



Transportation Corridor Study

Route 140 (Shrewsbury Street)

Town of Boylston, MA



FAY, SPOFFORD & THORNDIKE
July 2010



EXECUTIVE SUMMARY

ROUTE 140 TRANSPORTATION CORRIDOR STUDY

BOYLSTON, MASSACHUSETTS

Introduction

Fay, Spofford and Thorndike (FST) has been retained by the Town of Boylston to provide traffic/transportation engineering services to evaluate build-out of the Route 140 (Shrewsbury Street-West Boylston Street) corridor. The study area limits of the corridor study are from the Shrewsbury town line to the south near I-290, and to the West Boylston town line to the north. In addition to this section of Route 140, a portion of Route 70 (Main Street), south of Spruce Pond is also included. This corridor study is being conducted under a grant from the State through the Chapter 43D program, which is intended to expedite local permitting by identifying infrastructure needs related to existing and Priority Development Sites (PDS) of commercial, industrial or mixed use sites along the corridor. The key study area intersections include the following locations:

- *Route 140 (Shrewsbury Street)/East Temple Street*
- *Route 140(Shrewsbury Street)/Sewall Street North*
- *Route 140(Shrewsbury Street)/Sewall Street South*
- *Route 140(Shrewsbury Street)/West Boylston Street) /Main Street (Route 70)*
- *Route 140(Shrewsbury Street)/Colonial Drive (Shrewsbury)*

The intersections in the study area were evaluated in terms of traffic operations, accident history, lighting, traffic control, roadway and lane requirements and overall geometric requirements.

Study Parameters

Based on a 5-year horizon period build-out, background development, and trip generating characteristics; future conditions of priority development site (PDS) locations and other vacant parcels will be evaluated for safety, access and egress, layout and overall corridor impacts. The 5-year horizon year build-out is standard procedure with transportation studies conducted in the State and are outlined in the Massachusetts Environmental Policy Act (MEPA) regulations¹. The study area corridor can be seen in Figure 1.

Data Collection

Traffic Counts

A traffic count program was conducted on May 13, 2009) at the four (4) study area intersections in Boylston for two hours during the AM peak period (7-9 AM) and two hours during the PM peak period (4-6 PM). From the data, peak-hour traffic volumes for the study

¹ *Guidelines for EIR/EIS Traffic Impact Assessment*; Executive Office of Energy and Environmental Affairs/ Executive Office of Transportation and Public Works; July 1989

area intersections were determined. Generally peak hours were determined to be 7:30-8:30 AM and 4:45-5:45 PM.

Traffic Count Summary

A summary of the corridor traffic data is as follows:

Route 140/Route 70 process 1,900-2,000 vehicles during the peak hours and is the highest traffic volume location along the corridor. The other three locations process approximately the same volumes of 1,560-1,660 vehicles per hour.

The 24-hour hour volume (or average daily traffic) that was compiled from historical data along the corridor is as follows:

- *Route 140, at Shrewsbury Town Line = 15,000-16,800 vehicles per day*
- *Route 140, East of Main Street = 9,000 vehicles per day*
- *Route 140 at West Boylston Town Line = 11,100 vehicles per day*
- *Route 70, North of Route 140 = 5,200-5,600 vehicles per day*
- *Route 70, South of Route 140 = 6,200-6,300 vehicles per day*

Speed Study

A speed study was conducted along the corridor during the off-peak period in the area and average speeds were determined to be 50 mph northbound and 42 mph southbound. Speed limits vary along the corridor from 45 mph at the Shrewsbury Town Line, to 40 mph, north of Route 70 and 50 in the area of the Wachusett Reservoir.

Levels of Service

Using standard traffic engineering analysis procedures, the 2009 existing Levels of Service of the study area intersections are as follows:

Intersection	Levels of Service (AM/PM)
<i>Route 140 /East Temple Street*</i>	<i>C/F</i>
<i>Route 140/Sewall Street North*</i>	<i>E/F</i>
<i>Route 140/Sewall Street South*</i>	<i>F/F</i>
<i>Route 140/Route 70 (Main Street)</i>	<i>E/D</i>
<i>Note: LOS E or F is unacceptable and LOS A is the best condition; *LOS results for minor side street movement at noted intersection</i>	

Accident data

Accident data for the study area intersections in Boylston was also reviewed, and none of the study area intersections in Boylston were determined to have high accident crash rates. The adjacent intersection of Route 140/Colonial Drive in Shrewsbury was found to have a total of four (4) accidents over a three-year period.

Build-Out Conditions

Base No Build

For analysis of build-out conditions of the corridor, we have projected traffic data to the 2014 future condition by using a 1% annual growth rate, which has been confirmed by the Central Massachusetts Regional Planning Commission and the Town. In addition to the future year base condition, we have added traffic from projects that are already permitted or are in the pipeline. One such project included in the No Build condition is the Compass Pointe housing project on South Sewall Street.

Future Build-Out

Based of the project team assessment and coordination with the Town of vacant developable parcels, a full build-out program was developed based on Table 3.3 of the Communities Opportunities Group draft report. Using the Institute of Transportation Engineers Trip Generation, vehicle trip estimates were developed for the vacant parcels. In our assessment, we considered full-build out within the 5-year time frame (which is unlikely to occur) to test the transportation infrastructure conditions. Upon full build-out of the corridor, a total of 16,400 two-way daily vehicle trips (residential, commercial, retail, and industrial trips) could be realized along selected parts of the corridor.

Recommendations and Mitigation

Based on existing, future No Build and Build of the corridor, there are measures to mitigate impacts. The following is noted for each condition.

Existing Conditions/Short-Term Improvements

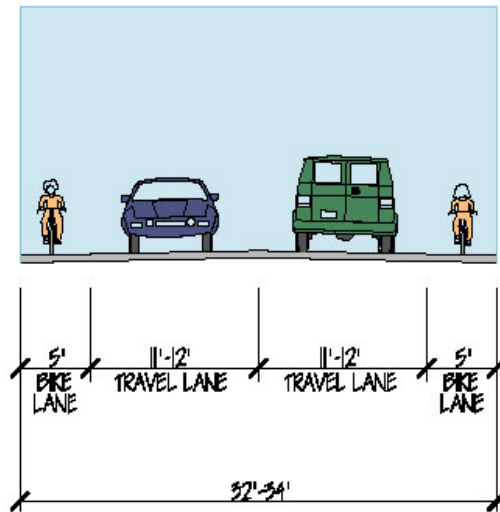
- *Establish an annual pavement marking program to upgrade the lane, edge line and center lines marking along the corridor and intersections;*
- *Erect Stop signs adjacent to Stop lines at area intersections;*
- *Install retroreflectivity signing along the corridor and at approach intersections;*
- *Close the connection from School Street to Shrewsbury Street, located just south from the East Temple Street and Route 140 intersection. Activity to School Street can be provided via the East Temple Street intersection or via Cross Street, via Colonial Drive;*
- *Consult with MassDOT to revise the signal timing and phasing based on recent FST data collected for the intersection and corridor;*
- *Initiate a program to make the South Sewall Street corridor, south of Route 140 and at the existing elementary school a more pedestrian friendly corridor. The Safe Routes to School program may be a mechanism to enhance mobility and safety.*

Future No Build Conditions/Long-Term Improvements

- *With the build-out of the Compass Pointe residential project, the Town should assure that the project proponent contributes to upgrading the roadway along the site frontage, install sidewalks and proper signing;*
- *The Town, working with the Central Massachusetts Regional Planning Commission, should undertake a traffic monitoring program which would consist of traffic data collection at study area intersections and include all vehicles (including trucks), bicycles and pedestrians to determine if traffic projections have been realized;*
- *The Town, working with the Central Massachusetts Regional Planning Commission should develop a list of transportation projects to be placed on the Transportation Improvement Program (TIP). At a minimum, this list should include corridor intersection upgrades and safety improvements.*

Future Build Conditions/Long-Term Improvements

- *Develop a Town-wide mechanism for the creation of an off-site infrastructure fund that would be used to mitigate private development related impacts. This fund would be primarily be used to assist in funding off-site improvements at Town owned intersections, roadways and corridors;*
- *Install and stripe an exclusive left turn lane on Route 140 northbound at the South Sewall Street intersection;*
- *Stripe a 5-foot wide bike lane along both sides of the Route 140 corridor roadway. A typical corridor cross section is shown.*



Conclusion

From review of existing conditions, very little geometric and traffic operational changes have occurred over the years along the corridor. Based on existing and future year traffic analysis, using an optimistic build-out (given this present economy) of Priority Development Sites (PDS) and other developable parcels, traffic operations will downgrade at area intersections. While the 5-year future year analysis may be somewhat overly conservative for future year assessment, the analysis conditions present a guideline of which future year conditions to review since not many private projects are in the Town pipeline.

To initiate the planning process to upgrade corridor and Town-wide facilities, the Town should work with the Central Massachusetts Regional Planning Commission (CMRPC) and the Town's consultants to have projects placed on the Transportation Improvement Program (TIP) for future consideration. Presently there are none listed for the Town. There are some immediate and short-term recommendations noted previously that could be implemented. It is recommended that this study serve as a guideline to upgrade the Corridor future build-out and development. These measures may consist of upgrading the existing traffic signal, erecting a new traffic signal, installing pavement markings and adding turn lanes and bike lanes. In addition, working with the CMRPC, a traffic monitoring and regular count project should be initiated to see if projected traffic volumes are realized. With the Town adopting a formal site plan review process, consideration will be given to access management, off-site mitigation and smart growth and sustainable site development.

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1. INTRODUCTION

1.1 OVERVIEW

Under a contract with the Town of Boylston and special Town Counsel, Blatman, Brobowski & Mead, and working with Community Opportunities Group, Fay, Spofford & Thorndike, LLC, (FST) has been retained to provide traffic/transportation engineering services to evaluate corridor build-out of the Route 140 (Shrewsbury Street-West Boylston Street) corridor. The study area limits of the corridor study are from the Shrewsbury town line to the south near I-290, and to the West Boylston town line to the north, which is adjacent to the Wachusett Reservoir. In addition to this section of Route 140, a portion of Route 70 (Main Street) to the south, south of Spruce Pond is also included. This corridor study is being conducted under a grant from the State through the Chapter 43D program, which is intended to expedite local permitting by identifying infrastructure needs related to existing and Priority Development Sites (PDS) of commercial, industrial or mixed use sites along the corridor. The key study area intersections include the following locations:

- Route 140(Shrewsbury Street)/East Temple Street
- Route 140(Shrewsbury Street)/Sewall Street North
- Route 140(Shrewsbury Street)/Sewall Street South
- Route 140(Shrewsbury Street/West Boylston Street)/Main Street (Route 70)

The intersections in the study area were evaluated in terms of traffic operations, accident history, lighting, traffic control, roadway and lane requirements, and overall geometric requirements. Based on a 5-year horizon period build-out, background developments, and trip generating characteristics, future conditions of priority development site (PDS) locations and other vacant parcels will be evaluated for safety, access and egress, layout, and overall corridor impacts. The 5-year horizon year build-out is standard procedure with transportation studies conducted in the State and are outlined in the Massachusetts Environmental Policy Act (MEPA) regulations¹. The study area corridor can be seen in Figure 1.

2. EXISTING CONDITIONS

2.1 GEOMETRICS and LAND USE

FST conducted a field reconnaissance on April 30, 2009 and May 12, 2009 to observe traffic operations, measure roadway and intersection geometry, record speed limits, note the presence of any traffic control devices and pavement markings, conduct a sign inventory, identify land uses and the general roadway network layout. Route 140 is a State-number route, but a Town-maintained roadway in the Town of Boylston and is functionally classified as a rural major collector. It has a right-of-way of 70 feet along the entire length of the corridor. At the

¹ *Guidelines for EIR/EIS Traffic Impact Assessment*; Executive Office of Energy and Environmental Affairs/ Executive Office of Transportation and Public Works; July 1989
Route 140 (Shrewsbury Street – West Boylston Street)
Boylston, MA



Figure 1
Study Area

Route 140 Corridor
Town of Boylston, Massachusetts



Schematic Diagram:
Not to Scale

I-290 interchange in Shrewsbury, Shrewsbury Street is under MassDOT control. Route 140 is identified as Shrewsbury Street from the Shrewsbury town line to Route 70 (Main Street) and then becomes West Boylston Street from Route 70 to the West Boylston Town line. Route 140 is generally a two-lane road with dispersed passing/no passing zones along various sections of the corridor. In the southern end of the corridor, there is a transitional three-lane cross section on Route 140, for a distance of 1,200 ^{+/-} feet and consisting of an exclusive 13-foot wide left-turn lane and one through lane in each direction. The 500-foot long left-turn lane serves the businesses on the west side of the corridor, which includes a Dunkin Donuts, Citgo gas station with convenience store and Chinese restaurant. Just north of the restaurant, the 3-lane section ends except at the Route 70 intersection where turn lanes are provided on Route 140. The remaining portion of the corridor is a two-lane roadway.

Land use along the corridor is a mix of commercial, retail, office, and light industrial. Near the Shrewsbury Town line is an abandoned gas station and adjacent to this site, the 3-lane section on Route 140 described earlier, begins. Continuing north along Shrewsbury Street to East Temple Street, the primary land use is on the west side of the road. There are small businesses consisting of a couple of construction companies, various light businesses at 238-240 Shrewsbury Street, Verizon offices and utility facility, Motor Home rental businesses, and a self-storage facility leading up to North and South Sewall Streets. Opposite South Sewall Street, at 81 Shrewsbury Street there is Greenleaf Place, which is a small retail plaza that includes a bank and gym. Continuing north along Shrewsbury Street, on the east side of the road are various retail businesses including a liquor store, post office, diner and a few vacant businesses. North of Route 70, the corridor is vegetated on both sides and borders the Wachusett Reservoir which is land that is owned and maintained by the Department of Conservation and Recreation (DCR). There are no sidewalks or pedestrian accommodations along the corridor. Speed limits vary along the corridor from 45 mph at the Shrewsbury end, to 40 north of Route 70, and 50 mph in the area of the Wachusett Reservoir.



Route 140, south of I-290



Route 140, between North and South Sewell Streets

Route 140 & East Temple Street

This four-way unsignalized intersection, shown below consists of Route 140 running in a north/south direction and East Temple Street approaching from the east. The fourth leg of the intersection is a newly paved driveway to a Motor Home rental business. The northern approach leg of Route 140 is 14-feet wide with one lane and a 6-foot wide shoulder area separated by a white edge line. The southern approach leg of Route 140 is 13-feet wide with one lane. The westbound approach leg of East Temple Street is approximately 22 feet wide, leaving space for a separate left-turn lane and right-turn lane at the intersection where it widens to 24 feet. There is a 6-foot, raised median island separating the entering and exit movements. In the area of this intersection, there is a passing zone only permitted for Route 140 southbound traffic. South of the intersection is a Verizon commercial building. Continuing east on East Temple Street away from the Route 140 corridor there is the Cyprian's golf course. See Figure 2 for an aerial of the intersection.



Looking Southbound from the Intersection



Looking Eastbound at the Intersection

Route 140 & North Sewall Street

This three-way unsignalized intersection consists of Route 140 running in a north/south direction and North Sewall Street approaching from the east. The southern approach of Route 140 is approximately 12-feet wide with a 10-foot shoulder. The northern approach leg of Route 140 is approximately 12-feet wide with an 11-foot wide shoulder, delineated with a solid white edge line. The eastern leg of North Sewall Street is 34-feet wide edge-to-edge, with solid white edge lines and a single lane for left and right turns. The road is separated by a broken yellow centerline with passing permitted northbound. To the northeast of the intersection, there is a single-family home, and to the northwest of the intersection, there is a retail plaza. A Stop sign and a worn Stop line control turns onto Route 140. See Figure 3 for an aerial of the intersection.



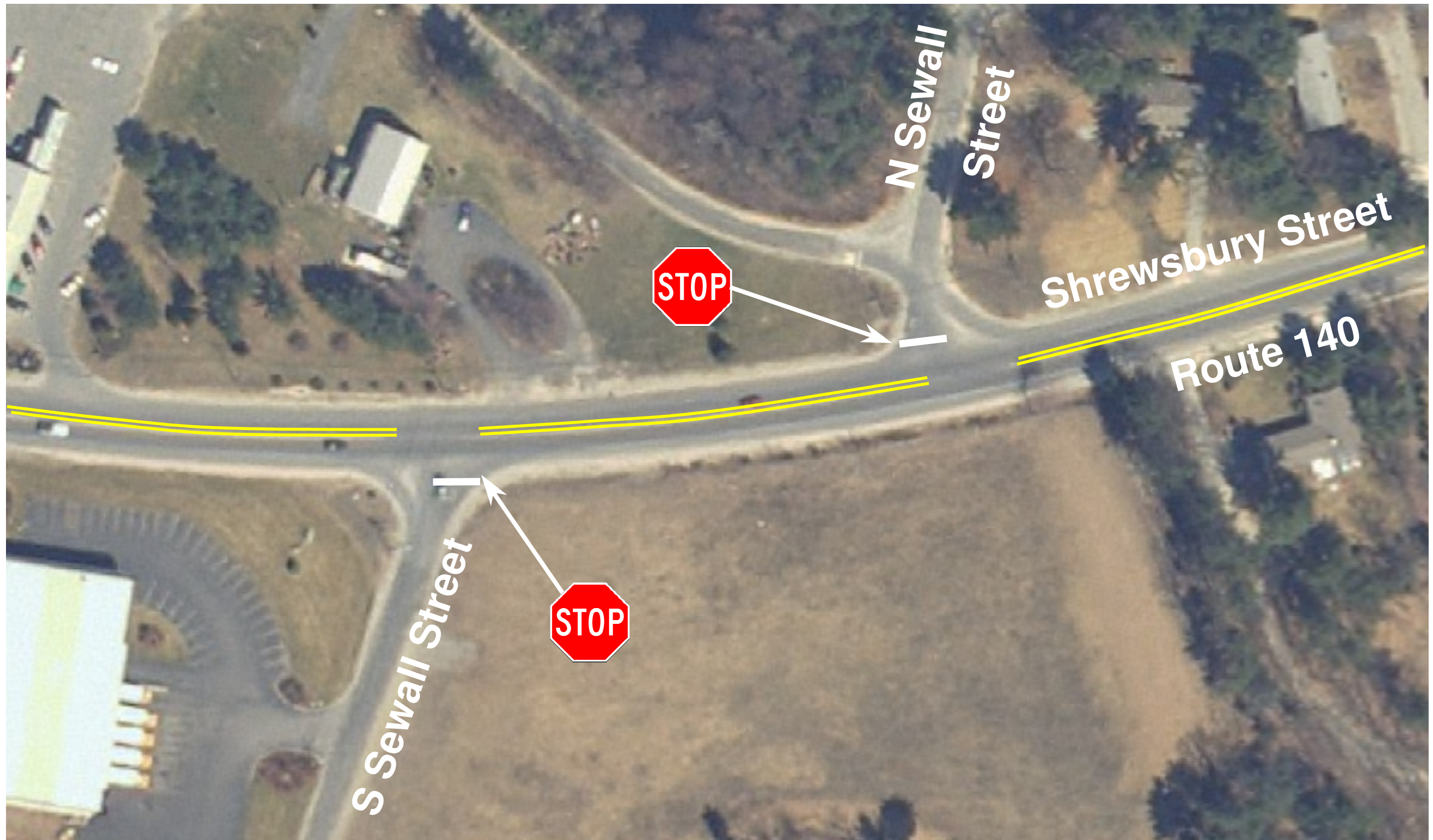
Schematic Diagram:
Not to Scale

Fay, Spofford & Thorndike, LLC
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Figure 2
Existing Conditions
East Temple Street

Route 140 Corridor
Town of Boylston, Massachusetts

July 2010



Schematic Diagram:
Not to Scale

Fay, Spofford & Thorndike, LLC
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Figure 3
Existing Conditions
N Sewall Street & S Sewall Street

Route 140 Corridor
Town of Boylston, Massachusetts

July 2010



Looking Southbound from Intersection



Looking At Route 140 from N. Sewell St

Route 140 & South Sewall Street

This four-way unsignalized intersection shown below consists of Route 140 running in an north/south direction and South Sewall Street approaching from the west. The fourth leg of the intersection is a driveway for the Greenleaf Place retail plaza at #81 Shrewsbury Street. The southern leg of Route 140 is 22-feet wide with one 12-foot lane. The northern leg of Route 140 is 24-feet wide with one 12-foot approach lane and a 12-foot shoulder. The western approach leg of South Sewall Street is approximately 13-feet wide with a single lane for left and right turns and through movements. The eastern approach leg serves Greenleaf Place for left and right turns and through movements. To the northwest and southwest of the intersection, there is a commercial building. South of the intersection along South Sewall Street is the town elementary school and a proposed residential development, currently under construction. Town-owned property is also located along South Sewall Street. A Stop sign controls turns from the minor approaches onto Route 140. A Stop line and word Stop (although pavement markings are worn) is present on the South Sewall approach. See Figure 3 for an aerial of the intersection.



Looking east from S. Sewall Street



Looking southbound along Rte 140 at the intersection

Route 140(Shrewsbury Street/West Boylston Street) & Main Street (Route 70)

This four-way signalized intersection consists of Route 140 running in an north/south direction and Main Street (Route 70). Route 70 is a State-controlled roadway and is classified as a rural major collector. To the south of Route 70, Route 140 is Shrewsbury Street and to the north, it becomes West Boylston Street. The southern approach leg of Route 140 consists of a 14-foot wide right turn/through lane and an 11.5-foot wide left turn lane with a 1-foot shoulder. The northern approach leg of Route 140 consists of a 14-foot wide right turn/through lane and an 11.5-foot wide left turn lane with a 3-foot shoulder. The northern approach leg of Main Street consists of a 14-foot wide right turn/through lane, 10.5-foot wide left turn lane, and a 2-foot shoulder. The southern approach leg of Main Street consists of a 12-foot wide right turn/through lane and an 11.5-foot wide left-turn lane. To the southeast of the intersection, there is Spruce Pond; to the northeast, is vacant commercially zoned land and a wooded area to the northwest. South of the intersection on Main Street is a 18.6-acre commercial parcel for sale where Christos Hot Dog stand currently operates out of a trailer and is adjacent to the Lions recreational facility/park. See Figure 4 for an aerial of the intersection.



Route 140 Northbound, south of Route 70



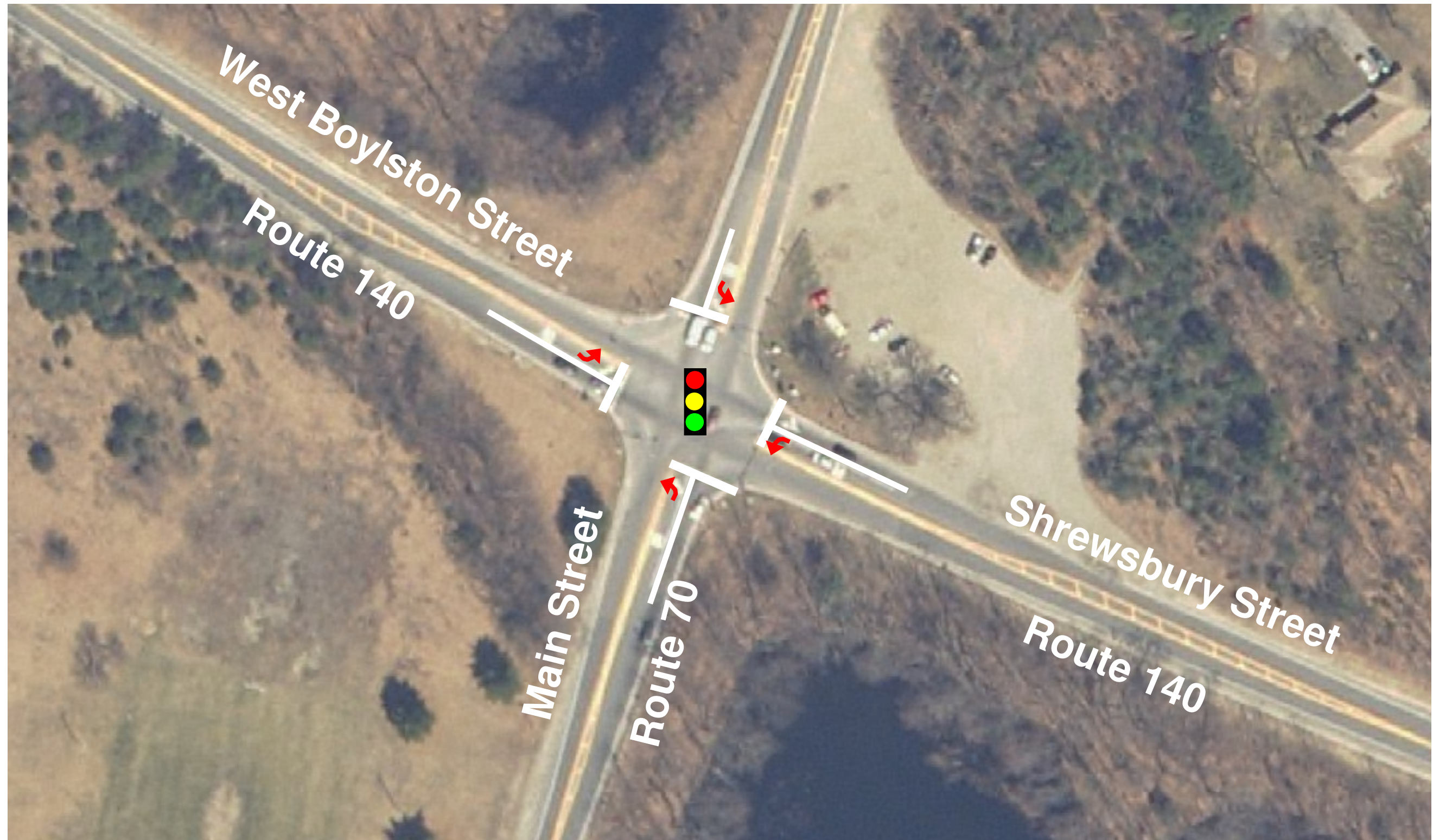
Route 70 eastbound, west of Route 140

2.2 DATA COLLECTION

Traffic Volumes

In order to evaluate traffic operating conditions at the study area intersections in Boylston, a traffic count program was conducted on May 13, 2009. This traffic count program consisted of manual turning-movement counts (TMCs) at four (4) study area intersections. The study area intersections are as follows:

- Route 140 & East Temple Street
- Route 140 & North Sewall Street
- Route 140 & South Sewall Street
- Route 140 & Main Street (Route 70)



Schematic Diagram:
Not to Scale

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Figure 4
Existing Conditions
Route 140 & Route 70

Route 140 Corridor
Town of Boylston, Massachusetts

July 2010

TMCs were taken at all four intersections for two hours during the AM peak period (7-9 AM) and two hours during the PM peak period (4-6 PM). From the data, peak-hour traffic volumes for the study area intersections were determined. Generally peak hours were determined to be 7:30-8:30 AM and 4:45-5:45 PM along the corridor.

Seasonality

Seasonality of traffic data was reviewed using the MassDOT database of seasonal factors and data from Permanent Count Station #8 in nearby Marlborough on I-290. Data indicates that the month of May, when our traffic data were collected, is 8% above the average month, thereby indicating that no seasonal adjustments are required for the traffic data. The balanced 2009 traffic volumes are shown in Figure 5.

Table 1 presents a summary of existing traffic volumes recorded as part of the traffic count program. These intersections process approximately the same amount of traffic during the AM and PM peak hours. This indicates that traffic volumes are relatively consistent during the peak periods. The corridor is a highly commuter-traveled corridor, with approximately 68%-74% of the directional hourly flow traveling southbound in the AM peak period (towards I-290) and 71%-75% traveling northbound in the PM peak period, thus reversing the directional pattern. The highest volumes were found at the signalized intersection of Route 140 and Main Street (Route 70).

Table 1
2009 Existing Traffic Volumes Entering Intersection*

<u>Location</u>	<u>AM Peak</u>	<u>PM Peak</u>
Route 140 & East Temple Street	1,560	1,650
Route 140 & North Sewall Street	1,570	1,660
Route 140 & South Sewall Street	1,600	1,650
Route 140 & Main Street (Route 70)	1,900	2,000

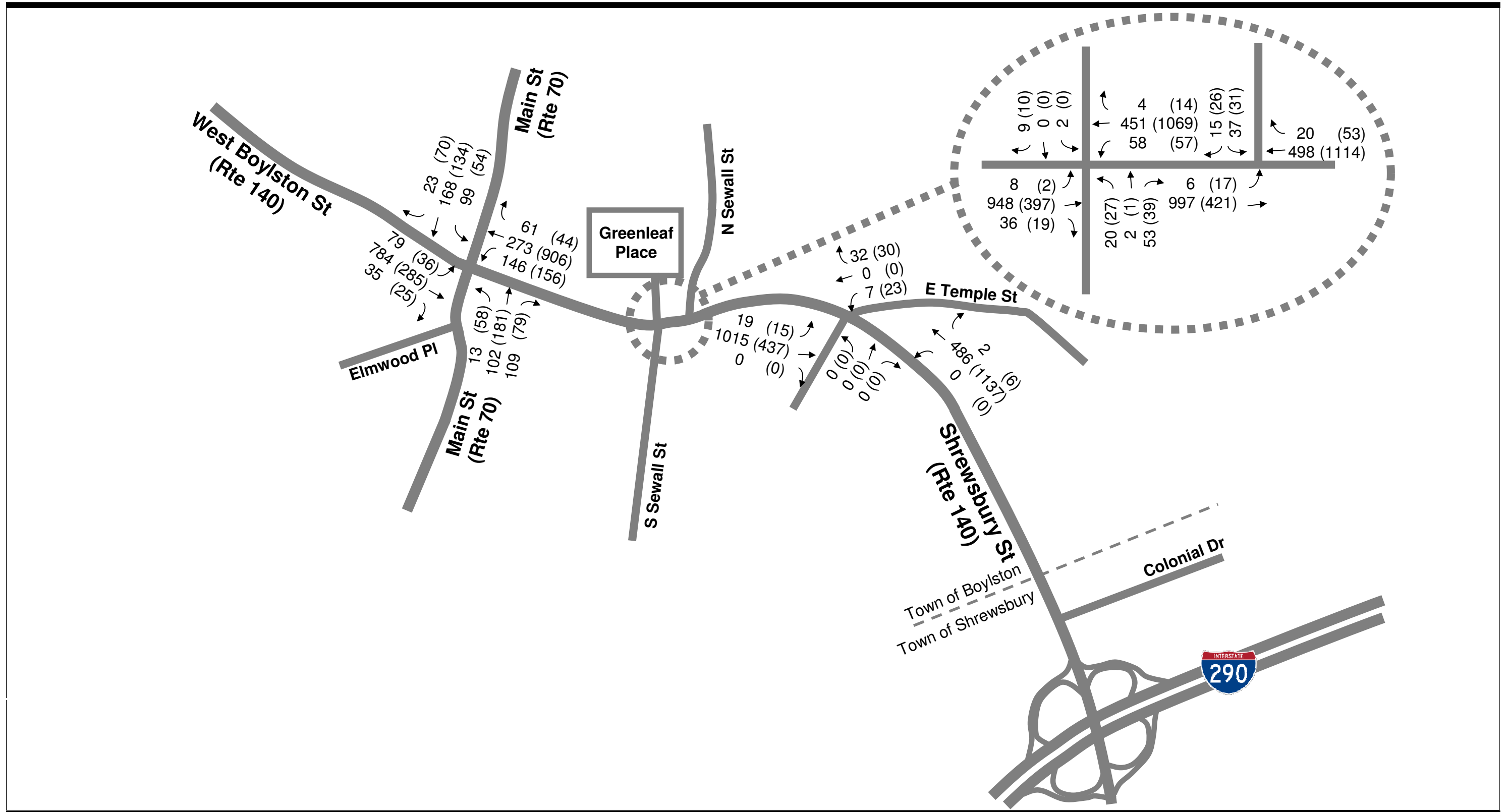
* Vehicles per hour

While automatic traffic recorder (ATR) counts along the corridor were not taken by FST for this study, historical data is available from MassDOT and the Central Massachusetts Regional Planning Commission (CMRPC) and is shown below in Table 2.

Table 2
Historical 24-Hour Traffic Volume Summary*

<u>Roadway</u>	<u>Location</u>	<u>Year</u>	<u>Average Daily Traffic **</u>
Rte 140 (Shrewsbury St)	At Shrewsbury Town Line	May 2004	15,000
Rte 140 (Shrewsbury St)	At Shrewsbury Town Line	May 2007	16,800
Rte 140 (Shrewsbury St)	East of Route 70 (Main St)	May 2004	9,000
Rte 140 (W. Boylston St)	At West Boylston T/L	May 2007	11,100
Rte 70 (Main Street)	North of Rte 140	May 2004	5,600
Rte 70 (Main Street)	North of Rte 140	May 2007	5,200
Rte 70 (Main Street)	South of Rte 140	August 2001	6,200
Rte 70 (Main Street)	South of Rte 140	May 2007	6,300

* Source: CMRPC and MassDOT; ** vehicles per day



Schematic Diagram:
Not to Scale

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Figure 5
2009 Existing AM (PM)
Peak Hour Traffic Volumes

Route 140 (Shrewsbury Street – West Boylston Street)
Town of Boylston, Massachusetts

AM Peak Hour: 7:30 – 8:30
PM Peak Hour: 5:00 – 6:00
Data Collected in May 2009
July 2010

It can be seen that north and south of Route 70 (Main Street) Route 140 has very different traffic volume fluctuations. Route 140 at the West Boylston town line carries approximately 11,100 vehicles per day. South of Route 70 (Main Street), Route 140 carries 9,000-16,800 vehicles per day, with the higher volume occurring at the Shrewsbury town line. North of the Route 140/Route 70 signalized intersection, Main Street carries approximately 5,400 vehicles per day, while south of the intersection, Main Street carries a higher volume of 6,300 vehicles per day. A graphic of these average daily traffic volumes can be seen in Figure 6.

Vehicle Speeds

A vehicle speed study was conducted along the corridor both in the northbound and southbound directions during the off-peak period using the car-following technique. Results, as seen in Table 3 indicate that the average speed in the northbound direction was 50 mph and was recorded to be less in the southbound direction with 42 mph. The low speed recorded was 48 mph in the northbound direction and 36 mph in the southbound direction. The high speed was noted to be 52 mph traveling northbound and 44 mph southbound. Speed limits vary along the corridor with 45 mph at the Shrewsbury town line, 40 mph north of Route 70, and 50 mph in the area of the Wachusett Reservoir. Our results indicate that the section where the speed study was conducted, the posted speed limit is 45 mph indicating that vehicles are traveling slightly over the speed limit in the northbound direction and below the speed limit in the southbound direction as motorists are traveling on a slight upgrade.

Table 3
Speed Study Summary

<u>Direction</u>	<u>Average Speed</u>	<u>Low Speed</u>	<u>High Speed</u>	<u>Posted Limit</u>
Northbound	50	48	52	45
Southbound	42	36	44	45

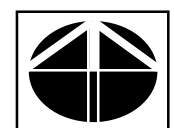
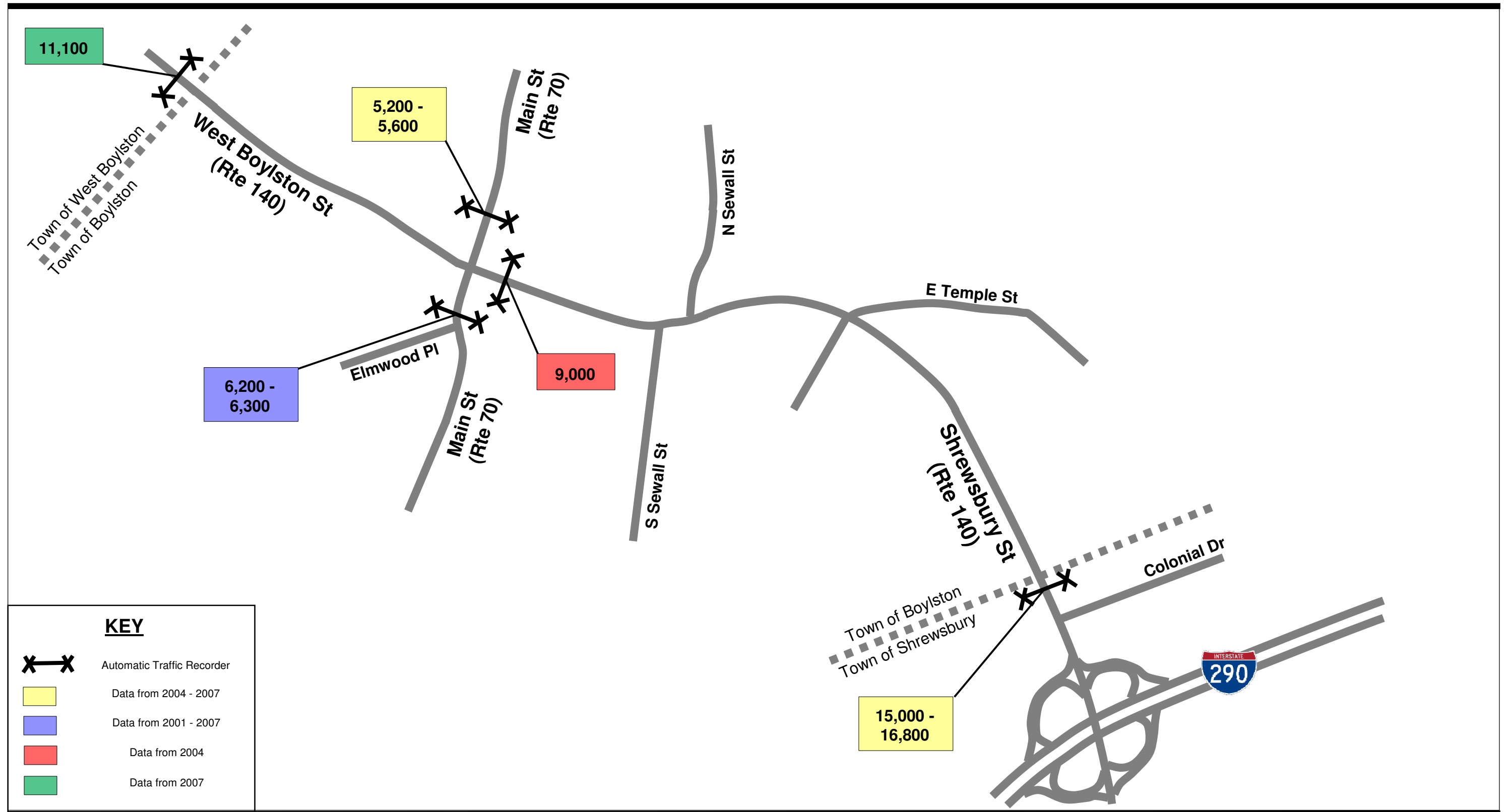
2.3 TRAFFIC OPERATIONS

Level of Service (LOS) is an expression of the quality of flow of traffic. LOS is a commonly used and accepted measure of the effectiveness of peak hour traffic operating conditions. It takes into account automobile and truck volumes, roadway width, speed, grade, parking restrictions, pedestrian activity, and traffic control devices.

LOS is designated in a range from Level “A”, which is the optimal condition where roadway operations are at their best, to Level “F” which indicates excessive delays. Levels “A” through “D” are typically associated with acceptable levels of peak hour traffic operations. At Level “E”, the ratio of the approach volume to capacity, or v/c ratio, of an intersection is between 90 and 100 percent of its theoretical capacity. Traffic congestion is considered to be unacceptable at Level of Service “E” or “F”.

All capacity analysis for the study area intersections in Boylston was performed in accordance with the methodologies set forth in the 2000 Highway Capacity Manual¹. LOS at

¹ *Highway Capacity Manual*; Transportation Research Board; 2000
Route 140 (Shrewsbury Street – West Boylston Street)
Boylston, MA



Schematic Diagram:
Not to Scale

Figure 6
Average Daily Traffic Volumes

Route 140 (Shrewsbury Street – West Boylston Street)
Town of Boylston, Massachusetts

signalized and unsignalized intersections is based on estimates of delay per vehicle. Table 3 presents a summary of the Level of Service criteria for unsignalized and signalized intersections.

Table 4
Intersection Level of Service Criteria

Level of Service	Unsignalized Delay (sec/veh.)	Signalized Delay (sec/veh)
A	≤10	≤10
B	>10 to 15	>10 to 20
C	>15 to 25	>20 to 35
D	>25 to 35	>35 to 55
E	>35 to 50	>55 to 80
F	>50	>80

Source: Highway Capacity Manual, 2000

Table 4 presents a summary of existing traffic operating conditions for the Route 140 study area intersections. As the results indicate, traffic operations are generally acceptable. During the PM peak period, there are long delays for the minor unsignalized streets, most notably in the PM peak periods where volumes are the heaviest.

Table 5
2009 Existing Level of Service Summary

<i>Signalized</i> Route 140 (NB/SB) Movement	AM Peak				PM Peak			
	Delay ¹	LOS	v/c ²	Queue ³	Delay ¹	LOS	v/c ²	Queue ³
<i>Signalized Intersection</i>								
<u>Route 140 at Main Street (Route 70)</u>								
Southbound Lt	25.0	C	0.40	60	26.4	C	0.25	33
Southbound Th/Rt	103.6	F	1.16	623	13.9	B	0.43	151
Northbound Lt	25.5	C	0.57	100	27.7	C	0.62	106
Northbound Th/Rt	12.7	B	0.43	160	88.5	F	1.13	749
Route 70 Northbound Lt	18.5	B	0.06	17	23.3	C	0.31	50
Route 70 Northbound Th/Rt	23.1	C	0.43	105	29.6	C	0.66	178
Route 70 Southbound Lt	29.3	C	0.52	93	26.8	C	0.38	50
Route 70 Southbound Th/Rt	23.9	C	0.49	121	24.7	C	0.49	117
Overall	56.7	E	0.86		53.8	D	0.96	
<i>Unsignalized</i>								
<u>East Temple Street</u>								
East Temple St WB Lt/Th/Rt	21.8	C	0.17	N/A	70.9	F	0.53	N/A
<u>North Sewall Street</u>								
North Sewall St WB Lt/Th/Rt	46.9	E	0.40	N/A	58.9	F	0.49	N/A
<u>South Sewall Street/Greenleaf Plaza Driveway</u>								
South Sewall St EB Lt/Th/Rt	57.9	F	0.56	N/A	63.9	F	0.56	N/A
Greenleaf Driveway WB Lt/Th/Rt	24.9	C	0.06	N/A	21.1	C	0.05	N/A

1. Control Delay in seconds per vehicle

2. Volume-to-capacity ratio

3. 95th percentile queue in feet per lane; N/A = Not Applicable

2.4 ACCIDENT HISTORY

In addition to reviewing traffic operating conditions within the study area, FST also investigated recent accident trends along the Route 140 corridor. As part of this effort, the accident history for the study area intersections were investigated for the three-year period of 2005, 2006, and 2007 from the MassDOT database for the following locations:

- Route 140 & East Temple Street
- Route 140 & North Sewall Street
- Route 140 & South Sewall Street
- Route 140 & Main Street (Route 70)
- Route 140 & Colonial Drive (in Shrewsbury)

Table 6 summarizes the accidents occurring at the intersections in the study area over this three-year period. The accidents occurring in areas between the intersections or along the roadway links are shown in Table 7.

Although the number of accidents alone is important, the actual exposure or potential for an individual driver being involved in an accident is reflected in the crash rate. The crash rate is defined as the number of accidents per million entering vehicles (MEV) at an intersection, and for the roadway link (the segment between the intersections), this measure is the number of million entering vehicles over that respective link. Using MassDOT's Crash Rate Worksheet (actual computations can be found in the Appendix), it can be seen that all of the study area intersections are below the statewide accident rate of 0.82 MEV and the MassDOT District 3 crash rate of 0.93 for signalized intersections. The unsignalized intersections are also below the State and District 3 rates of 0.62 MEV and 0.68 MEV, respectively. Thus the three-year data indicates there is not a high accident location along the Route 140 Corridor. We have reviewed Colonial Drive in Shrewsbury and this summary and review of data indicates a total of four (4) accidents were recorded over the three-year period.

3. FUTURE CONDITIONS

To assess future year conditions, an analysis was conducted to review the likely build out or change of existing land use implications along the Corridor. To do this, a 5-year future year condition was selected. The time frame is consistent with Environmental Impact Reports submitted to the Massachusetts Environmental Policy Act (MEPA) Unit. The 5-year time frame is outlined in the *Guidelines for Traffic Impact Assessments*, produced by the Executive Office of Energy and Environmental Affairs and Executive Office of Transportation and Public Works. A future year condition network is essentially comprised of two components: Normal or general background growth and site-specific development

3.1 GENERAL BACKGROUND GROWTH RATE

The Town of Boylston and the surrounding communities have seen some moderate traffic growth along the Route 140 and the I-290 corridors. In order to account for the continuation of

Route 140 (Shrewsbury Street – West Boylston Street) Intersection 3-Year Crash History

Table 6

	Colonial Dr	East Temple Street	N Sewall Street	S Sewall Street	Main Street (Rte 70)	Total
Signalized?	No	No	No	No	Yes	
Year						
2005	1	1	2	0	4	7
2006	1	0	2	0	4	6
<u>2007</u>	<u>2</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>4</u>	<u>4</u>
Total	4	1	4	0	12	17
Collision Type						
Angle	2	0	0	0	6	6
Head-on	0	0	0	0	0	0
Rear-end	1	0	2	0	2	4
Sideswipe	0	0	0	0	2	2
<u>Unknown</u>	<u>1</u>	<u>1</u>	<u>2</u>	<u>0</u>	<u>2</u>	<u>5</u>
Total	4	1	4	0	12	17
Severity						
Fatality	0	0	0	0	0	0
Hit and Run	0	0	0	0	0	0
Injury	1	0	0	0	6	6
Property	3	1	4	0	6	11
Bicyclist	0	0	0	0	0	0
Pedestrian	0	0	0	0	0	0
<u>Unknown</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	4	1	4	0	12	17
Time of Day						
7:00 AM – 9:00 AM	0	0	0	0	3	3
9:01 AM – 3:59 PM	2	0	3	0	6	9
4:00 PM – 6:00 PM	2	0	1	0	1	2
<u>6:01 PM – 6:59 AM</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>2</u>	<u>3</u>
Total	4	1	4	0	12	17
Day of Week						
Monday-Friday	4	1	4	0	10	15
<u>Saturday-Sunday</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>2</u>	<u>2</u>
Total	4	1	4	0	12	17
Pavement Conditions						
Dry	3	0	1	0	6	7
Wet	0	0	1	0	5	6
Snow	0	1	2	0	0	3
Ice	0	0	0	0	0	0
<u>Unknown</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>	<u>1</u>
Total	4	1	4	0	12	17
Intersection Crash Rate	N/A	0.125	0.171	0.464	0.313	N/A
MHD State Crash Rate	N/A	0.62	0.62	0.62	0.82	
Above MHD Crash Rate?	N/A	No	No	No	No	

Route 140 (Shrewsbury Street – West Boylston Street) Roadway Links 3-Year Crash History

Table 7

	Between Shrewsbury Town Line & East Temple Street	Between East Temple Street & N Sewall Street	Between N Sewall Street & S Sewall Street	Between S Sewall Street & Main Street (Rte 70)	Total
Year					
2005	11	0	0	2	13
2006	6	0	0	2	8
<u>2007</u>	<u>9</u>	<u>0</u>	<u>0</u>	<u>4</u>	<u>13</u>
Total	26	0	0	8	34
Collision Type					
Angle	12	0	0	1	13
Head-on	2	0	0	0	2
Rear-end	3	0	0	2	5
Sideswipe	2	0	0	1	3
<u>Unknown</u>	<u>7</u>	<u>0</u>	<u>0</u>	<u>4</u>	<u>11</u>
Total	26	0	0	8	34
Severity					
Fatality	0	0	0	0	0
Hit and Run	0	0	0	0	0
Injury	12	0	0	3	15
Property	13	0	0	5	18
Bicyclist	0	0	0	0	0
Pedestrian	0	0	0	0	0
<u>Unknown</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1</u>
Total	26	0	0	8	34
Time of Day					
7:00 AM – 9:00 AM	5	0	0	1	6
9:01 AM – 3:59 PM	8	0	0	3	11
4:00 PM – 6:00 PM	3	0	0	2	5
<u>6:01 PM – 6:59 AM</u>	<u>10</u>	<u>0</u>	<u>0</u>	<u>2</u>	<u>12</u>
Total	26	0	0	8	34
Day of Week					
Monday-Friday	23	0	0	6	29
<u>Saturday-Sunday</u>	<u>3</u>	<u>0</u>	<u>0</u>	<u>2</u>	<u>5</u>
Total	26	0	0	8	34
Pavement Conditions					
Dry	15	0	0	5	20
Wet	9	0	0	2	11
Snow	0	0	0	1	1
Ice	2	0	0	0	2
<u>Unknown</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	26	0	0	8	34

general traffic growth along the corridor, research was conducted into the MassDOT database of permanent traffic count stations in the area. Research indicates that permanent count Station #8 in nearby Marlborough on I-290 is the nearest station to evaluate traffic growth in the area. Data from this station historically shows a 1% annual growth rate. In addition, given the current economic climate, it would appear this growth rate would be appropriate for this corridor. In addition, the historical volumes recorded along both the northern and southern segments of Route 70 show little change from year to year. This growth rate was also reviewed with the Town and the CMRPC. The 1% annual growth rate (1.051) was applied to the existing peak hour traffic volumes to create the base future 2014 No Build traffic network. Traffic was also generated from the development projects that have been permitted or are currently under review by the Town and by estimating the potential build-out of undeveloped parcels along the corridor.

3.2 PLANNED DEVELOPMENT PROJECTS

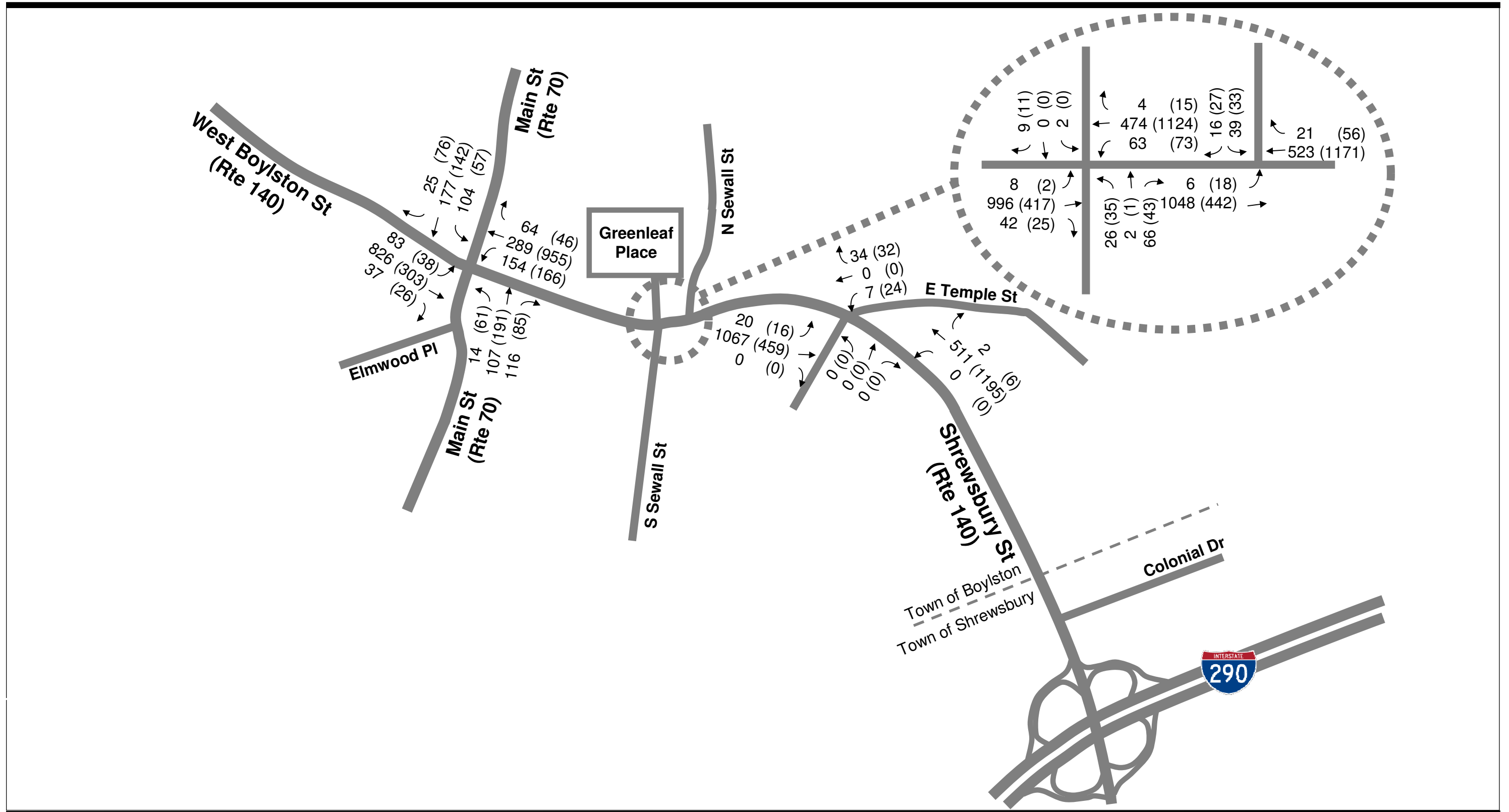
Activity

The Town of Boylston identified the development projects listed in Table 7 as projects that have been permitted or are currently under review by the Town. For a conservative analysis, the study assumes that these projects will be constructed and fully occupied in the 2014 No Build-out. Traffic generated by these development projects was added to the general background growth rate to arrive at the 2014 No Build peak hour traffic volumes. The No Build traffic network is shown in Figure 7.

Table 8 Area Projects Permitted or Under Review*		
Project Name/Location	Land Use	Development Size Proposed
Specialty Retail – Rte 140/Rte 70	Retail/Commercial	10,000 SF
Compass Pointe-S. Sewall Rd	Residential	48 units
* Data secured from Town Files		

Analysis

The procedures for traffic analysis for future conditions were the same that were utilized for existing conditions that are outlined in the 2000 Highway Capacity Manual (HCM), and the results are shown in Table 9.



Schematic Diagram:
Not to Scale

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Figure 7
2014 No Build AM (PM)
Peak Hour Traffic Volumes

Route 140 (Shrewsbury Street – West Boylston Street)
Town of Boylston, Massachusetts

Table 9
2014 Future No Build Level of Service Summary

<i>Signalized</i> Route 140 (NB/SB) Movement	AM Peak				PM Peak			
	Delay ¹	LOS	v/c ²	Queue ³	Delay ¹	LOS	v/c ²	Queue ³
<i>Signalized Intersection</i>								
<u>Route 140 at Main Street (Route 70)</u>								
Southbound Lt	22.1	C	0.32	62	26.4	C	0.27	35
Southbound Th/Rt	142.5	F	1.25	665	14.2	B	0.45	161
Northbound Lt	25.5	C	0.59	105	29.2	C	0.65	112
Northbound Th/Rt	15.5	B	0.51	171	112.8	F	0.34	796
Route 70 Northbound Lt	18.1	B	0.07	18	24.4	C	0.34	53
Route 70 Northbound Th/Rt	23.0	C	0.45	111	31.3	C	0.70	195
Route 70 Southbound Lt	30.6	C	0.56	102	29.6	C	0.44	61
Route 70 Southbound Th/Rt	23.8	C	0.50	126	25.5	C	0.53	125
Overall	74.0	E	0.92		65.7	E	1.02	
<i>Unsignalized</i>								
<u>East Temple Street</u>								
East Temple St WB Lt/Th/Rt	23.5	C	0.19	N/A	92.8	F	0.64	
<u>North Sewall Street</u>								
North Sewall St WB Lt/Th/Rt	57.2	F	0.48	N/A	76.0	F	0.59	N/A
<u>South Sewall Street/Greenleaf Plaza Driveway</u>								
South Sewall St EB Lt/Th/Rt	101.6	F	0.81	N/A	136.0	F	0.87	N/A
Greenleaf Driveway WB Lt/Th/Rt	30.1	D	0.08	N/A	22.6	C	0.06	N/A

1. Control Delay in seconds per vehicle

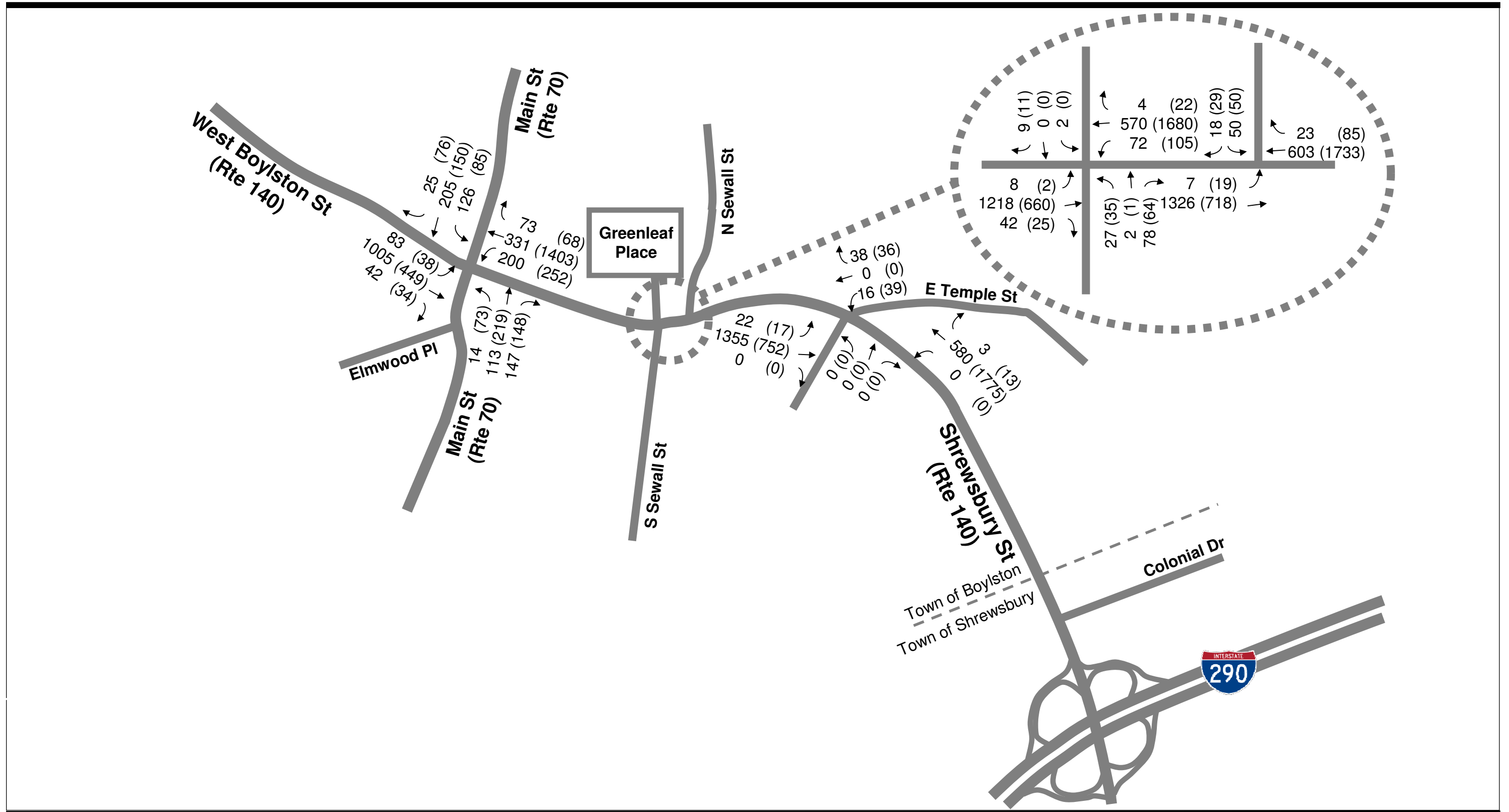
2. Volume-to-capacity ratio

3. 95th percentile queue in feet per lane; N/A = Not Applicable

3.3 POTENTIAL DEVELOPMENT PROJECTS

The Town of Boylston and the project team identified vacant parcels listed in Table 9 as locations that could potentially add traffic to the Route 140 corridor. Table 9 is a condensed summary of Table 3.3 of the Draft Corridor Plan¹. Although these parcels may or not be developed within the 5-year horizon, this study assumes that development will take place on these parcels by the 2014 build-out year. Traffic generated by these potential development projects was incorporated with the general background rate and planned development projects to arrive at the 2014 Build peak hour volumes in Figure 8.

¹ Route 140 Corridor Plan; Community Opportunities Group, Inc; February 8, 2010
Route 140 (Shrewsbury Street – West Boylston Street)
Boylston, MA



Schematic Diagram:
Not to Scale

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Figure 8
2014 Build AM (PM)
Peak Hour Traffic Volumes

Route 140 (Shrewsbury Street – West Boylston Street)
Town of Boylston, Massachusetts

Table 10 Potential Developable Parcels or PDS*			
Parcel Number/Location	Anticipated Land Use	Acreage	Estimated Daily Trips**
16-47/E. Temple St	Residential	6.7	180
9-18/School St		3.5	90
17-39/Shrewsbury St		14.8	390
12-25-2/ Shrewsbury St		47.3	1,230
17-40/ Shrewsbury St		4.2	110
16-51/Carol St		2.0	50
9-14/ Shrewsbury St		2.9	80
13-33/W. side of Shrewsbury St	Industrial	1.7	350
9-7/ W. side of Shrewsbury St		6.0	520
12-15/ W. side of Shrewsbury St		3.9	430
9-2 & 4/ W. side of Shrewsbury St		6.8	560
12-17B/ W. side of Shrewsbury St	Commercial/Retail	2.4	1,330
W. side of Shrewsbury St		146	19,300
* Parcels numbers and acreage secured from Table 3.3 of COGI Draft Study; ** <i>Trip Generation</i> ; Institute of Transportation Engineers; 2008			

The AM and PM peak hour trips from the potential build out of the above parcels were determined using the trip estimating procedures outlined in *Trip Generation*, published by the Institute of Transportation Engineers. These trips were then assigned onto the 2014 No Build traffic network using existing and future traffic patterns to create the AM and PM peak hour 2014 Build traffic networks. Analysis procedures used previously were then undertaken and the results are summarized in Table 10 for full build-out of the corridor. These build-out volumes also reflect development in the adjacent communities.

Table 11
2014 Future Build-Out Level of Service Summary

<i>Signalized</i> Route 140 (NB/SB) Movement	AM Peak				PM Peak			
	Delay ¹	LOS	v/c ²	Queue ³	Delay ¹	LOS	v/c ²	Queue ³
<i>Signalized Intersection</i>								
<u>Route 140 at Main Street (Route 70)</u>								
Southbound Lt	23.3	C	0.32	62	27.9	C	0.27	35
Southbound Th/Rt	277.1	F	1.56	839	20.1	C	0.68	278
Northbound Lt	25.9	C	0.62	139	38.3	D	0.81	202
Northbound Th/Rt	15.8	B	0.55	203	320.6	F	1.67	1232
Route 70 Northbound Lt	20.3	C	0.09	18	32.0	C	0.48	62
Route 70 Northbound Th/Rt	27.6	C	0.56	128	70.1	E	0.99	283
Route 70 Southbound Lt	86.7	F	0.95	142	62.4	E	0.78	102
Route 70 Southbound Th/Rt	29.0	C	0.62	146	29.4	C	0.59	131
Overall	139.1	F	1.16		177.7	F	1.43	
<i>Unsignalized</i>								
<u>East Temple Street</u>								
East Temple St WB Lt/Th/Rt	85.3	F	0.60	N/A	-	F	4.19	N/A
<u>North Sewall Street</u>								
North Sewall St WB Lt/Th/Rt	218.8	F	1.04	N/A	-	F	3.06	N/A
<u>South Sewall Street/Greenleaf Plaza Driveway</u>								
South Sewall St EB Lt/Th/Rt	372.9	F	1.50	N/A	-	F	4.47	N/A
Greenleaf Driveway WB Lt/Th/Rt	69.1	F	0.18	N/A	48.8	E	0.13	N/A

1. Control Delay in seconds per vehicle

2. Volume-to-capacity ratio

3. 95th percentile queue in feet per lane; N/A = Not Applicable

It can be seen from this worst-case or full build-out scenario, long delays (LOS F) will occur at the study area intersections.

4. ROADWAY AND INTERSECTION IMPROVEMENT PROJECTS

4.1 CURRENT PROJECTS

Our discussions with town officials and review of the current Transportation Improvement Program (TIP) published by the CMRPC indicate that there are no roadway or intersection projects proposed within the next five years. It is expected that roadway paving and minor drainage improvements would occur, but would not affect traffic impacts along the corridor.

4.2 TRAFFIC SIGNAL WARRANT ANALYSIS

The need to provide traffic signal control for the study area intersections, either presently or in the future was evaluated based on existing and projected traffic volumes and procedures found in the Manual on Uniform Traffic Control Devices (MUTCD). In order to justify installation of traffic signals at an intersection, two or more of the following eight signal warrants should be met. A brief description of each warrant is provided in the Appendix under a separate cover.

- Warrant 1 – Eight-Hour Vehicular Volume
- Warrant 2 – Four-Hour Vehicular Volume
- Warrant 3 – Peak Hour
- Warrant 4 – Pedestrian Volume
- Warrant 5 – School Crossings
- Warrant 6 – Coordinated Signal System
- Warrant 7 – Crash Experience
- Warrant 8 – Roadway Network

FST has reviewed existing and projected traffic volume data, travel speed data, and intersection crash data for the following three intersections in order to determine whether traffic signal installation is justified under existing conditions for the Route 140 corridor:

- Route 140 & East Temple Street
- Route 140 & North Sewall Street
- Route 140 & South Sewall Street

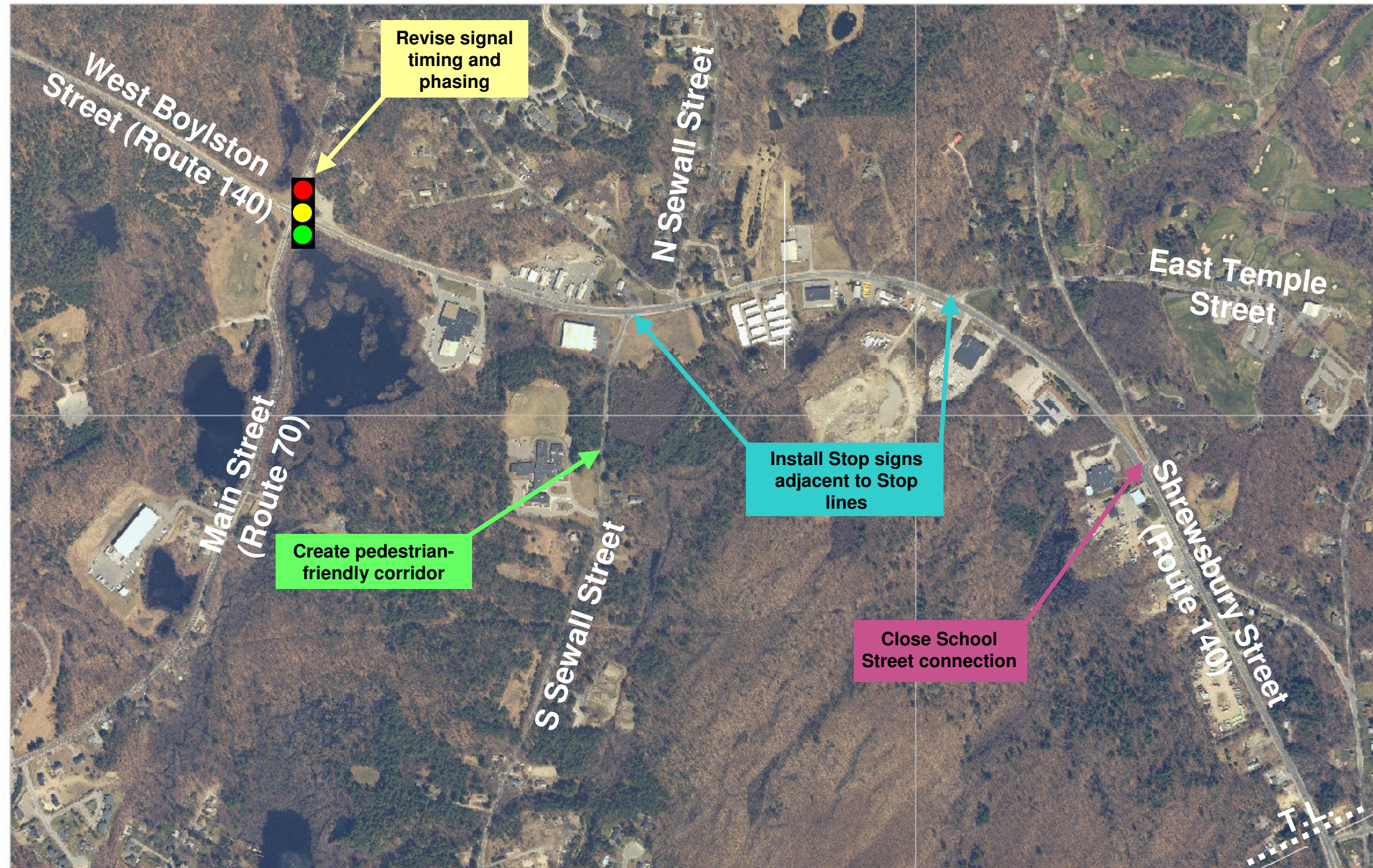
Based on our review of these warrants, only Warrant 3, the Peak Hour warrant is satisfied for the South Sewall and Route 140 (Shrewsbury Street) intersection.

4.3 RECOMMENDED IMPROVEMENT PROJECTS

In order to attempt to accommodate the projected traffic volumes, roadway and intersection improvements were evaluated for the Route 140 corridor. A summary is presented for both the existing, short-term and long-term build-out conditions along with an order-of-magnitude cost estimate for each improvement. See Figure 9 for a summary of the recommended short-term improvements and Figure 10 for long-term improvements.

Existing Conditions/Short-Term Improvements

- Establish an annual pavement-marking program to upgrade the lane, edge line and centerlines marking along the corridor and intersections. \$3,000-\$8,000;
- Erect Stop signs adjacent to the Stop lines at area intersections. \$2,000;



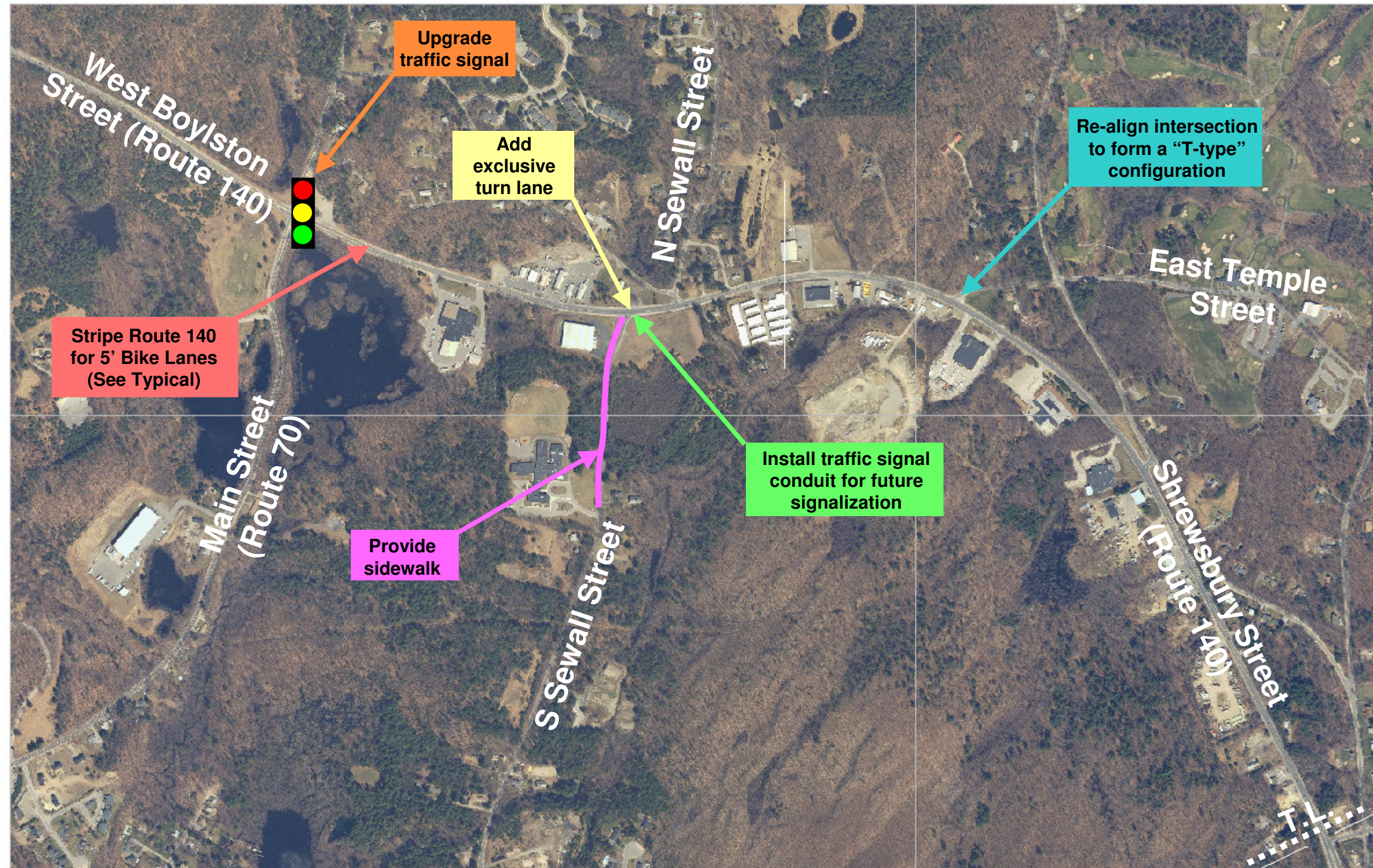
Schematic Diagram:
Not to Scale

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Figure 9
Short-Term Improvements

Route 140 Corridor
Town of Boylston, Massachusetts

July 2010



Schematic Diagram:
Not to Scale

Fay, Spofford & Thorndike, LLC
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Figure 10
Long-Term Improvements

Route 140 Corridor
Town of Boylston, Massachusetts

July 2010

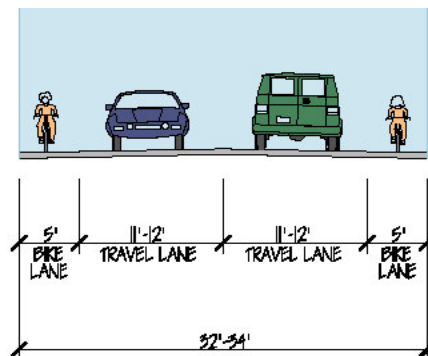
- Install retroreflectivity signing along the corridor and at approach intersections. \$3,000-\$5000;
- Close the connection from School Street to Shrewsbury Street, located just south from the East Temple Street intersection with Route 140. Activity to School Street can be provided via the East Temple Street intersection or via Cross Street, via Colonial Drive. \$3,500;
- Consult with MassDOT to revise the signal timing and phasing based on recent FST data collected for the intersection and corridor. \$1,500;
- Initiate a program to make the South Sewall Street corridor, south of Route 140 and at the existing elementary school a more pedestrian friendly corridor. The Safe Routes to School program (www.saferoutesinfo.org) may be a mechanism to enhance mobility and safety such as adding a sidewalk. \$1,000.

Future No Build Conditions/Long-Term Improvements

- With the build out of the Compass Pointe residential project, the Town should assure that the project proponent contributes to upgrading the roadway along the site frontage, install sidewalks and proper signing;
- The Town, working with the Central Massachusetts Regional Planning Commission, should undertake a traffic monitoring program which would consist of traffic data collection at study area intersections and include all vehicles (including trucks), bicycles and pedestrians to determine if traffic projections have been realized;
- The Town, working with the Central Massachusetts Regional Planning Commission should develop a list of transportation projects to be placed on the Transportation Improvement Program (TIP). At a minimum, this list should include corridor intersection upgrades, safety improvements and intersection re-alignment, especially at the East Temple Street and Route 140 intersection.

Future Build Conditions/Long-Term Improvements

- Develop a Town-wide mechanism for the creation of an off-site infrastructure fund that would be used to mitigate private development related impacts. This fund would be primarily used to assist in funding off-site improvements at Town owned intersections, roadways and corridors. Access management of proposed curb cuts should also be reviewed closely during site plan review;
- Install and stripe an exclusive left-turn lane on Route 140 northbound at the South Sewall Street intersection. \$20,000-\$40,000;
- Construct a sidewalk on South Sewall Street from the elementary school to Route 140. \$8,000-\$15,000;
- Stripe a 5-foot wide bike lane along both sides of the Route 140 corridor roadway. A typical corridor cross section is shown on Figure 11.



Proposed Typical Cross Section
Figure 11

5.0 CONCLUSION

From review of existing conditions, very little geometric and traffic operational changes have occurred over the years along the corridor. Based on existing and future year traffic analysis, using an optimistic build-out (given this present economy) of Priority Development Sites (PDS) and other developable parcels, traffic operations will downgrade at area intersections. While the 5-year future year analysis may be somewhat overly conservative for future year assessment, the analysis conditions present a guideline of which future year conditions to review since not many private projects are in the Town pipeline.

To initiate the planning process to upgrade corridor and Town-wide facilities, the Town should work with the Central Massachusetts Regional Planning Commission (CMRPC) and the Town's consultants to have projects placed on the Transportation Improvement Program (TIP) for future consideration. Presently there are none listed for the Town. There are some immediate and short-term recommendations noted previously that could be implemented. It is recommended that this study serve as a guideline to upgrade the Corridor future build-out and development. These measures may consist of upgrading the existing traffic signal, erecting a new traffic signal, installing pavement markings and adding turn lanes and bike lanes. In addition, working with the CMRPC, a traffic monitoring and regular count project should be initiated to see if projected traffic volumes are realized. With the Town adopting a formal site plan review process, consideration will be given to access management, off-site mitigation and smart growth and sustainable site development.