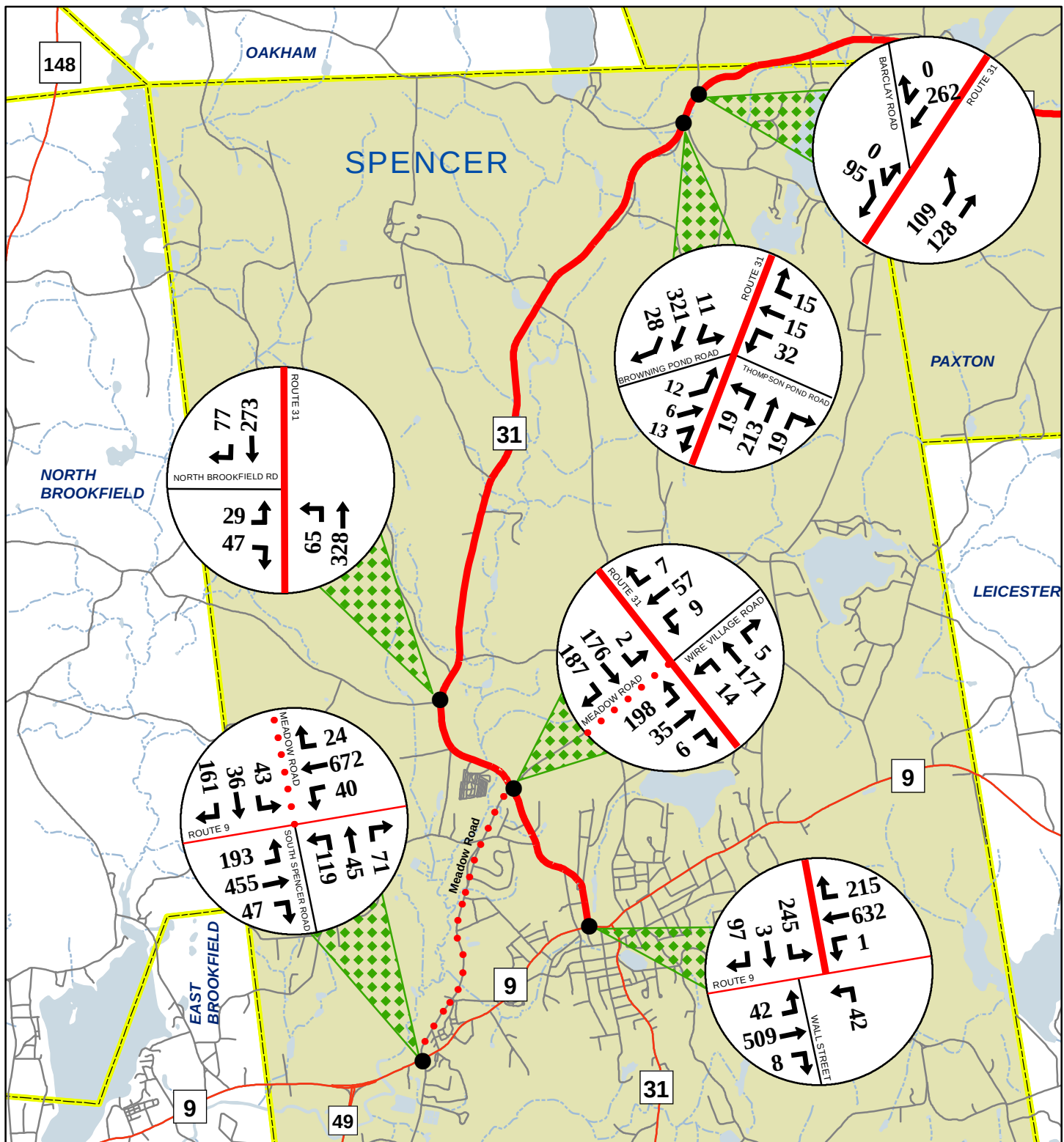
- Route 31 - Holden, Paxton, Spencer
- Route 31 Corridor Profile Extension
- State Numbered Routes
- Other Roadways



Source: Data provided by the US Census Bureau, Central Massachusetts 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 in = 0.75 miles



ROUTE 31 CORRIDOR PROFILE: SPENCER

Projected 2023 Traffic Flows

PM Peak Hour Period

Figure 37



Legend

- Route 31 - Holden, Paxton, Spencer
- ... Route 31 Corridor Profile Extension
- State Numbered Routes
- Other Roadways



Source: Data provided by the US Census Bureau, Central Massachusetts 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 in = 0.75 miles

3.7 Route 31 Intersections Peak Hour Level of Service (LOS) Analyses

Table 6 lists the existing and projected Levels of Service (LOS) for the focus intersections. The complete LOS worksheets have been provided in the document's Technical Appendix. The following notable trends have been observed:

- The signalized intersection with the worst LOS was Route 31 & Route 122A in Holden. For existing conditions, it has a LOS of "C" in the AM and "D" in the PM. The LOS was one letter grade worse for the projected 2023 conditions. The other three signalized intersections had a LOS of either "B" or "C" for existing and projected 2023 conditions.
- Route 31 & Route 122A also had the longest delays in the AM and PM for existing and projected 2023 conditions. This intersection had a volume to capacity (V/C) of 1.19 in the PM for the 2023 projection. The higher the V/C, especially when over 1, the longer it takes for vehicles to travel through a intersection.
- For existing conditions, most unsignalized intersections had a LOS of "C" or above. The additional intersection of Route 31 & Manning Street had a LOS of "D" in the AM and "E" in the PM.
- Projected 2023 conditions were much worse for Route 31 & Manning Street. The delays lengthened by at least 20 seconds for the AM and PM, and the LOS for both time periods was an "F". The majority of the remaining unsignalized intersections had a LOS of either "B" or "C". Also, Holden Commons and Reservoir Street/Mixer Road intersections drop to a "D" in the PM from a "C" in the existing condition.

TABLE 6

**Intersection Level Of Service (LOS) Analyses Results:
Existing Conditions & Projected 2023 Conditions**

N E T W O R K													
COMMUNITY	ROUTE 31 INTERSECTION	Existing Balanced						2023 Projected					
		AM			PM			AM			PM		
		V/C ¹	Delay ²	LOS	V/C ¹	Delay ²	LOS	V/C ¹	Delay ²	LOS	V/C ¹	Delay ²	LOS
SIGNALIZED													
Holden	Route 31/Route 122A	0.82	30	C	0.84	37	D	0.94	35	D	1.19	66	E
Paxton	Route 31/Route 122	0.56	14	B	0.39	12	B	0.64	14	B	0.62	13	B
Spencer	Route 31/Route 9*	0.67	21	C	0.89	26	C	0.76	23	C	0.99	33	C
	Route 9/Meadow Rd/South Spencer Rd**	0.53	12	B	0.50	12	B	0.43	12	B	0.60	13	B
UNSIGNALIZED ³													
Holden	Route 31/Manning St**	0.65	33	D	0.87	42	E	0.82	53	F	1.02	76	F
	Route 31/Holden Commons	0.09	15	B	0.31	19	C	0.12	17	C	0.55	29	D
	Route 31/Reservoir St/Mixter Rd	0.11	19	C	0.20	21	C	0.13	23	C	0.26	27	D
Paxton	Route 31(Holden Rd)/Grove St	0.29	13	B	0.54	16	C	0.34	13	B	0.62	19	C
	Route 31(Maple St)/Grove St	0.44	14	B	0.22	12	B	0.51	15	C	0.26	13	B
	Route 31/Route 56	0.41	16	C	0.48	17	C	0.48	18	C	0.57	21	C
	Route 31/Suomi St	0.06	10	B	0.06	10	A	0.07	11	B	0.07	10	A
Spencer	Route 31/Barclay Rd	0.12	9	A	0.12	10	B	0.13	9	A	0.14	11	B
	Route 31/Browning Pond/Thompson Pond	0.15	13	B	0.14	14	B	0.18	14	B	0.17	16	C
	Route 31/North Brookfield Rd	0.27	14	B	0.14	13	B	0.33	15	C	0.17	14	B
	Route 31/Meadow Rd/Wire Village Rd	0.28	13	B	0.48	20	C	0.33	14	B	0.61	26	D

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 collected by VHB

**Additional intersections

4.0 SAFETY MANAGEMENT SYSTEM (SMS)

For this Corridor Profile, CMRPC staff researched vehicle crash information for the three-year period from January 2010 to December 2012 for the town of Paxton and from July 2010 to June 2013 for the town of Spencer. For the town of Holden, the crash research period was the 18-month period from January 2012 to July 2013. Crash reports filed at the Holden, Paxton and Spencer Police Departments were utilized for this effort. This chapter will discuss the results of the crash reports for all three towns in this study.

Included for each town is a summary table of all recorded crashes, split by separate categories in order to aid analysis. The nine categories are severity, crash type, day of week, time of day, weather conditions, light conditions, road conditions, season, and general location. Also, crash diagrams were made of the one or two intersections with the most crashes for each town. These diagrams show where each crash occurred at the intersection and what type of crash it was. Information about each crash is also included below the diagram. Lastly, every recorded crash is listed in a summary table which displays the various category information and relevant details.

To help aid in the analysis, a crash rate was also calculated for each of the focus intersections in this study. The more frequently a crash occurs the higher the crash rate will be. Rates are calculated and shown as “number of crashes per million vehicles entering” the intersection, a standard rate used in most comparisons. As indicated in **Table 7**, three intersections exceeded the average crash rate for the MassDOT District 3 region. The highest crash rate belongs to the intersection of Route 31/Meadow Road/Wire Village Road in the town of Spencer with a value of 1.713, which is over two times the District average. Route 31/Route 122A in the town of Holden had the second highest rate with a 1.399. Route 31/Holden Commons was the only focus intersection without a crash for this study.

Table 7

Vehicle Crash Rates at Focus Intersections

Focus Intersection	Crash Rate (per million entering vehicles)	Average Crash Rate (District 3)	Percent of District Average
Holden			
Route 31/Route 122A	1.399	0.890	157%
Route 31/Holden Commons	0.000	0.660	0%
Route 31/Mixter Rd/Reservoir St	0.416	0.660	63%
Paxton			
Route 31(Holden Rd)/Grove St	0.484	0.660	73%
Route 31(Maple St)/Grove St	0.558	0.660	85%
Route 31/Route 56	0.938	0.660	142%
Route 31/Route 122	0.685	0.890	77%
Route 31/Suomi St	0.298	0.660	45%
Spencer			
Route 31/Barclay Rd	0.304	0.660	46%
Route 31/Browning Pond Rd/ Thompson Pond Rd	0.387	0.660	59%
Route 31/North Brookfield Rd	0.339	0.660	51%
Route 31/Meadow Rd/Wire Village Rd	1.713	0.660	260%
Route 9/Route 31 (Pleasant Street)	0.507	0.890	57%
Route 9/Meadow Rd/South Spencer Road*	0.762	0.890	86%

Notes: (1) Intersection crash rates were calculated from vehicle collision information compiled through research at the Holden Police Department for a 18-month period from January 2012 to July 2013. Paxton crash data was collected for a three-year period from January 2010 to December 2012. Lastly, the Spencer crash data was collected for a three-year period from July 2010 to June 2013. (2) The most recent crash rate average for MassDOT District 3 is 0.89 for signalized intersections and 0.66 for unsignalized intersections. MassDOT specifies this rate for comparative use within the District.

**Additional study intersection*

4.1 Town of Holden Crash Analysis

For the town of Holden, vehicle crash records were analyzed for a period of 18 months. All crashes along Route 31 from Route 122A to the Paxton town line were tabulated. Also, crashes on minor streets that were close to or at Route 31 were also included. All important information from the crash reports was organized and included in the various tables and figures that follow.

As shown in **Table 8**, there were a total of 51 crashes reported in the 18 months. The Route 122A intersection had the most with a total of 24. Property damage only crashes accounted for over 80% of the total. Rear-end crashes were the most prevalent with a total of 21. Angle crashes were the second most with ten. The fall season had the least amount of crashes with only 12% occurring within those three months. The remaining seasons were similar to each other with about 30%. Most of the crashes happened on a Friday and the fewest occurred on Tuesdays and Sundays. Only 20% of the crashes were during the AM or PM peak periods, with the remaining 80% falling within the rest of the time. Over 50% of the crashes occurred in clear weather, during the day, and on a dry roadway surface, but not necessarily at the same time.

Figure 38 is a crash diagram of the Route 31/Route 122A intersection. This diagram displays the location of each of the 24 crashes that occurred at this location. There were three sideswipe crashes heading away from the intersection on Route 122A. This could be due to drivers changing lanes to avoid slower traffic. There were 11 rear-end crashes; ten of them were on the approach to the intersection. There were five angle crashes from vehicles exiting the Mobile gas station in the southeast corner of the intersection. Some of these could be “courtesy crashes” in which one driver stops to let a vehicle enter the roadway while another vehicle already on the roadway continues with his right of way. Lastly, there were three cross move crashes, one fixed object crash and one car that ran off the road.

In **Table 9**, all 51 of the Route 31 crashes are listed. The crashes are ordered by the location starting with Route 122A and then heading south towards the Paxton town line. The details about each crash are listed along with any violations or comments. Out of the 51 crashes, 34 occurred at intersecting streets and the remaining 17 crashes happened between the minor streets. The lines shaded in gray are non-intersection crashes.

Table 8

**SUMMARY OF REPORTED VEHICLE CRASHES
ON ROUTE 31 IN THE TOWN OF HOLDEN
JANUARY 1, 2012 - JULY 31, 2013**

<u>Route 31 Location</u>	<u>Jan '012-July '013</u>	<u>Day of the Week:</u>		
Route 122A	24	Monday	8	16%
Pleasant Street	3	Tuesday	4	8%
Towle Drive	1	Wednesday	8	16%
Avery Heights	1	Thursday	9	18%
Greystone Drive	2	Friday	12	22%
Mixer Road/Reservoir Street	2	Saturday	6	12%
South Road	1	Sunday	4	8%
Other Roadway Segments	17		51	100%
Total	51			
Severity:		Time of Day:		
Property damage only	42	7 - 9 AM	2	4%
Personal injury	9	4 - 6 PM	9	18%
Fatality	0	Remainder	40	78%
	51		51	100%
Crash Type:		Weather Conditions:		
Rear End	21	Clear	26	51%
Angle	10	Rain	16	31%
Fixed Object	6	Snow	7	14%
Sideswipe	5	Cloudy	2	4%
Ran Off Road	4		51	100%
Cross Move	4	Light Conditions:		
Hit Deer	1	Daylight	29	57%
	51	Dark	13	25%
		Dusk	8	16%
Season:		Dawn	1	2%
Winter	15		51	100%
Spring	14	Road Conditions:		
Summer	16	Dry	27	53%
Fall	6	Wet	16	31%
	51	Snow	7	14%
		Icy	1	2%
			51	100%

(Bold text indicates crash diagram compiled)

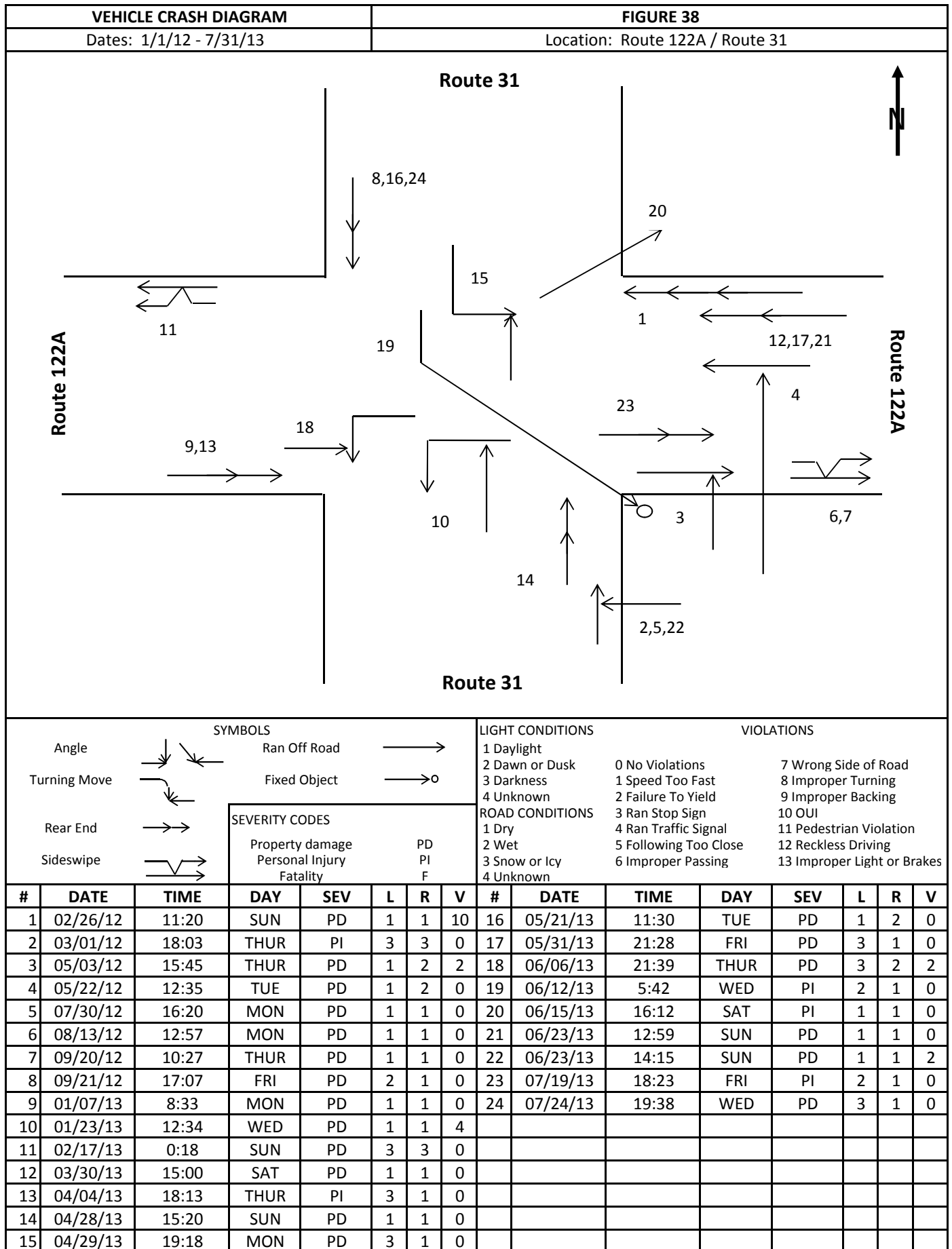


TABLE 9 Holden - Route 31 Vehicle Crash Inventory

#	HPD ID #	Route 31 Location	Date	Day of Week	Time of Day	Type	Severity	Conditions			Violations/Comments
								Weather	Light	Road	
1	12-36	Route 31/Route 122A	02/26/12	Sunday	11:20	Rear End	Property Damage	Clear	Daylight	Dry	OUI
2	12-40	Route 31/Route 122A	03/01/12	Thursday	18:03	Angle	Personal Injury	Snow	Dusk	Snowy	None
3	12-64	Route 31/Route 122A	05/03/12	Thursday	15:45	Angle	Property Damage	Rain	Daylight	Wet	Failure to Yield
4	12-77	Route 31/Route 122A	05/22/12	Tuesday	12:35	Angle	Property Damage	Rain	Daylight	Wet	None
5	12-120	Route 31/Route 122A	07/30/12	Monday	16:20	Angle	Property Damage	Clear	Daylight	Dry	None
6	12-129	Route 31/Route 122A	08/13/12	Monday	12:57	Sideswipe	Property Damage	Clear	Daylight	Dry	None
7	12-147	Route 31/Route 122A	09/20/12	Thursday	10:27	Sideswipe	Property Damage	Clear	Daylight	Dry	None
8	12-148	Route 31/Route 122A	09/21/12	Friday	17:07	Rear End	Property Damage	Cloudy	Daylight	Dry	None
9	13-7	Route 31/Route 122A	01/07/13	Monday	8:33	Rear End	Property Damage	Clear	Daylight	Dry	None
10	13-25	Route 31/Route 122A	01/23/13	Wednesday	12:34	Cross Move	Property Damage	Clear	Daylight	Dry	Ran Red Light
11	13-42	Route 31/Route 122A	02/17/13	Sunday	0:18	Sideswipe	Property Damage	Snow	Dark	Snowy	None
12	13-62	Route 31/Route 122A	03/30/13	Saturday	15:00	Rear End	Property Damage	Clear	Daylight	Dry	None
13	13-65	Route 31/Route 122A	04/04/13	Thursday	18:13	Rear End	Personal Injury	Clear	Dusk	Dry	None
14	13-76	Route 31/Route 122A	04/28/13	Sunday	15:20	Rear End	Property Damage	Clear	Daylight	Dry	None
15	13-77	Route 31/Route 122A	04/29/13	Monday	19:18	Cross Move	Property Damage	Clear	Dark	Dry	None
16	13-94	Route 31/Route 122A	05/21/13	Tuesday	11:30	Rear End	Property Damage	Rain	Daylight	Wet	None
17	13-96	Route 31/Route 122A	05/31/13	Friday	21:28	Rear End	Property Damage	Clear	Dark	Dry	None
18	13-98	Route 31/Route 122A	06/06/13	Thursday	21:39	Cross Move	Property Damage	Rain	Dark	Wet	Failure to Yield
19	13-100	Route 31/Route 122A	06/12/13	Wednesday	5:42	Fixed Object	Personal Injury	Cloudy	Dark	Dry	Driver Lost Consciousness
20	13-103	Route 31/Route 122A	06/15/13	Saturday	16:12	Ran Off Road	Personal Injury	Clear	Daylight	Dry	Motorcycle Crash
21	13-108	Route 31/Route 122A	06/23/13	Saturday	12:59	Rear End	Property Damage	Clear	Daylight	Dry	None
22	13-109	Route 31/Route 122A	06/23/13	Sunday	14:15	Angle	Property Damage	Clear	Daylight	Dry	Failure to Yield
23	13-121	Route 31/Route 122A	07/19/13	Friday	18:23	Rear End	Personal Injury	Clear	Daylight	Dry	None
24	13-128	Route 31/Route 122A	07/24/13	Wednesday	19:38	Rear End	Property Damage	Clear	Dark	Dry	None
25	12-16	Route 31/Pleasant St	01/27/12	Friday	13:51	Angle	Property Damage	Rain	Daylight	Wet	Car Was Backing Up
26	12-85	Route 31/Pleasant St	06/05/12	Tuesday	9:05	Rear End	Property Damage	Rain	Daylight	Wet	Car Was Backing Up
27	12-210	Route 31/Pleasant St	12/15/12	Saturday	16:59	Rear End	Property Damage	Clear	Dusk	Dry	None
28	12-149	75 Reservoir St	09/22/12	Saturday	18:44	Angle	Property Damage	Rain	Dusk	Wet	Failure to Yield R-O-W
29	12-127	94 Reservoir St	08/10/12	Friday	15:14	Rear End	Property Damage	Rain	Daylight	Wet	Driver Not Paying Attention
30	12-201	94 Reservoir St	12/05/12	Wednesday	16:44	Rear End	Property Damage	Rain	Dusk	Wet	None
31	13-122	164 Reservoir St	07/09/13	Friday	9:51	Rear End	Property Damage	Clear	Daylight	Dry	Driver Not Paying Attention
32	12-176	Route 31/Towle Dr	10/29/12	Monday	18:32	Fixed Object	Property Damage	Rain	Dark	Wet	Tree Fell on Car
33	12-136	Route 31/Avery Hts	08/31/12	Friday	14:27	Angle	Personal Injury	Clear	Daylight	Dry	None

Data Collected from January 2012 Through July 2013

Lines Shaded in Gray are Non Intersection Crashes

TABLE 9 Holden - Route 31 Vehicle Crash Inventory

#	HPD ID #	Route 31 Location	Date	Day of Week	Time of Day	Type	Severity	Conditions			Violations/Comments
								Weather	Light	Road	
34	12-206	Route 31/Greystone Dr	12/07/12	Friday	15:55	Rear End	Property Damage	Rain	Daylight	Wet	Stopped For School Bus
35	13-60	Route 31/Greystone Dr	03/20/13	Wednesday	10:31	Angle	Property Damage	Clear	Daylight	Dry	None
36	12-169	421 Reservoir St	10/24/12	Wednesday	23:24	Ran Off Road	Property Damage	Rain	Dark	Wet	Driver Fell Asleep
37	12-10	Route 31/Mixter Rd	01/20/12	Friday	13:58	Angle	Property Damage	Snow	Daylight	Snowy	Ran Stop Sign
38	12-87	Route 31/Mixter Rd	06/07/12	Thursday	10:34	Ran Off Road	Personal Injury	Rain	Daylight	Wet	Driver Lost Consciousness
39	13-73	46 South Rd	04/23/13	Tuesday	16:49	Rear End	Property Damage	Rain	Dusk	Wet	None
40	12-71	177 South Rd	05/18/12	Friday	16:08	Sideswipe	Personal Injury	Clear	Daylight	Dry	Driver Suffered From Illness
41	12-35	250 South Rd	02/24/12	Friday	23:32	Fixed Object	Property Damage	Snow	Dark	Snowy	OUI / Hit Guardrail
42	12-150	South Rd over Causeway	09/22/12	Saturday	22:47	Hit Deer	Property Damage	Rain	Dark	Wet	None
43	13-15	270 South Rd	01/17/13	Thursday	7:23	Fixed Object	Property Damage	Clear	Dawn	Icy	Lost Control and Hit Tree
44	12-63	South Rd/Pole #39s	04/30/12	Monday	10:46	Fixed Object	Property Damage	Clear	Daylight	Dry	Driver Was On Medication
45	13-54	South Rd/Unknown	03/07/13	Thursday	18:50	Cross Move	Personal Injury	Snow	Dark	Snowy	Driver Lost Control
46	13-33	Route 31/South Rd	01/30/13	Wednesday	4:52	Fixed Object	Property Damage	Snow	Dark	Snowy	Lost Control and Hit Tree
47	12-133	Route 31/Near South Rd	08/29/12	Wednesday	11:40	Ran Off Road	Property Damage	Clear	Daylight	Dry	Tried to Avoid Another Car
48	12-220	60 Paxton Rd	12/27/12	Thursday	18:18	Sideswipe	Property Damage	Snow	Dark	Snowy	Driver Lost Control
49	12-29	84 Paxton Rd	02/13/12	Monday	16:33	Rear End	Property Damage	Clear	Dusk	Dry	Solar Glare
50	12-28	108 Paxton Rd	02/13/12	Monday	16:33	Rear End	Property Damage	Clear	Dusk	Dry	Truck Backing Up
51	13-99	264 Paxton Rd	06/07/13	Friday	19:00	Rear End	Property Damage	Rain	Daylight	Wet	None

4.2 Town of Paxton Crash Analysis

For the town of Paxton, vehicle crash records were analyzed for a period of three years. All crashes along Route 31 from the Holden town line to the Spencer town line were tabulated. Also, crashes on minor streets that were close to or at Route 31 were also included. All important information from the crash reports was organized and included in the various tables and figures that follow.

As shown in **Table 10**, there were a total of 48 crashes reported in the three-year period. The Route 56 and Route 122 intersections had the most crashes with a total of eight and nine respectively. Property damage only crashes accounted for over 94% of the total. Only three of the 48 crashes caused personal injuries. The top two crash types were angle and fixed object crashes. Each of these types were over 20% of the total number of crashes. Unusually, there were also five sideswipe crashes. These types of crashes are more common on multi-lane roadways. There were also five crashes that involved a vehicle striking a deer. With a large portion of the roadway being in a wooded area, this is not uncommon. The winter season had the most crashes with a total of 18 or 37%. Most of the crashes happened on a Wednesday or Saturday with both of the days accounting for more than 20% of the total. Monday had the fewest amount of crashes with a total of three. The majority of crashes occurred outside of the AM and PM peak periods. Most crashes happened during clear weather and a dry roadway surface. Also, crashes occurred almost as frequently during darkness as in the daytime.

The crash diagram in **Figure 39** is for the Route 31/Route 56 intersection. Route 56 has the right of way and Route 31 is controlled by stop signs. There were a total of eight crashes in the three-year period at this intersection. Of the eight crashes, only one of them caused a personal injury. There were seven angle crashes and one fixed object crash. One of the angle crashes occurred because a vehicle went through the stop sign without stopping. Three of the crashes happened on a snow or icy roadway, but most of them were on a dry road. **Figure 40** is a crash diagram for the intersection of Route 31 and Route 122. There were a total of nine crashes at this intersection during the study period. There were no personal injuries resulting from these nine crashes. There were two sideswipe crashes, one on Route 122 eastbound and one on Route 31. There were two rear-end collisions and one angle crash. There were also four cross movement crashes. The unusual geometry of this intersection might have been a factor in the four cross movement crashes. For one of the cross movement crashes, the driver did not yield to oncoming traffic. The majority of crashes were during the day and on a dry roadway surface.

In **Table 11**, all 48 of the Route 31 crashes are listed. The crashes are ordered by the location starting with the Holden town line and then heading south towards the Spencer town line. The details about each crash are listed along with any violations or comments. Out of the 48 crashes, 35 occurred at intersecting streets and the remaining 13 crashes happened between the minor streets. The lines shaded in gray are non-intersection crashes. Of the 48 crashes, five of drivers involved were cited for driving violations.

Table 10

**SUMMARY OF REPORTED VEHICLE CRASHES
ON ROUTE 31 IN THE TOWN OF PAXTON
JANUARY 1, 2010 - DECEMBER 31, 2012**

<u>Route 31 Location</u>	<u>Jan '10-Dec '12</u>	<u>Day of the Week:</u>		
Bel Arbor Drive	1	Monday	3	6%
Grove St/Holden Road	4	Tuesday	5	10%
Grove St/Maple Street	4	Wednesday	10	21%
Whitney Drive	1	Thursday	5	10%
Route 56	8	Friday	6	13%
Route 122	9	Saturday	12	25%
Shanandoah Road	2	Sunday	7	15%
Keep Avenue	2		48	100%
Suomi Street	2			
Nanigan Road	1	<u>Time of Day:</u>		
Unknown	1			
Other Roadway Segments	13	7 - 9 AM	8	17%
Total	48	4 - 6 PM	9	19%
		Remainder	31	64%
<u>Severity:</u>			48	100%
		<u>Weather Conditions:</u>		
Property damage only	45			
Personal injury	3	Clear	29	60%
Fatality	0	Snow	9	19%
	48	Rain	6	13%
		Cloudy	3	6%
<u>Crash Type:</u>		Fog	1	2%
Angle	12		48	100%
Fixed Object	10	<u>Light Conditions:</u>		
Rear End	7			
Cross Move	6	Daylight	20	41%
Sideswipe	5	Dark	19	40%
Hit Deer	5	Dusk	6	13%
Ran Off Road	2	Dawn	3	6%
Hit Parked Car	1		48	100%
	48	<u>Road Conditions:</u>		
<u>Season:</u>		Dry	28	58%
		Snow	9	19%
Winter	18	Wet	7	15%
Spring	8	Icy	4	8%
Summer	11		48	100%
Fall	11			
	48			

(Bold text indicates crash diagram compiled)

TABLE 11 Paxton - Route 31 Vehicle Crash Inventory

#	PPD ID #	Route 31 Location	Date	Day of Week	Time of Day	Type	Severity	Conditions			Violations/Comments
								Weather	Light	Road	
1	12-1	At Holden Town Line	01/02/12	Monday	1:19	Fixed Object	Property Damage	Cloudy	Dark	Snowy	Fell Asleep & Hit Tree
2	12-9	320 Holden Rd	02/29/12	Wednesday	16:22	Fixed Object	Property Damage	Clear	Dusk	Icy	Hit Guardrail
3	Unk	Holden St/Bel Arbor Dr	04/01/11	Friday	7:00	Rear End	Property Damage	Snow	Daylight	Snowy	None
4	12-34	78 Holden Rd	11/07/12	Wednesday	15:50	Fixed Object	Property Damage	Snow	Daylight	Snowy	Hit Utility Pole
5	11-42	64 Holden Rd	07/02/11	Saturday	22:25	Rear End	Property Damage	Clear	Dark	Dry	Driver Stopped for Dog
6	10-27	Grove St/Holden St	07/07/10	Wednesday	16:00	Angle	Property Damage	Clear	Daylight	Dry	None
7	Unk	Grove St/Holden St	09/11/11	Sunday	8:30	Angle	Property Damage	Clear	Daylight	Dry	Car Backing out of Driveway
8	11-66	Grove St/Holden St	10/29/11	Saturday	15:21	Sideswipe	Property Damage	Snow	Daylight	Snowy	Hit Car Turning Onto Holden Rd
9	11-70	Grove St/Holden St	12/02/11	Friday	12:39	Rear End	Property Damage	Clear	Daylight	Dry	None
10	Unk	228 Grove St	02/02/11	Wednesday	6:45	Angle	Property Damage	Snow	Dawn	Snowy	Car Backing out of Driveway
11	11-2	211 Grove St	01/06/11	Thursday	19:44	Hit Parked Car	Property Damage	Clear	Dark	Dry	None
12	10-29	Grove St/Maple St	07/27/10	Tuesday	19:53	Rear End	Property Damage	Clear	Dusk	Dry	Car Backing up Hit Other Car
13	10-32	Grove St/Maple St	08/21/10	Saturday	22:28	Fixed Object	Personal Injury	Clear	Dark	Dry	Motorcycle Hit Tree, Oper Error
14	11-10	Grove St/Maple St	02/06/11	Sunday	16:18	Cross Move	Property Damage	Clear	Dusk	Dry	None
15	11-23	Grove St/Maple St	04/01/11	Friday	5:36	Fixed Object	Property Damage	Snow	Dark	Icy	Lost Control & Hit Fire Hydrant
16	12-42	Maple St/Whitney Dr	12/21/12	Friday	20:02	Cross Move	Property Damage	Clear	Dark	Dry	None
17	Unk	Rte 31/Rte 56	04/13/10	Tuesday	18:41	Angle	Property Damage	Clear	Dark	Dry	None
18	10-52	Rte 31/Rte 56	12/01/10	Wednesday	17:51	Angle	Property Damage	Rain	Dark	Wet	Failure to Yield Right-of-Way
19	11-35	Rte 31/Rte 56	05/17/11	Tuesday	17:13	Angle	Personal Injury	Foggy	Dusk	Wet	Failure to Stop at Stop Sign
20	11-43	Rte 31/Rte 56	07/07/11	Thursday	9:26	Angle	Property Damage	Clear	Daylight	Dry	None
21	11-72	Rte 31/Rte 56	12/07/11	Wednesday	8:02	Fixed Object	Property Damage	Rain	Daylight	Wet	Took Eyes Off Road & Hit Pole
22	12-8	Rte 31/Rte 56	02/29/12	Wednesday	10:04	Angle	Property Damage	Clear	Daylight	Dry	None
23	12-16	Rte 31/Rte 56	06/06/12	Wednesday	18:22	Angle	Property Damage	Clear	Daylight	Dry	None
24	12-33	Rte 31/Rte 56	11/02/12	Friday	22:54	Angle	Property Damage	Clear	Dark	Dry	None
25	Unk	Rte 31/Rte 122	01/02/10	Saturday	10:45	Sideswipe	Property Damage	Snow	Daylight	Snowy	None
26	Unk	Rte 31/Rte 122	12/02/10	Thursday	17:15	Cross Move	Property Damage	Clear	Dark	Dry	None
27	11-11	Rte 31/Rte 122	02/15/11	Tuesday	10:40	Cross Move	Property Damage	Clear	Daylight	Dry	None
28	11-33	Rte 31/Rte 122	05/08/11	Sunday	18:08	Sideswipe	Property Damage	Rain	Dusk	Wet	None
29	11-40	Rte 31/Rte 122	06/24/11	Friday	8:12	Rear End	Property Damage	Rain	Daylight	Wet	None
30	11-56	Rte 31/Rte 122	09/10/11	Saturday	17:14	Rear End	Property Damage	Clear	Daylight	Dry	None
31	11-58	Rte 31/Rte 122	09/15/11	Thursday	13:49	Cross Move	Property Damage	Cloudy	Daylight	Dry	Failure to Yield Right-of-Way
32	12-17	Rte 31/Rte 122	06/13/12	Wednesday	11:40	Angle	Property Damage	Rain	Daylight	Wet	Funeral Procession Thru Red Light
33	12-31	Rte 31/Rte 122	10/27/12	Saturday	19:25	Cross Move	Property Damage	Clear	Dark	Dry	None

Data Collected in 2010 Through 2012

Lines Shaded in Gray are Non Intersection Crashes

TABLE 11 Paxton - Route 31 Vehicle Crash Inventory

#	PPD ID #	Route 31 Location	Date	Day of Week	Time of Day	Type	Severity	Conditions			Violations/Comments
								Weather	Light	Road	
34	10-50	61 West St	11/22/10	Monday	18:11	Hit Deer	Property Damage	Clear	Dark	Dry	None
35	11-36	61 West St	05/28/11	Saturday	19:02	Sideswipe	Property Damage	Cloudy	Dark	Dry	Marked Lane Violation
36	11-3	West St/Shanandoah Rd	01/08/11	Saturday	21:02	Fixed Object	Property Damage	Snow	Dark	Snowy	Hit Utility Pole
37	11-32	West St/Shanandoah Rd	05/31/11	Tuesday	21:40	Hit Deer	Property Damage	Clear	Dark	Dry	Deer Ran Into Car
38	12-18	145 West St	06/17/12	Sunday	1:14	Ran Off Road	Personal Injury	Clear	Dark	Dry	Swerved to Miss Animal
39	10-45	West St/Keep Ave	10/24/10	Sunday	18:30	Sideswipe	Property Damage	Clear	Dark	Dry	Tried to Avoid Car, But Couldn't
40	11-15	West St/Keep Ave	02/26/11	Saturday	12:20	Rear End	Property Damage	Clear	Daylight	Dry	Failure to Use Car in Start/Stop
41	Unk	West St/Suomi St	11/02/10	Tuesday	16:10	Angle	Property Damage	Clear	Daylight	Dry	Car Backing up Hit Other Car
42	11-46	West St/Suomi St	07/11/11	Monday	8:00	Hit Deer	Property Damage	Clear	Daylight	Dry	Deer Hit Fedex Truck
43	10-54	226 West St	12/11/10	Saturday	8:20	Fixed Object	Property Damage	Snow	Daylight	Snowy	Lost Control & Hit Pole
44	12-11	226 West St	03/03/12	Saturday	21:02	Ran Off Road	Property Damage	Clear	Dark	Icy	Lost Control Over Ice
45	11-4	500' East of Black Hill Rd	01/09/11	Sunday	7:38	Fixed Object	Property Damage	Snow	Dawn	Snowy	Lost Control & Hit Guardrail
46	10-22	West St/Nanigan Rd	06/06/10	Sunday	20:47	Hit Deer	Property Damage	Rain	Dark	Wet	None
47	12-36	500 West St	11/14/12	Wednesday	17:12	Hit Deer	Property Damage	Clear	Dusk	Dry	None
48	Unk	Unknown	12/11/10	Saturday	8:00	Fixed Object	Property Damage	Clear	Dawn	Icy	Lost Control & Hit Pole

4.3 Town of Spencer Crash Analysis

For the town of Spencer, vehicle crash records were analyzed for a three-year period. All crashes along Route 31 from the Paxton town line to Route 9 were tabulated. Also, crashes on minor streets that were close to or at Route 31, were also included. All important information from the crash reports was organized and included in the various tables and figures that follow.

As shown in **Table 12**, there were a total of 70 crashes reported during the three-year study period. The Meadow Road/Wire Village Road intersection had the most with a total of 16. The second highest was the Main Street intersection. Property damage crashes accounted for 64% of the total. Of the 70 crashes, 25 of them caused personal injuries. Angle crashes were the most common occurrence with a total of 21, followed by fixed object crashes with 18. The winter season had the most crashes with a total of 27, which is almost 40% of the crashes. The top three days that vehicle crashes occurred were Wednesday, Saturday, and Sunday, all of which had ten or more crashes. Only 30% of the crashes were during the AM or PM peak periods, with the remaining 70% the rest of the time. Over 50% of the crashes occur during clear weather. Of the 70 crashes, 29 happened during the daytime and 21 occurred when it was dark. Lastly, the majority (57%) of crashes were on a dry roadway surface.

Figure 41 is a crash diagram of the Route 31/Meadow Road/Wire Village Road intersection. This diagram displays the location of each of the 16 crashes that occurred at this location. Of the 16 crashes, 12 of them were angle crashes. Of the 12 angle crashes, drivers were cited for either running the stop sign or failure to yield in eight. The remaining four crashes were a cross movement, a sideswipe, a fixed object, and a head-on collision. Of the 16 crashes, over half of them caused personal injuries. Seven of the 16 crashes were during the daytime hours and ten were on dry roads. **Figure 42** is a crash diagram for the intersection of the Route 31/Route 9/Wall Street. There were a total of ten crashes at this intersection. There were no personal injury crashes at this location. There were eight rear-end crashes and two angle crashes. Four rear-end crashes were heading westbound, two were traveling eastbound, and the last two occurred on Wall Street. Seven out of ten crashes were during the daylight hours.

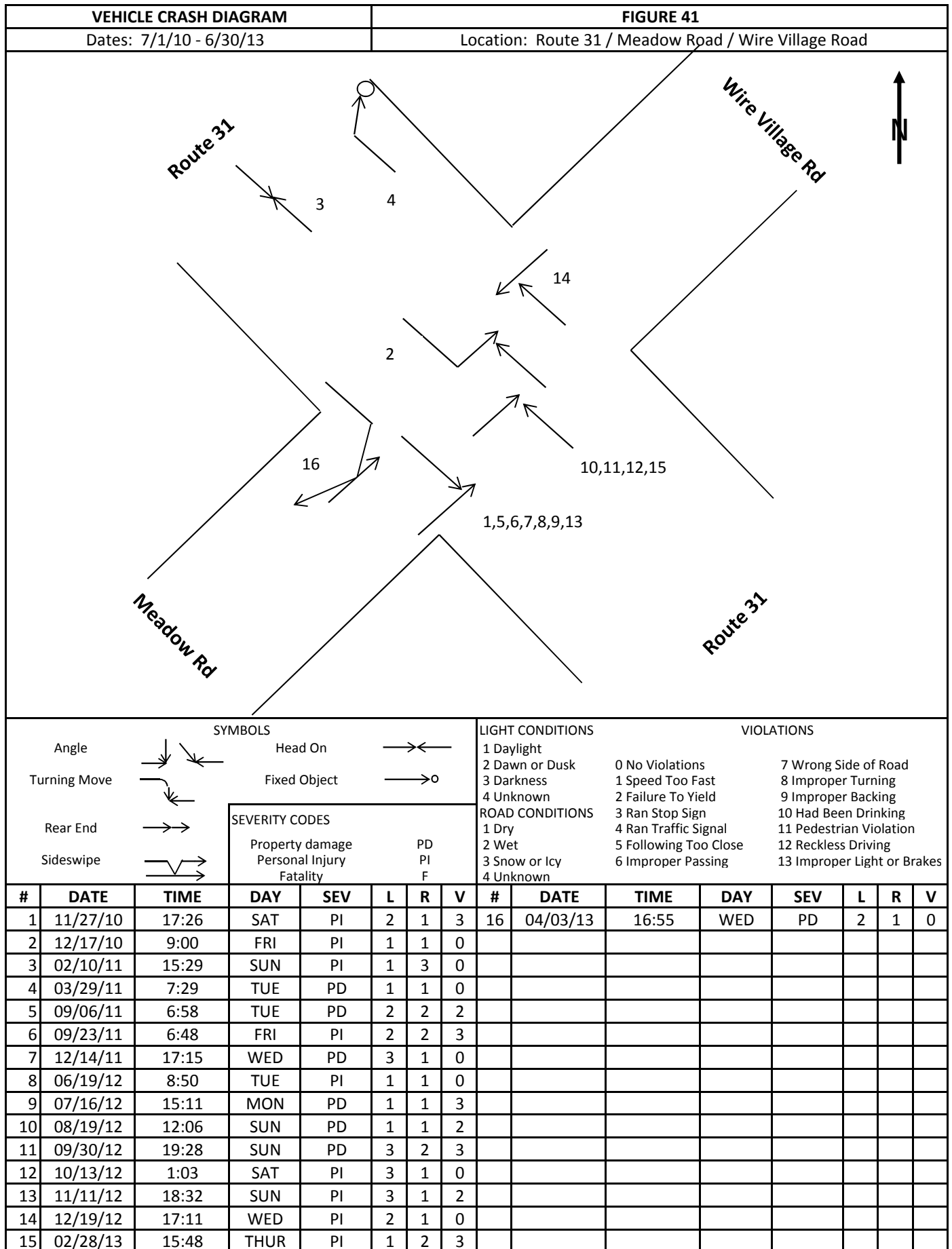
In **Table 13**, all 70 of the Route 31 crashes are listed. The crashes are ordered by the location starting with the Paxton town line and then heading south towards Route 9. The details about each crash are listed along with any violations or comments. Out of the 70 crashes, 43 occurred at intersecting streets and the remaining 27 crashes happened between the minor streets. The lines shaded in gray are non-intersection crashes. There were 17 crashes that involved the driver losing control of the vehicle and there were 16 crashes that the driver of at least one of the vehicles involved was cited for a violation.

Table 12

**SUMMARY OF REPORTED VEHICLE CRASHES
ON ROUTE 31 IN THE TOWN OF SPENCER
JULY 1, 2010 - JUNE 30, 2013**

<u>Route 31 Location</u>	<u>July '10-June '13</u>		<u>Day of the Week:</u>	
Barclay Road	2		Monday	9 13%
Browning Pond/Thompson Pond	3		Tuesday	9 13%
Alta Crest Road	1		Wednesday	10 14%
Northwest Road	2		Thursday	9 13%
North Brookfield Road	3		Friday	8 11%
Smithville Cross Road	2		Saturday	13 19%
Meadow Road/Wire Village Road	16		Sunday	12 17%
Smithville Road	2			70 100%
High Street	1			
Prouty Street	1		<u>Time of Day:</u>	
Main Street	10		7 - 9 AM	6 9%
Unknown	2		4 - 6 PM	15 21%
Other Roadway Segments	25		Remainder	49 70%
Total	70			70 100%
<u>Severity:</u>			<u>Weather Conditions:</u>	
Property damage only	45	64%		
Personal injury	25	36%	Clear	36 51%
Fatality	0	0%	Cloudy	14 20%
	70	100%	Snow	14 20%
			Rain	6 9%
				70 100%
<u>Crash Type:</u>			<u>Light Conditions:</u>	
Angle	21	30%		
Fixed Object	18	26%	Daylight	29 42%
Rear End	11	16%	Dark	21 30%
Ran Off Road	4	6%	Dusk	12 17%
Cross Move	3	4%	Dawn	8 11%
Sideswipe	3	4%		70 100%
Hit Deer	3	4%		
Head On	3	4%	<u>Road Conditions:</u>	
Hit Parked Car	2	3%		
Other	2	3%	Dry	40 57%
	70	100%	Wet	14 20%
			Snow	11 16%
<u>Season:</u>			Icy	5 7%
Winter	27	39%		70 100%
Spring	13	19%		
Summer	10	14%		
Fall	20	28%		
	70	100%		

(Bold text indicates crash diagram compiled)



VEHICLE CRASH DIAGRAM								FIGURE 42																					
Dates: 7/15/09 - 7/15/12								Location: Route 31 / Route 9 / Wall Street																					
Route 9 Route 31 Wall St Route 9																													
SYMBOLS Angle Turning Move Rear End Sideswipe Head On Fixed Object								SEVERITY CODES <table style="width:100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Property damage</td> <td style="width: 50%;">PD</td> </tr> <tr> <td>Personal Injury</td> <td>PI</td> </tr> <tr> <td>Fatality</td> <td>F</td> </tr> </table>								Property damage	PD	Personal Injury	PI	Fatality	F								
Property damage	PD																												
Personal Injury	PI																												
Fatality	F																												
LIGHT CONDITIONS 1 Daylight 2 Dawn or Dusk 3 Darkness 4 Unknown								VIOLATIONS <table style="width:100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">0 No Violations</td> <td style="width: 50%;">7 Wrong Side of Road</td> </tr> <tr> <td>1 Speed Too Fast</td> <td>8 Improper Turning</td> </tr> <tr> <td>2 Failure To Yield</td> <td>9 Improper Backing</td> </tr> <tr> <td>3 Ran Stop Sign</td> <td>10 Had Been Drinking</td> </tr> <tr> <td>4 Ran Traffic Signal</td> <td>11 Pedestrian Violation</td> </tr> <tr> <td>5 Following Too Close</td> <td>12 Reckless Driving</td> </tr> <tr> <td>6 Improper Passing</td> <td>13 Improper Light or Brakes</td> </tr> </table>								0 No Violations	7 Wrong Side of Road	1 Speed Too Fast	8 Improper Turning	2 Failure To Yield	9 Improper Backing	3 Ran Stop Sign	10 Had Been Drinking	4 Ran Traffic Signal	11 Pedestrian Violation	5 Following Too Close	12 Reckless Driving	6 Improper Passing	13 Improper Light or Brakes
0 No Violations	7 Wrong Side of Road																												
1 Speed Too Fast	8 Improper Turning																												
2 Failure To Yield	9 Improper Backing																												
3 Ran Stop Sign	10 Had Been Drinking																												
4 Ran Traffic Signal	11 Pedestrian Violation																												
5 Following Too Close	12 Reckless Driving																												
6 Improper Passing	13 Improper Light or Brakes																												
ROAD CONDITIONS 1 Dry 2 Wet 3 Snow or Icy 4 Unknown																													
#	DATE	TIME	DAY	SEV	L	R	V	#	DATE	TIME	DAY	SEV	L	R	V														
1	01/10/10	16:49	SUN	PD	2	1	0																						
2	02/08/10	16:10	MON	PD	2	1	0																						
3	05/25/11	18:52	WED	PD	3	1	0																						
4	07/09/11	11:07	SAT	PD	1	1	0																						
5	08/26/11	11:30	FRI	PD	1	1	0																						
6	09/03/11	14:35	SAT	PD	1	1	0																						
7	11/28/11	14:46	MON	PD	1	1	0																						
8	01/01/12	13:00	SUN	PD	1	1	0																						
9	01/24/12	10:55	TUE	PD	1	1	0																						
10	07/11/12	7:30	WED	PD	1	1	0																						

TABLE 13 Spencer - Route 31 Vehicle Crash Inventory

#	SPD ID #	Route 31 Location	Date	Day of Week	Time of Day	Type	Severity	Conditions			Violations/Comments
								Weather	Light	Road	
1	410236	N Spencer Rd/Barclay Rd	09/16/10	Thursday	17:26	Gross Move	Personal Injury	Clear	Dusk	Dry	Failure to Yield
2	416995	N Spencer Rd/Barclay Rd	01/19/11	Wednesday	22:45	Sideswipe	Property Damage	Cloudy	Dark	Dry	OUI
3	415493	243 N Spencer Rd	12/21/10	Tuesday	10:02	Fixed Object	Personal Injury	Cloudy	Daylight	Wet	Lost Control & Hit Tree
4	439175	N Spencer Rd/Browning Pond	03/04/12	Sunday	16:15	Rear End	Property Damage	Clear	Dusk	Dry	None
5	439456	N Spencer Rd/Browning Pond	03/09/12	Friday	15:22	Angle	Personal Injury	Snow	Daylight	Wet	None
6	455402	N Spencer Rd/Browning Pond	12/27/12	Thursday	18:00	Sideswipe	Property Damage	Snow	Dark	Snowy	Driver Lost Control
7	462323	Near Black & White Restaurant	05/10/13	Friday	6:26	Fixed Object	Personal Injury	Clear	Dawn	Dry	Driver Fell Asleep & Hit Tree
8	418189	N Spencer Road/2000' N of Hastings	02/11/11	Friday	14:37	Hit Deer	Property Damage	Clear	Daylight	Dry	None
9	418298	N Spencer Road/2000' N of Hastings	02/14/11	Monday	9:03	Hit Deer	Property Damage	Cloudy	Daylight	Wet	None
10	459384	N Spencer Rd/Utility Pole #111	03/16/13	Saturday	3:40	Fixed Object	Property Damage	Cloudy	Dark	Icy	Lost Control & Hit Pole
11	439891	N Spencer Rd/Utility Pole #110	03/18/12	Sunday	21:05	Ran Off Road	Property Damage	Clear	Dark	Dry	Swerved to Avoid Animal
12	452917	167 N Spencer Rd	11/10/12	Saturday	10:35	Gross Move	Personal Injury	Clear	Daylight	Dry	Failure to Yield
13	437273	N Spencer Rd/Utility Pole #103	01/26/12	Thursday	6:55	Fixed Object	Personal Injury	Snow	Dawn	Snowy	Lost Control & Hit Pole
14	419503	N Spencer Rd/Utility Pole #97	03/08/11	Tuesday	17:42	Fixed Object	Property Damage	Clear	Dusk	Icy	Lost Control & Hit Pole
15	415580	130 N Spencer Rd	12/25/10	Saturday	6:30	Fixed Object	Property Damage	Clear	Dawn	Snowy	Lost Control & Hit Tree
16	415818	130 N Spencer Rd	12/28/10	Tuesday	10:15	Fixed Object	Property Damage	Cloudy	Daylight	Icy	Lost Control & Hit Tree
17	460405	107 N Spencer Rd	04/05/13	Friday	15:46	Rear End	Personal Injury	Cloudy	Daylight	Wet	3rd Car Also Involved
18	418871	N Spencer Road/Alta Crest Rd	02/24/11	Thursday	19:49	Hit Deer	Property Damage	Snow	Dark	Snowy	None
19	423815	89 N Spencer Rd	05/27/11	Friday	13:32	Ran Off Road	Property Damage	Cloudy	Daylight	Dry	Driver Lost Control
20	419340	87 N Spencer Rd	03/05/11	Saturday	1:47	Fixed Object	Property Damage	Cloudy	Dark	Wet	OUI/Hit Guardrail
21	424880	N Spencer Rd/Northwest Rd	06/15/11	Wednesday	22:47	Fixed Object	Personal Injury	Clear	Dark	Dry	Driver Fell Asleep & Hit Pole
22	432440	N Spencer Rd/Northwest Rd	10/29/11	Saturday	19:40	Angle	Property Damage	Snow	Dark	Snowy	Slid Thru Stop Sign
23	452733	N Spencer Rd/N Brookfield Rd	11/07/12	Wednesday	16:52	Angle	Property Damage	Snow	Dusk	Snowy	Slid Thru Stop Sign
24	452762	N Spencer Rd/N Brookfield Rd	11/08/12	Thursday	1:17	Hit Parked Car	Property Damage	Snow	Dark	Snowy	Slid Thru Stop Sign
25	456407	N Spencer Rd/N Brookfield Rd	01/16/13	Wednesday	6:25	Angle	Property Damage	Snow	Dawn	Snowy	Slid Thru Stop Sign
26	451968	35 N Spencer Rd	10/25/12	Thursday	18:46	Ran Off Road	Property Damage	Cloudy	Dark	Dry	None
27	415061	N Spencer Rd/Utility Pole #29	12/13/10	Monday	17:40	Fixed Object	Personal Injury	Rain	Dark	Wet	Lost Control & Hit Pole
28	438887	N Spencer Rd/Smithville Cross Rd	02/27/12	Monday	18:08	Head On	Personal Injury	Clear	Dark	Dry	3rd Car Also Involved
29	452921	N Spencer Rd/Smithville Cross Rd	11/10/12	Saturday	12:16	Hit Piece of Wood	Property Damage	Clear	Daylight	Dry	Board Fell Off Vehicle
30	435714	Near Pine Grove Cemetery	12/26/11	Monday	1:31	Fixed Object	Property Damage	Rain	Dark	Icy	Lost Control & Hit Pole
31	457995	Near Pine Grove Cemetery	02/16/13	Saturday	7:32	Fixed Object	Property Damage	Snow	Dawn	Wet	Lost Control & Hit Pole
32	414209	N Spencer Rd/Meadow Rd	11/27/10	Saturday	17:26	Angle	Personal Injury	Clear	Dusk	Dry	Ran Stop Sign
33	415226	N Spencer Rd/Meadow Rd	12/17/10	Friday	9:00	Gross Move	Personal Injury	Clear	Daylight	Dry	None

Data Collected from July 2010 to June 2013

Lines Shaded in Grey are Non Intersection Crashes

TABLE 13 Spencer - Route 31 Vehicle Crash Inventory

#	SPD ID #	Route 31 Location	Date	Day of Week	Time of Day	Type	Severity	Conditions			Violations/Comments
								Weather	Light	Road	
34	418644	N Spencer Rd/Meadow Rd	02/10/11	Sunday	15:29	Head On	Personal Injury	Clear	Daylight	Icy	Driver Lost Control
35	420660	N Spencer Rd/Meadow Rd	03/29/11	Tuesday	7:29	Fixed Object	Property Damage	Clear	Daylight	Dry	Hit Bridge Railing
36	429578	N Spencer Rd/Meadow Rd	09/06/11	Tuesday	6:58	Angle	Property Damage	Rain	Dawn	Wet	Failed to Grant Right of Way
37	430353	N Spencer Rd/Meadow Rd	09/23/11	Friday	6:48	Angle	Personal Injury	Rain	Dawn	Wet	Ran Stop Sign
38	435195	N Spencer Rd/Meadow Rd	12/14/11	Wednesday	17:15	Angle	Property Damage	Cloudy	Dark	Dry	None
39	444903	N Spencer Rd/Meadow Rd	06/19/12	Tuesday	8:50	Angle	Personal Injury	Cloudy	Daylight	Dry	None
40	446481	N Spencer Rd/Meadow Rd	07/16/12	Monday	15:11	Angle	Property Damage	Clear	Daylight	Dry	Ran Stop Sign
41	448330	N Spencer Rd/Meadow Rd	08/19/12	Sunday	12:06	Angle	Property Damage	Clear	Daylight	Dry	Failed to Grant Right of Way
42	450704	N Spencer Rd/Meadow Rd	09/30/12	Sunday	19:28	Angle	Property Damage	Cloudy	Dark	Wet	Ran Stop Sign
43	451308	N Spencer Rd/Meadow Rd	10/13/12	Saturday	1:03	Angle	Personal Injury	Clear	Dark	Dry	None
44	452986	N Spencer Rd/Meadow Rd	11/11/12	Sunday	18:32	Angle	Personal Injury	Clear	Dark	Dry	Failed to Grant Right of Way
45	454954	N Spencer Rd/Meadow Rd	12/19/12	Wednesday	17:11	Angle	Personal Injury	Cloudy	Dusk	Dry	None
46	458580	N Spencer Rd/Meadow Rd	02/28/13	Thursday	15:48	Angle	Personal Injury	Snow	Daylight	Wet	Ran Stop Sign/Speeding
47	460289	N Spencer Rd/Meadow Rd	04/03/13	Wednesday	16:55	Sideswipe	Property Damage	Clear	Dusk	Dry	None
48	429484	N Spencer Road/Unknown Location	09/04/11	Sunday	6:27	Fixed Object	Personal Injury	Cloudy	Dawn	Dry	Fell Asleep & Hit Tree
49	431711	Pleasant St/Smithville Rd	10/16/11	Sunday	17:45	Rear End	Personal Injury	Clear	Dusk	Dry	None
50	456403	Pleasant St/Smithville Rd	01/16/13	Wednesday	5:10	Ran Off Road	Property Damage	Snow	Dark	Snowy	Vehicle Lost Control
51	450889	91 Pleasant St	10/04/12	Thursday	14:00	Angle	Personal Injury	Rain	Daylight	Wet	Car Backing Out of Driveway
52	417991	89 Pleasant St	02/10/11	Thursday	23:16	Head On	Personal Injury	Snow	Dark	Snowy	Driver Lost Control
53	416448	87 Pleasant St	01/08/11	Saturday	20:28	Fixed Object	Property Damage	Snow	Dark	Snowy	Lost Control & Hit Pole
54	424732	83 Pleasant St	06/11/11	Saturday	17:55	Fixed Object	Property Damage	Rain	Dusk	Wet	Hit Pole
55	413515	80 Pleasant St	11/14/10	Sunday	8:00	Angle	Property Damage	Clear	Daylight	Dry	None
56	429537	78 Pleasant St	09/05/11	Monday	12:30	Rear End	Property Damage	Clear	Daylight	Dry	None
57	456710	Pleasant St/High St	01/21/13	Monday	17:27	Fixed Object	Property Damage	Snow	Dark	Wet	Hit Street Sign
58	446883	Pleasant St/Prouty St	07/22/12	Sunday	13:00	Hit Parked Car	Property Damage	Clear	Daylight	Dry	None
59	463874	8 Pleasant St	06/04/13	Tuesday	15:23	Hit Pedestrian	Personal Injury	Clear	Daylight	Dry	A Child Ran Into the Street
60	463419	Pleasant St/Unknown Location	05/28/13	Tuesday	18:07	Fixed Object	Personal Injury	Clear	Dusk	Dry	Hit Pole/Drive on Cellphone
61	-	Pleasant St/Main St	01/10/10	Sunday	16:49	Rear End	Property Damage	Clear	Dusk	Dry	Driver Inattention
62	-	Pleasant St/Main St	02/08/10	Monday	16:10	Rear End	Property Damage	Clear	Dusk	Dry	Sun Glare
63	-	Pleasant St/Main St	05/25/11	Wednesday	18:52	Rear End	Property Damage	Clear	Daylight	Dry	Driver Inattention
64	-	Pleasant St/Main St	07/09/11	Saturday	11:07	Rear End	Property Damage	Clear	Daylight	Dry	Driver Inattention
65	-	Pleasant St/Main St	08/26/11	Friday	11:30	Angle	Property Damage	Clear	Daylight	Dry	Failed to Grant Right of Way
66	-	Pleasant St/Main St	09/03/11	Saturday	14:35	Rear End	Property Damage	Clear	Daylight	Dry	Driver Inattention

Data Collected from July 2010 to June 2013

Lines Shaded in Grey are Non Intersection Crashes

TABLE 13 Spencer - Route 31 Vehicle Crash Inventory

#	SPD ID #	Route 31 Location	Date	Day of Week	Time of Day	Type	Severity	Conditions			Violations/Comments
								Weather	Light	Road	
67	-	Pleasant St/Main St	11/28/11	Monday	14:46	Angle	Property Damage	Clear	Daylight	Dry	None
68	-	Pleasant St/Main St	01/01/12	Sunday	13:00	Rear End	Property Damage	Clear	Daylight	Dry	Following Too Closely
69	-	Pleasant St/Main St	01/24/12	Tuesday	10:55	Angle	Property Damage	Clear	Daylight	Dry	Failed to Grant Right of Way
70	-	Pleasant St/Main St	07/11/12	Wednesday	7:30	Rear End	Property Damage	Clear	Daylight	Dry	Following Too Closely

The crash data for Pleasant St/Main St was collected from July 2009 to July 2012

4.4 Town of Spencer Additional Study Segment: Meadow Road

Requested from the town of Spencer, Meadow Road was an additional roadway segment that was studied for the Route 31 Corridor Profile. Similar to Route 31, vehicle crash records were analyzed for a three-year period. All crashes along Meadow Road from Route 31 to Route 9 were tabulated. However, crashes at the Route 31/Meadow Road/Wire Village Road were not included as part of this additional analysis as they have been already analyzed elsewhere. Crashes on minor streets that were close to or at Meadow Road were also included. All important information from the crash reports was organized and included in the various tables and figures that follow.

As shown in **Table 14**, there were a total of 29 crashes reported during the three-year study period. The Route 9 intersection had the most with a total of 13. There were only three crashes that caused a personal injury and the rest was property damage only. Angle crashes were the most common occurrence with a total of nine, followed by sideswipes and rear-ends with five each. The crashes were evenly distributed between the four seasons with a range of six to nine crashes in each. The top two days that vehicle crashes occurred most frequently were Friday and Sunday. Both days accounted for at least 20% of the overall crashes. Only seven crashes occurred during the AM or PM peak periods, with the remaining 22 the rest of the time. The majority of crashes were during clear weather, during the daytime hours, with dry roadway conditions, but not always occurring at the same time.

Figure 43 is a crash diagram of the Meadow Road/Route 9/South Spencer Road intersection. This diagram displays the location of each of the 13 crashes that occurred at this location. There were four sideswipe crashes and three each of angle, rear-end, and cross movement crashes. Two of the angle crashes occurred at the Hess gas station at the southwest corner of the intersection. This could have happened when the exiting vehicle did not see the vehicle in the second travel lane while a vehicle in the first travel lane was stopped. The other angle crash was caused by a vehicle that drove through the red light. Fortunately, only one of the 13 crashes resulted in personal injury. All but three crashes were during the daylight hours and only three were not on a dry roadway surface.

In **Table 15**, all 29 of the Meadow Road crashes are listed. The crashes are ordered by the location starting with 100 Meadow Road and then heading south towards Route 9. The details about each crash are listed along with any violations or comments. Out of the 29 crashes, 19 occurred at intersecting streets and the remaining ten crashes happened between the minor streets. The lines shaded in gray are non-intersection crashes. There were 7 crashes that the driver of at least one of the vehicles involved was cited for a violation. Also, there were two vehicle crashes in which the driver lost control of the vehicle and hit a tree.

Table 14

**SUMMARY OF REPORTED VEHICLE CRASHES
ON MEADOW ROAD IN THE TOWN OF SPENCER
JULY 1, 2010 - JUNE 30, 2013**

<u>Meadow Rd Location</u>	<u>July '10-June '13</u>		<u>Day of the Week:</u>	
Smithville Road	3		Monday	4 14%
School Street	1		Tuesday	2 7%
Fourth Avenue	1		Wednesday	5 17%
Olde Main Street	1		Thursday	2 7%
Route 9	13		Friday	6 21%
Other Roadway Segments	10		Saturday	3 10%
Total	29		Sunday	7 24%
				29 100%
			<u>Time of Day:</u>	
<u>Severity:</u>			7 - 9 AM	4 14%
Property damage only	26	90%	4 - 6 PM	3 10%
Personal injury	3	10%	Remainder	22 76%
Fatality	0	0%		29 100%
	29	100%	<u>Weather Conditions:</u>	
<u>Crash Type:</u>			Clear	12 42%
Angle	9	31%	Cloudy	9 31%
Sideswipe	5	17%	Rain	5 17%
Rear End	5	17%	Snow	3 10%
Cross Move	3	10%		29 100%
Fixed Object	3	10%	<u>Light Conditions:</u>	
Hit Parked Car	2	7%	Daylight	20 68%
Hit Deer	1	4%	Dark	7 24%
Other	1	4%	Dusk	1 4%
	29	100%	Dawn	1 4%
				29 100%
<u>Season:</u>			<u>Road Conditions:</u>	
Winter	8	27%	Dry	15 51%
Spring	6	21%	Wet	12 42%
Summer	9	31%	Snow	2 7%
Fall	6	21%		29 100%
	29	100%		

(Bold text indicates crash diagram compiled)

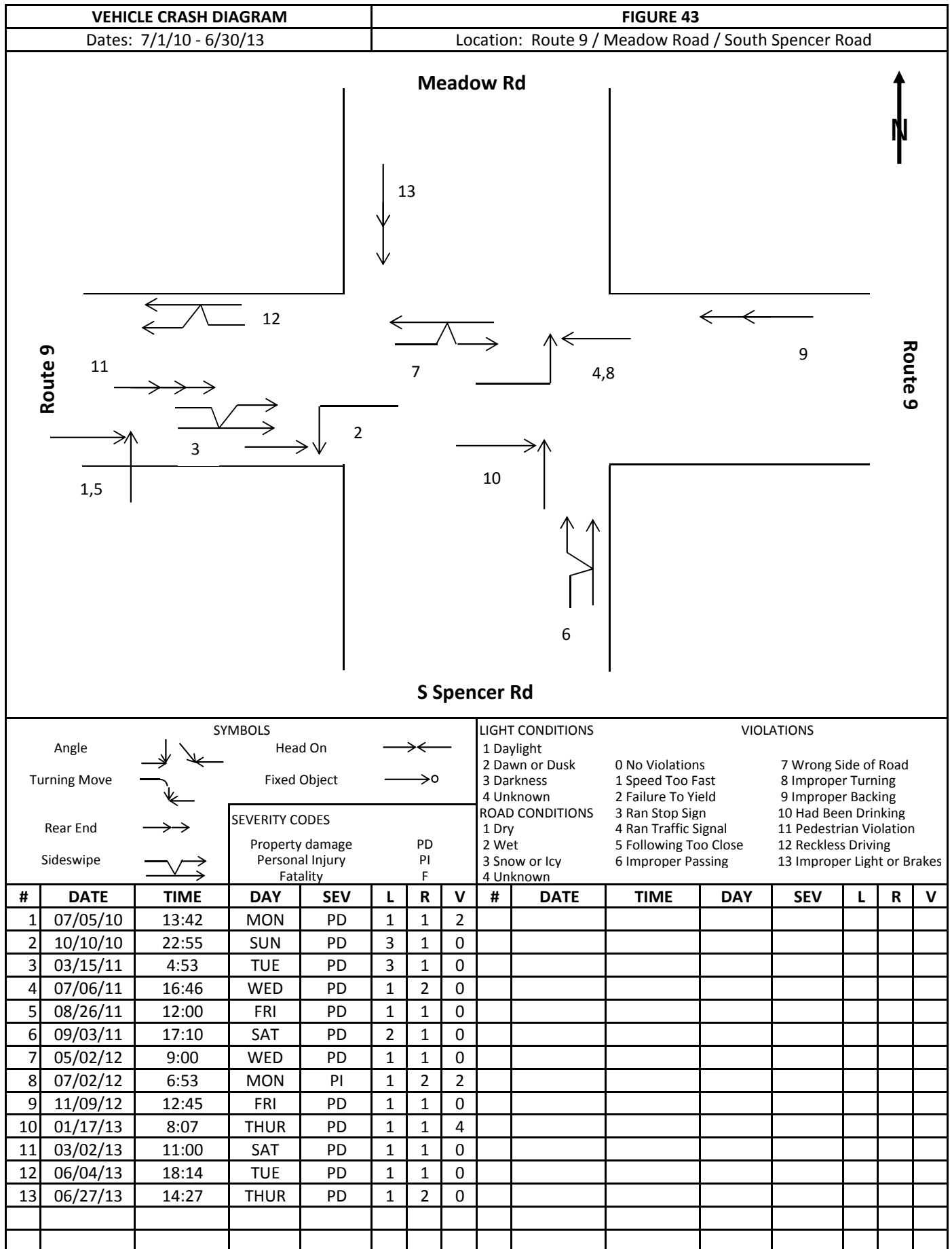


TABLE 15 Spencer - Meadow Road Vehicle Crash Inventory

#	SPD ID #	Meadow Road Location	Date	Day of Week	Time of Day	Type	Severity	Conditions			Violations/Comments
								Weather	Light	Road	
1	459078	100 Meadow Rd	03/09/13	Saturday	18:40	Fixed Object	Property Damage	Clear	Dark	Dry	Hit Pole
2	411283	97 Meadow Rd	10/04/10	Monday	7:00	Angle	Property Damage	Cloudy	Daylight	Wet	Car Backing Out of Driveway
3	418672	91 Meadow Rd	02/21/11	Monday	10:19	Hit Parked Car	Property Damage	Snow	Daylight	Wet	None
4	463737	90 Meadow Rd	06/02/13	Sunday	23:03	Hit Parked Car	Property Damage	Cloudy	Dark	Wet	Hit and Run Accident
5	437626	Meadow Rd/Smithville Rd	02/01/12	Wednesday	20:29	Angle	Personal Injury	Cloudy	Dark	Wet	Ran Stop Sign
6	449954	Meadow Rd/Smithville Rd	09/16/12	Sunday	20:30	Angle	Property Damage	Clear	Dark	Dry	None
7	456414	Meadow Rd/Smithville Rd	01/16/13	Wednesday	8:49	Angle	Property Damage	Snow	Daylight	Snowy	Slid Thru Stop Sign
8	425003	Meadow Rd/School St	06/17/11	Friday	9:56	Angle	Property Damage	Rain	Daylight	Wet	Failure to Yied Right of Way
9	415163	Meadow Rd/Fourth Ave	12/15/10	Wednesday	18:10	Hit Deer	Property Damage	Cloudy	Dark	Wet	None
10	449917	Near Sewer Pumping Station	09/16/12	Sunday	6:45	Hit Sewer Station	Property Damage	Clear	Dawn	Dry	None
11	457626	34 Meadow Rd	02/08/13	Friday	14:52	Fixed Object	Personal Injury	Snow	Daylight	Snowy	Lost Control & Hit Tree
12	416466	30 Meadow Rd	01/09/11	Sunday	9:22	Fixed Object	Property Damage	Cloudy	Daylight	Wet	Lost Control & Hit Tree
13	456103	Meadow Rd/Olde Main St	01/11/13	Friday	14:15	Angle	Property Damage	Rain	Daylight	Wet	Failure to Yield Right of Way
14	422362	1 Meadow Rd	05/01/11	Sunday	11:58	Rear End	Property Damage	Clear	Daylight	Dry	None
15	422718	1 Meadow Rd	05/08/11	Sunday	10:30	Sideswipe	Property Damage	Rain	Daylight	Wet	None
16	426688	Meadow Rd/Big Y Plaza Entrance	07/15/11	Friday	17:20	Rear End	Property Damage	Clear	Daylight	Dry	None
17	405649	Meadow Rd/Route 9	07/05/10	Monday	13:42	Angle	Property Damage	Clear	Daylight	Dry	Failure to Yield Right of Way
18	411606	Meadow Rd/Route 9	10/10/10	Sunday	22:55	Cross Move	Property Damage	Clear	Dark	Dry	None
19	419897	Meadow Rd/Route 9	03/15/11	Tuesday	4:53	Sideswipe	Property Damage	Cloudy	Dark	Dry	None
20	425068	Meadow Rd/Route 9	07/06/11	Wednesday	16:46	Cross Move	Property Damage	Rain	Daylight	Wet	None
21	428867	Meadow Rd/Route 9	08/26/11	Friday	12:00	Angle	Property Damage	Clear	Daylight	Dry	None
22	429453	Meadow Rd/Route 9	09/03/11	Saturday	17:10	Sideswipe	Property Damage	Clear	Dusk	Dry	None
23	442287	Meadow Rd/Route 9	05/02/12	Wednesday	9:00	Sideswipe	Property Damage	Cloudy	Daylight	Dry	None
24	445682	Meadow Rd/Route 9	07/02/12	Monday	6:53	Cross Move	Personal Injury	Cloudy	Daylight	Wet	Failure to Yield While Turning
25	452875	Meadow Rd/Route 9	11/09/12	Friday	12:45	Rear End	Property Damage	Clear	Daylight	Dry	None
26	456468	Meadow Rd/Route 9	01/17/13	Thursday	8:07	Angle	Property Damage	Clear	Daylight	Dry	Ran Red Light
27	458688	Meadow Rd/Route 9	03/02/13	Saturday	11:00	Rear End	Property Damage	Cloudy	Daylight	Dry	None
28	463888	Meadow Rd/Route 9	06/04/13	Tuesday	18:14	Sideswipe	Property Damage	Clear	Daylight	Dry	None
29	465150	Meadow Rd/Route 9	06/27/13	Thursday	14:27	Rear End	Property Damage	Rain	Daylight	Wet	None

5.0 PAVEMENT MANAGEMENT SYSTEM (PMS)

5.1 Pavement Management Concepts

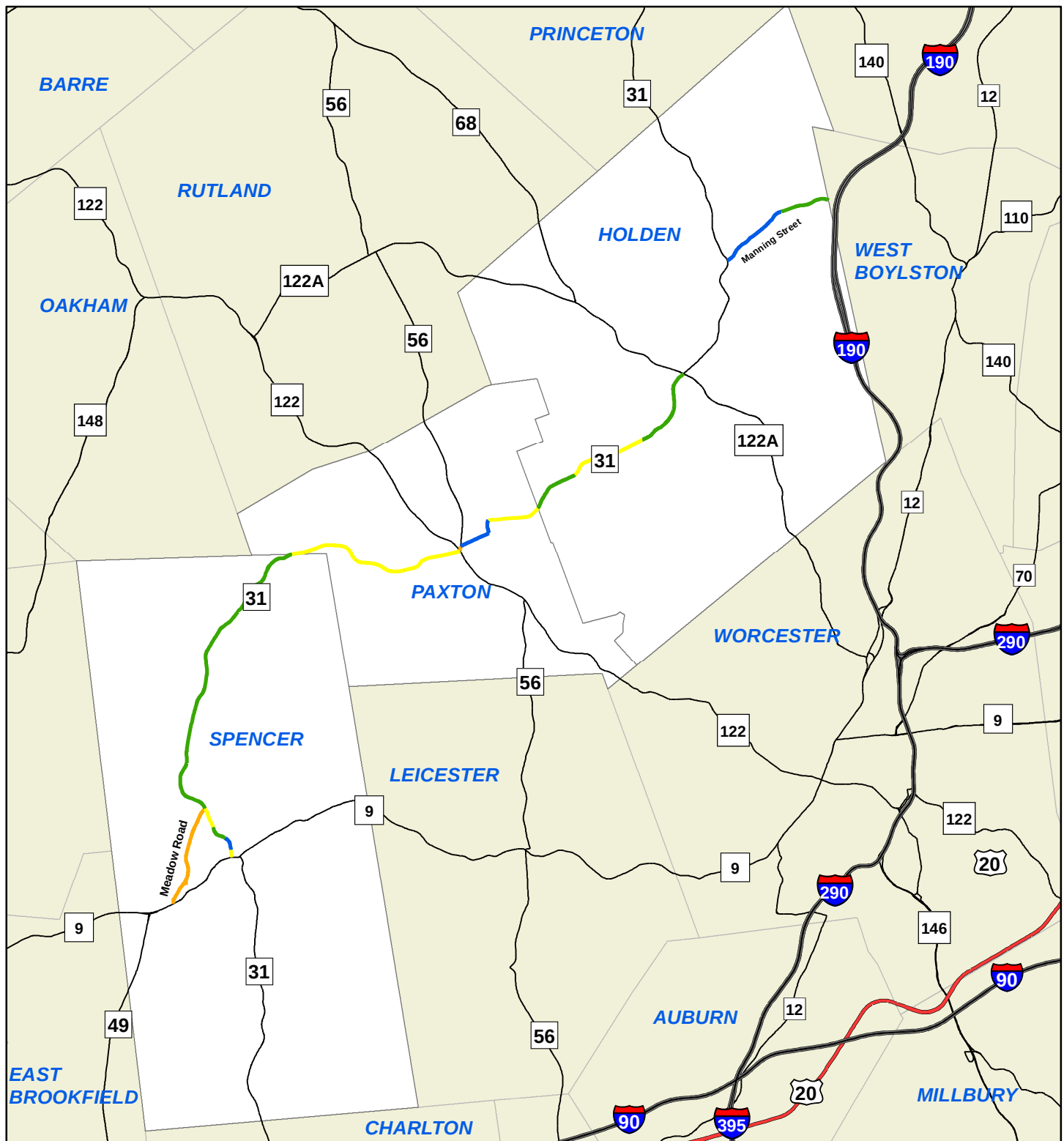
Pavement management is an asset management system designed to assist decision-makers in determining the most cost-effective strategies to address poor or failing roadway conditions. In general, a successful Pavement Management System (PMS) defines a roadway network, identifies the condition of each segment 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 31 from Route 122A in the town of Holden to Route 9 in the town of Spencer. Manning Street in Holden and Meadow Road in Spencer were also analyzed. The pavement data was collected by conducting “windshield surveys.” A team of two CMRPC representatives inspected Route 31, 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 44 displays the current pavement conditions for Route 31 represented by Overall Condition Index (OCI) Recommended Action. *Cartegraph* produced OCI Recommended Action categories that suggest the extent of action necessary to bring a road segment to “Excellent” condition. **Table 16** shows the OCI and Recommended Action for each roadway segment.



ROUTE 31 CORRIDOR PROFILE

Host communities of Holden, Paxton and Spencer

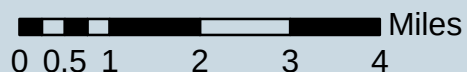
Pavement Condition

Figure 44



Pavement Condition

- Excellent
- Fair
- Very Poor
- Good
- Poor



Source: Data provided by the US Census Bureau, Central Massachusetts 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 interpreting positional accuracy.

Table 16

Route 31 Pavement Analysis Recommendations

Town	Street	From	To	Length	Plan Activity	OCI
Holden	MANNING STREET*	WEST BOYLSTON TOWN LINE	NORTH STREET	0.75 mi	ROUTINE MAINTENANCE	83.2
Holden	MANNING STREET	NORTH STREET	GENERAL HOBBS ROAD	0.71 mi	DO NOTHING	94.4
Holden	MANNING STREET	GENERAL HOBBS ROAD	WACHUSETT STREET	0.40 mi	DO NOTHING	94.4
Holden	RESERVOIR STREET	MAIN STREET	AVERY HEIGHTS DRIVE	0.61 mi	ROUTINE MAINTENANCE	87.2
Holden	RESERVOIR STREET	AVERY HEIGHTS DRIVE	SOUTH ROAD	0.68 mi	ROUTINE MAINTENANCE	84.0
Holden	SOUTH ROAD (EB/WB)	RESERVOIR STREET	PAXTON ROAD	1.20 mi	PREVENTATIVE MAINTENANCE	61.3
Holden	PAXTON ROAD	SOUTH ROAD	PAXTON TOWNLINE	0.79 mi	ROUTINE MAINTENANCE	81.7
Paxton	HOLDEN ROAD	GROVE STREET	HOLDEN TOWNLINE	0.70 mi	PREVENTATIVE MAINTENANCE	48.5
Paxton	GROVE STREET	MAPLE STREET	HOLDEN ROAD	0.40 mi	DO NOTHING	99.2
Paxton	MAPLE STREET	RICHARDS AVENUE	GROVE STREET	0.40 mi	DO NOTHING	98.4
Paxton	CHURCH STREET	PLEASANT STREET	RICHARDS AVENUE	0.10 mi	STRUCTURAL IMPROVEMENT	25.3
Paxton	WEST STREET	SUOMI STREET	PLEASANT STREET	0.80 mi	PREVENTATIVE MAINTENANCE	64.0
Paxton	WEST STREET	BLACKHILL ROAD	SUOMI STREET	0.70 mi	PREVENTATIVE MAINTENANCE	57.2
Paxton	WEST STREET	SPENCER TOWNLINE	BLACKHILL ROAD	1.00 mi	PREVENTATIVE MAINTENANCE	49.1
Spencer**	NORTH SPENCER ROAD	PAXTON TOWNLINE	BARCLAY ROAD	0.69 mi	ROUTINE MAINTENANCE	69.6
Spencer	NORTH SPENCER ROAD	BARCLAY ROAD	PLEASANT STREET	4.53 mi	DO NOTHING	88.2
Spencer	PLEASANT STREET	MEADOW ROAD	200' N OF SMITHVILLE ROAD	0.50 mi	PREVENTATIVE MAINTENANCE	51.5
Spencer	PLEASANT STREET	200' N OF SMITHVILLE ROAD	100' N OF HIGH STREET	0.42 mi	ROUTINE MAINTENANCE	80.2
Spencer	PLEASANT STREET	100' N OF HIGH STREET	400' N OF MAIN STREET	0.53 mi	DO NOTHING	99.7
Spencer	PLEASANT STREET	400' N OF MAIN STREET	MAIN STREET	0.14 mi	PREVENTATIVE MAINTENANCE	64.2
Spencer	MEADOW ROAD*	PLEASANT STREET	WEST MAIN STREET	1.98 mi	STRUCTURAL IMPROVEMENT	33.6

*The towns of Holden & Spencer requested that these two additional roadways be analyzed.

**The pavement in the town of Spencer was collected and analyzed by Fay, Spofford & Thorndike.

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 (pot hole, 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 planeing 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 fall in this category.

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.

5.2 Town of Holden Overall Condition Index (OCI)

The latest pavement data for Route 31 was collected in 2012. As the map depicts, most of Route 31 is in the "Routine Maintenance" category, while the remaining portion falls under the "Preventative Maintenance" category. Low severity alligator cracking is the most prevalent distress found along Route 31. 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 pot holes as pavement pieces are pulled out of the cracks from repeated traffic loads and exposure to the freeze-thaw cycle.

For the "Routine Maintenance" roadway sections staff also observed localized low severity transverse/longitudinal cracks, low to medium severity surface wear, minimal distortions, and minor rutting. In the lone "Preventative Maintenance" segment there were medium severity

alligator and transverse/longitudinal cracks, low severity surface wear, and high severity rutting.

In addition, the combined OCI of Manning Street is 90.7, which is in the “Do Nothing” category. Low severity distortions, alligator cracks, and rutting that were observed in the field.

5.3 Town of Paxton Overall Condition Index (OCI)

For the town of Paxton the pavement data was collected in 2011. Conditions might thus be worse now; this depends how much road maintenance has been done by the town over the last few years. The map shows that Route 31 is mainly in the “Preventative Maintenance” category, but there are a couple of sections such as Grove Street and Maple Street that are in the “Do Nothing” category. Lastly, the Church Street segment is in the “Structural Improvement” category. The Holden Road segment has an OCI of 48.5 and thus categorized as “Preventative Maintenance”, but it could as easily be considered “Structural Improvement” since the OCI of 48.5 is right on the border of the categories.

Holden Road was found to have medium severity of distortions, alligator cracking, block cracking, and rutting. Distortions are bumps in the road, often a result of other distresses. Distortions affect the rideability of the road and may cause drivers to slow their traveling speed or even prevent them from traveling the posted speed. All of these distresses have an extent of either low or medium along this segment. Extent means the amount of the roadway that a distress occupies within a given segment. Church Street is another poor section of Route 31 with an OCI rating of 25.3. “Structural Improvement” is recommended for this section. This segment has medium severity of alligator cracking, block cracking, and rutting. It also has low severity distortion, but these occur along a good extent of the roadway. The remaining portion of Route 31 from Route 122 to the Spencer town line falls in the “Preventative Maintenance” category. The average OCI for this section is 56.8. Distortions, alligator and transverse/longitudinal cracking, rutting, and surface wear were observed in the field. Rutting has the highest extent along this section with nearly 50%. Rutting is a dip or trough-like feature found in the vehicular wheel-paths of a road. These troughs are the result of a sub-base degradation resulting from inappropriate base mix or poor drainage. Ruts are caused by the road’s inability to consistently handle the weight of traveling vehicles.

5.4 Town of Spencer Overall Condition Index (OCI)

The pavement data in the town of Spencer was collected and analyzed in 2012 by the engineering firm Fay, Spofford & Thorndike. Route 31 was split into six segments. There were four segments for Pleasant Street and two segments for North Spencer Road. Most of North Spencer Road is considered in excellent condition with an OCI of 88.2 corresponding to the “Do Nothing” category. This part of North Spencer Road was a 4.53 mile segment. A short section from Barclay Road to the Paxton town line has an OCI of 69.6 and is in the “Routine Maintenance” category. The rest of Route 31 is called Pleasant Street. It was split up into four

segments for the purpose of pavement data collection and analysis. The Pleasant Street segments all had an OCI of 50 or higher. There was one segment that was a half mile long which was in the “Do Nothing” category. The remaining three segments were either in the “Routine Maintenance” or “Preventative Maintenance” categories.

In addition, Meadow Road is just less than two miles in length; it starts at Route 31 and heads southeast to meet Route 9. Its OCI rating was 33.6 corresponding to “Structural Improvement” category.

6.0 BRIDGES & MAJOR DRAINAGE STRUCTURES

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 31 Corridor Profile Bridges

Within the Route 31 study area, MassDOT maintains the first two bridges listed in **Table 17**. The third bridge is maintained by the town of Spencer. The bridge over the P&W Railroad is located just south of Route 122A in the town of Holden. It was originally built in 1983 and its AASHTO rating is 77.3. This bridge is considered “Functionally Obsolete”. The first bridge in Spencer is located just south of Hastings Road over the Seven Mile River. It was built in 1938 and its AASHTO rating is 66.7. This bridge is also considered “Functionally Obsolete”. The second bridge in Spencer is located north of Meadow Road over Seven Mile River. It was built in 1952 and its AASHTO rating is 53.2. In addition to the three bridges, there are also numerous culverts along the corridor.

Table 17

Route 31 Corridor Profile Bridges

Town	Bridge #'s	Facility Name (Over)	Facility or Waterbody Name (Under)	Year Built	AASHTO Rating	Deficiency*
Holden	H-18-002	Route 31	PWRR	1983	77.3	FO
Spencer	S-23-012	Route 31	Seven Mile River	1938	66.7	FO
Spencer	S-23-002	Route 31	Seven Mile River	1952	53.2	

*: FO = Functionally Obsolete

SD = Structurally Deficient

6.3 Town of Holden

As shown in the previous **Table**, bridge number H-18-02 is located on Route 31 (Reservoir Street) over the Providence & Worcester Railroad (P&W RR) and is state-owned. The bridge was built in 1983, replacing an antiquated wood structure. Overall, the bridge is in fair to satisfactory condition. On a ratings scale of 1 (poor) to 10 (good), the Deck is rated a five, Superstructure is a five, and the Substructure is a seven. As observed in the field, there are signs of wearing and other deterioration.

A sidewalk exists only on northwesterly side of bridge and is inconvenient for pedestrians. With the lack of sidewalk on the southeasterly side of the bridge, senior housing residents and all other users need to cross Route 31 twice to gain access between the Holden town center area and the shopping plaza along with other commercial land uses. There is limited sight distance available on each bridge approach. It is difficult to spot pedestrians in the crosswalks adjacent to the bridge. It appears that a super-elevated deck contributes to this situation.

The host community of Holden seeks ADA accessibility for the bridge and an additional sidewalk on the southeastern side to complement the one that exists. Further, the existing sidewalk appears to be too narrow. Ideally, the additional sidewalk would be constructed without expansion as the existing deck appears to be quite wide.

According to MassDOT District #3 staff, this bridge will require future maintenance activities. Such maintenance would include the deck being stripped down to the box beams, which would allow for the application of a new membrane and wearing surface. Currently, the start date and estimated repair cost is unknown.

Also of note, according to the Providence & Worcester Railroad, the under clearance of this bridge is only 19' – 4". This clearance is insufficient for double stacked intermodal containers. The P&W indicates that an additional 14" of under clearance is needed to accommodate

modern rail freight traffic. The railroad will need to work with MassDOT to address this identified clearance issue without furthering adverse line of sight impacts on the bridge approaches as described above.

6.4 Town of Spencer

As can be seen in **Table 17**, there are two bridges in the town of Spencer on Route 31. Community officials have noted the importance of the Route 31 bridges. Bridge number S-23-012 is town-owned and is located over the Seven Mile River adjacent to Hastings Road. Bridge number S-23-002 is state-owned and is located over the Seven Mile River just north of Meadow Road. Both bridges are critical to regional travel as well as to trucking and rail-to-trucking flows serving local and greater regional land uses. The New England Automotive Gateway (NEAG) operator has commented that, although minimal volumes of trucks use Route 31, any bridge closure due to storm damage or structural issues would cause lengthy diversions to gain access to I-190 north in Sterling. Thus continued deterioration of the bridges is a concern of the host community. According to MassDOT District #3, neither of these bridges is currently in any MassDOT program for rehabilitation or replacement.

Route 31 over Seven Mile River (adjacent to Hastings Road)

This bridge was built in 1938. Overall, it is in fair to satisfactory condition. The Deck rating is a five, the Superstructure is a six, and the Substructure is a six. The deck, curbs, parapets, and railing are deteriorating towards poor condition. The bridge inspection report (located in the Technical Appendix) shows these severe deficiencies should be addressed as soon as possible. At minimum, this bridge could use a deck replacement that would include repairs to the previous listed items. Also, the bridge is slightly angled at this location as opposed to being in line with the current roadway alignment. According to community officials, at least two times in the past three years there has been flooding along this segment of Route 31 that has required the closure of the roadway. This problem is a concern for emergency response to North Spencer. Due to this occurring issue, the town would like to begin planning for future improvements. According to MassDOT staff, the bridge will likely be a candidate for a superstructure replacement or full replacement, but it has not reached a sufficient stage of deterioration.

Route 31 over Seven Mile River (just north of Meadow Road)

This bridge was built in 1952 after the previous bridge was destroyed in a flood. The overall condition is satisfactory to good. The Deck rating is six, the Superstructure is seven, and the Substructure is five. The most significant issue appears to be some isolated scour. Although the bridge is posted at a 20/25/40 weight restriction for 2, 4, and 6 axles, it meets all statutory loading and MassDOT has indicated it is not a concern for normal use. The bridge is posted if a special permit is ever needed for an overloaded vehicle. MassDOT District #3 staff does not consider this structure as a candidate for any major rehabilitation or replacement at this time.

Hastings Road over Turkey Hill Brook

Another concern for the community is Hastings Road, a somewhat parallel travel alternative to Route 31. There is a town-owned bridge issue where Hastings Road goes over Turkey Hill Brook. Hastings Road is seen as a very important secondary route to/from the north and the northwest. This route is the only viable detour bypassing Route 31. The MassDOT bridge list does not include this structure in its inventory so it is probably classified as a culvert. At the time this study was compiled, the Hastings Road bridge was restricted to one vehicle at a time, as the cross-section has been reduced to one lane. Fairly recent damage to the structure caused the lane reduction. Town officials now view Hastings Road as a poor alternative diversion route in the event of a future Route 31 closure.

The replacement of the Hastings Road bridge over Turkey Hill Brook has been estimated to cost approximately \$400K. At this time, limited local funds have yet to be allocated to replace or repair the bridge. Further, short of replacement, it has been estimated to cost approximately \$200K to make all necessary minimum corrective repairs at one time. This would include newly engineered crash railings, new wing walls, and general drainage improvements. Town officials have indicated that costs could vary depending upon the extent of drainage work or other suggested improvements, such as including a sidewalk for the adjacent Wire Village little league baseball parks. For safety purposes, it would be ideal to include realignment and geometric improvements to the two intersections on each approaching side of the bridge. It appears that the existing roadway geometry was a contributing factor in a vehicle crash where a driver struck and demolished the pre-existing steel guardrail on the easterly side of the bridge. The crash involved a vehicle traveling eastbound on Wire Village Road driven by a person not familiar with the area. The vehicle went through the first intersection and could not navigate the turn, destroying the guardrail. It appears that there could have been a visual perception of Wire Village Road flowing through both intersections and across the bridge more freely/easily than it truly does. Realignment work could fix this misperception of the roadway. The town is reluctant to spend \$200K for the minimal repairs described above when the preferred long-term solution includes realigning and making the approaches and intersections on each end safer.

6.5 Major Drainage Structures

Using the previously described Environmental Profile maps compiled for the Route 31 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 31 through each town. **Figures 45, 46 and 47** show the location of each identified major water crossing, denoted by a red pentagon symbol. Inside each pentagon is an identifier number corresponding to the major drainage structures observed in each Route 31 host community.

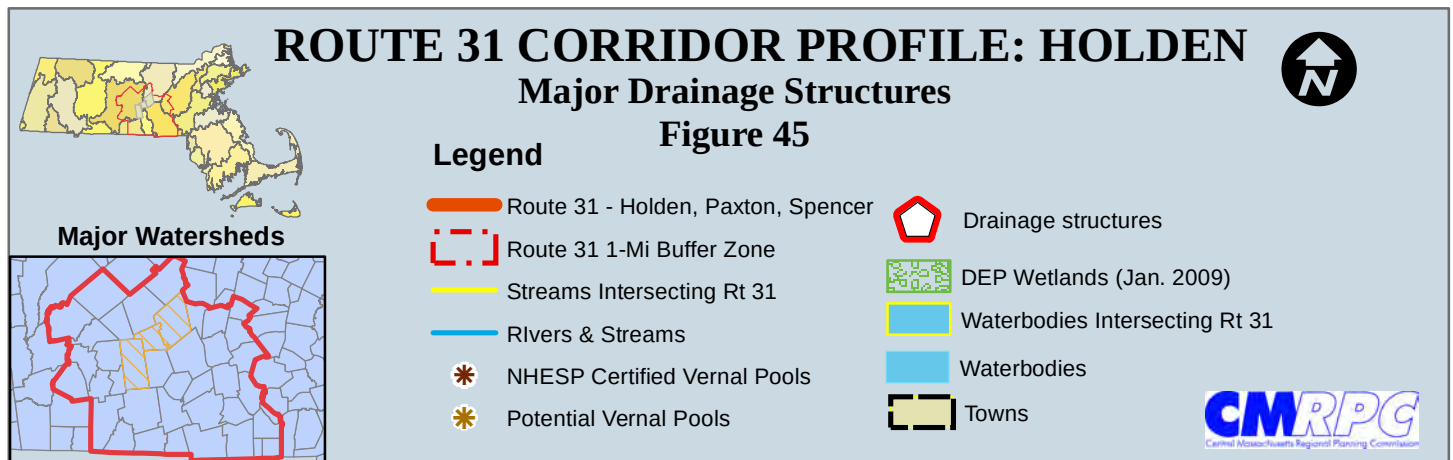
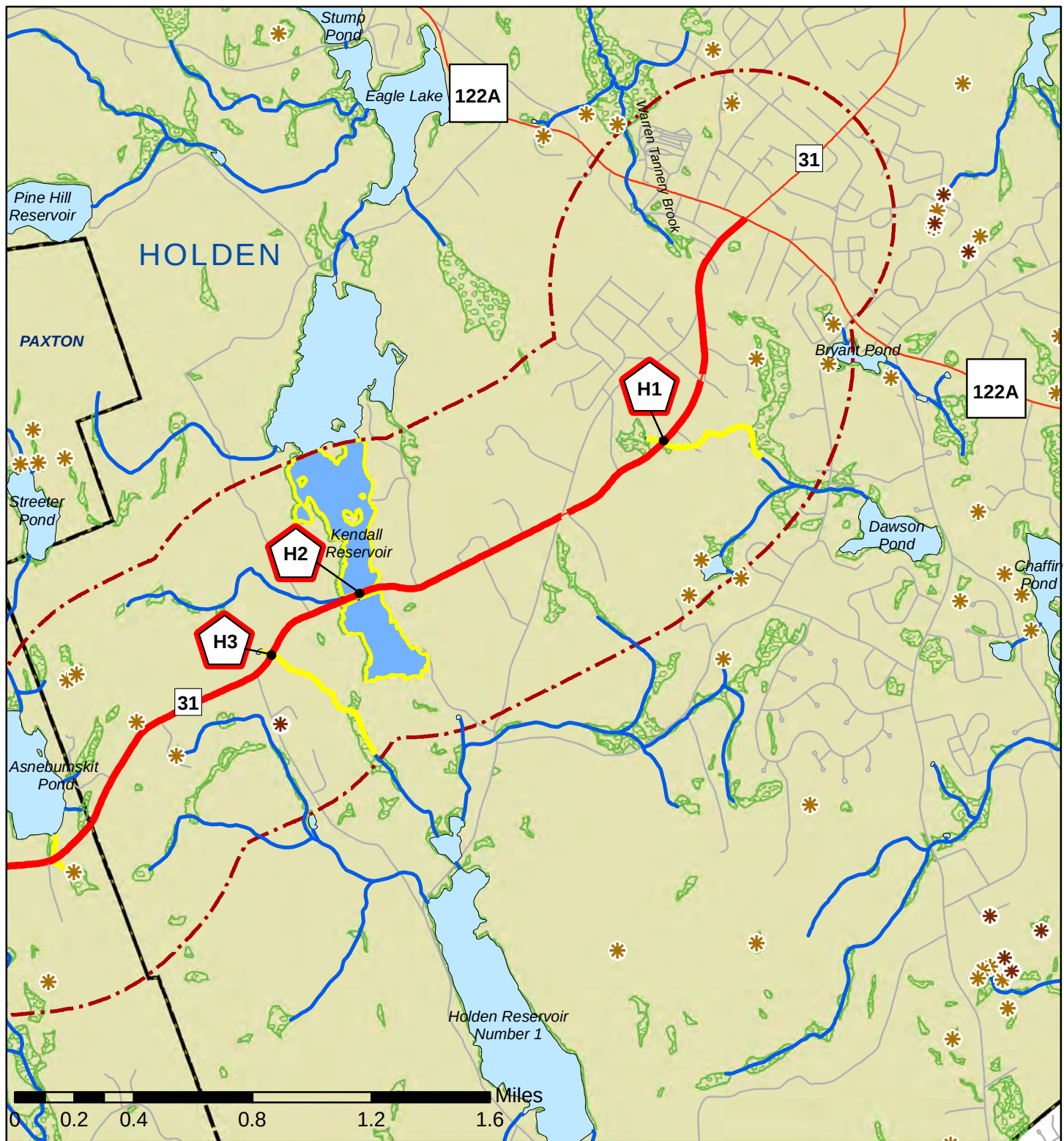
Staff then conducted a field visit to locate and observe the various drainage structures along Route 31. In total, 20 distinct structures were reviewed: 3 in Holden, 6 in Paxton and 11 in Spencer. Accompanying the graphics, **Table 18** summarizes key information about each of the major drainage structures surveyed in the field. This information includes: pipe material and diameter, general condition, estimated pipe length, field observations, and any additional notes.

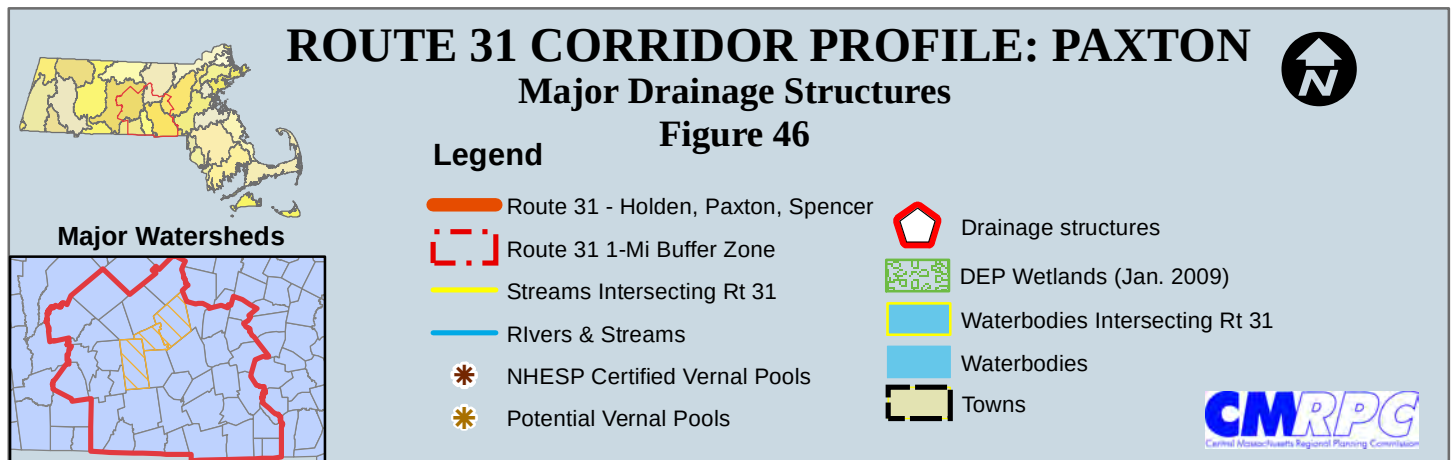
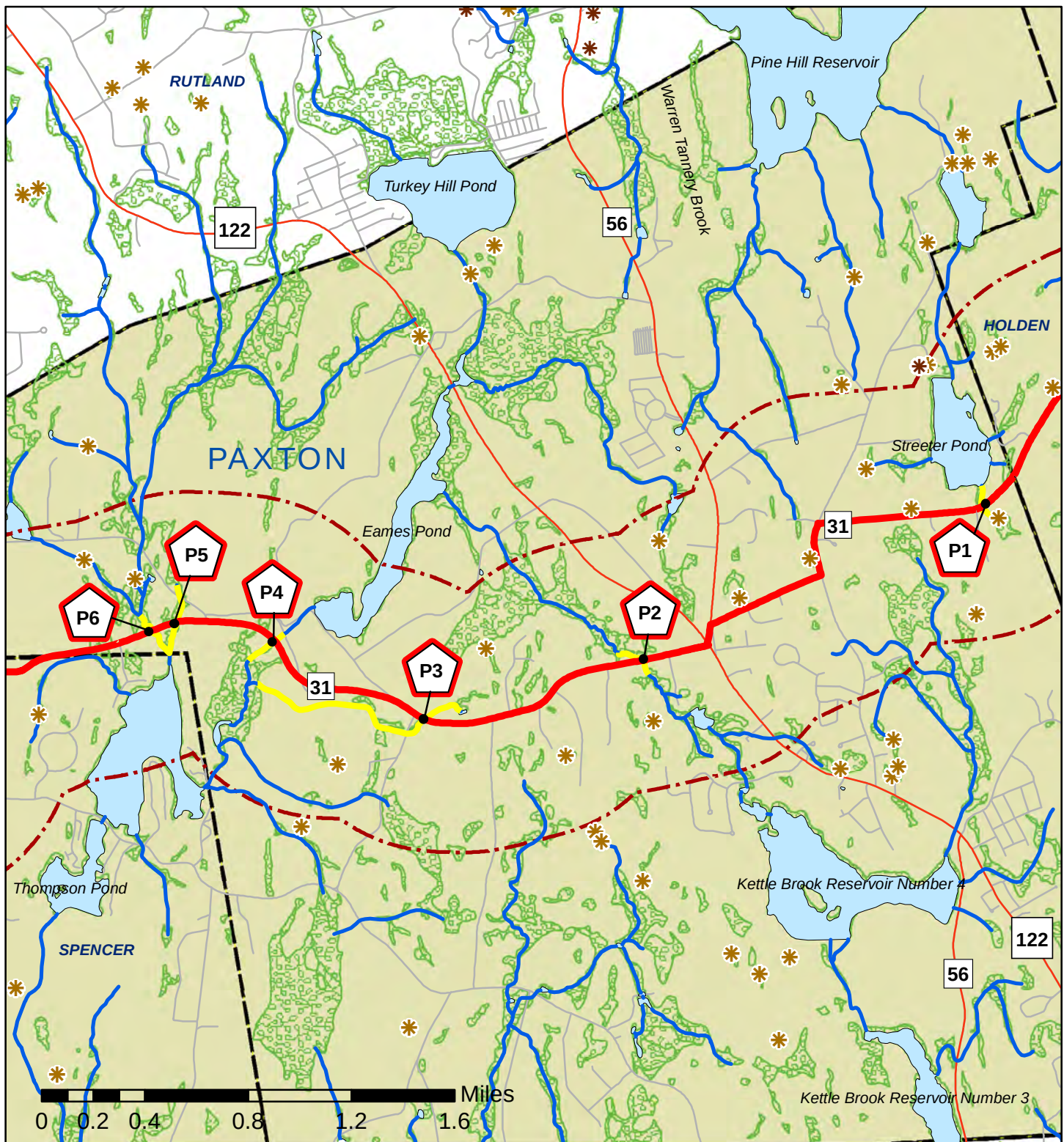
A majority of the observed structures are in fair condition, along with a number in good or poor condition. Most structures observed were concrete or corrugated steel. The pipe sizes are mainly one to two feet, although there is one major culvert in the town of Paxton that is 12 feet wide. Other noted field observation include: overgrown vegetation and yard waste around structures, some culvert blockage, no safety fences, some erosion around structures, and noted wildlife activity.

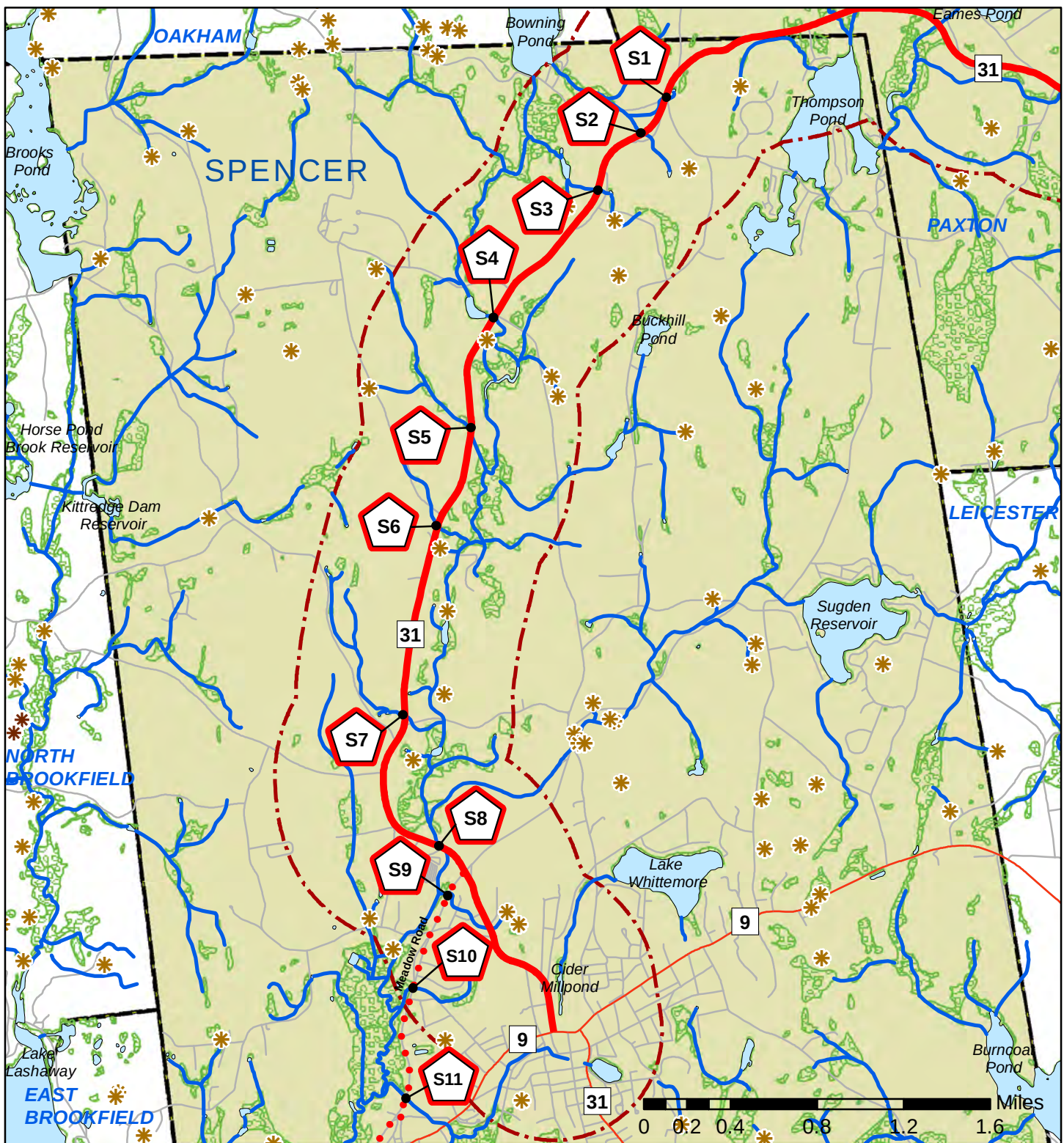
Accompanying the table are **Figures 48, 49 and 50** that show photos taken in the field of various major drainage structures in each host community. The study document's accompanying Technical Appendix includes additional photos of the 20 major drainage structures observed in the field not included in this document. As can be seen from the photos, many unique drainage structures exist along Route 31. No standard design exists and many 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 31 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.
- 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.







ROUTE 31 CORRIDOR PROFILE: SPENCER

Major Drainage Structures

Figure 47

Legend

- Route 31 - Holden, Paxton, Spencer
- - - Route 31 1-Mi Buffer Zone
- Streams Intersecting Rt 31
- Rivers & Streams
- * NHESP Certified Vernal Pools
- * Potential Vernal Pools
- S Drainage structure or bridge
- DEP Wetlands (Jan. 2009)
- Waterbodies Intersecting Rt 31
- Waterbodies
- Towns

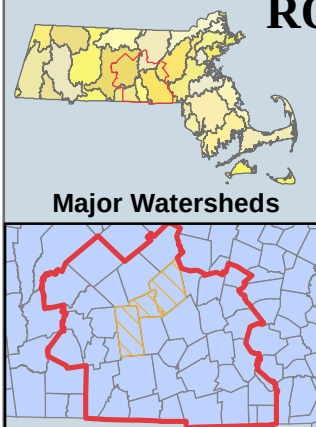


Table 18
Route 31 & Meadow Road
Inventory of Major Drainage Structures

Assigned Map #	Host Community	Primary Materials	General Condition	Approx. Pipe Size	Approx. Length	Field Observations	Additional Notes
HOLDEN							
H1		Concrete pipe Stone retaining wall without mortar	Fair	2'	50'	Next to Stonybrook estates Suggest safety fence	Clogged channel NB SB clogged, fallen stone & could be easily blocked
H2		Corrugated steel Rte 31 SB	Poor/Fair	1'	33'	Rte 31 Kendall Reservoir viaduct Large pipe under viaduct not visible from road	Existing catch basins with no pre treatment
H3		Stone & mortar	Fair	Unknown Heavy brush & poison ivy	26'	Tree growing in structure	Wadsworth Brook When small pond overflows water pours into catchment structure into pipe under road
PAXTON							
P1		Concrete Stone head wall with deterioration noted	Fair	Unknown Heavy brush & poison ivy	26' under Rte 31	Outlet area overgrown NB outlet could not be found, possibly located adjacent to Bel Arbor Dr	Brush cutting & ditch cleaning warranted

Table 18
Route 31 & Meadow Road
Inventory of Major Drainage Structures

Assigned Map #	Host Community	Primary Materials	General Condition	Approx. Pipe Size	Approx. Length	Field Observations	Additional Notes
P2		Concrete Pipe	Fair/Poor	4' main pipe	53'	4 outlet pipes SB	Fair amount of branches & brush NB side, overgrown channel
		Corrugated steel	Some steel rot noted	1' & 2' steel pipe		3 outlet pipes NB	
		Concrete wing walls w/ stone & mortar cap				Culvert clear flowing	
						Catch basin drain outlet adjacent to culvert	Small hand made dam on SB side
P3						Suggest safety fence	Concrete scour on NB
						12' drop to 2' water, rocks	
		Corrugated steel	Poor	2'	105' diagonal under Rte 31	Sand build up in outlet NB	
		Stone headwall without mortar	Steel rot noted			Headwall stones falling away on NB	
P4						Wing wall structure suggested for inlet SB	
						Outlet structure suggested for outlet NB with safety fence	
		1/4" steel corrugate oval	Good	12'	81'	Suggest safety fence	Downstream scour at pipe outlet
		Piled stone slabs above pipe				Large crack in pavement above culvert structure	Downstream erosion due to mini waterfall
P4						Suggest modern wing walls on downstream side NB	

Table 18
Route 31 & Meadow Road
Inventory of Major Drainage Structures

Assigned Map #	Host Community	Primary Materials	General Condition	Approx. Pipe Size	Approx. Length	Field Observations	Additional Notes
P5		Corrugated steel	Poor/Failure	2'	63'	Outlet crushed on NB side	Clogged pipe, blockage rotting, perhaps undersized
		Stone & mortar wing wall failing				Swale arrangement both sides	Stagnated swamp water
						Suggest modern wing walls	Rotted screen SB
							Fallen trees NB
P6		1/8" steel corrugated oval	Fair/Good	6'	65'	Large crack in pavement above culvert structure	Built early 1960's
		Stone & mortar headwall	Some rot SB			Small pool with erosion SB	Nearby resident indicated localized flooding problem in part due to beavers
						Large downstream channel NB	
Suggest safety fence							Dam building materials starting to accumulate in center of culvert
SPENCER							
S1		NB concrete block Drainage chamber with connectors	Good/Fair	1' 2 inlets, 1 drainage channel	Unknown 63' from NE catch basin to MH cover; Additional 49' to NW corner	SB outlet could not be located	Extensive, modern drainage system
S2		Unknown & obscured BLOCKED by yard waste	Unknown	Unknown	37'	SB outlet yard waste blockage Suggest advisory sign "Keep Area Clear-No Yard Waste"	Extensive, modern drainage system

Table 18
Route 31 & Meadow Road
Inventory of Major Drainage Structures

Assigned Map #	Host Community	Primary Materials	General Condition	Approx. Pipe Size	Approx. Length	Field Observations	Additional Notes
S3		Concrete with stone slabs	Good/Fair	2'	91' (31' road width)	SB inaccessible	One can see through the length of the pipe NO blockage
S4 S-23-012		Concrete with some steel decking Bridge S-23-012	Fair overall Poor bridge rail	Approx 20' x 6' (width x height)	32'	SEVERE concrete spaulding on guardrails, wing walls and beam mounting areas DETERIOATED beam connection Rebar exposure, efflorescence & spalling on superstructure & wing walls	Some downstream scour Clear downstream channel
S5		Concrete with stone work	Fair/Poor	1'	44'	SB drainage swale noted SB catch basin	
S6		Granite cap with concrete & stone	Fair/Poor	1'-2'	45'	SB drainage swale noted	Located prior to Alta Crest Rd Near Guaranteed Fitness
S7		Concrete with stone headwall	Fair overall Stone & mortar in poor condition	2'	56'	SB significant leaves have potential to clog pipe Upstream footbridge observed	Suggest potential safety fence Perfectly clear intermediate catchment area

Table 18
Route 31 & Meadow Road
Inventory of Major Drainage Structures

Assigned Map #	Host Community	Primary Materials	General Condition	Approx. Pipe Size	Approx. Length	Field Observations	Additional Notes
S8 S-23-002		Concrete & steel bridge structure Built 1952 Last painted 6/95	Good/Fair	Open box	34' deck roadway width	Nearby catch basin pipe blocked near cemetery POSTED 20, 25, 40 depending on # axles Substandard concrete railing	Safety fencing suggested for top of bridge wing walls Scour noted adjacent to SE ing wall, fairly significant
S9		Granite cap with concrete & stone Corrugated steel	Good/Fair	1'	50'	Recent maintenance activities noted Areas adjacent to pipe inflow and outflow clear of all debris	Home made headwall failing
S10		Stone & mortar headwall Loose granite cap slab, acts like see-saw Concrete pipe	NB is poor, failing headwall noted SB is fair, some deterioration	2'	57'	NB headwall could collapse Fair amount of erosion eroded 1' connecting drain SB better than NB, fair condition SB siltation, some blockage	Woodland animal tracks noted for potential for wildlife X-ing
S11		Concrete	Good	3' dual pipe arrangement	40'	Lots of brush on sides Some sediment on NB side in front of pipes	Pipes exhibit minimal wear

Figure 48
Town of Holden
Route 31 Major Drainage Structures Photos



Culvert #H1 northbound side



Culvert #H1 southbound side



Culvert #H2 northbound side



Culvert #H2 southbound side



Culvert #H3 northbound side



Culvert #H3 southbound side

Figure 49
Town of Paxton
Route 31 Major Drainage Structures Photos



Culvert #P1 southbound side



Culvert #P2 southbound side



Culvert #P3 southbound side



Culvert #P4 northbound side



Culvert #P5 southbound side



Culvert #P6 southbound side

Figure 50
Town of Spencer
Route 31 Major Drainage Structures Photos



Culvert #S3 northbound side



Bridge(S-23-012) #S4 northbound side



Culvert #S6 southbound side



Culvert #S7 northbound side



Bridge(S-23-002) #S8 southbound side



Culvert #S11 northbound side

7.0 PUBLIC TRANSPORTATION

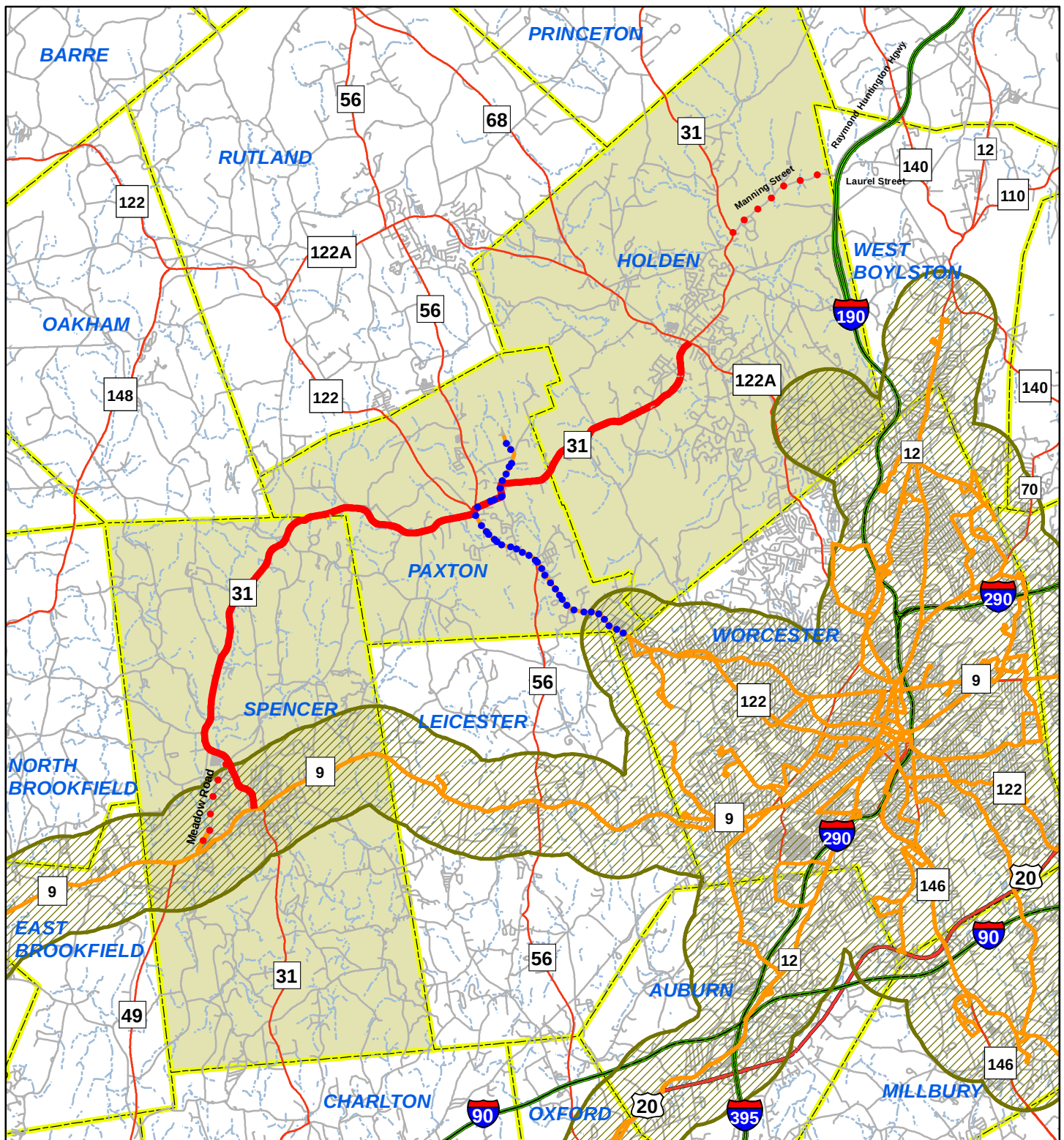
7.1 Regional and Profile Area Services

The Worcester Regional Transit Authority (WRTA) provides transit service for the greater Worcester region. Local fixed-route service is provided within several communities, and flex-route service has begun in some areas. Paratransit service is available to eligible individuals, including Americans with Disabilities Act (ADA) complementary service and expanded paratransit that serves an area that is larger than that covered by ADA services. ADA services operate within 3/4 mile of fixed-route services and at the same times. Non-ADA service is generally available for elders and people with disabilities, with service hours varying by community or eligibility. These services are generally provided by Councils on Aging and are subsidized by the WRTA.

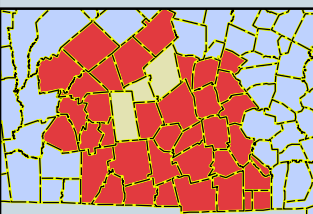
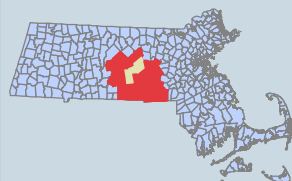
Figure 51 shows WRTA fixed route service and complementary paratransit service areas within the Route 31 host communities. It also shows WRTA flex route service to Paxton.

All WRTA transit vehicles that provide fixed route service are equipped with bicycle racks. Thus, the potential utility of future bicycle racks in the various communities is enhanced. While the WRTA employs a number of environmentally-friendly electric buses at this time, these vehicles will not serve outlying areas such as the Route 31 corridor profile region unless a “fast charger” is installed in an area community, such as the Meadow Road location identified in Section 1.9.

For further general transit information, see the Technical Appendix which includes a number of transit-related news articles as well as the Paxton flex route schedule.



ROUTE 31 CORRIDOR PROFILE Worcester Regional Transit Authority Service Area Legend



- Route 31 - Holden, Paxton, Spencer
- Route 31 Corridor Extensions
- Paxton Shuttle
- Interstate
- U.S. Route
- State Route
- Roads
- WRTA Fixed Routes
- WRTA ADA Service Area
- Streams



Source: Data provided by the US Census Bureau, Central Massachusetts 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 interpreting positional accuracy.

0 0.5 1 2 3 4 Miles

7.2 Town of Holden

Existing Service

Currently there is no fixed route service to Holden and thus no complementary paratransit in general. The WRTA paratransit zone does encompass part of a corner of the community which is adjacent to the city of Worcester.

Paratransit service is however offered to all elders and people with disabilities town-wide. This service is in effect on weekdays between 9 AM-4 PM. It is provided by the Holden Council on Aging through a contract with the WRTA. The WRTA provides a van and reimburses the Council on Aging for operating costs. The WRTA also has a grant through Community Transit Grants to extend additional service to all elders and people with disabilities for travel between Holden and Worcester between 6-9 AM and 4-6 PM.

Future Outlook

There is potential for the return of fixed route service on Main Street. Such a route did formerly exist, terminating in Jefferson. The completion of a “comprehensive service analysis” document by WRTA consultant URS Corporation may shed further light on this possibility. The report is due in June of 2015.

7.3 Town of Paxton

Existing Service

Paxton recently joined the WRTA service area in July 2013. On December 11, 2013, flex route service was established with a WRTA vehicle for two days a week. It begins near the town center area and nearby Anna Maria College and terminates at Worcester’s Union Station. Service runs from about 6-9 AM and 3-6 PM on Wednesdays and Fridays.

Future Outlook

There may be an opportunity for increased frequency of flex route service along with increased local commitments for funding. The completion of a “comprehensive service analysis” document by WRTA consultant URS Corporation may shed further light on this possibility. The report is due in June of 2015.

7.4 Town of Spencer

Existing Service

Fixed route service is currently provided by two routes. Weekday service from Worcester to Brookfield runs from early morning to early evening, including stops at Spencer Center and the

Spencer DPW. There is similar service on Saturday which ends in Spencer on its western leg. ADA paratransit service is available within ¾ mile of these fixed routes.

Additional paratransit service is offered to all elders and people with disabilities in Spencer on weekdays between 8 AM-3 PM. This service is operated by SCM Elderbus. The WRTA provides a van and reimburses Elderbus for operating costs.

Future Outlook

There may be an opportunity for increased frequency of service. The completion of a “comprehensive service analysis” document by WRTA consultant URS Corporation may shed further light on this possibility. The report is due in June of 2015.

The Spencer Highway Department property is currently used by the WRTA as a bus dwelling/parking area. The host community of Spencer has recently indicated the potential for an electric “fast charge” station or in the long term a Park & Ride Lot at this site. Commuters could drive to the lot, leave their cars and utilize the fixed route service to travel on to Worcester. This potential site use may be investigated further as a future Park & Ride activity under the region’s Congestion Management Program (CMP).

8.0 ALTERNATIVE MODES

8.1 Introduction

Various state initiatives, compacts and design criteria revisions have served to raise awareness about alternative modes of transportation including primarily public transit (detailed in another section of the CP), bicycling and walking. Specifications for this Route 31 Corridor Profile effort also included long distance hiking trails – namely, the Mid-State Trail – as well as traditional pedestrian access.

8.2 GreenDOT

The GreenDOT initiative is MassDOT’s sustainability policy which supports the implementation of existing state laws, Executive Orders and other MassDOT policies.¹ The policy overreaches all MassDOT activity, from planning to construction and systems operations. GreenDOT’s three primary objectives are to reduce greenhouse gas (GHG) emissions, to promote the healthy transportation options of walking, bicycling and public transit, and to support smart growth development.

Among GreenDOT’s core planning goals related to mode shift and healthy transportation are the design of a multimodal transportation system, the promotion of healthy transportation and livable communities, and an increase in the use of bicycling, public transit and walking. In particular, a specific goal exists to triple the overall trip share of alternative modes. All goals are associated with specific strategies to be applied within reasonable timeframes. GreenDOT seeks to make real mode shift feasible by increasing the access and connectivity of all modes, improving transit performance, expanding commuter options, and by increasing the number of Complete Streets designed projects.

8.3 MassDOT Healthy Transportation

The Transportation Reform Law (2009) established the Healthy Transportation Compact (HTC) which promotes improved public health through active transportation. Active transportation refers to walk, bike and transit. 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

¹ The State policy includes: Climate Protection and Green Economy Act (Mass. Gen. L. c. 21N); Green Communities Act (Chapter 169 of the Acts of 2008); Healthy Transportation Compact (section 33 of Chapter 25 of the Acts of 2009); Leading by Example (Executive Order of Governor Patrick, no. 488); MassDOT’s youMove Mass planning initiatives; and the “Complete Streets” design standards of the 2006 MassDOT Highway Division Project Development and Design Guide, as amended.

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. GreenDOT healthy transportation strategies were built upon the HTC spirit. 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 and make the connection between health and transportation are: Mass in Motion, Safe Routes to School, and the Healthy Transportation Policy Directive, among other initiatives.

8.4 Healthy Transportation Policy Directive

MassDOT's Healthy Transportation Policy Directive requires all state transportation projects to increase bicycling, transit and walking options. This new Directive is intended to promote multimodal access for all transportation customers. MassDOT has made it clear that everyone in Massachusetts must be given the opportunity to bike, walk, or take transit instead of driving.

All MassDOT facilities will consider adjacent land uses and be designed to include wider sidewalks, landscaping, crossing opportunities and other features to enhance healthy transportation options. Reviews will be conducted of 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.

8.5 Community Health Improvement Plan (CHIP)

The City of Worcester Division of Public Health in collaboration with community partners has released a Community Health Improvement Plan (CHIP). The CHIP identifies major health priorities for the Greater Worcester region and includes specific objectives and strategies. The Town of Holden is part of the Central Massachusetts Regional Public Health Alliance. 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 Complete Streets transportation policy throughout the region.

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.

8.6 Complete Streets

What is now 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.

8.7 Bicycling in the Corridor

Paved shoulders reduce passing conflicts between motor vehicles and bicyclists and pedestrians and make the crossing pedestrian more visible to motorists. They also provide for storm water discharge farther from the travel lanes, reducing hydroplaning, and splash and spray to following vehicles, pedestrians and bicyclists. In rural areas, they provide space for bicyclists to ride at their own pace.

Existing Route 31 conditions include roadway shoulders with minimal width that are too narrow to serve as breakdown lanes and recovery/clearance areas. In the future, five foot shoulders would be preferable along the entire corridor. In some areas this goal would admittedly be a challenge due to existing narrow roadway footprints and the existence of various roadside features such as large trees and historic stonewalls.

In Paxton, planned improvements to the Holden Road segment of Route 31 call for 11 foot travel lanes with 5 foot shoulders. This typical roadway cross section specification could perhaps be utilized along other segments of the study corridor.

8.8 Pedestrian Facilities and Activity in the Corridor

Limited sidewalks currently exist in the corridor area. They are mostly in the vicinity of town center areas. Spencer has a sidewalk betterment program which includes both proposed new sidewalks and improvements to existing sidewalks that primarily connect schools, shopping and the downtown area. Similar efforts could be considered as appropriate in the other towns.

With regard to crossing the primary corridor roadway, Route 31, triggered pedestrian phases to traffic signals are available at Route 122A in Holden and Route 122 in Paxton. In Spencer, the intersections of Route 9 with Meadow Road & South Spencer Road and Route 9 with Route 31 provides for pedestrian call time. Crosswalks could be considered at other key locations along the study corridor where demand appears to be high.

Walkable Community Workshops are short interactive courses that involve learning the basics, touring an area on foot to identify issues, and cooperatively determining a plan for making improvements. Special topics may include schools, major roads, land use, neighborhood design and the needs of the mobility impaired. CMRPC also conducts Neighborhood SAFE studies that provide communities with small area infrastructure assessments from a pedestrian and bicyclist safety perspective.

Host communities are at various stages in the use of these informative tools. Holden and Paxton have both completed a Neighborhood SAFE program for their town centers, while Spencer plans to utilize the Neighborhood SAFE program for the Meadow Road area. They are also requesting a Road Safety audit for the roadway itself.

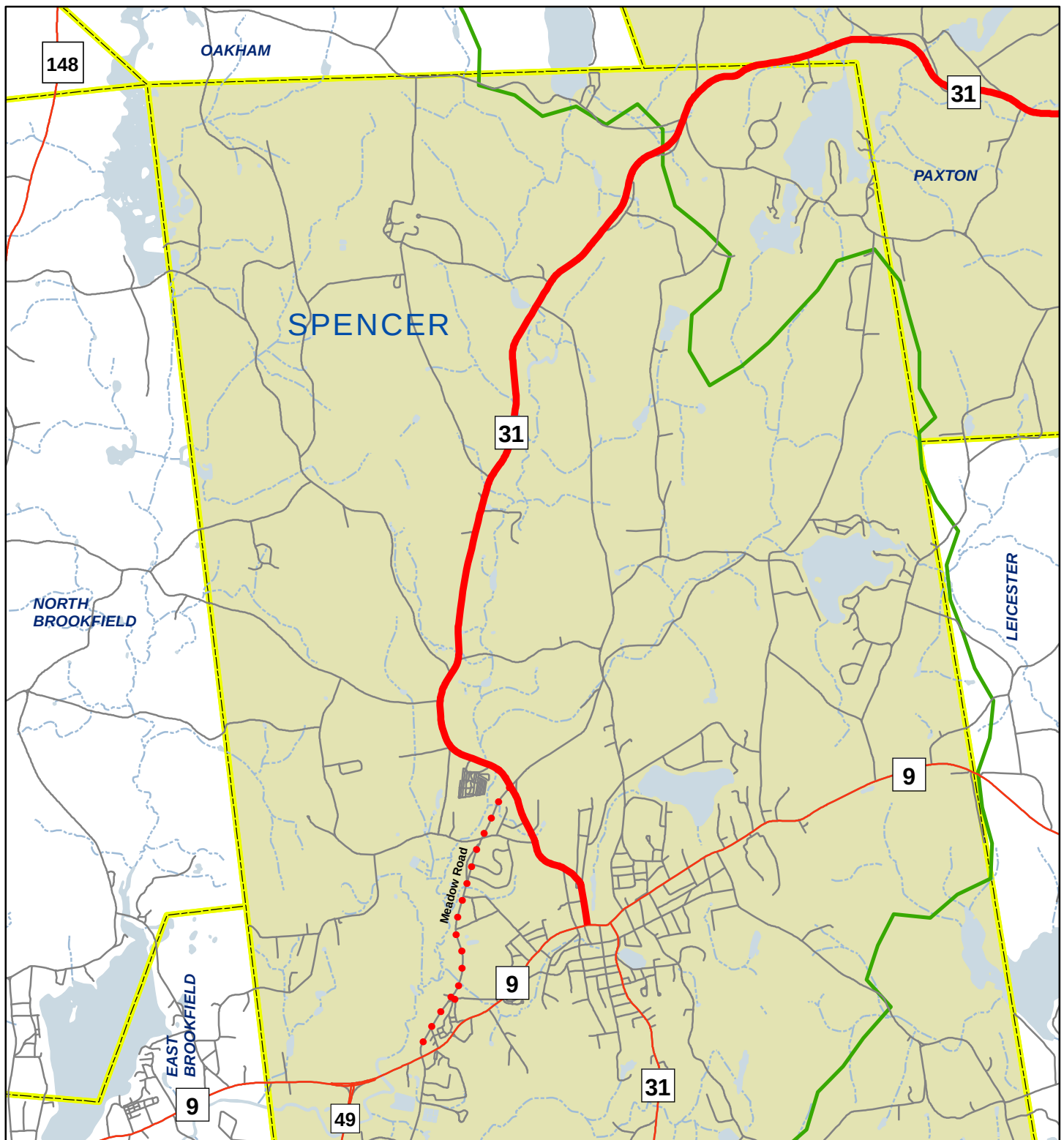
8.9 Regional Trails in the Corridor

The Midstate Trail is a scenic footpath which runs 92 miles through Worcester County from the Rhode Island border to the New Hampshire border. The trail is considered highly accessible, scenic, and remarkably rural despite its proximity to urban areas. The trail includes the summits of Mount Wachusett and Mount Watatic, as well as many interesting geologic, historic, and natural features. Central portions of the trail climb the flanks and summits of drumlins such as Moose Hill and Buck Hill in Spencer.

In the host community of Spencer, the Mid-State Trail crosses Route 31 in North Spencer in vicinity of the landmark Black & White Restaurant. **Figure 52** indicates the location of the Mid-State Trail in the town of Spencer using a green line. From the adjacent communities of Leicester and Paxton, the Mid-State Trail continues on to skirt Spencer state forest in North Spencer before crossing Route 31. The trail then essentially parallels Browning Pond Road before entering the town of Oakham.

The Midstate Trail Committee, under the auspices of the Worcester chapter of the Appalachian Mountain Club, continues the administration and maintenance of the Trail. The Committee is augmented by a larger group of resident volunteer maintainers who are invaluable to the survival of the Midstate Trail. Local mountain club chapters assist with hike publicity and recruitment of maintainers. The Committee welcomes anyone willing to help maintain a part of this “close to home” trail. The Department of Environmental Management has provided support, map printing, and publicity over the years.

We note here also that the long distance MassCentral Rail Trail crosses Route 31 in host community Holden, north of the defined Corridor Profile study area.



ROUTE 31 CORRIDOR PROFILE: SPENCER

Midstate Trail Alignment

Figure 52

Legend

- Route 31 - Holden, Paxton, Spencer
- ... Route 31 Corridor Profile Extension
- State Route
- Other Roadways
- Midstate Trail

1 in = 0.75 miles



Source: Data provided by the US Census Bureau, Central Massachusetts 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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9.0 OVERALL CORRIDOR PROFILE FINDINGS

The Corridor Profile effort essentially 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.

9.1 Route 31 Intersections

Table 19 through Table 21 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 the Route 31 and beyond and other considerations such as obstructed lines of sight or the need for bicycle and pedestrian accommodations.

The following are Route 31 observations from the included tables:

- Generally, all study intersections operate at acceptable Levels of Service in the LOS “B” and LOS “C” ranges, indicative of low to moderate delay. In most cases, Route 31 flows are relatively unimpeded. The town of Holden has the worst delay, especially near the center of town. Although not considered within the limits of the Corridor Profile, the Route 31/Manning Street intersection was analyzed and is the worst intersection for delay in current and future years.
- Most intersections had fewer than ten reported vehicle crashes during the study period. The Route 31/Route 122A intersection in Holden had the most with a total of 24 (during an 18-month period). The majority of crashes within the three towns were property damage only. However, the Route 31/Meadow Road/Wire Village Road intersection in Spencer had nine personal injury crashes, which was over half of the total crashes at that location.
- In the town of Holden the Council On Aging (COA) provides transit service to elders and disabled. Currently, the Worcester Regional Transit Authority (WRTA) does not provide service along Route 31 in Holden. SCM Elderbus serves the elderly and disabled population in Paxton. There is also a WRTA shuttle that serves a portion of Route 31 between Grove Street and Route 122 and travels to the WRTA hub in Worcester. SCM Elderbus is also the primary provider in Spencer. WRTA Route 33 has no stops on Route 31, but it does end at the Spencer DPW on Meadow Road on multiple trips during the day.

- The percentage of heavy vehicles using the Route 31 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.
- The environmental analysis conducted for the Corridor Profile effort noted recreation/conservation, wooded swamp, vernal pools and water supply protection land parcels adjacent to Route 31 throughout the three towns. There are also historical/cultural land, forest land, agricultural land, and rare wildlife species habitats at some study intersections. As can readily be realized, the need to protect and preserve sensitive adjacent properties will need to be part of the design process for any of the improvement options.
- The need for bicycle and pedestrian connectivity and maintaining clear lines of sight should be considered for many intersections. The intersection of Route 31 and Route 56 in Paxton is a wide pavement area. A plan to make this intersection more defined should be considered. The Route 31/Barclay Road intersection in Spencer is currently a “Y”-type intersection. The possibility of realigning it to a “T”-type intersection should be considered.

Table 19

**Town of Holden
Route 31 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 31/Route 122A	AM = C (D) PM = D (E)	Total = 24 PI - 5, PD - 19	Holden COA provides service to elders and disabled in the town of Holden	AM = 5.7% PM = 1.1%	Historical/cultural, potential vernal pools, wooded swamp	Town center, need for bicycle & ped connectivity
Route 31/Holden Commons	AM = B (C) PM = C (D)	No Crashes	Holden Council on Aging	AM = 2.5% PM = 1.0%	Historical/cultural, potential vernal pools, wooded swamp	Flashing operation, need for bicycle & ped connectivity
Route 31/Mixer Rd/ Reservoir St	AM = C (C) PM = C (D)	Total = 2 PI - 1, PD - 1	Holden Council on Aging	AM = 4.3% PM = 1.5%	Water supply, potential vernal pools, species of conservation concern, wooded swamp	Need to maintain clear lines of sight
Route 31/Manning St****	AM = D (F) PM = E (F)	Did not research this location	Holden Council on Aging	AM = 4.8% PM = 2.6%	Water supply, town forest, potential vernal pools, species of conservation concern, wooded swamp	Manning St used to access I-190 north

* Intersection Level-of-Service Existing (Projected 2023)

**PI = Personal Injury, PD = Property Damage

***There is currently no Fixed Route service in Holden

****This additional intersection was added per request by the town of Holden

Table 20

**Town of Paxton
Route 31 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 31(Holden Rd)/ Grove St	AM = B (B) PM = C (C)	Total = 4 PI -0, PD - 4	Paxton Shuttle service / SCM Elderbus provides service to elders and disabled in the town of Paxton	AM = 3.4% PM = 2.7%	Water supply, potential vernal pools, wooded swamp	Flashing beacon, need to maintain clear lines of sight
Route 31(Maple St)/ Grove St	AM = B (C) PM = B (B)	Total = 4 PI - 1, PD - 3	Paxton Shuttle service / SCM Elderbus provides service to elders and disabled in the town of Paxton	AM = 2.8% PM = 1.7%	Water supply, potential vernal pools, wooded swamp	Need for bicycle & pedestrian accommodations on Maple St
Route 31/Route 56	AM = C (C) PM = C (C)	Total = 8 PI - 1, PD - 7	Paxton Shuttle service / SCM Elderbus provides service to elders and disabled in the town of Paxton	AM = 3.9% PM = 1.9%	Historical/cultural, potential vernal pools, wooded swamp	Expansive pavement area, no stop for Route 56 southbound
Route 31/Route 122	AM = B (B) PM = B (B)	Total = 9 PI - 0, PD - 9	Paxton Shuttle service / SCM Elderbus provides service to elders and disabled in the town of Paxton	AM = 1.7% PM = 1.6%	Historical/cultural, potential vernal pools, wooded swamp	Town center, need for bike & pedestrian connectivity
Route 31/Suomi St	AM = B (B) PM = A (A)	Total = 2 PI - 0, PD - 2	SCM Elderbus provides service to elders and disabled in the town of Paxton	AM = 2.7% PM = 1.8%	Recreation, potential vernal pools, wooded swamp	Suomi St provides connection to Marshall St

*Intersection Level-of-Service Existing (Projected 2023)

**PI = Personal Injury, PD = Property Damage

***WRTA Paxton Shuttle does serve a portion of Route 31 between Grove Street and Route 122

Table 21

**Town of Spencer
Route 31(& Meadow Rd) 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 31/Bardlay Rd	AM = A (A) PM = B (A)	Total = 2 PI - 1, PD - 1	SCM Elderbus provides service to elders and disabled in the town of Spencer	AM = 3.5% PM = 2.0%	Recreation, potential vernal pools, species of conservation concern, wooded swamp	"Y"-type intersection
Route 31/Browning Pond Rd/ Thompson Pond Rd	AM = B (B) PM = B (C)	Total = 3 PI - 1, PD - 2	SCM Elderbus	AM = 4.5% PM = 2.5%	Recreation & conservation, potential vernal pools, species of conservation concern, wooded swamp	Expansive pavement area
Route 31/North Brookfield Rd	AM = B (C) PM = B (B)	Total = 3 PI - 0, PD - 3	SCM Elderbus	AM = 3.5% PM = 0.4%	Agriculture, potential vernal pools, wooded swamp	Limited lines of sight, northbound road approach is steep
Route 31/Meadow Rd/ Wire Village Rd	AM = B (B) PM = C (D)	Total = 16 PI - 9, PD - 7	SCM Elderbus	AM = 3.5% PM = 0.4%	Historical/cultural, recreation, potential vernal pools, wooded swamp	Limited lines of sight, adjacent Eagleton St
Route 31/Route 9/ Wall St	AM = C (C) PM = C (C)	Total = 10 PI - 0, PD - 10	SCM Elderbus	AM = 6.8% PM = 1.5%	Historical/cultural, recreation, potential vernal pools, deep marsh	Off set geometry planned for improvement
Meadow Rd/Route 9/ South Spencer Rd****	AM = B (B) PM = B (B)	Total = 13 PI - 1, PD - 12	SCM Elderbus / WRTA Fixed Route #33 serves a portion of Meadow Rd	AM = 5.4% PM = 1.5%	Historical/cultural, water protection land, potential vernal pools, species of conservation concern, wooded swamp	Commercial area, need for bicycle & pedestrian connectivity

*Intersection Level-of-Service Existing (Projected 2023)

**PI = Personal Injury, PD = Property Damage

***WRTA Fixed Route service has no stops on Route 31, but Route #33 ends at Spencer DPW on Meadow Road.

****This additional intersection was added per request by the town of Spencer

9.2 Route 31 Roadway Segments

The Corridor Profile findings for Route 31 roadway segments are summarized in **Tables 22, 23, and 24**. Similar to the previous tables, the roadway segment tables list each Route 31 study segment, number of documented vehicle crashes, the field observed condition of the paved roadway surface, the observed condition of Route 31 drainage culverts and bridge structures, the availability of public transit, the daily percentage of heavy vehicles using the Route 31 segments, environmental considerations adjacent to Route 31 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 98 recorded segment vehicle crashes during the defined research period. Of the three towns, Spencer had the most crashes with a total of 52. Of the 98 crashes, only 19 caused personal injuries. The worst segments in Spencer were between Browning Pond Road and North Brookfield Road and on Meadow Road from Route 31 to Route 9. These two segments each had 16 vehicle crashes.
- Roadway pavement condition along Route 31 in Holden, Paxton, and Spencer is based on a calculated “Overall Condition Index” (OCI) which is derived from the pavement distress (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. Route 31 OCI in the town of Holden ranged from 55 to 68, which is considered in the “preventative maintenance” category. In Paxton, there are two roadway segments that have an OCI under 50 and need “structural improvement” to upgrade the roadway to excellent condition. The rest of Route 31 is either in excellent condition or needs “preventative maintenance”. Most of the Spencer segments were in good condition and in the “do nothing” or “routine maintenance” categories. The only segment in poor condition was Meadow Road with an OCI rating of 34.
- There were three culverts in the town of Holden and all of them are in fair condition. There were six culverts in the town of Paxton. Most of them were located between Suomi Street and the Spencer town line. The condition of these culverts is a mixture of poor, fair, and good. The town of Spencer had the most, with a total of 11. The majority of them are located between Browning Pond Road and North Brookfield Road. Most of these structures are in good/fair or fair/poor condition.
- As indicated in the intersection findings, the Council On Aging (COA) provides transit service to elders and disabled in the town of Holden. Currently, the Worcester Regional Transit Authority (WRTA) does not provide service along Route 31 in Holden. SCM Elderbus serves the elderly and disabled population in Paxton. There is also a WRTA shuttle that serves a portion of Route 31 between Grove Street and Route 122 and

travels to the WRTA hub in Worcester. SCM Elderbus is also the primary provider in Spencer. WRTA Route 33 has no stops on Route 31, but it does end at the Spencer DPW on Meadow Road on multiple trips during the day.

- The average percentage of heavy vehicles using Route 31 through Holden, Paxton, and Spencer ranged from 4% to nearly 9%. The highest percentage was observed on the segment of Route 31 between Grove Street and Route 56 in Paxton and the lowest was between Holden Commons and Mixer Road in Holden.
- As noted in the intersection findings, the environmental analysis conducted for the Corridor Profile effort noted recreation/conservation, wooded swamp, vernal pools and water supply protection land parcels adjacent to Route 31 throughout the three towns. There are also historical/cultural land, forest land, agricultural land, and rare wildlife species habitats along some study segments. As can readily be realized, the need to protect and preserve sensitive adjacent properties will need to be part of the design process for any of the improvement options.
- In the “other considerations” column, it is noted that the roadway through the town of Holden has many curves and limited pavement width, along with steep grades in some areas. The additional segment of Manning Street is used to access I-190. For Paxton, the northern section of Route 31 (Holden Road) is seeking TIP programming. There is also a need for major water line improvements between Route 122 and Suomi Street. In Spencer, there is a need to maintain the lines of sight in some segments and there are inconsistent roadway widths along Route 31.

Table 22
Town of Holden
Route 31(& Manning Street) Roadway Segments:
Overall Corridor Profile Findings

Route 31 Roadway Segments	Safety Analysis*	Pavement Condition**	Bridge/Culverts Observed Condition	Public Transit***	Freight Movement Daily % of Heavy Vehicles	Environmental Consultation Analysis	Other Considerations
Route 122A to Holden Commons Plaza	Total = 6 PI - 0, PD - 6	OCI = 55.1 <i>Preventative Maintenance</i>	None	Holden COA provides service to elders and disabled in the town of Holden	4.4%	Historical/cultural, potential vernal pools, wooded swamp	Heavily used segment, bridge over railroad
Holden Commons to Mixter Rd	Total = 6 PI - 1, PD - 5	OCI = 54.5 <i>Preventative Maintenance</i>	Culvert H1 - fair condition	Holden Council on Aging	4.0%	Potential vernal pools, wooded swamp	Curves and limited pavement width
Mixter Rd to Paxton Town Line	Total = 13 PI - 2, PD - 11	OCI = 67.7 <i>Preventative Maintenance</i>	Culvert H2 - fair/poor condition Culvert H3 - fair condition	Holden Council on Aging	6.0%	Water supply, certified vernal pools, species of conservation concern, wooded swamp	Steep grades
West Boylston Town Line to Route 31**** (Manning Street)	Did not research this segment	OCI = 88.8 <i>Routine Maintenance</i>	Did not observe this segment	Holden Council on Aging	6.7%	Water supply, town forest potential vernal pools, species of conservation concern, wetland buffer	Used to access I-190 north

*PI = Personal Injury, PD = Property Damage

**OCI = Overall Condition Index, Ranging From 0 - 100

***There is currently no Fixed Route service in Holden

****This additional segment was added per request by the town of Holden

Table 23
Town of Paxton
Route 31 Roadway Segments:
Overall Corridor Profile Findings

Route 31 Roadway Segments	Safety Analysis*	Pavement Condition**	Bridge/Culverts Observed Condition	Public Transit***	Freight Movement Daily % of Heavy Vehicles	Environmental Consultation Analysis	Other Considerations
Holden Town Line to Grove St	Total = 5 PI - 0, PD - 5	OCI = 48.5 <i>Structural Improvement</i>	Culvert P1 - fair condition	SCM Elderbus provides service to elders and disabled in the town of Paxton	6.0%	Water supply, certified vernal pools, wooded swamp	Improvement project, seeks TIP programming
Holden Rd to Maple St	Total = 2 PI - 0, PD - 2	OCI = 99.2 <i>Do Nothing</i>	None	Paxton Shuttle service / SCM Elderbus provides service to elders and disabled in the town of Paxton	6.2%	Water supply, potential vernal pools, wooded swamp	Recently reconstructed as a "Complete Street"
Grove St to Route 56	Total = 1 PI - 0, PD - 1	OCI = 98.4 <i>Do Nothing</i>	None	Paxton Shuttle service / SCM Elderbus provides service to elders and disabled in the town of Paxton	8.7%	Historical/cultural, potential vernal pools, wooded swamp	Challenge to accommodate bicycle & pedestrians
Route 56 to Route 122	None	OCI = 25.3 <i>Structural Improvement</i>	None	Paxton Shuttle service / SCM Elderbus provides service to elders and disabled in the town of Paxton	7.5%	Historical/cultural, potential vernal pools, wooded swamp	Adjacent to town common & old cemetery
Route 122 to Suomi St	Total = 7 PI - 1, PD - 6	OCI = 64.0 <i>Preventative Maintenance</i>	Culvert P2 - fair/poor condition	SCM Elderbus provides service to elders and disabled in the town of Paxton	5.7%	Recreation & conservation, potential vernal pools, wooded swamp	Need for major water line improvements
Suomi St to Spencer Town Line	Total = 6 PI - 0, PD - 6	OCI = 53.2 <i>Preventative Maintenance</i>	Culvert P3 - Poor condition Culvert P4 - good condition Culvert P5 - poor/fail condition Culvert P6 - good/fair condition	SCM Elderbus provides service to elders and disabled in the town of Paxton	8.0%	Recreation & conservation, potential vernal pools, wooded swamp, rare species habitat	Adjacent State Park

*PI = Personal Injury, PD = Property Damage

**OCI = Overall Condition Index, Ranging From 0 - 100

***WRTA Paxton Shuttle does serve a portion of Route 31 between Grove Street and Route 122

Table 24
Town of Spencer
Route 31 (& Meadow Rd) Roadway Segments:
Overall Corridor Profile Findings

Route 31 Roadway Segments	Safety Analysis*	Pavement Condition**	Bridge/Culverts Observed Condition	Public Transit***	Freight Movement Daily % of Heavy Vehicles	Environmental Consultation Analysis	Other Considerations
Paxton Town Line to Barclay St	None	OCI = 69.6 <i>Routine Maintenance</i>	None	SCM Elderbus provides service to elders and disabled in the town of Spencer	8.0%	Recreation, potential vernal pools, wooded swamp	Substandard roadway geometry
Barclay St to Browning Pond Rd	Total = 1 PI - 1, PD - 0	OCI = 88.2 <i>Do Nothing</i>	Culvert S1 - good/fair condition	SCM Elderbus	8.0%	Recreation, potential vernal pools, species of conservation concern, wooded swamp	Need to maintain lines of sight
Browning Pond Rd to North Brookfield Rd	Total = 16 PI - 5, PD - 11	OCI = 88.2 <i>Do Nothing</i>	Culvert S2 - unknown condition Culvert S3 - good/fair condition Bridge S4 - fair condition Culvert S5 - fair/poor condition Culvert S6 - fair/poor condition Culvert S7 - fair condition	SCM Elderbus	6.3%	Conservation, agriculture, potential vernal pools, species of conservation concern, wetland buffer, wooded swamp	Roadway widths vary, town-owned bridge over Seven Mile River
North Brookfield Rd to Meadow Rd	Total = 6 PI - 1, PD - 5	OCI = 88.2 <i>Do Nothing</i>	Bridge S8 - good/fair condition Functionally obsolete	SCM Elderbus	6.7%	Historical/cultural, potential vernal pools, wooded swamp	Need to maintain lines of sight
Meadow Rd to Route 9	Total = 13 PI - 6, PD - 7	OCI = 73.9 <i>Routine Maintenance</i>	None	SCM Elderbus	5.2%	Recreation, potential vernal pools, deep marsh	State-owned bridge over Seven Mile River
Route 31 to Route 9 (Meadow Road)	Total = 16 PI - 2, PD - 14	OCI = 33.6 <i>Structural Improvement</i>	Culvert S9 - good/fair condition Culvert S10 - fair/poor condition Culvert S11 - good condition	SCM Elderbus / WRTA Fixed Route #33 serves a portion of Meadow Rd	6.5%	Historical/cultural, water protection land, potential vernal pools, species of conservation concern, wooded swamp	Roadway widths vary

*PI = Personal Injury, PD = Property Damage

**OCI = Overall Condition Index, Ranging From 0 - 100 / Data was collected by Fay, Spofford & Thorndike (FST)

***WRTA Fixed Route Service has no Stops on Route 31, but Route #33 ends at Spencer DPW on Meadow Road.

10.0 SUGGESTED IMPROVEMENT OPTIONS

Based on observations made in the field, host community comments, and the standardized analyses conducted for the Route 31 Corridor Profile effort, a series of suggested improvement options were summarized for all three towns as well as the overall corridor. Comprehensive in nature, the host communities will still need to select and prioritize those improvements that would be included as part of any future design effort.

10.1 Corridor-Wide

Figure 53 shows each of the corridor-wide suggested improvement options list below. These suggested improvement options can be completed at intersections and roadway segments, where needed, in each of the host communities. **Table 25** shows the Projected 2023 LOS results as well as potential future year improvements for the Route 31 focus intersections. Some of these improvements are discussed in further detail later in the section.

The following summarizes the suggested improvement options included in the **Figure**:

- Continue to maintain traffic control signage, signals and pavement markings.
- Suggested treatments for unsignalized intersections include cutting back vegetation within the right-of-way, insuring proper placement of “Stop” and “Stop Ahead” signs on minor approaches, complete with stop bar pavement markings. On the major approaches of Route 31, assure proper placement of yellow diamond warning signs for four-way or T-type intersections as appropriate.
- Consider installation of modern chevron-style warning signs on identified sharp curves in the roadway (Route 31 southbound prior to Kendall Reservoir causeway.) High Friction Surface Treatments (HFST) should also be considered on sharp roadway curves with a documented crash history.
- Repair/improve damaged guardrails. Install new guardrail as deemed necessary. Consider double beam guard rail at strategic locations, for example, along the Kendall Reservoir causeway.
- Trim or remove numerous trees & other vegetation within roadway right-of-way, particularly in lesser developed areas, providing a clear zone for safety. Where major trees are removed, seek to replace them 3 to 1. A professional arborist will need to determine tree health and coordinate removal of potentially hazardous growth.
- Apply curb cut consolidation & other “Access Management” improvements for local roads and abutting private driveways along the entire length of Route 31.

- Follow a “Complete Streets” design approach that accommodates all users: pedestrians, bicycles, cars and trucks.
- Suggested roadway width consistency: MassDOT design criteria was recently revised for bicycle and pedestrian accommodation. *Design waivers may be issued based on local conditions, such as steep slopes and wetlands, for example.* Two options include:
 - o 11 foot lanes & 5 foot shoulders = 32 foot pavement width
 - o 12 foot lanes & 5 foot shoulders = 34 foot pavement width
- Pavement crack sealing should be conducted on a periodic basis.
- Safety fences should be installed along the top of major culverts. Some culvert headwalls observed in the field are fairly high, up to 12 feet.
- Ever mindful of roadway drainage structure preservation, begin a program of ongoing maintenance and replacement. Participation in the UMass-Amherst vulnerability assessment analysis is recommended.
- Necessary utility work must precede roadway surface improvements.

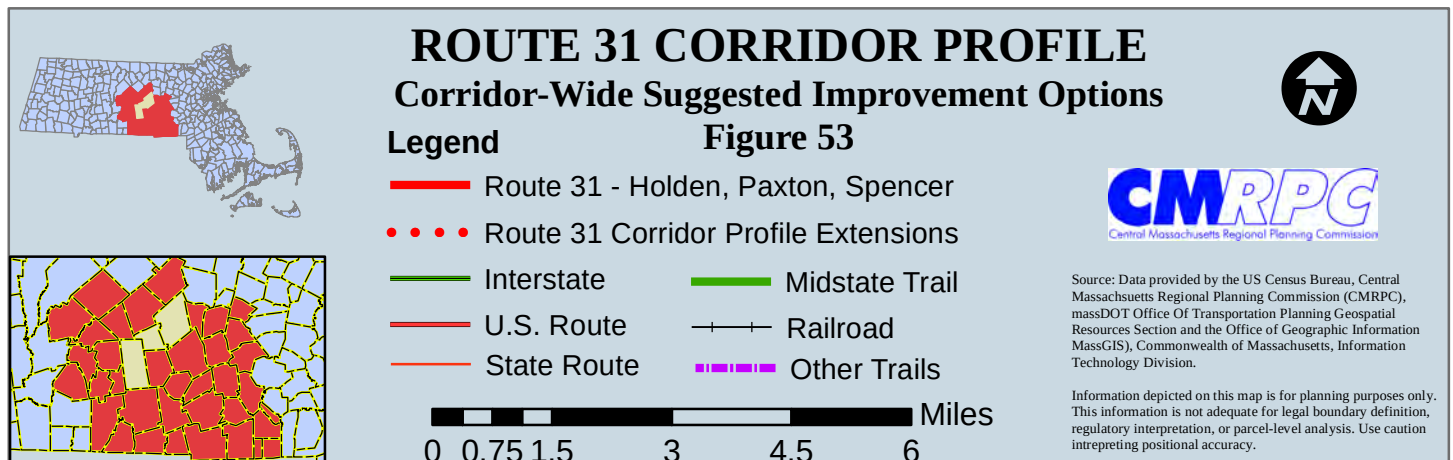
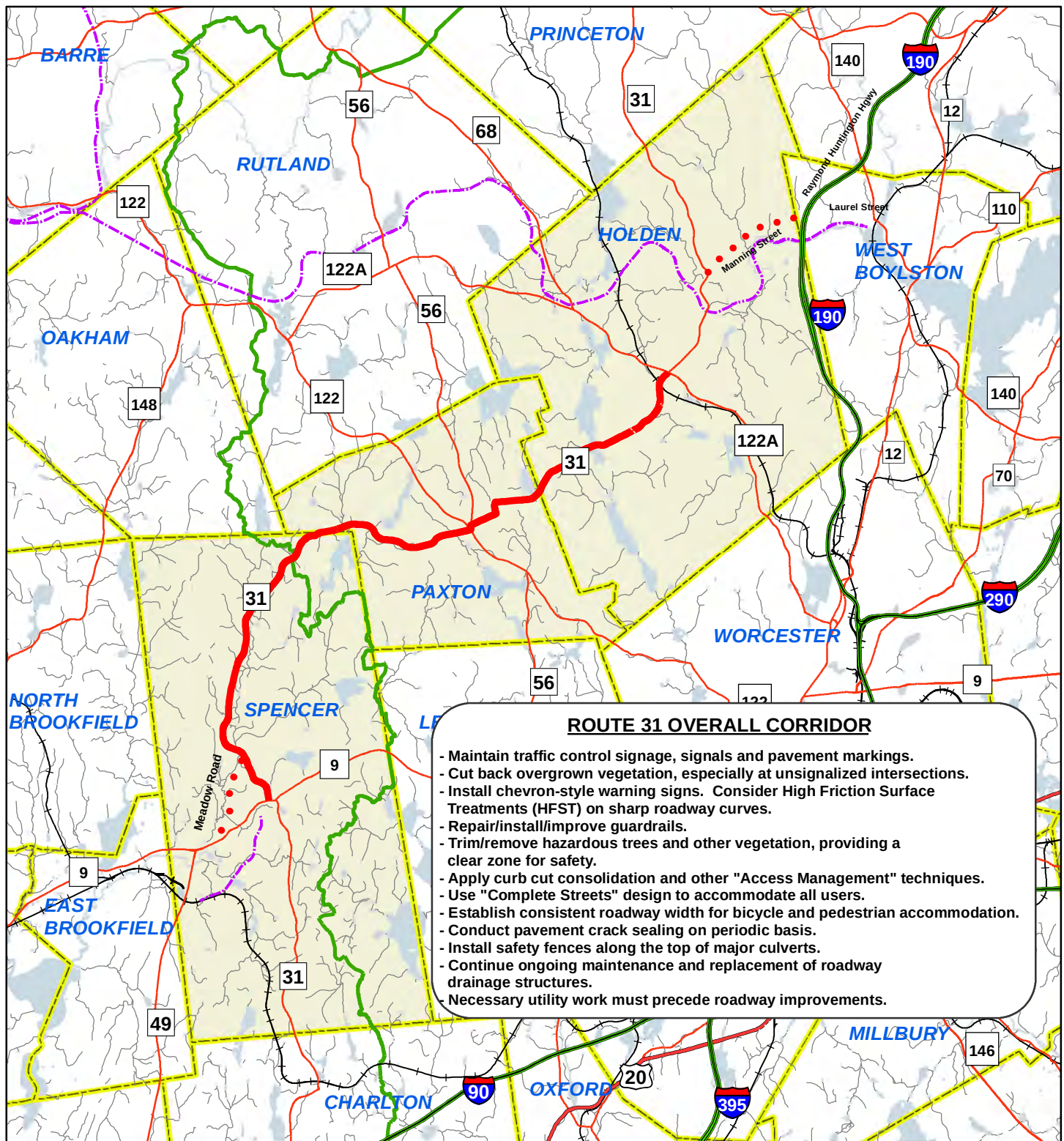


TABLE 25
Intersection Level Of Service (LOS) Analyses Results:
Projected 2023 "Do Nothing" and Potential Future Year Improvements

<u>COMMUNITY</u>	<u>ROUTE 31 INTERSECTION</u>	N E T W O R K						
		<u>2023 Projected</u>				<u>Potential</u>		
		V/c ¹	Delay ²	LOS	V/c ¹	Delay ²	LOS	<u>Future Year Improvements</u>
Holden	SIGNALIZED							
	Route 31/Route 122A	0.94	35	D	1.19	66	E	Minimal improvement w/existing controller & detection equipment, Potential future equipment upgrade
	Route 31/Route 122	0.64	14	B	0.62	13	B	Potential future NB left-turn lane
	Route 31/Route 9*	0.76	23	C	0.99	33	C	Programmed TIP Project,
Spencer	Route 9/Meadow Rd/South Spencer Rd**	0.43	12	B	0.60	13	B	Projected LOS: AM = B(19), PM = C(22) Minimal improvement w/existing controller & detection equipment
Holden	UNSIGNALIZED³							
	Route 31/Manning St**	0.82	53	F	1.02	76	F	Future study for potential signal control
	Route 31/Holden Commons	0.12	17	C	0.55	29	D	Improve flashing beacon equipment
	Route 31/Reservoir St/Mixer Rd	0.13	23	C	0.26	27	D	Install consistent signage
Paxton	Route 31(Holden Rd)/Grove St	0.34	13	B	0.62	19	C	Maintain flashing beacon
	Route 31(Maple St)/Grove St	0.51	15	C	0.26	13	B	Add pedestrian accommodations
	Route 31/Route 56	0.48	18	C	0.57	21	C	Better intersection definition
	Route 31/Suomi St	0.07	11	B	0.07	10	A	Maintain lines of sight
Spencer	Route 31/Barclay Rd	0.13	9	A	0.14	11	B	Nearby potential curve straightening
	Route 31/Browning Pond/Thompson Pond	0.18	14	B	0.17	16	C	Better intersection definition
	Route 31/North Brookfield Rd	0.33	15	C	0.17	14	B	Maintain lines of sight
	Route 31/Meadow Rd/Wire Village Rd	0.33	14	B	0.61	26	D	Consider modern roundabout,
								Projected LOS: AM = A(5), PM = A(7)

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 collected by VHB

**Additional intersections

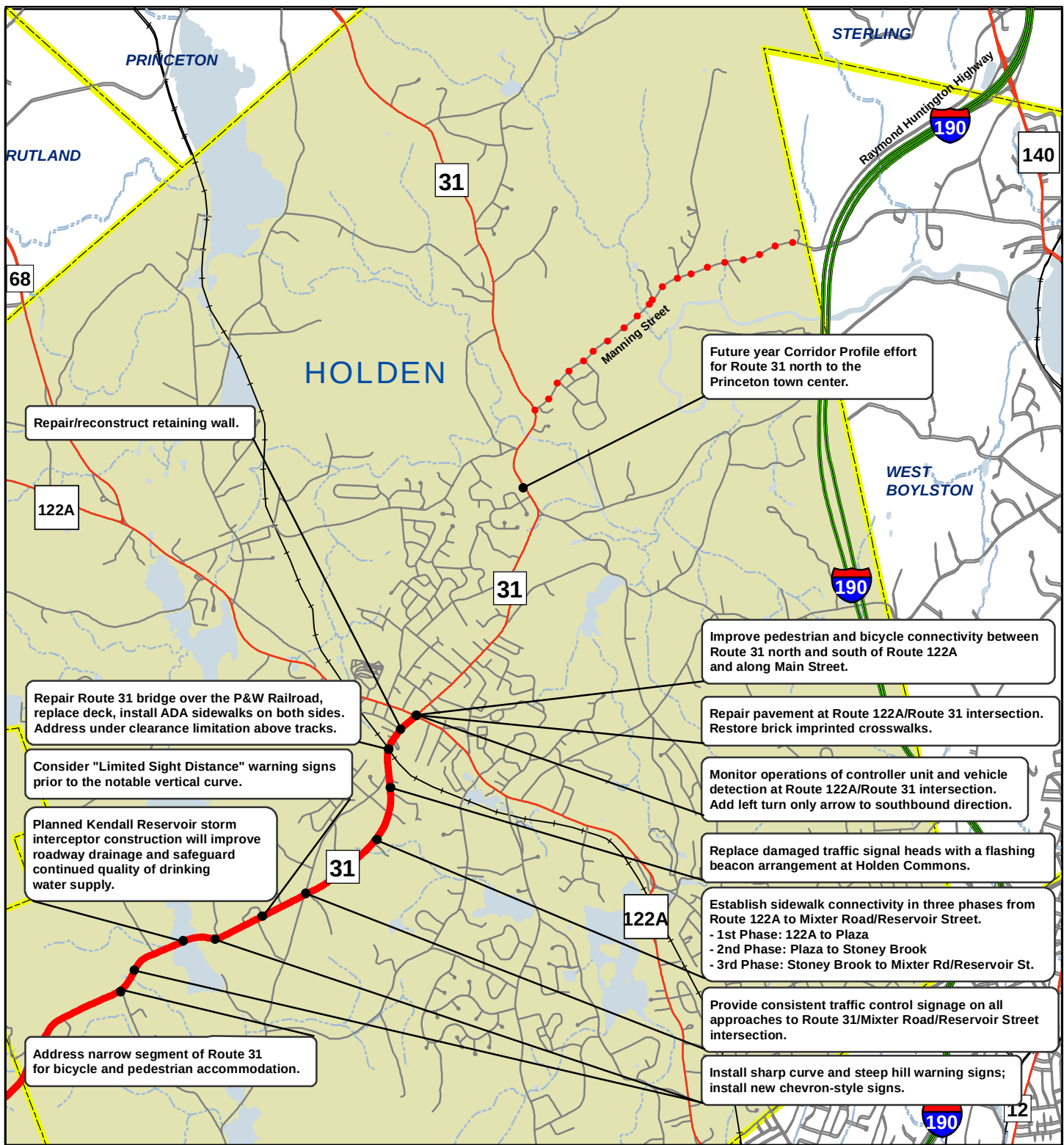
10.2 Town of Holden

Figure 54 shows the suggested improvement options and their locations in the town of Holden. These improvement options include:

- Town seeks a future year Corridor Profile effort for Route 31 north of Route 122A to the Princeton town center. This study would include Route 31 and adjoining Manning Street. *In this current study, some cursory data was reviewed for this segment of Route 31.*
- A “Neighborhood SAFE” workshop has been conducted for Holden in the town center area. Connectivity is sought between Route 31 north and south of Route 122A as well as along Route 122A, the host community’s Main Street.
- Pavement repairs are needed at the intersection of Route 122A with Route 31 in the town center. Repairs are specifically needed to the brick imprinted crosswalks where utility repairs have been made.
- Periodically check operations, as well as the capabilities, of the existing controller unit and vehicle detection at the Route 122A intersection with Route 31. Also, add left turn only arrow for vehicles traveling in southbound direction. *This intersection is maintained by MassDOT. Coordination between the host community of Holden and MassDOT is required to implement suggested improvements at this study location.*
- Repair retaining wall alongside Route 31 adjacent to the historic burial ground in the town center.
- Newly revised MassDOT design criteria seeks consistent roadway widths for bicycle and pedestrian accommodation. *(Various widths are suggested in the previous section)*
- Seek connected, consistent sidewalks along Route 31 from Route 122A to Mixer Road. This is the busiest section of Route 31 studied as part of this effort with the highest observed daily traffic volumes. A phased approach is suggested as there are major trees situated alongside Route 31 in some areas, presenting various challenges. Suggested phasing is as follows:
 - 1st Phase: 122A to Plaza *(early success, filling gaps, providing example of consistency, begin necessary outreach with abutters)*
 - 2nd Phase: Plaza to Stoney Brook subdivision access
 - 3rd Phase: Stoney Brook subdivision access to Mixer Road intersection
- Consider future repairs to the Route 31 bridge over the Providence & Worcester Railroad. This bridge was constructed in 1983 and will need some level of rehabilitation

in the future. The community seeks sidewalks on both sides of the bridge. Future year improvements need to include ADA retrofits as well as address under clearance issues. Currently, an additional 2" of under clearance is necessary for Phase 1 double stack while another 14" would be required to accommodate Phase 2 double stack. In addition to under clearance issues, consideration should also be given to insuring adequate utility conduits beneath the structure. *MassDOT is responsible for maintenance of the Route 31 bridge over the P&W.*

- Consider replacing damaged signal heads with a flashing beacon arrangement at Route 31/Holden Commons; consider LED use for improved visibility. Traffic signal equipment at this location has been on flashing operation since installation. *The Holden Light Department has indicated that the electrical costs for the existing traffic signal at the Route 31/Holden Commons entrance are paid for by the Holden Commons management.*
- Provide for consistent traffic control signage on all approaches to Route 31/Mixer Road/Reservoir Street intersection.
- Consider "Limited Sight Distance" yellow diamond warning signs prior to the notable vertical curve south of the Route 31/Mixer Road/Reservoir Street intersection.
- Install consistent, modern sharp curve and steep hill yellow diamond warning signs prior to the downgrades on both sides of reservoir viaduct. Install new chevron-style signs, taking advantage of MassDOT warning sign program for dangerous or high hazard curves.
- The Kendall Reservoir storm interceptor, planned by the city of Worcester, is intended to minimize unfiltered roadway runoff discharge into the reservoir. This project will help safeguard the water quality in the city's drinking water system. Currently at the 75% design stage, construction is planned to start during late summer or early fall of 2014.
- In the future, the particularly narrow segment of Route 31 between the reservoir causeway and South Street should be widened for adequate bicycle and pedestrian accommodation.



ROUTE 31 CORRIDOR PROFILE: HOLDEN

Suggested Improvement Options

Figure 54

Legend

- Route 31 - Holden, Paxton, Spencer
- ... Route 31 Corridor Profile Extension
- Interstate
- State Numbered Routes
- Other Roadways
- +— Railroad



Source: Data provided by the US Census Bureau, Central Massachusetts 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 interpreting positional accuracy.

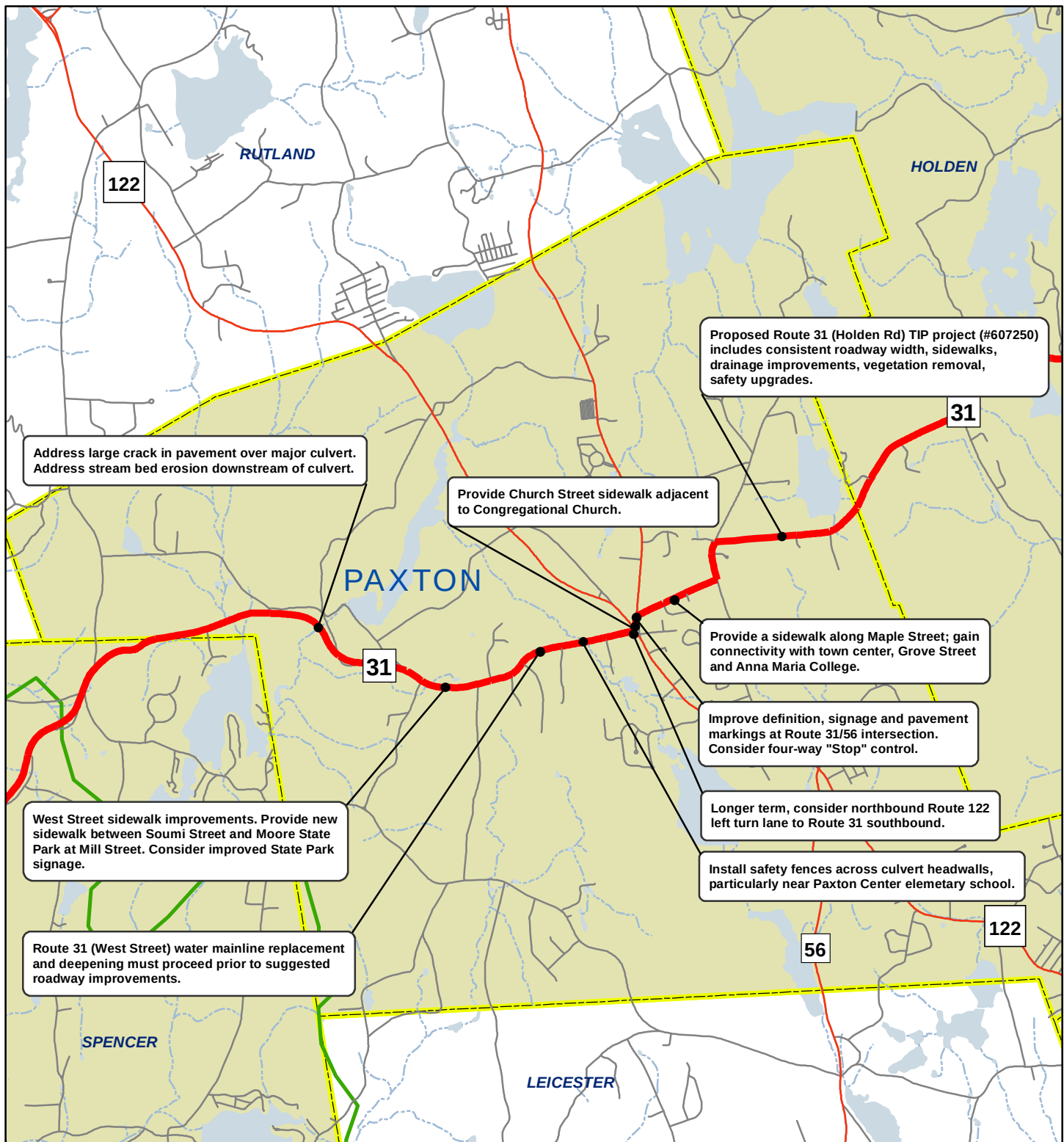
1 in = 0.79 miles

10.3 Town of Paxton

As seen in **Figure 55**, the map shows the suggested improvement options for the town of Paxton as well as their general location. A summary of the improvements are listed below:

- The town of Paxton is seeking a listing on the CMMPO's TIP for an improvement project for Route 31 (Holden Road) reclamation. The proposed project has been approved by MassDOT Project Review Committee (#607250) and is shown in **Figure 56**. The project has yet to be programmed on the TIP by the MPO. At this time, it is anticipated that funding may be available for FY 2019, at the earliest. The proposed project includes:
 - Improve deteriorating pavement and berm while providing a consistent roadway width for bicycle & pedestrian accommodation
 - A sidewalk along one side of the road from Grove Street to Bel Arbor Drive. On the other side, a sidewalk will be installed from Grove Street and end at Paxton's new senior housing development (*seeking design waiver*)
 - Roadway drainage improvements, some catch basins/culverts (*mostly country style drainage*)
 - Access management improvements (*minimal*)
 - Tree, vegetation trimming and/or removal within Route 31 right-of-way
 - Improve/replace guardrails where necessary
- Provide a sidewalk in some manner along Maple Street, providing connectivity between town center, Grove Street and Anna Maria College campus. Mindful of namesake maple trees, alternative paths need to be investigated to gain the intended connectivity.
- Tighten the intersection of Route 31 with Route 56 (Richards Avenue) in the town center. This location is somewhat confusing as to which approach has right of way. Provide for improved intersection definition, reducing the large area of open, unmarked pavement. Reduce curve radius in front of the town library. Improve pavement markings and also consider four-way "Stop" control signage for improved safety.
- Narrow width of Church Street noted. Consider a sidewalk adjacent to the Congregational Church for pedestrian accommodation and connectivity.
- "Neighborhood SAFE" workshop was requested for Paxton center area. The workshop was held on May 29, 2014 and the final report has been completed.
- In the future, at Paxton center, consider northbound Route 122 left turn lane to Route 31 southbound. Two lanes would separate vehicle flows and also provide for improved bicycle and pedestrian accommodation. *If considered, this improvement would require strip widening adjacent to the town common.*

- Route 31 (West Street) water mainline replacement and deepening must proceed prior to most improvements suggested for this roadway segment.
- Sidewalk improvement and connectivity is suggested along West Street. Consider expanding the sidewalk between Soumi Street and the entrance to Moore State Park at Mill Street. Consider linkage to park trails, pathways, and parking area. Also, provide improved State Park signage.
- Safety fences should be installed across culvert headwalls at specific locations, particularly near the Paxton Center elementary school.
- Address large crack in pavement over major culvert adjacent to Moore State Park to prevent deterioration to top of the corrugated steel pipe. Further, address erosion on downstream side of the Moore State Park culvert where a “perched crossing” exists.
- Continue regular drainage structure/culvert maintenance along Route 31.



ROUTE 31 CORRIDOR PROFILE: PAXTON

Suggested Improvement Options

Figure 55

Legend

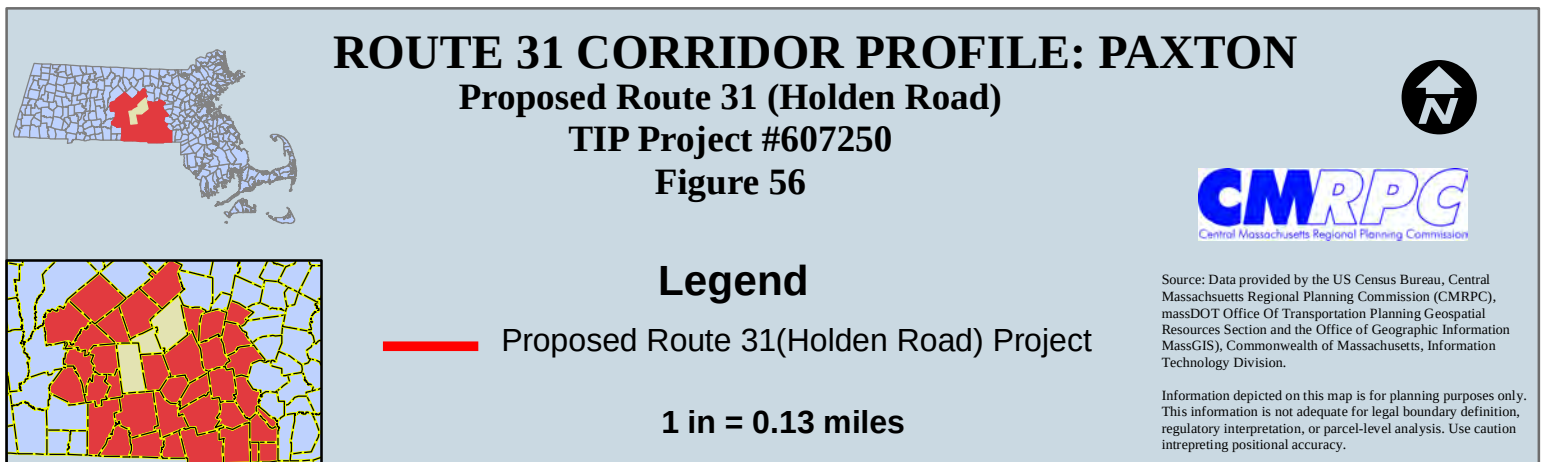
- Route 31 - Holden, Paxton, Spencer
- State Route
- Other Roadways
- Midstate Trail

1 in = 0.75 miles



Source: Data provided by the US Census Bureau, Central Massachusetts 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 interpreting positional accuracy.



10.4 Town of Spencer

Figure 57 shows where and what type of improvements could be made along Route 31 in Spencer. A summary of these suggested improvement options are provided below:

- Considered a longer-term recommendation, realign/straighten the Route 31 curve in Spencer just south of the Paxton town line. This improvement would supplement earlier realignments to Route 31 made in the 1960's/1970's. Evidence of various realignments can be seen between Northwest Road and the Browning Pond Road/Thompson Pond Road intersection. Various options for consideration:
 - Same alignment (relocate house and garage)
 - New alignment, north
 - New alignment, south

Depending on the preferred alignment selected by the host community, there would be the need to acquire the necessary right-of-way for the project, mindful of any environmental challenges. The alignment options are shown in **Figure 58**.

- Tighten the intersection of Route 31 with Browning Pond Road/Thompson Pond Road in North Spencer. Provide for improved intersection definition, reducing the fairly large area of open, unmarked pavement. Improve traffic control signage and pavement markings. As observed in the field, there is an extensive closed drainage system in this area.
- Replace Route 31 bridge over Seven Mile River adjacent to Hastings Road, estimated at nearly \$1 million (S-23-012). Various levels of corrosion to both concrete and steel noted on structure. The deck has numerous areas of cracking and the concrete bridge railings are deteriorating as it is approaching the end of useful service. Town's consultant has recommended that the bridge be replaced with a butted deck beam bridge type with crash approved steel bridge rails. The existing abutments and wing walls can be modified and included in the reconstruction. Advantages of this design include fairly rapid construction while minimizing environmental impacts by reducing costly work in the waterway.
- Drainage improvements in North Spencer are planned to be implemented in 2014. New culvert installation is meant to alleviate observed recurring Route 31 flooding. This local project will add another culvert to complement two existing that become overwhelmed in various storm events. The new culvert is considered an overflow culvert designed to *not* change riparian conditions, that is, when the existing culverts are flooded beyond capacity the water will flow down a newly constructed drainage ditch and into the new

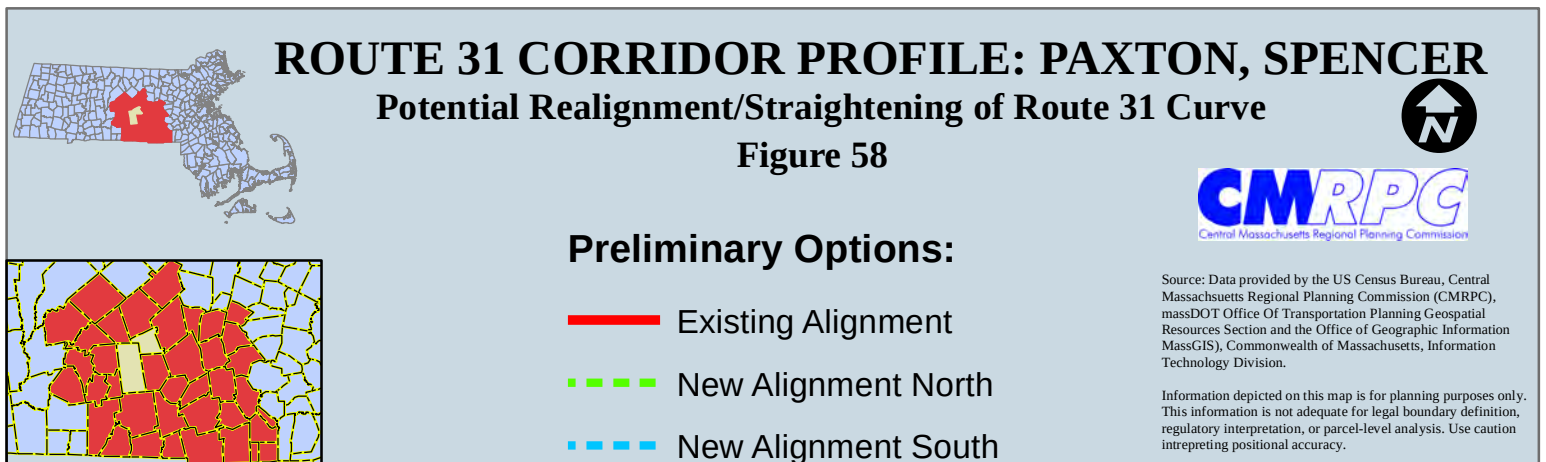
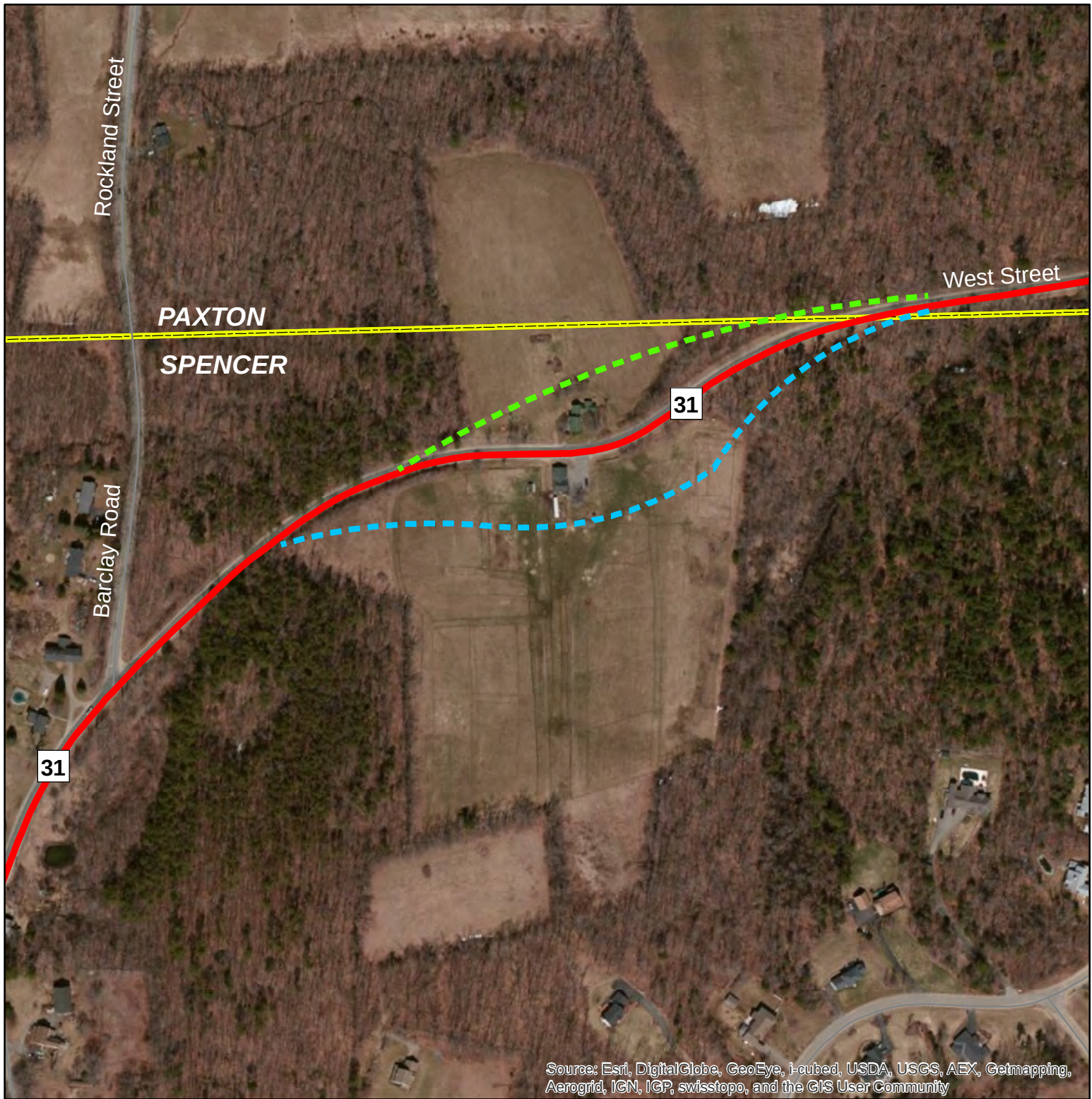
culvert under Route 31. It will drain to the same area it went to when it flooded the roadway. Also, continue regular culvert inspection and maintenance.

- Replace Route 31 bridge near Meadow Road over Seven Mile River (S-23-002). Currently posted at a 20/25/40 weight rating for 2, 3 and 4 axles, respectively, the host community requests that the bridge be added to the TIP project listing. Various observed deficiencies with the deck and superstructure, concrete cracks and deteriorating steel. Structural cracks in substructure abutments and wing walls. In the field, various levels of erosion were observed around the wing walls. (*MassDOT-owned structure.*)
- Implement improvements at the Route 31/Meadow Road/Wire Village Road intersection. In the short term, track effectiveness of recently installed advance warning signs on each approach to the intersection. Selectively trim/remove trees and other vegetation within the roadway right-of-way. As a further basic improvement, consider the installation of rumble strips on the Meadow Road approach supplementing traffic control signage, indicating the need to stop ahead. Review lane widths and consider minor geometric improvements. Consider additional overhead highway lighting at this study location.

In the longer term, consider installation of a modern roundabout at the Route 31/Meadow Road/Wire Village Road intersection. For a single lane roundabout, calculations show a level of service grade of “A” for the AM and PM time periods. For the existing geometry, the level of service is a “B” in the AM and “D” in the PM.

- Host community requests “Neighborhood SAFE” workshop for Meadow Road as well as a Road Safety Audit (RSA). Town seeks sidewalks on Meadow Road for pedestrian connectivity, part of a larger effort by the community to improve sidewalks radiating from the downtown “urban” area. In addition, town seeks RSA for Route 9 (West Main Street) between Meadow Road/South Spencer Road and Route 49.
- Further investigate the potential for an electric bus “fast charge” station or Park & Ride facility to potentially be sited adjacent to the Spencer Highway Department. WRTA vehicles already stop/dwell at this location. Perhaps consider other transit rider sidewalk/accessibility improvements.
- At the intersection of Route 9/Meadow Road/South Spencer Road, the town has suggested improvements to the South Spencer Road northbound approach. Improve vehicle queuing lanes by lengthening and widening, providing two approach lanes with a paved shoulder. The community intends to work with adjacent employer FLEXcon to implement this improvement.

- Mindful of Flexcon generated traffic volumes, consider full length transit bus turn outs or similar in the location of the Big Y plaza. Options include the existing grassy areas on Meadow Road as well as in front of Flexcon on Route 9. Further, perhaps a transit vehicle routing through the Plaza could be considered.
- Repair/replace locally-owned Hastings Road bridge over Turkey Hill Brook, now reduced to one lane. Hastings Road viewed as emergency alternate roadway to Route 31.



11.0 HOST COMMUNITY PROJECT PRIORITIZATION & PRELIMINARY COST ESTIMATES

This report section serves as the conclusion to the Route 31 Corridor Profile document. Referencing the comprehensive listing of suggested improvement options previously summarized, the members of the Route 31 Technical Advisory Group were asked to select the “top three priorities” for their respective host community. The planning staff, in turn, determined preliminary cost estimates for each of the town-identified priorities. Generally, the host community’s below listed priorities illustrate the following:

Holden: A phased sidewalk plan is envisioned for Route 31 from Route 122A to Mixer Road. Also, the town will need to monitor the work of others, particularly the city of Worcester’s installation of the storm water interceptor system at the Kendall Reservoir causeway.

Paxton: The community intends to continue pursuing federal-aid TIP funding through the CMMPO, perhaps for FY 2019. Further, the drinking water trunk line on West Street needs to be replaced.

Spencer: Documented bridge needs as well as roadway resurfacing and consider the suggested option to realign the Route 31 curve in North Spencer carry notable costs. Also, Meadow Road needs to be studied and improved.

11.1 Town of Holden

#1 Priority

Seek connected, consistent sidewalks along Route 31. A phased approach is suggested as there are major trees situated alongside Route 31 in some areas, presenting various challenges. Suggested phasing is as follows:

- 1st Phase: 122A to Holden Commons shopping plaza (0.43 miles or 2,270 feet) (*early success, filling gaps, providing example of consistency, begin necessary outreach with abutters*). This phase could also include bridge work over the P&W Railroad.
- 2nd Phase: Plaza to Stoney Brook subdivision access (0.44 miles or 2,323 feet)
- 3rd Phase: Stoney Brook subdivision access to Mixer Road intersection (0.40 miles or 2,112 feet)

Totals for sidewalk installation: 1.7 miles or 8,976 feet

The installation of new sidewalks is often a difficult cost estimate to generalize. When a sidewalk is being added to a roadway where none currently exists, one may have to construct a new drainage system or, at the very least, upgrade the existing drainage, which could potentially turn into a roadway reconstruction project. Many times, there would be an additional cost for utility relocation and the mitigation of identified environmental impacts. Further, there are possible impacts to other infrastructure such as retaining walls, drainage culverts, bridges and etc. which may also need to be addressed.

The MassDOT-owned bridge over the P&W Railroad would need to be modified to accommodate sidewalks on both sides. Currently, a sidewalk exists on the south side of the bridge structure. Further, the future needs of the P&W Railroad may require raising the bridge to increase clearances below the structure so that railcars loaded with double stacked containers can fit beneath. Raising the bridge would likely require additional retaining walls and the costs to modify the structure are substantial. In order to raise the bridge over the railroad, widen to add another sidewalk as well as replace the deck surface, it is estimated to be in the vicinity of \$2.5M+ in current dollars.

The MassDOT Highway Division, District #3 office, examined the proposed phases of the suggested sidewalk improvement & installation project in order to provide a preliminary cost estimate. MassDOT's pricing was based on weighted average bid prices, recently obtained. Should the local community bid the project, perhaps better pricing could be realized. It should be mentioned that there are no costs included for right-of-way, potential utility relocations as well as environmental permitting. Further, proposed Phases 2 and 3 have the sidewalk located on the southbound side of Route 31 in order to avoid the steep slope. Should the host community want to locate the sidewalk on the northbound side, it would likely involve additional earthwork and/or retaining wall construction, as well as additional right-of-way impacts.

Preliminary Estimated Cost: Total \$762,000

(Estimate provided by MassDOT Highway Division, District #3 office)

1st Phase: \$148,000*

2nd Phase: \$316,000

3rd Phase: \$298,000

**Under Phase 1, bridge improvements could cost an additional \$2.5M+*

#2 Priority

Install consistent, modern sharp curve and steep hill yellow diamond warning signs prior to the downgrades on both sides of reservoir viaduct. Install new chevron-style signs, taking advantage of MassDOT warning sign program for dangerous or high hazard curves.

Preliminary Estimated Cost: \$2,000
(MassDOT & Local DPW)

#3 Priority

The Kendall Reservoir storm interceptor, planned by the City of Worcester, is intended to minimize unfiltered roadway runoff discharge into the reservoir. This project will help safeguard the water quality in the city's drinking water system. Currently at the 75% design stage, construction is planned to start during early fall of 2014.

Preliminary Estimated Cost: \$800,000
(City of Worcester)

11.2 Town of Paxton

#1 Priority

The town of Paxton is seeking a listing on the CMMPO's TIP for an improvement project for Route 31 (Holden Road) reclamation. The proposed project has been approved by MassDOT Project Review Committee (#607250). The project has yet to be programmed on the TIP by the MPO. At this time, it is anticipated that funding may be available for FY 2019, at the earliest. The proposed project includes:

- Improve deteriorating pavement and berm while providing a consistent roadway width for bicycle & pedestrian accommodation
- A sidewalk along one side of the road from Grove Street to Bel Arbor Drive. On the other side, a sidewalk will be installed from Grove Street and end at Paxton's new senior housing development
- Roadway drainage improvements, some catch basins/culverts (*mostly country style drainage*)
- Access management improvements (*minimal*)
- Tree, vegetation trimming and/or removal within Route 31 right-of-way
- Improve/replace guardrails where necessary

Current Estimated 2015-2018 TIP cost: \$3.3 million
(\$2.640M federal/\$660K state, MassDOT)

#2 Priority

Tighten the intersection of Route 31 with Route 56 (Richards Avenue) in the town center. This location is somewhat confusing as to which approach has right of way. Provide for improved intersection definition, reducing the large area of open, unmarked pavement. Reduce curve

radius in front of the town library. Improve pavement markings and also consider four-way “Stop” control signage for improved safety.

Preliminary Estimated Cost: \$150,000

(Local DPW or hired contractor)

#3 Priority

Route 31 (West Street) water mainline replacement and deepening must proceed prior to most improvements suggested for this roadway segment. At this time, the town’s plan is to install 6,700 feet, or 1.3 miles, of pipe between Route 122 at the town center and South Street.

Preliminary Estimated Cost: \$1.5 million

(Includes engineering and contingencies, hired water line contractor)

11.3 Town of Spencer

#1 Priority

Town seeks sidewalks on Meadow Road for pedestrian connectivity, part of a larger effort by the community to improve sidewalks radiating from the downtown “urban” area. Also, the town envisions the reconstruction and modernization of Meadow Road as a “Complete Street” as a long-term goal. Host community Spencer requests a “Neighborhood SAFE” workshop for Meadow Road as well as a Road Safety Audit (RSA). Further, town seeks RSA for Route 9 between Meadow Road/South Spencer Road and Route 49.

Estimated linear length of sidewalks envisioned for Meadow Road:

- 1st Phase: Route 31 to Spencer Highway Department (1.27 miles or 6,705 feet)
 - 2nd Phase: Spencer Highway Department to Route 9 (0.34 miles or 1,795 feet)
- Totals for sidewalk installation: 1.61 miles or 8,500 feet

Sidewalks Installation Preliminary Estimated Cost: \$700,000

(Estimate provided by MassDOT)

Meadow Road (1.61 miles) Reconstruction Preliminary Estimated Cost: \$2.5+ Million

(Estimate provided by the town of Spencer Utilities & Facilities Superintendent)

#2 Priority

Replace Route 31 bridge over Seven Mile River adjacent to Hastings Road, estimated at nearly \$1 million (S-23-012). Various levels of corrosion to both concrete and steel noted on structure. The deck has numerous areas of cracking and the concrete bridge railings are deteriorating as it is approaching the end of useful service. Town’s consultant has recommended that the bridge be replaced with a butted deck beam bridge type with crash approved steel bridge rails. The

existing abutments and wing walls can be modified and included in the reconstruction. Advantages of this design include fairly rapid construction while minimizing environmental impacts by reducing costly work in the waterway.

Preliminary Estimated Cost: \$1 million
(Hired bridge contractor)

Replace Route 31 bridge near Meadow Road over Seven Mile River (S-23-002). Currently posted at a 20/25/40 weight rating for 2, 3 and 4 axles, respectively, the host community requests that the bridge be added to the TIP project listing. Various observed deficiencies with the deck and superstructure, concrete cracks and deteriorating steel. Structural cracks in substructure abutments and wing walls. In the field, various levels of erosion were observed around the wing walls. *(MassDOT-owned structure.)*

Preliminary Estimated Cost: \$2 million
(Hired bridge contractor)

Repair/replace locally-owned Hastings Road bridge over Turkey Hill Brook, now reduced to one lane. Hastings Road viewed as emergency alternate roadway to Route 31.

Preliminary Estimated Cost: \$400,000
(Hired bridge contractor)

#3 Priority

Pavement preservation should be strongly considered and the resurfacing of Route 31 (5.6 miles) should be completed as soon as possible to avoid further pavement deterioration and higher reconstruction costs. The pavement condition varies for Route 31 as well as the roadway width, which ranges from 24 feet to 28 feet.

Consider including the realignment/straightening of the Route 31 curve in Spencer just south of the Paxton town line. This improvement would supplement earlier realignments to Route 31 made in the 1960's/1970's. Evidence of various realignments can be seen between Northwest Road and the Browning Pond Road/Thompson Pond Road intersection. Various options for consideration:

- Same alignment (relocate house and garage)
- New alignment north
- New alignment south

Depending on the preferred alignment selected by the host community, there would be the need to acquire the necessary right-of-way for the project, mindful of any environmental challenges. *Considered a longer-term recommendation.*

Route 31 Resurfacing Preliminary Cost Estimates
(MMA/MassDOT Current \$ Values)

- 2" overlay = **\$680K**
- 4" overlay = **\$1.7 Million**
- Full Depth Reconstruction = **\$4.3 Million**

Route 31 Curve Realignment/Straightening Preliminary Estimated Cost: \$4 Million
(Based on similar CMMPO TIP cost estimates)

11.4 Potential Funding Sources

In large part, Route 31 is locally-maintained by the host communities. Depending on cost, some suggested improvements can be perhaps be implemented by host community public works or highway department personnel. Locally accomplished, some basic Route 31 improvement options could be funded by the state's Chapter 90 Program which provides local aid for highway purposes.

For more costly improvements, beyond local funding capabilities, the Route 31 host communities have the opportunity to seek funding for multi-modal improvements through the Transportation Improvement Program (TIP) developed by the Central Massachusetts Metropolitan Planning Organization (CMMPO). A process carried out annually by the CMMPO, the TIP provides funding for improvements on federal-aid eligible highways, including Route 31. MassDOT-Highway Division oversees and takes a major role in improvements suggested and eventually implemented along the federal-aid highway system.

The Route 31 study was modeled after a similar multi-community effort that focused on Route 140 in the host communities of Princeton, Sterling and Westminster. The Route 140 effort led to multi-modal highway improvements in the town of Princeton that are programmed for funding on the region's CMMPO TIP. Planned improvements are anticipated to benefit not only the host community but the greater region as well.

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