Pioneer Valley Planning Commission

TRANSPORTATION AND SAFETY STUDY

SOUTH HADLEY

NEWTON STREET (ROUTE 116) / LYMAN STREET (ROUTE 33) INTERSECTION

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Prepared in cooperation with the Town of South Hadley, Massachusetts Department of Transportation and the U.S. Department of Transportation - Federal Highway Administration and the Federal Transit Administration.

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ABBREVIATIONS

1	a.m.	Afore Meridian
2	LOS	Level of Service
3	MassDOT	Massachusetts Department of Transportation
4	MPH	Miles per Hour
5	MUTCD	Manual on Uniform Traffic Control Devices
6	p.m.	Post Meridian
7	PVPC	Pioneer Valley Planning Commission
8	Rd.	Road
9	St.	Street
10	TMC	Turning Movement Counts

I. INTRODUCTION

The intersection of Newton Street (MA Route 116) with Lyman Street (MA Route 33) in South Hadley currently appears as the 98th ranked intersection on the Top 100 High Crash Intersections report for the Pioneer Valley Region. This ranking prompted PVPC to conduct a safety study at this intersection as a part of the FY 2010 Unified Planning Work Program, to verify the factors that could contribute to the crashes at this location. The study examines the existing traffic operations at the intersection and includes an analysis of the history of crashes at this intersection. It provides a series of short-term recommendations to improve existing traffic operations and increase safety.

A. STUDY AREA

The intersection of Newton Street (MA Route 116) with Lyman Street (MA Route 33) is located in southern part of the Town of South Hadley. It is a signalized intersection with a mixture of commercial and residential development in the vicinity. A Shell gas station is located on the northeast corner of the intersection and a TD Bank North and an insurance agency are located on the southwest corner of the intersection. The remaining two corners of the intersection provide access to local residences. There are a number of curb cuts along both Newton Street and Lyman Street in the vicinity of the intersection.

At the time of the field inventory, the pavement condition of the streets in the vicinity of the intersection was poor. Granite curbing, sidewalks and crosswalks with pedestrian push buttons are provided on all four approaches to the intersection. Pavement markings were observed to be in fair to poor condition and both Newton Street and Lyman Street are illuminated by street lights.

Newton Street (MA Route 116) is classified as an urban extension (U3) of a minor arterial. It has northeast-southwest alignment in the vicinity of its intersection with Lyman Street. Both approaches of Newton Street provide exclusive left turn lanes with shared through/right turn lanes. Right turns on red are prohibited from both approaches. Advance Pedestrian Crossing Signs are located on both approaches to the intersection.

Lyman Street (MA Route 33) is classified as an urban extension (U3) of a minor arterial to the southwest of the intersection and as a local street to the northwest

of the intersection. Both approaches of Lyman Street provide one lane shared travel lane for all movements with right turns on red prohibited. An access driveway for a shopping plaza intersects with Lyman Street immediately to the east of the Shell gas station approximately 125 feet from the intersection with Newton Street.

Figure 1: Study Area

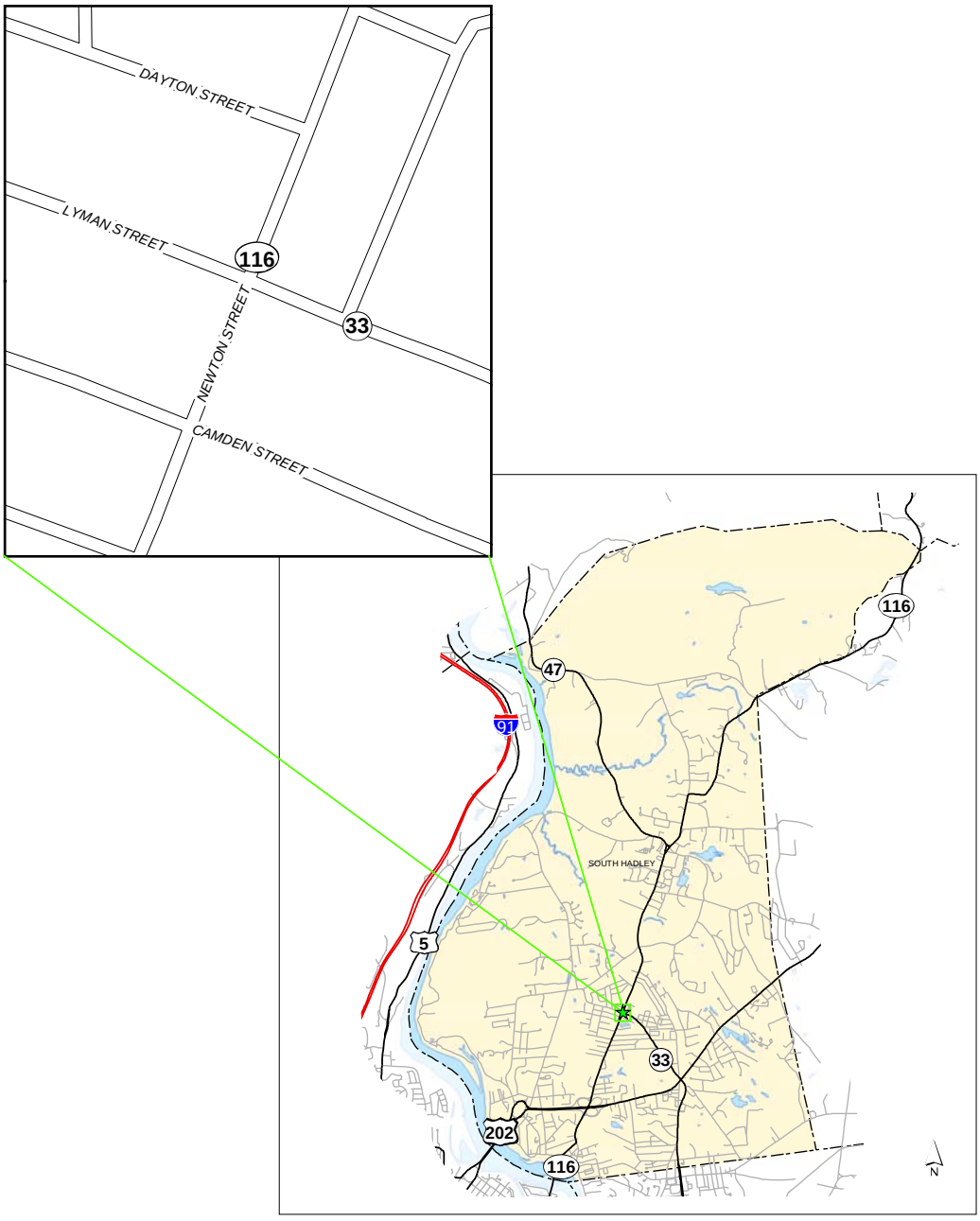


Figure 2: Pavement Markings and Signs at the Intersection

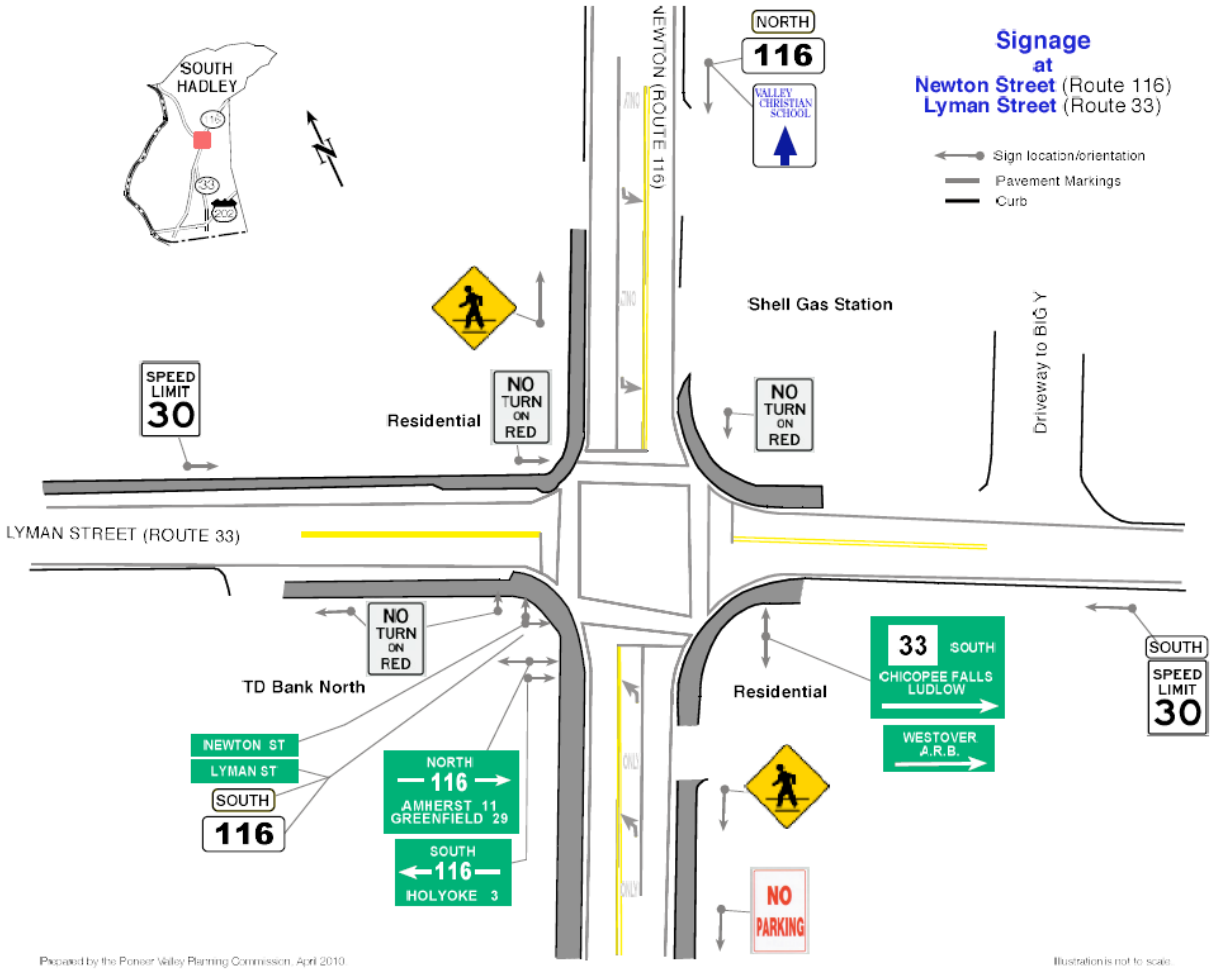


Figure 3: Aerial Image of the Intersection

II. EXISTING TRANSPORTATION CONDITIONS

This section provides a technical evaluation of the transportation components of the intersection. It includes a presentation of the data collected, analysis of traffic operations, and a series of observations and conclusions derived from the analysis.

A. PEAK HOUR VOLUME AND TURNING MOVEMENT COUNTS

Turning Movement Counts (TMC's) were conducted for the intersection during the peak commuter periods. The weekday peak commuter period occurs during the morning hours of 7:00 AM to 9:00 AM and the afternoon hours of 2:00 PM to 6:00 PM for intersections in the vicinity of schools. The TMC's were conducted to identify the peak four consecutive 15 minute periods of traffic through the intersection. These consecutive peak 15 minute periods constitute a location's Peak Hour Volume. The peak hour of traffic volume represents the most critical period for operations and will be the focus for some of the analysis conducted in this study.

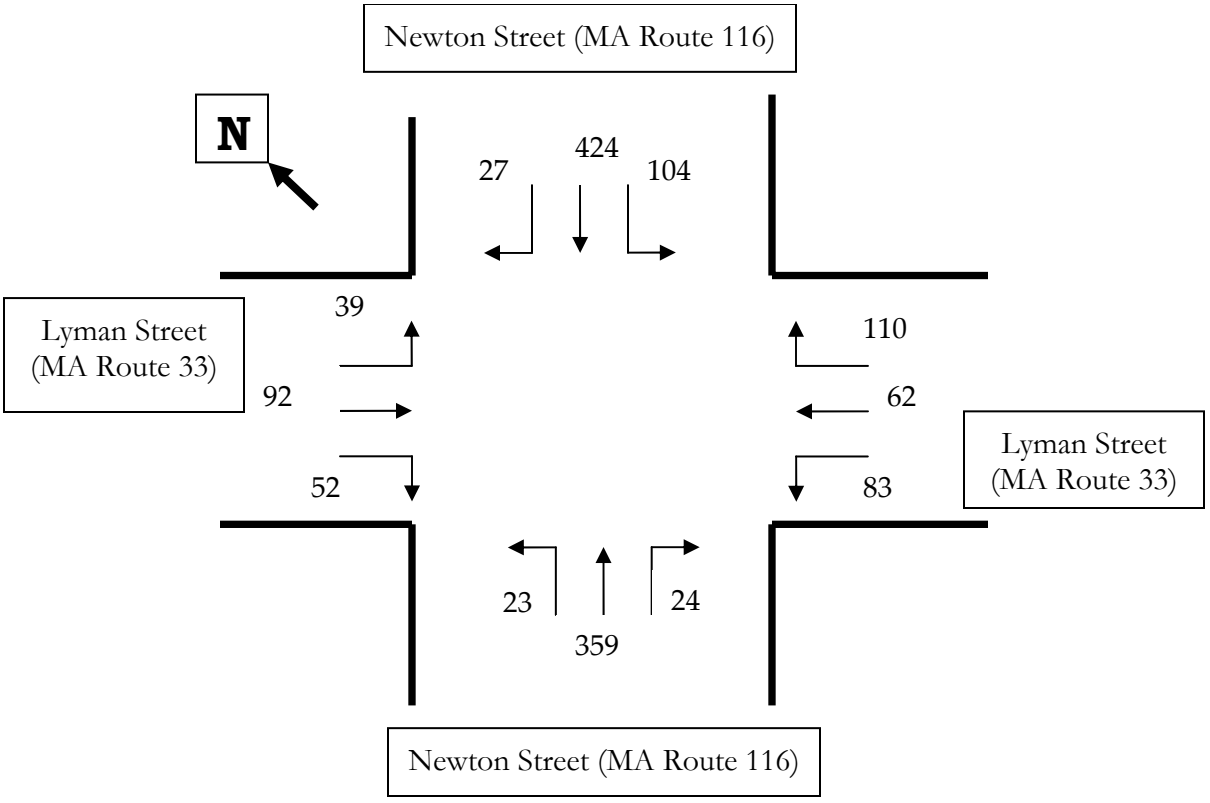
The TMC data also identifies the number of heavy vehicles and pedestrians on the roadway. Heavy vehicles include trucks, recreational vehicles and buses. The percentage of heavy vehicles in the traffic flow is an important component in calculating the serviceability of a corridor or intersection and the existing level of service. Trucks impact traffic flow because they occupy more roadway space than passenger cars and have poorer operating capabilities with respect to acceleration, deceleration and maneuverability. Nearly 3% of the total vehicles entering the intersection during the morning peak hour and 0.5% of the total vehicles entering the intersection during the afternoon peak hour were classified as heavy vehicles. Five pedestrians were observed at the intersection during the afternoon peak hour while no pedestrians were observed during the morning peak hour.

As traffic volumes tend to fluctuate over the course of the year, the Massachusetts Department of Transportation (MassDOT) develops traffic volume adjustment factors to reflect monthly variations. These factors were examined to determine how traffic conditions at the intersection of Newton Street with Lyman Street compare to average monthly conditions. The TMC data

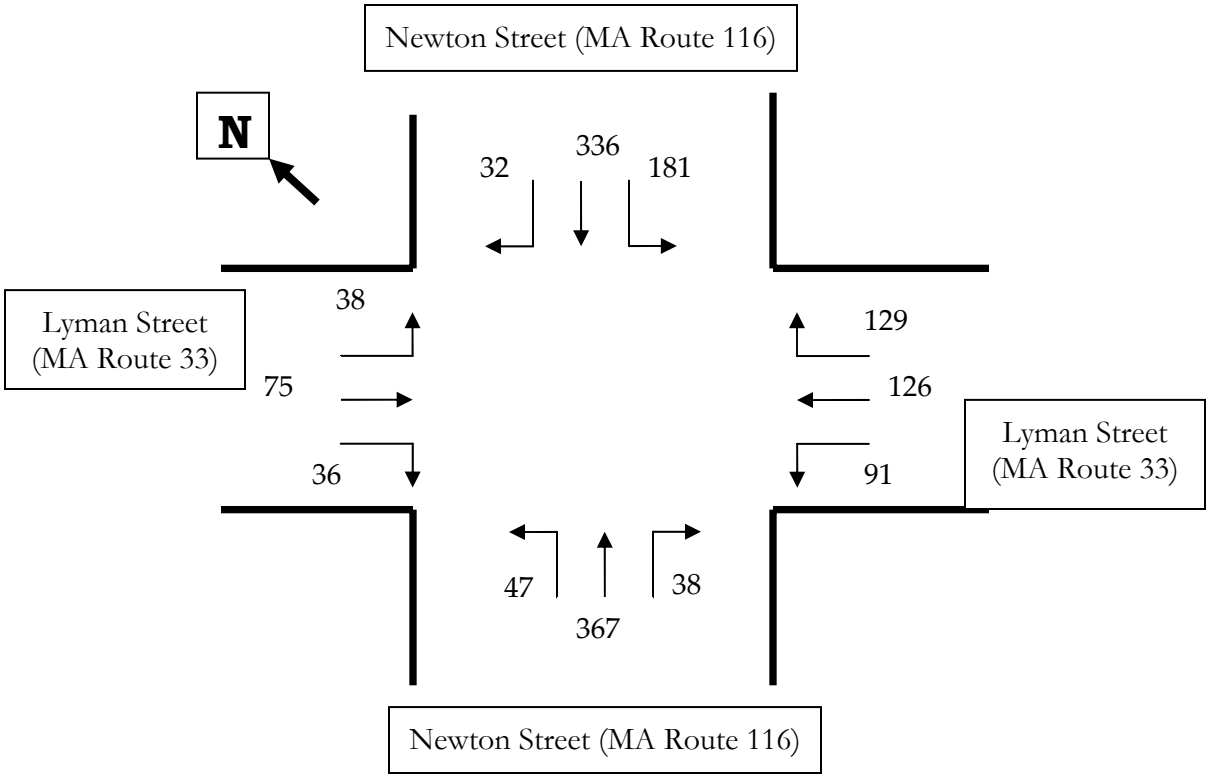
was collected in the month of February and the adjustment factors for the roadways classified as urban extension (U3) of minor arterial were used to reflect the monthly variations. The afternoon peak hour volume at the intersection was observed to be slightly higher than the morning peak hour volume. Also, the volume on the Newton Street northbound approach was higher than the volume on the southbound approach for both the morning and afternoon peak hours. A summary of peak hour traffic volumes is shown in Figure 4.

Figure 4: Turning Movement Counts

Morning Peak Hour (7:15 am – 8:15 am)



Afternoon Peak Hour (4:15 pm – 5:15 pm)



B. SAFETY

To study safety, PVPC obtained the crash history of the intersection from the Massachusetts Department of Transportation (MassDOT) and the South Hadley Police Department. Actual crash reports were studied and analyzed to form a collision diagram of the intersection. The crash history for calendar years 2005 and 2006 was provided by MassDOT. The crash history for the 2007 to 2009 calendar years was provided by the South Hadley Police Department.

1. Crash Rate Analysis

The crash rate per million entering vehicles was calculated to compare the value at the intersection to the average value for MassDOT District 2 signalized intersections. In The crash rate per million entering vehicles was calculated. theory, crash rates can increase as the traffic volume along the roadway increases as the potential for conflict is increased. The crash rate per million entering vehicles takes into consideration the number of crashes at an intersection and the number of vehicles that enter the intersection over the course of an average day. Based on MassDOT data, the average crash rate for signalized intersections in District 2 is 0.94.

As can be seen from Table 1, the crash rate at the intersection of Newton Street with Lyman Street is 0.76. This value is lower than the average crash rate value for other similar intersections in the region. Almost 50% of the crashes (11 out of 23) are rear end type collisions. Weather and road condition information was not available for the crashes that occurred in calendar years 2007 and 2008. No crashes were reported for the 2009 calendar year.

2. Collision Diagram

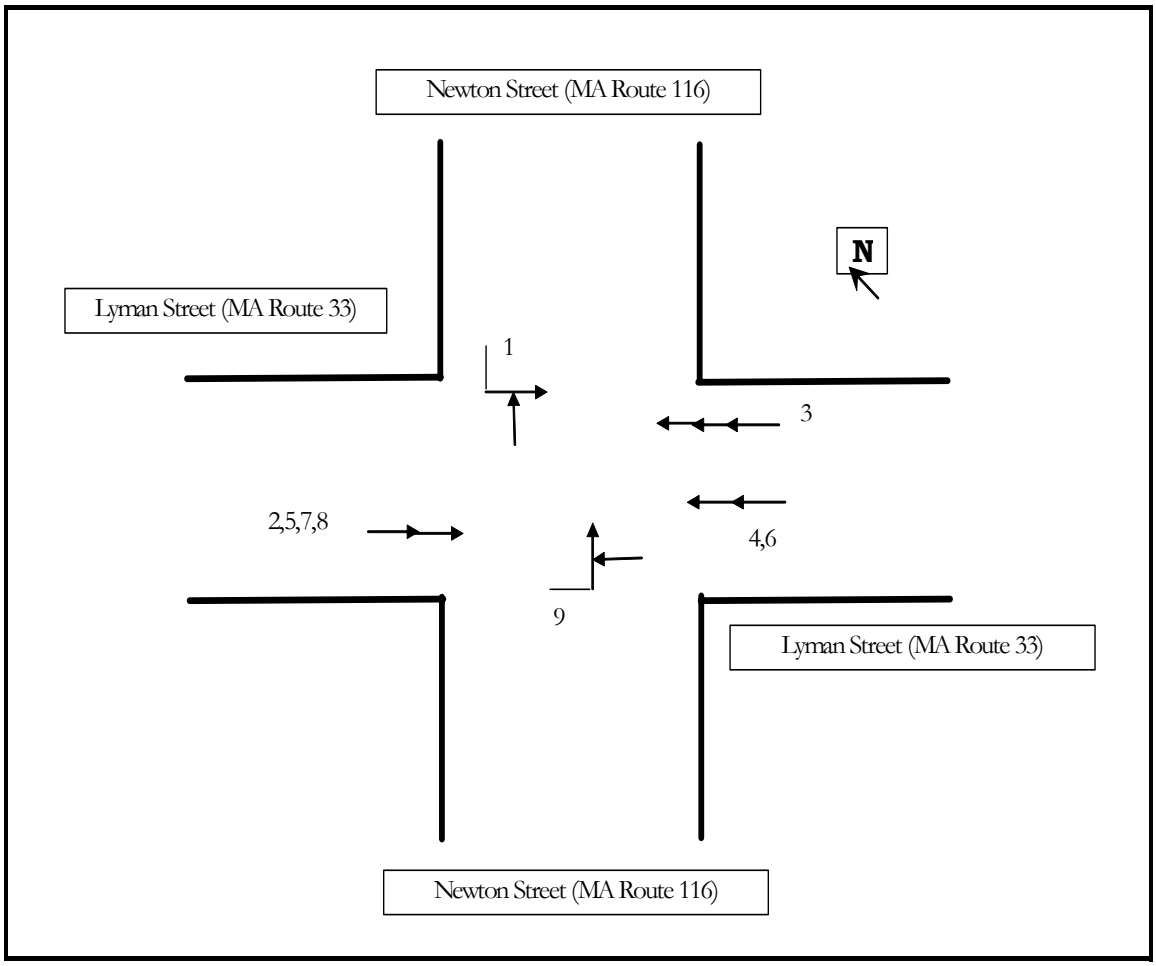
PVPC obtained the crash reports from the South Hadley Police Department for the calendar years of 2007 to 2009. The objective was to analyze the collision patterns and determine factors that may contribute to crashes at this intersection. Figure 5 shows the collision diagram for the intersection. The details of the crashes shown in the figure are summarized in Table 2.

Table 1: Crash History

Year	Total # of Crashes	Type		Severity		Weather Condition		Road Condition		Crash Rate
2005	6	Head On	1	Property Damage	5	Clear	3	Dry	2	
		Rear End	3	Non fatal Injury	1	Cloudy	1	Wet	4	
		Side Swipe	2			Rain	2			
2006	8	Angle	5	Property Damage	6	Clear	5	Dry	5	
		Rear End	1	Non fatal Injury	2	Cloudy	1	Wet	2	
		Side Swipe	1			Rain	1	Snow	1	
		Single Vehicle	1			Snow	1			
2007	4	Angle	1	Property Damage	2	Not Known	4	Not Known	4	
		Rear End	3	Non fatal Injury	2					
2008	5	Angle	1	Property Damage	3	Rain	1	Wet	1	
		Rear End	4	Non fatal Injury	2	Not Known	4	Not Known	4	
2009	0									
Total	23		23		23		23		23	**0.76**

Source: MassDOT, South Hadley Police Department

Figure 5: Collision Diagram



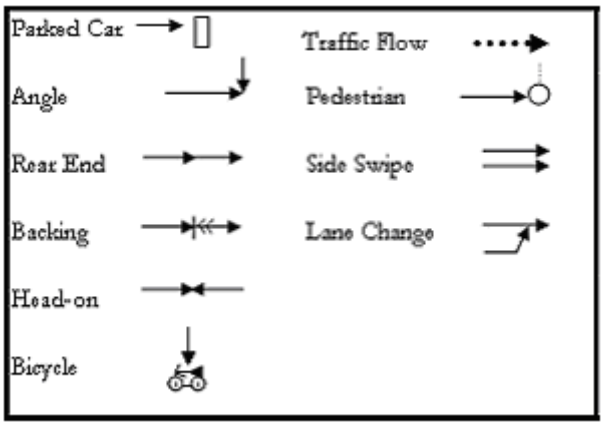


Table 2: Crashes included in Collision Diagram

	DATE	TIME	DAY	SEV.	L	P
1	02/21/07	9:45 PM	WED	I	3	13
2	03/24/07	12:12 PM	SAT	PD	1	5
3	05/14/07	4:17 PM	MON	I	1	5
4	11/21/07	8:26 PM	WED	PD	3	5
5	06/10/08	5:08 PM	TUE	PD	2	5
6	07/16/08	11:58 AM	WED	PD	1	5
7	10/09/08	8:57 AM	THU	I	1	5
8	10/09/08	3:55 PM	THU	I	1	5
9	10/17/08	12:33 PM	FRI	PD	1	13

Source: South Hadley Police Department

Light Condition (L)
1. Daylight
2. Dawn/Dusk
3. Darkness
4. Unknown

Pattern (P)

0. Not Known	7. Wrong side of road
1. Speed too fast	8. Improper turning
2. Parked Car	9. Improper backing
3. Ran Stop Sign	10. Sideswipe
4. Ran Traffic Signal	11. Pedestrian violation
5. Rear End	12. Human Error
6. Improper Passing	13. Angle

Fatality	F
Personal Injury	I
Property Damage	PD

As can be seen from the collision diagram 7 out of 9 crashes were rear end type collisions occurring on both approaches of Lyman Street. One crash occurred between vehicle turning left onto Newton Street from Lyman Street southeast bound approach and through moving vehicle from Lyman Street northwest bound approach. Only one crash occurred between vehicles on Newton Street approaches. Therefore it can be observed that there might be some safety issues at Lyman Street approaches.

C. LEVEL OF SERVICE ANALYSIS

The intersection was examined with regard to capacity and delay characteristics to determine the existing Level of Service (LOS). LOS is an indicator of the operating conditions which occur on a roadway under different volumes of traffic and is defined in the 2000 Highway Capacity Manual by six levels, 'A' through 'F'. A number of operational factors can influence the LOS including geometry, travel speeds, delay, and the number of pedestrians. Table 3 presents the LOS designations for a signalized intersection.

Table 3: Level of Service Designations for Signalized Intersections

Category	Description	Delay (in seconds)
LOS A	Describes a condition of free flow, with low volumes and relatively high speeds. There is little or no reduction in maneuverability due to the presence of other vehicles and drivers can maintain their desired speeds. Little or no delays result for side street motorists.	< 10.0
LOS B	Describes a condition of stable flow, with desired operating speeds relatively unaffected, but with a slight deterioration of maneuverability within the traffic stream. Side street motorists experience short delays.	>10.0 to 20.0
LOS C	Describes a condition still representing stable flow, but speeds and maneuverability begin to be restricted. Motorists entering from side streets experience average delays.	>20.0 to 35.0
LOS D	Describes a high-density traffic condition approaching unstable flow. Speeds and maneuverability become more restricted. Side street motorists may experience longer delays.	>35.0 to 55.0
LOS E	Represents conditions at or near the capacity of the facility. Flow is usually unstable, and freedom to maneuver within the traffic stream becomes extremely difficult. Very long delays may result for side street motorists.	>55.0 to 80.0
LOS F	Describes forced flow or breakdown conditions with significant queuing along critical approaches. Operating conditions are highly unstable as characterized by erratic vehicle movements along each approach.	> 80.0

Source: Highway Capacity Manual 2000

Depending on the time of day and year, a roadway may operate at varying levels. Level of Service 'A' represents the best operating conditions and is an indicator of ideal travel conditions with vehicles operating at or above posted speed limits with little or no delays. Conversely, LOS 'F', or failure, generally indicates forced flow conditions illustrated by long delays and vehicle queues. Level of Service 'C' indicates a condition of stable flow and is generally considered satisfactory in rural areas. Under LOS 'D' conditions, delays are considerably longer than under LOS 'C', but are considered acceptable in urban areas. At LOS 'E' the roadway begins to operate at unstable flow conditions as the facility is operating at or near its capacity.

Table 4: Existing Level of Service

APPROACH	MOVEMENT	AM Peak Hour		PM Peak Hour	
		Delay*	LOS**	Delay*	LOS**
Newton Street	Southbound Through/Right	22.6	C	20.5	C
	South bound Left	39.7	D	32.4	C
Lyman Street	Eastbound Left/Through/Right	26.3	C	26.3	C
Newton Street	Northbound Through/Right	14.6	B	9.7	A
	Northbound Left	35.0	C	40.5	D
Lyman Street	Westbound Left/Through/Right	46.1	D	42.5	D

Source: PVPC

* Delay in Seconds

** LOS – Level of Service

The maximum delays at the intersection have been observed on the westbound approach of Lyman Street which operates at LOS 'D'.

Left Turns from Newton Street were also calculated to operate at LOS 'D'.

III. RECOMMENDATIONS

Based on the field survey and analysis, the following short term recommendations have been made to improve transportation and safety conditions at the intersection.

A. PAVEMENT

Overall the pavement at the intersection is in poor condition with transverse cracking and weathering present at certain locations. Both the roads are urban extensions of minor arterials which carry a high volume of traffic. It is recommended that the Town of South Hadley and MassDOT keep monitoring the pavement condition and initiate the necessary repair measures required to maintain the quality of the pavement.

The pavement markings are somewhat faded. The crosswalk markings at the intersection and the pavement edge lines have also faded. It is recommended that the Town of South Hadley and MassDOT consider repainting pavement markings in the vicinity of the intersection.

B. SIGNALS AND SIGNS

The pedestrian signal for the crosswalk across the Lyman Street eastbound approach does not have a visor. It is recommended that MassDOT consider installing a signal visor for this signal head. A high percentage of rear end crashes at both Lyman Street approaches suggest the need to make signals more prominent to increase safety at the intersection. Installing back plates on all the signal heads will assist in making the signal heads more visible. It is recommended that MassDOT consider checking the effects of wind loading on the spanwire assembly to examine the feasibility of adding back plates to the signal assembly to improve visibility and to reduce the probability of red-light running and rear end crashes. It is also recommended that MassDOT consider adding near side signal heads on strain poles at both Lyman Street approaches in addition to back plates to further improve signal visibility.

'No Turn on Red' sign for Lyman Street southeast bound approach is damaged and it is recommended that MassDOT consider replacing it. The guide sign for Route 116 for the same approach is also damaged and almost covered by a light pole and vegetation. It is recommended that MassDOT examine the condition and positioning of this sign and consider moving and/or replacing it accordingly. It is also recommended that the Town of South Hadley consider installing 'Signal Ahead' and 'Pedestrian Crosswalk' warning signs in advance of both approaches of Lyman Street to inform the drivers about the approaching signal. This will also help to reduce the approaching speed of the vehicles and potentially reduce the probability of rear end crashes.

C. CONGESTION AND SAFETY

The Level of Service analysis shows that all the approaches operate within LOS range of A to D during both peak hours. Also the field inventory and data collection does not indicate any crucial safety problem. Precautionary measures like maintaining pavement, signage, pavement markings and signal equipment quality and monitoring the intersection from time to time would ensure safe and efficient operation of the intersection for longer time period.