Prepared by the

MONTACHUSETT REGIONAL PLANNING COMMISSION (MRPC)

Route 117 Corridor Profile
Town of Lancaster, Massachusetts

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September 2013

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1.0 INTRODUCTION

1.1 The Route 117 Lancaster Corridor Profile

The Town of Lancaster requested the Montachusett Regional Planning Commission (MRPC) to conduct a study of Route 117 through the community in the spring of 2013. In its efforts the MRPC in turn has engaged town officials to form an informal Steering Committee to assist, offer guidance and provide local knowledge that would contribute to a Corridor Profile along the road. The goal is to assess the conditions and problems that may exist along Route 117 and offer recommendations and avenues to make improvements where necessary. After much data collection, analysis, site visits and public engagement the MRPC presents the following ***Route 117 Lancaster Corridor Profile*** to the community.

1.2 Transportation Management System "Corridor Profile"

A Corridor Profile correlates the information generated by the Transportation Management Systems along a particular highway corridor and analyzes performance-based data, suggests both operational and physical improvements, and may identify candidate projects for further study. From the range of data and analyses produced and maintained by the MRPC, a corridor profile allows for the comprehensive integration and consideration of a wide range of transportation planning factors. The end result is usually a number of suggested improvement options for the identified issues for the consideration of the communities involved and the Massachusetts Department of Transportation (MassDOT) Highway Division. These proposed improvement projects have the potential to be advanced through the MassDOT project development process and possible programming in the annual Transportation Improvement Program (TIP) document.

The Route 117 Lancaster Corridor Profile includes the following Management System data:

- **Traffic Counting:** Daily Automatic Traffic Recorder (ATR) counts and associated historical growth rates;
- **Congestion Management Process (CMP):** Historical and current peak-hour Turning Movement Counts at study intersections and associated Level of Service (LOS) analyses;
- **Travel Time Analysis:** A profile of travel time moving through the corridor highlighting where slowdowns typically occur and possible obstacles interrupting the smooth flow of traffic;
- **Transportation Safety Planning Program:** In-depth vehicle crash research in cooperation with the local Police Department 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 condition rating;
- **Freight Planning:** Daily percentage of heavy vehicles utilizing Route 117 roadway segments.

1.3 Route 117 Characteristics

The roadway segment of Route 117 through Lancaster has a total length of 4.7 miles and is functionally classified as a Rural Minor Arterial for 2.21 miles in the western section and an Urban Principal Arterial for 2.49 miles in the eastern section of the road. This classification makes the highway federal-aid eligible for funding of any potential improvements.

Jurisdictional responsibility for entire Route 117 corridor through town lies with the Town of Lancaster.

Statewide, MassDOT oversees and takes a major role in improvements suggested and eventually implemented along the federal-aid highway system. The following table summarizes functional classification for Route 117 in Lancaster. At the end of the chapter is a base map of the study area.

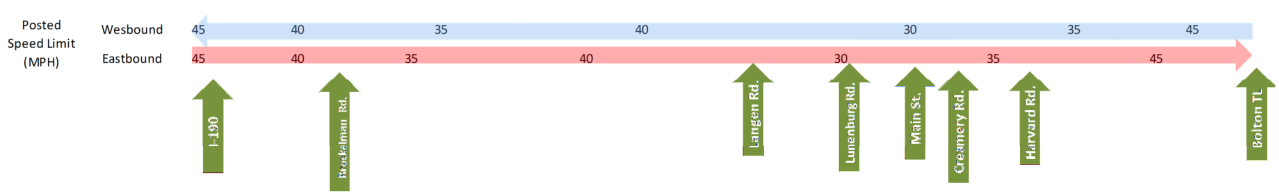
Route 117 Characteristics

Road Name	From/To	Length	Functional Class	Jurisdiction
Main St.	Leominster City Line to I-190 NB off-ramp	0.16	Urban Principal Arterial	Town
Main St.	I-190 NB off Ramp to Schumacher Rd.	2.21	Rural Minor Arterial	Town
North Main St./Seven Bridge Rd. (After Rte. 70 south approach	Schumacher Rd. to Bolton Town Line	2.33	Urban Principal Arterial	Town
	Total	4.70		

Route 117 also has varying characteristics throughout its entire length within this study area. It is a two lane undivided roadway with surface widths that vary from 24 to 34 feet. Density is low along the road with mostly residential abutments. The Junction with Route 70 consists of the most congestion and conflict points as both Route 70 and 117 merge for approximately 0.3 miles roughly half-way through the corridor. There also exists a freight rail crossing in the eastern section which can be a direct conflict to traffic on Route 117.

Speed limits generally vary from 30 to 45 miles per hour along Route 117. The higher speeds are found approaching the line with Bolton in both directions in the eastern segment and in the western segment approaching I-190. Figure 1-1 below shows the speed limits and locations found along the corridor.

FIGURE 1-1 Corridor Speed Limits



1.4 Corridor Issues within the Community

As part of the development process to identify various areas of concern within the community, Committee members were asked to highlight issues/problems within the corridor. These concerns would focus on perceived and/or known safety problems as well as other issues that needed to be addressed from the towns' perspective.

The following issues/concerns related to Route 117 were identified by Committee participants for the Town of Lancaster:

- Impacts of possible future developments along both Route 117 and Route 70 leading to increased traffic volumes through the corridor.
- Intersections along the corridor especially with Route 70.
- Flooding along the easternmost segment in the "Bolton Flats" area.

1.5 Intersection Figures

Through discussions with project participants and the Steering Committee, eight intersections were identified for review and analysis as part of this study. AM and PM peak hour turning movement counts were conducted at these locations.

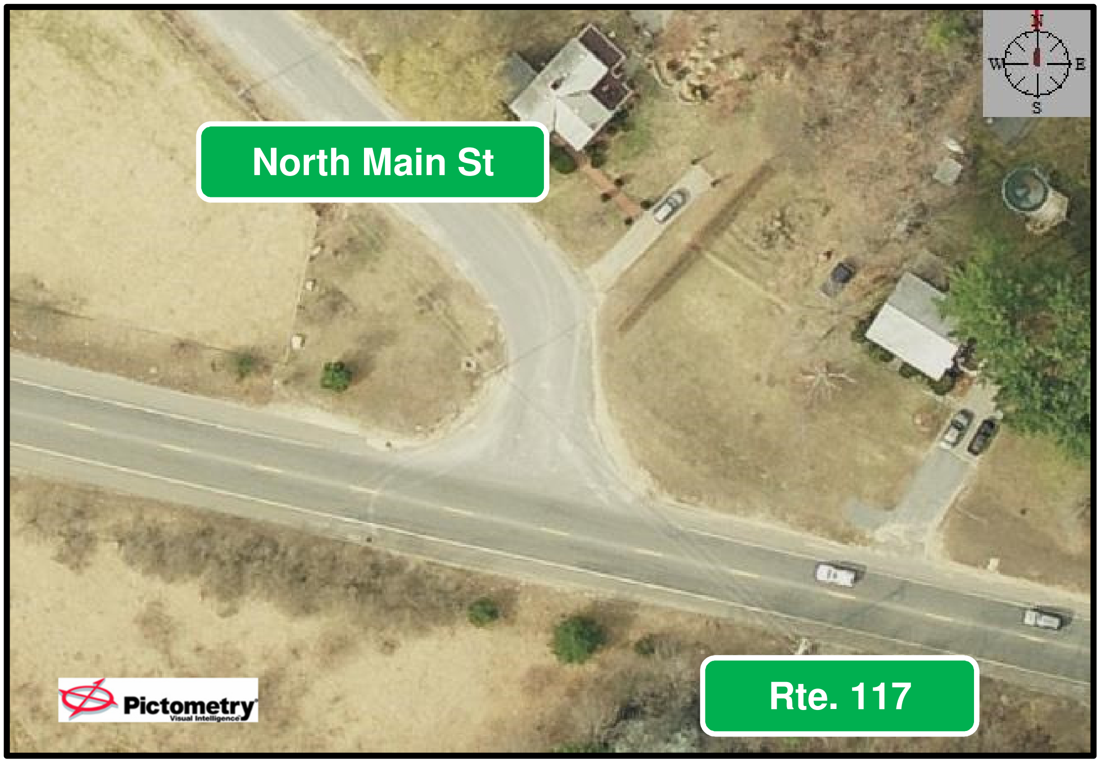
The intersections from east to west are:

Route 117 with:

North Main Street
Brockelman Road
Ponakin Road
Langen Road
Lunenburg Road (Route 70)
Main Street (Route 70)
Creamery Road
Harvard Road

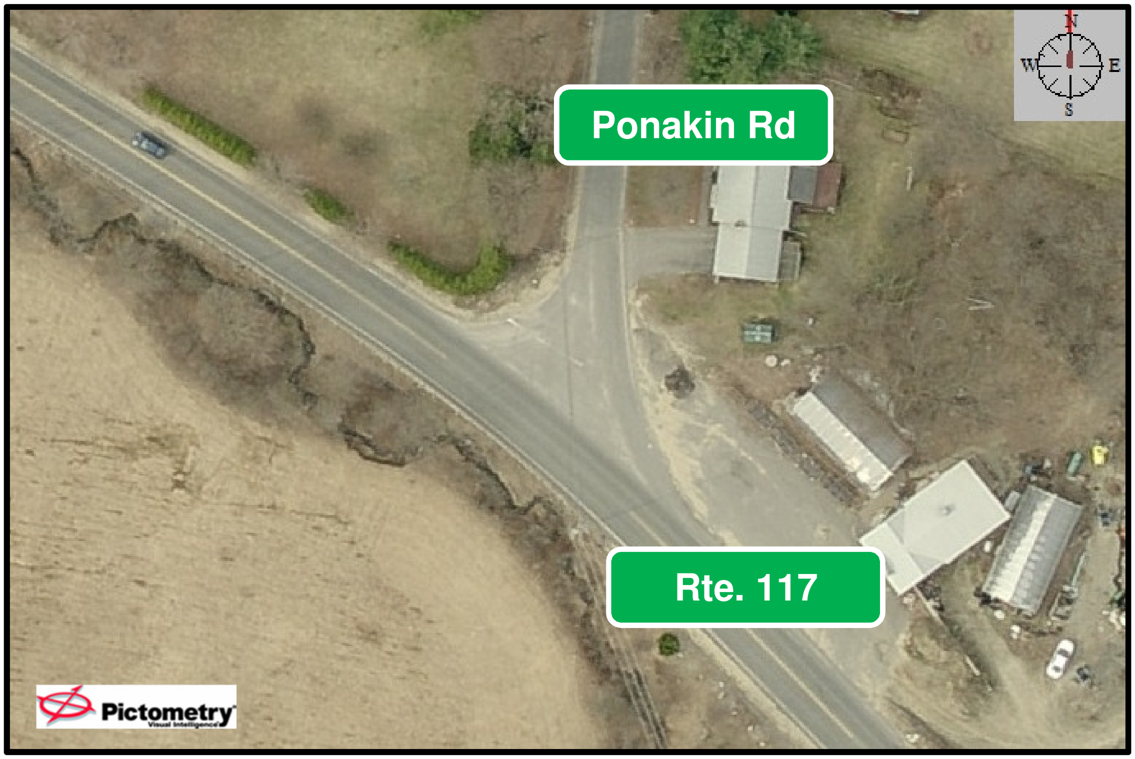
The following are aerial photographs of the intersections examined from east to west along Rte. 117.

North Main Street

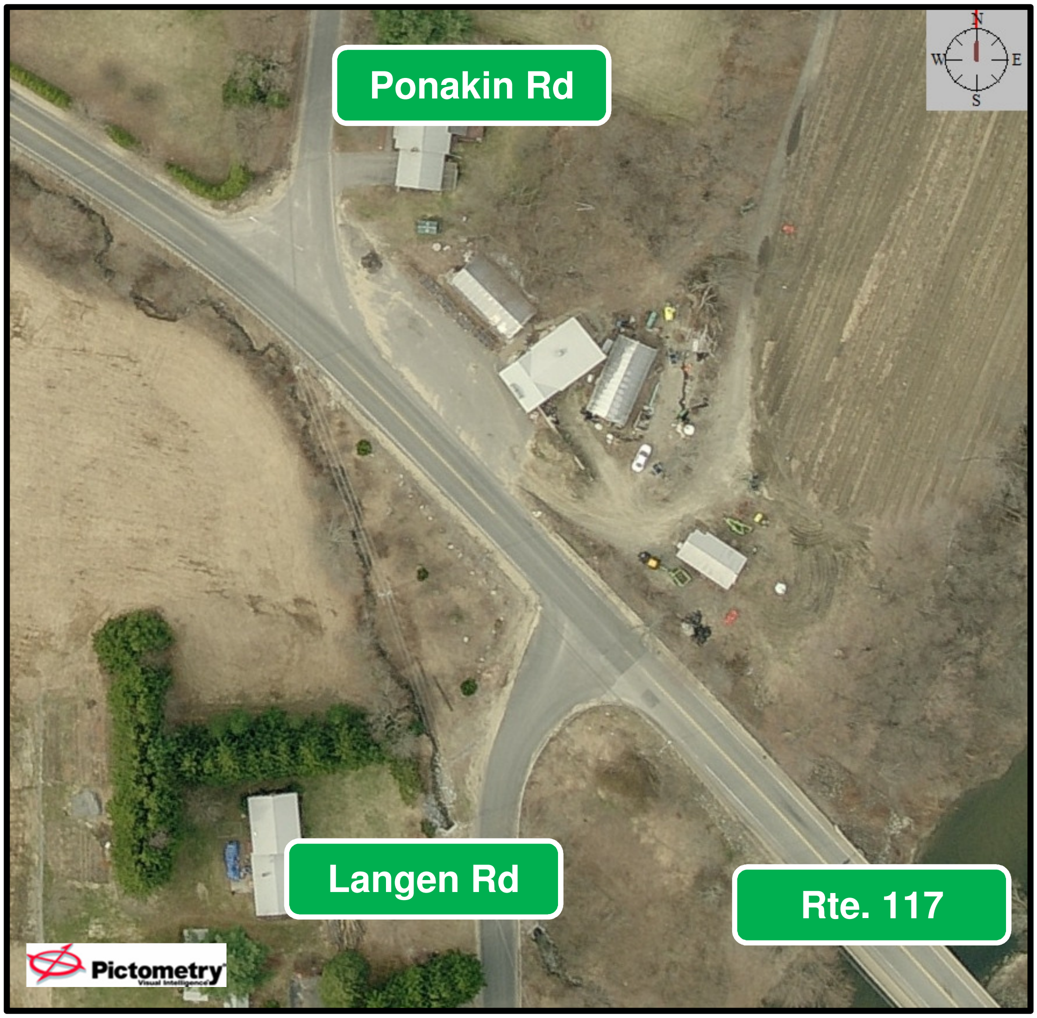


Brockelman Road

Ponakin Road



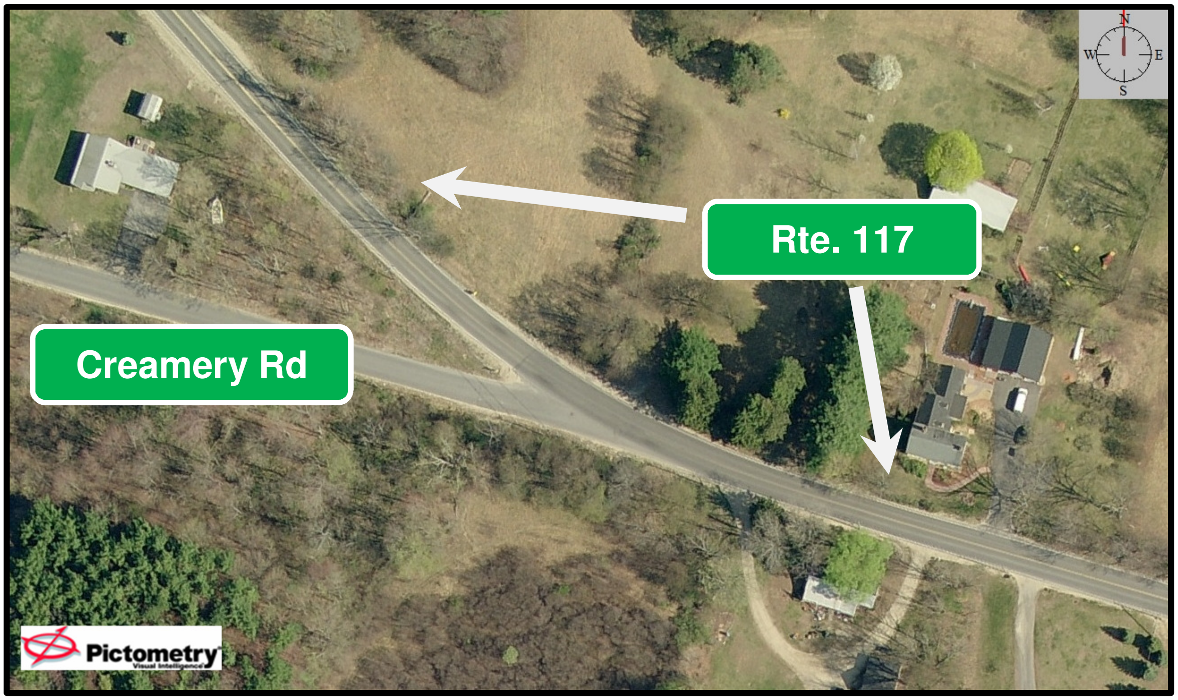
Langen Road



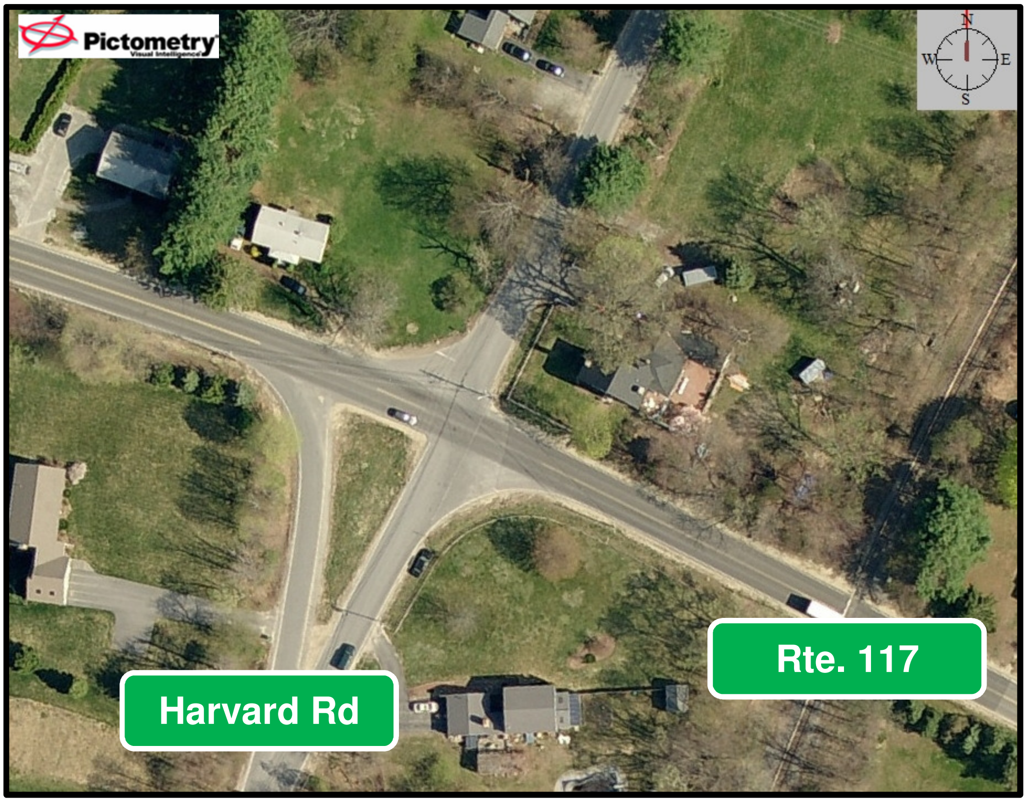
Lunenburg Road (Rte. 70)

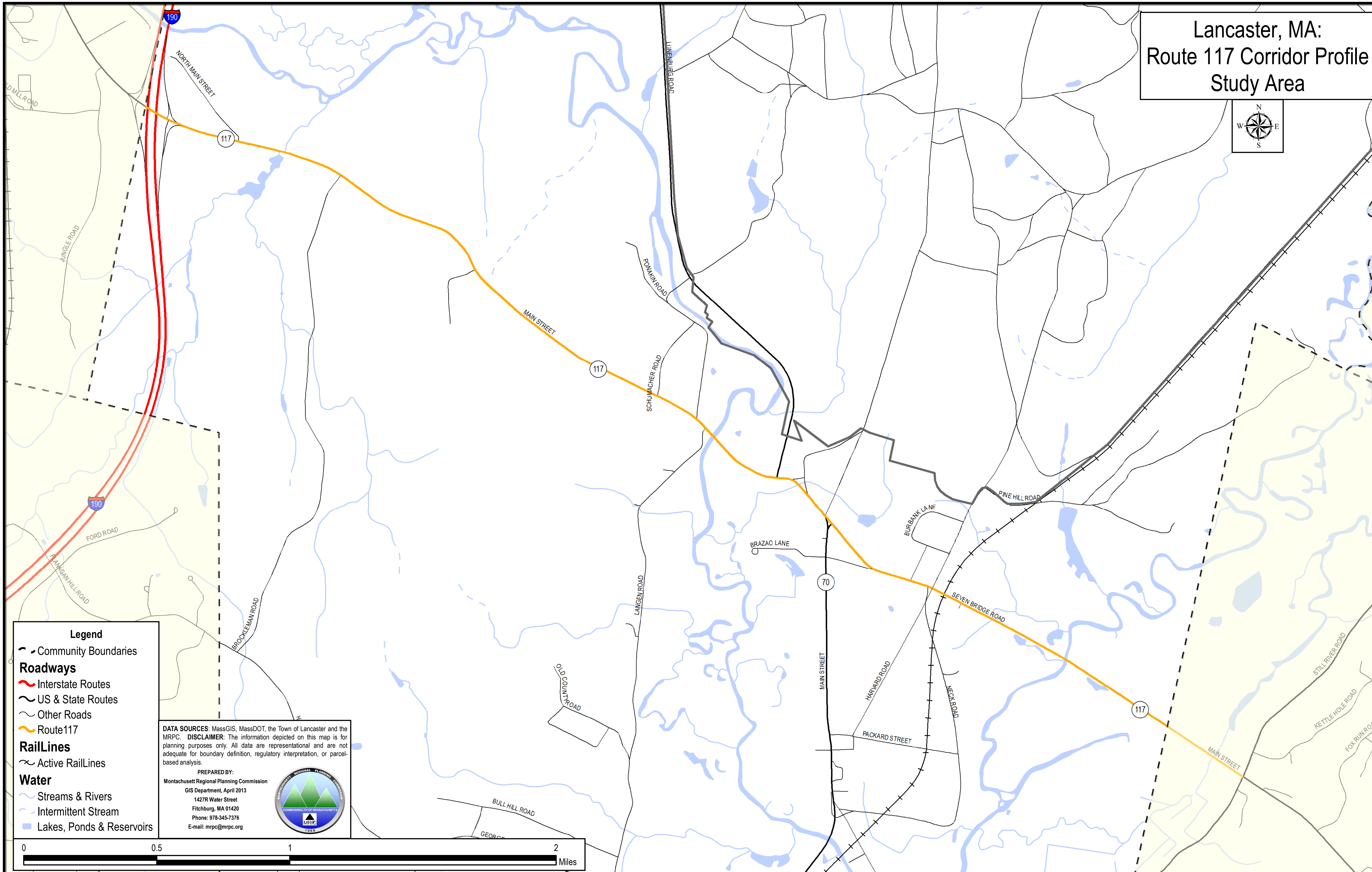
Main Street (Rte. 70)

Creamery Road



Harvard Road





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2.0 ROUTE 117 ENVIRONMENTAL

2.1 Environmental Profiles

In order to assess the environmental conditions along the Route 117 corridor, various Geographic Information System (GIS) datasets were compiled and analyzed. As part of the analysis, a one half mile buffer was developed around Route 117. The following summarizes the datasets compiled and the environmental features found within the community.

Wetlands

The following tables provide a snapshot of the identified wetlands areas classified as marsh/bog or wooded marsh that lie within the corridor buffer. A large section directly abutting the eastern end of Route 117 is classified as a wooded marsh. This area, the “Bolton Flats” is the most environmentally impacted segment of the corridor. Refer to the map “*Environmental Constraints*” at the end of the chapter for details of wetlands along the corridor.

Wetland Acreage

WetlandType	Acres
Marsh/Bog	82.78
Wooded Marsh	437.48

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 identified within the corridor include:

- *Certified Vernal Pools*
- *Potential Vernal Pools*
- *BioMap Core Habitat* - This depicts the most viable habitats for rare species in Massachusetts.
- *BioMap2 Critical 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).

Critical natural landscape areas exist throughout Route 117 but are the most prevalent along the Bolton Flats area. NHESP conservation areas are summarized in the table below and are depicted on the “*Environmental Constraints*” map at the end of this chapter.

NHESP Acreage

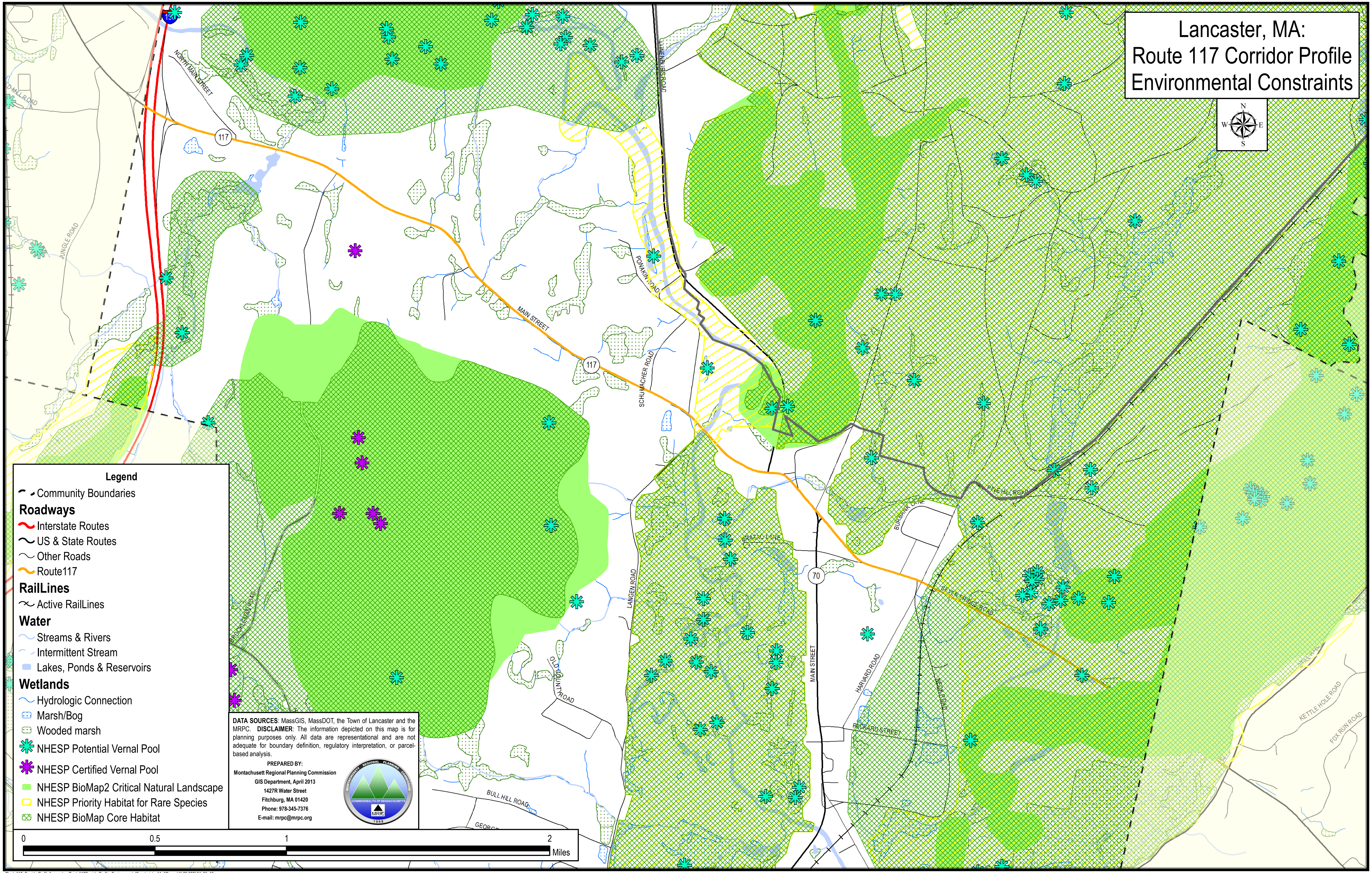
NHESP Data Type	Acres
NHESP BioMap2 Core Habitat	1638.64
NHESP Priority Habitat for Rare Species	1250.05
NHESP BioMap2 Critical Natural Landscape	645.39

Open Space

Identified open space locations within the corridor buffer are summarized in the following table. Various open space parcels exist through the corridor. Most notable are the Bartlett Pond Conservation Area on the western most section and the Bolton Fairgrounds on the eastern section. Refer to the map "*Open Space*" at the end of this chapter for detail along the Route 117 corridor.

Open Space Acreage

Open Space Data Type	Acres
Other	102.16
Protected	349.73
Unprotected	154.53



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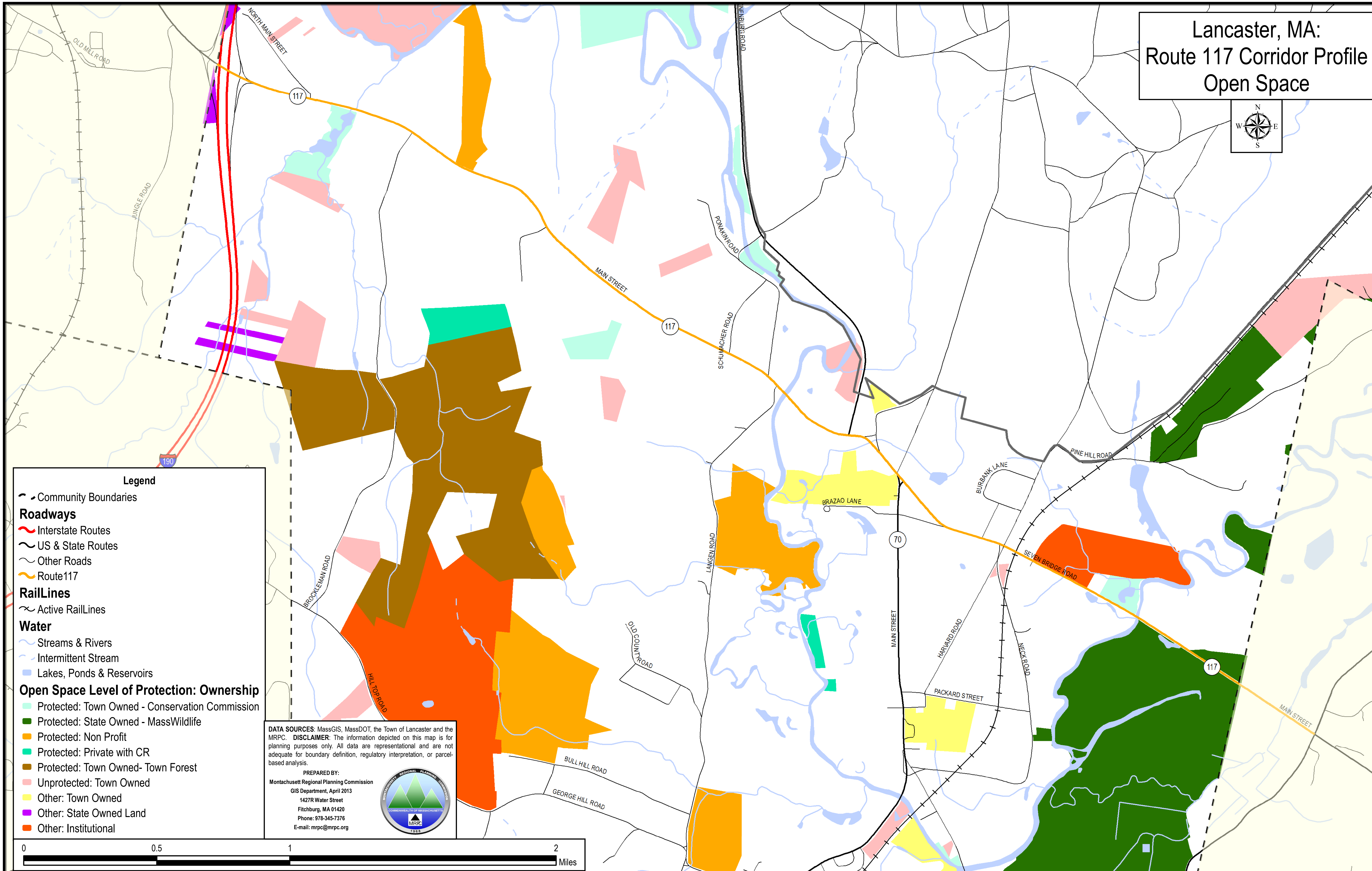

Lancaster, MA:
Route 117 Corridor Profile
Open Space
N
W
E
S
Legend
Community Boundaries
Roadways
Interstate Routes
US & State Routes
Other Roads
Route117
RailLines
Active RailLines
Water
Streams & Rivers
Intermittent Stream
Lakes, Ponds & Reservoirs
Open Space Level of Protection: Ownership
Protected: Town Owned - Conservation Commission
Protected: State Owned - MassWildlife
Protected: Non Profit
Protected: Private with CR
Protected: Town Owned- Town Forest
Unprotected: Town Owned
Other: Town Owned
Other: State Owned Land
Other: Institutional
DATA SOURCES: MassGIS, MassDOT, the Town of Lancaster and the MRPC. DISCLAIMER: The information depicted on this map is for planning purposes only. All data are representational and are not adequate for boundary definition, regulatory interpretation, or parcel-based analysis.
PREPARED BY:
Montachusett Regional Planning Commission
GIS Department, April 2013
1427R Water Street
Fitchburg, MA 01420
Phone: 978-345-7376
E-mail: mrpc@mrpc.org
0
0.5
1
2
Miles
OLD MILL ROAD
NORTH MAIN STREET
JUNGLE ROAD
117
190
MAIN STREET
PONAKIN ROAD
SCHUMACHER ROAD
BRAZAO LANE
LANGEN ROAD
BROCKLEMAN ROAD
HILL TOP ROAD
OLD COUNTY ROAD
BULL HILL ROAD
GEORGE HILL ROAD
70
MAIN STREET
HARVARD ROAD
NECK ROAD
PACKARD STREET
BURBANK LANE
PINE HILL ROAD
SEVEN BRIDGE ROAD
MAIN STREET

3.0 TRAFFIC CONGESTION ANALYSIS

3.1 Overview of Traffic Congestion Analysis Methods

The following analysis methods were used to evaluate traffic congestion on Route 117 in Lancaster.

Traffic Volume Counts and Peak Hour Determination

MRPC has conducted twenty-four hour (minimum) traffic counts at key locations along this corridor. Besides total traffic volume data, speed and vehicle class data was also counted. The count data are then analyzed to determine AM and PM peak hours. Once the AM and PM peak hours are determined, peak hour intersection turning movement traffic counts were completed at the study area intersections to assess intersection operations at peak traffic hours.

Intersection Peak Hour Level-of-Service (LOS) Analysis

The Level Of Service (LOS) of a roadway traffic facility represents the quality of traffic flow and is used to assess the operation of that traffic facility during peak hours. LOS analyses are based on the methods in the *Highway Capacity Manual* (2010) (HCM). LOS is defined differently for each type of traffic facility, such as an unsignalized intersection, signalized intersection, two-lane road, or multi-lane road.

Intersection LOS Criteria

LOS criteria are defined by the average amount of delay experienced by a vehicle at the intersection due to the traffic controls (i.e., signs or signals). For unsignalized intersections each approach is assessed independently, since the LOS of the major and minor approaches may differ greatly. LOS E and F indicate unacceptable intersection operation. The table below summarizes the LOS average control delay criteria for intersections controlled by STOP signs and those controlled by traffic signals.

Level of Service (LOS) Criteria

LOS	Average Control Delay (seconds per vehicle)	
	Stop Controlled	Signalized
A	<10.0	<10.0
B	10.1 – 15.0	10.1 – 20.0
C	15.1 – 25.0	20.1 – 35.0
D	25.1 – 35.0	35.1 – 55.0
E	35.1 – 50.0	55.1 – 80.0
F	>50.0	>80.0

3.2 Historical Traffic Count Observations

The following table lists Route 117 adjusted average daily traffic (AADT) based on the traffic counts the MRPC conducted at comparable locations from 1999 to 2013. Route 117 displays an overall increase in traffic volume over the last 5 years. However, there is a 0.24 mile stretch in which Route 117 and Route 70 converge that shows a 5.17% decrease since 2009. In fact traffic volume measured at this location in 2013 seems to closely resemble volume in 1999.

Route 117 Lancaster Traffic Volume Growth Rates

YEAR	East of I-190 ADT	Approximate Annual Growth Rate	Rte. 70/117 ADT	Approximate Annual Growth Rate	Bolton Town Line ADT	Approximate Annual Growth Rate
1999	13,800		16,300			
2000			17,300			
2001						
2002						
2003		-10.14%				
2004	13,600			7.36%	11,900	
2005						
2006			20,000			
2007						
2008	12,400				11,400	5.04%
2009			17,500			
2010						9.65%
2011		3.23%		-5.71%		
2012					13,800	
2013	12,800		16,500		12,500	

A comparison to traffic volume growth factors for the entire Montachusett Region (based upon multiple locations from the MRPC count database) has shown a decrease in overall volumes for both urban and rural communities. Between 2006 and 2010, traffic volumes region wide have seen an annual growth rate of -0.81 percent. Slowdowns in the economy as well as gas price increases may have contributed to these reductions. This analysis will be recalculated for the 2015 Regional Transportation Plan (RTP).

The following table shows the annual growth rates for the Montachusett Region based upon the count history from 2006 to 2010 for 93 locations across the region.

Montachusett Traffic Volume Annual Growth Factors

	No. of Locations	2006 Total Volumes	2010 Total Volumes	Annual Growth Rates 2006-2010
Total - Regionwide	93	749,935	725,959	-0.81%
Urban Only	41	478,081	469,255	-0.46%
Rural Only	52	271,854	256,704	-1.42%

3.3 Existing Daily Traffic Volumes

MRPC conducted twenty-four hour automatic traffic counts at seven locations along the Route 117 corridor. Locations are listed in the following table and were conducted during the months of May and June 2013.

Corridor Traffic Volumes and AADT

Route	Location of Count	Date	Raw Count Total	Eastbound (Rte. 70 Northbound)	Percent	Westbound (Rte. 70 Southbound)	Percent	AADT*
117	E. of I-190	5/28/2013	14,335	7,093	49.5%	7,242	50.5%	12,800
117	W. of Rte. 70	5/28/2013	13,462	6,725	50.0%	6,737	50.0%	11,800
70	N. of Rte. 117	5/28/2013	7,584	3,774	49.8%	3,810	50.2%	6,800
117 / 70	E. of Lunenburg Rd.	5/28/2013	18,600	9,259	49.8%	9,341	50.2%	16,500
70	S. of Rte. 117	6/4/2013	7,101	3,338	47.0%	3,763	53.0%	6,800
117	E. of Main / Rte. 70	5/28/2013	13,468	6,533	48.5%	6,935	51.5%	11,900
117	Bolton Town Line	6/4/2013	14,007	6,708	47.9%	7,299	52.1%	12,500
*Adjusted Average Daily Traffic								

Volumes range from a high of 18,600 at the convergence of Route 117 and Route 70 to a low of 7,101 south of Route 117 on Main Street (Route 70). Along Route 117 itself traffic is slightly higher at the western and eastern ends of the corridor as compared to the middle segments not including where Routes 117 and 70 converge.

Westbound traffic on Route 117 is slightly more than traffic flowing eastbound while on Route 70 southbound traffic is somewhat higher.

3.4 Route 117 Intersection Peak Hour Traffic Volumes

MRPC conducted AM and PM turning movement counts (TMCs) at each study area intersection in along the corridor during the months of May and June 2013. The intersections and the A.M. and P.M. turning volumes are listed in the table below.

Route 117 Turning Movement Count Locations and Volumes

Route 117 at	Date	AM Peak	PM Peak
North Main St.	5/14/2013	1,028	1,407
Brockelman Rd.	5/6/2013	1,169	1,647
Ponakin Rd.	5/9/2013	1,183	1,508
Langen Rd.	5/7/2013	1,198	1,508
Lunenburg Rd. (Rte. 70)	5/21/2013	1,828	1,868
Main St. (70)	6/4/2013	1,721	1,982
Creamery Rd.	5/8/2013	1,076	1,532
Harvard Rd.	6/4/2013	1,170	1,858

The complete TMC datasheets can be found in the Technical Appendix.

3.5 Route 117 Intersection Peak Hour Level-of-Service (LOS) Analysis

Level of Service analysis was then conducted for the AM and PM peak hours based upon the TMC's listed above to determine the operational conditions of Route 117. The following tables provide the results of this analysis for all intersections along the corridor.

Complete LOS worksheets can be found in the Technical Appendix.

Route 117 Intersection Peak Hour Level of Service (LOS)

Route 117 Intersection With	Approach	Peak Hours	Lane Group	AM		PM	
				Delay (sec.)	LOS	Delay (sec.)	LOS
North Main St.	Rte. 117	8:00 - 9:00 AM	EB Left	7.3	A	7.8	A
	N. Main St.	5:00 - 6:00 PM	Left/Right	11.3	B	10.8	B
Brockelman Rd.	Rte. 117	7:15 - 8:15 AM	WB Left	9.6	A	8.6	A
	Brockelman Rd.	4:30 - 5:30 PM	Left/Right	23.7	C	46	E
Ponakin Rd.	Rte. 117	7:15 - 8:15 AM	WB Left	9.6	A	8.7	A
	Ponakin Rd.	4:00 - 5:00 PM	Left/Right	24.6	C	49.6	E
Langen Rd.	Rte. 117	7:15 - 8:15 AM	EB Left	8.1	A	9.9	A
	Langen Rd.	4:00 - 5:00 PM	Left/Right	24.5	C	37	E
Lunenburg Rd. (Rte. 70)	Rte. 117	6:00 - 7:00 AM 5:15 - 6:15 PM	EB Left	8.9	A	12	B
	Lunenburg Rd. (Rte. 70)		Left	+	F	+	F
			Right	12.1	B	20.6	C
Main St. (Rte. 70)	Rte. 117	6:45 - 7:45 AM	WB Left	11.9	B	8.9	A
	Main St. (Rte. 70)	4:45 - 5:45 PM	Left/Right	+	F	+	F
Creamery Rd.	Rte. 117	7:00 - 8:00 AM	WB Left	12.2	B	8.1	A
	Creamery Rd.	4:00 - 5:00 PM	Left/Right	14.1	B	14.4	B
Harvard Rd.	Rte. 117	7:15 - 8:15 AM	EB LRT	12.1	B	8.2	A
			WB LRT	8.5	A	9.4	A
	Harvard Rd.	5:00 - 6:00 PM	NB LRT	+	F	24.6	C
			SB LRT	+	F	30.2	D

*+ = Higher than the threshold (Over 50 seconds of delay LOS F)

The Level of Service analysis conducted shows that most intersections are within the desired LOS. However, the two major intersections (117/70) are a LOS of F in both the AM and PM peak hours and Harvard Road is a LOS F in the PM peak hour. Entering Route 117 from Brockelman Road, Ponakin Road and Langen Road in the PM peak hour drivers can expect a less than desirable LOS (E).

3.6 Route 117 Speed and Vehicle Classification Analysis

As part of the information collected for traffic volumes along the corridor, speed and vehicle classification data was also obtained. This provides a better picture of the traffic along the route.

Speed Data

To assess the conditions along the corridor, at the locations where 24 hour counts were being conducted, data on the traffic speed was obtained. Data presented indicates the 85th percentile speed at each location. The 85th percentile speed is that speed at which 85 percent of the traffic is traveling at or below. It is often used to help establish speed limits and can indicate if speeding is an issue for a road or segment. From this data the following table was developed that summarizes and highlights conditions on Route 117:

Route 117 – 85th Percentile Speed Data

		Eastbound (117)/Northbound (70)			*Westbound (117)/Southbound (70)*		
Route	Location of Count	85th Percentile Speed (PS)	Posted Speed Limit	MPH Above or Below (-) Speed Limit	85th Percentile Speed	Posted Speed Limit	MPH Above or Below (-) Speed Limit
117	E. of I-190	46	40	6	45	45	0
117	W. of Rte. 70	40	30	10	42	30	12
70	Rte. 70 N. of Rte. 117	51	40	11	51	25	9
117	E. of Lunenburg Rd.	37	30	7	33	30	3
70	Rte. 70 S. of Rte. 117	34	30	4	36	30	6
117	E. of Main St. / Rte. 70	40	30	10	40	30	10
117	Bolton Town Line	45	45	0	46	45	1

As seen from the table above most measured 85th percentile speeds are at or slightly above the posted speed limit, the exception being the approaches to the junction of Route 117 and Route 70 located in the center of the corridor. Route 117 through Lancaster generally acts as a suburban arterial road serving through commuters between the Leominster area and I-495. Development is mostly light residential throughout with speed limits around 40 MPH. These characteristics change abruptly in the center of the corridor where the road intersects and merges with Route 70. The area around the two intersections with Route 70 (Lunenburg Rd. and Main St.) exist a slightly denser residential area along with close proximity to a school zone (Mary Rowlandson Elementary and Luther Burbank Middle School). The combination of these three factors, traffic from Route 70, denser residential with side street access and a School Zone, call for lower posted speed limits ranging from 20 to 30 MPH. The above measured 85th percentile speeds which are significantly higher than the posted speeds should be addressed in this area. Additional signage and continued enforcement of the speed limit may be necessary. If improvements to either Route 117/70 intersection involve installing traffic lights additional measures should be applied as the increased occurrences of rear end accidents typically accompany such improvements.

Vehicle Classification

As part of the MRPC's annual traffic count program, data has been collected on vehicle classification at various locations across the region. Based upon a comparison of counts conducted at 13 common locations in 2007 and 2010, percentages of truck traffic and its growth rate have been calculated for the Montachusett region. Data for 2010 shows that at the 13 locations surveyed, the truck percentage of the total volume was 3.16 percent. This is an increase from 2007 data, where the truck percentage was calculated at 2.49 percent. This historical data is typically calculated for the RTP.

Montachusett Region Vehicle Classification Counts 2007-2010

	2007	2010
Total Vehicles	142,567	98,741
Total Trucks	3,556	3,125
% of Trucks	2.49%	3.16%
% Change		0.67%

Number of Count Locations Surveyed: 13

The table below is taken from the Massachusetts Department of Transportation's (MassDOT) Truck Peak Hour & Average Day History Report. It is a historical representation of vehicle classification counts taken along Route 117 in Lancaster dating back to 2006.

MassDOT Vehicle Class Data on Route 117

Route	Location of Count	Year	Percent of Trucks*
117	Between Routes 117/70 intersections	2006	4%
		2008	3%
		2009	3%

* averages for trucks only

At each location where traffic counts were conducted, data was also collected on the number and types of vehicles encountered. Traffic was categorized into 13 separate groupings that approximately correspond to the Federal Highway Administration (FHWA) vehicle classification definitions. Vehicle classification counts were categorized as follows:

- Bikes/Motorcycles -- All two or three-wheeled motorized vehicles and includes motorcycles, motor scooters, mopeds, motor-powered bicycles, and three-wheel motorcycles.
- Cars & Trailers -- All sedans, coupes, and station wagons manufactured primarily for the purpose of carrying passengers and including those passenger cars pulling recreational or other light trailers.
- Two Axle Long (Four Tire Single Unit Vehicles) -- All two axle, four tire, vehicles, other than passenger cars Including pickups, panels, vans, and other vehicles such as campers, motor homes, ambulances, hearses, carryalls, and minibuses.
- Buses -- All vehicles manufactured as traditional passenger-carrying buses with two axles and six tires or three or more axles.
- Two Axle, Six Tire, Single Unit Trucks -- All vehicles on a single frame including trucks, camping and recreational vehicles, motor homes, etc., with two axles and dual rear wheels.
- Three Axle Single Unit Trucks -- All vehicles on a single frame including trucks, camping and recreational vehicles, motor homes, etc., with three axles.
- Four Axle Single Unit Trucks -- All trucks on a single frame with four axles.
- Less Than Five Axles Double Unit Trucks -- All vehicles with fewer than five axles consisting of two units, one of which is a tractor or straight truck power unit.

- Five Axle Double Unit Trucks -- All five axle vehicles consisting of two units, one of which is a tractor or straight truck power unit.
- Less Than Six Axles Multi Unit Trailer Trucks -- All vehicles with less than six axles consisting of three or more units, one of which is a tractor or straight truck power unit.
- Six Axle Multi-Trailer Trucks -- All six axle vehicles consisting of three or more units, one of which is a tractor or straight truck power unit.
- More Than Six Axle Multi-Trailer Trucks -- All vehicles with more than six axles consisting of three or more units, one of which is a tractor or straight truck power unit.

The following table provides a breakdown of buses and heavy truck traffic for each direction at each count location. Heavy trucks were defined as all vehicles classified Two Axle, Six Tire, Single Units and above.

Route 117 Vehicle Classification Counts

Route	Location of Count (East to West)	Direction	Count Volumes	Buses	Percent Buses of Volume	Trucks	Percent Trucks of Volume	Total Trucks & Buses	Percent Trucks & Buses of Volume
117	E. of I-190	Eastbound	6,887	45	0.65%	322	4.68%	367	5.33%
		Westbound	6,994	48	0.69%	370	5.29%	418	5.98%
		Total	13,881	93	0.67%	692	4.99%	785	5.66%
117	W. of Rte. 70	Eastbound	6,322	62	0.98%	396	6.26%	458	7.24%
		Westbound	6,453	75	1.16%	482	7.47%	557	8.63%
		Total	12,775	137	1.07%	878	6.87%	1,015	7.95%
70	N. of Rte. 117 *	Northbound	7,571	32	0.42%	163	2.15%	195	2.58%
		Southbound	7,608	31	0.41%	175	2.30%	206	2.71%
		Total	15,179	63	0.42%	338	2.23%	401	2.64%
117	E. of Lunenburg Rd.	Eastbound	8,755	72	0.82%	534	6.10%	606	6.92%
		Westbound	8,643	74	0.86%	482	5.58%	556	6.43%
		Total	17,398	146	0.84%	1,016	5.84%	1,162	6.68%
70	S. of Main St. / Rte. 70*	Northbound	6,333	43	0.68%	214	3.38%	257	4.06%
		Southbound	7,478	37	0.49%	201	2.69%	238	3.18%
		Total	13,811	80	0.58%	415	3.00%	495	3.58%
117	E. of Main St. / Rte. 70	Eastbound	6,250	72	1.15%	376	6.02%	448	7.17%
		Westbound	6,676	78	1.17%	505	7.56%	583	8.73%
		Total	12,926	150	1.16%	881	6.82%	1,031	7.98%
117	Bolton Town Line*	Eastbound	12,861	117	0.91%	713	5.54%	830	6.45%
		Westbound	13,798	89	0.65%	746	5.41%	835	6.05%
		Total	26,659	206	0.77%	1,459	5.47%	1,665	6.25%
TOTAL AVERAGES		**Eastbound**	**7,854**	**63**	**0.80%**	**388**	**4.88%**	**452**	**5.68%**
		Westbound	**8,236**	**62**	**0.77%**	**423**	**5.19%**	**485**	**5.96%**
		Total	**16,090**	**125**	**0.79%**	**811**	**5.03%**	**936**	**5.82%**

* Indicates counts taken over a two day period

Truck traffic measured along the corridor was heavier than both the MRPC Regional Historic Counts and the MassDOT historic counts along Route 117. The overall average truck volume of the counts taken for this study is 5.03%; however, the tables below show a better representation of Route 117 itself when Route 70 counts are separated from the average.

Route 70/Route 117 Comparison

Route	Direction	Count Volumes	Buses	Percent Buses of Volume	Trucks	Percent Trucks of Volume	Total Trucks & Buses	Percent Trucks & Buses of Volume
Route 70 AVERAGES	Northbound	6,952	38	0.55%	189	2.77%	226	3.32%
	Southbound	7,543	34	0.45%	188	2.49%	222	2.95%
	Total	14,495	72	0.50%	377	2.62%	448	3.11%
Route 117 AVERAGES	Eastbound	8,215	74	0.90%	468	5.72%	542	6.62%
	Westbound	8,513	73	0.90%	517	6.26%	590	7.17%
	Total	16,728	146	0.90%	985	6.00%	1,132	6.90%

A 6 percent volume of trucks along Route 117 is considerably higher than the most recent MassDOT historical data shows. A factor that may continue this trend of increasing truck volume is the possibility of future commercial and industrial developments along the northern leg of Route 70 (Lunenburg Road).

3.7 Travel Time Data

Route 117 corridor travel time data was collected using a GPS Device and TravTime 2.0™, a software program which measures travel time and delays. MRPC has taken three travel time runs in each direction during the afternoon peak hour. From this an average travel time can be computed during the peak hour through the corridor. This data is compared to free flow travel time to depict a travel time index rating. The free-flow travel time is the amount of time in seconds it takes to travel a particular corridor at the posted speed limit without any delay. The travel time index (TTI) is a ratio between the average peak hour travel time and free-flow travel time. For example a TTI value of 1.30 indicates that the average travel time at peak hour takes 30 percent longer than free flow travel time. The Sample area for travel time starts at I-190 in the west and ends at the junction of Route 117/110 just over the town line in Bolton to the east. The first table below shows the results from the runs that were taken while second table shows the different congestion levels of the TTI based upon the Functional Classification of the roadway, in this case an arterial.

Afternoon Peak Hour Travel Time in Minutes

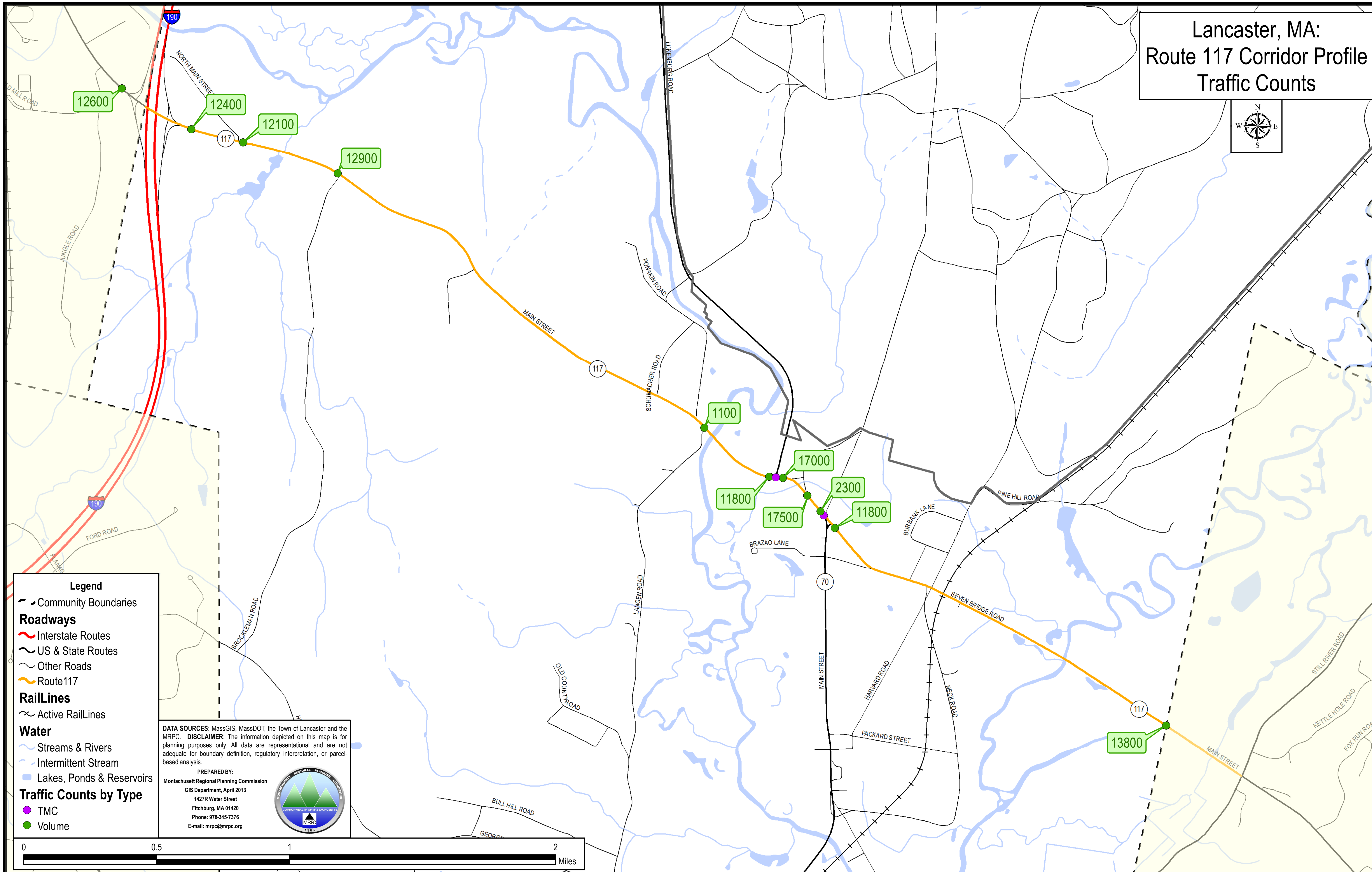
	Run 1	Run 2	Run 3	Average Time	Travel Time Index (TTI)
Eastbound	8.68	8.33	8.93	8.65	**1.15**
Westbound	8.3	8.47	11.95	9.57	**1.28**
Posted Speed Limit = Average 40 MPH		Corridor Distance = 5.0 Miles		Free Flow Travel Time (Minutes) = 7.5 WB / 7.5 EB	

Travel Time Index (TTI) Levels Of Congestion

Functional Class	No/Low Congestion	Moderate Congestion	High Congestion	Severe Congestion
Arterials	< 1.5	1.5 - 2.0	2.0 - 2.6	> 2.6

*Source: Federal Highway Administration

The Travel Time results do not indicate any severe delays during peak hours. The TTI levels are below thresholds for congestion on an Arterial road.


Lancaster, MA:
Route 117 Corridor Profile
Traffic Counts
N
S
E
W
12600
12400
12100
12900
1100
17000
11800
17500
2300
11800
13800
117
190
70
NORTH MAIN STREET
MAIN STREET
JUNGLE ROAD
FORD ROAD
LUNENBURG ROAD
PONAKIN ROAD
SCHUMACHER ROAD
LANGEN ROAD
BROCKLEMAN ROAD
OLD COUNTY ROAD
BULL HILL ROAD
BRAZAO LANE
BURBANK LANE
PINE HILL ROAD
SEVEN BRIDGE ROAD
HARVARD ROAD
NECK ROAD
PACKARD STREET
STILL RIVER ROAD
KETTLE HOLE ROAD
FOX RUN ROAD
Legend
Community Boundaries
Roadways
Interstate Routes
US & State Routes
Other Roads
Route117
RailLines
Active RailLines
Water
Streams & Rivers
Intermittent Stream
Lakes, Ponds & Reservoirs
Traffic Counts by Type
TMC
Volume
DATA SOURCES: MassGIS, MassDOT, the Town of Lancaster and the MRPC. DISCLAIMER: The information depicted on this map is for planning purposes only. All data are representational and are not adequate for boundary definition, regulatory interpretation, or parcel-based analysis.
PREPARED BY:
Montachusett Regional Planning Commission
GIS Department, April 2013
1427R Water Street
Fitchburg, MA 01420
Phone: 978-345-7376
E-mail: mrpc@mrpc.org
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4.0 ROUTE 117 SAFETY ANALYSIS

4.1 Overview of Safety Analysis

The safety analysis consists of the following:

- The crash reports for the most recent 3-year period were obtained from the local police department. 2010 MassDOT crash data was also used a source when each crash record could be verified with a local crash report
- The crash reports were then analyzed to determine crash locations, crash characteristics and contributing factors
- In the analysis that follows and if they exist, high crash locations were examined individually after being examined in context with other crashes due to the severity and frequency of crashes at the locations

  High crash locations are determined by either one of two Criteria:
  1) Crash cluster locations that are within the top 5% of crash clusters in the MRPC region. A crash cluster location is a location where a minimum of two crashes have occurred
  2) To address a certain crash trend that needs to be reduced. The trend needs to be documented and taken under advisement usually by a committee of interested parties that should include MassDOT

  For more on high crash locations see the *MRPC Highway Safety Improvement Program - Candidate Eligibility Criteria* (see Appendix) which provides some thresholds for Highway Safety Improvement Program (HSIP) eligibility

- Generally, crash locations fall into two categories – intersection and road segment. Crashes that occur within two-hundred feet of an intersection are considered to have occurred within the limits of the intersection. Road segment crashes occur outside the two-hundred foot distance and are divided into in-lane crashes and lane departure crashes
- The following crash characteristics of road segment and intersection crashes were examined:
  - Crash Years
  - Time of Day
  - Crash Severity
  - Crash Manner
  - Critical Approach - the approach direction that saw the highest percentage of crashes
  - In-lane Crashes / Lane Departure Crashes for road segment crashes
- The following Contributing Factors were examined:
  - Road Surface Condition
  - Ambient Light Condition
  - Weather Condition
  - Cold Months (October – March) versus Warm Months (April – September)
  - Summary of at-fault vehicle driver error or other contributing factor based on the crash narratives found in the crash reports. Common at-fault vehicle driver errors include, but are not limited to:
    - Distractions
    - Following too closely
    - Driving too fast
    - Inattention to events on roadway
    - Attempting to enter the traffic stream with inadequate gaps in traffic
- Crash Diagrams were constructed for high crash locations and other locations as needed
- Maps showing all crash locations were constructed

4.2 Crash Analysis

For the 3-year and 3-month period of February 8, 2010 to May 30, 2013, a total of 98 verifiable crashes occurred on Route 117 in Lancaster (see the mapped crashes on the Figures that follow).

4.2a - Crashes by Segment from West to East

The Route 117 segment from the North Main Street intersection to just beyond the Ponikin Road intersection experienced 27 (28% of total) verifiable crashes. This segment will be designated as **Crash Analysis Section 1** for the remainder of this chapter. The Route 117 segment that experienced the highest crash total occurred from the Langen Road intersection to the Main Street (Route 70) intersection which experienced 59 (60% of total) verifiable crashes. This segment will be designated as **Crash Analysis Section 2** for the remainder of this chapter. And from just east of the Main Street (Route 70) intersection to approximately 1,400 feet beyond the railroad crossing, Route 117 experienced 12 (12% of total) verifiable crashes. This segment will be designated as **Crash Analysis Section 3** for the remainder of this chapter.

Crash Analysis Section 1 (Section 1)

Table 4-1: Section 1 Intersection & Road Segment Crashes (west to east)

Crash Analysis Section 1	
NORTH MAIN STREET / Rte 117 (these crashes not verified and not included in analysis)	3
Road Segment Crashes	0
MAIN STREET / BARTLETT POND	1
Road Segment Crashes	1
BROCKELMAN ROAD / MAIN STREET	**4**
Road Segment Crashes	**7**
MAIN STREET 75 feet EAST FROM COLONY LANE	**1**
Road Segment Crashes	**1**
MAIN STREET / DEVONSHIRE WAY	**4**
Road Segment Crashes	**4**
MAIN STREET / SCHUMACHER ROAD	**3**
Road Segment Crashes (between Ponakin Rd & Langen Rd)	1
Intersection Crash Total	13
Road Segment Crash Total	14
Crash Analysis Section 1 Crash Total	**27**

Section 1 is shown in Figures 4-1 and 4-2. Figure 4-1 begins at North Main Street and ends at Colony Lane. Figure 4-2 begins at Colony Lane and ends at Ponakin Road. The length of the road segment is about 2.1 miles. Table 4-1 provides road segment and intersection crash totals. This Section has no Criteria 1 high crash locations. Criteria 2 high crash locations need to be determined.

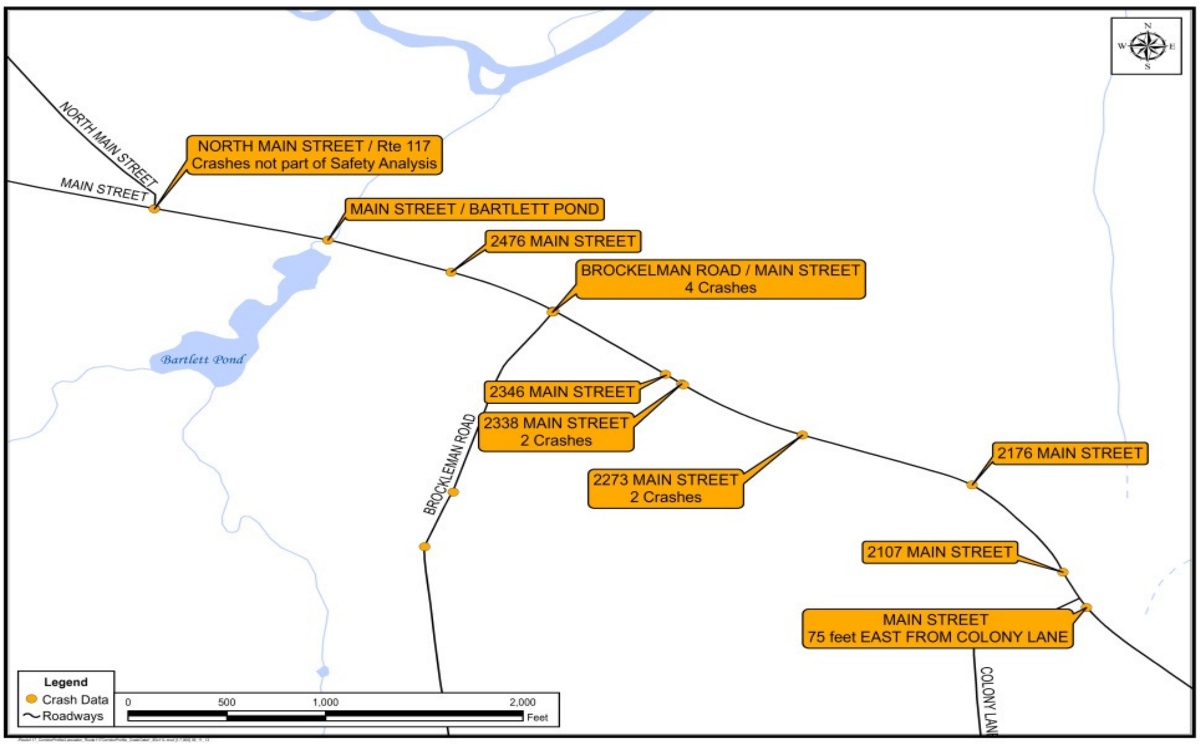
28% of the total verifiable crashes on Route 117 occurred in Section 1 which is the second highest percentage of any Section. Of the 27 verifiable crashes that occurred in this Section, 52% were road segment crashes and 48% were intersection crashes. The number of verifiable crashes could be higher if the three MassDOT crashes that occurred at the North Main Street and Route 117 intersection were to be verified with local crash reports. 92% of the road segment crashes occurred between Brockelman Road and Schumacher Road of which 100% occurred at driveways. Of the intersection crashes 86% occurred at and in between the Brockelman Road and the Schumacher

Road intersections. Combined, these road segment crashes and intersection crashes account for 89% of the total crashes for this Section.

Intersection Crash Characteristics

Of the intersection crashes, 2010 saw the highest percentage of crashes with 46% while 2012 saw 23% of the crashes. 23% of the crashes occurred between the hours of 11:00 – 12:00 PM which is the highest hour. The hours of 8:00 – 9:00 AM, 3:00 – 4:00 PM, and 6:00 – 7:00 PM saw 15% of the crashes each. 31% of the intersection crashes resulted in an injury crash and were distributed fairly evenly along Section 1. Rear-end crashes accounted for the highest crash manner at 62% of the total crashes followed distantly by single vehicle crashes at 15%. Of the four possible critical approach directions for crashes to occur, the eastbound direction saw the highest percentage of crashes at 46%. The westbound direction was also significant with 38%

Figure 4-1: Crash Analysis Section 1 (west to east) (continued below)



Intersection Crash Contributing Factors

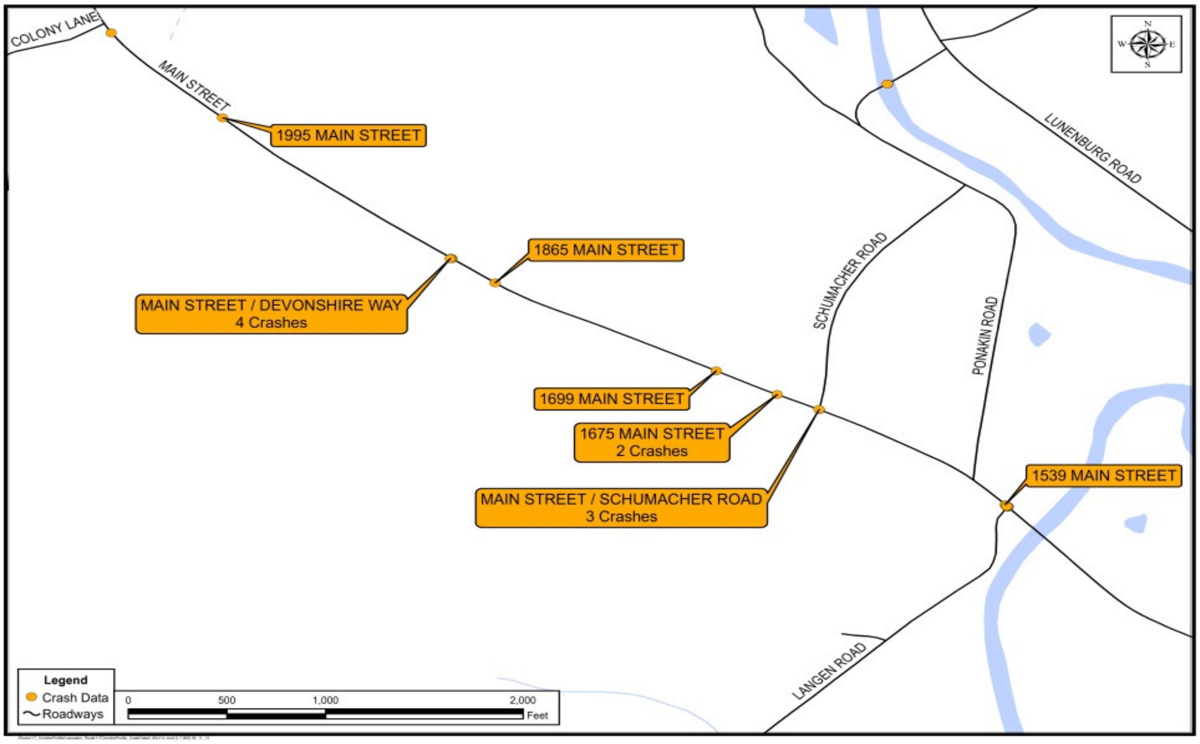
Adverse road surface conditions and adverse weather conditions were reported on 23% of the crash reports for each condition. Adverse ambient light conditions were reported on 31% of the crash reports. Crashes occurred at a higher percentage of 54% during warm months while 46% of the crashes occurred during cold months.

An analysis of the crash narratives found in the crash reports revealed that at-fault vehicle driver error was the most significant contributing factor in 62% of the crashes. Two quotes from two different crash reports provide examples of the types of driver error that occurred in these crashes:

"…… was **following too close** when ……"
"…… was **unable to stop in time** and ……"

At-fault vehicle driver error was a partial contributing factor in 15% of the crashes. Crashes not involving driver error accounted for 23% of the crashes which involved wildlife that were unavoidable.

Figure 4-2: Crash Analysis Section 1 (west to east)



Road Segment Crash Characteristics

Of the road segment crashes, 2012 saw the highest percentage of crashes with 64% while 2010 and 2011 each saw 14% of the crashes. 100% of the crashes occurred at driveways. The 7:00 – 8:00 AM hour, the 3:00 – 4:00 and 4:00 – 5:00 PM hours saw 14% of the crashes each. The PM hours between 3:00 – 5:00 saw 28% of the crashes. 29% of the crashes resulted in an injury crash and were distributed fairly evenly along Section 1.

In-lane crashes accounted for 79% while lane departure crashes accounted for 21% of the total crashes. Lane departure crashes accounted for 75% of the road segment crashes that resulted in injury crashes. Of the in-lane crashes, rear-end crashes accounted for the highest crash manner at 73%. Of the lane departure crashes, single vehicle crashes accounted for the highest crash manner at 67% of which 100% crashed into utility poles. Of the four possible critical approaches for crashes to occur, the eastbound direction saw the highest percentage of crashes at 71%.

Road Segment Crash Contributing Factors

Adverse road surface conditions were reported on 36% of the crash reports. Adverse weather conditions were reported on 29% of the crash reports. Adverse ambient light conditions were reported on 43% of the crash reports. Crashes occurred at a higher percentage of 57% during warm months while 43% of the crashes occurred during cold months.

An analysis of the crash narratives found in the crash reports revealed that at-fault vehicle driver error was the most significant contributing factor in 71% of the crashes. Two quotes from two different crash reports provide examples of the types of driver error that occurred in these crashes:

"…… was **not paying attention** and struck ……"
"…… (driver) in car 2 **failed to notice** that Car 1 had stopped ……"

At-fault vehicle driver error was a partial contributing factor in another 7% of the crashes. Crashes not involving driver error accounted for 21% of the crashes of which 66% involved wildlife that were unavoidable.

Crash Analysis Section 2 (Section 2)

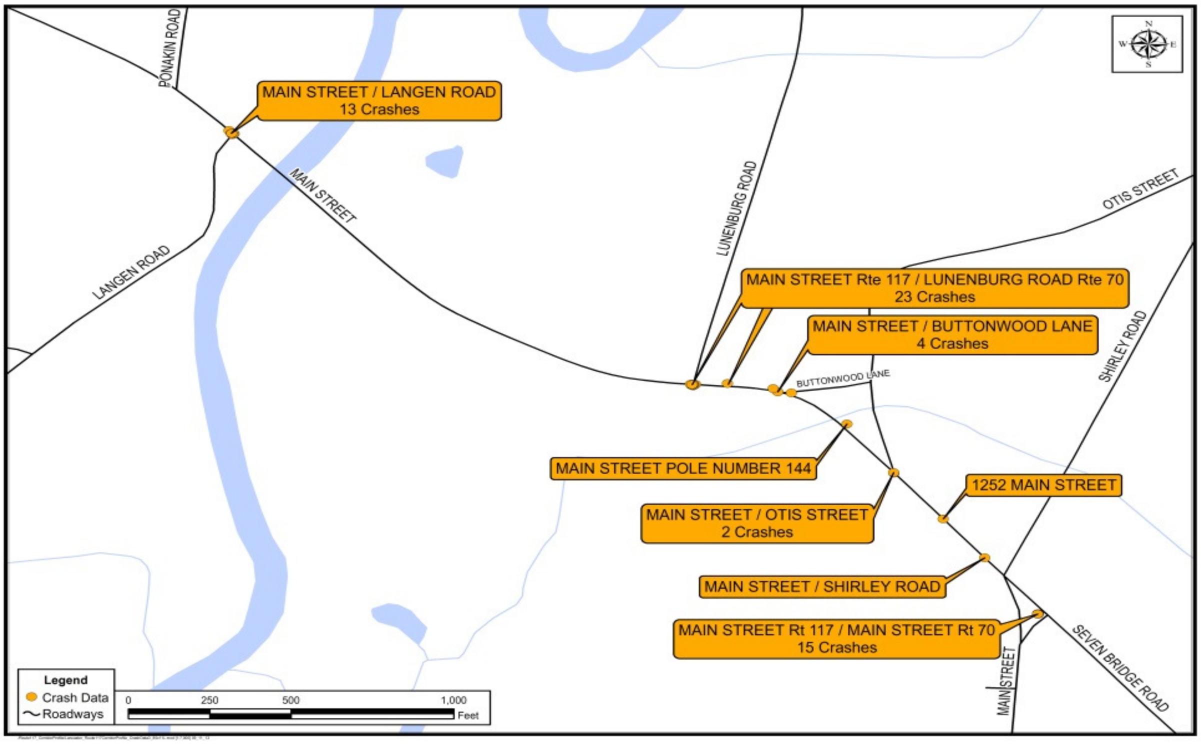
Table 4-2: Section 2 Intersection & Road Segment Crashes (west to east)

Crash Analysis Section 2	
MAIN STREET / LANGEN ROAD	13
Road Segment Crashes	0
MAIN STREET (Rte 117) / LUNENBURG ROAD (Rte 70)	**22**
Road Segment Crashes	0
MAIN STREET / BUTTONWOOD LANE	4
Road Segment Crashes	1
MAIN STREET / OTIS STREET	2
Road Segment Crashes	1
MAIN STREET / SHIRLEY ROAD	1
Road Segment Crashes	0
MAIN STREET (Rte 117/70) / MAIN ST (Rte 70)	**15**
Intersection Crash Total	57
Road Segment Crash Total	2
Crash Analysis Section 2 Crash Total	**59**

Section 2 is shown in Figure 4-3 and begins at Langen Road and ends at Main Street (Route 70). The length of the road segment is about 0.6 miles. Figure 4-5 below shows the Main Street (Route 117) and Lunenburg Road (Route 70) intersection and the Main Street (Routes 117/70) and Main Street (Route 70) intersection. The locations in Figures 4-5 will most likely qualify as high crash locations (referred to as *two high crash locations* in the analysis that follows). Table 4-2 provides road segment crash and intersection crash totals.

60% of the total verifiable crashes on Route 117 occurred in Section 2 which is the highest percentage of any Section. Of the total for Section 2, 78% (46 crashes) occurred on the roadway that lies in between, and includes, the *two high crash locations*. Of the 59 verifiable crashes that occurred in Section 2, 96.6% were intersection crashes and only 3.4% were road segment crashes.

Figure 4-3: Crash Analysis Section 2 (west to east)



Of the intersection crashes, 39% occurred at the Main Street (Route 117) and Lunenburg Road (Route 70) intersection, 26% occurred at the Main Street (Route 117/70) and Main Street (Route 70) intersection and 23% occurred at the Main Street and Langen Road intersection. Both road segment crashes occurred on the roadway between the *two high crash locations*. NOTE: the *two high crash locations* and the Main Street and Langen Road intersection are examined in greater detail below.

Intersection Crash Characteristics

The remaining 12% of intersection crashes occurred at intersections that lie in between the *two high crash locations* and are examined here. 2010 saw the highest percentage of crashes with 57% while 2013 saw 29% of the crashes. Each of the hours of 6:00 – 7:00 AM and 8:00 – 9:00 PM saw 29% of the crashes occur. 43% of the intersection crashes resulted in an injury crash of which 67% occurred at the Main Street and Buttonwood intersection. Rear-end crashes accounted for the highest crash manner at 57% of the total crashes followed by single vehicle crashes at 29%. Of the four possible critical approaches for crashes to occur, the westbound direction saw the highest percentage of crashes at 71%.

Intersection Crash Contributing Factors

Adverse road surface conditions were reported on 43% of the crash reports. Adverse weather conditions were reported on 29% of the crash reports. Adverse ambient light conditions were reported on 14% of the crash reports. Crashes occurred at a higher percentage of 71% during cold months while 29% of the crashes occurred during warm months.

An analysis of the crash narratives found in the crash reports revealed that at-fault vehicle driver error was the most significant contributing factor in 71% of the crashes. Two quotes from two different crash reports provide examples of the types of driver error that occurred in these crashes:

"…… was pulling out of driveway, **but didn't see** vehicle 1 ……"
"…… appears operator three **too close to avoid collision** ……"

At-fault vehicle driver error was a partial contributing factor in the remaining 29% of the crashes.

Road Segment Crash Characteristics

With only 2 (3.4%) of the total verifiable crashes in this Section, road segment crashes are not a significant issue on the roadway in this Section. One was an in-lane/rear-end crash while one was a lane departure/single vehicle crash that struck a utility pole and accounted for the injury crash. Of the four possible directions for crashes to occur, one crash occurred in the eastbound direction while the other crash occurred in the westbound direction.

Road Segment Crash Contributing Factors

Adverse road surface conditions were reported on one of the crash reports. Adverse weather conditions were reported on one of the crash reports. Adverse ambient light conditions were reported on one of the crash reports. Both crashes occurred during cold months.

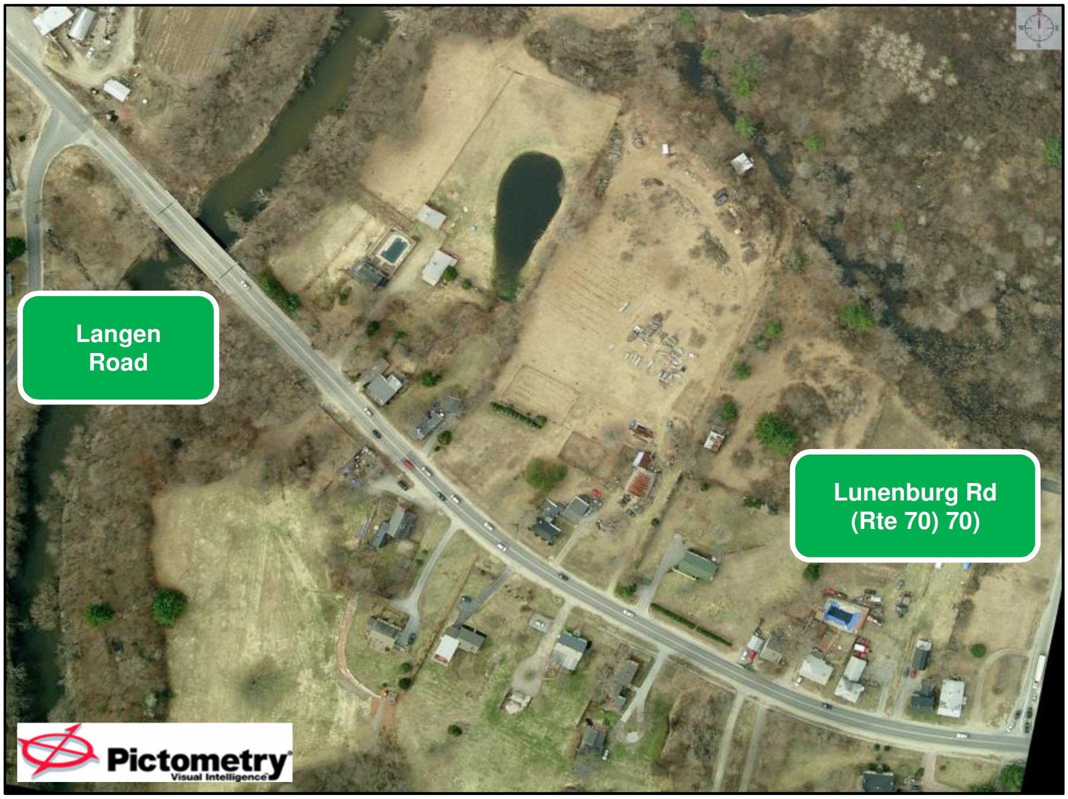
An analysis of the crash narratives found in the crash reports revealed that at-fault vehicle driver error was the most significant contributing factor in one of the crashes. At-fault vehicle driver error was a partial contributing factor in the other crash.

Potential High Crash Location: Main Street and Langen Road Intersection

The Main Street and Langen Road intersection most likely will not qualify as a standalone high crash location with an EPDO total of only 25. However, consideration should be given to including this intersection with the Main Street (Route 117) at Lunenburg Road (Route 70) and the Main Street (Route 117/70) at Main Street (Route 70) intersections for safety improvements as both will most likely qualify as high crash locations. This is being proposed based on the following three reasons:

- 90% of the rear-end crashes occurred on the westbound approach (see the Crash Diagram in the Technical Appendix)
- Of the three possible critical approaches for crashes to occur at this intersection, the westbound direction saw the highest percentage of crashes at 85%
- The intersection is in fairly close proximity to the Main Street (Route 117) and Lunenburg Road (Route 70) intersection at approximately 1,800 feet to the west (see Figure 4-4)

Figure 4-4: Langen Rd in Relation to Lunenburg Rd (west to east)



Intersection Crash Characteristics

Of the 13 intersection crashes, 2012 saw the highest percentage of crashes with 46% while 2010 saw 38% of the crashes. The hours of 3:00 – 4:00 PM and 5:00 – 6:00 PM saw 31% of the crashes each. 23% of the intersection crashes resulted in an injury crash. Rear-end crashes accounted for the highest crash manner at 77% of the total crashes.

Intersection Crash Contributing Factors

Adverse road surface conditions were reported on 8% of the crash reports. Adverse weather conditions were reported on 15% of the crash reports. Adverse ambient light conditions were reported on 15% of the crash reports. Crashes occurred at a higher percentage of 69% during cold months while 31% of the crashes occurred during warm months.

An analysis of the crash narratives found in the crash reports revealed that at-fault vehicle driver error the most significant contributing factor in 77% of the crashes. Two quotes from two different crash reports provide examples of the types of driver error that occurred in these crashes:

"…… V1 behind V2 **failed to see** V2 slowing ……"
"…… who **did not notice** her slow down ……"

At-fault vehicle driver error was a partial contributing factor in the remaining 23% of the crashes.

Intersections that Most Likely Qualify as High Crash Locations: Main Street (Route 117); And Lunenburg Road (Route 70) & Main Street (Route 117/70) and Main Street (Route 70) Intersections

The Main Street (Route 117) at Lunenburg Road (Route 70) and Main Street (Route 117/70) at Main Street (Route 70) Intersections are in fairly close proximity to each other at approximately 1,400 feet (see Figure 4-5 below).

Figure 4-5: Lunenburg Road (Route 70) & Main Street (Route 70) in Relation to Each Other (west to east)

Main Street (Route 117) and Lunenburg Road (Route 70) Intersection Analysis

Twenty three (23) crashes occurred at the Main Street (Route 117) and Lunenburg Road (Route 70) intersection. 26% of the crashes resulted in an injury crash while the remaining 74% of crashes were property damage only crashes (see the Crash Diagram in the Appendix). This intersection will most likely qualify as a high crash location as the EPDO total for the cluster of crashes, which totals 47, would place the intersection within the top 5% of crash clusters in the MRPC region.

Intersection Crash Characteristics

Of the 23 intersection crashes, 2011 saw the highest percentage of crashes with 39% while 2012 saw 26% of the crashes. 22% of the crashes occurred during the hour of 3:00 – 4:00 PM and 4:00 – 5:00 PM saw 17% of the crashes each. Angle crashes accounted for the highest crash manner at 52% followed by rear-end crashes at 26% of the total crashes. Of the four possible critical approaches for crashes to occur, the southbound direction saw the highest percentage of crashes at 78% (see the Crash Diagram in the Technical Appendix).

Intersection Crash Contributing Factors

Adverse road surface conditions were reported on 35% of the crash reports. Adverse weather conditions were reported on 26% of the crash reports. Adverse ambient light conditions were reported on 9% of the crash reports. Crashes occurred at a higher percentage of 59% during warm months while 43% of the crashes occurred during cold months.

An analysis of the crash narratives found in the crash reports revealed that at-fault vehicle driver error the most significant contributing factor in 83% of the crashes. Five quotes from five different crash reports provide examples of the types of driver error that occurred in these crashes:

"…… **thought** the traffic was moving ……"
"…… **thought** vehicle #1 was turning onto ……"
"…… **did not see** vehicle coming westbound ……"
"…… was **too close** to car 2 ……"
"…… **thought** she observed the said vehicle with its directional ……"

At-fault vehicle driver error was a partial contributing factor in the remaining 17% of the crashes.

Main Street (Route 117/70) and Main Street (Route 70) Intersection Analysis

Fifteen (15) crashes occurred at the Main Street (Route 117/70) and Main Street (Route 70) intersection. 36% of the crashes resulted in an injury crash while the remaining 67% of crashes were property damage only crashes (see the Crash Diagram in the Technical Appendix). This intersection will most likely qualify as a high crash location as the EPDO total for the cluster of crashes, which totals 35, would place the intersection within the top 5% of crash clusters in the MRPC region.

Intersection Crash Characteristics

Of the 15 intersection crashes, 2011 saw the highest percentage of crashes with 40% while 2012 and 2013 each saw 27% of the crashes. 27% of the crashes occurred during each of the hours of 7:00 – 8:00 AM and 5:00 – 6:00 PM. Angle crashes accounted for the highest crash manner at 73%. Of the three possible critical approaches for crashes to occur, the northbound direction saw the highest percentage of crashes at 73% (see the Crash Diagram in the Technical Appendix).

Intersection Crash Contributing Factors

Adverse road surface conditions were reported on 40% of the crash reports. Adverse weather conditions were reported on 27% of the crash reports. Adverse ambient light conditions were reported on 40% of the crash reports. Crashes occurred at a higher percentage of 60% during cold months while 40% of the crashes occurred during warm months.

An analysis of the crash narratives found in the crash reports revealed that at-fault vehicle driver error the most significant contributing factor in 77% of the crashes. Three quotes from three different crash reports provide examples of the types of driver error that occurred in these crashes:

"Operator **did not see** east bound vehicle ……"
"…… **did not notice** that Car#1 had come to a stop ……"
"…… MV 2 **did not come to a full stop** (at STOP sign) ……"

At-fault vehicle driver error was a partial contributing factor in the remaining 23% of the crashes.

Crash Analysis Section 3 (Section 3)

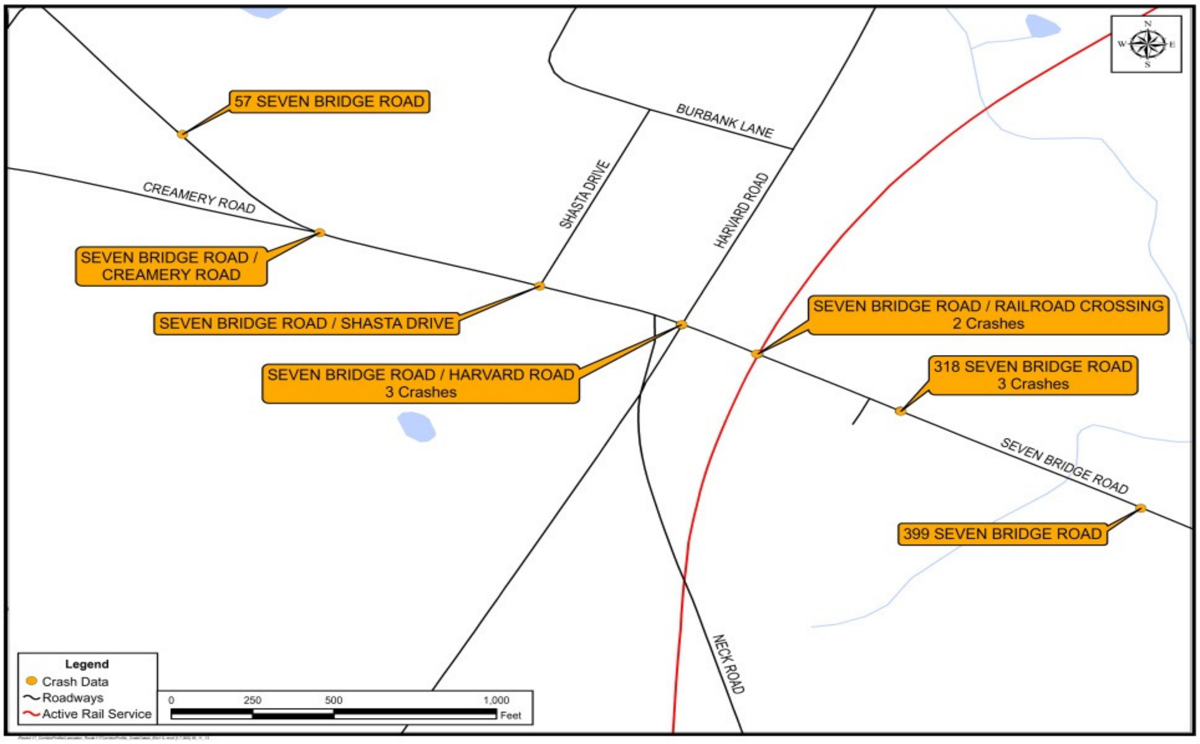
Table 4-3: Section 3 Intersection & Road Segment Crashes (west to east)

Crash Analysis Section 3		
Road Segment Crashes (between Main St (Rte 70) & Creamery Rd)		1
SEVEN BRIDGE ROAD / CREAMERY ROAD	1	
Road Segment Crashes		0
SEVEN BRIDGE ROAD / SHASTA DRIVE	1	
Road Segment Crashes		0
SEVEN BRIDGE ROAD / HARVARD ROAD	3	
Road Segment Crashes		0
SEVEN BRIDGE ROAD / RAILROAD CROSSING	2	
Road Segment Crashes (within 1,400 feet east of Railroad Crossing)		4
Intersection Crash Total	7	
Road Segment Crash Total		5
Crash Analysis Section 3 Crash Total	**12**	

Section 3 is shown in Figure 4-6 and begins just east of Main Street (Route 70) ends approximately 1,400 feet east of the railroad crossing. The length of the road segment is about 0.8 miles. This Section will not qualify as a standalone high crash location under Criteria 1. However, with 42% of the crashes resulting in an injury crash, this Section may be considered under Criteria 2. Table 4-3 provides the crash totals.

12% of the total verifiable crashes on Route 117 occurred in Section 3 which is the lowest percentage of any Section. Of the total for Section 3, 75% (9 crashes) occurred on approximately a 1,600 foot road segment that begins at the Seven Bridge Road and Harvard Street intersection then moves west and 60% of the injury crashes occurred on this segment. Of the 12 verifiable crashes that occurred in Section 3, 58% were intersection crashes and 42% were road segment crashes.

Figure 4-6: Crash Analysis Section 3 (west to east)



Intersection Crash Characteristics

Of the 7 intersection crashes, 2010 saw the highest percentage of crashes with 57% while 2011 saw the remaining 43% of the crashes. 29% of the crashes occurred during the hour of 4:00 – 5:00 PM. 29% of the intersection crashes resulted in an injury crash. Rear-end crashes accounted for the highest crash manner at 71% followed by angle crashes at 29% of the total crashes. Of the four possible critical approaches for crashes to occur, the eastbound and westbound directions shared equal percentages of crashes at 43% each.

Intersection Crash Contributing Factors

Adverse road surface conditions, adverse weather conditions and adverse ambient light conditions were not reported on at significant percentages on the crash reports. Crashes occurred at a higher percentage of 71% during cold months while 29% of the crashes occurred during warm months.

An analysis of the crash narratives found in the crash reports revealed that at-fault vehicle driver error was the most significant contributing factor in 86% of the crashes. One quote from one crash report provides an example of the types of driver error that occurred in these crashes:

“vehicle #2 **pulled out into roadway** in front of vehicle #1. vehicle 1 **had no time or chance to avoid** collision”

At-fault vehicle driver error was a partial contributing factor in the remaining 14% of the crashes.

Road Segment Crash Characteristics

Of the road segment crashes, 2011 saw the highest percentage of crashes with 80% while 2010 saw the remaining 20% of the crashes. 80% of the crashes occurred on the 1,600 foot road segment mentioned above. No hour of the day saw more than 14% of the crashes occur within a sixty minute time period. 60% of the crashes resulted in an injury crash.

Of the total crashes in-lane crashes accounted for 60% while lane departure crashes accounted for 40%. In-lane crashes accounted for 67% of the injury crashes. Rear-end crashes accounted for 100% of the in-lane crashes. Single vehicle crashes accounted for 100% of the lane departure crashes. Of the four possible critical approaches for crashes to occur, the eastbound direction saw the 100% of the crashes.

Road Segment Crash Contributing Factors

Adverse road surface conditions were reported on 20% of the crash reports. Adverse weather conditions were reported on 20% of the crash reports. Adverse ambient light conditions were reported on 20% of the crash reports. Crashes occurred at a higher percentage of 80% during warm months while 20% of the crashes occurred during cold months.

An analysis of the crash narratives found in the crash reports revealed that at-fault vehicle driver error was the most significant contributing factor in 100% of the crashes. Two quotes from two different crash reports provide examples of the types of driver error that occurred in these crashes:

"…… (driver) then **lost control** of the vehicle ……"
"…… vehicle 2 crashes into the rear of vehicle 1 **without braking** ……"

4.3 Conclusions for Developing Countermeasures

Based on the above analysis developing countermeasures to improve safety on Route 117 should be undertaken to address the following conclusions:

4.3a - Section 1: North Main Street intersection to just beyond the Ponakin Road intersection

This Section should be examined as a possible high crash location under Criteria 2 based on the following most significant conclusions:

- Rear-end crashes are the highest occurring crash manner in this Section:
    - Account for 62% of the intersection crashes
    - Account for 57% of the road segment crashes
- 100% of the road segment crashes occurred at driveways
- 30% of the crashes resulted in injury crashes of which 38% were lane departure crashes and the injury crashes were distributed fairly evenly along the Section
- The approach direction that saw the highest percentage of crashes occur was the eastbound direction. 71% of the road segment crashes and 46% of the intersection crashes occurred in the eastbound direction
- At-fault vehicle driver error was the most significant contributing factor in 62% of the intersection crashes and 71% of the road segment crashes

If this Section is approved as a Criteria 2 high crash location, countermeasures for this Section should include the most recent developments in low cost improvement measures. The measures should include warning signs, pavement markings, pavement markers, guardrail improvements, low cost geometric improvements and vegetation removal as needed.

4.3b - Section 2: Langen Road intersection to the Main Street (Route 70) intersection

Two intersections in this Section will most likely qualify as high crash location under Criteria 1 based on the following most significant conclusion:

- The Main Street (Route 117) and Lunenburg Road (Route 70) intersection has a crash cluster with an EPDO total of 47 points. This places the intersection in the top 5% of crash clusters in the MRPC region

  Other conclusions include:
    - 39% of the crashes occurred during the hours of 3:00 – 5:00 PM which are the crash peak hours. The crash peak hours occur before the PM traffic peak hour which is 5:15 – 6:15 PM
    - Angle crashes accounted for the highest crash manner at 52% followed by rear-end crashes at 26%
    - 26% of the crashes resulted in injury crashes but this intersection had the highest percentage of injury crashes in this Section with 33%
    - The approach direction that saw the highest percentage of crashes occur was the southbound direction. 78% of the intersection crashes occurred in the southbound direction
    - At-fault vehicle driver error was the most significant contributing factor in 83% of the intersection crashes

  The countermeasures for this intersection should include, but not be limited to, major geometric improvements such as auxiliary turning lanes and widening approaches that includes installing a properly designed traffic signal or converting the intersection to a roundabout. The countermeasures should also include the most recent developments in low cost improvement measures. The measures should include warning signs, pavement markings, pavement markers, guardrail improvements, low cost geometric improvements and vegetation removal as needed.

- The Main Street (Route 117/70) and Main Street (Route 70) intersection has a crash cluster with an EPDO total of 35 points. This places the intersection in the top 5% of crash clusters in the MRPC region

  Other conclusions include:
    - 27% of the crashes occurred during the each of the hours of 7:00 – 8:00 AM and 5:00 – 6:00 PM which are the crash peak hours. The crash peak hours coincide with the AM and PM traffic peak hours of 6:45 – 7:45 AM and 4:45 – 5:45 PM
    - Angle crashes accounted for the highest crash manner at 73%
    - 36% of the crashes resulted in injury crashes
    - The approach direction that saw the highest percentage of crashes occur was the northbound direction. 73% of the intersection crashes occurred in the northbound direction
    - At-fault vehicle driver error was the most significant contributing factor in 77% of the intersection crashes

  The countermeasures for this intersection should include, but not be limited to, major geometric improvements such as auxiliary turning lanes and widening approaches that includes installing a properly designed traffic signal or converting the intersection to a roundabout. The countermeasures should also include the most recent developments in low cost improvement measures. The measures should include warning signs, pavement markings, pavement markers, guardrail improvements, low cost geometric improvements and vegetation removal as needed.

The Main Street and Langen Road intersection is potentially a high crash location based on the following most significant conclusions that show how the intersection has close ties to intersections to the east:

- The intersection is in fairly close proximity to the Main Street (Route 117) and Lunenburg Road (Route 70) intersection at approximately 1,800 feet to the west
- 90% of the rear-end crashes occurred on the westbound approach indicating that the vehicles involved in the crashes originated from the Main Street (Route 117) and Lunenburg Road (Route 70) and the Main Street (Route 117/70) and Main Street (Route 70) Intersections

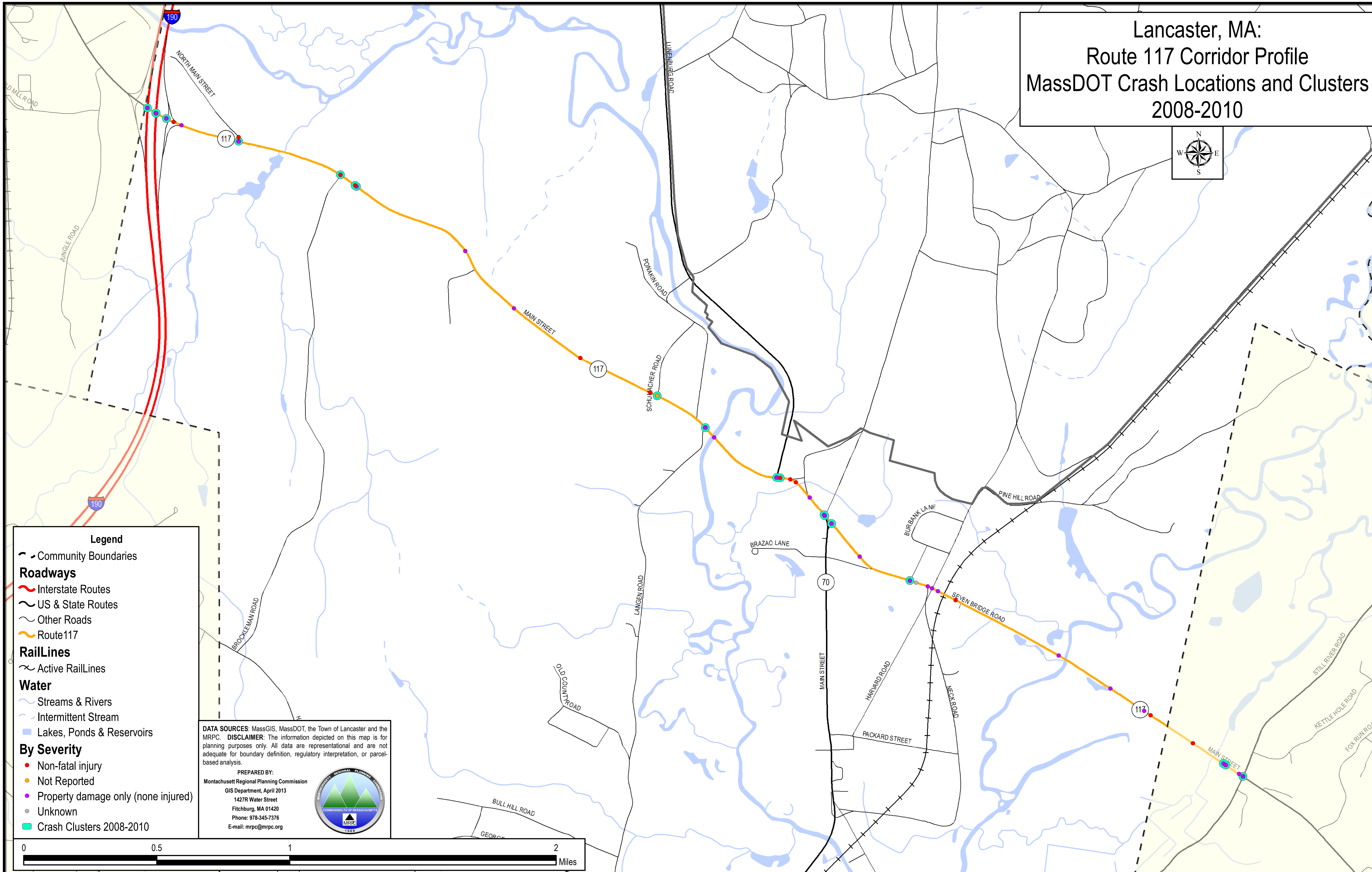
  Other conclusions include:
  - 31% of the crashes occurred during the each of the hours of 3:00 – 4:00 PM and 5:00 – 6:00 PM which are the crash peak hours. The crash peak hours occur before and after the PM traffic peak hour which is 4:00 – 5:00 PM
  - Rear-end crashes accounted for the highest crash manner at 77%
  - 23% of the crashes resulted in injury crashes
  - The approach direction that saw the highest percentage of crashes occur was the westbound direction. 85% of the intersection crashes occurred in the westbound direction
  - At-fault vehicle driver error was the most significant contributing factor in 77% of the intersection crashes

  The countermeasures for this intersection should include, but not be limited to, major geometric improvements such as auxiliary turning lanes and widening approaches or converting the intersection to a roundabout. The countermeasures should also include the most recent developments in low cost improvement measures. The measures should include warning signs, pavement markings, pavement markers, guardrail improvements, low cost geometric improvements and vegetation removal as needed.

4.3c - Section 3: From just east of the Main Street (Route 70) intersection to approximately 1,400 feet beyond the railroad crossing

At this time, no countermeasures to improve safety for this Section will be recommended based on the following conclusion:

- As indicated in the analysis for this Section no crashes occurred on here in 2012 and for the first five months of 2013. As project development moves forward for Route 117 a follow-up safety analysis should be conducted for this Section to determine what has changed.



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5.0 Pavement Management System (PMS)

5.1 Introduction

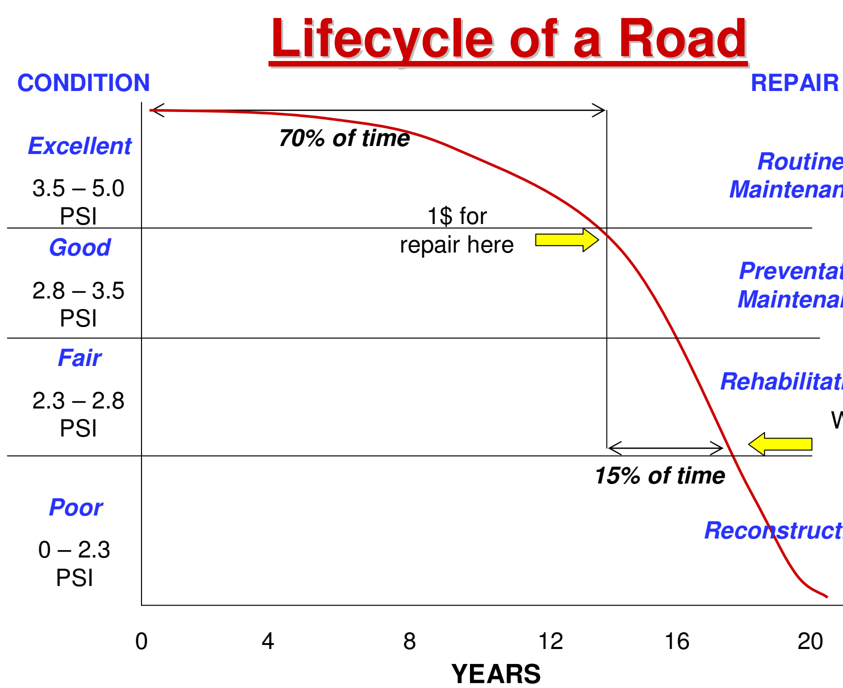
Pavements are the single largest capital investment in any highway system. MRPC in cooperation with MassDOT maintains pavement condition data on all Federal Aid eligible miles of roadway in the Montachusett region in what is known as a Pavement Management System (PMS). The Montachusett Pavement Management System is a tool used to provide an ongoing inventory of pavement conditions along this network in the region. The data maintained is utilized when prioritizing projects for federal funding and assessing current and future needs in our infrastructure.

Although the existing pavement conditions were not determined to be a major contributing factor to the safety or overall operability of Route 117 in Lancaster analysis was conducted as part of this corridor profile.

5.2 Concepts

Pavement condition is expressed by assigning a Pavement Serviceability Index (PSI) number from 0 to 5 to segments along the roadway. A PSI of 5 is indicative of optimal pavement conditions, usually a newly paved stretch of road, while a PSI of 0 indicates a road that is failing, to the point of being impassable by an average passenger vehicle. See Figure 5-1 below for details of the numerical values projected in the PSI.

Figure 5-1



4

The graph above displays PSI scores and correlating repair strategies. Also displayed is the curve representing deterioration of the pavement over time. As shown in the graph the cost of repair increases dramatically at a certain point in a pavements “lifecycle”. Ideally routine and preventative maintenance techniques should be applied at strategic times to keep costs low while maintaining an acceptable PSI, however, implementing this principle can prove to be challenging as budgets often do not keep up with a large network of deteriorating roadways.

5.3 Pavement Condition along Corridor

The most recent data on the Route 117 study area was collected by MassDOT in 2012 using an Automatic Road Analyzer (ARAN) vehicle mounted with various cameras, lasers and measuring instruments to determine a pavements overall condition and updated by MRPC surveys in 2013.

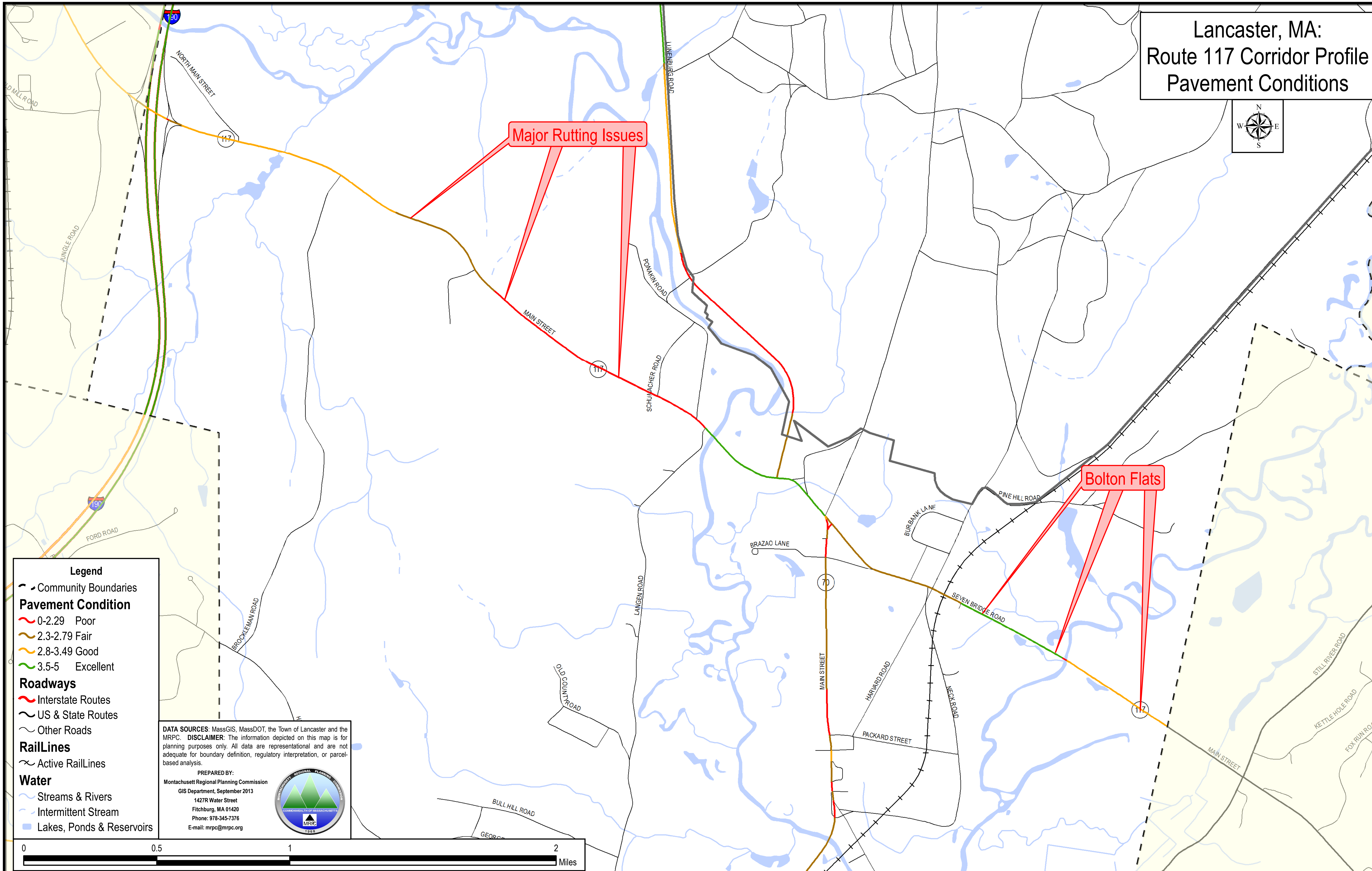
The following tables are meant to provide a magnitude of scale estimate for various road repair strategies. An estimated repair cost was developed through consultation with MassDOT and other Regional Planning Agencies during the development of the 2012 Regional Transportation Plan. These estimates are used to illustrate the potential cost needs to bring or maintain the various road segments to an "excellent" condition. Actual costs would depend on a more precise review of conditions and repair needs. The map "*Pavement Conditions*" at the end of this chapter displays conditions along the corridor.

Pavement Repair Costs

PSI	Condition	Associated Repair	Miles	Repair Cost Per Sq. Yard	Yards	Projected Repair Cost
0.00-2.29	Poor	Reconstruction	0.95	$45.00	40,642	$1,828,882
2.30-2.79	Fair	Rehabilitation (Mill/Overlay)	1.19	$18.00	50,178	$903,203
2.80-3.49	Good	Preventative Maintenance	1.50	$8.50	66,797	$567,773
3.50-5.00	Excellent	Routine Maintenance	1.06	$0.75	43,254	$32,440
						$3,332,299

The majority of Route 117 through the corridor was determined to be in fair to good condition. Typical defects on the problem areas in the western section of the corridor seem to be mostly rutting issues. Conversations with the town Department of Public Works have revealed that many overlays over the years have been applied without a full depth reconstruction. Typically rutting occurs over time without repairs to the pavement base and the application of layer after layer of overlays can lead to the reduced effectiveness in the binder used between layers making the road susceptible to potholes. The existing rutting is a safety issue as water puddles in ruts and are a hazard to drivers.

Although the eastern portion of the corridor was determined to have a generally good to excellent pavement condition, concerns with drainage exist around the Bolton Flats area. During major rain events and spring thaws the Nashua River floods in this area and in recent years has caused the closure of Route 117 on a few occasions. The capacity of culverts in this area should be examined and strong consideration should be given to the possibility of raising the height of the roadway through this section.



DATA SOURCES: MassGIS, MassDOT, the Town of Lancaster and the MRPC. **DISCLAIMER**: The information depicted on this map is for planning purposes only. All data are representational and are not adequate for boundary definition, regulatory interpretation, or parcel-based analysis.

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6.0 MULTI-MODAL CONSIDERATIONS

6.1 Complete Streets Policy

The concept of Complete Streets is that all users of the road should be accommodated. Automobiles, bicyclists, public transportation vehicles and riders, and pedestrians of all ages and abilities should have equal access to roadway use. Instituting a Complete Streets policy ensures that transportation planners and engineers consistently design and operate the entire roadway with all users in mind. MRPC considers the Complete Streets as an important part of our planning process.

6.2 Walkability

A walkable community is one that allows residents access to major community elements that are generally within a 10 minute walking distance. Those community elements may include shopping centers, town hall, library, post office, and the senior center. The term “Walkability” refers to how friendly an area is to walking. Factors that make a community walkable include street connectivity and design, pedestrian features, access for all roadway users (vehicles and pedestrians), desirable streetscapes, and pedestrian safety features. Being a walkable community doesn’t necessarily refer to only transportation features; aspects like socialization and walking for exercise can also play a part.

6.3 Route 117 Corridor Bicycle and Pedestrian Usage

Route 117 as a whole is not a busy bicyclist or pedestrian road. Due to generally narrow road width and narrow to non-existent shoulders it is not accommodating to all modes. Pavement width is mostly 24’ or less throughout the corridor while Right of Way is typically 40’ or more which gives the option to add bike lanes and sidewalks along the road in the future. With any future improvements or reconstruction projects along the corridor it is recommended to accommodate bicyclists and pedestrians with the addition of bike lanes and sidewalks where possible.

One exception is the Bolton Flats area in which road width and ROW width are both 24’, leaving no room for additional width for bike and pedestrian use. Added signage would be ideal in this location reminding motorists to “Share the Road”.

"Bolton Flats" Area of Corridor

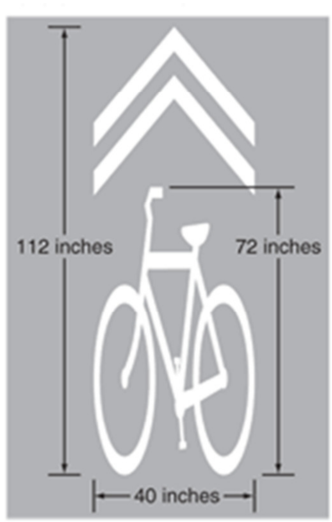
Typical Cross Section of Roadway along Corridor

6.4 Route 117/70 Focus Area

Bicycle and pedestrian usage of Route 117 through the corridor varies. Route 70, which offers wide shoulders on both sides of Route 117, makes it a popular bike route, however, Route 117 does not offer the same accommodations. The lack of almost any shoulder on much of Route 117 discourages bicycle use as conflicts with cars on the narrow road cause hazards. The center section of the corridor, in which Routes 117 and 70 merge for over two tenths of a mile, however, does experience significant bike and pedestrian traffic. This area also is in close proximity to the nearby Elementary and Middle schools as well as nearby trails along the Nashua River which could also attract users.

For the purpose of this profile this central area was made a main focus in regards to bike and pedestrian accommodations as it is likely to see the most use and possibly see an increase in future use. The map "*Bicycle and Pedestrian Focus Area*" at the end of this chapter highlights this focus area.

Pedestrians through this area have access to sidewalks separated from the road which provides safe access through the area. As mentioned above and seen in the pictures on the focus area map however, shoulders on Route 117 do not allow enough room for bicycles to comfortably navigate through the focus area. Although travel lanes are meant to be shared by bikes and cars, no visible indications acknowledging bike use exist. To improve awareness, signage should be installed making drivers aware of the need to share the road. Additionally a shared lane pavement marking along the outside edge of the travel lines may be necessary for this section of Route 117.



Walking Audit

A walking audit was conducted by MRPC staff in the vicinity of the Route 117/Route 70 intersections (north and south). During this audit, the following were observed:

- Sidewalks – Are there sidewalks within the focus area? Is the width/condition acceptable (at least 4 feet wide)? Do they have handicap access ramps at each crossing and crosswalk? Are there large cracks, bumps, dips, etc. present?

- Roadways – Are the current roadways in good condition? Is speeding a problem? Are large trucks an issue? Are drivers able to see pedestrians in crosswalks – is there adequate sight distance?

- Crosswalks – Are the current crosswalks adequate? Do you feel safe while crossing at the crosswalks? Is the striping on the crosswalk visible?

- Trails – Are the trails in the area accessible to the study area? Are there guide signs to help people navigate to those trails and trail parking areas?

- Shade Trees/Benches – Are there sufficient areas to take a rest? Will you be walking in the sun most of the time or are their shaded areas to cool off in the summer?

6.5 Summary of Findings

The following summarizes the findings that Staff developed regarding the positives and negatives of walkability for the Lancaster Route 117 focus area based on the observation topics mentioned above.

Sidewalks – The major roadways (Route 117 and Route 70) had sidewalks within the focus area. This includes the area of the Elementary School. Overall, the sidewalks are in good condition with the exception of a few areas that had some grass patches. (see photo below)

Vegetation along sidewalk

Roadways – Both Route 117 and Route 70 are in good condition in this area. There were no concerns regarding roadway conditions in respect to bikes and pedestrians.

Crosswalks – There were a handful of crosswalks along the roadways in this area. Most of these, however, do not have curb cuts and are located in areas without sidewalks. Crosswalk signage is present and visible.


Crosswalks and signage along Route 117 – No curb cuts or direct connection with sidewalk

<u>Trails</u> – There are currently no direct trail connections in this focus area. (See map "*Trail Inventory*" at the end of this chapter)

<u>Shade Trees/Benches</u> – There are numerous trees all along Route 117 but there didn't appear to be any benches. While walking along the sidewalks, the trees provided the perfect amount of shade to escape the hot sun if necessary.


Shade trees along Route 117

6.6 Recommendations

When streets and town centers are designed only for cars, they become barriers for pedestrians of all abilities, who cannot get from point A to point B safely. As a result, many people end up in their cars, missing out on opportunities for much needed fresh air, socialization and physical activity.

Based upon the data collected and the analysis conducted, the following recommendations resulted:

Sidewalks

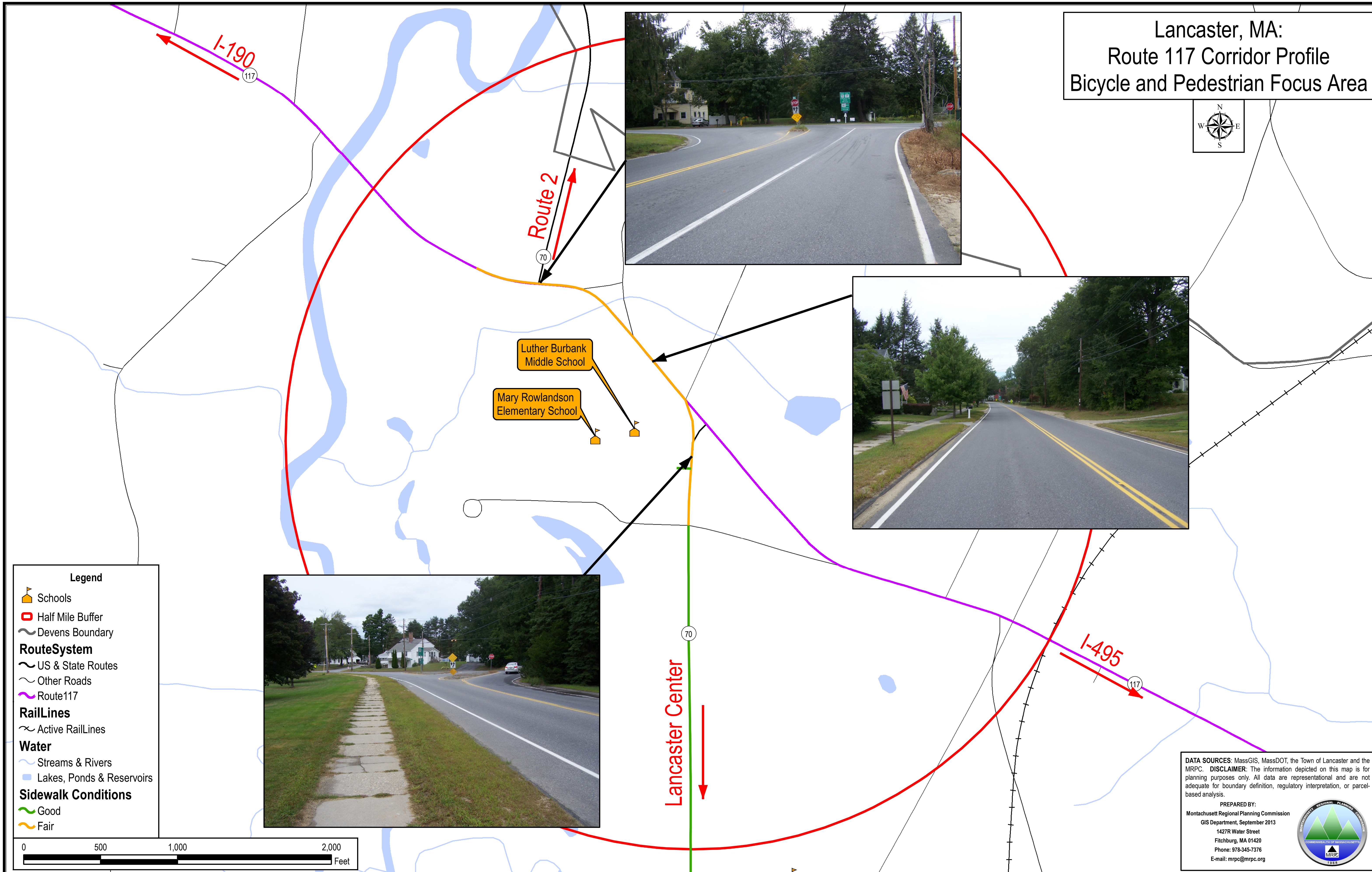
- Clear all vegetation from sidewalks
- Continue to maintain existing sidewalks, keeping them free of debris, vegetation, snow, etc.
- Mandate sidewalks in all developments, and bicycle lanes where appropriate.

Crosswalks

- Consider traffic calming techniques such as road narrowing or adding bump outs at major crosswalk locations along Route 70 and 117.
- Add curb cuts at all crosswalks
- Have crosswalks connect to sidewalks
- Continue to maintain crosswalk striping

Roadways

- Consider Bike Lanes along Route 70 and 117.
- Warning signs look great and should continue to be placed and maintained in the school area to warn all drivers of pedestrians, cyclists and children. Placement of all regulatory and guidance signs should conform to guidelines established by Massachusetts Department of Transportation (MassDOT) – Highway Division and the "Manual on Uniform Traffic Control Devices" (MUTCD).
- Continue to monitor and regulate speeding.



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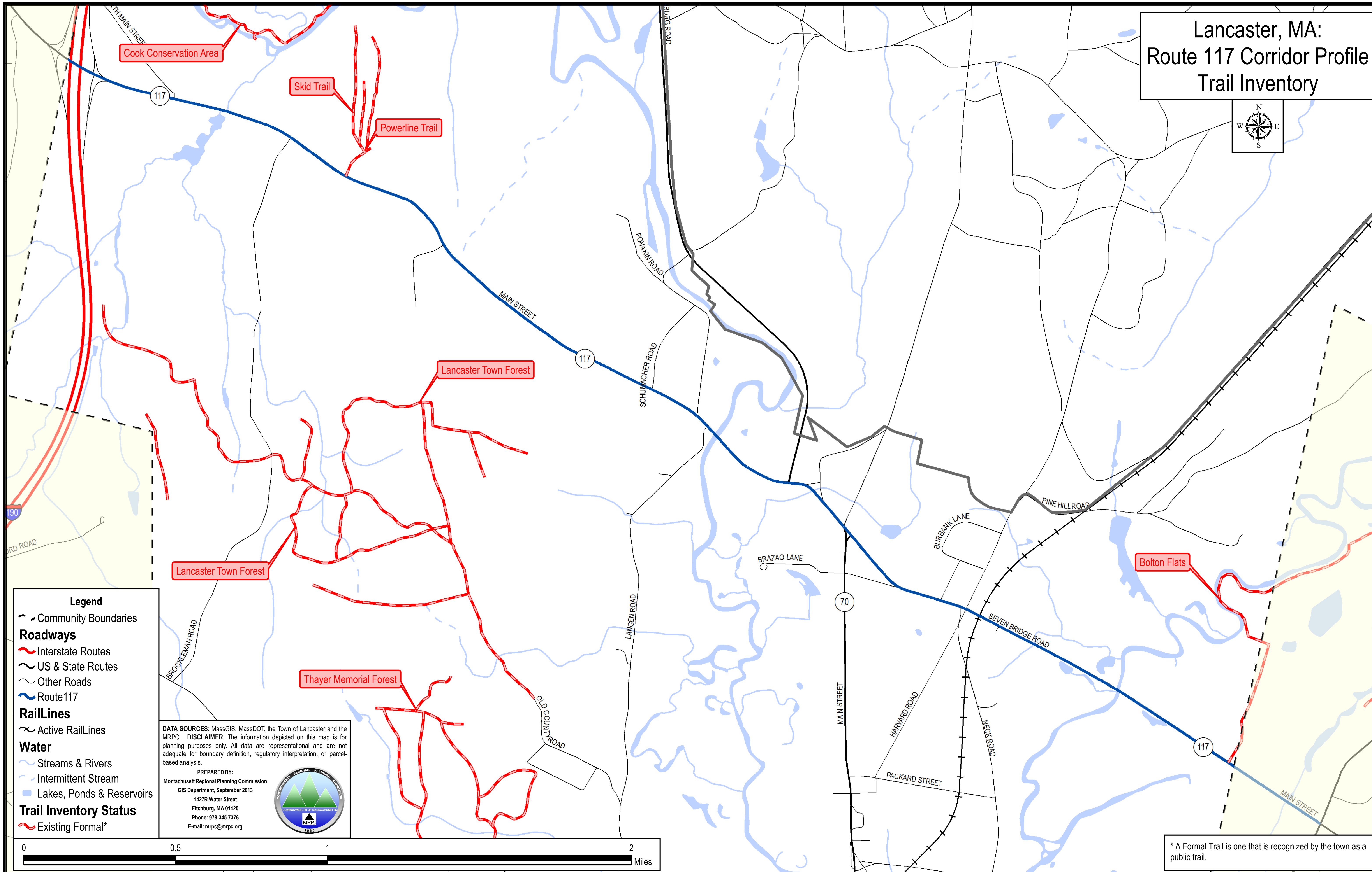

Lancaster, MA:
Route 117 Corridor Profile
Trail Inventory
N
W
E
S
Cook Conservation Area
Skid Trail
Powerline Trail
Lancaster Town Forest
Lancaster Town Forest
Thayer Memorial Forest
Bolton Flats
117
117
117
70
190
MAIN STREET
SEVEN BRIDGE ROAD
PONAKIN ROAD
SCHUMACHER ROAD
LANGEN ROAD
BROCKLEMAN ROAD
OLD COUNTY ROAD
BRAZAO LANE
BURBANK LANE
PINE HILL ROAD
MAIN STREET
HARVARD ROAD
NECK ROAD
PACKARD STREET
MAIN STREET
Legend
Community Boundaries
Roadways
Interstate Routes
US & State Routes
Other Roads
Route117
RailLines
Active RailLines
Water
Streams & Rivers
Intermittent Stream
Lakes, Ponds & Reservoirs
Trail Inventory Status
Existing Formal*
DATA SOURCES: MassGIS, MassDOT, the Town of Lancaster and the MRPC. DISCLAIMER: The information depicted on this map is for planning purposes only. All data are representational and are not adequate for boundary definition, regulatory interpretation, or parcel-based analysis.
PREPARED BY:
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GIS Department, September 2013
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Phone: 978-345-7376
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0
0.5
1
2
Miles
* A Formal Trail is one that is recognized by the town as a public trail.

7.0 Other Systems

7.1 Sight Distance Analysis

There are a number of minor intersections that enter onto Route 117 through the corridor. Sight distance measurements have been made at all of these. Sight distance is the length of the roadway which is visible to the driver. Sufficient sight distance length is based on either the design speed or the average measured 85th **P**ercentile vehicle travel **S**peed (PS). In other words, if the speeds of all vehicles are ranked from the fastest to the slowest, the 85th PS separates the fastest 15% from the slower 85%. Sight distance analysis for STOP controlled intersections was completed for this study.

At a STOP controlled intersection, the driver of a vehicle stopped at a minor approach of an intersection with a STOP sign on the major approaches needs to be able to see a certain distance in both directions along the major road in order to safely turn onto, or cross, the major road. The driver should have an unobstructed view of the area around the intersection. The lengths along the intersecting street should be sufficient enough to allow the driver a safe departure to avoid a crash.

The three intersection movements are:

- RIGHT TURN – needs sufficient sight distance to allow a departing vehicle to complete two maneuvers before being overtaken by an oncoming vehicle traveling in the right lane at or near the posted speed limit or the 85th PS. The vehicle must make a right-turn and then accelerate.
- CROSSOVER – needs sufficient sight distance to allow a departing vehicle to cross two lanes with vehicles coming from both directions traveling at or near the posted speed limit or the 85th PS.
- LEFT TURN – needs sufficient sight distance to allow a departing vehicle to complete three maneuvers before being overtaken by oncoming vehicles from both directions traveling at or near the posted speed limit or the 85th PS. First it must clear the traffic oncoming from the left, then it must enter the traffic flow oncoming from the right, and then accelerate to the posted speed limit.

The right-turn and crossover movements have the same minimum recommended sight distance. The left turn movement requires a longer minimum recommended sight distance from the right.

The following are descriptions of those intersections that were determined to have less than adequate stop controlled sight distance according the recommondations of the American Association of State Highway and Transportaiton Officials (AASHTO).

Route 117 at North Main Street

Direction: Looking West (Right)

Speed Limit: 40 MPH

Recommended Sight Distance: 445 ft.

Measured Sight Distance: 327 ft.

Notes: Private trees and bushes block the view at this location. Removal would greatly increase visibility and would provide the recommended sight distance.

Route 117 at Brockelman Road

Direction: Looking East (Right)

Speed Limit: 40 MPH

Recommended Sight Distance: 445 ft.

Measured Sight Distance: 162 ft.

Notes: Bushes and trees on a private property block sight distance. Trimming or removing these obstacles would improve conditions but probably not provide adequate sight distance.

Route 117 at Brockelman Road

Direction: Looking West (Left)

Speed Limit: 40 MPH

Recommended Sight Distance: 385 ft.

Measured Sight Distance: 203 ft.

Notes: Foliage from trees on a private property blocks sight distance. Trimming may help. Sight distance significantly increases with leaf drop seasons.

Route 117 at Colony Lane

Direction: Looking East (Right)

Speed Limit: 35 MPH

Recommended Sight Distance: 390 ft.

Measured Sight Distance: 135 ft.

Notes: A Private fence and foliage blocks sight distance. Trimming of foliage may slightly increase sight distance however without removal or redesign of private fence significant improvements are unlikely.

Route 117 at Colony Lane

Direction: Looking West (Left)

Speed Limit: 35 MPH

Recommended Sight Distance: 335 ft.

Measured Sight Distance: 257 ft.

Notes: Signage blocks sight distance. Removal or relocation of existing commercial sign would provide adequate sight distance.

Route 117 at Devonshire Way

Direction: Looking West (Left)

Speed Limit: 40 MPH

Recommended Sight Distance: 385 ft.

Measured Sight Distance: 199 ft.

Notes: Trimming of trees along roadway may greatly increase sight distance.

Route 117 at Devonshire Way

Direction: Looking East (Right)

Speed Limit: 40 MPH

Recommended Sight Distance: 445 ft.

Measured Sight Distance: 120 ft.

Notes: Removal or trimming of trees and brush growing around utility pole and side of road will greatly increase sight distance.

Route 117 at Ponakin Road

Direction: Looking West (Right)

Speed Limit: 40 MPH

Recommended Sight Distance: 445 ft.

Measured Sight Distance: 181 ft.

Notes: Shrubbery and trees on a private property block sight distance. Adequate sight distance could be attained by trimming or removing these obstacles.

Route 117 at Main Street

Direction: Looking East (Right)

Speed Limit: 30 MPH

Recommended Sight Distance: 335 ft.

Measured Sight Distance: 158 ft.

Notes: Private bushes and trees block sight distance. Trimming may slightly increase but not resolve sight distance issue.

Route 117 at Harvard Road (South)

Direction: Looking West (Right)

Speed Limit: 35 MPH

Recommended Sight Distance: 390 ft.

Measured Sight Distance: 311 ft.

Notes: Trimming of private bushes and foliage would improve sight distance.

Route 117 at Harvard Road (South)

Direction: Looking East (Left)

Speed Limit: 35 MPH

Recommended Sight Distance: 335 ft.

Measured Sight Distance: 130 ft.

Notes: Blocked by private fence, garden and foliage. Adequate sight distance could be attained by trimming.

Route 117 at Harvard Road (North)

Direction: Looking East (Right)

Speed Limit: 35 MPH

Recommended Sight Distance: 390 ft.

Measured Sight Distance: 306 ft.

Notes: Private fence slightly reduces sight distance.

Route 117 at Boat Launch

At the eastern end of the corridor along the Nashua River in the Bolton Flats there are a number of driveways leading to various pullovers on the North side of Route 117. A large farm accounts for a few of these but most notable is a public boat launch and parking area allowing access to the Nashua River. Visibility is a concern at this location due to overgrowth along the roadway; however, hazards are magnified as vehicles possibly towing trailers loaded with canoes are likely to access this launch. Visibility at this site should be increased and additional roadway signage indicating that the launch pull over exists should be installed.

7.2 Signal Warrant Analysis

7.2a – Main Street (Route 117) at Lunenburg Road (Route 70)

Traffic data and HCS results are applied to a *Signal Warrant* program, the program uses the *Manual on Uniform Traffic Control Devices (MUTCD)*, published by the U.S. Department of Transportation, which provides the procedure to test which warrants are satisfied for the intersection being analyzed. Detailed printouts from the data used in the *Signal Warrant* results are in the **Appendix**. The following is a description of the signal warrants applied to the intersection of Route 117 (Main St.) and Route 70 (Lunenburg Rd.).

Main St. (Rt. 117) at Lunenburg Rd. (Rt. 70)

Warrant One, Eight-Hour Vehicular Volume

The application of this warrant is intended for intersections where the volume is the principal reason for considering a signal installation. The satisfaction of this warrant is based on the total volume traveling on each approach for each of any 8-hours in a day. The *MUTCD* states that for an intersection with two lane approaches on one road and one lane on another,

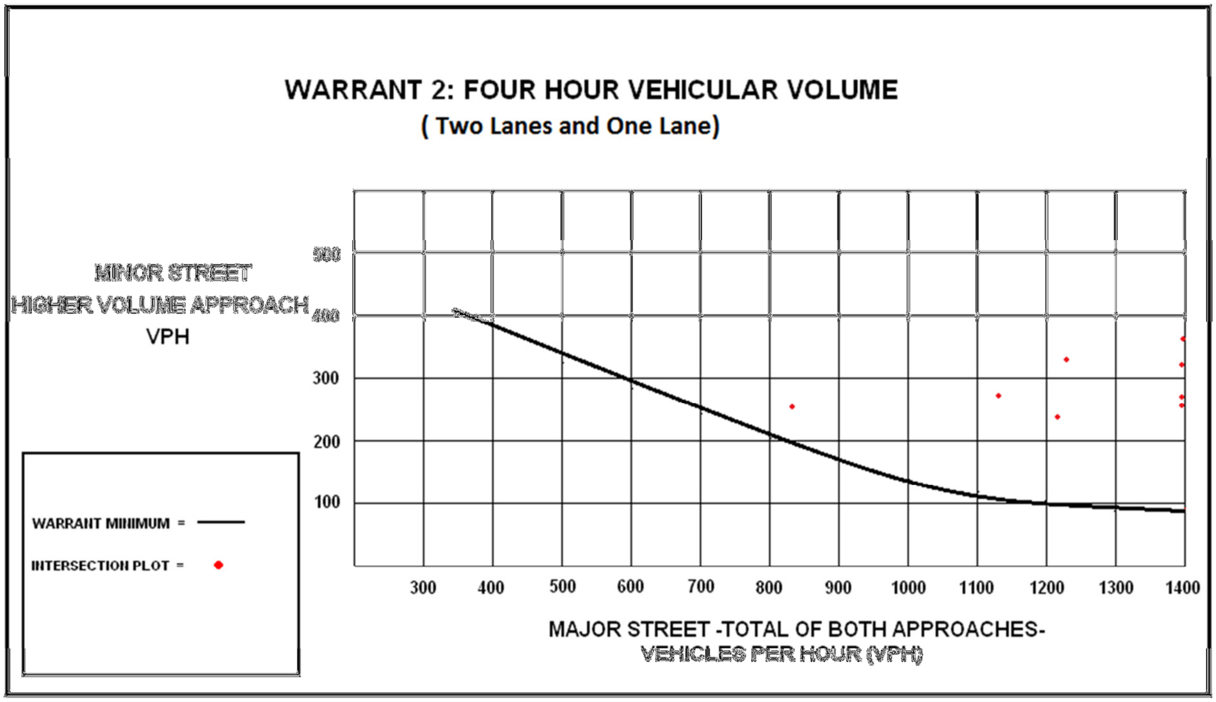
> **(1A)** the minimum volume required to satisfy the warrant is a total 600 vehicles per hour (vph) on both major approaches and 150 vph on the higher volume minor street approach.
>
> Or
>
> **(1B)** 900 vph on both major approaches and 75 vph on the higher volume minor street approach are used where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

The minimum volumes were met for this location; therefore, this warrant is satisfied. A summary of the hours that were satisfied for each approach is in **Table 1.**

Warrant Two, Four-Hour Vehicular Volume

The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal. The four hour volume warrant is satisfied when, for each of any four hours of an average day, the plotted points representing the vehicles per hour (vph) on the major street (total of both approaches) and corresponding vph on the higher volume minor street approaches (one direction approaching) all fall above the curve in Figure 4C-1 of the *MUTCD* for the existing combination of approach lanes. This figure is reproduced in below in **Figure 1**. A summary of the hours that were satisfied for each approach is in **Table 1.**

Figure 1: Warrant 2 Results



For this intersection, the number of vph on the major and minor streets falls above the plotted line on the curve in **Figure 1** for 8 hours as seen in the warrant curve. This warrant is satisfied.

Warrant Three, Peak Hour Delay

The peak hour delay warrant is intended for application where traffic conditions are such that for one hour of the day, minor street traffic suffers undue delay in entering or crossing the major street. The peak hour delay warrant is satisfied when the following conditions exist for one hour (any four consecutive 15-minute periods) of an average weekday:

(1A)

- The total delay experienced by the traffic on one minor street approach (one direction only) controlled by a stop sign equals or exceeds four vehicle-hours for a one-lane approach and five vehicle hours for a two-lane approach, and

- The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes, and

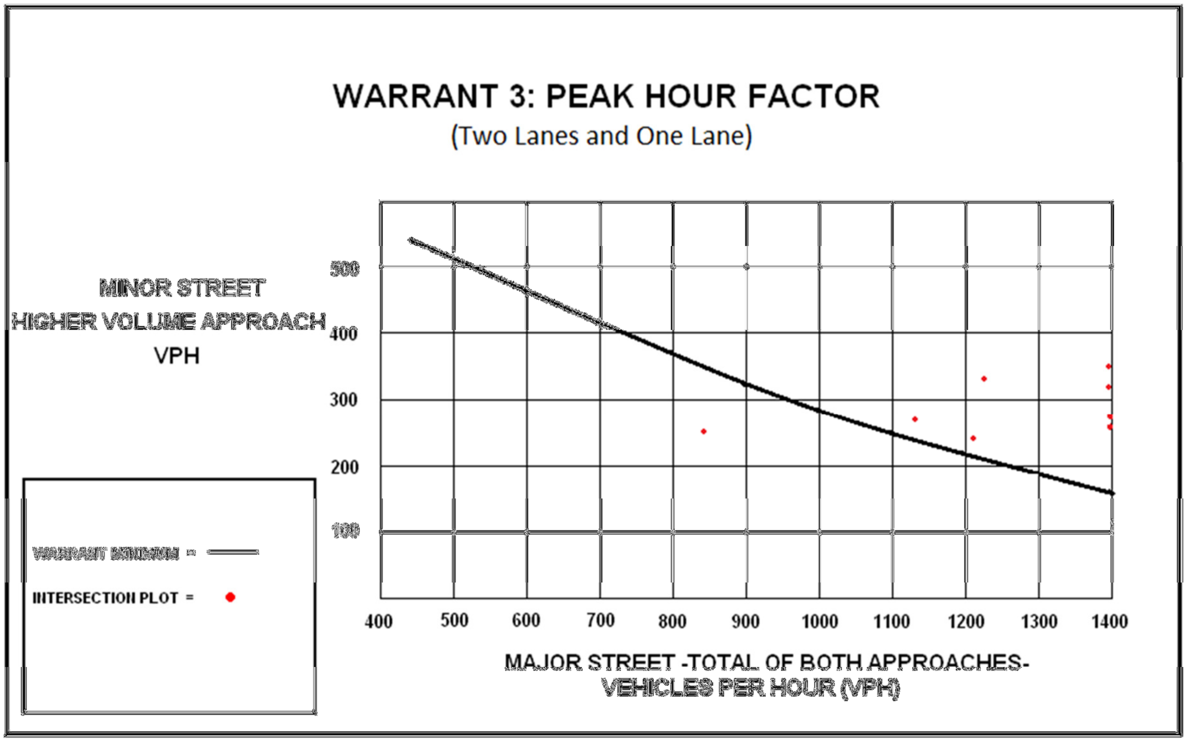
- The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more approaches or 650 vph for intersections with three approaches.

Or

(1B)

The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4C-3 of the *MUTCD* for the existing combination of approach lanes. This Figure is reproduced below in **Figure 2**. A summary of the hours that were satisfied for each approach is in **Table 1.**

Figure 2: Warrant 3 Results



As seen in **Figure 2** above, this warrant is also met by showing at least the required one hour period plotted above the line in the graph. Therefore, warrant three is met. A summary of the hours that were satisfied for each approach is in **Table 1.**

Table 1: Warrants 1 – 3 Results

Time	Major Approach Volume	Minor Approach	Total Volume	Meets 1A	Meets 1B	Meets 2	Meets 3
6-7 AM	1,472	356	1,828	Yes	Yes	Yes	Yes
7-8 AM	1,225	328	1,553	Yes	Yes	Yes	Yes
8-9 AM	832	253	1,085	Yes	Yes	Yes	No
2-3 PM	1,126	279	1,405	Yes	Yes	Yes	Yes
3-4 PM	1,423	312	1,735	Yes	Yes	Yes	Yes
4-5 PM	1,444	289	1,733	Yes	Yes	Yes	Yes
5-6 PM	1,573	277	1,850	Yes	Yes	Yes	Yes
6-7 PM	1,206	239	1,445	Yes	Yes	Yes	Yes

Warrant Four, Pedestrian Volume

The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street. Pedestrians were not observed at this location during site visits and were not determined to have a significant impact on this location. Therefore this warrant is not applicable.

Warrant Five, School Crossing

This warrant applies to established school crossings only, where a gap study is done to find the frequency and adequacy of the gaps in the traffic stream as related to the number and size of the school students crossing the intersection. This warrant is not applicable at this intersection.

Warrant Six, Progressive Movement

Progressive movement control sometimes necessitates traffic signal installations at intersections in order to maintain proper grouping of vehicles and effectively regulate group speed. This warrant is not applicable at this intersection because it is not part of a coordinated signal system.

Warrant Seven, Crash Experience

The *MUTCD* states that a signal is warranted when five or more crashes of types correctable by traffic signals, each involving personal injury or property damage, have occurred within a 12 month period, and the road has an existing traffic volume of not less than 80% of the required volumes for warrants 1A and 1B. The crash experience warrant also requires that adequate trial of less restrictive measures with satisfactory monitoring and enforcement has failed to reduce the accident frequency, and requires that a signal will not seriously disturb progressive traffic flow. The following table, **Table 2**, lists those accidents susceptible to correction by a traffic signal. From the crash data provided earlier in this report it was found that two possible groups of at least five crashes perceived to be correctable by a traffic signal occurred in a 12 month period in the last three years. While the first two criteria of this warrant, 5 or more correctable crashes in a 12 month period and meeting the 80% volume for warrant 1 (A & B) is met, the second criteria of adequate trial of less restrictive measures with satisfactory monitoring and enforcement has not occurred. Therefore this warrant is only partially satisfied. Installation of a signal based on this warrant would likely require consultation and agreement with the Massachusetts Department of Transportation (MassDOT). **Table 2** below highlights crash types correctable by traffic signals.

Table 2: Possible Warrant Seven Crashes

#	DATE	TIME	LC	RC
1	4/26/10	2:53 PM	1	1
2	5/19/20	6:32 AM	1	2
3	9/29/10	7:37 AM	1	2
4	10/28/10	6:32 AM	1	2
5	10/28/10	3:47 PM	1	1
6	1/13/11	8:36 AM	1	2
7	2/13/11	10:59 AM	1	1
8	4/13/11	11:58 AM	1	2
9	5/2/11	4:16 PM	1	1
10	6/24/11	7:35 AM	1	2
11	10/20/11	6:09 AM	2	1
12	10/20/11	3:38 PM	1	1
13	12/17/11	3:45 PM	1	1
14	12/26/11	5:31 PM	3	1
15	1/19/12	3:34 PM	1	2
16	4/1/12	3:14 PM	1	1
17	8/21/12	12:41 PM	1	1
18a	10/23/12	4:20 PM	1	1
18b	10/23/12	4:20 PM	1	1
19	10/30/12	10:18 AM	1	2
20	2/23/12	6:05 AM	1	1
21	4/4/13	4:20 PM	1	1
22	4/27/13	1:07 PM	1	1

Warrant Eight, Roadway Network

At some intersections, a traffic signal may be warranted to encourage concentration and organization of the traffic flow network. This warrant is applicable when the common intersection of two or more major routes has a total existing, or immediately projected, entering volume of at least 1,000 vehicles during the peak hour of a typical weekday, or each of any five hours of a Saturday or Sunday.

A major route has one or more of the following characteristics: 1) is part of the street or highway system that serves the principle network for through traffic flow; 2) It includes rural or suburban highways outside, entering or traversing a city; 3) It appears as a major route on an official plan such as a major street plan in an urban area traffic and transportation study.

This warrant is met as two major Routes (Routes 117 and 70) meet at this location and an entering volume of 1,000 VPH exists during multiple hours of a typical weekday.

Table 3: Chart of Signal Warrants

	NOT APPLICABLE	SATISFIED	NOT SATISFIED
WARRANT ONE: Eight-Hour Vehicular Volume		X	
WARRANT TWO: Four-Hour Vehicular Volume		X	
WARRANT THREE: Peak Hour		X	
WARRANT FOUR: Pedestrian Volume	X		
WARRANT FIVE: School Crossing	X		
WARRANT SIX: Coordinated Signal System	X		
WARRANT SEVEN: Crash Experience		X*	
WARRANT EIGHT: Roadway Network		X	

* Warrant Seven meets the volume and crash data criteria, however, the adequate trial of less restrictive measures with satisfactory monitoring and enforcement has not been met.

7.2b - Seven Bridge Road (Route 117) at Main Street (Route 70)

Traffic data and HCS results are applied to a *Signal Warrant* program, the program uses the *Manual on Uniform Traffic Control Devices (MUTCD)*, published by the U.S. Department of Transportation, which provides the procedure to test which warrants are satisfied for the intersection being analyzed. Detailed printouts from the data used in the *Signal Warrant* results are in the **Appendix**. The following is a description of the signal warrants applied to the intersection of Route 117 (Seven Bridge Rd.) and Route 70 (Main St.).

Seven Bridge Rd. (Rt. 117) at Main St. (Rt. 70)

<u>Warrant One, Eight-Hour Vehicular Volume</u>

The application of this warrant is intended for intersections where the volume is the principal reason for considering a signal installation. The satisfaction of this warrant is based on the total volume traveling on each approach for each of any 8-hours in a day. The *MUTCD* states that for an intersection with one-lane approaches on both major and minor streets,

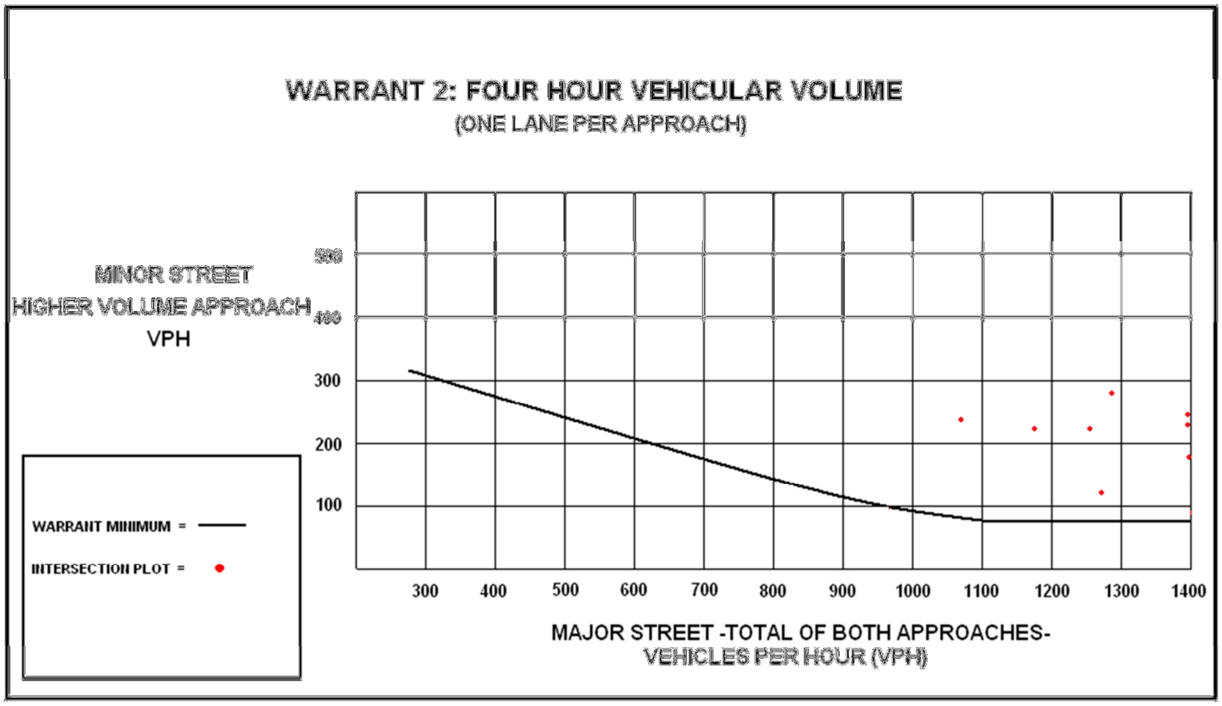
> **(1A)** the minimum volume required to satisfy the warrant is a total 500 vehicles per hour (vph) on both major approaches and 150 vph on the higher volume minor street approach.
>
> Or
>
> **(1B)** 750 vph on both major approaches and 75 vph on the higher volume minor street approach are used where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

The minimum volumes were met for this location; therefore, this warrant is satisfied. A summary of the hours that were satisfied for each approach is in **Table 1.**

<u>Warrant Two, Four-Hour Vehicular Volume</u>

The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal. The four hour volume warrant is satisfied when, for each of any four hours of an average day, the plotted points representing the vehicles per hour (vph) on the major street (total of both approaches) and corresponding vph on the higher volume minor street approaches (one direction approaching) all fall above the curve in Figure 4C-1 of the *MUTCD* for the existing combination of approach lanes. This figure is reproduced in below in **Figure 1**. A summary of the hours that were satisfied for each approach is in **Table 1.**

Figure 1: Warrant 2 Results



For this intersection, the number of vph on the major and minor streets falls above the plotted line on the curve in **Figure 1** for 8 hours as seen in the warrant curve. This warrant is satisfied.

Warrant Three, Peak Hour Delay

The peak hour delay warrant is intended for application where traffic conditions are such that for one hour of the day, minor street traffic suffers undue delay in entering or crossing the major street. The peak hour delay warrant is satisfied when the following conditions exist for one hour (any four consecutive 15-minute periods) of an average weekday:

(1A)

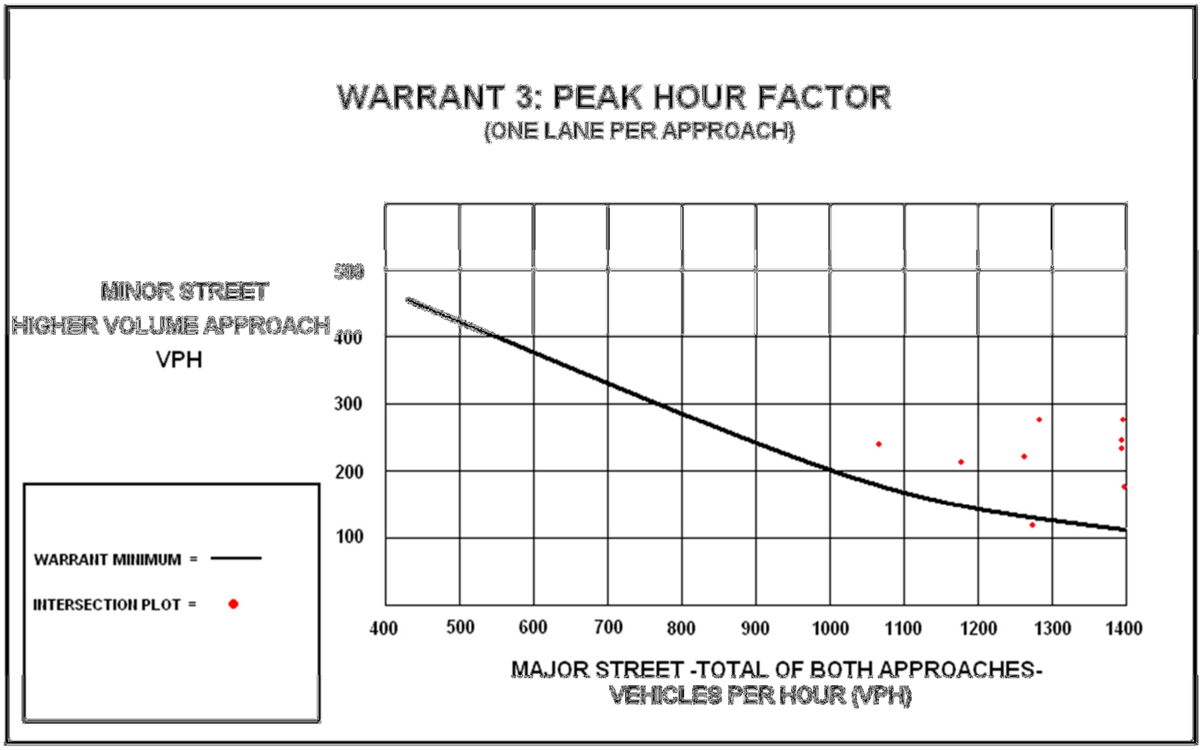
- The total delay experienced by the traffic on one minor street approach (one direction only) controlled by a stop sign equals or exceeds four vehicle-hours for a one-lane approach and five vehicle hours for a two-lane approach, and
- The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes, and
- The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four or more approaches or 650 vph for intersections with three approaches.

Or

(1B)

The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4C-3 of the *MUTCD* for the existing combination of approach lanes. This Figure is reproduced below in **Figure 2**. A summary of the hours that were satisfied for each approach is in **Table 1.**

Figure 2: Warrant 3 Results



As seen in **Figure 2** above, this warrant is also met by showing at least the required one hour period plotted above the line in the graph. Therefore, warrant three is met. A summary of the hours that were satisfied for each approach is in **Table 1.**

Table 1: Warrants 1 – 3 Results

Time	Major Approach Volume	Minor Approach	Total Volume	Meets 1A	Meets 1B	Meets 2	Meets 3
6-7 AM	1,273	114	1,387	No	Yes	Yes	No
7-8 AM	1,528	179	1,707	Yes	Yes	Yes	Yes
8-9 AM	1,267	220	1,487	Yes	Yes	Yes	Yes
2-3 PM	1,066	237	1,303	Yes	Yes	Yes	Yes
3-4 PM	1,294	288	1,582	Yes	Yes	Yes	Yes
4-5 PM	1,554	238	1,792	Yes	Yes	Yes	Yes
5-6 PM	1,654	247	1,901	Yes	Yes	Yes	Yes
6-7 PM	1,185	215	1,400	Yes	Yes	Yes	Yes

Warrant Four, Pedestrian Volume

The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street. Pedestrians were not observed at this location during site visits and were not determined to have a significant impact on this location. Therefore this warrant is not applicable.

Warrant Five, School Crossing

This warrant applies to established school crossings only, where a gap study is done to find the frequency and adequacy of the gaps in the traffic stream as related to the number and size of the school students crossing the intersection. The *MUTCD* states that…

> *"The need for a traffic control signal shall be considered when an engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of schoolchildren at an established school crossing across the major street shows that the number of adequate gaps in the traffic stream during the period when the school children are using the crossing is less than the number of minutes in the same period (see Section7A.03) and there are a minimum of 20 schoolchildren during the highest crossing hour."*

A total of 2 pedestrians (not school children) were observed during the entire eight hours observed, therefore, this warrant is not satisfied.

Warrant Six, Progressive Movement

Progressive movement control sometimes necessitates traffic signal installations at intersections in order to maintain proper grouping of vehicles and effectively regulate group speed. This warrant is not applicable at this intersection because it is not part of a coordinated signal system.

Warrant Seven, Crash Experience

The *MUTCD* states that a signal is warranted when five or more crashes of types correctable by traffic signals, each involving personal injury or property damage, have occurred within a 12 month period, and the road has an existing traffic volume of not less than 80% of the required volumes for warrants 1A and 1B. The crash experience warrant also requires that adequate trial of less restrictive measures with satisfactory monitoring and enforcement has failed to reduce the accident frequency, and requires that a signal will not seriously disturb progressive traffic flow. The following table, **Table 2**, lists those accidents susceptible to correction by a traffic signal. From the crash data provided earlier in this report it was found that two possible groups of at least five crashes perceived to be correctable by a traffic signal occurred in a 12 month period in the last three years. While the first two criteria of this warrant, 5 or more correctable crashes in a 12 month period and meeting the 80% volume for warrant 1 (A & B) is met, the second criteria of adequate trial of less restrictive measures with satisfactory monitoring and enforcement has not occurred. Therefore this warrant is only partially satisfied. Installation of a signal based on this warrant would likely require consultation and agreement with the Massachusetts Department of Transportation (MassDOT). **Table 2** below highlights crash types correctable by traffic signals.

Table 2: Possible Warrant Seven Crashes

#	DATE	TIME	LC	RC
1	7/30/10	3:36 PM	1	1
2	2/16/11	4:42 PM	2	1
3	10/9/11	10:39 AM	1	1
4	11/2/11	7:30 AM	1	1
5	11/22/11	2:04 PM	1	1
6	11/22/11	5:35 PM	3	1
7	12/27/11	5:38 PM	3	2
8	4/26/12	7:34 AM	1	1
9	6/13/12	2:17 PM	1	2
10	7/25/12	5:06 PM	1	1
11	10/10/12	7:25 AM	1	2
12	1/9/13	5:36 PM	2	2
13	1/17/13	7:15 AM	1	4
14	2/11/13	7:26 PM	3	3
15	5/20/13	8:20 PM	3	1

Warrant Eight, Roadway Network

At some intersections, a traffic signal may be warranted to encourage concentration and organization of the traffic flow network. This warrant is applicable when the common intersection of two or more major routes has a total existing, or immediately projected, entering volume of at least 1,000 vehicles during the peak hour of a typical weekday, or each of any five hours of a Saturday or Sunday.

A major route has one or more of the following characteristics: 1) is part of the street or highway system that serves the principle network for through traffic flow. 2) It includes rural or suburban highways outside, entering or traversing a city. 3) It appears as a major route on an official plan such as a major street plan in an urban area traffic and transportation study.

This warrant is met as two major Routes (Routes 117 and 70) meet at this location and an entering volume of 1000 VPH exists during multiple hours of a typical weekday.

Table 3: Chart of Signal Warrants

	NOT APPLICABLE	SATISFIED	NOT SATISFIED
WARRANT ONE: Eight-Hour Vehicular Volume		X	
WARRANT TWO: Four-Hour Vehicular Volume		X	
WARRANT THREE: Peak Hour		X	
WARRANT FOUR: Pedestrian Volume	X		
WARRANT FIVE: School Crossing			X
WARRANT SIX: Coordinated Signal System	X		
WARRANT SEVEN: Crash Experience		X*	
WARRANT EIGHT: Roadway Network		X	

* Warrant Seven meets the volume and crash data criteria, however, the adequate trial of less restrictive measures with satisfactory monitoring and enforcement has not been met.

8.0 SUMMARY OF RECOMMENDATIONS

CHAPTER 3: Traffic Congestion Analysis

- In the area around the junctions of Route 117 and Route 70 (Route 117 intersections with Lunenburg Rd. and Main St.) additional signage and continued enforcement of the speed limit may be necessary. If improvements to either Route 117/70 intersection involve installing traffic lights additional measures should be applied as the increased occurrences of rear end accidents typically accompany such improvements.

CHAPTER 4: Route 117 Safety Analysis

- Potential funding for safety improvements could possibly be pursued through the Highway Safety Improvement Program (HSIP). Specifically:
    - Segment from North Main St. to Ponakin Rd. (Criteria 2)
    - Route 117 and Route 70 intersections (Criteria 1)

CHAPTER 5: Pavement Management System (PMS)

- Full depth reconstruction will be needed on the western end of the corridor from I-190 to Langen Rd.
- Along the Bolton Flats area flooding issues should be addressed and long term improvements should consider upgrades to culverts and raising roadway height.

CHAPTER 6: Multi-Modal Considerations

- All improvements indicated in Chapter 6 along the focus area between Route 117 and Route 70 intersections should be considered in an effort to develop a more “Complete Street”.
- Add signage to “Share the Road” on those segments with narrow shoulders to remind motorists of other modes using the roadway.
- Increasing roadway width should be included in any future projects in those areas with inadequate shoulders.

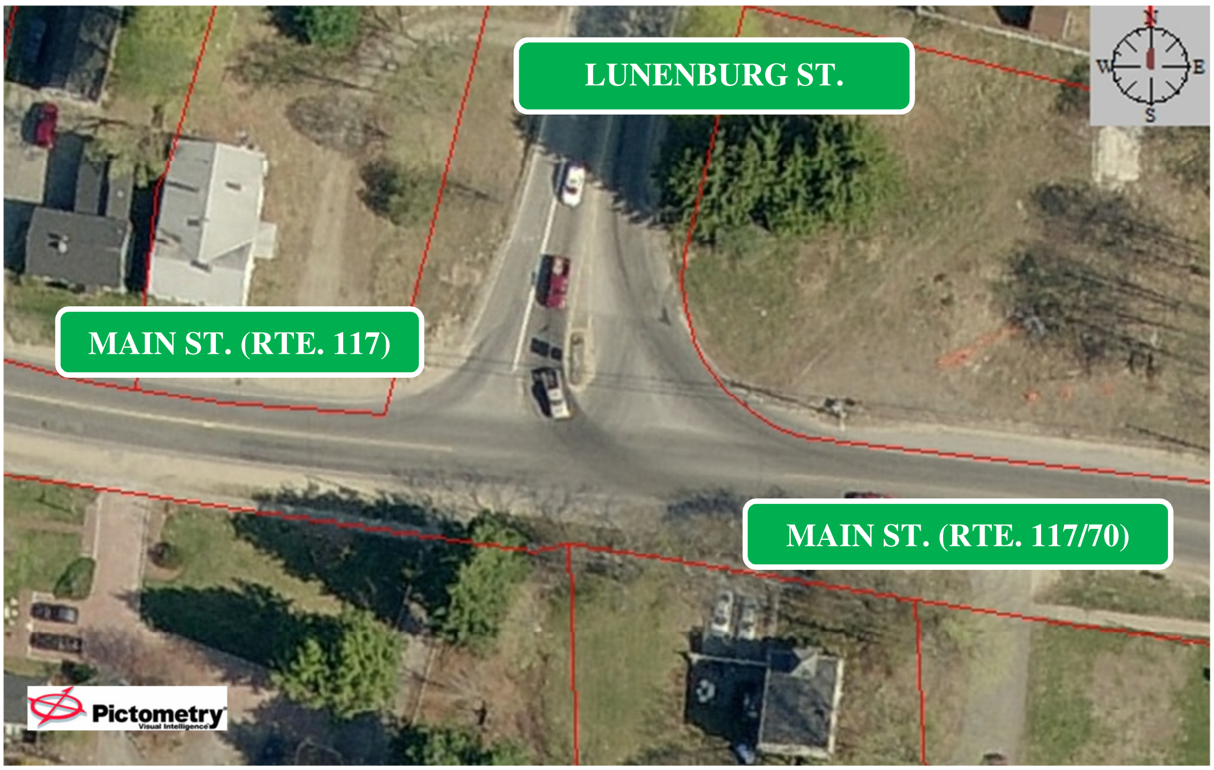
CHAPTER 7: Other Systems

- Proper measures should be taken to improve and maintain sight distance at the following intersections with Route 117:
    - North Main Street
    - Brockelman Road
    - Colony Lane
    - Devonshire Way
    - Ponakin Road
    - Main Street
    - Harvard Road
    - Boat launch to the Nashua River

Major intersection improvements of Route 117 and Route 70 (2 Intersections)

The following alternative improvements to consider were presented to the Steering Committee at these two vital intersections. After discussion it was determined that the installation of Roundabouts would be the prefered alternative for long term improvements at both locations. Also recommended by MRPC are geometric improvements to the intersection of Route 117 and Langen Road.

Route 117 at Route 70 (Lunenburg Road)



Existing Conditions

- Designated left and right turn lanes on Route 70 (Lunenburg Rd.) onto Route 117
- No Designated turn lanes on Route 117

Existing Problems

- LOS on minor approach (Lunenburg Rd./Rte.70) during peak hours
- High crash location

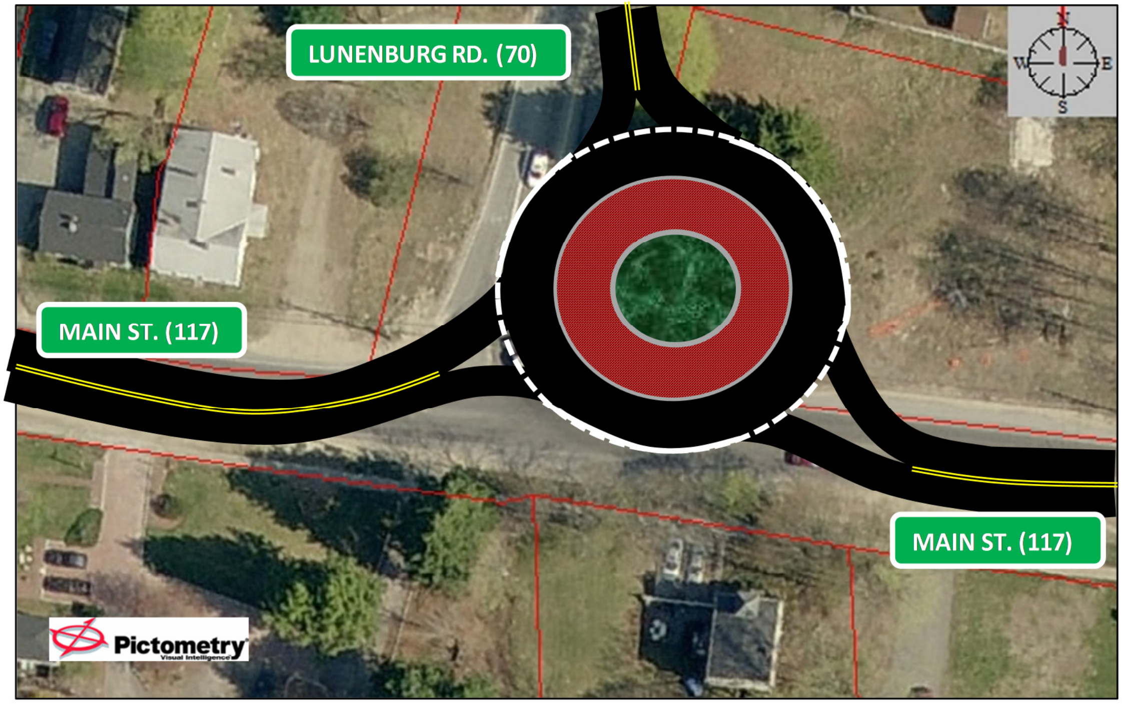
Alternative 1

- Designated left and right turn lanes on Route 70 (Lunenburg Rd.) onto Route 117
- Channelized right hand turn lane of Route 117 Westbound onto Route 70

Estimated Cost: $100,000

<u>Improvements</u>

- Slight improvement to LOS of Minor Approach (Lunenburg St./Rte70)



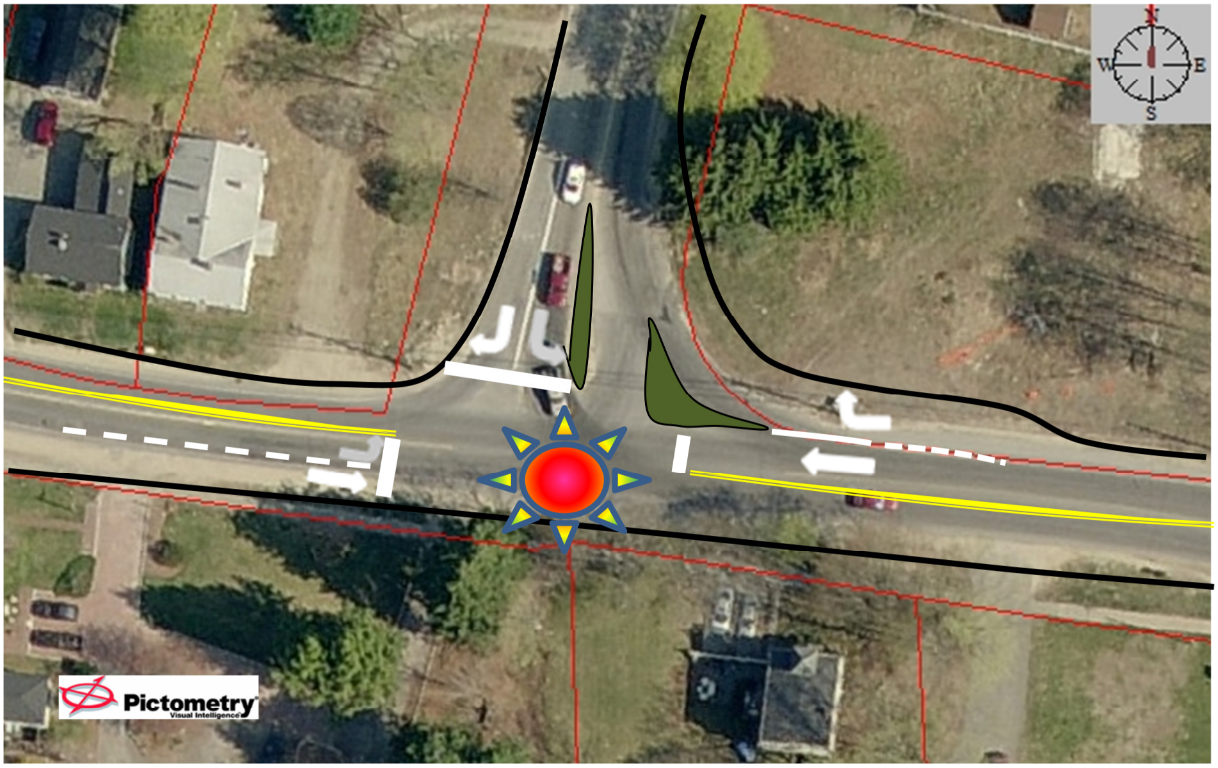
Alternative 2

- Modern Roundabout concept with 135' diameter

Estimated Cost: $1,750,000

Improvements

- Improved LOS at minor approach
- Traffic calming along congested segment of corridor
- Safety improvements (Often results in reduction in both number of crashes and crash severity



Alternative 3

- Designated left and right turn lanes on Route 70 (Lunenburg Rd.) onto Route 117
- Channelized right hand turn lane of Route 117 Westbound onto Route 70
- Designated thru and left turn lanes on Route 117 Eastbound
- Installation of Traffic Light

Estimated Cost: $1,100,000

Improvements

- Improved LOS of minor approach
- Traffic calming along congested section of corridor

Route 117 at Route 70 (Main St.)

Existing Conditions

- Channelized right turn lane on Route 117 Eastbound onto Route 70 (Main St.)
- Route 70 Northbound shared left/right turn lane with storage capacity of approximately 3 cars turning left

Existing Problems

- LOS of minor approach (Main St./Rte. 70)
- Inadequate intersection sight distance
- High crash location

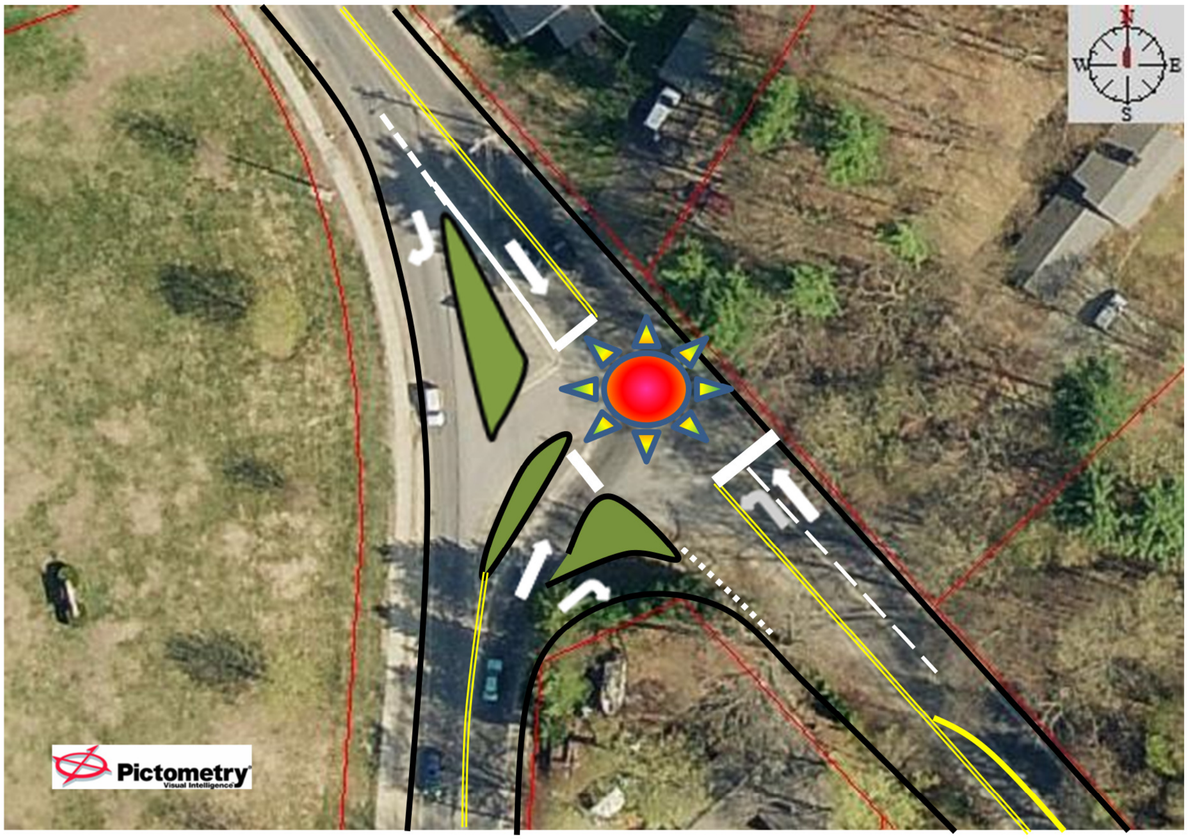
Alternative 1

- Channelized right turn lane on Route 117 Eastbound
- Channelized right turn lane on Route 70 onto Route 117 Eastbound
- Designated left and thru lanes on Route 117 Westbound
- Clear obstructions to intersection sight distance

Estimated Cost: $100,000

Improvements

- Improved LOS for Route 117 Westbound left onto Route 70
- Improved LOS for minor Street approach (Main St/Rte.70)
- Safety Improvement: Increased intersection sight distance



Alternative 2

- Channelized right turn lane on Route 117 Eastbound
- Channelized right turn lane on Route 70 onto Route 117 Eastbound
- Designated left and thru lanes on Route 117 Westbound
- Installation of Traffic Light

Estimated Cost: $750,000

Improvements

- Improved LOS for minor street approach
- Slight LOS improvement on Route 117 Westbound
- Safety improvement in resolving sight distance issue may be offset by addition of Traffic Signal (Traffic Signals are known to increase rear end collisions)

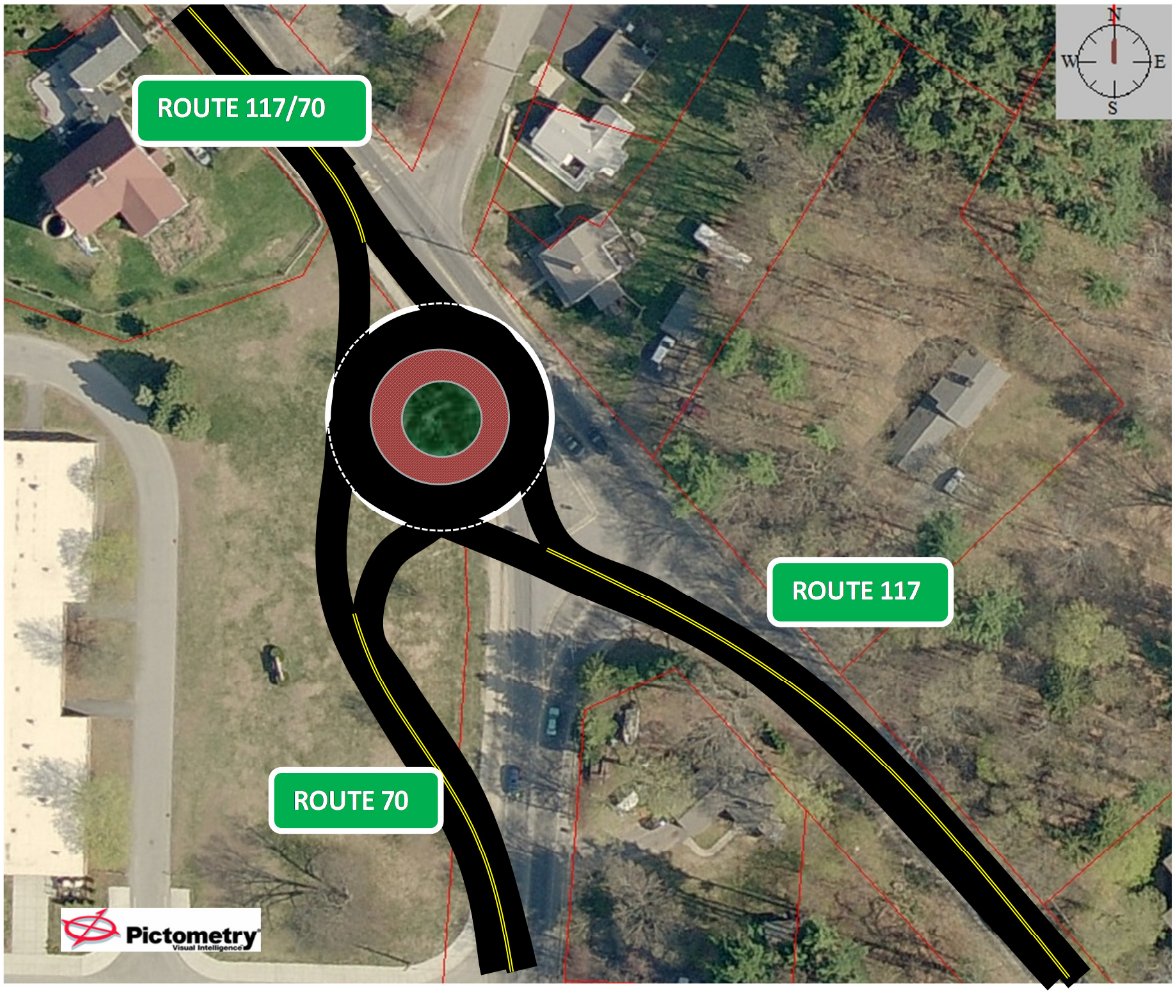
Alternative 3

- Channelized right turn lane on Route 117 Eastbound onto Route 70 (Main St.)
- Channelized right turn lane on Route 70 onto Route 117 Eastbound
- Route 70 Northbound designated left turn lane
- Designated left and thru lanes on Route 117 Westbound
- Relocation of the intersection 150’ West to improve sight distance

Estimated Cost: $500,000

<u>Improvements</u>

- Safety improvement: increased intersection sight distance on minor street approach
- LOS improvement on minor approach
- Slight LOS improvement on Route 117 Westbound



Alternative 4

- Installation of a modern Roundabout with 135’ diameter

Estimated Cost: $1,750,000

Improvements

- Improved LOS at minor approach
- Traffic calming along congested segment of corridor
- Safety improvements (Often results in reduction in both number of crashes and crash severity

Route 117 at Langen Road

Existing Conditions

- Shared/Flared Right and Left Turns on minor road

Existing Problems

- High crash location (Rear Ends)

Alternative

- Add designated Left turn lane on Route 117 Westbound
- Add channelized right turn lane on Langen Road onto Route 117 Eastbound
- Add Traffic Island
- Move minor intersection West and “T” off minor street approach

Estimated Cost: $150,000

Improvements

- Reduction of rear-end crashes on Route 117 Westbound
- Improved sight distance at minor intersection
- Improved LOS for minor street right turns

9.0 SUGGESTED NEXT STEPS

9.1 Project Development

Project Development is the process that takes a transportation improvement from concept through construction.

Every year the Montachusett region receives federal and state funds for projects to improve the transportation network in local communities. These funds and projects are prioritized through the Montachusett Metropolitan Planning Organization, a regional advisory group that annually develops the Montachusett Transportation Improvement Program (TIP).

For a community to receive funds, the project must follow a multi-step review and approval process required by the Massachusetts Department of Transportation (MassDOT) Highway Division. This process is summarized in the flowchart below.

Project proponents are required to follow this process whenever MassDOT Highway Division is involved in the decision-making process. The project development procedures are, therefore, applicable to any of the following situations:

- When MassDOT is the proponent; or
- When MassDOT is responsible for project funding (state or federal-aid projects); or
- When MassDOT controls the infrastructure (projects on state highways).

Projects with local jurisdiction and local funding sources are not required to go through this review process unless the project is located on the National Highway or Federal-Aid Systems.

Project Development Process

	PROCESS	***OUTCOMES***
STEP I	Problem / Need / Opportunity Identification	1. Project Need Form (PNF)
STEP II	Planning	2. Project Planning Report (If Necessary)
STEP III	Project Initiation	3. Project Initiation Form (PIF) 3. Identification of Appropriate Funding 3. Definition of Appropriate Next Steps 3. Project Review Committee Action
STEP IV	Environmental / Design / ROW Process	4. Plans, Specs and Estimates (PS&E) 4. Environmental Studies and Permits 4. Right-of-Way Plans 4. Permits
STEP V	Programming	5. Regional and State Transportation Improvement Programs (TIP) 5. Programming of Funds
STEP VI	Procurement	6. Construction Bids and Contractor Selection
STEP VII	Construction	7. Build Project
STEP VIII	Project Assessment	

Source: MassDOT Highway Division

The project development process is designed to progressively narrow the projects focus in order to develop a project that addresses identified needs at that location. There should be opportunities for public participation throughout.

The eight steps in the above figure are described in detail in Chapter 2, Project Development Guide of the MassDOT Highway Division Design Guidebook (http://www.mhd.state.ma.us/default.asp?pgid=content/designGuide&sid=about).

In summary, to get a project constructed, a community should:

1. Meet with the District Office of the MassDOT Highway Division to review and discuss the potential project. The District office can provide the community with information and feedback about the possible project's scope, cost, issues, etc.
2. Submit a Project Need Form (PNF), along with any support materials, on the potential project to the District office.
3. After review and feedback from MassDOT Highway Division on the PNF, a Project Initiation Form (PIF), again with any supporting materials, is prepared and submitted to the District office.
4. MassDOT and the Project Review Committee (PRC) act upon the PIF. If the project is approved by the PRC, the community is notified and, if applicable, initiates the design process for the project.
5. The municipality hires a design consultant and also begins work on the right of way plans as well as any permits, local approvals, etc.
6. During this phase the project is incorporated into the regional Transportation Improvement Program (TIP) by the MPO. Placement and prioritization of the project is based upon available funds, evaluation criteria scoring, design status and public support and comments.
7. Design public hearing is held at the 25% design phase.
8. Design progresses to 100% and all plans, specifications and estimates (PS&E) are completed. Project is then ready for advertisement by MassDOT.

Copies of the PNF and PIF can be found in the Appendix of this report.

9.2 Montachusett Metropolitan Planning Organization (MMPO)

All urbanized areas with a population greater than 50,000 are required by the U.S. Department of Transportation (USDOT) Federal regulations to designate an MPO for the area. The establishment of an MPO is necessary for the State to receive Federal transportation funds. In the Montachusett Region, the Montachusett Regional Planning Commission (MRPC) serves as staff for the MPO. The MRPC staff annually produces a Transportation Improvement Program (TIP) and Unified Planning Work Program (UPWP). In addition, a Regional Transportation Plan is updated periodically to reflect the changing transportation needs of the area. A 2012 Regional Transportation Plan was prepared and endorsed by the MPO on August 24, 2011.

The MPO in the Montachusett Region (after reorganization in October 2001) is currently comprised of the following signatories:

- Secretary and CEO of the Massachusetts Department of Transportation (MassDOT);
- Administrator of MassDOT Highway Division;
- Chairman of the MRPC;
- Chairman of Montachusett Regional Transit Authority (MART)*;
- Mayor of the City of Fitchburg
- Mayor of the City of Gardner
- Mayor of the City of Leominster
- Four Representatives from the four identified Subregions of towns in the MRPC region

*This member will be represented by one of the Mayors from Fitchburg, Gardner or Leominster.

The MMPO Subregions are composed as such:

Subregion 1 - Athol, Hubbardston, Petersham, Phillipston, Royalston, Templeton, Winchendon;
Subregion 2 - Ashburnham, Ashby, Groton, Townsend, Westminster;
Subregion 3 - Ayer, Harvard, Lunenburg and Shirley;
Subregion 4 - Clinton, Lancaster, Sterling.

These 10 members serve as the MPO Policy Board for the regional "3C" (comprehensive, cooperative, and continuing) transportation planning process.

9.3 The Transportation Improvement Program (TIP) – Development and Process

The TIP is a prioritized listing of transportation projects proposed for implementation during the future four federal fiscal years and is updated every year by the841 MMPO. TIP projects are identified by funding category so that where necessary priorities may be established for projects within each funding program. Unless otherwise noted, the agency responsible for implementing highway projects is the Massachusetts Department of Transportation Highway Division and, for transit projects, the Montachusett Regional Transit Authority.

MRPC staff annually develops the TIP project listing from sources that include the MassDOT's Project Information System, MassDOT Highway Division Districts 2 and 3, local officials, the Montachusett Joint Transportation Committee (MJTC), the Long and Short Range Elements of the Regional Transportation Plan (RTP), and the Montachusett Metropolitan Planning Organization (MPO).

Prioritization of projects is based upon input from MassDOT regarding project design and implementation status, local prioritization from chief elected officials, scoring of the project based upon the Transportation Evaluation Criteria (TEC), fiscal constraints for the Montachusett Region, consensus vote by the MJTC and formal adoption by the MPO. Throughout this procedure, input from local citizens are reviewed and considered where appropriate in the prioritization process.

An initial project listing is obtained from MassDOT and the local communities. These projects are then reviewed one by one to ascertain their current status as to design and potential advertising dates. Projects are then scored and evaluated utilizing the Transportation Evaluation Criteria (TEC) developed by the MassDOT. The TEC is a series of criteria to "be applied by the appropriate implementing agency during the project development stage to ensure that our limited budgetary and staff resources are committed to the best proposals; to assist the MPO process of programming federal funding through the regional Transportation Improvement Programs; and to examine existing projects in the pipeline to determine which should ultimately proceed to design and construction." Final scores based upon the TEC then become part of the decision and prioritization process.

From this information, a project listing by fiscal year is developed. This fiscal listing is then compared to the Federal funding target allocation for the region. The listing is then reviewed by state and local officials, as well as the MJTC and the MMPO, to determine fiscal constraint by funding year. Any problems are then identified. Through the MMPO, projects are adjusted and prioritized in order to resolve the identified problems.

In conformance established procedures with the MMPO Public Participation Program (PPP), developed to ensure a "proactive public involvement process ... in developing plans and TIPs, the draft TIP is distributed for a federally mandated 30 day public review and comment period. Following completion of the 30 day review period, any comments or issues received are addressed and reflected in the final TIP. This document is then reviewed by the MJTC, MRPC and MMPO and is recommended for endorsement by the MMPO at a subsequent MMPO meeting.

The fully endorsed TIP is then distributed to Federal, State and local agencies and groups, including FTA, FHWA, the Environmental Protection Agency (EPA) and the Department of Environmental Protection (DEP) again in conformance with the PPP.

At any time during the Federal Fiscal Year, an amendment to the TIP can be developed and endorsed by the MMPO following similar procedures established for the TIP, i.e. a draft amendment is prepared and released for a 30 day public review and comment period, reviewed by the MJTC, MRPC and the MMPO and endorsed if deemed appropriate.

9.4 Funding Programs

Several funding sources exist on the federal and state level that may be applicable to the preferred projects identified by the communities within this report. As the municipality begins the project development process, the following funding sources/options may come into play during the design, implementation and construction phases. The community should note that a funding program need not be identified as part of the PNF or PIF process but can be determined as the project limits and scope become defined.

The following is a brief listing of Federal, State and Local funding programs that may be potential sources for road, bridge, trail and sidewalk projects identified in this corridor profile. Information is based upon the recent federal surface transportation funding legislation known as Moving Ahead for Progress in the 21st Century (MAP-21). This legislation has created a more streamlined, performance-based and multimodal program to address the challenges facing the country's transportation system. For further information on some of these programs please contact the MRPC or MassDOT Highway Division. Additional information on MAP-21 can be found at the Federal Highway Administration (FHWA) website, www.fhwa.dot.gov/map21/

MAP-21 Restructuring

MAP-21 restructures core highway formula programs. Activities carried out under some existing formula programs – the National Highway System Program, the Interstate Maintenance Program, the Highway Bridge Program, and the Appalachian Development Highway System Program – are incorporated into the following new core formula program structure:

- National Highway Performance Program (NHPP)
- Surface Transportation Program (STP)
- Congestion Mitigation and Air Quality Improvement Program (CMAQ)
- Highway Safety Improvement Program (HSIP)
- Railway-Highway Crossings (set-aside from HSIP)
- Metropolitan Planning

It creates two new formula programs:

- Construction of Ferry Boats and Ferry Terminal Facilities – replaces a similarly purposed discretionary program.
- Transportation Alternatives (TA) – a new program, with funding derived from the NHPP, STP, HSIP, CMAQ and Metropolitan Planning programs, encompassing most activities funded under the Transportation Enhancements, Recreational Trails, and Safe Routes to School programs under SAFETEA-LU.

MAP-21 creates a new discretionary program – Tribal High Priority Projects (THPP) – and continues the following current discretionary programs:

- Projects of National and Regional Significance (PNRS)
- On-the-Job Training Supportive Services
- Disadvantaged Business Enterprise (DBE) Supportive Services
- Highway Use Tax Evasion (Intergovernmental enforcement projects)
- Work Zone Safety Grants

It also eliminates most current discretionary programs, but many of the eligibilities are covered in other programs:

- Delta Region Transportation Development
- Ferry Boats Discretionary
- Highways for LIFE Demonstration Program
- Innovative Bridge Research and Deployment
- Interstate Maintenance Discretionary
- National Historic Covered Bridge Preservation
- National Scenic Byways
- Public Lands Highway Discretionary
- Railway-Highway Crossing Hazard Elimination in High Speed Rail Corridors
- Transportation, Community, and System Preservation
- Truck Parking Pilot Program
- Value Pricing Pilot Program (no additional funding, but authority remains)

Federal Programs:

- *National Highway Performance Program (NHPP)* - The enhanced National Highway System (NHS) is composed of approximately 220,000 miles of rural and urban roads serving major population centers, international border crossings, intermodal transportation facilities, and major travel destinations. It includes the Interstate System, all principal arterials (including some not previously designated as part of the NHS) and border crossings on those routes, highways that provide motor vehicle access between the NHS and major intermodal transportation facilities, and the network of highways important to U.S. strategic defense (STRAHNET) and its connectors to major military installations.

- *Surface Transportation Program (STP)* - MAP-21 continues the STP, providing an annual average of $10 billion in flexible funding that may be used by States and localities for projects to preserve or improve conditions and performance on any Federal-aid highway, bridge projects on any public road, facilities for nonmotorized transportation, transit capital projects and public bus terminals and facilities.

  Most current STP eligibilities are continued, with some additions and clarifications. Activities of some programs that are no longer separately funded are incorporated, including transportation enhancements (replaced by "transportation alternatives" which encompasses many transportation enhancement activities and some new activities), recreational trails, ferry boats, truck parking facilities, and Appalachian Development Highway System projects (including local access roads). Explicit eligibilities are added for electric vehicle charging infrastructure added to existing or included in new fringe and corridor parking facilities, and projects and strategies that support congestion pricing, including electronic toll collection and travel demand management strategies and programs.

- *Congestion Mitigation and Air Quality (CMAQ)* - The CMAQ program provides a flexible funding source to State and local governments for transportation projects and programs to help meet the requirements of the Clean Air Act. Funding is available to reduce congestion and improve air quality for areas that do not meet the National Ambient Air Quality Standards for ozone, carbon monoxide, or particulate matter (nonattainment areas) as well as former nonattainment areas that are now in compliance (maintenance areas). States with no nonattainment or maintenance areas may use their CMAQ funds for any CMAQ- or STP-eligible project.

- *Highway Safety Improvement Program (HSIP)* - SAFETEA-LU enacted in August 2005 authorized funding for the Federal surface transportation programs for highways, highway safety, and transit. MAP-21 continues HSIP, with average annual funding of $2.4 billion, including $220 million per year for the Rail-Highway Crossings program.

The HSIP emphasizes a data-driven, strategic approach to improving highway safety on all public roads that focuses on performance. The foundation for this approach is a safety data system, which each State is required to have to identify key safety problems, establish their relative severity, and then adopt strategic and performance-based goals to maximize safety. Every State is required to develop a Strategic Highway Safety Plan (SHSP) that lays out strategies to address these key safety problems.

- Transportation Alternatives (TA) - MAP-21 establishes a new program to provide for a variety of alternative transportation projects that were previously eligible activities under separately funded programs. This program is funded at a level equal to two percent of the total of all MAP-21 authorized Federal-aid highway and highway research funds, with the amount for each State set aside from the State's formula apportionments. Unless a State opts out, it must use a specified portion of its TA funds for recreational trails projects. Eligible activities include:
    - Transportation alternatives (new definition incorporates many transportation enhancement activities and several new activities)
    - Recreational trails program (program remains unchanged)
    - Safe routes to schools program
    - Planning, designing, or constructing roadways within the right-of way of former Interstate routes or other divided highways.

<u>State Programs:</u>

- *Community Development Block Grants (CDBG) Funds* - The CDBG program is a federally funded, competitive grant program designed to help small cities and towns meet a broad range of community development needs.

- *Public Works Economic Development (PWED) Funds* -The PWED program was created by the State Legislature to assist municipalities in funding transportation infrastructure for the purpose of stimulating economic development.

- *Small Town Road Assistance Program (STRAP) Funds* -The STRAP program provides funding for transportation projects that improve public safety and promote economic development in small towns with a population less than 7,000. Eligible costs include: (1) Project design costs; (2) Cost of updating plans, specifications and estimates where preliminary engineering and related planning has already been undertaken; (3) Costs associated with standard construction activities as allowed under M. G. L., Chapter 90. Section 34, Subsection 2(a); (4) Payment for outside engineering services for design and construction provided that engineering services will be performed by a registered professional engineer or a registered land surveyor with a background of satisfactory performance.

- *Community Development Action Grants (CDAG)* -The CDAG program provides funding for publicly owned or managed projects that have a significant impact on the overall economic condition of a city or town, including activities that will significantly improve the conditions of low and moderate income persons through: (a) the support of workforce housing needs across a range of incomes; (b) the generation and/or retention of long term employment; (c) the leveraging of significant private investment; and (d) the improvement of physical conditions.

- *Massachusetts Opportunity Relocation and Expansion (MORE) Funds* - The Massachusetts Opportunity Relocation and Expansion (MORE) Jobs Capital Program provides grant funding for public infrastructure improvements needed to support business expansion in the Commonwealth of Massachusetts. The program stimulates job creation and economic growth across the state by providing the public infrastructure development companies need.

Local Sources:

- *Chapter 90 Transportation Funds* -The Chapter 90 Program entitles municipalities to reimbursement of documented expenditures for Capital Improvement Projects for Highway Construction, Preservation and Improvement Projects that create or extend the life of Capital Facilities under the provisions of General Laws Chapter 90, Section 34, Clause 2(a) on approved Projects. Eligible Highway Construction projects include resurfacing, microsurfacing, pug mill mix (cold mix), drainage, intersections, sidewalks, footbridges, berms and curbs, traffic controls and related facilities, right-of-way acquisition, street lighting (excluding operating costs and decorative enhancements), bridges, and tree planting/landscaping in association with a project.

- *Tax Increment Financing (TIF)* -Tax Increment Financing (TIF) is an alluring tool that allows municipalities to promote economic development by earmarking property tax revenue from increases in assessed values within a designated TIF district. The rules for tax increment financing, and even its name, vary across the 48 states in which the practice is authorized. TIF expenditures are often debt financed in anticipation of future tax revenues.

- *Business Improvement Districts (BID)* - Business Improvement Districts (BID) are special assessment districts in which property owners vote to initiate, manage and finance supplemental services or enhancements above and beyond the baseline of services already provided by their local city or town governments. A special assessment, or common area fee, is levied only on property within the district and the assessments are collected and expended within the district for a range of services and/or programs, including marketing and public relations, improving the downtown marketplace or city/town center, capital improvements, public safety enhancements, and special events.

- Specific local taxes to residential property owners for sidewalk construction and/or repair.

- Town Meeting Warrant articles/budgetary line items.

- Subdivision Regulation requirements for developers to construct sidewalks for new residential developments and similar regulations for commercial developments.

Other Possible Funding Sources:

- Private contributions (foundations, businesses, individuals, etc.)

- Local bank grants, loans or bonds

Other Ideas for Sidewalk/Trail Construction:

- Donated time and/or materials from local contractors

- Volunteers to clear and build trails (Wachusett Greenways model)

- Eagle Scout projects

- Tax credits for citizens who repair/build public sidewalks in front of their property with their own funds