

# 2013 Major Bottleneck In-Depth Analysis and Action Plan

Central Street and Harrison Boulevard from Canton Street Route 27 in Stoughton to Route 28 at East/West Spring Street in Avon



October 2013



Old Colony Planning Council  
70 School Street  
Brockton, MA 02301

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**Report Preparation**

**Ray Guarino, Senior Transportation Planner**

[rguarino@ocpcrpa.org](mailto:rguarino@ocpcrpa.org)

**Eric Arbeene, Community Planner**

[earbeene@ocpcrpa.org](mailto:earbeene@ocpcrpa.org)

**Data Collection and Analysis**

**James R. Watson, AICP, Comprehensive Planning Supervisor**

[jwatson@ocpcrpa.org](mailto:jwatson@ocpcrpa.org)

**Jed Cornock, Transportation Planner**

[jcornock@ocpcrpa.org](mailto:jcornock@ocpcrpa.org)

**Bruce Hughes, Economic Development/Community Planner**

[bhughes@ocpcrpa.org](mailto:bhughes@ocpcrpa.org)

**William McNulty, Senior Transportation Planner**

[wmcnulty@ocpcrpa.org](mailto:wmcnulty@ocpcrpa.org)

**Kyle Mowatt, Transportation Planner**

[kmowatt@ocpcrpa.org](mailto:kmowatt@ocpcrpa.org)

**Mapping and Graphics**

**Susan McGrath, GIS Coordinator**

[smcgrath@ocpcrpa.org](mailto:smcgrath@ocpcrpa.org)

**Andrew Vidal, Communications/GIS/ Specialist**

[avidal@ocpcrpa.org](mailto:avidal@ocpcrpa.org)

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**OCPC TRANSPORTATION STAFF**

|                      |   |
|----------------------|---|
| Charles Kilmer, AICP | Assistant Director/Transportation Program Manager |
| Eric Arbeene         | Community Planner                                 |
| Shawn Bailey         | Temporary Transportation Technician               |
| Jed Cornock          | Transportation Planner                            |
| Paul Chenard         | Transportation Planner                            |
| Raymond Guarino      | Senior Transportation Planner                     |
| Susan McGrath        | GIS Coordinator                                   |
| William McNulty      | Senior Transportation Planner                     |
| Kyle Mowatt          | Transportation Planner                            |
| Andrew Vidal         | Communications/GIS Specialist                     |

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## OCPC STAFF

|                     |   |
|---------------------|---|
| Pasquale Ciaramella | Executive Director                                |
| Eric Arbeene        | Community Planner                                 |
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| Lila Burgess        | Ombudsman Program Director                        |
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# 1 Introduction

## 1.1 Bottleneck Identification

The Old Colony Planning Council (OCPC) Bottleneck Reduction Improvement Program (Phase I) was established in 2010 to identify and target specific congestion chokepoint areas in the region's roadway network. The 2010 "Phase I" Major Bottleneck Identification Study focused on identifying and prioritizing bottleneck locations throughout the Old Colony region for further in-depth study.

The 2013 Major Bottleneck In-Depth Analysis and Action Plan focuses on the Central Street/Harrison Boulevard corridor. The study area includes the Central Street/Harrison Boulevard corridor from the Central Street (Route 27)/West Street intersection in Stoughton, including Harrison Boulevard in Avon, to East Main Street (Route 28), including a short segment of East Main Street (Route 28) to the East Main Street (Route 28)/East Spring Street/West Spring Street intersection in Avon. The study area is shown in Figure 1.

The identification process in Phase I was data driven and included the utilization of local agency knowledge and direct observation.<sup>1</sup> The process utilized the Old Colony Congestion Management Process (CMP), corridor studies, and other traffic studies by OCPC or other agencies and/or consultant engineers. A matrix was developed that included location, bottleneck type (recurring versus incident-related), previous studies, and improvements to the facility (recently implemented or planned), as well as data driven performance measures including Volume to Capacity (V/C) ratios and levels-of-service (LOS). Public outreach included surveys in which stakeholders identified bottleneck priorities. Priorities were given to those locations that were not covered in recent studies and/or were not scheduled for improvement in the Old Colony Transportation Improvement Program (TIP).

The Federal Highway Administration defines bottlenecks as: "*Localized sections of highway experiencing delay and restricted free movement at a point of congestion during the peak commuter periods*". Bottlenecks are categorized into two types: non-recurring bottlenecks, which are random and happen at work zones, special events, crashes, and incidents, and recurring bottlenecks, which happen under fixed conditions and involve the design, or function of a facility. These occur at confluences or choke points where peak hour surging periodically overwhelms the roadway's physical ability to handle the traffic, (i.e., capacity). Examples of recurring bottlenecks include ramps, lane drops, weaves, merges, grades, underpasses, tunnels, narrow lanes, lack of shoulders, bridge lane reduction, curves, and poorly operating traffic signals. This study includes analysis for recurring bottlenecks only.

Bottleneck analyses were developed to meet the objectives of the *2012 Old Colony Regional Transportation Plan (RTP)*. Figure 2 documents the connection between the bottleneck analysis, the objectives of the RTP, and the overall RTP goal for enhancing and protecting regional mobility.

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<sup>1</sup> "An Agency Guide on How to Establish Localized Congestion Mitigation Programs", FHWA's Bottleneck Reduction Initiative Program Office of Operations, March 2011, page 2-10.





**Figure 2 - Relationship of the Bottleneck Study and the Old Colony Regional Transportation Plan (RTP)**



## 1.2 Study Purpose and Scope

This study includes an in-depth analysis of the Central Street/Harrison Boulevard bottleneck area in Stoughton and Avon for the purpose of developing short-term and long-term actions that enhance the efficiency of traffic flow and circulation. This study includes traffic data collection (average daily traffic and peak hour turning movements), analyses of existing traffic conditions (intersection peak hour levels-of-service, speeds, and heavy vehicles), an inventory of physical conditions (pavement width, lane use, signage, traffic control, and pavement conditions), a review of land use and community goals, and a review and analysis of crash data within the study area. In addition, traffic forecasts and level-of-service analyses for future (five-year horizon) peak hour conditions were performed for this study. Traffic analyses were completed utilizing standard practices published in the *Highway Capacity Manual*, published by the Institute of Transportation Engineers (ITE). The traffic analysis software used to complete this study included SYNCHRO (including SimTraffic) and HCS Software. Signal Warrant analyses were performed in accordance with national standards as established in the *Manual on Uniform Traffic Control Devices* (MUTCD) by the Federal Highway Administration (FHWA). Traffic data collection and crash analyses were completed in accordance with the procedures and techniques in the *Manual of Traffic Engineering Studies* by ITE. In addition to data collection, other information was obtained from the Massachusetts Registry of Motor Vehicles, the Massachusetts Department of Transportation (MassDOT), The Federal Highway Administration (FHWA), and the Massachusetts Geographic Information System (MassGIS).

Pedestrian and bicycle accommodations, are included in this study. The “Complete Streets” concept (designing roads to accommodate all road users), traffic calming, access management, and reviews of local and state existing plans and master plans were discussed in the public outreach meetings to develop specific improvements projects and to define a long term vision for the study area corridor and intersections.

## 1.3 Public Outreach

Public outreach is essential for developing collaboration and consensus among stakeholders within the study process. An important part of the public outreach process includes the identification of stakeholders, especially those who have the potential to be impacted by the study, those who are important in implementation of improvements, and those who have interest in the study and process. OCPC’s identification process included reaching out to the business community, the public at large, and groups that have been traditionally underserved including the elderly, groups with Limited English Proficiency (LEP), minorities, and people below the poverty line.

A list of abutters of the study area in Avon and Stoughton was compiled utilizing geocoded files to develop mailing lists for public meeting notification. Meeting flyers were mailed to 305 abutters and town officials in Stoughton and 45 abutters and town officials in Avon.

Public outreach is essential for maintaining consistency in state, regional, and local plans and for initiating specific projects in the communities for inclusion in the region’s Transportation Improvement Program (TIP), as well as for identifying bottlenecks and their causes. OCPC’s public outreach process included a project website page on OCPC’s website and an on-line survey as well as a comprehensive meeting and contact schedule to reach a cross section of the general public, public officials, and interested parties. The website page provided an overview of the project, notices of public meetings, and the conclusions and improvements resulting from the study. The public meetings included workshops and presentations of existing traffic, transit, non-motorized vehicles, and land use conditions, as well as discussions that facilitated audience input. OCPC held the public workshops at a variety of

venues including the Portuguese National Club in Stoughton, the Stoughton Senior Center, and the Avon Public Library to reach underserved groups such as those with Limited English Proficiency. A number of different media, including on-line and newspaper outlets, were utilized to publicize the meetings and the study survey. Copies of the public outreach notice flyers are included in the appendices.

The public outreach process included:

- Early notification of meetings and periodic sharing of information
- A thorough search and identification of stakeholders, including non-traditional participants
- Open meetings held at convenient and accessible locations
- Meeting information available in a variety of media and in electronic accessible formats (world-wide web)
- A variety of visualization techniques were employed to disseminate information
- Meeting techniques included open house, visual presentation, and workshop/discussion formats

Table 1 summarizes officials, agencies, and organizations contacted and who participated in the study process.

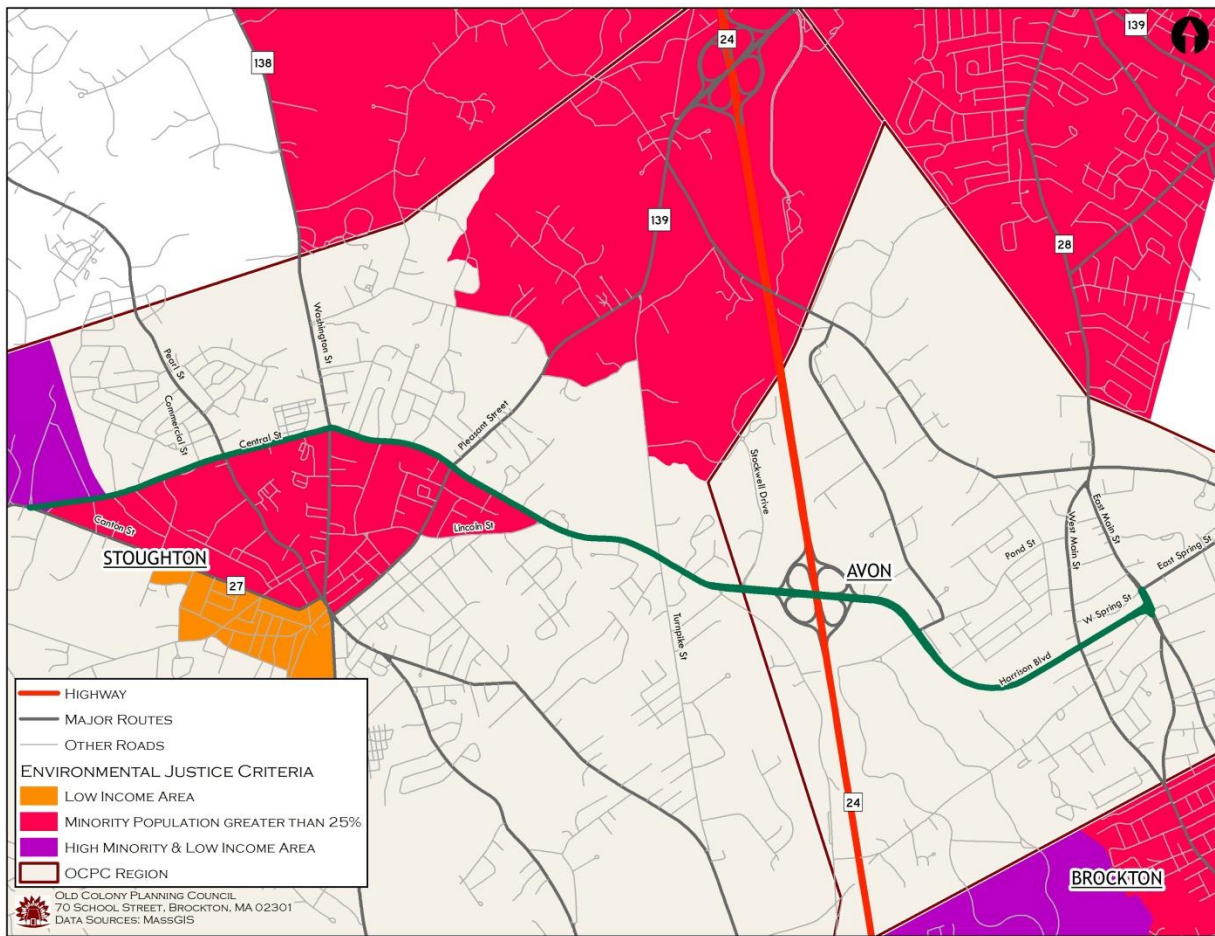
**Table 1 – Study Participants**

|                                 |  |
|---------------------------------|--|
| Old Colony JTC                  | Stoughton Engineering                    |
| Avon Highway/DPW                | Stoughton Highway/DPW                    |
| Avon Town Administrator         | Stoughton Town Administration            |
| Avon Police                     | Stoughton Police                         |
| Avon Fire                       | Stoughton Fire                           |
| Avon Planning Board             | Stoughton Pioneering Healthy Communities |
| Avon Public School Department   | Stoughton Planning Board                 |
| Metro South Chamber of Commerce | Stoughton Conservation Officer           |
| Avon Council on Aging           | Stoughton Chamber of Commerce            |
| Brockton Area Transit (BAT)     | Stoughton Public School Department       |
| Avon Housing Authority          | Stoughton Council on Aging/Youth Council |
| FHWA                            | Stoughton Housing Authority              |

OCPC’s public outreach program identified stakeholders based on federal aid guidelines, which includes providing access to Environmental Justice populations, as well as the business community, individuals and businesses involved in mobility, and other interested parties and individuals. Figure 3 shows the Environmental Justice areas in the study area.

In addition to the stakeholder meetings and public outreach meetings, OCPC developed a survey to help identify and prioritize strategies and improvements to address bottlenecks within the study area. The surveys were available through the OCPC website and hard copies of the survey were also distributed at the public outreach sessions. A copy of the survey is included in the appendix to this report.

Figure 3 – Environmental Justice Areas





**Bottleneck Study Workshop – Stoughton (Stoughton Senior Center)**

The purpose of the survey was to garner input from individuals who could not attend the study workshop, to raise awareness of the issues, and to give the general public the opportunity to participate anonymously. Individuals were encouraged to leave contact information to provide additional input and keep them updated on study meetings. The survey was available electronically through Survey Monkey linked to the OCPC website. The survey was also distributed to the public at large through a mass mailing to stakeholders in the study area corridor. In order to reach out to all ethnic groups in the study area, the survey was also available in Spanish and Portuguese (a demographic profile of the area based on the Census American Community Survey on languages spoken in households showed the potential for Spanish and Portuguese speakers in the study area). The survey included the following questions:

1. What location(s) along Central Street and/or Harrison Boulevard have you experienced the worst congestion?
2. What time periods do you typically experience traffic congestion?
3. How much delay do you usually experience at this location and at what time of the year?
4. What do you believe is the cause of congestion?
5. What do you believe is the best solution to the traffic congestion problems?
6. What safety concerns do you have regarding the Central Street Harrison Boulevard corridor and what do you think are the best solutions to address these concerns?

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Survey Results Question 1: What location(s) along Central Street and/or Harrison Boulevard have you experienced the worst congestion?

| Location                                     | Number of Responses |
|--|---------------------|
| Pleasant Street (Route 139)/Central Street   | 9                   |
| Washington Street (Route 138)/Central Street | 9                   |
| Pearl Street/Central Street                  | 5                   |
| Central Street/Tosca Drive/Canton Street     | 4                   |
| Entire Central Street corridor in Stoughton  | 3                   |
| Central Street/Turnpike Street               | 3                   |
| Central Street/Island Street                 | 2                   |

Survey Results Question 2: What time periods do you typically experience traffic congestion?

| Time Period              | Number of Responses |
|--------------------------|---------------------|
| Early Morning (5 – 7 am) | 1                   |
| Morning (7 – 9 am)       | 7                   |
| Mid-day (9 – 2 pm)       | 0                   |
| Afternoon (2 – 4 pm)     | 6                   |
| Evening (4 – 6 pm)       | 10                  |
| After 6 pm               | 2                   |
| All Day                  | 10                  |

Survey Results Question 3: How much delay do you usually experience at this location and at what time of the year?

| Delay                     | Number of Responses |
|---------------------------|---------------------|
| Five Minutes              | 3                   |
| Ten Minutes               | 3                   |
| Fifteen Minutes           | 1                   |
| 20 minutes or more        | 4                   |
| School Time               | 2                   |
| All Year-Most of the Time | 8                   |

Survey Results Question 4: What do you believe is the cause of congestion?

| Response   | Number of Responses |
|--|---------------------|
| Poor signal timing, intersection layout and lane designation     | 10                  |
| Too much volume for available capacity                           | 8                   |
| Too much aggressive driving/People ignoring rules of the road    | 5                   |
| Too many motorists cutting through Stoughton/no alternate routes | 4                   |
| Too much school traffic  | 2                   |
| Too many driveways along the road creating conflicts             | 1                   |

Survey Results Question 5: What do you believe is the best solution to the traffic congestion problems?

| Response   | Number of Responses |
|--|---------------------|
| Coordinate traffic signals/improve and update signals/add protected left turns | 11                  |
| More police enforcement  | 3                   |
| Provide alternate routes   | 3                   |
| Widen the road/add capacity  | 3                   |

Survey Results Question 6: What safety concerns do you have regarding the Central Street/Harrison Boulevard corridor and what do you think are the best solutions to address those concerns?

| Response   | Number of Responses |
|--|---------------------|
| More police enforcement  | 5                   |
| More sidewalks along Central Street/Refuge needed for pedestrians (especially at Central Street/Washington Street) | 4                   |
| Add a signal to the Central Street/Island Street intersection  | 2                   |
| Improve traffic signals at Central Street/Washington Street for Central Street left turns                          | 2                   |
| Improve pedestrian safety at Washington Street/Pearl Street  | 1                   |
| Signalize Central Street at West Street  | 1                   |
| Signalize Canton Street/Tosca Drive/Central Street   | 1                   |
| Reconstruct Pleasant Street at Central Street and widen lanes  | 1                   |
| Widen the road and widen the shoulders for bicyclists  | 1                   |

## 2 Previous Studies and Planned Improvements

### 2.1 Old Colony Route 27 Corridor Study - Stoughton

In 2008, OCPC completed a comprehensive study of the Route 27 corridor in the communities of Stoughton, Brockton, Whitman, and East Bridgewater to identify traffic and safety problems, and to develop feasible solutions in keeping with the visions and character of the communities. The recommendations in the report were intended to serve as a basis for including improvement projects in the Old Colony Transportation Improvement Program (TIP). Safety and traffic operations analyses for three of the Bottleneck Study intersections were included in the *Old Colony Route 27 Corridor Study*. These include the Central Street (Route 27)/West Street intersection, the Central Street (Route 27)/Island Street intersection, and the Central Street/Canton Street (Route 27)/Tosca Street intersection.

The Route 27 Study documented safety hazards and included improvement recommendations for the West Street/Central Street (Route 27) intersection. The report stated that the crosswalk distance for pedestrians at the intersection is 110 feet across West Street from the east side to the Hansen Elementary School located on the west side. There is a painted traffic island within the intersection on the West Street northbound approach that channels traffic. This creates a separate left turn and right turn lane on West Street and a separate lane for Central Street westbound left turn traffic entering West

Street and Central Street eastbound right turn traffic entering West Street. This painted island increases turning movement conflicts at the intersection and offers no refuge for pedestrians crossing the 110 feet from curb to curb across West Street.

A residential development has been slated for a parcel located on the north side of Central Street, just north of the West Street intersection. This project has been discontinued; however, the owners could decide at any time to commence with permitting. Mitigation for the development, which was called “Woodbridge Crossing” before it was halted, called for the installation of traffic signals at the West Street/Central Street (Route 27) intersection. The mitigation included the addition of a northern leg at the intersection for access to the development, thereby making it a four-way intersection. The Route 27 Corridor Study recommended, along with the installation of traffic signals with pedestrian signal actuation, that a refuge island be installed to enhance pedestrian safety. The volumes at the intersection satisfied signal warrants in the *Manual on Uniform Traffic Control Devices (MUTCD)*, which were completed for the corridor study.

The traffic study for the Woodbridge Crossing development did not address the need for safety improvements and improvements to relieve congestion at the Route 27 (Central Street)/Canton Street/Tosca Drive intersection. Signalization of the intersection will improve safety and increase the level-of-service (LOS) from “F” to “B” and “C”. The signal will also create gaps in the through traffic for vehicles accessing Island Street to and from Route 27. The signal warrant analysis for this intersection is included in the appendix to this report

## **2.2 Old Colony 2012 Major Bottleneck In-Depth Analysis Route 138 – Stoughton and Route 104 - Bridgewater**

The *Old Colony 2012 Major Bottleneck In-Depth Analysis Study* for Route 138 in Stoughton and Route 104 in Bridgewater included analysis for the Central Street/Washington Street (Route 138) intersection in Stoughton. Potential improvements for this intersection in that study include converting the left lane on the Central Street eastbound approach to an exclusive left turn lane. Additional improvements included revising the signal timing and phasing to include a protected phase for the eastbound left turn movement and adding a median on the northbound and southbound approaches to prevent vehicles that turn in and out of curb cuts from interfering with intersection traffic operations. The medians will also provide refuge for pedestrians crossing Washington Street. In addition to the median, a Rapid Rectangular Flashing Beacon was recommended to enhance safety for pedestrians crossing Washington Street between Lincoln Street and Central Street. As a result of the *Old Colony 2012 Bottleneck Study*, MassDOT District 5 developed a project proposal to design and implement improvements to enhance safety and reduce congestion on Route 138 at this intersection. This project proposal was subsequently approved by the MassDOT Project Review Committee (PRC).

## **2.3 Safety and Operations Analyses at Central Street at Pearl Street in Stoughton – CTPS, February 2011**

The Central Transportation Planning Staff (CTPS) completed a technical memorandum summarizing safety and traffic operations analyses as well as potential improvement options for the intersection of Central Street at Pearl Street in Stoughton in February of 2011. The study concluded that Central Street, as a major arterial in the north section of Stoughton, experiences heavy traffic volumes in both directions. The intersection is congested during peak periods on almost all approaches, especially in the peak direction. The safety analysis indicated that the median and its adjacent traffic signal post on the Central Street eastbound approach to the intersection are hazardous to drivers, especially those from the south making a left turn or those from the east traveling at a high speed. The issues for the intersection were summarized as follows:



- High number of crashes and high crash rate at the intersection
- Outdated traffic signal system
- No standard pedestrian signal indications
- Questionable location of the traffic median on Central Street
- Traffic congestion during peak hours, especially on Central Street
- High proportion of WB right turns and SB left turns causing traffic queues

The technical memo provided level-of-service analyses for a number of alternatives that included upgrades in signal operations, changes to the signal timing and phasing, and modification in lane use. The alternatives include:

- 1) Operate the upgraded signal system under the existing intersection layout
- 2) Modify the westbound approach to a left/through shared lane and an exclusive right turn lane, and operate the upgraded signal system under the existing phasing sequence
- 3) Modify the westbound approach to a left/through shared lane and a through/right shared lane, and operate the upgraded signal system under the existing phasing sequence
- 4) Add an exclusive left turn lane to the southbound approach, and operate the upgraded signal system under the existing phasing sequence
- 5) Modify the westbound approach to a left/through shared lane and an exclusive tight turn lane, add an exclusive left turn lane to the southbound approach, and operate the upgraded signal system under the existing phasing sequence
- 6) Modify the westbound approach to a left/through shared lane and a through/right shared lane, add an exclusive left turn lane to the southbound approach, and operate the upgraded signal system under the existing phasing sequence

The memo concluded that Alternatives 3, 4, 5, and 6 would likely require land takings and have some impacts on the surrounding areas. Alternative 2 is operationally more favorable than Alternative 1, as it would noticeably improve traffic operations, with reduced delays. In order to improve operations and safety, the memo stated that the signal system should include the following features:

- Install a fully actuated traffic signal system with standard pedestrian signals and push buttons
- Replace the existing post-mounted signals with overhead signal indications supported by a cable system or mast arms, which can be clearly viewed on all approaches from a distance
- Remove the traffic median on Central Street, and replace it with hatched pavement markings if necessary
- Maintain the existing crosswalks and sidewalks at the intersection
- Include a pre-emption function for emergency vehicles
- Install wheelchair ramps meeting ADA (American with Disabilities Act)/AAB(Massachusetts Architectural Access Board) standards at all corners of the intersection
- Install accessible (audible) countdown pedestrian signals
- Improve lighting conditions at the intersection

#### **2.4 Road Safety Audit for East Main Street (Route 28)/East Spring Street/West Spring Street - Avon**

Old Colony Planning Council, at the request of the Massachusetts Department of Transportation (MassDOT), conducted a Road Safety Audit (RSA) on Wednesday, May 2, 2012 to identify safety issues and potential safety improvements at the East Main Street (Route 28)/East Spring Street/West Spring Street intersection in Avon. The purpose of the RSA was to identify and evaluate potential improvements that can be included as part of future efforts for projects and reconstruction. Short-term, low-cost potential improvements can be considered for immediate implementation by a municipality, as

appropriate, with long-term, high cost improvements considered for inclusion in the Old Colony Transportation Improvement Program (TIP).

The RSA concluded that there are heavy left turns from East Spring Street to East Main Street (Route 28) southbound, which turn right to Harrison Boulevard westbound during the morning peak hour. These volumes reverse direction during the afternoon peak with heavy vehicle flows from Harrison Boulevard eastbound turning left to East Main Street (Route 28) northbound, and then turn right to East Spring Street headed eastbound. The RSA documented significant angle type crashes involving vehicles making a left-turn from the stop-sign controlled East Spring Street approach with a second vehicle traveling along Route 28 northbound. The Route 28 northbound approach currently consists of one shared left-turn/through lane and one shared through/right-turn lane. The RSA team noted that the outside shared through/right-turn lane generally operates as a “de facto” right-turn lane due to the heavy right-turn volume onto East Spring Street. Left turning motorists from East Spring Street eastbound often expect that Route 28 northbound motorists traveling along the outside lane are going to make a right-turn and may begin to enter the intersection prematurely. RSA participants noted that right-turning motorists often do not use their directional signal. An additional observation was that larger trucks typically use the Route 28 inside lane to make a right-turn onto East Spring Street due to the limited turning radius at the intersection, which further contributes to motorist confusion.

The ability to make a left-turn at this intersection is complicated by sight distance limitations at the southeast corner caused by the combination of the slight incline on the East Spring Street westbound approach and the presence of a small crest vertical curve approximately 150 feet south of the intersection along Route 28 northbound. As a result, motorists at the East Spring Street westbound approach typically pull past the stop line, often encroaching on Route 28 northbound, to see oncoming traffic. RSA team members also noted that vehicles (particularly large trucks, which are prevalent along the corridor) traveling in the Route 28 northbound outside lane often block the visibility of the vehicles traveling along the inside lane.

Based on the RSA field observations, the RSA team determined that the intersection of Route 28/East Spring Street/West Spring Street has the following issues that affect safety:

- Unclear lane usage
- Sight distance/intersection geometry
- Worn pavement markings
- Limited pedestrian accessibility
- Worn and/or limited signage
- Congestion and driver frustration
- Heavy vehicle activity and constrained turning radii

The RSA team identified a number of short-term and long-term improvements for the East Main Street (Route 28)/East Spring Street/West Spring Street intersection, although the RSA report stated that further study and design work need to be conducted to determine the feasibility of making some of the improvements.

The potential improvements identified by the RSA team include:

- Improve and maintain pavement markings and remove those that are unnecessary (short-term)
- Improve pedestrian accessibility (short-term)
- Monitor/enforce travel speed (short-term)

- Re-evaluate crosswalk locations (short-term)
- Replace damaged guide signage (short-term)
- Evaluate potential changes in lane usage (short-term)
- Consider geometric modifications and/or changes to traffic control (long-term)
- Evaluate lane usage and traffic operations along the Route 28 corridor (long-term)
- Install traffic signals (long term)

## **2.5 Traffic Impact Report IKEA Expansion - Stockwell Drive, Stoughton/Avon**

The IKEA home furnishings retailer located on Stockwell Drive, is proposing to expand their existing facilities. The proposal is for 60,000 square feet of added warehouse and home delivery space. The traffic impact report for the proposal concluded that traffic from the expansion would not result in any changes in levels-of-service or delay at intersections in the surrounding road network, except at the roundabout at the Stockwell Drive/IKEA site drive, which is exceeding capacity during the week-end mid-day peak periods. The study recommended improvements included adding police details for traffic control at the IKEA roundabout as necessary during the December and peak IKEA sales periods. The study also recommended updating signs and worn pavement markings at the roundabout to conform to the latest changes in the Manual on Uniform Traffic Control Devices.

## **2.6 Traffic Impact and Access Study for Proposed Restaurant Depot, Avon**

The Restaurant Depot, which is a wholesale cash and carry foodservice supplier that sells products for independent restaurants, caterers and non-profits is proposing a development to be located on the west side of Bodwell Street, north of Pond Street in Avon. According to the traffic impact and access study for the project, the site currently consists of an 86,000 square foot warehouse building and a 35,560 square foot office building. The new development will consist of the razing of the office building and the modification of the existing warehouse building for the 88,800 square foot Restaurant Depot. The Restaurant Depot is not open to the general public, but to those who operates a business or non-profit and uses commercial foodservice products. Access to the site will be provided by way of the existing driveway to Bodwell Street, a new driveway south of the existing building to Bodwell Street, and an existing right-of-way to Pond Street. Parking for 246 vehicles will be provided.

The traffic impact and access study recommendations for the project stated that the Pond Street driveway should provide entering movements only, as sight distances exiting the driveway are restricted. The Bodwell Street driveways should consist of one lane in and one lane out, with the exiting lane under STOP sign control. As the northerly most driveway will be for trucks only, the exiting radius for the right turn movement should be enlarged to 60 feet such that exiting trucks will not cross the centerline of Bodwell Street.

### 3 Existing Conditions

#### 3.1 Study Area Roadway Characteristics

Central Street in Stoughton is a two lane urban minor arterial that provides east west regional access to and from Route 24. Central Street is under local jurisdiction (Town of Stoughton) and intersects Harrison Boulevard (referred to as Dykeman Way at this location) approximately 500 feet west of Stockwell Drive. The posted speed limit on Central Street varies between 30 and 40 miles per hour. It is posted at 35 miles per hour eastbound just east of the Canton Street (Route 27) intersection, 30 miles per hour east of the Pleasant Street (Route 139) intersection, and 40 miles per hour between Pleasant Street (Route 139) and Turnpike Street. There is a sidewalk along the north side of Central Street from the passenger rail grade crossing east to the Lincoln Street intersection. There is a sidewalk on the south side of Central Street from Lincoln Street east to Turnpike Street.

Central Street varies in width. It is 28 feet wide with two foot shoulders and 12 foot travel lanes from Canton Street to the passenger rail crossing. Central Street is 36 to 37 feet wide east of Washington Street with one foot shoulders and 17 foot travel lanes.

Harrison Boulevard continues east from its intersection with Central Street to connect to Route 24 (Exit 19 Interchange) in Avon and terminates at East Main Street (Route 28). Harrison Boulevard is a two lane road except for the section between Stockwell Drive and Pond Street where it is a four-lane cross section as it intersects with Route 24 on and off ramps. Harrison Boulevard is classified as an urban minor arterial and is under state jurisdiction. East Main Street (Route 28) is an urban principal arterial and is under state jurisdiction between Harrison Boulevard and East and West Spring Street in Avon. East Main Street (Route 28) consists of two travel lanes in each direction separated by a raised median between Harrison Boulevard and East and West Spring Street. The speed limit along Route 28 is 40 miles per hour.

Harrison Boulevard provides two 12 foot travel lanes with 12 foot shoulders on both sides between Pond Street and Route 28. The speed limit is posted at 40 miles per hour westbound and 40 and 50 miles per hour eastbound. There are no sidewalks on Harrison Boulevard.

##### 3.1.1 Average Daily Traffic, Prevailing Speeds, and Heavy Vehicles

Automatic traffic recorders were used to determine the average daily traffic (ADT) at specific locations on Central Street and Harrison Boulevard as well as on key intersecting streets. The traffic recorders were installed for a minimum 48-hour period and recorded traffic in both directions in one-hour intervals. The traffic recorders were programmed to record vehicle speeds and the number of heavy vehicles in the traffic stream, as well as the traffic volumes. They were installed at a number of locations within the study area. Table 2 shows the average daily traffic (24-hour total for both directions of travel), as well as the prevailing 85<sup>th</sup> percentile speeds, and the percentage of heavy vehicles in the traffic stream for the study corridor. The automatic traffic recorder counts are included in the appendix to this study.

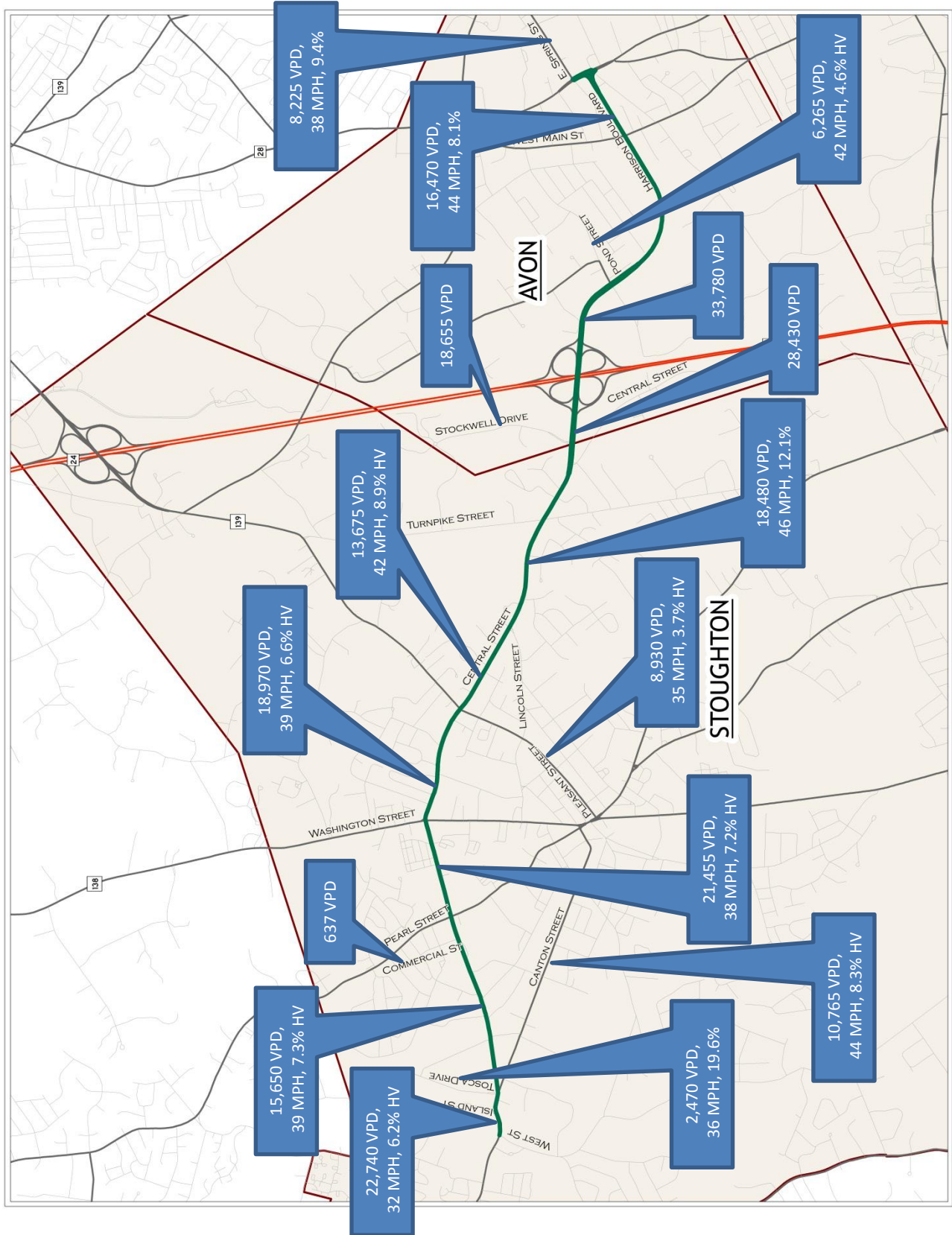
**Table 2 – 2013 Automatic Traffic Recorder Counts\***

| Location   | 2013 Average Daily Traffic | 85th Percentile Speed | Percent Heavy Vehicles |
|--|----------------------------|-----------------------|------------------------|
| Central Street (Route 27) west of Canton Street (Route 27) | 22,740                     | 32 MPH                | 6.2%                   |
| Central Street East of Canton Street (Route 27)            | 15,650                     | 39 MPH                | 7.3%                   |
| Canton Street (Route 27) east of Central Street            | 10,765                     | 44 MPH                | 8.3%                   |
| Tosca Drive North of Central Street                        | 2,470                      | 36 MPH                | 19.6%                  |
| Commercial Street north of Central Street                  | 637                        | NA                    | NA                     |
| Central Street West of Washington Street (Route 138)       | 21,455                     | 38 MPH                | 7.2%                   |
| Central Street East of Washington Street (Route 138)       | 18,970                     | 39 MPH                | 6.6%                   |
| Central Street East of Pleasant Street                     | 13,675                     | 42 MPH                | 8.9%                   |
| Pleasant Street South of Central Street                    | 8,930                      | 35 MPH                | 3.7%                   |
| Central Street West of Turnpike Street                     | 18,480                     | 46 MPH                | 12.1%                  |
| Harrison Boulevard (Dykeman Way) West of Route 24          | 28,430                     | NA                    | NA                     |
| Harrison Boulevard East of Route 24                        | 33,780                     | NA                    | NA                     |
| Stockwell Drive North of Central Street                    | 18,655                     | NA                    | NA                     |
| Pond Street East of Bodewell Drive                         | 6,265                      | 42 MPH                | 4.6%                   |
| Harrison Boulevard West of Route 28                        | 16,470                     | 44 MPH                | 8.1%                   |
| East Spring Street East of Route 28                        | 8,225                      | 38 MPH                | 9.4%                   |

\*Counts were from 2012 and were increased by 1 percent per year to reflect 2013 volumes. MPH = Miles Per Hour. NA = Not Available

The highest daily traffic volumes were recorded on Harrison Boulevard east of Route 24 with 33,780 vehicles per day. The lowest average daily volumes in the study area corridor were recorded on Central Street east of Pleasant Street at 13,675. Figure 4 shows the Average Daily Traffic, the 85<sup>th</sup> Percentile Speeds, and the percentage of heavy vehicles in the Central Street/Harrison Boulevard corridor. The 85<sup>th</sup> Percentile speed is the speed at which 85 percent of the traffic is traveling at or less.

Figure 4 - Vehicles Per Day (VPD), 85<sup>th</sup> Percentile Speeds (MPH), and Percent Heavy Vehicles (HV)



### 3.1.2 2013 Intersection Peak Hour Levels-of-Service (LOS)

This study includes analysis at fifteen intersections (ten signalized and five un-signalized) in the Central Street/Harrison Boulevard corridor. Level-of-service analyses (LOS) were completed for the study area intersections to determine the operating conditions during the morning and afternoon peak hours. Level-of-service analysis is a qualitative and quantitative measure based on the analysis techniques published in the *Highway Capacity Manual* by the Transportation Research Board. Level-of-service is a general measure that summarizes the overall operation of an intersection or transportation facility. It is based upon the operational conditions of a facility including lane use, traffic control, and lane width, and takes into account such factors as operating speeds, traffic interruptions, and freedom to maneuver. Level-of-service represents a range of operating conditions and is summarized with letter grades from “A” to “F”, with “A” being the most desirable. Level-of-service “E” represents the maximum flow rate or the capacity on a facility. The following describes the characteristics of each level-of-service:

- LOS "A" represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream.
- LOS "B" is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is still relatively unaffected.
- LOS "C" is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream. Occasional backups occur behind turning vehicles.
- LOS "D" represents high-density, but stable, flow. Speed and freedom to maneuver are restricted, and the driver experiences a below average level of comfort and convenience as operations approach the capacity of the facility. Small increases in traffic flow will generally cause operational problems at this level.
- LOS "E" represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform level. Freedom to maneuver within the traffic stream is extremely limited, and generally requires forcing other vehicles to give way. Congestion levels and delay are very high.
- LOS "F" is representative of forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount that can traverse the point, resulting in lengthy queues and delay.

The LOS definitions describe conditions based on a number of operational parameters. There are certain parameters utilized as measures of effectiveness for specific facilities. In the case for intersections, two-lane highways, and arterials, which represent the physical conditions that typify the study area corridors, time delay, average stop delay, and average travel speed are used as measures of operational effectiveness to which levels-of-service are assigned. Table 3 shows the delay criteria for each level-of-service for both un-signalized and signalized intersections.

**Table 3 - Level-of-Service Criteria Average Delay in Seconds**

| Level-of-Service | Stop Sign | Traffic Signal |
|------------------|-----------|----------------|
| A                | 0 to 10   | 0 to 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            |

Table 4 summarizes the signalized and un-signalized levels-of-service for the bottleneck study area intersections under existing peak hour conditions. Failed traffic operations at intersections in Table 4 (LOS “E” and “F”) are shown in shaded blocks. Level-of-Service “D” represents long delays, with volumes approaching congestion, although it is considered acceptable in urban areas.

**Table 4 – 2013 Intersection Level-of-Service Analysis**

| <b>SIGNALIZED INTERSECTIONS (Overall LOS)</b>                            | <b>AM Peak Hour</b> | <b>PM Peak Hour</b> | <b>Saturday Peak Hour</b> |
|--|---------------------|---------------------|---------------------------|
| Central Street at Pearl Street   | F                   | F                   | NA                        |
| Central Street at Washington Street (Route 138)                          | D                   | E                   | NA                        |
| Central Street at Pleasant Street (Route 139)                            | F                   | D                   | NA                        |
| Central Street at Lincoln Street/YMCA Driveway                           | B                   | D                   | NA                        |
| Central Street at Turnpike Street  | D                   | C                   | C                         |
| Central Street at Harrison Boulevard (Dykeman Way)                       | B                   | B                   | B                         |
| Harrison Boulevard (Dykeman Way) at Stockwell Drive)                     | A                   | B                   | C                         |
| Harrison Boulevard at Pond Street  | B                   | B                   | B                         |
| Harrison Boulevard at West Main Street                                   | D                   | C                   | NA                        |
| Harrison Boulevard at East Main Street (Route 28)                        | C                   | C                   | NA                        |
|  |                     |                     |                           |
| <b>NON-SIGNALIZED INTERSECTIONS</b>                                      |                     |                     |                           |
| Central Street (Route 27) at West Street                                 |                     |                     |                           |
| Central Street WB ( Route 27) left turn                                  | A                   | A                   | NA                        |
| West Street NB left turn   | F                   | F                   | NA                        |
| West Street NB right turn  | F                   | F                   | NA                        |
| Central Street (Route 27) at Island Street                               |                     |                     |                           |
| Central Street (Route 27) EB left turn                                   | A                   | A                   | NA                        |
| Island Street SB left turn   | F                   | F                   | NA                        |
| Island Street SB right turn  | F                   | F                   | NA                        |
| Central Street (Route 27) at Canton Street (Route 27) and Tosca Drive    |                     |                     |                           |
| Central Street SW left, all moves  | F                   | F                   | NA                        |
| Canton Street (Route 27) WB all moves                                    | C                   | D                   | NA                        |
| Tosca Drive SB all moves   | B                   | B                   | NA                        |
| Central Street at Commercial Street                                      |                     |                     |                           |
| Central Street EB left turns   | A                   | A                   | NA                        |
| Commercial Street SB all moves   | D                   | F                   | NA                        |
| West School NB all moves   | E                   | E                   | NA                        |
| East Main Street (Route 28) at East Spring Street and west Spring Street |                     |                     |                           |
| East Main Street (Route 28) SB left turns                                | A                   | A                   | NA                        |
| East Main Street (Route 28) NB left turns                                | A                   | A                   | NA                        |
| East Spring Street WB all moves  | F                   | F                   | NA                        |
| West Spring Street EB all moves  | D                   | D                   | NA                        |

The results of the existing peak hour level-of-service analysis in Table 4 show that three of the ten signalized intersections experience poor levels-of-service (Level-of-Service “E” and “F”) during the morning and/or afternoon peak hours. These intersections with poor peak hour levels-of-service, which indicate traffic congestion and long delays, include Central Street at Pearl Street, Central Street at Washington Street (Route 138) and Central Street at Pleasant Street (Route 139). As shown in Table 4, all of the un-signalized intersections show poor peak hour levels-of-service on the critical side street



approaches, indicating congestion and long delays, especially for vehicles entering and exiting the Central Street/Harrison Boulevard corridor to and from side streets.

### **3.1.3 Intersection Crash Experience**

Crash data within the Central Street/Harrison Boulevard bottleneck corridor study area was obtained for the latest available three-year period (2009-2010-2011) from the Massachusetts Department of Transportation (MassDOT). The data is compiled by MassDOT and was made available by the Massachusetts Registry of Motor Vehicles. The data was compiled and analyzed in accordance with the standard practices published by the Institute of Transportation Engineers (ITE) in the *Manual of Traffic Engineering Studies*. Crash rates were calculated and compared with the average crash rates for the State and for MassDOT District 5.

Crash rates are used, according to the *Manual of Traffic Engineering Studies* to characterize the crash exposure of a facility. Crash rates for intersections are calculated based on the average number of crashes per million entering vehicles (MEV). The statewide average crash rates are 0.80 MEV for signalized intersections and 0.60 MEV for un-signalized intersections. The Massachusetts DOT District 5 average crash rates are 0.77 MEV for signalized intersections and 0.58 MEV for un-signalized intersections.

The purposes for analyzing crash data include:

- To define and identify high crash locations
- To justify the installation of traffic control devices
- To evaluate the geometric design (including lane use) and proposed changes in traffic regulations
- To justify expenditures for improvements that offer crash reduction or prevention
- To identify a need for traffic enforcement
- To identify needs in pedestrian and bicycle safety and certain actions causing crashes that can be prevented through driver and/or public education

The number of crashes often increases as traffic volumes increase. Traffic growth creates more opportunities for crashes and therefore increases vehicle exposure to crashes. A particular condition that causes crashes at an intersection can become exacerbated with increased traffic, and frequency will therefore rise. The crash rate utilized for intersection analysis is the crash rate per million entering vehicles, which is the average number of accidents per year (over three years) times one million, divided by the number of vehicles entering the intersection in a year.

Table 5 summarizes the number of crashes and corresponding crash rates for the study area corridor intersections for the three year history 2009, 2010, and 2011. Crash rates that exceed the statewide and District 5 crash rate averages are shaded.

**Table 5 - Intersection Crashes and Crash Rates**

| Intersection Location                                    | Traffic Control   | Injury crash | Property damage only | Fatals | Number of Crashes | Crash Rate | Percent Injury crashes |
|--|-------------------|--------------|----------------------|--------|-------------------|------------|------------------------|
| Central Street at West Street                            | Stop Sign         | 5            | 6                    | 0      | 11                | 0.52       | 45%                    |
| Central Street at Island Street                          | Stop Sign         | 9            | 11                   | 0      | 20                | 0.83       | 45%                    |
| Canton Street (Route 27)/Tosca Drive at Central Street   | Stop Sign (3-way) | 5            | 18                   | 0      | 23                | 1.07       | 22%                    |
| Commercial/West School driveway Street at Central Street | Stop Sign (2-way) | 3            | 4                    | 0      | 7                 | 0.47       | 43%                    |
| Pearl Street at Central Street                           | Signal            | 9            | 23                   | 0      | 32                | 1.17       | 28%                    |
| *Washington Street (Route 138) at Central Street         | Signal            | 13           | 59                   | 0      | 72                | 1.72       | 18%                    |
| Pleasant Street (Route 139) at Central Street            | Signal            | 10           | 32                   | 0      | 42                | 1.48       | 24%                    |
| Lincoln Street/YMCA Entrance at Central Street           | Signal            | 4            | 8                    | 0      | 12                | 0.58       | 33%                    |
| Central Street at Turnpike Street                        | Signal            | 8            | 20                   | 0      | 28                | 1.35       | 29%                    |
| Dykeman Way (Harrison Blvd) at Central Street            | Signal            | 1            | 8                    | 0      | 9                 | 0.42       | 11%                    |
| Stockwell Drive at Harrison Boulevard                    | Signal            | 0            | 4                    | 0      | 4                 | 0.13       | 0%                     |
| Harrison Boulevard at Pond Street                        | Signal            | 15           | 13                   | 0      | 28                | 0.66       | 54%                    |
| Harrison Boulevard at West Main Street                   | Signal            | 4            | 13                   | 0      | 17                | 0.47       | 24%                    |
| Harrison Boulevard at East Main Street (Route 28)        | Signal            | 4            | 15                   | 0      | 19                | 0.68       | 21%                    |
| East Main Street at East and West Spring Street          | Stop Sign         | 8            | 17                   | 0      | 25                | 1.48       | 32%                    |

*Average Massachusetts statewide: signalized 0.80 MEV, un-signalized 0.60, and MassDOT District 5 Crash Rate: signalized 0.77 signalized and 0.58 un-signalized. \*On Massachusetts Top 200 Hazardous Intersection List.*

Table 5 shows that the Washington Street (Route 138)/Central Street intersection had the most crashes with 72 crashes within the three year study period. This intersection also had the highest crash rate, 1.72, which is more than double the statewide and District 5 average. In addition, this intersection is listed in MassDOT’s Top 200 Hazardous intersection List (ranked 16<sup>th</sup>). The Pleasant Street (Route 139)/Central Street intersection had the second highest number of crashes with 42 crashes. This intersection also has a crash rate that is almost double the statewide District 5 average. Other intersections that exceeded the statewide and District crash rate average (shown in shaded blocks) include: Central Street at Island Street, Canton Street (Route 27)/Tosca Drive at Central Street, Pearl Street at Central Street, Central Street at Turnpike Street, and East Main Street at East and West Spring Street.

### 3.1.4 Land Use and Zoning

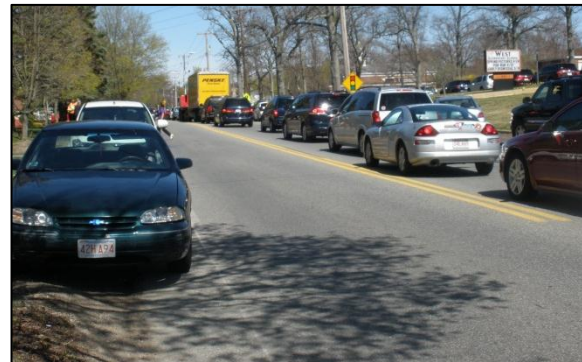
Land use along the Central Street/Harrison Boulevard corridor in Stoughton and Avon varies and includes residential, commercial, industrial, and institutional (school) uses. New development within the corridor includes the proposed expansion of the IKEA home furnishings retailer on Stockwell Drive. This expansion includes 60,000 square feet of added warehouse and home delivery space to the existing IKEA facility on Stockwell Drive. In addition, a restaurant wholesale warehouse store is slated to open in

Avon on Bodwell Street. Other potential development includes a residential condominium development in Stoughton off of Central Street (Route 27) just north of the Central Street/West Street intersection. This residential development was withdrawn; however, the potential that the developer will pursue permitting and construction remains a possibility.

There are two elementary schools in the corridor in Stoughton; the Hansen School, which is located adjacent to the Central Street/West Street intersection, and the West School, which is located just west of the Central Street/Pearl Street intersection. Queues from vehicles waiting to pick-up and or drop off students back out of the school driveways at both schools onto Central Street creating hazardous conditions for vehicles and pedestrians. The queues on Central Street due to school traffic are especially long at the West School, where vehicles waiting for student pick-up back onto Central Street, wrapping around the corner and onto Simpson Street. These queues force long delays and queuing on Central Street, especially in the eastbound direction in the afternoon when vehicles on Central Street have to slow down and maneuver around parked vehicles. In addition to the vehicles on Central Street eastbound at the side of the road waiting to access the West School driveway, many parents park along the westbound side and cross traffic to pick up students, exacerbating the congested and hazardous conditions.



Vehicles waiting on the side of the road on Central Street for West School student pickup



Congestion at West School entrance (left) and cars parked on Central Street, westbound side, in front of school

Although commercial areas are sparsely interspersed throughout the corridor, there is a concentration of heavy commercial use on Stockwell Drive at the Stoughton-Avon Town Line just west of the Route 24 interchange. There is also a concentration of commercial uses surrounding the Washington Street (Route 138)/Central Street intersection. There are heavy concentrations of industrial and warehouse facilities on Island Street, Evans Drive, and Tosca Drive in Stoughton, and on Bodwell Street in Avon. Although there are residences and businesses along Central Street in Stoughton, Harrison Boulevard is without driveway access for adjacent land uses along the side of the road in Avon.

Zoning along Central Street in Stoughton is mainly residential, but includes industrial zoning, which encompasses an area north of Central Street in the vicinity north and east of the Central Street/Tosca Drive/Canton Street (Route 27) intersection. The high percentages of truck traffic within the traffic flow in the Central Street corridor are due to these industrial areas. The area surrounding the Washington Street (Route 138)/Central Street intersection is zoned General Business. A small section of Industrial and General Business is located on Central Street at the Avon Town Line.

Zoning along Harrison Boulevard in Avon is business, industrial, and residential. There is no direct access off of Harrison Boulevard so access is off of intersecting streets with commercial uses off of Stockwell Drive, and industrial uses off of Pond Street and Bodwell Street, which accounts for the high percentage of truck traffic in this part of the corridor. Zoning maps of Stoughton and Avon are included in the appendix to this report

### **3.1.5 Pavement Conditions**

OCPC uses pavement management software (PMS) to maintain a region-wide data base of pavement surface conditions for federal aid roads. The PMS includes a data base that documents the severity and extent of pavement deterioration and the implications for cost of maintenance and repair. The severity and extent of pavement surface deterioration is obtained via a windshield survey of roads and then entered into the PMS. The software calculates Pavement Condition Index (PCI) scores for the surveyed road segments. This is an index derived from an evaluation of pavement distress factors, average daily traffic, and roadway classification. The PCI is based on a scale of 1 to 100, with 100 indicating a flawless road surface. PCI scores of 95 or higher indicate that the road surface is in “Excellent” condition.

PCI scores between 85 and 94 normally indicate that the road has some distresses but is in “Good” condition. Roads with scores between 65 and 84 are in “Fair” condition and are in need of maintenance or mill and overlay repairs. Roads with scores below 65 are in “Poor” condition and need base rehabilitation or reconstruction and overlay.

OCPC conducted a windshield survey of the Central Street and Harrison Boulevard corridor as part of the region-wide pavement management system. The survey results show that Harrison Boulevard is in “Good” to “Excellent” condition with no repair or maintenance recommended. Route 28, in the study area between Harrison Boulevard and East and West Spring Street, is also in “Good” condition with no repair or maintenance recommended. Central Street (Route 27), between West Street and Canton Street is in “Fair” condition with “Routine Maintenance” recommended. Central Street between Canton Street (Route 27) and Pearl Street is in “Good” condition with no maintenance or repair required, and in “Fair” condition between Pearl Street and the Avon Town Line with “Routine Maintenance” and “Rehabilitation” required.

### **3.1.6 Pedestrian and Bicycle Accommodations**

The Central Street/Harrison Boulevard Corridor is mostly a two lane facility except for the section between Stockwell Drive and Pond Street, which provides four lanes of travel. The lane widths and shoulder widths vary on Central Street. Central Street is approximately 30 to 32 feet wide with one or two foot shoulders and two 12 to 13 foot travel lanes from Canton Street to Washington Street. Central Street is 36 to 37 feet wide east of Washington Street with one foot shoulders and 17 foot travel lanes. The one foot and two foot shoulders are not adequate for bicycle travel. The posted speed limit on Central Street is 35 miles per hour eastbound just east of the Canton Street (Route 27) intersection, 30 miles per hour east of the Pleasant Street (Route 139) intersection, and 40 miles per hour between Pleasant Street (Route 139) and Turnpike Street.

Although the varying roadway widths between Canton Street and Washington Street might prevent the widening of the shoulders to a consistent four feet on each side to accommodate bicycles, pavement markings (sharrows) can be used to indicate that motorists must share the road with bicycles.<sup>2</sup> East of the rail crossing, the shoulders can be widened to four feet, which would allow for the two travel lanes to be narrowed to 12 feet. The 17 foot wide travel lanes on Central Street east of Washington Street can be narrowed to 12 feet to allow for two five foot shoulders for bicycle lanes.

There is a sidewalk along the north side of Central Street from the passenger rail grade crossing east to the Lincoln Street intersection. This sidewalk is in poor conditions and lacks curbing, especially in the section across from the west School. Motorists often park on the sidewalk across from the West school for student pick-up because this sidewalk lacks curbing. There are no sidewalks on the south side of Central Street between Pearl Street and Washington Street, which is a significant obstacle for pedestrians crossing Pearl Street at Central Street for access to the West School and for pedestrian access to businesses surrounding the Washington Street (Route 138)/Central Street intersection. There is a sidewalk on the south side of Central Street from Lincoln Street east to Turnpike Street. Pearl street north and South of Central Street also contains gaps in the sidewalk system, which creates hazards for students walking to the West School and to the Stoughton High School and Middle School south of the West School.

Harrison Boulevard is a two lane road except for the section between Stockwell Drive and Pond Street where it is a four-lane cross section as it intersects with Route 24 on and off ramps. It provides five foot shoulders on both sides of the road. East Main Street (Route 28) consists of two travel lanes in each direction separated by a raised median between Harrison Boulevard and East and West Spring Street. The speed limit along Route 28 is 40 miles per hour (mph); however, prevailing speeds are five to ten miles per hour higher than the posted speed.

The *2013 OCPC Bicycle and Pedestrian Connectivity and Livability Study* provides a comprehensive inventory of existing bicycle and pedestrian facilities within the OCPC region. The study evaluated the existing levels-of-service (LOS) for bicycle and pedestrian facilities. The criteria used for bicycle LOS included number of vehicle lanes, width of lanes, existence of paved shoulders, width of shoulders, the average daily traffic, percentage of heavy vehicles in traffic, on street parking, and posted speed limits. The pedestrian LOS criteria included the number of lanes, average daily traffic, prevailing traffic speeds, percentage of heavy vehicles, road widths, paved shoulders, sidewalk widths, and sidewalk buffer widths and types. The OCPC study showed poor levels-of-service (“E” and “F”) for pedestrian and bicycle travel within the Central Street/Harrison Boulevard corridor. Maps depicting the LOS for the corridor from this study are included in the appendix to this report. The study concluded that bicycle routes in Stoughton should be included on Central Street from Canton Street (Route 27) to the Central Street/Turnpike Street intersection. Five foot bicycle lanes should be added to Central Street where the pavement width is wide enough, and sharrows should be used in those sections where the pavement is narrow and the speed limit is 35 miles per hour (in accordance with the MUTCD). Signage delineating bicycle use should also be posted to enhance bicycle safety.

### **3.1.7 Environmental Issues**

Any improvements made within the study area to improve safety and/or relieve congestion should take into account the diversity of environmental features in this particular area. Figure 5 shows the types

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<sup>2</sup> The manual on Uniform Traffic Control Devices (MUTCD) recommends the use of Sharrows only on roads with posted speed limits at 35 MPH and under.

and location of environmental resources found within the study area. On the whole, the Stoughton and Avon bottleneck study area is a well-developed area, with minimal environmental issues or constraints. The only water resource area of note within the study area is West Trout Brook, which bisects Harrison Boulevard just east of West Main Street.

#### **3.1.7.1 Floodplains**

Flooding is most likely to occur within Federal Emergency Management Agency (FEMA) designated floodplains. Floodplains usually consist of low, flat, periodically flooded lands adjacent to streams, rivers, lakes and wetlands. Floodplains are separated into two frequency categories; 100 year floodplains (an area that has a 1 percent probability of occurring in any given year) and 500 year floodplains (an area that has a 0.2 percent probability of occurring in any given year). There are three areas within the study area located within a floodplain. The first location is a 100 Year floodplain at the intersection of Central Street and Marden Road in Stoughton. The second location is a 100 Year floodplain on Central Street in the area of the Holy Sepulchre Cemetery and Clotilda Road in Stoughton. The third location is a 100 Year floodplain also on Central Street (which is also Route 27 at this location) just east of the intersection of Central Street and West Street. This location also consists of a small unnamed stream travelling underneath the road leading to a small wetland south of Central Street.

#### **3.1.7.2 Aquifers**

Aquifers are extensive groundwater supplies formed from ancient glacial deposits. The only aquifer within the study area is located along Central Street in Stoughton, from the intersection of Central Street and Ewing Drive to an area just east of the intersection of Central Street and Clotilda Road.

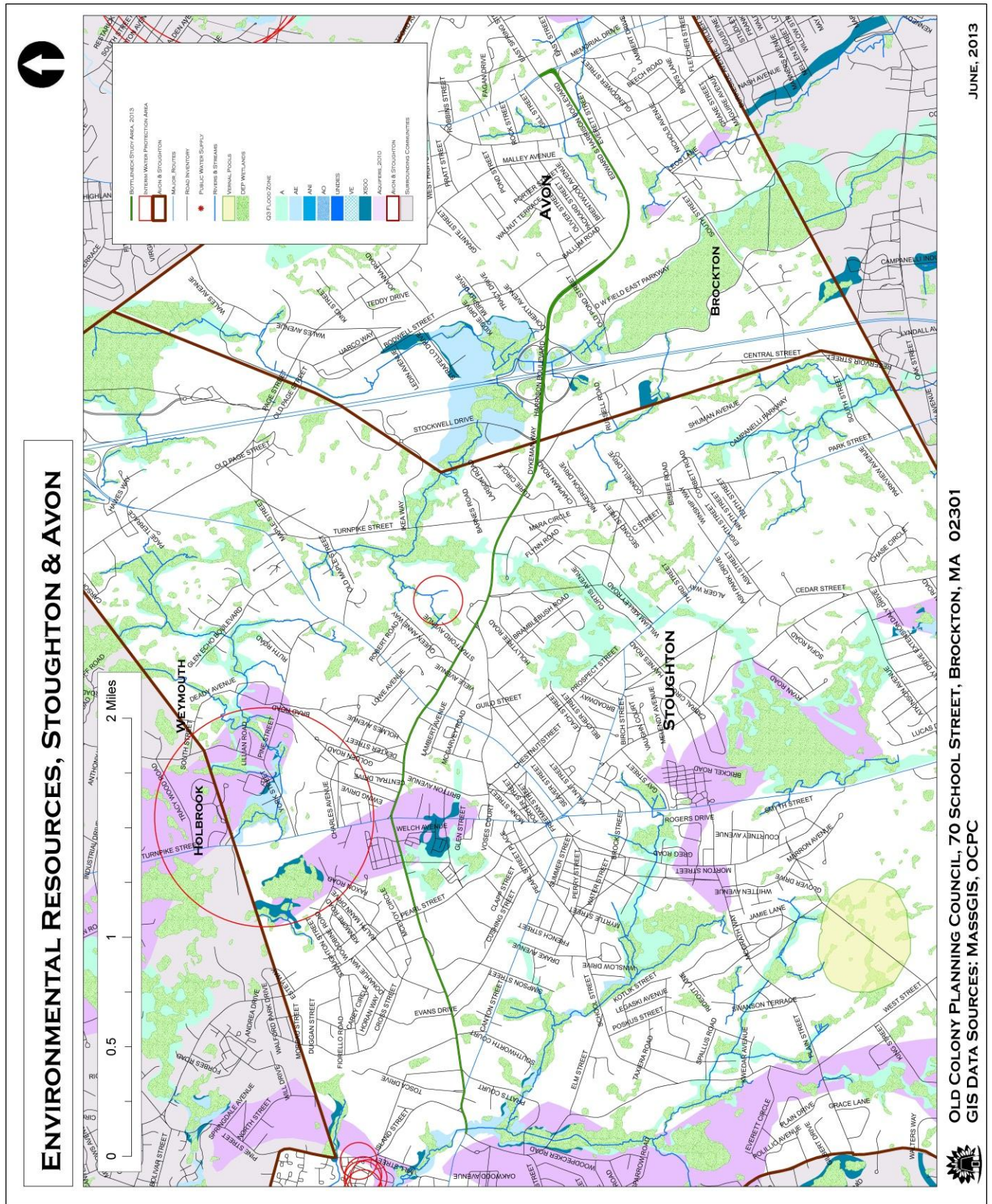
#### **3.1.7.3 Wetlands**

Wetlands are areas of land that are saturated with water, either on a seasonal or permanent basis. Wetlands serve many important environmental functions, such as recharging groundwater supplies, providing floodwater capacity and providing fish and wildlife habitat. While the presence of wetlands within the study area is limited, there are three areas where wetlands are present. The first area is located just north of Harrison Boulevard, south of Brentwood Avenue and east of Avon Place in Avon. The second area is also in Avon and is located just south of Harrison Boulevard, north of Pond Street and adjacent to D.W. Field Park. The third area is located just south of Central Street in Stoughton, across from the Holy Sepulchre Cemetery.

#### **3.1.7.4 DEP Approved Zone II Areas**

Zone II areas are areas of an aquifer which contribute water to a well under the most severe pumping and recharge conditions that can be realistically anticipated (180 days of pumping at approved yield, with no recharge from precipitation). The only Zone II location within the study area is located just east of the intersection of Central Street (Route 27) and West Street in Stoughton.

Figure 5 – Environmental Resources



## 4 Future Conditions and Operations

### 4.1 Planned Improvements and Traffic Forecasts

A five-year time horizon (Year 2018) has been chosen for analysis of future conditions, which is consistent with state guidelines for traffic studies. An average annual growth rate of 1.0 percent was used as a background growth rate to increase 2013 traffic to approximate future 2018 traffic. The average annual growth rate was derived from the overall regional growth for roads and arterials similar to the bottleneck study areas based on previous traffic counts in the OCPC region archived by OCPC in its automatic traffic count program.

OCPC consulted with local officials to identify planned developments and potential improvements that impact future traffic within the bottleneck study areas. Projects identified with potential increases in traffic include the proposed expansion of IKEA at Stockwell Drive and the Restaurant Depot on Bodwell Street in Avon. The number of trips (trip generation) expected from the two projects that will impact the Central Street corridor were obtained from traffic studies completed for the projects and are summarized in Table 6.

**Table 6 Trip Generation Planned Development**

|                             | IKEA Trip Generation (Vehicles) | Restaurant Depot Trip Generation (Vehicles) |
|-----------------------------|---------------------------------|---|
| Daily Trips Weekday         | 586                             | 598   |
| Daily Trips Saturday        | 970                             | N/A   |
| AM Peak Entering            | N/A                             | 30  |
| AM Peak Exiting             | N/A                             | 15  |
| AM Peak Total               | N/A                             | 45  |
| PM Peak Entering            | 36                              | 41  |
| PM Peak Exiting             | 42                              | 37  |
| PM Peak Total               | 78                              | 78  |
| Saturday Peak Hour Entering | 93                              | N/A   |
| Saturday Peak Hour Exiting  | 70                              | N/A   |
| Saturday Peak Hour Total    | 163                             | N/A   |

N/A = Not Available

No-Build peak hour traffic conditions were estimated, which reflect 2018 peak hour operating conditions. These No-Build conditions were derived by multiplying the 2013 peak hour volumes by one percent per year and then adding to that the trip generation from the IKEA proposal and the Restaurant Depot.

### 4.2 Build Conditions

The overall goal of this study is to develop short-term and long-term actions that enhance the efficiency of traffic flow and circulation. In addition, the OCPC bottleneck identification and in-depth analysis efforts were undertaken to enhance safety and protect regional mobility, which is a stated goal in the *Old Colony Regional Transportation Plan*. The recommendations developed for this study were developed to reach these stated goals. A number of alternative recommendations are considered in this study based on the public outreach program, which included surveys, stakeholder meetings, and public workshops. Previous studies that focused on the study area were also taken into consideration as well as proven techniques to ameliorate specific congestion and safety problems. Local master plans in Stoughton and Avon were reviewed in order to coordinate regional improvements with local visions and



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goals. Table 7 summarizes the alternative recommendations, their environmental impacts, potential costs, and estimated implementation periods.

**Table 7 - Alternative Recommendations**

| Alternative Recommendation  | Right-of-way impacts   | Environmental impact | Consensus in public outreach | Cost (low, medium, high)* | Implementation (short term, mid term, long term)** |
|---|------------------------|----------------------|------------------------------|---------------------------|--|
| Upgrade pavement markings and sign retro-reflectivity, install consistent crosswalk markings throughout the corridor, and upgrade signals in the corridor to include pre-emption for emergency vehicles   | none                   | none                 | high                         | low                       | short term   |
| Add shoulders and appropriate bicycle signage on both sides of Central Street between Canton Street and Washington Street (or "sharrows" markings where the width is not sufficient for shoulders)  | none                   | none                 | moderate                     | low                       | short term   |
| Construct and improve sidewalks (in conformance to ADA standards) along both sides Central Street from Canton Street to Washington Street by adding curbing and constructing sidewalks where sidewalk gaps exist especially on the south side of Central Street from Pearl Street to Washington Street  | none                   | none                 | high                         | high                      | long term  |
| Reconstruct Central Street/West Street intersection to create conventional "T" intersection, add traffic islands for pedestrian refuge, eliminate painted island  | none                   | tbd+                 | high                         | medium                    | short term   |
| Signalize Central Street/West Street intersection, create a four-way intersection with the construction of northern West Street extension access to residential area, add an exclusive left turn lane on the westbound approach   | none                   | none                 | high                         | high                      | mid term   |
| Reconstruct Central Street at Island Street to create conventional "T" intersection, make Island Street one way northbound and Mill Street one way southbound and connect to the extension of West Street   | none                   | none                 | high                         | high                      | mid term   |
| Signalize Central Street at Canton Street/Tosca Drive and improve intersection alignment to accommodate large trucks. Add an exclusive left turn lane eastbound and a right turn lane westbound on the Canton Street approach/ or consider the installation of a roundabout   | possible row++ takings | none                 | high                         | high                      | mid term   |
| Construct a new road accessing the West Elementary School from playground behind the school via Simpson Street  | none                   | none                 | moderate                     | high                      | mid term   |
| At the Central Street/Pearl Street intersection, reconstruct to improve turning radii for trucks, upgrade traffic signals, remove center island on the eastbound approach, install overhead signals, add left turn storage lane southbound approach, stripe the westbound approach to two general purpose lanes, add pedestrian actuated signals, and widen Central Street westbound to include two receiving lanes | possible row takings   | none                 | high                         | high                      | mid term   |
| Improvements to the Route 138/ Central Street intersection include reconstruct the intersection, revise signal timing and phasing, add longer "all red" between phases, make left lane eastbound an exclusive left lane, and add islands on Route 138 to reduce driveway interference with intersection traffic   | possible row takings   | none                 | high                         | high                      | long term  |
| Central Street/Pleasant Street (Route 139) intersection - Reconstruct intersection with left turn lanes, upgrade traffic signals, install back plates for visibility, allow lead/lag for turn protection, and increase clearance (all-red). intersection  | possible row takings   | none                 | high                         | high                      | long term  |
| Revise the timing and phasing at the Central Street/Turnpike Street intersection to allow for lead lag protected phasing on the eastbound and westbound approaches  | none                   | none                 | moderate                     | low                       | short term   |
| Route 28/West Spring Street/East Spring Street intersection - Install traffic signals and make geometric improvements to improve operating conditions, reduce driver frustration, and improve overall safety at the intersection.   | none                   | none                 | high                         | high                      | long term  |

\*Low = < \$10,000, Medium = \$10,000 to \$50,000, High =>\$50,000, \*\*Short term = < 1 year, Mid-term = 1 to 3 years, Long-term = > 3 years, +tbd=to be determined, ++row=right-of-way

Improvement techniques and best practices presented as alternative solutions for consideration were derived from a number of sources including those outlined in the National Cooperative Highway Research Program (NCHRP) Report 500 series. The reports documented best practices in different areas of emphasis (safety at signalized intersections, un-signalized intersections, pedestrian and bicycle safety, etc.) Other sources include the FHWA's Bottleneck Reduction Initiative Program, which outlines short-term, low-cost operational and geometric improvements for localized bottleneck reduction.

### **4.3 Projected Intersection Operations**

Level-of-service analyses (LOS) were completed for the study area intersections to determine the operating conditions that are expected to occur during the morning and afternoon peak hours under future 2018 operating conditions. Table 8 shows the signalized and un-signalized LOS for the study area intersections for future 2018 peak hour conditions. Congestion at intersections in Table 8 (LOS "E" and "F") is shown in shaded blocks.

Table 8 shows improved levels-of-service under 2018 Build peak hour conditions compared to 2018 No-Build conditions. A number of signalized intersections will experience improvements in levels-of-service under 2018 Build peak hour operations over 2018 No-Build peak hour operations. The LOS at the Central Street/Pearl Street intersection improves from "F" in the morning and afternoon peak hour to "D" in the morning peak hour and "C" in the afternoon peak hour. The Central Street/Washington Street (Route 138) intersection experiences improved levels-of-service in the Build conditions over the No-Build conditions from LOS "E" during the morning and afternoon peak hours to LOS "D". In addition, the Central Street/Pleasant Street (Route 139) intersection shows improved LOS in the morning peak hour from LOS "F" to LOS "E" from the 2018 No-Build to the 2018 Build conditions and the Central Street/Turnpike Street intersection experiences improvement in the afternoon peak hour, from LOS "D" to LOS "C" under 2018 Build conditions over 2018 No-Build conditions. Table 8 also shows future "Build" peak hour analysis for the Central Street (Route 27) at Canton Street (Route 27) and Tosca Drive intersection assuming a single lane roundabout was installed. The analysis showed that the intersection would operate under failed operating conditions during the 2018 future conditions with a roundabout.

**Table 8 - 2018 No-Build and 2018 Build Levels-of-Service**

| <b>SIGNALIZED INTERSECTIONS (Overall LOS)</b>                         | No-Build<br>AM<br>Peak | No-Build<br>PM Peak | No-Build<br>Saturday<br>Peak | Build<br>AM<br>Peak | Build<br>PM<br>Peak | Build<br>Saturday<br>Peak |
|---|------------------------|---------------------|------------------------------|---------------------|---------------------|---------------------------|
| Central Street (Route 27) at West Street                              | NA                     | NA                  | NA                           | B                   | A                   | NA                        |
| Central Street (Route 27) at Canton Street (Route 27) and Tosca Drive | NA                     | NA                  | NA                           | B                   | C                   | NA                        |
| Central Street at Pearl Street  | F                      | F                   | NA                           | D                   | C                   | NA                        |
| Central Street at Washington Street (Route 138)                       | E                      | E                   | NA                           | D                   | D                   | NA                        |
| Central Street at Pleasant Street (Route 139)                         | F                      | D                   | NA                           | E                   | D                   | NA                        |
| Central Street at Lincoln Street/YMCA Driveway                        | C                      | D                   | NA                           | C                   | D                   | NA                        |
| Central Street at Turnpike Street                                     | E                      | D                   | C                            | E                   | C                   | C                         |
| Central Street at Harrison Boulevard (Dykeman Way)                    | B                      | B                   | B                            | B                   | B                   | B                         |
| Harrison Boulevard (Dykeman Way) at Stockwell Drive                   | A                      | B                   | C                            | A                   | B                   | C                         |
| Harrison Boulevard at Pond Street                                     | C                      | B                   | B                            | C                   | B                   | B                         |
| Harrison Boulevard at West Main Street                                | D                      | C                   | NA                           | D                   | C                   | NA                        |
| Harrison Boulevard at East Main Street (Route 28)                     | C                      | C                   | NA                           | C                   | C                   | NA                        |
| East Main Street (Route 28) at West Spring Street/East Spring Street  | NA                     | NA                  | NA                           | C                   | B                   | NA                        |
|   |                        |                     |                              |                     |                     |                           |
| <b>NON-SIGNALIZED INTERSECTIONS</b>                                   |                        |                     |                              |                     |                     |                           |
| Central Street (Route 27) at West Street                              |                        |                     |                              |                     |                     |                           |
| Central Street WB (Route 27) left turn                                | A                      | B                   | NA                           | NA                  | NA                  | NA                        |
| West Street NB left turn  | F                      | F                   | NA                           | NA                  | NA                  | NA                        |
| West Street NB right turn   | F                      | F                   | NA                           | NA                  | NA                  | NA                        |
| Central Street (Route 27) at Island Street                            |                        |                     |                              |                     |                     |                           |
| Central Street (Route 27) EB left turn                                | A                      | A                   | NA                           | B                   | A                   | NA                        |
| Island Street SB left turn  | F                      | F                   | NA                           | F                   | F                   | NA                        |
| Island Street SB right turn   | F                      | F                   | NA                           | F                   | F                   | NA                        |
| Central Street (Route 27) at Canton Street (Route 27) and Tosca Drive |                        |                     |                              |                     |                     |                           |
| Central Street SW, all moves  | F                      | F                   | NA                           | NA                  | NA                  | NA                        |
| Canton Street (Route 27) WB all moves                                 | D                      | D                   | NA                           | NA                  | NA                  | NA                        |
| Tosca Drive SB all moves  | B                      | B                   | NA                           | NA                  | NA                  | NA                        |
| Central Street at Commercial Street                                   |                        |                     |                              |                     |                     |                           |
| Central Street EB left turns  | A                      | A                   | NA                           | A                   | A                   | NA                        |
| Commercial Street SB all moves  | E                      | F                   | NA                           | E                   | F                   | NA                        |
| West School NB all moves  | E                      | E                   | NA                           | E                   | E                   | NA                        |
| East Main Street (Route 28) at West Spring Street/East Spring Street  |                        |                     |                              |                     |                     |                           |
| East Main Street (Route 28) SB left turns                             | A                      | A                   | NA                           | NA                  | NA                  | NA                        |
| East Main Street (Route 28) NB left turns                             | A                      | A                   | NA                           | NA                  | NA                  | NA                        |
| East Spring Street WB all moves                                       | F                      | F                   | NA                           | NA                  | NA                  | NA                        |
| West Spring Street EB all moves                                       | D                      | E                   | NA                           | NA                  | NA                  | NA                        |
|   |                        |                     |                              |                     |                     |                           |
| <b>ROUNDBABOUT ANALYSIS</b>   |                        |                     |                              |                     |                     |                           |
| Central Street (Route 27) at Canton Street (Route 27) and Tosca Drive | NA                     | NA                  |                              | F                   | F                   |                           |

NA=Not Applicable

Recommended improvements include installing traffic signals at a number of the study area intersections. These intersections include the Central Street/West Street intersection and the Central Street (Route 27)/Canton Street (Route 27)/Tosca Drive intersection in Stoughton, and the East Main Street (Route 28)/East Spring Street/West Spring Street intersection, in Avon. Table 8 shows the signalized level-of-service analysis for these intersections for the 2018 Build conditions, compared with the un-signalized level-of-service analysis for 2018 No-Build scenario. The overall levels-of-service for these intersections under signalized conditions showed acceptable levels (LOS “A”, “B”, and “C”) for morning and afternoon peak hours under the 2018 Build conditions, compared to failed levels-of-service (LOS “E” and “F”) for the critical movements for the same intersections under 2018 No-Build un-signalized conditions.

## 5 Sustainability and Livability

The *2012 Old Colony Regional Transportation Plan* included goals to incorporate livability principles and sustainable practices into transportation plans and programs for maximizing the efficiency of existing transportation investments, providing better access within and between activity centers, reinvesting in aging suburban corridors, restoring complete streets and networks, and maintaining a transportation system that provides reliable, safe access to jobs, education, health care, and goods and services.

Sustainability encourages alternative, non-motorized modes to conserve energy and reduce reliance on fossil fuels. Principles for creating more sustainable neighborhoods include designing streets and the rights-of-way to encourage shared pedestrian, bicycle, and vehicular use. A new design strategy, often referred to as “Complete Streets”, enables safe road access and operation for all users including pedestrians, bicyclists, motorists, and public transportation users of all ages and abilities. Complete Streets make it easy to cross the street, walk, and bicycle to and from destinations (shops, work, school, etc.) by integrating safety for non-motorized travel in the design and construction of roads.

The Federal Highway Administration (FHWA) defines Livability in the following way: “Livability is about tying the quality and location of transportation facilities to broader opportunities such as access to good jobs, affordable housing, high quality schools, and safe streets. This includes addressing safety and capacity issues on all roads through better planning and design.”

In January of 2013, the Old Colony Planning Council completed the *Bicycle and Pedestrian Connectivity and Livability Study*. The purpose of the study was to improve the quality of life in the OCPC communities by integrating transit, bicycle, and pedestrian amenities into residential and commercial/industrial areas. Objectives in the study include:

- To conduct an extensive public participation and outreach process in order to identify the areas of need for bicycle and pedestrian infrastructure improvements
- To collect the bicycle and pedestrian related data in areas identified by the communities’ stakeholders groups and develop improvements to the overall non-motorized network within communities and between communities

The Old Colony Planning Council staff met with engineers, planners, public works and highway staff, police and fire officials, and councils-on-aging and youth councils to discuss pedestrian and bicycle transportation issues in the communities. The public participation process, which included citizens, businesses, individuals of traditionally underserved groups such as Limited English Proficiency populations and non-profit organizations, served to educate and inform stakeholders on initiatives such as livability, sustainability, and climate change. The process helped OCPC set alternative network goals

and document local bicycle and pedestrian improvement needs. Some of the long term goals of the study included:

- Increasing multimodal transportation centers (Transit Oriented Development) that serve business, residential, and mixed-use developments
- Supporting the development of Transit Oriented Developments in Kingston, Plymouth, Bridgewater, Hanson, and Easton Commuter Rail stations
- Supporting the designation, (by year 2035), of Kingston, Plymouth, Halifax, Hanson, Whitman, and Easton Commuter Rail stations as TOD's
- Increasing bicycle and pedestrian infrastructure networks and amenities in the OCPC Region by 2015
- Completing, by 2020, 40 percent of previously identified OCPC short-term bicycle infrastructure projects
- Implementing, by 2035, 50 percent of the identified long-term bicycle and pedestrian projects

The *Old Colony 2013 Bicycle and Pedestrian Connectivity and Livability Study* identified a lack of pedestrian and bicycle accommodations along the Central Street corridor in Stoughton. The corridor lacks sidewalks along the south side of the road and shoulders on both sides of the road for bicycle use. There are a number of destinations within the corridor including the Hansen Elementary School, the West Elementary School, and the Stoughton District Court. In addition, the Central Street corridor is used for access to the Middle School on Cushing Street and Stoughton High School on Pine Street. The *Old Colony 2013 Bicycle and Pedestrian Connectivity and Livability Study* recommended shoulders for bicycle lanes on Central Street from Canton Street (Route 27) to Turnpike Street as well as sidewalk improvements on Pine Street from the Canton Town Line to Stoughton center. The study included sidewalk improvements in Avon at the Harrison Boulevard/East Main Street (Route 28) intersection and along east Main Street to the East Main Street (Route 28)/East Spring Street/West Spring Street intersection. The bicycle and pedestrian levels-of-service and recommended improvements from the *OCPC 2013 Bicycle and Pedestrian Connectivity and Livability Study* for Avon and Stoughton are included in the appendix to this report.

## 6 Conclusions and Recommendations

### 6.1 Overall Short Term and Long Term Improvements

The study area communities, Stoughton and Avon, should work with state agencies and developers to implement short term and long-term improvements to the overall safety, physical conditions, and traffic operations at the study area locations for motor vehicle traffic and other users. The following overall improvements were identified in regards to traffic, pedestrian, and bicyclist safety and operation:

Overall short term improvements:

- Pavement marking revision and re-striping (centerlines, crosswalks, fog lines, side street stop lines)
- New and revised signing upgraded to meet MUTCD reflectivity standards
- Replace missing speed limit signs and/or post legal limit signs where none exist
- Improve lighting along the road and at intersections
- Clear vegetation to improve sight distances at intersections and driveways, and to provide recovery areas for lane departures
- Relocate and or remove fixed objects (utility poles, trees, etc.) that are too close to travel lanes and present lane departure hazards

- Construct, reconstruct, and replace sidewalks in conformance with the Americans with Disabilities Act
- Install post mounted curve delineators and chevrons
- Enhance speed management by providing immediate and strict speed enforcement
- Traffic signal updates and modifications (improvements to equipment, coordination, and timing and phasing)
- Lane use revisions

Overall long term improvements:

- Implement construction and/or operational improvements, such as adding or expanding shoulders, straightening dangerous curves, and realigning and improving hazardous intersections
- Realign intersections and remove obstacles to improve sight distances at intersections
- Continue to utilize pavement management system
- Request that OCPC routinely monitor traffic conditions as part of its regional growth monitoring efforts.
- Study area communities should continue to participate in the Joint Transportation Committee (JTC) and Metropolitan Planning Organization (MPO)

According to the NHCRP reports, driver awareness of downstream intersections and traffic control devices is important to intersection safety. The inability to perceive an intersection, upcoming traffic controls, or the back of a stopped queue in time to react as necessary can result in safety problems. Drivers caught unaware could be involved in serious crashes, especially at intersections with high speeds on the approaches. Installing or upgrading signs and pavement markings on intersection approaches can help better prepare drivers for the intersection ahead. This includes advance guide signs, advance street name signs, larger signs, warning signs, pavement markings, overhead street signing, post-mounted delineators, and better intersection lighting.

## **6.2 Identified Problem areas and Recommendations**

### **6.2.1 Complete Streets and Bicycle and Pedestrian Improvements**

Complete Streets principles contribute toward the safety, health, economic viability, and quality of life in a community by providing greater opportunities in multi-modal and non-motorized transportation. This is achieved through the development of a comprehensive, integrated transportation network that accommodates pedestrians, bicyclists, and public transportation riders. A Complete Streets network is intended to accommodate people of all ages and abilities, including children, youth, families, older adults, and individuals with disabilities.

The *OCPC Bicycle and Pedestrian Connectivity and Livability Study 2013* recommended adding Central Street as a designated bicycle path in Stoughton. However, as previously stated, Central Street is 28 feet wide with two foot shoulders and 12 foot travel lanes from Canton Street to the passenger rail crossing. The lack of pavement width in this section will not allow the addition of adequate shoulders for bicycle use on both sides of the roads; however, because the posted speed limit on Central Street is 35 miles per hour just east of the Canton Street (Route 27) intersection, sharrows can be utilized, along with appropriate signage, and can improve bicycle safety on this section of the road.

East of the rail crossing, Central Street widens to 32 feet to Washington Street and it is 36 to 37 feet wide east of Washington Street with one foot shoulders and 17 foot travel lanes. The desirable width is

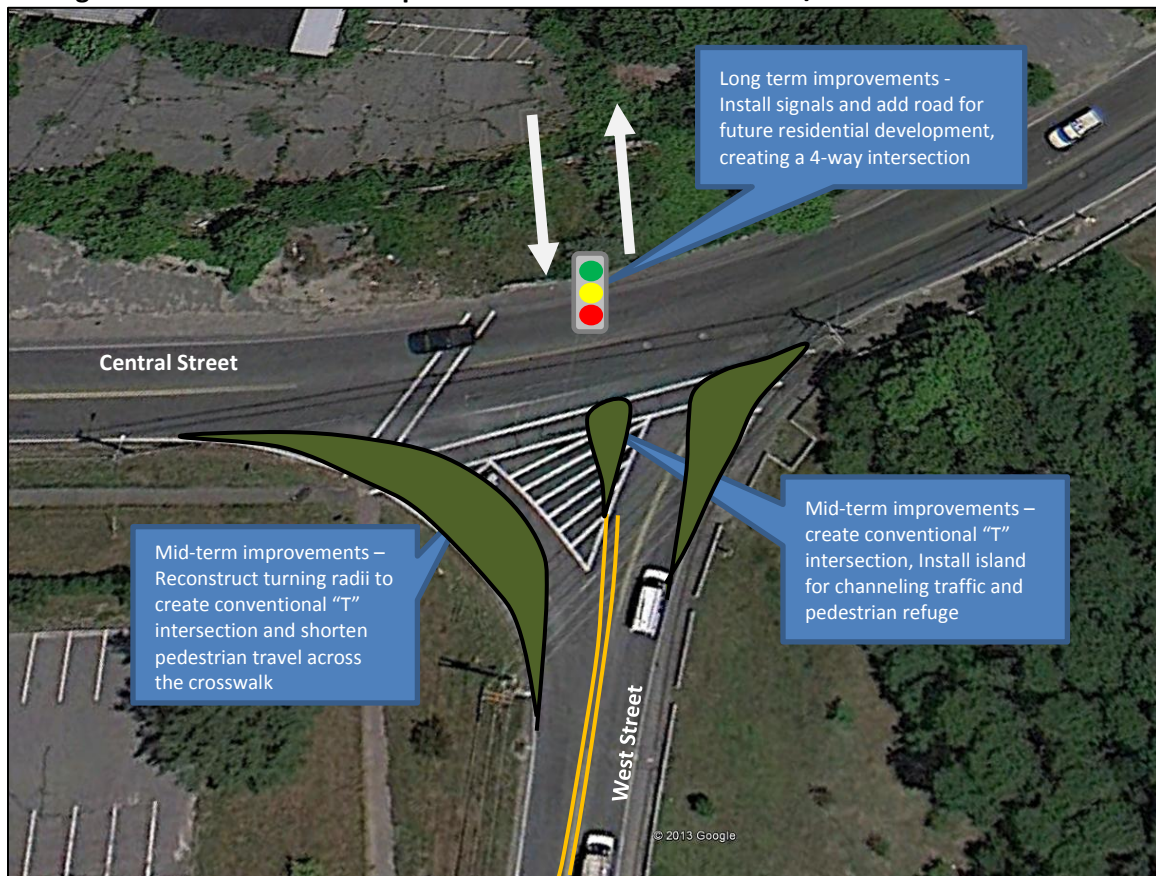
four feet for bicycle accommodation, according to the *Urban Bikeway Design Guide*, published by National Association of City Transportation Officials (NACTO), with five feet being the preferred width. Central Street, from the rail crossing to Washington Street is wide enough to add four foot shoulders on both sides of the road for bicycle use. East of Washington Street, Central Street is wide enough to add five foot shoulders for bicycles to Turnpike Street.

As previously stated, there is a sidewalk along the north side of Central Street from the passenger rail grade crossing east to the Lincoln Street intersection. Sidewalks are lacking; however, on the south side of Central Street with sidewalks on the south side only in the vicinity of the West School and between Lincoln Street and Turnpike Street. The construction of a sidewalk between Pearl Street and Washington Street would eliminate a significant obstacle for pedestrians accessing the West School and for pedestrian access to businesses surrounding the Washington Street (Route 138)/Central Street intersection.

### **6.2.2 Central Street at West Street**

The intersection of Central Street (Route 27) and West Street is a three-way intersection with a stop sign controlling the West Street northbound approach. Based on the calculated level-of-service, long delays occur at the intersection in both the morning and afternoon peak hours, resulting in a level-of-service grade of “F” for the critical northbound left turn and right turn movements for existing and future “no-build” conditions. The current configuration of the intersection includes a painted island which channels vehicles turning left from Central Street to the inside of the island creating conflicts with vehicles on West Street headed northbound turning left and with vehicles on Central Street headed eastbound turning right to West Street. In addition, the current configuration has a long crosswalk across West Street (over 100 feet), which increases pedestrian exposure to traffic turning movements at the intersection.

**Figure 6 – Recommended Improvements to the Central Street/West Street Intersection**



Improvements to the intersection should be made in two stages that include mid-term improvements and long-term improvements. The mid-term improvements include the reconstruction of the turning radii and the installation of a raised island to create a conventional “T” intersection. This reduces the turning movement conflicts under the current conditions with the painted island. In addition, the reconfiguration of the turning radii creates a shorter walking distance for pedestrians across the crosswalk and the raised island provides pedestrian refuge. The second stage of improvements would involve creating a northern leg at the intersection, (for access to a proposed residential development) and installing traffic signals. Previous residential proposals for the parcel north of the West Street intersection included making the intersection a four-way for access and signaling the intersection as mitigation for traffic due to the development. Signalization would not only help reduce traffic delays, (LOS “B” and “A” under build conditions, compared to “F” under existing conditions) it would improve pedestrian safety with the installation of pedestrian actuated signals at the intersection.

The results of signal warrants for this intersection, which were completed by OCPC for the 2008 Route 27 Corridor study, were satisfied and are included in the appendix to this report. The recommended improvements for the Central Street/West Street intersection were coordinated and are based on consultation with the Town of Stoughton’s Transportation Task Force.

### 6.2.3 Central Street at Island Street

The Route 27 (Central Street)/Island Street intersection is located between West Street and Canton Street. It is 500 feet east of West Street and about 450 feet west of Canton Street. This intersection operates at LOS “F” during the morning and afternoon peak hours, with heavy traffic flows during the



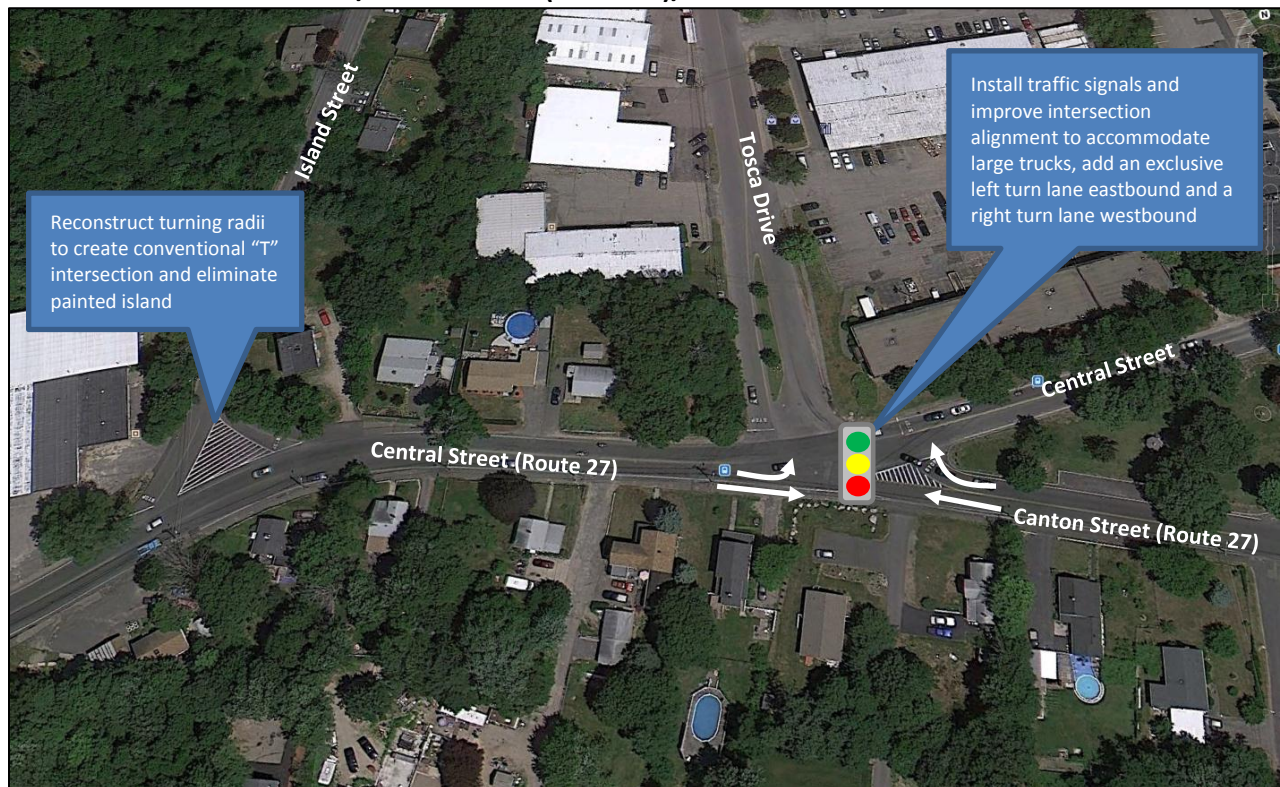
morning and afternoon peak hours and throughout the day. This intersection has poor alignment that limits sight distances for turning movements. A faded painted island in the Island Street approach is designed to channel vehicle movements; however, this island increases conflicting movements at the intersection. A traffic impact and access study for a proposed residential development, which was to be located north of the Central Street/West Street intersection, recommended geometric improvements to the this intersection that included; the widening of Route 27 eastbound to add an exclusive left turn lane, widening Route 27 westbound to provide a through lane and channeled right turn lane, widening Island Street to provide an exclusive left turn lane and channeled right turn lane, and widening Island Street between the proposed site driveway and Route 27 from 20 to 24 feet. In addition, the signalization of the Central Street/West Street intersection and the Central Street/Canton Street (Route 27)/Tosca Drive intersection will help create gaps in the Central Street traffic flow for vehicles entering and exiting Island Street.

#### **6.2.4 Central Street/Canton Street (Route 27)/Tosca Drive**

The Route 27 (Central Street)/Canton Street/Tosca Drive intersection is a poorly aligned, unconventional four-way intersection. The intersection has stop control on three of the four approaches; the Canton Street (Route 27) westbound approach, the Central Street southwest approach, and the Tosca Drive southbound approach. The Central Street (Route 27) eastbound approach is uncontrolled and vehicles have the right of way. This traffic control configuration, with stop control on three of the four approaches, often confuses motorists regarding which stop sign controlled approach should go when a gap occurs in the Central Street (Route 27) eastbound traffic. Throughout most of the day, because of heavy traffic volumes, vehicles are continually arriving on the Central Street southwest stop approach and the Canton Street (Route 27) westbound stop approach. In addition, the Tosca Street southbound approach has a high percentage of trucks in the traffic flow (20 percent trucks). These trucks taking left and right turns from Tosca Drive take wide turns and encroach on through lane traffic on Central Street.

This intersection operates under failed forced flow conditions, LOS "F" conditions, during the morning and afternoon peak hours. There are long queues on the Central Street and Canton Street approaches during the peak hour and throughout most of the day. Installing traffic signals at this intersection will improve safety and improve the LOS from "F" during the morning and afternoon peak hours to LOS "B" during the morning peak hour and LOS "C" during the afternoon peak hour. The signal will also create gaps in the through traffic for vehicles accessing Island Street and West Street from Route 27. The signal warrant analysis for the intersection is included in the appendix to this report. In addition, the improvements include widening the Central Street (Route 27) eastbound approach and adding an exclusive left turn lane, and widening the Canton Street (Route 27) westbound approach and adding an exclusive right turn lane. Future 2018 peak hour level-of-service analysis was performed for this intersection assuming the installation of a single lane roundabout. The future peak hour analysis results show that this intersection would operate under LOS "F" or failed conditions (long delays) under 2018 peak hour conditions if a single lane roundabout was installed.

**Figure 7 – Recommended Improvements at Central Street/Island Street Intersection and Central Street/Canton Street (Route 27)/Tosca Drive Intersection**



### **6.2.5 Island Street Mill Street One-Way pair**

The Island Street/Central Street (Route 27) intersection is poorly aligned and currently utilizes a painted island to channel traffic. This painted island increases vehicle conflicts as vehicles enter and exit Island Street on both sides of it. A recurring theme at the public outreach meeting, which was brought up by the Stoughton Police Safety officer, was to remove the painted island, re-align the Island Street/Central Street intersection, and make the street one way northbound away from Central Street. This would eliminate left and right turns from Island Street to Central Street. Vehicles that utilize Island Street for access to Central Street would use Mill Street, which would be made one way southbound to Central Street, and a future extension of West Street, which would be a two way road connected to Island Street providing signalized access to and from Central Street. In addition, a new road would be constructed to connect the West Street connection to Mill Street. Figure 8 shows the recommended improvements to the road way network.

**Figure 8 – Recommended Improvements at Island Street and Mill Street (one-way pair)**



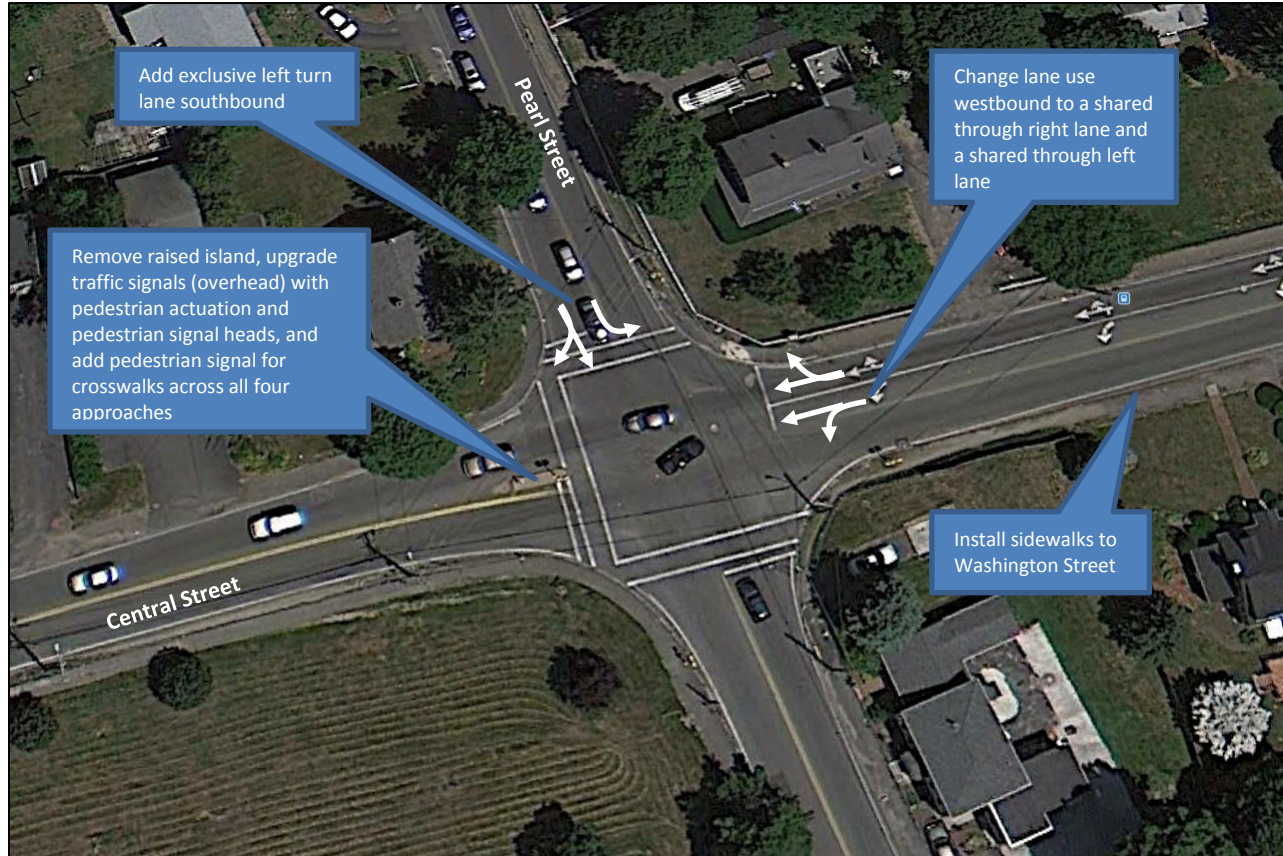
### 6.2.6 Central Street at Pearl Street

The Central Street/Pearl Street intersection presents a major bottleneck in the Central Street corridor in Stoughton. This intersection is impacted by a number of factors including heavy commuter volumes, as well as heavy volumes due to trips to and from Stoughton schools, with the West School located approximately 600 feet west of the intersection, the high school located 2,000 feet south of the intersection, and the middle school located south of the West School with access via Simpson Avenue off of Central Street. There are heavy right turn volumes on Central Street westbound in the morning peak hour to Pearl Street northbound and heavy left turns southbound on Pearl Street to Central Street eastbound during the afternoon peak hour.

This intersection is a high crash location with a high crash rate (1.17 crashes per million entering vehicles). The traffic signal system is outdated with a pre-timed timing and phasing scheme. The intersection has pedestrian actuation buttons; however, there are no pedestrian signals, instead the traffic signals indicate red and yellow balls on all approaches for the pedestrian phase, which is outdated and confusing to some motorists. The eastbound approach contains a raised island, which is often hit by turning vehicles (as indicated in the crash data). There are long queues on all approaches, especially on Central Street, which experiences heavy volumes throughout the day. The vehicles entering and exiting the West School add to the queuing and delay as vehicles enter and exit the site, interfering with through traffic. In addition, vehicles waiting to enter the West Street School queue along Central Street eastbound and block through traffic. Some motorists park illegally along the westbound side of the

West School, which blocks westbound traffic and backing traffic into the intersection. A crossing guard is stationed at the Commercial Street intersection on Central Street to stop traffic for children entering and exiting the school.

**Figure 9 – Recommended Improvements at Central Street/Pearl Street Intersection**



A Safety and Operations Analyses Memo for the Central Street/Pearl Street intersection was completed by CTPS in 2011 and made the following recommendations for the intersection:

- Install a fully actuated traffic signal system with standard pedestrian signals and push buttons
- Replace the existing post-mounted signals with overhead signal indications supported by a cable system or mast arms, which can be clearly viewed on all approaches from a distance
- Remove the traffic median on Central Street, and replace it with hatched pavement markings if necessary
- Maintain the existing crosswalks and sidewalks at the intersection
- Include a pre-emption function for emergency vehicles
- Install wheelchair ramps with ADA (American with Disabilities Act)/AAB(Massachusetts Architectural Access Board) standards at all corners of the intersection
- Install accessible (audible) countdown pedestrian signals
- Improve lighting conditions at the intersection

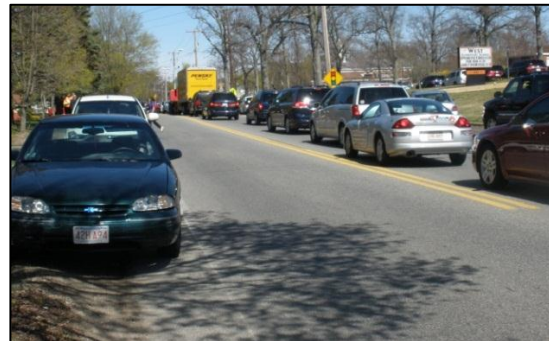
In addition, the CTPS study recommended alternatives for improvements with changes in lane configuration and signal timing and phasing. These alternatives include:

1. Modify the WB approach to an LT/TH shared lane and an exclusive RT lane, and operate the upgraded signal system under the existing phasing sequence
2. Modify the WB approach to an LT/TH shared lane and a TH/RT shared lane, add an exclusive LT lane to the SB approach, and operate the upgraded signal system under the existing phasing sequence

Both of these alternatives improve the overall level-of-service from LOS “F” to LOS “D”. Alternative 2 would require possible right of way takings to widen the southbound approach to add the southbound left turn lane.

### 6.2.7 Improvements to the West Street School Access

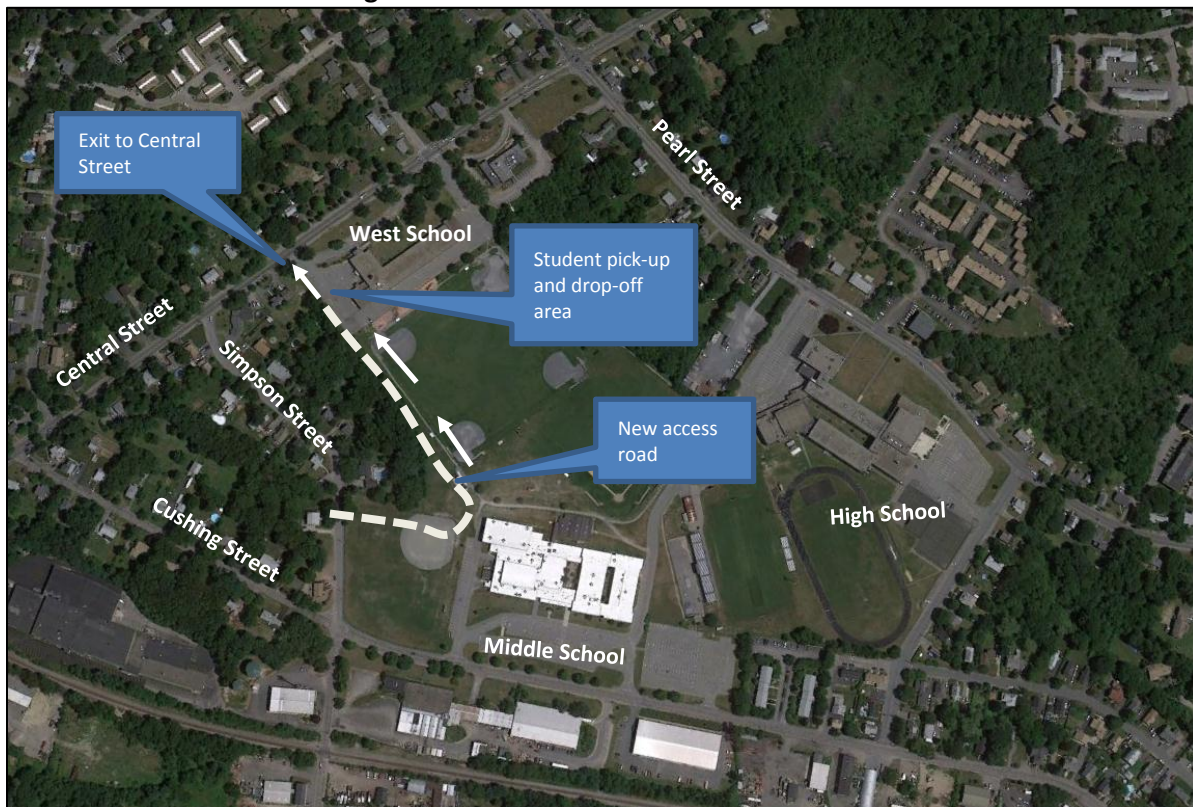
Vehicles accessing the West School, which is located on Central Street just west of the Central Street/Pearl Street intersection, for student drop offs and pick-ups when school is in session, create a reoccurring bottleneck during the morning peak hour and in the afternoon when school is dismissed, just before the afternoon peak hour. OCPC conducted a Road Safety Audit (RSA) in cooperation with the Stoughton School Department and town officials on April 24, 2013. As part of the RSA, participants of the audit observed afternoon school dismissal and traffic operations during student pick-up. The queues from the drop offs and pick-ups extend back out of the school driveway onto Central Street creating hazardous conditions for vehicles and pedestrians. These queues extend back on Central Street and continue onto Simpson Street. Traffic on Central Street slows down as vehicles maneuver around parked vehicles on both the eastbound and westbound direction. In addition, vehicles stop frequently to allow pedestrians to cross along Central Street as students and parents access the school from their parked vehicles along the westbound side.



Vehicles parked along the eastbound side (left) and vehicles parked along both sides of Central Street (right) on both sides of the street.

The long term solution developed as a result of the Road Safety Audit and in consultation with the Stoughton Transportation Task Force, is to create a new driveway that would allow vehicles to access the West School from the back of the building and exit onto Central Street. This would take West School traffic behind the school and off of Central Street altogether. The land behind the West School is owned by the Town of Stoughton school department, so there would be no additional costs due to right of way acquisition. The new road would extend from Simpson Street and cut through the edge of the existing playgrounds behind the West Street School and the middle school. The road would allow access to the side of the West Street School where the zone for student pick-up and drop offs is located. Figure 10 shows the proposed recommendations.

**Figure 10 – New West Street School Access**



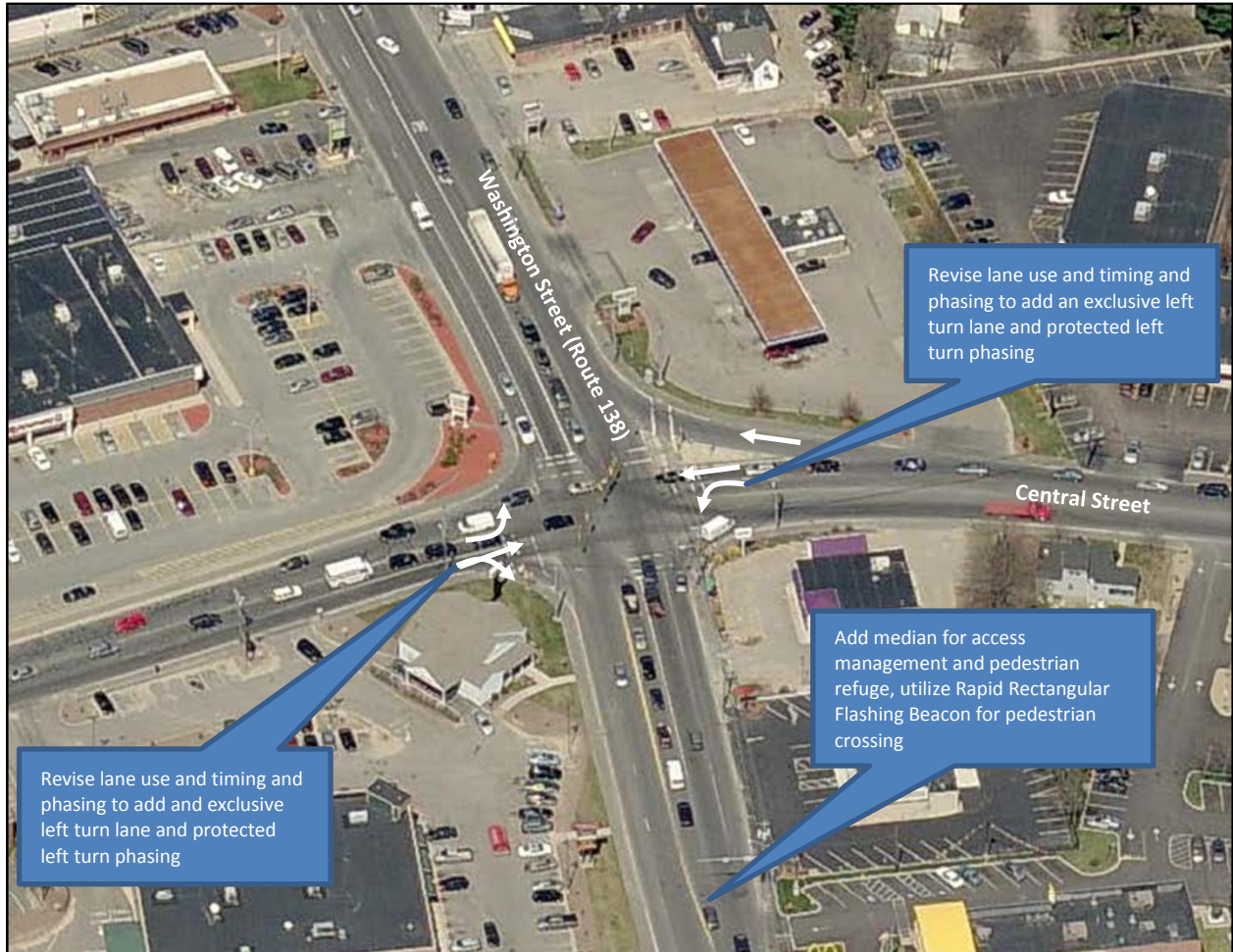
**6.2.8 Central Street at Washington Street (Route 138)**

Potential improvements at the Central Street/Washington Street (Route 138) intersection were discussed in depth at the public meetings by stakeholders. Converting the left lane on the eastbound approach to an exclusive left turn lane, along with protected phasing, will help reduce long queues on the Central Street approaches, and along with a longer all red signal in the timing will help prevent left turns from getting caught in the intersection as the phase changes to green for Washington Street. A median should be added on the northbound and southbound approaches to prevent vehicles from turning in and out of curb cuts and interfering with intersection traffic operations. A Rapid Rectangular Flashing Beacon can be installed on Route 138 south of the intersection to improve pedestrian safety, along with the added medians for refuge. MassDOT has initiated an improvement project for this intersection that will consider these improvements as well as other improvements and will schedule a Road Safety Audit to further develop improvements to enhance safety. This improvement project is listed in the Appendix of the FFY 2014-2017 Old Colony Transportation Improvement Program.

Improvements that address safety at this location and within the Route 138 corridor include:

- Add a median between Central Street and School Street to provide for pedestrian refuge and improve Access Management.
- Improve/upgrade pavement markings, and remove the passing zone (if the median is not implemented)
- Add bicycle lanes on both sides of Route 138 between the town center and Canton Town Line.
- Utilize Rapid Rectangular Flashing Beacon for crosswalks across Route 138 south of Central Street to Lincoln Street.
- Improve sidewalks along Route 138 north of Lincoln Street to Central Street.

**Figure 11 – Recommended Improvements at Central Street/Washington Street (Route 138) Intersection**



**Rapid Rectangular Flashing Beacon (Pedestrian Warning Sign, pedestrian actuated)**

### 6.2.9 Central Street at Pleasant Street (Route 139)

The Central Street/Pleasant Street (Route 139) intersection in Stoughton has an elevated crash rate of 1.48 crashes per million entering vehicles (MEV), substantially above the MassDOT District 5 regional average of 0.77 per MEV for signalized intersections. In addition, delays are common during the morning and afternoon peak hours with heavy traffic flows throughout the day resulting in LOS “F” for the morning peak hour and LOS “D” during the afternoon peak hour. Over half (50 percent) of the crashes involve angle type crashes or head-on crashes, which indicates the need for improvements that reduce driver confusion and crash exposure for critical movements at the intersection. Improvements that reduce crash exposure include reconstructing the intersection with dedicated left turn lanes on the eastbound and westbound approaches, left turn signal phasing protection, and modifying phasing for lead/lag phasing for turn protection. These improvements were discussed and endorsed by stakeholders at the public meetings for the study. In addition, recommended improvements include increasing signal clearance (all-red) time, restricting right turns on red, installing back plates on signal heads to increase visibility, replacing signal bulbs with brighter LED bulbs to increase signal visibility, enhancing roadway striping and pavement markings (including turning movement guide lines), and Improving sight lines through the clearing of roadside and hanging vegetation.

**Figure 12 – Recommended Improvements at Central Street/Pleasant Street (Route 139) Intersection**



### 6.2.10 Central Street at Turnpike Street

The Central Street/Turnpike Street intersection operates at LOS “D” during the morning peak hour and LOS “C” during the afternoon peak hours. These levels-of-service are expected to decline with the morning peak hour at LOS “E” and the afternoon peak hour at LOS “D” conditions under 2018 no-build conditions. The crash rate at 1.35 crashes per MEV also exceeds the MassDOT District 5 average of 0.77. Fifty percent of the crashes at the intersection are angle type crashes. Lead lag protected phases on the Central Street eastbound and westbound approaches will help to alleviate the angle type collisions, and

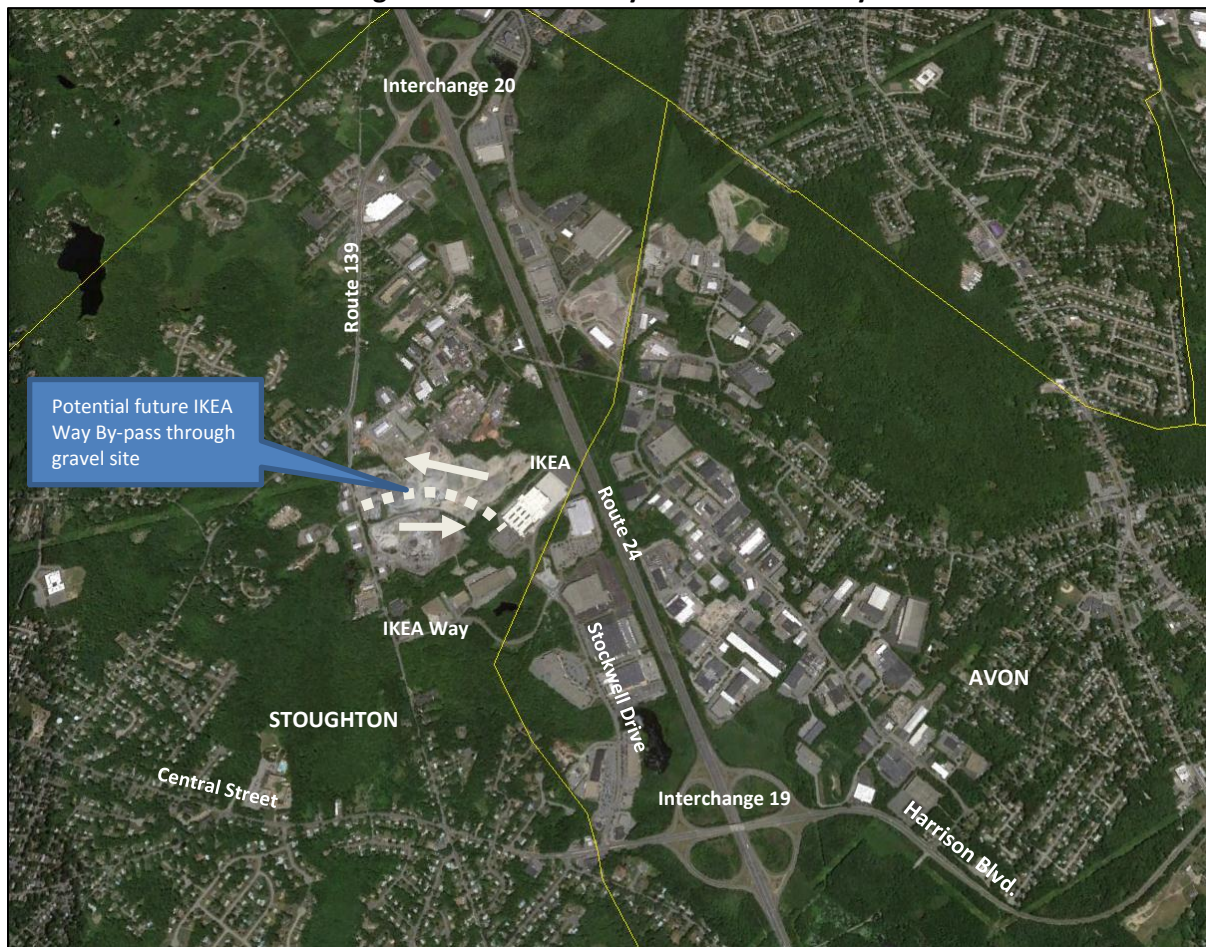


will also improve the afternoon peak hour from LOS “D” to LOS “C” under 2018 Build conditions over 2018 No-Build conditions.

### 6.2.11 IKEA Way

IKEA, the home furnishings retailer, is proposing an expansion of their existing facility at the end of Stockwell Drive in Stoughton. The expansion includes 60,000 square feet of added warehouse and home delivery space. The traffic impact report for the proposal concluded that traffic from the expansion would not result in any changes in levels-of-service or delay at intersections in the surrounding road network, except at the roundabout at the Stockwell Drive/IKEA site drive, which is exceeding capacity during the weekend mid-day peak periods. The study included a number of improvements including adding police details for traffic control at the IKEA roundabout as necessary during the December and peak IKEA sales periods. In addition, the study recommended updating signs and worn pavement markings at the roundabout to confirm to the latest changes in the Manual on Uniform Traffic Control Devices. The potential exists for a bypass of Stockwell Drive to and from Turnpike Street to be built through a site that is currently used to extract gravel. When the mineral resources are depleted, this site has the potential for a direct route between the IKEA parking lot and Turnpike Street, which would relieve the congestion at the roundabout on Stockwell Drive.

**Figure 13 – Potential By-Pass for IKEA Way**



### **6.2.12 East Main Street (Route 28) at West Spring Street and East Spring Street**

This intersection is stop controlled at the East Spring Street westbound approach and the West Spring Street eastbound approach. The Road Safety Audit completed for this intersection by MassDOT concluded that there are heavy left turns from East Spring Street to East Main Street (Route 28) southbound, which turn right to Harrison Boulevard westbound during the morning peak hour. These volumes reverse direction during the afternoon peak with heavy vehicle flows from Harrison Boulevard eastbound turning left to East Main Street (Route 28) northbound, and then turn right to East Spring Street headed eastbound. The critical movements at the intersection; right turns, through movements and left turns on the East Spring Street approach experience long delays and backups (LOS "F") during the morning and afternoon peak hours under existing and No-Build conditions. There are significant angle type crashes involving vehicles making a left-turn from the East Spring Street approach with a second vehicle traveling along Route 28 northbound. The Route 28 northbound approach currently consists of one shared left-turn/through lane and one shared through/right-turn lane. The outside shared through/right-turn lane on Route 128 northbound generally operates as a "de facto" right-turn lane due to the heavy right-turn volume onto East Spring Street. Left turning motorists from East Spring Street eastbound often expect that Route 28 northbound motorists traveling along the outside lane are going to make a right-turn and may begin to enter the intersection prematurely.

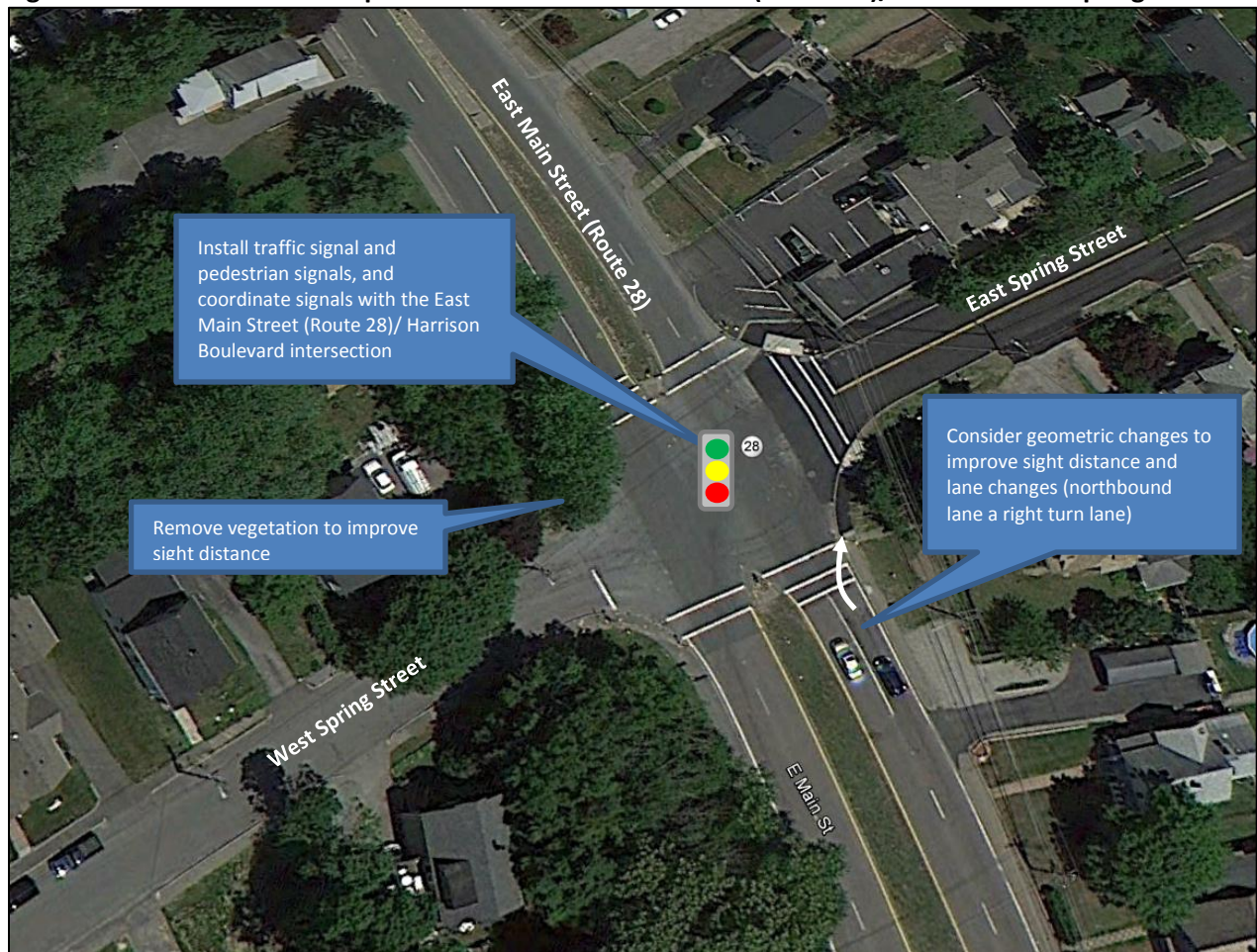
The difficulty in making a left-turn at this intersection from East Spring Street is amplified due to sight distance limitations at the southeast corner caused by the combination of the slight vertical incline on the East Spring Street westbound approach and the presence of a small crest vertical curve approximately 150 feet south of the intersection along Route 28 northbound. As a result, motorists at the East Spring Street westbound approach typically pull past the stop line, often encroaching on Route 28 northbound, to see oncoming traffic. Also large trucks, which are prevalent along the corridor, traveling in the Route 28 northbound outside lane often block the visibility of the vehicles traveling along the inside lane.

The Road Safety Audit identified a number of short-term and long-term improvements for the East Main Street (Route 28)/East Spring Street/West Spring Street intersection, although the RSA report stated that further study and design work need to be conducted to determine the feasibility of making some of the improvements.

The potential improvements identified by the RSA team include:

- Improve and maintain pavement markings and remove those that are unnecessary (short-term)
- Improve pedestrian accessibility (short-term)
- Monitor/enforce travel speed (short-term)
- Re-evaluate crosswalk locations (short-term)
- Replace damaged guide signage (short-term)
- Evaluate potential changes in lane usage (short-term)
- Consider geometric modifications and/or changes to traffic control (long-term)
- Evaluate lane usage and traffic operations along the Route 28 corridor (long-term)

**Figure 14 – Recommended Improvements at East Main Street (Route 28)/East and West Spring Street**



### 6.3 Funding for Improvements

The implementation of projects includes taking transportation improvements from the concept stage through to design and construction. Funding is an essential element in ensuring the implementation of recommended improvements. The MassDOT Project Development and Design Guide explains the project development process in Massachusetts and design standards for transportation projects. The MassDOT project development process consists of eight steps:

- I. Problem/Need/Opportunity Identification (A Project Need form is submitted to MassDOT)
- II. Planning (A project planning report is completed)
- III. Project Initiation (A Project Initiation Form is submitted to MassDOT)
  - Identification of Appropriate Funding
  - Definition of Appropriate Next Steps
  - Project Review Committee Action
- VI. Environmental Design and ROW Process (Includes Plans, Specifications, and Estimates, P, S, & E)
  - Environmental Studies and Permits
  - Right-of-Way Plans
  - Permits
- V. Programming (Old Colony TIP and State Transportation Improvement Program, STIP)

- Programming of Funds

VI. Procurement (Construction bids and contractor selection)

VII. Construction

VIII. Project Assessment

On sections of roadway owned and maintained by the municipality, the community typically initiates a project by completing and submitting the Project Need Form (available in the Appendix), as well as providing for project planning and design. Similarly, for state owned facilities, the MassDOT initiates projects and provides planning and design on their section of roads.

Many funding options are available for project construction, and are outlined below. Note that some funding programs, such as the Congestion Mitigation and Air Quality (CMAQ) Program, are for specific types of projects that meet specific criteria, while other programs such as Chapter 90 can be utilized on a much broader range of projects. Federal aid eligible regional transportation needs have outpaced available funding in the Transportation Improvement Program (TIP) for the past several years. All projects on the TIP go through a comprehensive evaluation process to determine priority for funding; therefore, the programming of the TIP is a competitive process. In general, the process to fund a project through the TIP may take up to five years. Therefore, due to this limitation of TIP funding, communities are encouraged to seek alternate funding avenues for their high priority projects. Examples of such options include using Chapter 90 funds, developer mitigation, or public/private partnerships with local stakeholders.

#### Funding Programs

- **Capital Improvement Program (CIP) and Local Funding** This program has historically been utilized to help provide the design and engineering of highway projects.
- **Exactions (Developer Mitigation Agreements)** Communities have increasingly turned to exactions as a means to meet new infrastructure and public service needs. Cities and towns use developer exactions as a strategy to offset the burdens of new development on the community. Exactions contribute to regional equity by ensuring that a new development pays a fair share of the public costs that they generate. Exactions consist of a developer's payment of funds to offset the cost of necessary construction, design, or maintenance of public infrastructure directly connected to the new development. Developers commit to an agreement for funding or constructing off-site improvements in exchange for the approvals to proceed with a development project.
- **Bridge Replacement and Rehabilitation Program** provides funds for rehabilitation and replacement of any bridge on a public road. Bridges on the federal aid system or off the federal aid system are eligible for these funds.
- **Chapter 90** provides state funding for highway construction, preservation, and improvement projects that create or extend the life of capital facilities. The level of funding is determined by a formula that is based upon public way mileage, population and level of employment in each community. The Chapter 90 Program is a reimbursement program, as the community must initially pay the cost of a particular project.
- **Community Development Block Grant (CDBG) Program** provides for the development or expansion of economic opportunities and the provision of decent housing and public facilities. Eligible use of funds includes community development (construction or reconstruction of streets, water and sewer facilities, neighborhood centers, recreation facilities, and other public works).

- **Congestion Mitigation and Air Quality Improvement Program (CMAQ)** directs funds toward transportation projects in Clean Air Act non-attainment areas for ozone and carbon monoxide. OCPC is located in the Boston non-attainment area for ozone.
- **National Highway System (NHS)** consists primarily of existing Interstate Highway routes and portions of the Primary System. This program was established to focus federal resources on roads that are the most important to interstate travel, national defense, inter-modal connections, and international commerce.
- **Non-Federal Aid (NFA)** provides state funds for projects that due to federal fiscal constraints would not be able to receive federal funding. Projects under this category are listed for informational purposes only.
- **Public Works Economic Development (PWED)** grants are designed to assist municipalities seeking infrastructure improvements that support economic development goals.
- **Surface Transportation Program (STP)** is a block grant type program that may be used for any roads (including NHS) that are not functionally classified as local or rural minor collectors. These roads are collectively referred to as federal-aid eligible roads.
- **Transportation Bond Bill (TBB)** authorizes and directs the MassDOT to expend monies for transportation projects such as reconstruction, resurfacing, rehabilitation or improvements of highways, bridges, and parking facilities. From this, the State will issue either general obligation or special obligation bonds.
- **Federal appropriations** allocate federal funding for federal aid eligible projects.

In September of 2010, the MassWorks Infrastructure Program was instituted to provide a one-stop shop for municipalities and other eligible public entities seeking public infrastructure funding to support economic development and job creation in Massachusetts. The Program is an administrative consolidation of six former grant programs:

- Public Works Economic Development Grant (PWED)
- Community Development Action Grant (CDAG)
- Growth Districts Initiative (GDI) Grant Program
- Massachusetts Opportunity Relocation and Expansion Program (MORE)
- Small Town Rural Assistance Program (STRAP)
- Transit Oriented Development (TOD) Program

The MassWorks Infrastructure Program is administered by the Executive Office of Housing and Economic Development, in cooperation with the Department of Transportation and Executive Office for Administration & Finance.

## **7 Appendices**

OCPC Automatic Traffic Recorder Counts  
OCPC and Consultant Turning Movement Counts  
OCPC Intersection Levels-of-Service  
Signal Warrant Analysis  
OCPC Intersection Crash Rate Calculation  
Public Meeting Flyers  
Public Meeting Surveys  
Bicycle and Pedestrian Levels-of-Service  
Bicycle and Pedestrian Improvements  
Avon Zoning Map  
Stoughton Zoning Map  
MassDOT Project Need Form  
MassDOT Project Initiation Form