



12

Safety





SAFETY

Introduction

Improving locations having quantifiable pre-existing safety problems is a key criterion for developing roadway improvement projects in the Montachusett MPO (MMPO) region. This follows the national goal of roadway safety improvement established in 2005 when Congress passed the Safe, Accountable, Flexible, Efficient Transportation Equity Act – A Legacy for Users (SAFETEA-LU). SAFETEA-LU requires each state to prepare a Strategic Highway Safety Plan (SHSP) that identifies safety needs and guides “investment decisions to achieve significant reductions in highway fatalities and serious injuries on all public roads.” Massachusetts completed its SHSP in 2006 with the two goals of:

- Achieving a 20% reduction from the 2004 total of 476 lives lost in traffic-related fatal crashes by 2010.
- Achieving a 20% reduction from the 2004 total of 6,059 nonfatal traffic-related injuries requiring hospitalization, or incapacitating injuries by 2010.

Based on data from the National Highway Traffic Safety Administration's Fatality Analysis Reporting System (FARS) fatalities in 2009 decreased nearly 29% from 2004. Based on data from the Massachusetts Department of Public Health and Health Care Finance, nonfatal traffic-related injuries requiring hospitalization in 2009 decreased nearly 18.4% from 2004. The 2010 total numbers for each are not available at this time. Therefore, Massachusetts has met its goal for fatalities and is on track for meeting the goal for injuries requiring hospitalizations and will continue to work to improve safety wherever and whenever safety needs to be improved.

A portion of these decreases may be related to a slowing economy and the spike in oil prices that combined to produce less vehicle trips that reduce Vehicle Miles Traveled (VMT) and slower vehicular speeds. VMT is a significant contributing factor to crash occurrence. Generally, if no safety improvements are made, the number of crashes will increase as VMT increases while the number of crashes will decrease as VMT decreases. The table below shows a VMT decrease of 7.6% between 2000 and 2010 in eastern Massachusetts.

Eastern Massachusetts VMT*	
Year	VMT
2000	139,062,169
2010	128,468,738
Difference	-10,593,431
% Difference	-7.6%
*Source: Ma Travel Demand Model	

The Massachusetts SHSP is available online at:

<http://www.mhd.state.ma.us/default.asp?pgid=content/traffic/shsp&sid=level2>

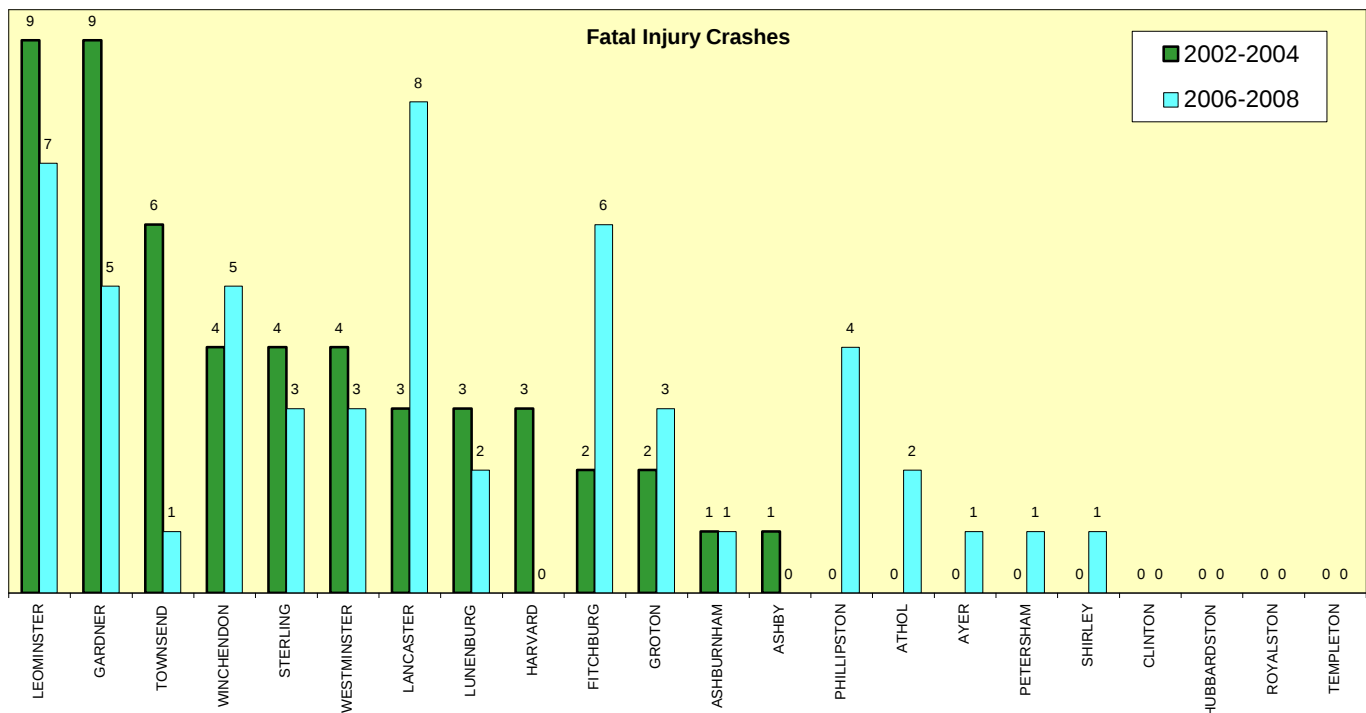


Safety Activities in the MMPO: 2007 - Present

In the 3-year period of 2006-2008 the MMPO saw the following results in vehicular crashes when compared to the 3-year period of 2002-2004:

- **5% reduction** in the overall number of crashes (15,828 vs 15,046 respectively)
- **22% reduction** in the number of injury crashes (4,516 vs 3,535 respectively)
- But fatal injury (FI) crashes have increased by **4%** (53 vs 51 respectively) which is opposite the statewide trend in Massachusetts as described above. However, the increase occurred simultaneously with a significant shift in where FI crashes occur. This is described below and illustrated in **Figure 1**:
 - 16 municipalities experienced FI crashes in 2006-2008 while only 13 municipalities experienced FI crashes in 2002-2004
 - FI crashes occurred in five municipalities that did not experience FI crashes in 2002-2004
 - In 2002-2004 Gardner & Leominster combined to account for 35% as nine FI crashes occurred in each municipality
 - However in 2006-2008 both municipalities saw a decrease; Gardner by -44% (-4 crashes) and Leominster by -22% (-2 crashes)
 - Two municipalities (Ashby & Harvard) that experienced FI crashes in 2002-2004 did not experience any in 2006-2008

Figure 1





- Lancaster saw the largest absolute increase with five FI crashes (+167%) while Townsend saw the largest absolute decrease with five FI crashes (-83%)
- Fitchburg and Phillipston each saw the second largest absolute increase with four FI crashes each (+200% and +100%)
- Clinton, Hubbardston, Royalston, and Templeton did not experience any FI injury crashes in either 3-year period
- Lane departure crashes accounted for 53% (28) of the FI crashes

A primary focus during the next 4-years covered by the MMPO 2012 RTP will be to identify the problems associated with this increase and location shift in FI crashes and to provide various corrective measures.

Completed/in Construction Projects that Include Safety Improvements Since 2007 that were Developed Prior to Full SHSP Implementation

Historically, the locations listed in **Table 1** have had significant safety problems. Projects were developed for these locations before the SHSP was fully implemented but incorporate many safety improvements in their design and construction. Also, the projects did not receive Highway Safety Improvement Program funding. All projects have been completed. For more information on these locations see *Chapter 13* of the MMPO 2007 RTP which can be found on our website at www.mrpc.org under *Documents - Reports/Studies/Forms*.

Table 1

Municipalities	Location	Improvement
Fitchburg	Route 12 at Bemis Road (Rte 12 Phase 1 & 2)	Signal upgrades, protected left turn lane
Leominster	Route 12 at State Street (Rte 12 Phase 1 & 2)	Signal upgrades, unprotected left turn lane
Fitchburg	John Fitch Highway and Mechanic Street (Rte 31)	Roundabout (photo below)



**Highway Safety Improvement Program (HSIP) / Road Safety Audits (RSA) and Project Development Status of Intersections Listed in 2007 RTP Subject to Traffic Study**

HSIP is the core Federal-aid program for funding safety improvement projects at any location that involves vehicles, pedestrians, or bicycles. In Massachusetts, the primary criterion to determine HSIP eligibility for a location that involves vehicular crashes is that it must be ranked in the top 5% of the vehicular Crash Clusters (described below) that occur within an MPO region. The Equivalent Property Damage Only (EPDO) ranking system (described below) is used for ranking locations. When the SHSP was first implemented, the minimum EPDO point total for a location to be considered in the MMPO top 5% of Crash Clusters was 34 points. Once a location is listed in the top 5% and a project is being developed for it, the completion of an RSA is required. Since 2008, preparation of an RSA is required in order to receive HSIP funding for a transportation facility project.

An RSA is a formal safety performance examination of an existing or future transportation facility (roadway, intersection, etc.) by an independent and multidisciplinary audit team that studies the facility from a variety of perspectives. A final RSA determines specific causes and identifies possible improvements in safety for all road users. An RSA contributes to designs that reduce the number and severity of crashes and helps to reduce costs.

During the 3-year period prior to the completion of the MMPO 2007 RTP, the MRPC focused on identifying safety problems at intersections when completing traffic studies. Using the intersection crash rate analysis method to identify safety problems at intersections, 16 intersections were studied of which 8 were identified as having a crash rate above the MassDOT District average crash rate.

Table 2 below is a list of the eight identified intersections. Sight distance, geometric, and other safety concerns were also considered. Only one intersection did not experience a non-fatal injury crash and one experienced a fatal injury crash.

Project development status:

- Three intersections have had projects completed:
 - The Route 68 at Route 62 intersection in Hubbardston which was completed in 2010
 - The School Street and Main Street intersection in Athol which was completed in 2009
 - Completed by the Town of Lancaster, low cost corrective measures were applied to the High Street and Mill Street intersection
- Two intersections in Lancaster are in project development:
 - The Lunenburg Road at Old Union Turnpike intersection (see figure below): will be converted to a roundabout. After the full SHSP implementation, this intersection became ranked in the top 5% of the Crash Clusters in the MMPO region and thus became an HSIP eligible project. An RSA was completed in August of 2010 to verify the safety problem and the recommended corrective measure of converting the intersection to a roundabout. This is the MMPO 2012 TIP HSIP project



- The Five Corners intersection: by the time the SHSP was implemented this intersection experienced a significant decrease in the occurrence of crashes which excludes the intersection from being ranked in the top 5% of the Crash Clusters in the MMPO region and therefore became ineligible to receive HSIP funding. There are five approaches to this intersection which will be converted to four approaches
- No projects under development for the three remaining intersections. Two intersections are in Ashburnham while the third is in Leominster

For more information on these intersections and a description of intersection crash rate analysis see *Chapter 13* of the MMPO 2007 RTP which can be found on our website at www.mrpc.org under *Documents - Reports/Studies/Forms*.

Lunenburg Road at Old Union Turnpike Intersection in Lancaster to be Converted to a Roundabout and an RSA was Completed for this Intersection



**Table 2: 2007 RTP Safety Problems & Project Development**

Municipalities	Street 1	Street 2	Fatality/ Injury	Sight Distance Problem	Geometric Problem	Other / Comments	Project Development Status	Improvement
Ashburnham	Route 101	Corey Hill/ Williams Rd	injuries	+	+	Solar Glare, Speed	NA	
Ashburnham	Route 101	Main Street (Route 12)		+	+	Congestion	NA	
Athol	School Street	Main Street	injuries	+	+		Project completed	Removal of horizontal and vertical alignment issues, and signage
Hubbardston	Route 68	Route 62	fatality & injuries	+	+		Project completed	Realignment and removal of sight distance obstructions
Lancaster	Five Corners		injuries	+	+	Many Access Points, driver confusion	Project under development	Conversion to 4-way intersection
Lancaster	High Street	Mill Street	injuries	+	+	Lack of awareness	Project completed	Signage
Lancaster	Lunenburg Road	Old Union Turnpike	injuries	+	+	Congestion, driver confusion	RSA, Project under development	Conversion to roundabout
Leominster	Merriam Avenue	Route 2 EB Ramp	injuries		+	Congestion	NA	

Other Improvements

Leominster - The Central Street and Willard Street Intersection (2010)



This project was the first HSIP eligible project to be completed in the MMPO and construction began in 2009. When a project was initiated for this intersection in 1996, it had a 3-year EPDO (see below for further discussion on EPDO) total of 71 based on a total of 21 crashes of which 10 were non-fatal injury crashes. Safety continued to be a problem in 2008 when it was ranked at #59 in the MRPC's *Most Dangerous*

Intersections and Interchanges in the Region list. Improvements included the installation of a new traffic signal, significant geometric improvements that provided for wider travel lanes and



improved extremely poor sight distance. New signage and pavement markings were also installed.

Gardner - Route 140: ARRA Project & MA Lead State Initiative to Reduce Fatal & Incapacitating Injuries Resulting from Lane Departure Crashes (2010)

Route 140 from Route 101 to the Green Street intersection was the subject of a lane departure RSA that was completed in 2008 to address the significant lane departure crash problem on the road. This was completed in response to the Massachusetts SHSP which describes a significant lane departure crash problem across the state. Improvements were completed as part of ARRA.

Countermeasures included retro-reflectorized signs and 6" wide pavement markings, recessed pavement markers, and edge line rumble strips. New guardrails were also installed with state of the art energy absorbing end terminals that replaced the old turned down (buried) end terminals which can cause rollover crashes and guardrail tabs were mounted on the guardrails. These safety improvements are proven countermeasures to help keep drivers in their travel lane under most adverse weather, road surface, or dark lighting conditions.

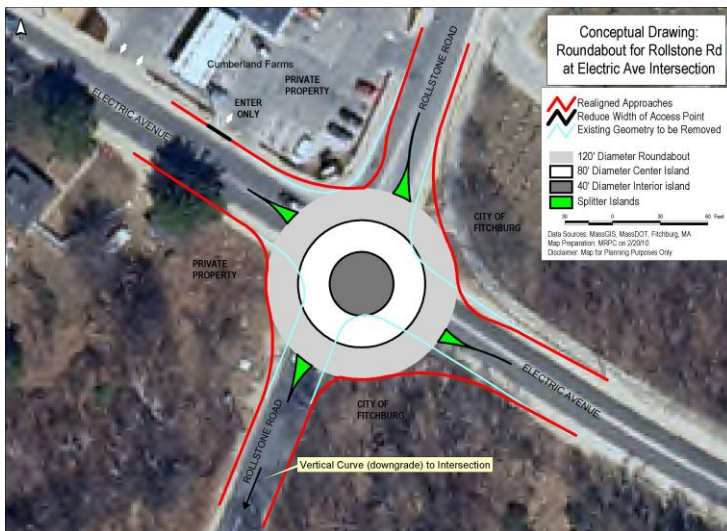
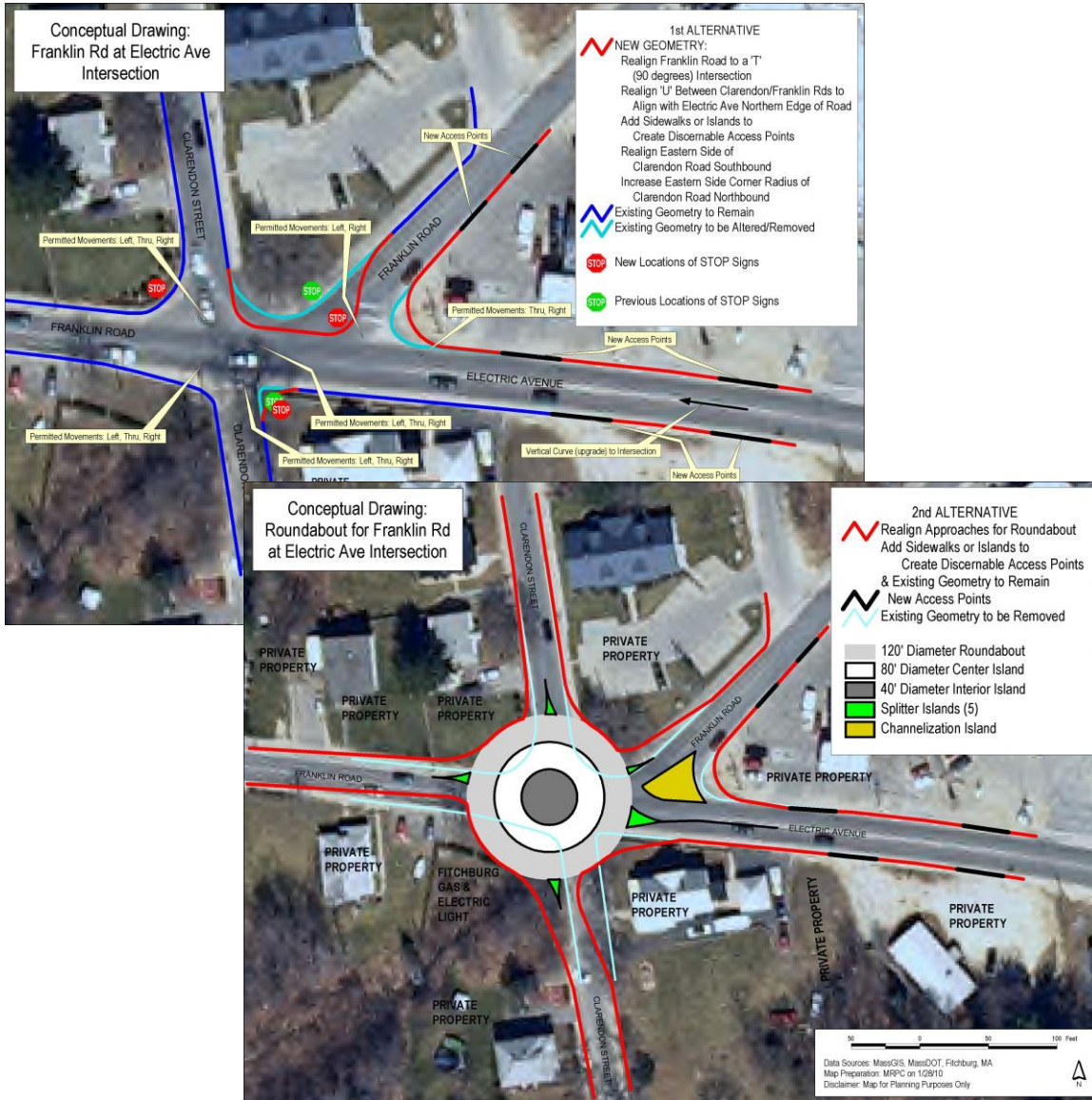


Locations Identified Since 2007 as Having Safety Problems upon Completion of a Traffic Study

Fitchburg - Electric Avenue from Franklin Road to Rollstone Road Traffic Study (2010)

The study revealed that the full length of the 1,400 foot corridor has safety problems with a crash rate well above the Massachusetts average crash rate for a road segment. At the time of this study, access management techniques were under construction on the road segment in between the intersections but on only the north side of the roadway.

Improvement alternatives for the Franklin Road intersection include but are not limited to - realigning minor street approaches, applying access management techniques to the business abutting the intersection, and converting the intersection to a roundabout. The improvements are conceptualized below.



Improvement alternatives for the Rollstone Road intersection include but are not limited to - adding left turn auxiliary lanes on Electric Avenue, remove sight distance obstructions, and converting the intersection to a roundabout which is conceptualized to the left.



Groton - Route 119 and Proctor/Townsend Road Traffic Study and Signal Warrant Analysis (2009)

The safety analysis, based on local crash reports, revealed that the intersection has an EPDO that places it in the top 5% of the Crash Clusters in the MMPO region and thus becomes an HSIP eligible project. Improvement alternatives include but are not limited to - adding auxiliary turn lanes on Route 119, adding acceleration lanes for right turns from minor approaches, adding right turn traffic islands on the minor street approaches, realigning minor approaches to right angle approaches, and remove sight distance obstructions.

Westminster & Sterling - Route 140 Corridor Profile (2010)

Based on local crash reports, the safety analysis revealed that each municipality has an intersection that is an HSIP eligible project. Along the road segments and at other intersections, in-lane crashes and lane departure crashes are a safety concern.

Westminster: The Route 140 at Route 2A/East Main Street intersection (pictured below) has a crash rate higher than the MassDOT District 3 average crash rate for a signalized intersection



and an EPDO point total that places it in the top 5% of the Crash Clusters in the MMPO region and thus becomes an HSIP eligible project.

Improvement alternatives include but are not limited to - adding a left turn phase to the signals and a protected left turn lane to each approach, and converting the intersection to a roundabout.

The crash rate for the Route 140 road segment from Honey Bee Lane to the Princeton Town Line is above the statewide average crash rate and nearly 70% of the crashes were lane departure crashes.

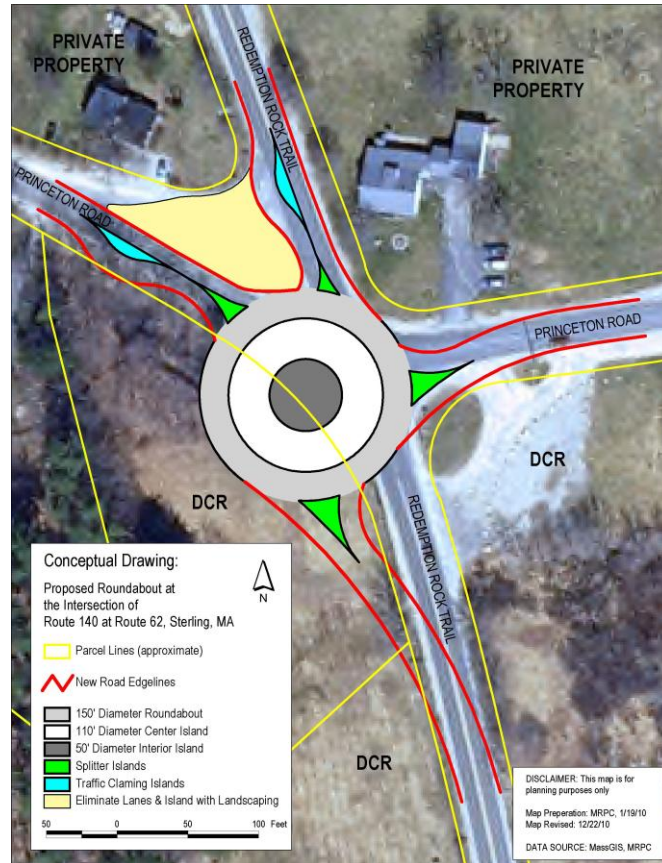
Improvement alternatives include but are not limited to - removing roadside vegetation, upgrading guardrails to existing standards, upgrading signage (particularly warning signs) and pavement markings, converting skewed intersections to 'T' (90 degrees) intersections, adding protected left turn lanes, and flattening sideslopes.



Sterling: The Route 140 at Route 62 (Princeton Road) intersection has a crash rate higher than the MassDOT District 3 average crash rate for a signalized intersection and an EPDO point total that places it in the top 5% of the Crash Clusters in the MMPO region and thus becomes an HSIP eligible project.

Improvement alternatives include but are not limited to - signalization, adding protected left and right turn lanes, and converting the intersection to a roundabout which is conceptualized to the left.

The crash rate for the Route 140 road segment north of Route 62 is above the statewide average crash rate and nearly 40% of the crashes were lane departure crashes.



Improvement alternatives coincide with the Westminster alternatives that include but are not limited to - removing roadside vegetation, upgrading guardrails to existing standards, upgrading signage (particularly warning signs) and pavement markings, converting skewed intersections to 'T' (90 degrees) intersections, adding protected left turn lanes, and flattening sideslopes.

Other Locations Identified as Having Safety Problems with Designs Complete or Under Development & Locations Eligible for Statewide HSIP Funding

With the exceptions of the South Street Corridor in Westminster, the Route 13 at Haws Street and Route 13 at River Street intersections in Leominster, the locations listed in **Table 3** below have Crash Clusters with an EPDO that places them in the top 5% of Crash Clusters in the MMPO region and thus become HSIP eligible projects.

The South Street Corridor has a crash rate that exceeds the statewide average crash rate for road segments by 76% and became the MMPO 2011 HSIP project. The Haws Street intersection and River Street intersection are included in the table because they are part of a safety improvement project. The locations with red-bolded text are eligible for statewide HSIP funding. The table provides a description of the safety improvements to be undertaken.



Table 3

Municipalities	Location	MassDOT Project #
Westminster	South Street Corridor from Dawley St. to Main St. (Rte. 2A)	602099
Leominster	Exit 31 - Rte. 2/Rte. 12 (N Main St.)	605104
Lancaster and Harvard	Exit 35 - Rte. 2/Lunenburg Road (Rte. 70)/Old Union TnPk/Fort Pond Road	605393
	Exit 36 - Rte. 2/Shirley Rd/Fort Pond Rd./Old Union TnPk	605393
	Exit 38 - Rte. 2/Ayer Rd. (Rte. 110/Rte. 111)	605393
Sterling	Leominster Rd. (Rte. 12)/Chocksett Rd.	604699
Leominster	Main St (Rte. 13)/Nashua St/Hamilton St	605651
	Main St (Rte. 13)/River St	605651
	Main St. (Rte. 13)/Haws St.	605651

MassDOT Project #	Status for 2012 RTP	Project Description
602099	Design Complete, Listed on 2011 TIP and construction begins this fall	Geometric improvements consist of realigning intersection approaches, roadway widening, limiting access points by installing sidewalks and granite curbing, and other safety improvements such as upgraded signing and pavement markings
605104	In Design, Listed on 2012 TIP	(see description below)
605393	In Design, Study Completed for Rte. 70 at Fort Pond. Also, Rte. 70 at Old Union which is Listed in 2012 TIP, Design Completed & Includes Rte. 2 Exit 35 EB ON Ramp	Geometric improvements consist of widening Route 2 at the exits to lengthen the acceleration and deceleration lanes for the ramps at these exits
605393	In Design, EB & WB Ramps to be Improved, Listed in 2014 TIP	
605393	In Design, EB & WB Ramps to be Improved, Listed in 2014 TIP	
604699	In Design, Listed in TIP Appendix	To be determined
605651	In Design, Fitchburg/Leominster/Lunenburg TAP Study (1999), Listed in 2014 TIP	Geometric improvements consist of widening a section of Route 13 from Hawes Street to Prospect Street, a new signal at Route 13 and Mead Street, existing signals will receive new signal equipment upgrades and coordination, other safety improvements such as upgraded signing and pavement markings
605651		
605651	In Design, Listed in 2014 TIP	

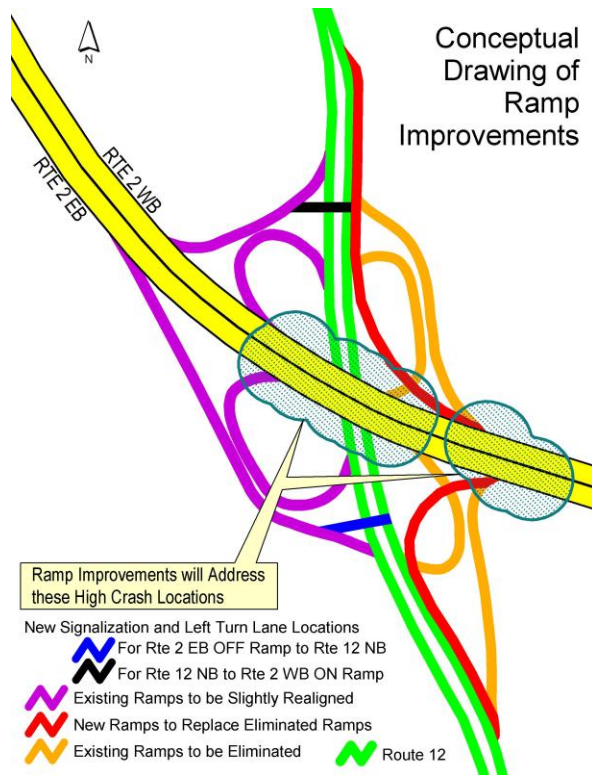
Exit 31 in Leominster

This interchange is the top location in the top 5% of the Crash Clusters in the MMPO region. Historically, this exit is consistently ranked at or near the top of dangerous locations in north central Massachusetts. Moreover the Route 12 bridge over Route 2, which was built in 1949, is severely in need of replacement. This can be seen visibly when traveling northbound on Route 12 where a section of the bridge on the right has been removed due to structural deficiency which is delineated by jersey barriers.

The good news is that a new bridge is being designed to replace this substandard bridge. Raising the clearance of the new bridge will be the most visible improvement and the conceptual



drawing below shows the improvements to be completed on the ramps that address the two (2) high crash locations shown on the drawing:



- The existing ON and OFF ramps on the east side of Route 12 will be eliminated (orange lines)
- A new Route 2 eastbound ON ramp from Route 12 northbound will be added (red line). It is designed to help vehicles accelerate and merge more smoothly onto Route 2
- A new Route 2 westbound OFF ramp to Route 12 northbound will be added (red line). It is designed to be considerably longer than the existing ramp and will include a merge lane
- A signalized westbound left turn from Route 12 northbound will be added for Route 2 westbound traffic (black line)

- A signalized northbound left turn from Route 2 eastbound OFF ramp will be added for Route 12 northbound traffic (blue line)
- The existing ON and OFF ramps on the west side of Route 12 will be slightly realigned



Roadway Safety Problem Areas

Screening Tools for Identifying & Locating Dangerous Locations

Screening tools identify and prioritize dangerous locations needing improvement in the MMPO region. Identified locations in need of study will be submitted for further study.

I) Phase I Report: Roadway Safety Conditions in the Montachusett Region (2008)

Developed by the MRPC, this screening tool covers MMPO roadway safety conditions over a 4-year period from 2002-2005. The *Equivalent Property Damage Only* (EPDO) crash severity rating system was used to determine dangerous intersections and interchanges.

EPDO rates a crash based on crash severity that gives one (1) point to a *PDO* crash; five (5) points for a crash involving at least one *Non-fatal Injury*; and ten (10) points to a crash that involves at least one *Fatal Injury*. After determining each crash EPDO rate, the rates of the crashes for each intersection and interchange are totaled. A high EPDO total indicates a dangerous location where crashes have the most severe consequences.

There are 114 dangerous intersections and interchanges identified in Table 2 of the *Phase I Report*. All locations are listed in **Table 6** below. The locations are sorted in descending order first by their EPDO total and second by total crashes and given a competitive regional and municipal rank. If there are multiple locations with the same EPDO total but different total number of crashes, locations with the lower total number of crashes are ranked higher because the crashes are more severe. Locations that have EPDO total of at least a 39 are considered dangerous with a priority for safety improvements.

Of the 114 locations twenty-three (or 20%) were interchange locations of which nineteen were in the top fifty (38% of top fifty). The top four most dangerous locations were Route 2 interchanges and six interchanges were ranked in the top ten. Of the nineteen in the top fifty, sixteen were Route 2 and three were Interstate 190 interchanges. The 23 interchanges accounted for 31% of the EPDO Total (2,838 of 9,249 points) and 31% of the Total Crashes (1,300 of 4,191 total crashes).

The full *Phase I Report* can be found on our website at www.mrpc.org under *Documents - Reports/Studies/Forms*.

II) Access Safety & Operational Analysis of Route 2 Interchanges and At-Grade Intersections in the MRPC Region (2009)

The analysis covers a 4-year period from 2003-2006. The primary reason for completing this analysis is due to the high number and high severity of crashes occurring on many of the Route 2 interchanges and at-grade intersections as described in our *Phase I Report*. This analysis takes a closer look at the thirty-three (33) Route 2 interchanges and at-grade intersections by identifying unsafe locations such as accel and decel lanes, merging and weaving areas between accel and decel lanes, grade separations or bridges, and ramp and minor street intersections.



The analysis uses our Geographic Information System (GIS) to identify and map unsafe locations and two MassDOT GIS datalayers - the **Crash Datalayers** covering years 2003-2006 were used to develop crash statistics while the 2003-2005 **Crash Clusters datalayer** (see description below) was used to identify and label the locations. The EPDO crash severity rating system was used to calculate the EPDO total of the dangerous locations. The interchanges and at-grade intersections that have dangerous locations are listed in **Table 6** below.

The full analysis can be found on our website at www.mrpc.org under *Documents - Reports/Studies Forms*.

III) Crash Clusters and the MassDOT 2006-2008 Top 200 Intersection Locations Report (2010)

This report covers the 3-year period from 2006-2008. This report identifies the top 200 most unsafe non-interchange intersection locations in the entire State. Unsafe intersection location identification relies on a methodology that locates Crash Clusters (Cluster or Clusters) at an intersection or midblock location by aggregating the crash data that occurs at the location through the use of Geographic Information System (GIS) processes. This method was first used on 2003-2005 crash data to create the *Top 200 High Crash Intersection Locations Report*. The method places a high priority on the geographic location of each crash which allows analysts to better evaluate the total crash experience at a location and relies on RMV crash data over the 3-year period of 2006-2008. According to the MassDOT description of this report, the method is based on the following:

“At the heart of the method ... is a 25 meter fixed search distance around each crash. In basic terms, this radius controls how far the application will search for adjacent crashes. Using a 25 meter radius, the analysis method found nearby crashes and merged their areas together, thus creating clusters. ... the clusters were then ranked by the number of Equivalent Property Damage Only (EPDO) crashes contained within their boundaries.”

Within the MMPO there are three intersections on the list. **Table 4** lists the intersection locations and **Figure 2** below shows the geographic extent of the Clusters and includes less significant Clusters within a 500 foot radius of the intersection.

Table 4: MMPO Intersections in Top 200 Intersection Locations Report

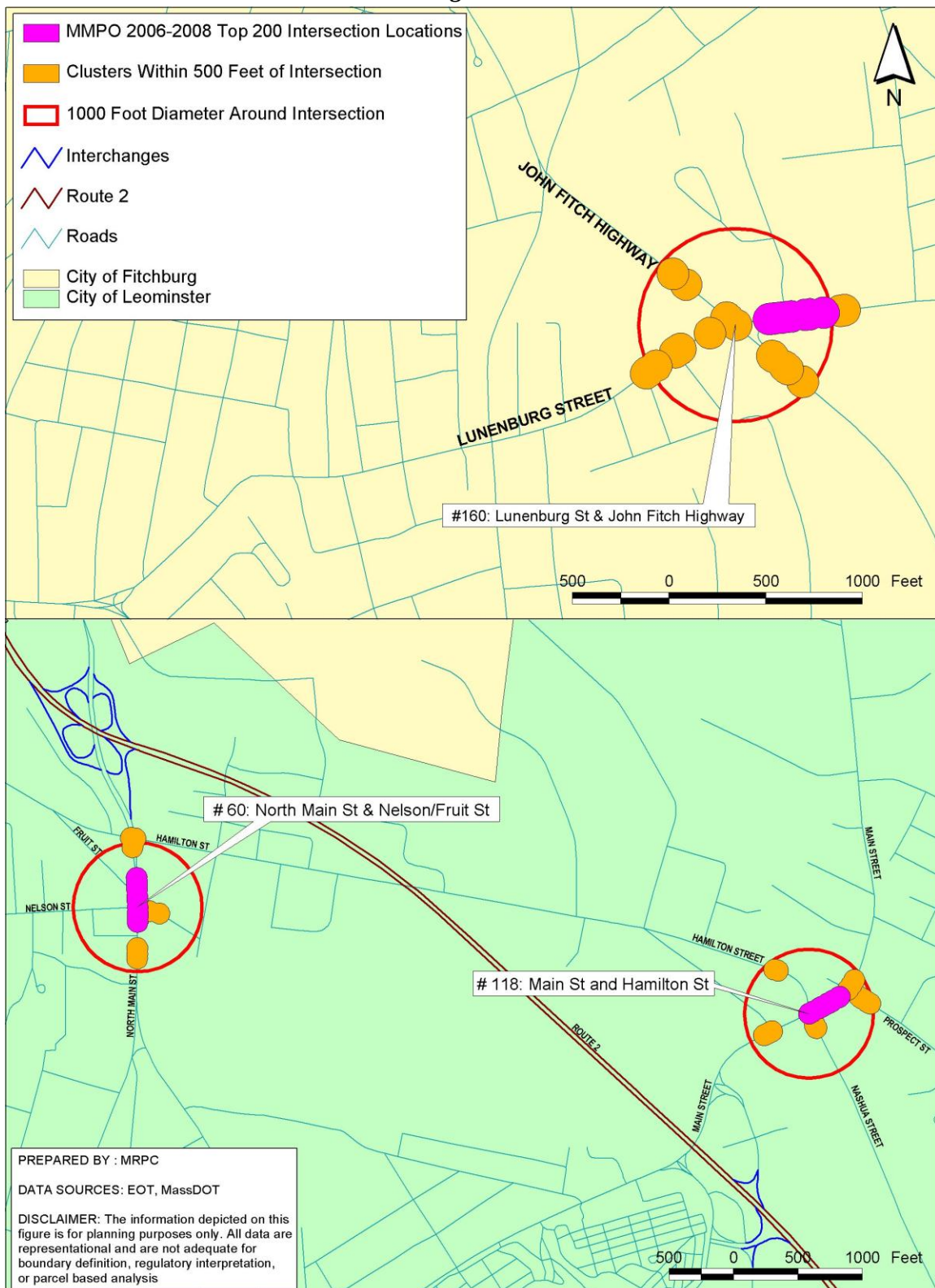
Municipalities	Intersections		Route Number	Crash Count	Non-fatal Injury	EPDO / Rank
Leominster	North Main Street	Fruit Street	12	86	19	162 / 60
Leominster	Main Street	Hamilton Street	13	85	11	129 / 118
Fitchburg	Lunenburg Street	John Fitch Highway	2A	55	15	115 / 160

Historically these intersections have been listed in dangerous location screening tools including the MassDOT *Top 1000 Crash Locations Report*, and the MRPC *Dangerous Intersections and Interchanges* list which are both discussed above.



Studies or RSAs have been prepared for all three intersections. The intersections are listed in **Table 6** below.

Figure 2





IV) HSIP Eligibility & Crash Clusters

In the MMPO during the 3-year period of 2006-2008 the top 5% of Clusters obtained a minimum EPDO point total of 33 points. **Table 5** lists the top 5% Cluster locations of which there are 88. Please note that Cluster locations with a street name in only the **Street 1** column occur at midblock locations of which there are eight. Many of the intersection locations can be found in the above screening tools and in **Table 6** below with the exception of the 29 locations highlighted in red-bolded text which are new locations.

Table 5: MMPO 2006-2008 HSIP Eligible Crash Clusters (continued below)

Municipalities	Crash Cluster Location				Crash Count	Fatal Injury	Non-fatal Injury	EPDO
	Street 1	Route Number	Street 2	Route Number				
LEOMINSTER	CONCORD TURNPIKE	2	NORTH MAIN STREET	12	110		26	214
LEOMINSTER	CONCORD TURNPIKE	2	HAWS STREET		96	1	24	201
LEOMINSTER	NORTH MAIN STREET	12	FRUIT STREET		86		19	162
HARVARD	CONCORD TURNPIKE	2	AYER ROAD	110	83		16	147
LEOMINSTER	MAIN STREET	13	HAMILTON STREET		85		11	129
LEOMINSTER	CONCORD TURNPIKE	2	MERRIAM AVENUE		57		15	117
FITCHBURG	LUNENBURG STREET	2A	JOHN FITCH HIGHWAY		55		15	115
FITCHBURG	WATER STREET	12	WANOOSNOC ROAD		48		12	96
FITCHBURG	SOUTH STREET		WANOOSNOC ROAD		32		15	92
STERLING	REDEMPTION RK TR	140	INTERSTATE 190	I-190	31	1	12	88
FITCHBURG	ROUTE 2	2	PRINCETON ROAD	31	42		11	86
LEOMINSTER	NORTH MAIN STREET	12	LINDELL AVENUE		47		9	83
FITCHBURG	ROUTE 2	2	MOUNT ELAM ROAD		34		12	82
GARDNER	PEARSON BLVD		ELM STREET		46		8	78
FITCHBURG	WHALON STREET		PIERCE AVENUE		30		9	66
WESTMINSTER	ROUTE 2	2	STATE ROAD EAST	2A	24		10	64
FITCHBURG	SUMMER STREET		JOHN FITCH HIGHWAY		24		10	64
LUNENBURG	MASSACHUSETTS AVE	2A	ELECTRIC AVENUE	13	28		9	64
LEOMINSTER	MAIN STREET	13	NORTH STREET		36		7	64
WESTMINSTER	ROUTE 2	2	RAMP-VILLAGE INN RD TO RT 2 EB		27		9	63
STERLING	LEOMINSTER ROAD	12	INTERSTATE 190	I-190	23		9	59
LEOMINSTER	NORTH MAIN STREET	12	ERDMAN WAY		39		5	59
LANCASTER	ROUTE 2	2	RAMP-RT 2 WB TO FORT PD RD		22		9	58
FITCHBURG	SOUTH STREET		OLD SOUTH STREET		25		8	57
FITCHBURG	MAIN STREET	2A	BOULDER DRIVE		29		7	57
TOWNSEND	MAIN STREET	119	SPAULDING STREET		29		7	57
GARDNER	TIMPANY BLVD	68	WEST BROADWAY	2A	33		6	57
STERLING	LEOMINSTER ROAD	12	CHOCKSETT ROAD		37		5	57
GARDNER	MAIN STREET	68	WILLOW STREET		32		6	56
LEOMINSTER	WEST STREET		PARK STREET		32		6	56
TOWNSEND	MAIN STREET	119	SCHOOL STREET	13	40		4	56
CLINTON	MAIN STREET	62	BROOK STREET	62	22		8	54
GARDNER	ROUTE 2	2			21		8	53
LEOMINSTER	MONUMENT SQUARE	12	MAIN STREET	12	33		5	53
LEOMINSTER	INTERSTATE 190	I-190	CONCORD TURNPIKE	2	20		8	52
LANCASTER	ROUTE 2	2	RAMP-RT 2 EB TO OLD TURNPK RD		20		8	52
LEOMINSTER	NEW LANCASTER RD	117			24		7	52
LEOMINSTER	NORTH MAIN STREET	12	HOSPITAL ROAD		27		6	51
LEOMINSTER	MILL STREET		SACK BOULEVARD		30		5	50
LEOMINSTER	MONUMENT SQUARE	12	CENTRAL STREET	12	21		7	49



Table 5 (continued)

Municipalities	Crash Cluster Location							
	Street 1	Route Number	Street 2	Route Number	Crash Count	Fatal Injury	Non-fatal Injury	EPDO
LUNENBURG	MASS AVE	2A	WHITE STREET		21		7	49
GARDNER	ROUTE 2	2			25		6	49
LEOMINSTER	MAIN STREET	13	MONTANA COURT		29		5	49
WINCHENDON	SPRING STREET	12	GLENALLAN STREET		16		8	48
GARDNER	CENTRAL STREET	101	ELM STREET		20		7	48
LEOMINSTR, FITCHB	NORTH MAIN STREET	12	NICHOLS STREET		20		7	48
LEOMINSTER	CENTRAL STREET	12	LITCHFIELD STREET		32		4	48
FITCHBURG	BEMIS ROAD		AIRPORT ROAD		19		7	47
CLINTON	MAIN STREET	62	WATER STREET	110	22		6	46
FITCHBURG	PRATT ROAD		CLARENDON STREET		22		6	46
LANCASTER	ROUTE 2	2	JACKSON ROAD		22		6	46
LANCASTER	MAIN STREET	117	NORTH MAIN STREET		21		6	45
LEOMINSTER	MAIN STREET	13	PROSPECT STREET		25		5	45
FITCHBURG	MAIN STREET		BLOSSOM STREET		25		5	45
LANCSTR,LEOMNSTR	ROUTE 2	2	CONCORD TURNPIKE	2	22	1	3	43
LEOMINSTER	NORTH MAIN ST	12			19		6	43
GARDNER	PARKER STREET	101	OAK STREET		27		4	43
FITCHBURG	MAIN STREET	2A	LUNENBURG STREET	2A	31		3	43
LANCASTER	INTERSTATE 190	I-190	MAIN STREET	117	13	1	5	42
STERLING	REDEMPTION RK TR	140	INTERSTATE 190	I-190	17		6	41
FITCHBURG	LUNENBURG STREET	2A	TOWNSEND STREET		25		4	41
LANCASTER	LUNENBURG ROAD	70	OLD TURNPIKE ROAD		16		6	40
GARDNER	BAKER STREET		PLEASANT STREET		20		5	40
LEOMINSTER	CENTRAL STREET	12	CHERLY DRIVE		15		6	39
LANCSTR,LEOMNSTR	INTERSTATE 190	I-190	MAIN STREET	117	18		5	38
GARDNER	TIMPANY BLVD	68	EMERALD STREET		18		5	38
FITCHBURG	WATER STREET	12	BENSON STREET		18		5	38
LEOMINSTER	NORTH MAIN ST	12			22		4	38
LUNENBURG	CHASE ROAD	13	MASSACHUSETTS AVE	2A	17		5	37
FITCHBURG	WESTMINSTER ST	2A	ASHBURNHAM STREET	12	17		5	37
LANCASTER	ROUTE 2	2	RAMP-RT 2 WB TO FORT PD RD		17		5	37
GARDNER	MAIN STREET	68	EMERALD STREET		21		4	37
STERLING	LEOMINSTER ROAD	12	INTERSTATE 190	I-190	12		6	36
LEOMINSTER	BLOSSOM STREET		MERRIAM AVENUE		16		5	36
LANCASTER	ROUTE 2	2	RAMP-RT 2 EB TO SHIRLEY RD		16		5	36
GROTON	MAIN STREET	119	LOWELL ROAD	40	20		4	36
FITCHBURG	JOHN FITCH HWAY				24		3	36
PHILLIPSTON	MOHAWK TRAIL	202			19		4	35
ASHBURNHAM	WILLIAMS ROAD		COREY HILL ROAD		14		5	34
WESTMINSTER	STATE ROAD EAST	2A	DEPOT ROAD		14		5	34
GROTON	BOSTON ROAD	119	SANDY POND ROAD		14		5	34
GARDNER	CITY HALL AVENUE		MAIN STREET	68	20	1	1	33
LANCASTER	MILL STREET		HIGH STREET	110	9		6	33
WESTMINSTER	MAIN STREET	2A	RAMP-RT 2 EB TO RTS 2A/140	140	13		5	33
LEOMINSTER	MERRIAM AVENUE		WASHINGTON STREET		13		5	33
WESTMINSTER	ROUTE 2	2	RAMP-RT 2 EB TO RT 140		13		5	33
GARDNER	CONANT STREET		TIMPANY BOULEVARD	68	17		4	33
FITCHBURG	SOUTH STREET		ROCKDALE AVENUE		17		4	33



Historical Comparison of Screening Tools; Project Development Status including Locations that Need Study

Table 6, which contains all the locations in Screening Tool I: *Phase I Report*, along with the 29 locations highlighted in red-bolded text in **Table 5** above are MMPO priority locations for further implementation of corrective measures to address safety problems. Other information includes whether or not the locations can be found in other screening tools and provides project development status information. The table shows that 52 of the locations that had safety problems from 2002 – 2005 continue to remain unsafe for years 2006 – 2008.

Table 6 (continued below)

Municipalities	Region Rank	Screening Tools: I, [*] (see below), II, III, IV					Project Development Status for 2012 RTP
		I Phase I Report Locations	*	II	III	IV	
Leominster	1	Rte. 2 (Exit 31)/N Main St. (Rte. 12)	X	X		X	In Design, Listed in 2012 TIP
Leominster	2	Rte. 2 (Exit 32)/Main St. (Rte. 13)	X	X		X	Fitchburg/Leominster/Lunenburg (F/L/L) TAP Study, Updated Safety Study Needed
Lancaster	3	Rte. 2 (Exit 35)/Lunenburg Road (Rte. 70)/Old Union Tnpk./Fort Pond Road	X	X		X	Studies Completed for Old Union & Ft Pond & an RSA completed for Old Union & Rte70 & is Listed in 2012 TIP, Design Completed & Includes Rte 2 Exit 35 EB ON Ramp
Harvard	4	Rte. 2 (Exit 38)/Ayer Rd. (Rte. 110;Rte. 111)	X	X		X	May need RSA, EB & WB Ramps to be Improved, Listed in 2014 TIP
Leominster	5	Main St (Rt 13)/Nashua St/Hamilton St	X		X	X	F/L/L TAP Study, Listed in 2014 TIP, in Design, May Need RSA
Leominster	6	Rte 2/Rte 190		X		X	Needs Study
Leominster	7	Monument Square (Main St/Mechanic St)	X			X	Needs Study
Leominster	8	N Main St. (Rte 12)/Nelson St./Water Tower Pl./Fruit St.	X		X	X	Study & PNF Completed, Improvements Recommended
Westminster	9	Rte. 2/140 (Exit 25)/State Rd. East (Rte 2A)/Hagar Park Rd.		X		X	Study Completed for Rte 2A & Rte 140 Intersection, Improvements Recommended
Sterling	10	Rte. 190 (Exit 6)/Leominster Rd. (Rte. 12)				X	Needs Study
Fitchburg	11	Bemis Rd./John Fitch HWY./Summer St.	X			X	Improvements Completed, Needs Follow Up
Fitchburg	12	John Fitch HWY/Lunenburg St. (Rte.2A)	X		X	X	Safety Audit Completed
Westminster	13	Rte. 2 (Exit 24)/W Main St. (Rte. 140)		X		X	Improvements Completed, Needs Follow Up
Leominster	14	Leominster Connector/Nashua St.	X				Improvements Completed Prior to 2007 RTP, Needs Follow Up
Leominster	15	N Main St (Rte 12)/Lindell Ave./Hamilton St				X	Study Completed, Improvements Recommended
Lancaster	16	Rte. 2 (Exit 36)/Shirley Rd/Fort Pond Rd./Old Union Tnpk		X		X	May need RSA, EB & WB Ramps to be Improved, Listed in 2014 TIP
Fitchburg	17	Rte. 2/Mount Elam Road		X		X	Study Completed, Improvements Recommended
Fitchburg	18	Water St. (Rte. 12)/Wanoosnoc Rd./Bemis Rd.	X			X	Improvements Completed, Needs Follow Up
Gardner	19	Pearl St. (Rte. 101)/Rte. 140					Improvements Completed, Needs Follow Up
Fitchburg	20	South St./Electric Ave./ Old South St.				X	Needs Study
Leominster	21	Merriam Ave./Lindell Ave.	X				In Design, Listed on 2012 TIP
Lunenburg	22	Massachusetts Ave. (Rte. 2A;Rte. 13)/Electric Ave. (Rte. 13)	X			X	Needs Study



Table 6 (continued below)

Municipalities	Region Rank	I Phase I Report Locations	*	II	III	IV	Status for 2012 RTP
Westminster	22	Rte. 2 (Exit 27)/Depot Rd./Narrows Rd. (Exit also in Fitchburg)		X		X	Needs Study
Fitchburg	24	South St./Wanoosnoc Rd./Whalon St.				X	Needs Study
Fitchburg	25	Rte. 2 (Exit 28)/Princeton Rd. (Rte. 31)		X		X	Needs Study
Phillipston	26	Rte. 2 (Exit 19)/Rte. 2A/Rte. 202 (Exit also in Templeton)		X			Needs Study
Leominster	27	Hamilton St./Crawford St./River St.	X				Improvements Completed, Needs Follow Up
Lunenburg	28	Massachusetts Ave. (Rte. 2A;Rte. 13)/Chase Rd. (Rte. 13)					Needs Study
Gardner	29	Rte. 2 (Exit 22)/Pearson BLVD.		X			Improvements Completed, Needs Follow Up
Gardner	30	Elm St./Central St.(Rte.101)/Pearl St.(Rte.101)/Green St.				X	Needs Study
Leominster	31	Central St. (Rte 12)/Litchfield St.				X	Needs Study
Lancaster	32	Rte. 2 (Exit 37)/Jackson Rd.		X		X	Improvements Completed, Needs Follow Up
Gardner	33	West Broadway (Rte.2A)/Timpany BLVD. (Rte.68)				X	Needs Study
Fitchburg	34	Bemis Rd./Airport Rd.				X	Needs Study
Sterling	34	Leominster Rd. (Rte. 12)/Chocksett Rd.				X	In Design, Listed in TIP Appendix , Safety Audit Recommended
Leominster	36	Rte. 2 (Exit 30)/Merriam Ave./Whalon St. (also in Fitchburg)		X		X	Study Completed for EB ON Ramp, Improvements Recommended, Safety Audit Recommended
Fitchburg	37	Rte.2 (Exit 30)/Whalon St./Merriam Ave. (Exit also in Leominster)		X			Needs Study
Lancaster	38	Rte. 190 (Exit 7)/N Main St (Rte. 117)				X	Improvements Completed, Needs Follow Up
Templeton	39	Rte. 2 (Exit 21)/Patriots Rd. (Rte. 2A)		X			Needs Study
Fitchburg	40	Kimble St. (Rte.12)/Laurel St./Cross St./Putnam St.					Needs Study
Townsend	41	Main St. (Rte. 119)/Elm St. (Rte. 13)					Needs Study
Leominster	42	Mechanic St. / Water St. (Depot Sq.)					Needs Study
Fitchburg	43	Mechanic St. (Rte.31)/John Fitch Hwy/ Rindge Rd. /Ashby State. Rd.	X				Improvements Completed, Needs Follow Up
Fitchburg	44	Main St. (Rte. 2A)/Rollstone St./Academy St.					Needs Study
Leominster	45	N Main St (Rte 12)/Erdman Way				X	Improvements Completed, Needs Follow Up
Gardner	46	Rte. 2 (Exit 23)/Timpany BLVD.		X			Improvements Completed, Needs Follow Up
Fitchburg	47	Water St. (Rte. 12)/Main St. (Rte. 2A)/Day St.					Needs Study
Leominster	48	Main St (Rte 13)/River St	X				F/L/L TAP Study, Listed in 2014 TIP, in Design
Gardner	49	Elm St./Temple St.					Needs Study
Sterling	50	Rte. 190 (Exit 5)/Redemption Rock Tr (Rte. 140)				X	Needs Study
Leominster	51	Main St. (Rte 13)/North St.				X	Improvements Completed, Needs Follow Up



Table 6 (continued below)

Municipalities	Region Rank	I Phase I Report Locations	*	II	III	IV	Status for 2012 RTP
Clinton	52	Main St. (Rte.70)/Brook St. (Rte.62)				X	Improvements Completed, Needs Follow Up
Gardner	53	Parker St. (Rte. 101)/Nichols St.					Needs Study
Fitchburg	54	Main St. (Rte 2A)/North St.					Improvements Completed, Needs Follow Up
Lunenburg	54	Massachusetts Ave. (Rte. 2A)/White St.				X	Needs Study
Leominster	56	N Main St. (Rte 12)/State St./Holman Ave.	X				Improvements Completed, Needs Follow Up
Leominster	57	Central St. (Rte 12)/Grant St./Beth Ave.					Needs Study
Townsend	58	Main St. (Rte. 119)/West Elm St./Canal St.					Needs Study
Fitchburg	59	Summer St./Harvard St.					Improvements Completed, Needs Follow Up
Leominster	59	Central St (Rte 12)/Willard St.					Improvements Completed, Needs Follow Up
Leominster	61	Mill St./Haws St./Sack Blvd				X	Needs Study
Winchendon	62	Spring St. (Rte 12)/ Glenallan St. (Rte 202)/ Hall Rd.				X	Needs Study
Leominster	63	Rte. 2 (Exit 34)/Mechanic St./Harvard St.		X		X	Improvements Completed, Needs Follow Up
Leominster	64	Merriam Ave./Washington St.				X	Needs Study
Leominster	65	Main St (Rt 13)/Prospect St.				X	Improvements Completed, Needs Follow Up
Fitchburg	66	Westminster St. (Rte. 2A)/Princeton Rd. (Rte. 12)					Needs Study
Leominster	67	Main St. (Rte 13)/N Main St. (Rte 12)/High St./Mill St.					Needs Study
Athol	68	South Main St. (Rte 2A)/Daniel Shays HWY					Needs Study
Groton	68	Main St. (Rte. 119,Rte. 225)/Lowell Rd. (Rte. 40)/Broadmeadow Rd.				X	Needs Study
Leominster	70	N Main St (Rte 12)/Nichols St./Battles St.				X	Improvements Completed, Needs Follow Up
Leominster	71	Main St. (Rte 13)/Haws St.					In Design, Listed in 2014 TIP, Safety Audit Recommended
Fitchburg	72	Bemis Rd./Intervale Rd.					Needs Study
Leominster	73	Main St. (Rte 12)/Merriam Ave./Columbia St.					Needs Study
Fitchburg	74	Water St. (Rte. 12)/Benson St.				X	Improvements Completed, Needs Follow Up
Leominster	75	Lancaster St. (Rte 117)/Elm Hill Ave.					Needs Study
Leominster	75	Merriam Ave./Blossom St.				X	Needs Study
Gardner	77	Timpany BLVD. (Rte. 68)/American Legion Circle					Needs Study
Lancaster	78	5 Corners - High St. Ext.(Rte.110)/Bolton Rd.(Rte.110)/Center Bridge Rd./Old Common Rd.					Study Completed, Improvements Recommended, Not HSIP Eligible as crash numbers decreased substantially
Sterling	79	Redemption Rock Trail (Rte. 140)/Princeton Rd. (Rte. 62)					Study Completed, Improvements Recommended, Safety Audit Recommended
Ayer	80	Carlton Circle					Needs Study



Table 6 (continued below)

Municipalities	Region Rank	I Phase I Report Locations	*	II	III	IV	Status for 2012 RTP
Fitchburg	81	Lunenburg St. (Rte. 2A)/Klondike Ave.					Needs Study
Phillipston	81	Rte. 2 (Exit 18)/Templeton Rd. (Exit also in Athol)		X			Needs Study
Leominster	83	Mechanic St./3RD St./Walker St.					Needs Study
Westminster	83	W Main St. (Rte. 140)/Simplex Drive					Improvements Completed, Needs Follow Up
Fitchburg	85	Main St. (Rte. 2A)/Central St./Boulder Dr.				X	Needs Study
Lancaster	85	Main St. (Rte.117)/Lunenburg Rd. (Rte. 70)					Study Completed, Improvements Recommended
Fitchburg	86	Main St. (Rte. 2A)/Oliver St.					Needs Study
Groton	86	Town Line Rd. (Rte. 119)/Proctor Rd./Townsend Rd.					Study Completed, Improvements Recommended, Safety Audit Recommended
Leominster	86	N Main St (Rte 12)/Washington St./Grove Ave.					Study Completed, Improvements Recommended
Harvard	89	Ayer Rd. (Rte. 110;Rte. 111)/Poor Farm Rd./Lancaster County Rd.					Needs Study
Athol	91	Main St. (Rte.2A)/Exchange St.					Needs Study
Fitchburg	92	Main St. (Rte.2A)/Summer St./ Lunenburg St. (Rte. 2A)				X	Needs Study
Leominster	93	Mechanic St./Fifth St.					Needs Study
Leominster	94	Main St (Rte 13)/Day St					Needs Study
Athol	95	Rte. 2 (Exit 17)/Rte. 2/Rte. 31		X			Needs Study
Fitchburg	95	Lunenburg St. (Rte.2A)/Townsend St./Boutelle St.	X			X	Needs Study
Templeton	95	Gardner Rd. (Rte. 101)/Patriots Rd. (Rte. 2A)/N Main St./S Main St.					Study Completed, Improvements Recommended, Safety Audit Recommended
Leominster	98	Mechanic St./Leominster Connector/Commercial Rd					Needs Study
Athol	99	Main St. (Rte. 32)/Chestnut St.					Improvements Completed, Needs Follow Up
Fitchburg	99	River St. (Rte. 2A;Rte. 31)/Main St. (Rte. 2A)					Needs Study
Fitchburg	101	Electric Ave./Rollston Rd.					Study Completed, Improvements Recommended
Leominster	101	Central St. (Rte 12)/Union St./Adams St.					Needs Study
Westminster	101	Rte. 2 (Exit 26)/Village Inn Rd.		X		X	Needs Study
Ashburnham	104	Center St. (Rte. 101)/Corey Hill Rd./ Williams Rd.				X	Study Completed, Improvements Recommended, Safety Audit Recommended
Clinton	105	Main St. (Rte.70;Rte.62;Rte110)/Union St. (Rte.70;Rte.62)					Needs Study
Fitchburg	105	Electric Ave./Mount Elam Rd.					Needs Study
Leominster	105	Lancaster St. (Rte 117)/Willard St.					Improvements Completed, Needs Follow Up
Lunenburg	105	Chase Rd. (Rte. 13)/West Townsend Rd.					Needs Study
Westminster	105	State Rd. East (Rte. 2A)/Depot Rd./Bartherick Rd.				X	Study Completed, Improvements Recommended, Safety Audit Recommended
Winchendon	110	Front St. (Rte 12 & 202)/ School St. (Rte 12)/ River St. (Rte 202)					Study Completed, Improvements Recommended, Safety Audit Recommended



Table 6 (continued)

Municipalities	Region Rank	I Phase I Report Locations	*	II	III	IV	Status for 2012 RTP
Groton	111	Main St. (Rte. 119;Rte. 111)/Fitchs Bridge Rd.					Needs Study
Fitchburg	112	Clarendon St./Pratt St.				X	Needs Study
Leominster	113	N Main St (Rte 12)/Hospital Rd				X	Needs Study
Clinton	114	Water St. (Rte.110)/Main St. (Rte.70)				X	Improvements Completed, Needs Follow Up
*The 2005 Top 1000 High Crash Locations Report (1999-2001 Crash Data)							

Of the 114 locations listed in **Table 6**, eight have projects listed in the 4-year 2012-2015 TIP, 17 have been studied and improvements have been recommended, 26 have had projects completed over the last several years and need follow-up studies. The remaining 62 locations are in need of study.

Focus areas over the next 4-years will be to move the locations that have been studied forward onto the TIP, conduct studies (RSAs) of at least the top 10 locations in need of study based on EPDO including locations in **Table 5** above, and begin to conduct follow-up studies at locations that have had projects completed. Potential corrective countermeasures can be found under the **Final Recommendations** section below. Other focus areas include identifying locations and projects that fall within environmental justice areas and to determine ownership.

Lane Departure Crashes

Lane departure crashes are defined as non-intersection crashes where a vehicle leaves its designated lane under the following situations:

- Single vehicle leaves the designated driving lane and road without striking another vehicle and collide with an object such as a utility pole, tree, guardrail, embankment or side slope, light pole, ditch, fence, median barrier, etc. These accounted for 64% of the LDCs that occurred in the MMPO. **Table 8** below provides details and is sorted by the *Municipal Total* column
- Vehicle leaves the designated driving lane that results in a head-on or sideswipe crash with oncoming vehicle or parked vehicle. These accounted for 36% of LDCs that occurred in the MMPO. **Table 7** provides details and is sorted by the *Total LDCs* column

MMPO Lane Departure Crash (LDC) Characteristics

Figure 3 below shows all MMPO LDCs and overlays them on municipalities. LDCs accounted for 21% (3,162) of the total number of crashes in the MMPO region, 22% (789) of the non-fatal injury crashes, but most notably 53% (28 of 53) of the fatal injury crashes.

Table 7

Municipalities	Total LDCs	Crash Severity		Crash Manner*	
		Fatal Injury	Non-fatal Injury	Head-on	Sideswipe
FITCHBURG	670	4	141	45	259
LEOMINSTER	561	3	136	39	224
GARDNER	358	3	61	22	148
WESTMINSTER	200	2	71	9	37
LUNENBURG	153	2	42	7	29
GROTON	152	1	43	12	27
HARVARD	152	0	43	3	23
TEMPLETON	130	0	28	4	22
STERLING	113	2	33	7	25
TOWNSEND	112	1	35	7	14
LANCASTER	106	3	41	9	32
ATHOL	87	2	22	11	24
ASHBURNHAM	73	0	19	3	7
AYER	61	1	17	4	18
WINCHENDON	55	1	15	9	9
SHIRLEY	50	1	11	2	5
ASHBY	40	0	13	1	3
PHILLIPSTON	36	1	9	3	4
CLINTON	33	0	5	3	20
PETERSHAM	14	1	3	0	3
HUBBARDSTON	6	0	1	2	4
TOTALS	3,162	28	789	202	937
*LD Crashes involving at least 2 Vehicles					

Total LDCs –

The combined municipalities having a total crash range between:

- 350 and 670 (yellow) - Fitchburg, Leominster, and Gardner combined to account for 50.3% of the total LDCs
- 100 and 200 (green) - Westminster, Lunenburg, Groton, Harvard, Templeton, Sterling, Townsend, and Lancaster combined to account for 35.4% of total LDCs

- 0 and 90 (blue) - Athol, Ashburnham, Ayer, Winchendon, Shirley, Ashby, Phillipston, Clinton, Petersham, and Hubbardston combined to account for 14.4% of total LDCs
- No LDCs occurred in Royalston

Fatal Injury Crashes –

The combined municipalities having a fatal injury crash range between:

- 3 and 4 (yellow) - Fitchburg, Leominster, Gardner, and Lancaster combined to account for 46.4% of total fatal injury LDCs
- 2 (no range) (green) - Westminster, Lunenburg, Sterling, and Athol combined to account for 28.6% of total fatal injury LDCs
- 1 (no range) (blue) - Groton, Townsend, Ayer, Winchendon, Shirley, Phillipston, and Petersham combined to account for 25% of total fatal injury LDCs

Non-fatal Injury Crashes –

The combined municipalities having a non-fatal injury crash range between:

- 130 and 150 (yellow) - Fitchburg and Leominster combined to account for 35.1% of total non-fatal injury LDCs
- 50 and 129 (green) - Westminster and Gardner combined to account for 16.7% of total non-fatal injury LDCs
- 30 and 49 (blue) - Groton, Harvard, Lunenburg, Lancaster, Townsend, and Sterling combined to account for 30% of total non-fatal injury LDCs
- 10 and 29 (brown) - Templeton, Athol, Ashburnham, Ayer, Winchendon, Ashby, and Shirley combined to account for 15.8% of total non-fatal injury LDCs
- 0 and 9 (dark blue) - Phillipston, Clinton, Petersham, and Hubbardston combined to account for 2.3% of total non-fatal injury LDCs

Head-on Crashes –

The combined municipalities having a head-on crash range between:

- 30 and 50 (yellow) - Fitchburg and Leominster combined to account for 41.6% of total head-on LDCs
- 10 and 49 (green) - Gardner, Groton, and Athol combined to account for 22.3% of total head-on LDCs
- 5 and 9 (blue) - Westminster, Lancaster, Winchendon, Lunenburg, Townsend, and Sterling combined to account for 23.8% of total head-on LDCs
- 0 and 4 (brown) - Templeton, Ayer, Harvard, Ashburnham, Phillipston, Clinton, Shirley, Hubbardston, and Ashby combined to account for 12.4% of total head-on LDCs

Sideswipe Crashes –

The combined municipalities having a sideswipe crash range between:

- 140 and 260 (yellow) - Fitchburg, Leominster, and Gardner combined to account for 67.3% of total sideswipe LDCs
- 20 and 139 (green) - Westminster, Lancaster, Lunenburg, Groton, Sterling, Athol, Harvard, Templeton, and Clinton combined to account for 25.5% of total sideswipe LDCs

- 0 and 19 (blue) - Ayer, Townsend, Winchendon, Ashburnham, Shirley, Phillipston, Hubbardston, Ashby, and Petersham combined to account for 7.2% of total sideswipe LDCs

Single Vehicle LDCs –

Table 8 shows the most harmful events, or collision with types, for single vehicle LDCs that occurred in the MMPO. The top three Most Harmful Events accounted for 64% of Single Vehicle LDCs:

- Utility Pole - 24.5%; Tree - 23.8%; Guardrail - 15.8%

The combined municipalities having a Single Vehicle LDC range between:

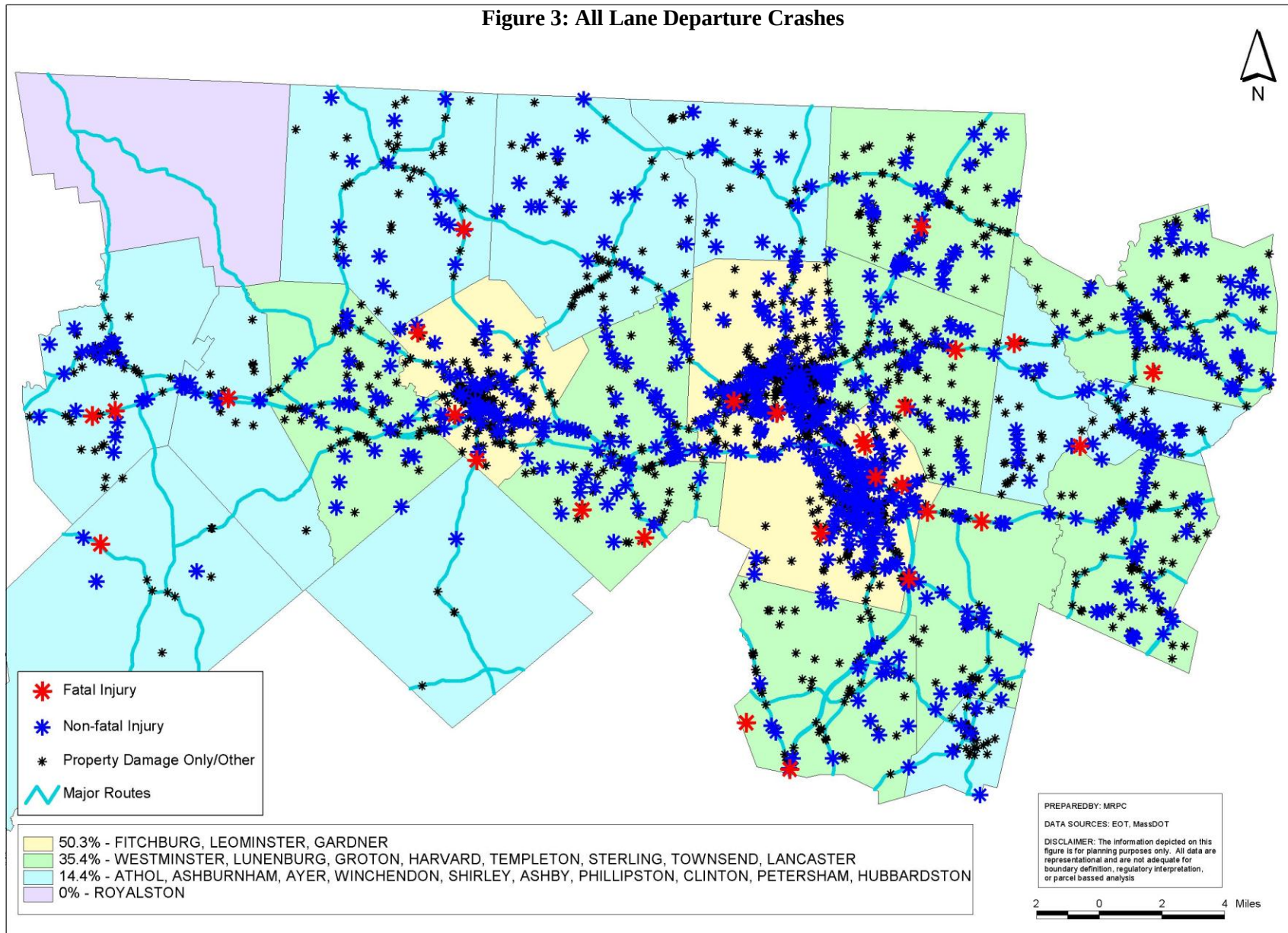
- 180 and 370 (yellow) - Fitchburg, Leominster, and Gardner combined to account for 42.1% of total Single Vehicle LDCs
- 100 and 179 (green) - Westminster, Harvard, Lunenburg, Groton, and Templeton combined to account for 30.4% of total Single Vehicle LDCs
- 50 and 99 (blue) - Townsend, Sterling, Lancaster, Ashburnham, and Athol combined to account for 17.4% of total Single Vehicle LDCs
- 0 and 49 (brown) - Shirley, Ayer, Winchendon, Ashby, Phillipston, Petersham, and Clinton combined to account for 10.1% of total Single Vehicle LDCs
- No Single Vehicle LDCs occurred in Hubbardston

Table 8

Municipalities	Most Harmful Event (Collision with)*									Municipal Total
	Utility Pole	Tree	Guardrail	Other Fixed Object	Embankment	Light Pole/ Other	Ditch	Fence	Other Total	
FITCHBURG	117	56	32	46	8	17	11	30	49	366
LEOMINSTER	93	46	30	36	14	22	2	9	46	298
GARDNER	48	27	34	21	11	11	9	4	23	188
WESTMINSTER	20	49	37	10	8	1	5	0	24	154
HARVARD	34	22	35	18	5	3	6	1	2	126
LUNENBURG	30	50	6	10	7	4	2	3	5	117
GROTON	32	40	12	6	6	3	3	1	10	113
TEMPLETON	11	22	35	3	5	6	9	2	11	104
TOWNSEND	23	36	4	4	5	4	5	2	8	91
STERLING	4	25	23	8	7	1	1	2	10	81
LANCASTER	6	15	26	4	2	1	3	1	7	65
ASHBURNHAM	14	21	9	7	4	2	2	1	3	63
ATHOL	11	4	11	9	1	5	3	3	5	52
SHIRLEY	15	12	6	3	1	1	0	0	5	43
AYER	13	9	0	5	1	3	0	2	6	39
WINCHENDON	8	16	3	1	3	1	1	1	3	37
ASHBY	9	13	4	3	1	0	0	1	5	36
PHILLIPSTON	3	8	10	0	2	0	3	0	3	29
PETERSHAM	0	7	2	1	0	0	1	0	0	11
CLINTON	5	3	0	1	0	1	0	0	0	10
HUBBARDSTON	0	0	0	0	0	0	0	0	0	0
TOTALS	496	481	319	196	91	86	66	63	225	2023
*LD Crashes involving Single Vehicles Only										



Figure 3: All Lane Departure Crashes





HSIP Eligible Roadways and LDCs

The 2007 RTP provided a list of roadways that experienced a minimum of three to four fatal and/or incapacitating injury crashes in the MMPO which are HSIP eligible. The list is replicated below:

- Route 2A (Patriots Road) in Templeton
- Green Street in Gardner (Including Route 140 section)
- Route 13 (Fitchburg Road) in Townsend
- Route 119 (Boston Road) in Groton
- Route 12 in Leominster (from Fitchburg CL to Sterling TL)
- Route 2 in Harvard (from Lancaster TL to Littleton TL)
- Route 495 in Harvard

From 2002-2008 LDCs remained a problem on most of these roadways with the exception of Route 495 in Harvard which experienced only two non-fatal injury LDCs. Also, based on the new information provided above concerning other roadways that includes an increase in fatal injury crashes and the 53% share held by LDCs one of the goals of the 2012 RTP will be to identify additional roadways that will need to be studied (or conduct road safety audits) so that countermeasures can be developed and implemented through the TIP.

Potential countermeasures can be found under the **Final Recommendations** section below.

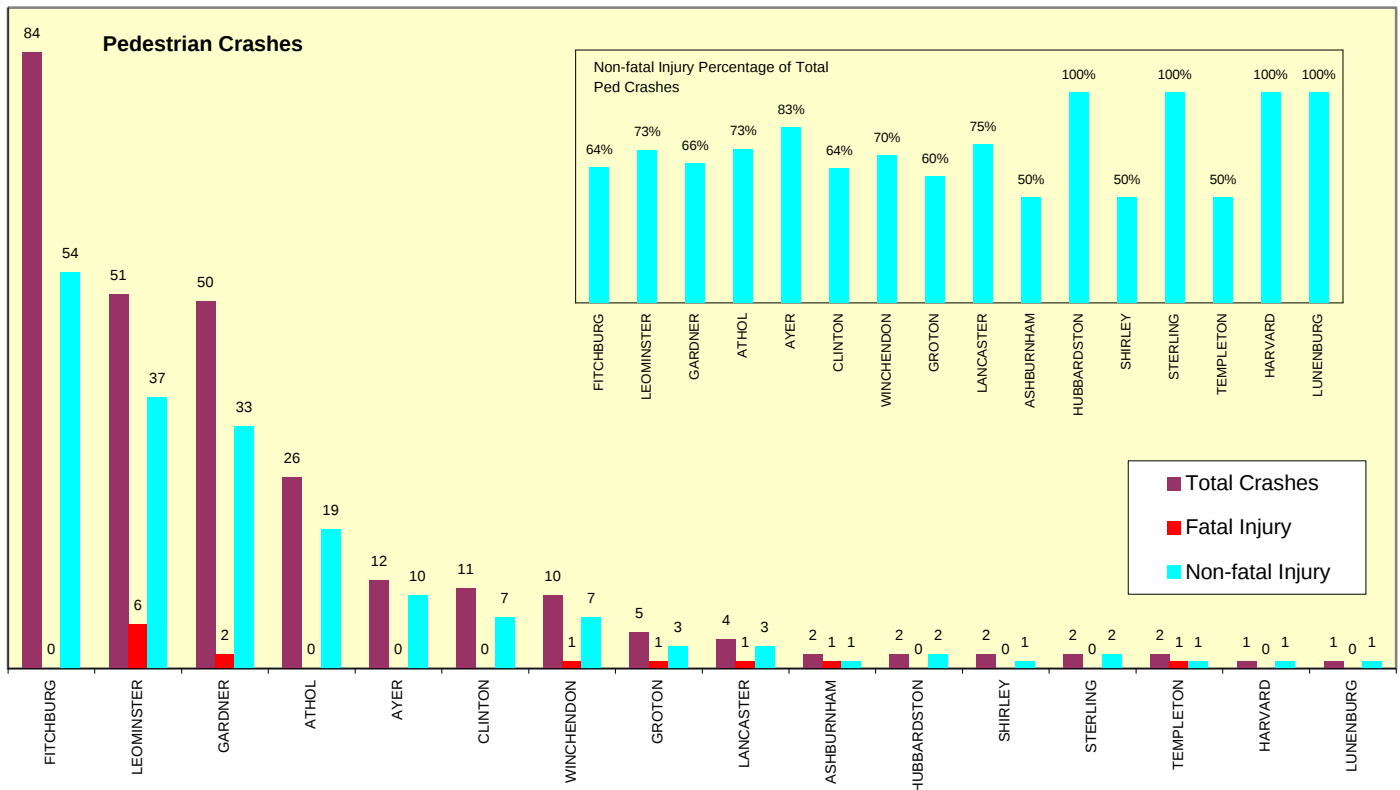


Pedestrian and Bicycle Crashes

Pedestrian Crashes

Figure 4 shows MMPO municipalities where 265 crashes involving pedestrians (PED) occurred. A focus during the next 4-years covered by the MMPO 2012 RTP will be to identify locations and projects that fall within environmental justice areas and to determine ownership.

Figure 4: 2002-2008 PED Crashes in the MMPO



Total Crashes –

The combined municipalities having a PED crash range between:

- 50 and 100 - Fitchburg, Leominster, and Gardner combined to account for 69.8% of total PED crashes
- 10 and 49 - Athol, Ayer, Clinton, and Winchendon combined to account for 22.3% of total PED crashes
- 1 and 9 - Groton, Lancaster, Ashburnham, Hubbardston, Shirley, Sterling, Templeton, Harvard, and Lunenburg combined to account for 7.9% of total PED crashes

Fatal Injury Crashes –

The combined municipalities having a PED fatal injury crash range between:

- 6 (no range) - Leominster stands alone in accounting for 46.2% of total PED fatal injury crashes



- 0 and 5 - Gardner, Winchendon, Groton, Lancaster, Ashburnham, and Templeton combined to account for 53.8% of total PED fatal injury crashes

Combined Fatal and Non-fatal Injury Crashes –

The combined municipalities having a PED fatal and non-fatal injury crash range between:

- 35 and 60 - Fitchburg, Leominster, and Gardner combined to account for 49.8% of total PED crashes
- 5 and 34 - Athol, Ayer, Clinton, and Winchendon combined to account for 16.6% of total PED crashes
- 0 and 4 - Groton, Lancaster, Ashburnham, Hubbardston, Shirley, Sterling, Templeton, Harvard, and Lunenburg combined to account for 7.2% of total PED crashes

Overall only 5% of the PED crashes resulted in a fatal injury crash but 69% of the PED crashes resulted in a non-fatal injury. Combined 73.6% of PED crashes resulted in either a fatal or non-fatal injury. No municipality with a minimum of 10 PED crashes had a non-fatal injury percentage below 64%.

Pedestrian High Crash Locations –

Table 9 shows the top 12 PED crash locations based on a minimum of three total PED crashes. The top two locations are HSIP eligible and are located in Fitchburg.

- In all 36 locations experienced two or more PED crashes
- Locations with two PED crashes account for 67% (24) of the 36 locations
- Only one PED fatal injury crash occurred at the 36 locations. It occurred in Gardner at the Pleasant Street at Main Street (Route 68) intersection
- Only 37% (99 of 265) of the total PED crashes occurred at the 36 locations
- Only 25% (65 of 265) of the total PED crashes that occurred at the 36 locations were non-fatal injury crashes
- The PED EPDO total of all 36 locations was 368 points
- The top 12 locations accounted for 53% (196 of 368) of the PED EPDO total of all 36 locations
- Fitchburg locations accounted for 35% (127 of 368) of the PED EPDO total for the 36 locations followed by Gardner with 22% (82 points)

Table 9

Municipalities	Street 1	Route #	Street 2	Rte #	Crash Count	Fatal Injury Crash	Non-fatal Injury Crash	EPDO
FITCHBURG	MAIN STREET	2A EB	HAYDEN PASSWAY		13	0	10	53
FITCHBURG	MAIN STREET	2A EB	BOULDER DRIVE		5	0	3	17
LEOMINSTER	CENTRAL STREET	R12 NB			4	0	4	20
GARDNER	PLEASANT STREET		MAIN STREET	68 NB	4	1	1	17
ATHOL	MAIN STREET	2A EB	EXCHANGE STREET		4	0	2	12
GARDNER	MAIN STREET		WASHINGTON STREET		3	0	3	15
LEOMINSTER	MONUMENT SQ	12 NB	PARK STREET		3	0	3	15
FITCHBURG	PEARL STREET		NORTH STREET		3	0	3	15
WINCHENDON	CENTRAL STREET	202 NB			3	0	2	11
GARDNER	PARKER STREET	101 NB	OAK STREET		3	0	1	7
GARDNER	PEARSON BLVD		ELM STREET		3	0	1	7
LEOMINSTER	MAIN STREET	12 NB	MERRIAM AVENUE		3	0	1	7



- With a PED EPDO total of 53 points, the Main Street at Hayden Passway intersection in Fitchburg surpassed the closest PED EPDO total by 33 points. The Gardner Central Street (Route 68) location had an PED EPDO total of 20 points

Pedestrian Single Crash Locations –

The remaining balance of 166 crashes occurred as follows:

- 75% (125 crashes) occurred at midblock locations
- 25% (41 crashes) occurred at intersection locations

Bicycle Crashes

From 2002-2008 150 crashes involving bicycles occurred in the MMPO. Fitchburg experienced the highest at 37% (56 crashes), followed by Leominster with 21% (31 crashes); Gardner 15% (23 crashes); then Athol and Ayer with 5% each (eight crashes each). The remaining 13% (24 crashes) were dispersed among 11 municipalities. The Main Street at Hayden Passway location is HSIP eligible.

If bicycle crashes are considered separately from either motor vehicle in traffic (MVTR) crashes or PED crashes they are not a significant safety issue in the MMPO. However, when they are overlapped at locations where a high number of MVTR and/or PED crash occurred the results reveals additional safety concerns at those locations. **Table 10** shows seven bicycle crash locations where a minimum of two bicycle crashes occurred and where a significant number of MVTR and PED crash occurred.

Table 10

Locations where a Minimum of 2 Bicycle Crashes Occurred									
ID	Municipalities	Street 1	Route #	Street 2	Rte #	Crash Count	Fatal Injury Crash	Non-fatal Injury Crash	EPDO
1B	LEOMINSTER	PLEASANT STREET		ADAMS STREET		2	0	1	6
		LANCASTER STREET	117 EB	CENTRAL STREET	12 NB	2	0	1	6
2B	GARDNER	MAIN STREET		PINE STREET		2	0	1	6
3B	FITCHBURG	MAIN STREET	2A EB	HAYDEN PASSWAY		4	0	3	16
		MAIN STREET	2A EB	BOULDER DRIVE		3	0	1	7
		LAUREL STREET	2A EB	PAYSON STREET		2	0	2	10
4B	FITCHBURG	LUNENBURG STREET	2A EB	REDMAN PLACE		2	0	1	6
and Nearby Pedestrian & Motor Vehicle in Traffic Crashes (MVTR) to Above Bicycle Locations									
ID	Municipalities	Street 1	Route #	Street 2	Rte #	PED Crash Total	MVTR Crash Total		
1B	LEOMINSTER	CENTRAL STREET	12 NB			10	212		
		MONUMENT SQUARE	12 NB	PARK STREET					
		MAIN STREET	12 NB	MERRIAM AVENUE					
2B	GARDNER	MAIN STREET		WASHINGTON STREET		3	14		
3B	FITCHBURG	MAIN STREET	2A EB	HAYDEN PASSWAY		22	219		
		MAIN STREET	2A EB	BOULDER DRIVE					
		LAUREL STREET	2A EB	SOUTH STREET					
		LUNENBURG STREET	2A EB	SUMMER STREET					
4B	FITCHBURG	BOUTELLE STREET		BERRY STREET		2	41		



- ID 3B in Fitchburg - these locations are within approximately 5/6 of a mile of each other where nine bicycle, 22 PED, and 219 MVTR crashes occurred
- ID 1B Leominster - these locations are within approximately 1/2 of a mile of each other where four bicycle, 10 PED, and 212 MVTR crashes occurred
- ID 4B in Fitchburg - these locations are within approximately 1/3 of a mile of each other where two bicycle, two PED, and 41 MVTR crashes occurred
- ID 4B in Gardner - these locations are within approximately 930 feet of each other where two bicycle, three PED, and 14 MVTR crashes occurred

A focus during the next 4-years covered by the MMPO 2012 RTP will be to identify locations and projects that fall within environmental justice areas and to determine ownership.

Safety and Environmental Justice

The purpose of this section is to conduct a preliminary analysis of roadway safety problems based on block group share of population below poverty level income and minority share of block group population within the MMPO. See **Figures 5** and **6** below for the block groups. A focus during the next 4-years covered by the MMPO 2012 RTP will be to identify locations that are HSIP eligible and HSIP projects within environmental justice areas.

Total Crashes

Table 11 below shows the percentage of total crashes per percentage share of population below poverty level income per Census block group and percentage share of minority population per Census block group.

Total Crashes and Population Below Poverty Level Income (PBPLI) –

There appears to be an inverse relationship between total crashes and PBPLI. The lower the PBPLI of a block group the higher the total number of crashes. The two most descriptive examples are:

- Block groups with between 0% - 5% PBPLI account for 39% of the total crashes
- Block groups with between 40% - 78% PBPLI account for only 1% of the total crashes

Total Crashes and Minority Share of Population (MSP) –

For the most part there appears to be an inverse relationship between total crashes and MSP with the exception of the 20% to 40% range. The three most descriptive examples are:

- Block groups with between 0% - 5% MSP account for 30% of the total crashes
- Block groups with between 20% - 40% MSP account for 26% of the total crashes
- Block groups with between 40% - 76% MSP account for only 6% of the total crashes

**Table 11**

Total Crash Percentage per Block Group					
Rank	Share of Population Below Poverty Level Income	Percent of Total Crashes	Rank	Minority Share of Population	Percent of Total Crashes
1	0-5%	39%	1	0-5%	30%
2	5-10%	24%	2	20-40%	26%
3	10-15%	19%	3	5-10%	19%
4	15-20%	7%	4	10-15%	13%
5	20-30%	7%	5	15-20%	6%
6	30-40%	3%	na	na	na
7	40-78%	1%	5	40-76%	6%
	Total	100%		Total	100%

Fatal and Non-fatal Injury Crashes

Figure 5 below shows the percentage of fatal and non-fatal injury crashes per percentage share of population below poverty level income per Census block group.

Figure 6 below shows the percentage of fatal and non-fatal injury crashes per percentage share of minority population per Census block group.

Fatal and Non-fatal Injury Crashes and PBPLI –

There appears to be an inverse relationship between fatal and non-fatal injury crashes and PBPLI. The lower the PBPLI of a block group the higher the number of fatal and non-fatal injury crashes. The two most descriptive examples are:

- Block groups with between 0% - 5% PBPLI account for 44% of the fatal & non-fatal injury crashes
- Block groups with between 40% - 78% PBPLI account for only 1% of the total fatal & non-fatal injury crashes

Fatal and Non-fatal Injury Crashes and MSP –

For the most part there appears to be an inverse relationship between total crashes and MSP with the exception of the 20% to 40% range. The three most descriptive examples are:

- Block groups with between 0% - 5% MSP account for 30% of the fatal & non-fatal injury crashes
- Block groups with between 20% - 40% MSP account for 24% of the fatal & non-fatal injury crashes
- Block groups with between 40% - 76% MSP account for only 5% of the fatal & non-fatal injury crashes



Figure 5

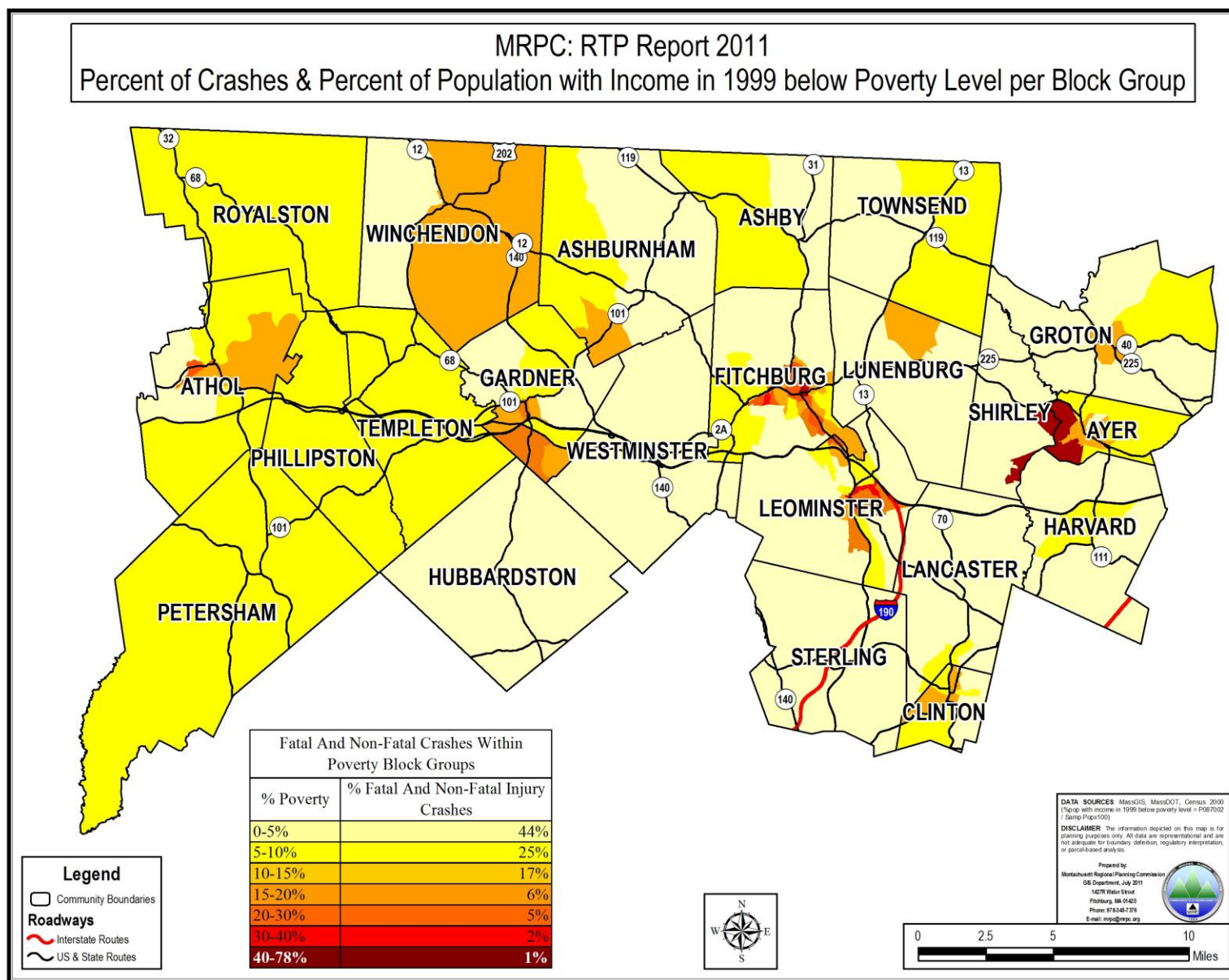
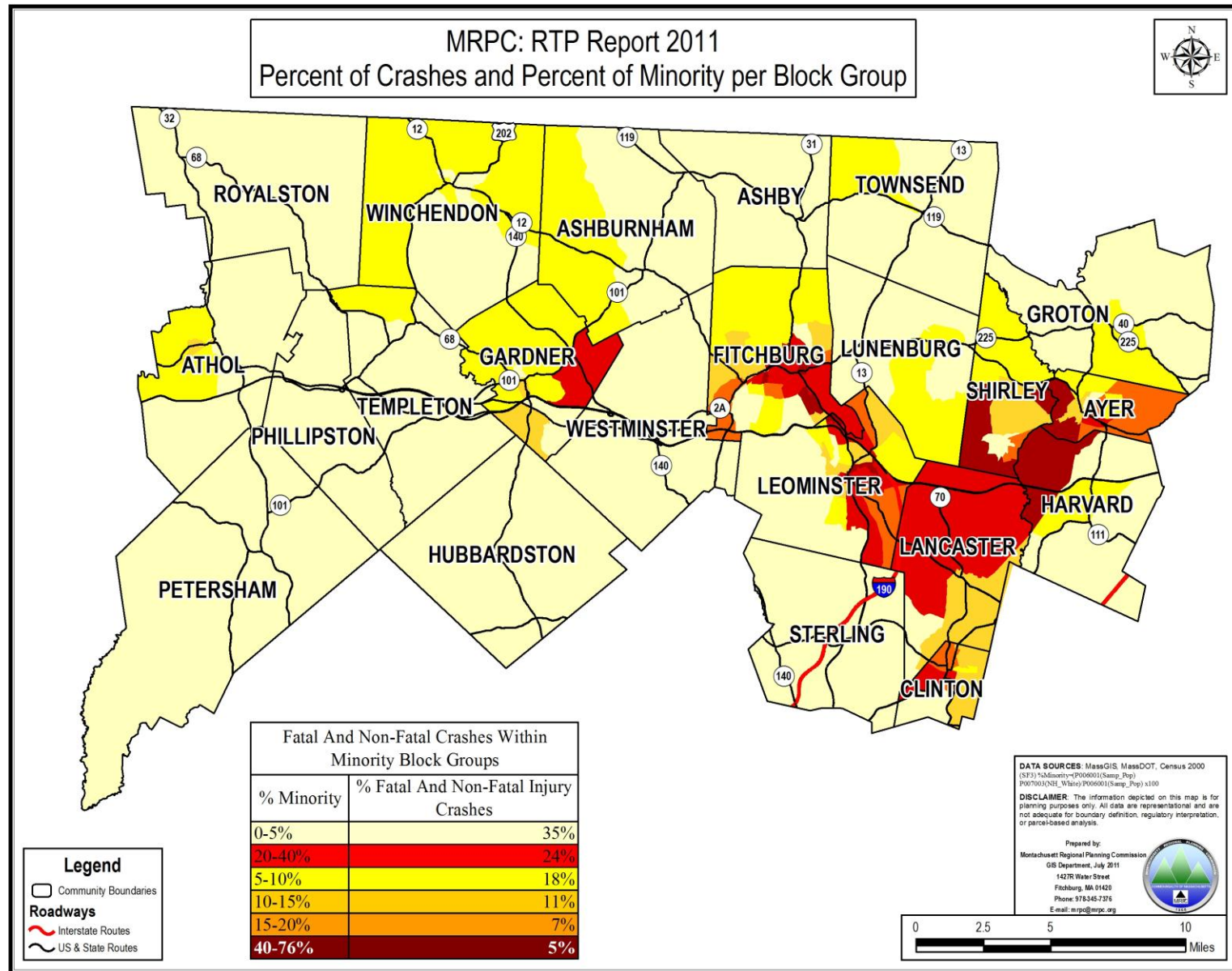




Figure 6





Final Recommendations

The final recommendations are aimed at continuing to meet and promote the goal of improving safety in the MMPO region.

Steps to Improve the Crash Table for the MMPO Region

MMPO staff will continue its ongoing effort to improve the crash data using the following proposed steps to be undertaken during the next four years:

1. Create community profiles of the above intersection and lane departure crash analysis for each MMPO municipality
2. Review the municipal profiles with each municipality and update the existing MassDOT crash table with crash reports from local police departments
3. Obtain crash reports from local police departments that are not in the MassDOT crash table
4. Update the MassDOT crash table using the crash reports from local police departments
5. Verify the interim (draft) MassDOT crash table with the local police departments and other municipal officials
6. Finalize the MassDOT crash table and submit it to MassDOT
7. Establish and maintain a list of contacts made during the update process for future updates

The new crash table can then be used as a source to conduct traffic or safety studies, intersection or roadway safety audits at dangerous locations so they can be prioritized and strategies can be recommended to reduce crashes.

Safety Projects/Improvement Recommendations/Estimated Cost/Further Study

Table 12 provides a general recommendation, estimated project costs, or whether at least an RSA should be conducted at HSIP eligible locations. Chapter 18 of this RTP is the source of the table. Many of the projects in this table will be forwarded during the next four years to meet the goal of improving roadway safety the MMPO region. A focus during the next 4-years covered by the MMPO 2012 RTP will be to identify the projects that fall within environmental justice areas and to determine ownership. See Chapter 18 for more information on this table.

Table 12: Safety Projects/Recommendations/Further Study List (continued below)

Municipalities	Project & Recommendation	2011 Est. Cost/ Comment
Ashburnham	Route 101 at Corey Hill/Williams Rd. - Geometric Improvements	\$675,000
	Route 101 (Central St.) at Main St. - Traffic Signal/Geometric Improvements	\$900,000
Athol	South Main St. (Rte. 2A) at Daniel Shays HWY - Intersection Improvements	Further Study
	Main St. (Rte. 2A) at Exchange St. - Intersection Improvements	Further Study
	Rte. 2 (Exit 17) at Rte. 31 - Interchange Improvements	Further Study
Ayer	Carlton Circle (Rte. 2A,110) - Safety Improvements	Further Study



Table 12 (continued below)

Municipalities	Project & Recommendation	2011 Est. Cost/ Comment
Clinton	Main St. (Rte. 70;Rte. 62;Rte110) at Union St. (Rte. 62) - Intersection Improvements	Further Study
Fitchburg	Route 2A at John Fitch Highway - Low cost intersection improvements	\$250,000
	Summer St. at Rte 2A (Moran Square) - Intersection Improvements	\$250,000
	Rte. 2 at Mount Elam Rd. - Safety Improvements	Further Study
	South St./ Electric Ave./ Old South St. - Intersection Improvements	\$875,000
	South St./ Wanoosnoc Rd./ Whalon St. - Intersection Improvements	\$875,000
	Bemis Rd. at Airport Rd. - Intersection Improvements	\$875,000
	Kimble St. (Rte. 12)/Laurel St./ Cross St./ Putnam St. - Geometric/Safety Improvements	\$875,000
	Main St. (Rte. 2A)/ Rollstone St./ Academy St. - Intersection Improvements	\$875,000
	Water St. (Rte. 12)/ Main St. (Rte. 2A)/ Day St. - Intersection Improvements	Further Study
	Westminster St. (2A) at Princeton Rd. (Rte. 12) - Intersection/Safety Improvements	\$875,000
	Bemis Rd. at Intervale Rd. - Intersection Improvements	\$875,000
	Lunenburg St. (Rte. 2A) at Klondike Ave. - Intersection Improvements	Further Study
	Main St. (Rte. 2A)/ Central St./ Boulder Dr. - Intersection/Signal Improvements	Further Study
	Main St. (Rte. 2A)/ Oliver St. - Intersection Improvements	Further Study
	Lunenburg St. (Rte. 2A)/ Townsend St./ Boutelle St. - Intersection Improvements	Further Study
	River St. (Rte. 2A;Rte 31) at Main St. (Rte. 2A) - Intersection Improvements	\$875,000
	Electric Ave. at Rollstone Rd. - Intersection Improvements	\$875,000
	Electric Ave. at Mt. Elam Rd. - Intersection Improvements	\$875,000
	Clarendon St. at Pratt St. - Intersection Improvements	Further Study
	John Fitch HGW/ Bemis Rd. - Corridor Improvements	\$19,700,000
Fitchburg/ Leominster	Rte. 2 (Exit 30)/Merriam Ave./Whalon St. - Improvements Recommended	\$1,250,000
Gardner	Elm St./Central St. (Rte. 101)/Pearl St. (Rte. 101)/Green St. - Intersection Improvements	\$875,000
	West Broadway (Rte. 2A) at Timpany BLVD. (Rte. 68)	\$875,000
	Elm St. at Temple St. - Safety Improvements	Further Study
	Parker St. (Rte. 101) at Nichols St. - Safety Improvements	Further Study
	Timpany BLVD. at American Legion Circle - Intersection Improvements	Further Study
Groton	Main St. (Rte. 119,Rte. 225)/Lowell Rd. (Rte. 40)/Broadmeadow Rd. - Intersection Improvements	\$675,000
	Main St. (Rte. 119,Rte. 225) at Fitch's Bridge Rd. - Intersection Improvements	\$675,000
Harvard	Rte 2 (Exit 38) Route 110/ 111/ Ayer Rd. - Safety Improvements	Further Study
	Ayer Rd. Corridor Improvements	Further Study
Harvard/ Lancaster	Route 2 Ramps @ 35, 36, & 38 - Reconstruction and Widening	\$2,080,000
Lancaster	Reconstruction on Route 70 (Lunenburg Road) At Old Union Turnpike	\$1,159,160
	Rte. 2 (Exit 36)/ Shirley Rd./ Fort Pond Rd./ Old Union TPK. - EB & WB Ramp Improvements	Further Study



Table 12 (continued below)

Municipalities	Project & Recommendation	2011 Est. Cost/ Comment
Leominster	Intersection & Signal Improvements at Merriam Avenue and Lindell Avenue	\$750,000
	Route 13 from Hawes St. to Prospect St. - Reconstruction	\$6,330,987
	Rte 2 at Rte 190 - Safety Improvements	\$1,250,000
	N. Main St. (Rte. 12)/Nelson St./Water Tower Pl./Fruit St. - Safety Improvements	Further Study
	N. Main St. (Rte. 12)/Lindell Ave./Hamilton St. - Safety Improvements	Further Study
	Central St. (Rte. 12) at Litchfield St. - Safety Improvements	Further Study
	Mechanic St. at Water St. (Depot Sq.) - Intersection Improvements	\$875,000
	Central St. (Rte. 12)/ Grant St./ Beth Ave. - Intersection Improvements	\$875,000
	Mill St./ Haws St./ Sack Blvd. - Intersection Improvements	Further Study
	Merriam Ave. at Washington St. - Intersection Improvements	Further Study
	Main St. (Rte. 13)/ N. Main St. (Rte. 12)/ High St./ Mill St. - Geometric/ Intersection Improvements	\$875,000
	Lancaster St. (Rte. 117) at Elm Hill Ave. - Intersection Improvements	Further Study
	Merriam Ave. at Blossom St. - Intersection Improvements	Further Study
	Mechanic St./ Third St./ Walker St. - Intersection Improvements	Further Study
	Mechanic St. at Fifth St. - Intersection Improvements	Further Study
	Main St. (Rte. 13)/ Day St. - Intersection Improvements	\$875,000
	Mechanic St./ Leominster Connector/ Commercial Rd. - Intersection Improvements	Further Study
	Central St. (Rte. 12)/ Union St./ Adams St. - Intersection Improvements	Further Study
	N. Main St. (Rte. 12) at Hospital Rd. - Intersection Improvements	Further Study
	N. Main St. (Rte. 12)/ Washington St./ Grove Ave. - Improvements Recommended	Further Study
Lunenburg	Massachusetts Ave. (Rte. 2A;Rte. 13)/Electric Ave. (Rte. 13) - Safety Improvements	Further Study
	Massachusetts Ave. (Rte. 2A;Rte. 13)/Chase Rd. (Rte. 13) - Safety Improvements	Further Study
	Massachusetts Ave. (Rte. 2A) at White St. - Intersection Improvements	\$875,000
	Chase Rd. (Rte. 13) at West Townsend Rd. - Intersection Improvements	\$875,000
Phillipston	Rte. 2 (Exit 19)/Rte. 2A/Rte 202 - Safety Improvements	Further Study
Sterling	Various improvements along Rte 140 recommended in Corridor Profile	\$7,900,000
	Route 12 and Chocksett Rd. - Intersection Improvements	\$1,500,000
	Rte. 190 (Exit 6)/Leominster Rd. (Rte. 12) - Safety Improvements	\$2,000,000
	Rte. 190 (Exit 5)/Redemption Rock Tr. (Rte. 140) - Safety Improvements	\$2,000,000
Templeton	Rte 101/Rte 2A/N. Main St./S. Main St. - Geometric Improvements	\$875,000
	Rte. 2 (Exit 21)/Patriots Rd. (Rte 2A) - Intersection/Ramp Improvements	Further Study
Townsend	Main St. (Rte. 119)/ West Elm St./ Canal St. - Intersection Improvements	\$875,000
Westminster	Reconstruction on South Street, from Dawley Street/Carter Road to Main Street (Route 2A)	\$3,257,450
	Various improvements along Rte. 140 recommended in Corridor Profile	\$13,500,000
	Rte. 2 at Rte. 140 (Exit 25)/State Rd. East (Rte. 2A)/Hagar Park Rd. - Safety Improvements	\$1,250,000
	Rte. 2 (Exit 27)/Depot Rd./Narrows Rd. - Safety Improvements	Further Study
	Rte. 2 (Exit 26) at Village Inn Rd. - Safety Improvements	Further Study
	State Rd. East (Rte. 2A)/ Depot Rd./ Bartherick Rd. - Intersection Improvements	Further Study
	Main St. (Rte. 2A)/ South St./ Leominster St. - Intersection Improvements	\$875,000

**Table 12** (continued below)

Municipalities	Project & Recommendation	2011 Est. Cost/ Comment
Winchendon	Rte. 12/River St./School St./Front St. (Tannery Sq.) - Traffic Signal/Geometric Improvements	\$1,000,000
	Spring St. (Rte. 12)/ Glenallan St. - Intersection Improvements	Further Study

2012 RTP Safety Focus, Countermeasures / Corrective Technique Recommendations

2012 RTP Focus/Study Areas from the Above Sections

- Develop a study to address fatal injury crashes which increased 4% when compared to the 3-year period of 2002-2004 and is opposite the decreasing statewide trend
 - Fatal injury crashes occurring as a result of LDCs should receive particular attention due to their 53% share of these deadly crashes. Roadway facilities will be studied or audited and countermeasures will be developed
- Assist MassDOT and MMPO municipalities that experience excessive lane departure crashes along corridors to conduct safety studies (RSAs at minimum) for those corridors
- Assist MMPO municipalities and MassDOT to move locations that have been identified and studied forward into project development and onto the TIP
- Assist MassDOT and MMPO municipalities that have locations in need of study based on an EPDO that exceeds the minimum threshold to conduct safety studies (RSAs at minimum) at those locations
- Assist MassDOT and MMPO municipalities that have HSIP eligible pedestrian and bicycle locations to conduct RSAs at those locations and develop improvements projects
- Develop follow-up studies of locations that have had project completed to determine how safety has changed
- Identify locations and HSIP projects that fall within environmental justice areas
- Determine the ownership of locations and HSIP eligibility

Countermeasures / Corrective Technique Recommendations

Please note that countermeasures to address the variety of safety problems in the MMPO can include but are not limited to the following:

Access Management Techniques will be Promoted

Major aspects of access management techniques include:

- Many safety problems along corridors are caused by poorly designed and uncoordinated curb cuts. Conflict points, especially left turns, interrupt traffic flow and increases the potential for crashes
- Access management techniques combine engineering design standards and zoning by-law regulations to provide safe and efficient traffic flow along a corridor. These techniques are intended to separate, or limit, the number of conflict points along a corridor



- M.L., Chapter 81, Section 21 allows MassDOT to regulate access onto state highways and gives them the ability to regulate access driveways on adjacent local streets that impact a state highway
 - However, on the grounds of safety municipal officials have the ability to comment on and object to these decisions
- Municipal officials have the power to create access regulations on roads other than state highways
- There are a variety of by-law regulations at the disposal of municipal officials
 - The by-law should provide standards and review requirements for access location, spacing, and design
 - A by-law can be as general or specific as the municipality desires
 - Authority should be granted to a local body such as the planning board or the highway department

Municipalities will be strongly encouraged to establish access management by-laws.

Intersection Improvements will be Promoted

Traffic Signal Improvements: signal phasing and/or timing, protected left-turn phase improvements; upgrade signal heads (backplates)

Geometric Improvements: convert intersection to a roundabout (photo below); add protected left turn or right turn lanes; install raised divisional or median islands



Regulatory Updates: prohibit parking near intersections; prohibit left turns, right turns, U turns

Improve Signs and Pavement Markings: install wider center line and edge line pavement markings; install intersection ahead, curve ahead, and other warning signs

Operational Improvements: convert intersections with no control to STOP controlled; install signals as warranted



Low Cost Safety Enhancements at Stop-controlled Intersections will be Promoted

Depending on the conclusions of a traffic study or intersection safety study/road safety audit the list of corrective measures listed below can address the safety issues at a stop-controlled intersection.

These low cost improvements are being implemented by MassDOT through the **Low Cost Safety Enhancements** program. The improvements provide a tool to ensure HSIP qualified projects are developed and can be prepared quickly to fill potential funding gaps in the TIP funding targets of regions. The program allows safety improvement projects to be completed at the municipal level by providing HSIP funding for the improvements that has not been available before for local roadway projects.

The low cost improvements have shown a crash reduction factor of 40%. The set of improvements includes the following items and should be implemented at stop-controlled intersections where feasible and practical to help reduce the number and severity of crashes:

- Doubled up (left and right) oversize, advance intersection warning signs with street name sign plaques on the mainline, uncontrolled approaches
- Doubled up (left and right) oversize, advance "stop ahead" intersection warning signs, on the stop controlled approaches
- Doubled up (left and right) oversize, "STOP" signs
- Installation of a minimum 6 foot wide raised splitter island on the stop approach (if feasible, and no widening is required)
- Properly placed stop bar(s)
- Removal of any foliage or parking that limits sight distance
- Double arrow warning signs at the stem of T intersections

Lane Departure Crash Corrective Measures will be Promoted

Depending on the conclusions of a traffic study or lane departure crash safety study/road safety audit the incomplete list of corrective measures listed below can address the safety issues along a corridor. The possible countermeasures are not limited to the following list.

To Reduce Speed

- Install advisory/warning speed signs
- Add other types of warning signs such as intersection or curve ahead signs
- Add slippery when wet warning signs
- Center lines should be added, restriped, or widened
- Road edge lines should be added, restriped or widened

To Protect against Roadside Hazards and Inform Driver of Edge of Road

- Install roadside guardrails with retroreflectorized tabs
- Replace buried guardrail end terminals with energy absorbing or flared end terminals



- Install edge line rumble strips
- Install edge line retroreflectorized pavement markers (raised or recessed)
- Road edge lines should be added, restriped or widened
- Install roadside cable barrier
- Place retroreflectorized markers or sheeting on roadside hazards
- Remove or relocate poles
- Remove roadside vegetation, sideslopes, outcrops

Opposing Lane / Head-on Crashes / Curve Delineation

- Place chevron warning signs along curves
- Add curve ahead warning signs
- Add slippery when wet warning signs
- Install center line retroreflectorized pavement markers (raised or recessed)
- Center lines should be added, restriped, or widened
- Install centerline rumble strips
- Median cable barrier or guardrail could be added

Pedestrian and Bicycle Corrective Measures will be Promoted

Corrective measures at the locations listed in Table 10 and Table 11 will be considered. Signage and pavement marking improvements designed to alert pedestrians, bicyclists, and motorists alike of the presence of each other will be considered.