ABINGTON AND BROCKTON ROUTE 123 CORRIDOR STUDY

January 2018

Old Colony Planning Council
70 School Street
Brockton, MA 02301

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1 Introduction

1.1 Study Purpose and Scope

The Abington and Brockton Route 123 Corridor Study focuses on the Route 123 corridor beginning in Abington, extending west from the Rockland line through Abington and Brockton. The study area does not include Route 123 in its entirety in Brockton and includes Route 123 to the Brockton Downtown (ending at the Belmont Street/Warren Avenue intersection). The study area encompasses approximately three miles in Abington and three miles in Brockton for a total of six miles. The purpose of the study is to identify, address, and alleviate deficiencies in the corridor thereby enhancing the movement of people and goods, improving circulation and traffic flow efficiency, improving safety and bicycle and pedestrian accommodation, and reducing gaps to essential services.

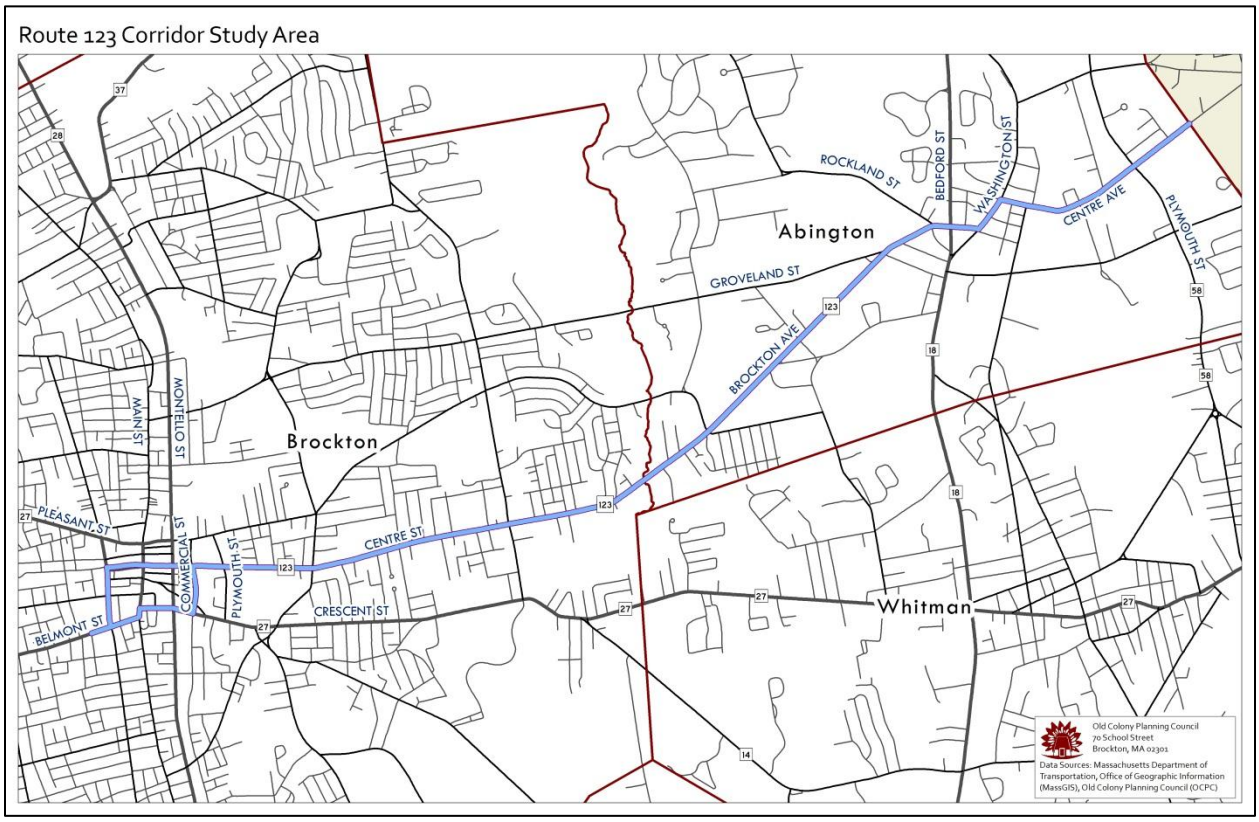
This study was completed in cooperation with the City of Brockton and the Town of Abington and includes a public outreach component with public meetings as well as meetings with stakeholders, such as downtown groups, business groups, local and state public officials, and other interested parties. The study area is shown in Figure 1.

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, a general assessment and review of public health (as well as the health impacts of transportation), and a review and analysis of crash data within the study area. Traffic forecasts and intersection peak hour level-of-service (LOS) analyses for future (five-year horizon) peak hour conditions were performed for the study.

Traffic analyses were completed utilizing standard practices in the *Highway Capacity Manual*, published by the Institute of Transportation Engineers (ITE). The traffic analysis software used to complete this study includes SYNCHRO (including SimTraffic). Signal Warrant analyses were performed in accordance with national standards 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, crash 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).

A review of pedestrian, transit, and bicycle accommodations is 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 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 intersection locations. In addition, safer pedestrian crossings and amenities for pedestrian circulation have been shown by engineering studies to enhance transit use. Improvements for pedestrians have been proposed to support transit use, and to ensure mobility and access for all users.

Figure 1 - Study Area



1.2 Public Outreach

The study process requires a broad-based public outreach program for the identification of transportation issues important to a cross section of stakeholders. The public outreach program helps to ensure that the planning process is comprehensive and equitable, and collaboration and consensus among stakeholders results in the development of improvements that reflect the vision of the study area communities. 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 the implementation of improvements, and those who have an interest in the study and process. Old Colony Planning Council's (OCPC) stakeholder identification 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), immigrants, minorities, and people below the poverty line.

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 (Americans with Disability Act, ADA accessible)
- 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 visual presentation and workshop/discussion formats

Public outreach is also important 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). The study outreach process includes posting information about the study on OCPC's website. The website page provides 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 facilitate audience input. The public presentations and workshops are held at a variety of venues that are screened for ADA accessibility by OCPC. The *Old Colony MPO ADA/Section 504 Transition Plan* was completed in 2017. This plan outlines OCPC's procedures for evaluating access to programs and premises for all individuals, including those with disabilities. Public meetings and stakeholder meetings for this corridor study were conducted according to the plans and procedures outlined in the *Old Colony MPO ADA/Section 504 Transition Plan*.

1.2.1 Public Workshops, Presentations, and Meetings

OCPC held a number of public workshops, meetings, and interviews with key stakeholders to garner input regarding existing deficiencies, potential for future infrastructure and land use changes, and potential improvements that can be developed into specific TIP projects.

A summary of these workshops, meetings, and interviews includes:

Old Colony JTC Meeting – September 8, 2016 and December 8, 2016

OCPC staff outlined the study scope, the study purpose, a summary of physical conditions, a summary of the existing traffic operations, and a summary of the intersection safety experience at regular meetings of the Old Colony JTC. Power Point presentation facilitated discussions with the JTC members on issues including traffic congestion, pedestrian and bicycle safety, and infrastructure needs.

Abington Business Association – March 7, 2017

At a regular meeting of the newly established Abington Business Association on March 7, 2017, OCPC staff presented the scope of the study and a summary of existing conditions. The existing conditions included intersection levels-of-service, intersection crash history, traffic controls, sidewalks and pedestrian signals, and physical conditions. The members discussed the potential traffic impacts of new residential developments in Hanover, the need for signal equipment updates, and the impacts of multiple driveways off of Route 123 due to the lack of access management in the corridor.

Abington Planning Board – May 1, 2017

OCPC staff presented an overview of the existing conditions of the Route 123 corridor to the Abington Planning Board on May 1, 2017. The members of the board reaffirmed the safety issues at the Route 123/Mill Street/Green Street intersection and the stretch of Route 123 between this intersection and the Wal-Mart signalized intersection. This area is included as a Highway Safety Improvement Program (HSIP) crash cluster (included within the top 5 percent of crash locations in the OCPC region). There were a number of concerns discussed by the board members including a lack of sidewalks on the north side of Route 123, which has a worn path due to pedestrians accessing Wal-Mart from residential neighborhoods. In addition, the Wal-Mart signals do not have pedestrian signals or crosswalks, yet pedestrians have been observed crossing at this location to access Wal-Mart. There is also a lane drop on Route 123 in the westbound direction which ends at the Route 123/Mill Street/Green Street intersection, as Route 123 transitions from four lanes to two lanes. There are a number of sideswipe crashes at this location. The board noted the lack of access management, which accounts for excess mid-block angle type accidents in this section of Route 123 at the commercial property driveways. The

board noted a lack of access management at commercial properties throughout the Route 123 corridor in Abington, which also creates safety and congestion concerns at the Route 123/Route 58 intersection. There are coffee take-out places on two of the intersection's corners and the other two corners also have driveways and businesses.

Public Workshop – May 16, 2017

A public workshop was held in order to garner input from the general public regarding opinions on traffic problems and potential improvements. The workshop was held on May 16, 2017 at the Brockton Public Library. The discussion focused on a number of traffic and safety issues that included education of pedestrians regarding safe street crossing, as well as traffic signal equipment upgrades, signal coordination, and restoring Main Street and Warren Avenue to two-way travel. The future of Brockton Downtown was discussed including the impact of the new proposed parking garage and the potential to improve pedestrian accommodation on Legion Parkway.

Ward 5 Meeting – May 23, 2017

At the request of Councilor Ann Beauregard, OCPC was invited to present a PowerPoint presentation and facilitate a discussion of the Route 123 Corridor Study issues for constituents from Ward 5. The ward meeting took place at the Brockton Public Library on Main Street at 6 p.m., May 23, 2017. A copy of the sign in sheet is included in the appendix of this report. The discussion covered a number of varying issues, including more audible signals for sight impaired pedestrians at downtown intersections including the Main Street at Legion Parkway (Route 123) intersection. A participant at the meeting noted that according to the American Council of the Blind, (ACB), the audible "chirping" sounds do not successfully warn sight impaired pedestrians when it is safe to cross. The recommended standard for the audible equivalent of when the "Walk" sign is on is a rapid ticking or beeping sound. Also recommended was a speech message saying the street name when the walk sign is on to cross the street, such as "Peachtree, Walk sign is on to cross Peachtree". In addition, the ACB recommends pushbutton locator tones, so that sight impaired can locate the push button and tactile arrows. A raised tactile arrow, either on the pushbutton or somewhere on the housing, lines up with the direction of travel on the crosswalk to direct people across the street.

Downtown Brockton Association (DBA) – June 28, 2017

OCPC was invited to present the existing conditions and the estimated future conditions of the Route 123 corridor and the peak hour intersection levels-of-service to the Downtown Brockton Association. The discussion centered around pedestrian circulation and safety in the downtown as well as the impacts of the potential one-way conversion of Main Street, Warren Avenue, Frederick Douglass Avenue, and West Elm Street to two-way traffic. The members also discussed the potential for redesigning Legion Parkway for improved pedestrian circulation and safety and the impact that this might have on parking. There is a lack of crosswalks across Legion Parkway, which has heavy pedestrian crossings during the day. Some parking spaces would have to be sacrificed to create crosswalks or raised crosswalks between the north and south sides of Legion Parkway.

Haitian Community Partners (HCP) – June 29, 2017

OCPC staff presented the existing conditions and the estimated future conditions of the Route 123 corridor and the peak hour intersection levels-of-service to the Haitian Community Partners located on 71 Legion Parkway (Route 123) in downtown Brockton. The discussion included pedestrian safety and circulation on Legion Parkway in the downtown as well as pedestrian safety in the vicinity of the East Junior High School and the adjacent playground. In addition, the members of the HCP offered advice for OCPC's safety education program. Although the Haitian Creole language is hundreds of years old, it is

only approximately 25 years old as a written language and not widely known. The HCP members suggested that a public information campaign regarding pedestrian safety that focuses on the Haitian community would be more effected via radio and/or utilizing brochures that include visuals.

District 5 MassDOT – August 4, 2017

OCPC staff met with MassDOT District 5 engineers and planners to discuss the traffic and safety issues within the Route 123 corridor in Abington and Brockton on August 4, 2017. The potential for signal improvements and coordination for the downtown signals was discussed as well as safety for pedestrians on Legion parkway. The discussion included the need to prevent trucks from knocking over signal posts due to poor turning radii at the Centre Street (Route 123)/Lyman Street/Cary Street intersection. Overhead signals would help visibility of the signal heads at this intersection; however, signal poles need to be placed better maybe further back) to avoid being hit by trucks.

Brockton Area Transit – August 14, 2017

At the Brockton Area Transit (BAT) meeting on August 14, 2017, regarding the Route 123 Corridor Study, BAT personnel had a number of issues important to efficient and safe bus circulation. These include:

- The utilization of the Intelligent Transportation System (ITS) strategy "Green Time Extension", to improve bus on-time service is recommended corridor wide at signalized intersections
- Consider bus turnouts at those locations where feasible, where right of way costs are minimal and transit widely utilized
- Bicycle lanes should not be in conflict with bus service
- Pavement markings on Legion Parkway eastbound, across the street from the Brockton Neighborhood Health Center, should accommodate a bus stop
- Sharrows on Legion Parkway would help reduce bus-bicycle conflict on Legion Parkway
- The Centre Street (Route 123)/Plymouth Street intersection should be signalized, this can be phased in with a series of short-term and then long-term improvements
- Parking on the south side of Centre Street (Route 123, the eastbound approach to the Centre Street/Plymouth Street intersection) should be restricted because it interferes with buses and heavy vehicles turning right from Centre Street to Plymouth Street
- Parking on the west side of Plymouth Street should be restricted as it also interferes with buses and heavy vehicles turning right from Centre Street to Plymouth Street
- Solar powered Stop Signs can be utilized (before the intersection is signalized) along with a traffic island for right turns at the Centre Street (Route 123)/Plymouth Street intersection
- Rumble strips can be utilized at the Centre Street (Route 123)/Plymouth Street intersection for traffic calming
- An exclusive right turn lane should be added on the Plymouth Street northbound and southbound approaches at the Centre Street (Route 123)/Plymouth Street intersection
- A bus turnout on the westbound side of Centre Street (Route 123) in front of the West Junior High School will improve efficiency and safety

Brockton Planning Department – August 22, 2017

The meeting with the Brockton Planning Director and staff took place in Brockton Downtown on August 22, 2017. Staff took a short walking tour of Main Street, Legion Parkway, and Warren Avenue and discussed traffic and safety issues as well as potential improvements. The meeting included discussions about the need for bicycle accommodation on Legion Parkway, which would be and extension of the bicycle lanes planned for Centre Street (Route 123 Westbound) between Montello Street and Main

Street. In addition, there is a need for at least three sidewalks across Legion Parkway, to provide for better connections between north and south sides of the street. The need for the addition of pedestrian actuated signals at the Legion Parkway (Route 123 Westbound)/Warren Avenue intersection was also discussed.

Brockton Downtown Festival – September 30, 2017

Old Colony Planning Council took part in the annual Brockton Downtown Fest and Marketplace, as it has in previous years. This year, the Downtown Fest was held on September 30, 2017. In addition to discussing the Route 123 Corridor study with the public, OCPC also handed out flyers advocating pedestrian and bicycle safety. These flyers are included in the appendix to this report.

Figure 2

OCPC's 2017 Annual Brockton Downtown festival set-up

1.2.2 On-Line Survey

OCPC developed an on-line questionnaire survey to help identify and prioritize problems and improvement strategies within the Route 123 study area. The questionnaire was available through a link on the OCPC website, and at the public outreach sessions. The survey was designed to raise awareness of the issues in the study area and to give the general public the opportunity to participate anonymously, although 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. The following tables, Table 1 through Table 7, summarize the survey questions and responses:

Question 1: At what intersection or location do you experience congestion or delays within the Route 123 Corridor in Abington or Brockton?

Table 1 - Question 1 Responses

Response	Number of Responses
No response	6
Brockton Ave/Groveland (Abington	1
Brockton Ave/Route 18(Abington	5
Belmont Street West of Main	1
Centre St at Quincy St	5
Centre Ave/Plymouth Rte 58 Abington	3
Centre St at Cary/Lyman Street	2
Belmont St/Main Street	1
Total	24

Question 2: What time period do you typically experience traffic congestion?

Table 2 - Question 2 Responses

Response	Number of Responses
All Day	9
Afternoon 4 to 6 pm	11
Morning	4
Total	24

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

Table 3 - Question 3A Responses:

Response	Number of Responses
No response	5
Five minutes	10
Ten Minutes	6
Twenty minutes or more	3
Total	24

Question 3B: What time of year?

Table 4 - Question 3B Responses:

Response	Number of Responses
No Response	11
School Time	5
All Year	8
Total	24

Question 4: What do you believe is the root cause for congestion and delay?

Table 5 - Question 4 Responses:

Response	Number of Responses
No response	9
Need a more direct east-west route through Brockton	1
Too much school related traffic	3
Widen the road for faster through traffic	3
Poor Signal Timing/Need better timing	2
Left turn lanes on Centre St at Quincy St	1
Poor Design Warren Avenue at Boys and girls Club	1
Lack of exclusive turning lanes	4
Total	24

Question 5: What improvements for safety and convenience do you think should be made in the study area for better walking and bicycling conditions?

Table 6 - Question 5 Responses:

Responses	Number of Responses
No response	11
Remove sidewalk obstacles	2
Protected bike lanes	2
Fix broken sidewalks	2
Better crossings at Abington T Station	1
Enhanced police enforcement	1
Better lighting	2
Repaint faded crosswalks	3
Total	24

Question 6: What is the most important safety issue(s) on Route 123 (for vehicles, pedestrians, bicycles, or other), and what do you think are the best solutions to address the issue?

Table 7 - Question 6 Responses:

Responses	Number of Responses
No response	4
Enhanced enforcement (speed, red light running)	5
Lower the posted speed limit	2
Add more sidewalks and safer crossings	4
Enhance pedestrian education and awareness	3
More exclusive turning lanes at intersections, better signal phasing	3
Too much driver distraction	1
Lane drops and lack of advanced warning	1
Need bicycle lanes	1
Total	24

1.2.3 Environmental Justice

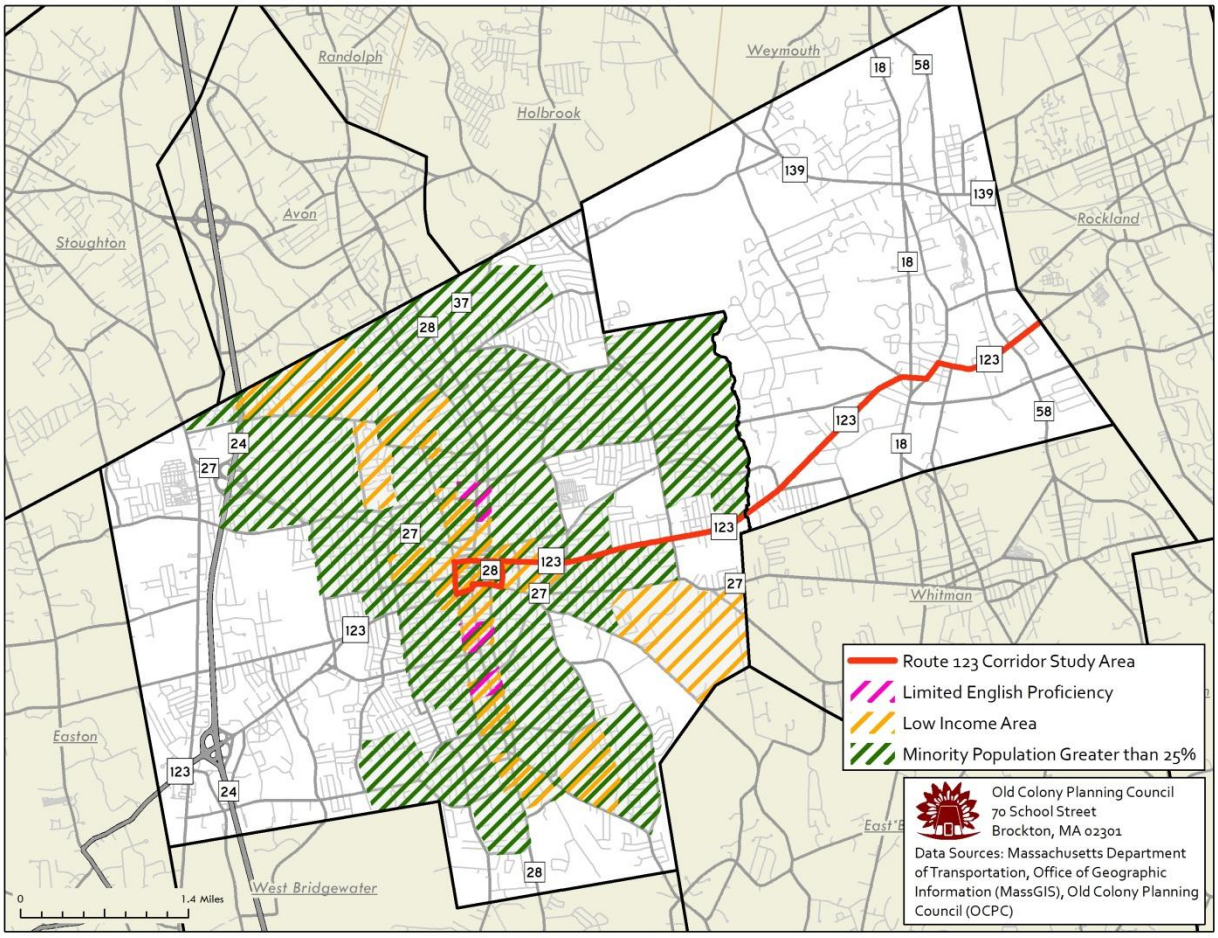
Environmental Justice Populations in the OCPC region were identified based on federal aid guidelines and utilizing census blocks and block groups that have high minority populations, high populations of low income, and high populations with limited English proficiency and foreign born populations. Figure 3 shows the Environmental Justice areas in the study area based on US Census data for block groups. As shown in Figure 3, the Route 123 corridor is located within the Environmental Justice areas in Brockton. There are three fundamental Environmental Justice principles:

- To avoid, minimize, or mitigate disproportionately high and adverse human health or environmental effects, including social and economic effects, on minority populations and low-income populations.
- To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.
- To prevent the denial of, reduction in, or significant delay in the receipt of project benefits by minority populations and low-income populations.

Public involvement is an integral part of transportation planning and project development decision-making. MassDOT directs greater access to information and opportunities for public participation in matters that may affect human health and the environment for minority populations and low-income populations. The objective of Environmental Justice is to ensure that there is equity in the distribution of transportation resources and services for low income and minority communities and neighborhoods. As part of this objective, Metropolitan Planning Organizations (MPOs) are required to provide full and fair participation for all socio-economic groups throughout their planning and decision-making processes. OCPC, through its public outreach process for this study, has identified Environmental Justice stakeholders and has actively sought out their participation in the study process.

Figure 3 shows that most of Route 123 in Brockton is located within the Environmental Justice areas. The potential improvements for this area are summarized in subsequent sections of this report. All potential improvements for Route 123 in Brockton fall within the Environmental Justice areas.

Figure 3 - Environmental Justice Areas



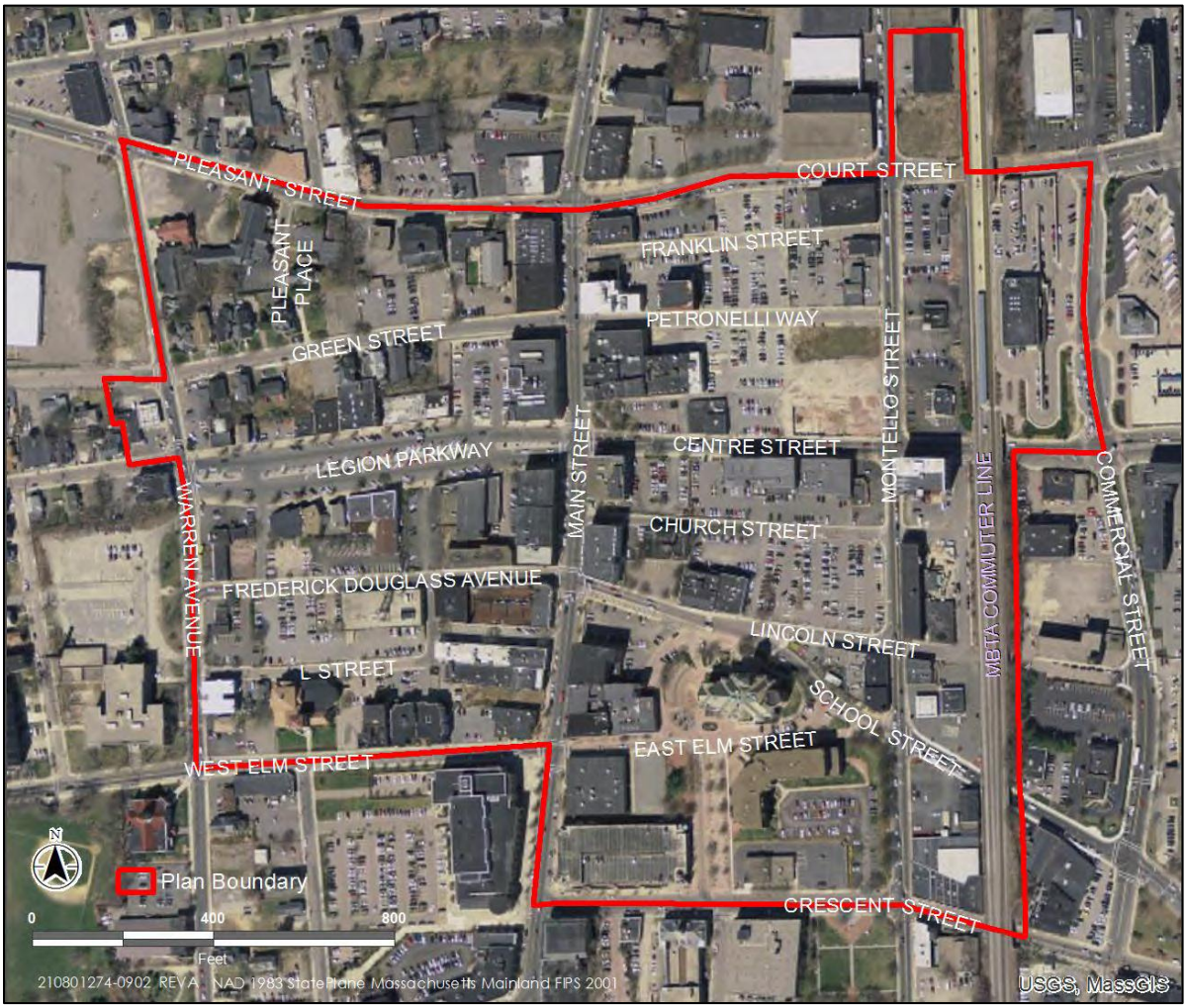
2 Previous Studies and Planned Improvements

2.1 Downtown Brockton Urban Revitalization Plan (URP)

The City of Brockton filed an *Environmental Notification Form (ENF)* in June 14, 2016 for its Downtown Urban Revitalization Plan (URP). The purpose of the plan, according to the ENF, is, "…to build a strong, diverse, attractive downtown that can establish itself as a major economic force in the city and the metro south region." The ENF states that the plan (URP) has been the result of many years of public planning efforts, included an extensive public participation process (in compliance with state Urban Renewal Regulations. The plan was developed in concert with the 2015 Brockton Downtown Action Strategy ("Action Strategy"), the City's District Improvement Financing (DIF) Program, and expanded 40R Smart Growth Zone.

According to the ENF, the Urban Revitalization Plan boundaries include 65.8 acres of land in the center of Brockton. Figure 4 shows the plan's boundaries. Route 123 is included within the plans boundaries including Centre Street, Legion Parkway, Warren Avenue, and Crescent Street.

Figure 4



Source: Brockton Downtown Urban Revitalization Plan ENF

According to the ENF, there the zoning districts within Brockton's downtown allow for commercial and industrial uses. These include:

- C-2: General Commercial Zone allows for a wide range of commercial uses, and temporary lodging is permitted as a special use. No residential uses are allowed in this zone.
- C-3: Central Business Zone allows the same uses as above, as well as community health centers and clinics.
- I-2: General Industrial Zone permits a variety of manufacturing businesses, tool and die operations, railroad yards, and lumber/building material sale and storage.

In addition to the zoning districts, in 2007 the City adopted three 40R Smart Growth Zoning Overlay Districts to allow for more residential development in the downtown. The 40R Smart Growth Districts include:

- The Downtown Core Sub-District – This district is bounded by West Railroad Avenue, Lincoln Street, Main Street, and Court Street. It allows building scales and densities that match existing structures, and is designed to stimulate investment in the area.

- The Arts and Culture Sub-District – This district is bounded by Green Street, Main Street, Warren Avenue, and West Elm Street. It allows performance or visual arts space to support existing mixed uses in the Legion Parkway and Frederick Douglass Avenue corridors.
- The Star Market Sub-District - This district focuses on creating a gateway to Downtown at the intersection of Pleasant Street and Warren Avenue. New development will be constructed with the building(s) fronting the roadways with parking at the side and rear.

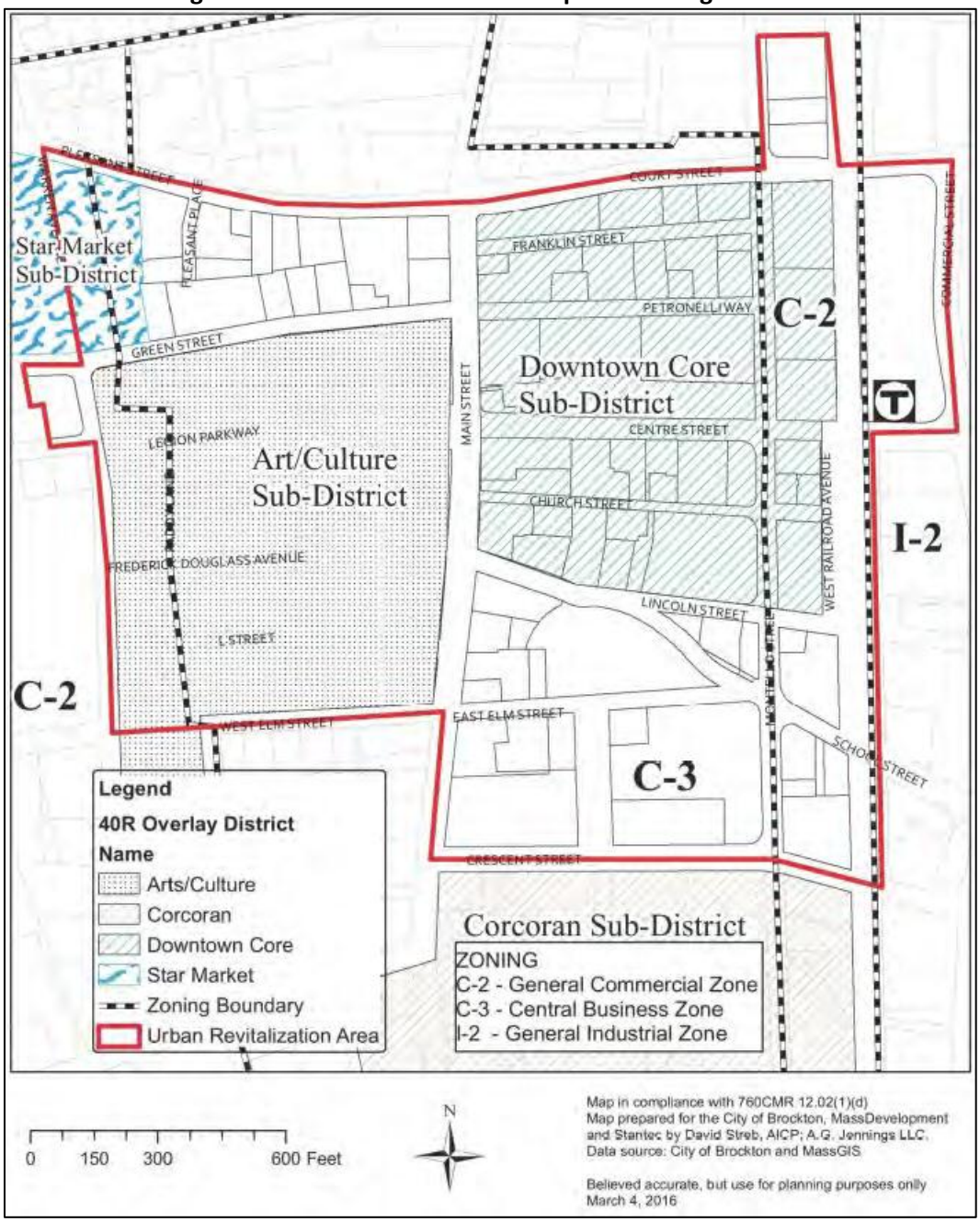
Figure 5 shows the zoning districts within Brockton Downtown as well as the 40R Smart Growth Zoning Overlay Districts.

It is expected that once the URP is approved by the Massachusetts Department of Housing and Community Development, it will enable the City to advance the community's vision in establishing the area as a regional governmental, service, and transit center. According to the ENF, the City is considering expanding the 40R Smart Growth Zoning District to cover all of the downtown area, increasing allowable residential densities in certain locations, and updating parking requirements to support a new public parking garage.

The specific actions proposed in the plan include the acquisition of properties (including land and buildings), demolition and clearance of properties, building rehabilitation, and business relocation. Some of these properties proposed for acquisition, clearance, or rehabilitation and redevelopment are along the Route 123 corridor on Legion Parkway and Centre Street. The plan will result in approximately 380 net new parking spaces in the downtown. This includes the removal of some surface spaces, and the addition of new spaces resulting from the construction of a new garage as well as adding some new surface spaces.

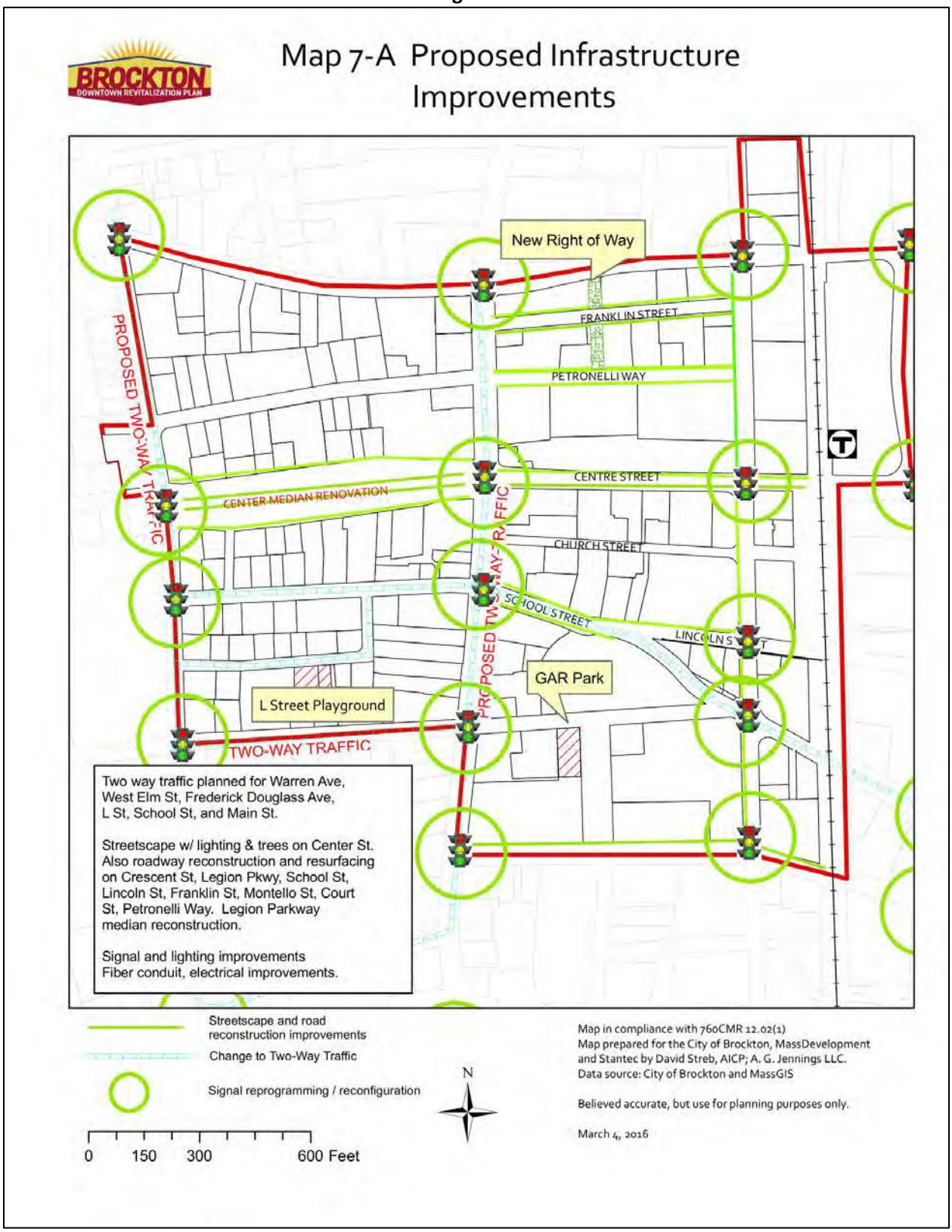
Figure 6 shows the proposed infrastructure improvements of the plan.

Figure 5 – Brockton Downtown Proposed Zoning Districts



Source: Brockton Downtown Urban Revitalization Plan ENF

Figure 6



Source: Brockton Downtown Urban Revitalization Plan ENF

Infrastructure improvements along the Route 123 corridor within Brockton Downtown include improvements to Centre Street at Montello Street, Centre Street at Main Street and Legion Parkway, Legion Parkway at Warren Avenue, Warren Avenue at Fredrick Douglass Drive, and Warren Avenue at West Elm Street. The plans call for two way traffic on Main Street, Warren Avenue, West Elm Street, Frederick Douglass Avenue, L Street, School Street, and Main Street. The plan calls for improvements to the streetscape, lighting, and trees on Legion Parkway as well as the reconstruction of the median on Legion Parkway.

2.2 New Brockton Downtown Parking Garage

The City of Brockton is proposing to construct a 414 space public parking garage in Brockton Downtown. The garage location is on the south side of Petronelli Way. This location is closest to Main Street and Legion Parkway. The project includes creating a new road connecting between Court Street and Court Street and making Petronelli Way a two-way street. The garage will replace spaces on existing surface lots that will be lost to redevelopment. The City is instituting a new parking management plan based on recommendations from a recently completed downtown parking study. Figure 7 shows parking garage location based on the *Downtown Brockton Urban Revitalization Plan ENF.*

Figure 7

The Metro South Chamber of Commerce expects the parking garage to be a facilitator of economic growth in the downtown. The garage will include 200 commercial spaces for downtown businesses, 55 residential spaces, and 159 public spaces for daily use for a total of 414 parking spaces.

According to the Metro South Chamber of Commerce, the total cost of the project including off-site improvements is estimated at 12.4 million dollars. Ten million dollars has been awarded to the City through the Massachusetts MassWorks program. Two million dollars will be financed by the City using bonding through the District Increment Finance program. Trinity Financial is expected to contribute $400,000 in equity contributions.

2.3 2014 Walk Assessment of Brockton Downtown – Walk Boston

The *2014 Bikeability Assessment for Brockton* was completed by the Massachusetts Bicycle Coalition, which included parts of the Route 123 corridor. The assessment, which was part of the MassDOT Bicycle and Pedestrian Safety Awareness and Enforcement Program, was funded by the federal Highway Safety Improvement Program (HSIP), in association with the Massachusetts Department of Public Health. The purpose of the program was to improve bicyclist and pedestrian safety in identified high-crash areas through collaboration among federal, state, regional and local agencies, as well as advocacy groups that include MassBike and WalkBoston. The collaboration included representatives from the Massachusetts Department of Transportation (MassDOT), Old Colony Planning Commission (OCPC), elected officials from City of Brockton, Brockton's Planning Department, and Brockton's Police Department. Walking as a mode encourages better health, a cleaner environment, and economically vibrant communities.

The WalkBoston assessment includes a variety of recommendations for improvements to the built environment due to infrastructure deficits such as faded crosswalks, uneven sidewalks, and traffic speeds. The recommendations include specific fixes such as painting faded crosswalks to further evaluations of locations for installing raised crosswalks. The assessment was intended to be utilized as a resource for the design of improvements. The assessment included School Street to Main Street, from School Street to Pleasant Street. It continued west on Pleasant Street, then south on Warren Avenue, and east on Legion Parkway and then back down Main to School Street. The assessment included all of Legion Parkway (Route 123) from Warren Avenue to Main Street. A summary of the improvements for the Route 123 corridor in Brockton downtown is included in the appendix to this report.

2.4 Signature Health Care (Brockton Hospital) New Cancer Center

Signature Health Center, located on 680 Centre Street, (Brockton Hospital) is currently constructing a two-story, 36,124 square foot building on Libby Street, adjacent to their existing facilities, to house their new cancer treatment center. The new cancer center will take up four existing vacant parcels. An adjacent parking lot will be constructed with curbing and landscaped areas for a total of 189 spaces. The required parking is 150 spaces. The project also includes improvements to storm water management and drainage. According to an article in the Brockton Enterprise, the project is a collaboration between Signature Healthcare and Beth Israel Deaconess Medical Center. The article stated that the center will include an expansion of radiation oncology, genetic counseling, early diagnostic services, social work, palliative care and other support programs offered at Signature Healthcare Brockton Hospital. Beth Israel Deaconess Medical Center is contributing its expertise in minimally invasive surgery, access to leading-edge clinical trials, pathology, molecular diagnostics and point-of-care consultation.

Access to and from the site is currently via Libby Street, although the site plan approval application does not specify vehicle access. The proponent, Signature Health Care, did not submit, nor was required by the City to submit a Traffic Access and Impact Study. Field visits to the construction site show that the access to and from the site will likely be off of Libby Street. Libby Street is two-way for a short distance between Route 123 and the Hospital main driveway, (a distance of about 400 feet). North of the main driveway, Libby Street is one-way to Quincy Avenue. Any new trips accessing the site will have to enter Libby Street from Route 123 because of the one-way restriction. Vehicles entering and exiting the site will have a potential traffic impact at the Centre Street (Route 123)/Libby Street intersection and the Centre Street (Route 123)/Quincy Street intersection (Quincy Avenue connects Quincy Street to Libby Street for vehicles exiting the site from the north). Figure 8 shows the construction of the new Signature Health care building and Figure 9 shows the potential access and exit from the site.

The Signature Health Care Oncology expansion project is expected to be completed by the fall of 2017, according to the Brockton Enterprise. An estimate of the trip generation due to the project was made based on the rates published in the *Trip Generation Manual* published by the Institute of Transportation Engineers (ITE) for Medical Office Building, land use code 720. The estimated new vehicle trips due to the project are summarized in Table 9.

Table 9

	In	Out	Total
Daily Trips	652	653	1305
AM Peak Trips	68	18	86
PM Peak Trips	36	93	129

Figure 8

Signature Health Care (Brockton Hospital) New Cancer Center under construction

Figure 9 Signature Health Care (Brockton Hospital) New Cancer Center Site Access

2.5 Centre Street (Route 123)/Montello Street Roadway Improvement Project

The reconstruction of a section of Centre Street (Route 123) commenced in July 2017. The project is funded utilizing a MassWorks grant to the City of Brockton. A copy of the design plans is included in the appendix to this report. The scope of the project includes the Centre Street (Route 123)/Montello Street (Route 28) intersection and Centre Street (Route 123) east from Montello Street to Main Street. Although the scope of the study does include the Centre Street (Route 123)/Montello Street (Route 28) intersection, it does not include the Centre Street (Route 123)/Legion Parkway/Main Street intersection. The project includes the reconstruction and repaving of the Centre Street (Route 123)/Montello Street (Route 28) intersection and Centre Street (Route 123), including the reconstruction of sidewalks at the intersection and on the south side of Centre Street (the sidewalks on the north side of the street were reconstructed with the completion of the Trinity Development). The project includes adding bicycle lanes to Centre Street (Route 123) and new pavement markings at the Centre Street (Route 123)/Montello Street (Route 28) intersection, which include sharrows for bicycle accommodation through the intersection. The project also includes traffic signal equipment upgrades, traffic timing and phasing upgrades, and reconstruction of the ADA ramps at the intersection. Figure 10 shows the construction in progress on Centre Street (Route 123).

Figure 10 Centre Street Reconstruction in Brockton

2.6 Centre Street (Route 123)/Plymouth Street Intersection Improvements

In January of 2017, the City of Brockton submitted a Project Need Form (PNF) to the Massachusetts Department of Transportation for safety improvements to the intersection of Centre Street (Route 123) at Plymouth Street. According to the PNF, the goal of the project is to improve safety and pedestrian accommodation at the intersection, which has a high crash rate. In addition, the PNF states that the intersection experiences congestion, particularly during the AM and PM Peak hours when traffic on Centre Street is at its heaviest. At this time, side-street (Plymouth Street) traffic has a difficult time finding sufficient gaps to enter and pass through the intersection. The level-of-service (LOS) for the side street movements (left turns, through movements, and right turns), is at LOS "F" during the morning and afternoon peak hours. The PNF states that there is heavy bicycle and pedestrian traffic through the intersection and the Plouffe School is located just south of the intersection. In addition, the Brockton Transit Centre and the passenger rail station are located a block away. Many commuters to these destinations arrive via walking or bicycle. This intersection is a high crash location, it is on the MassDOT Top 200 Hazardous Intersection list, and 72 percent of the crashes are angle type crashes. Potential improvements to the intersection include adding bicycle lanes, improving pedestrian accommodations, and installing traffic signals or a roundabout, making the intersection a potential gateway to Brockton's downtown. An on-site coordination meeting was held on June 12, 2017 with participation from the City of Brockton, MassDOT District 5, and OCPC. The purpose of the meeting was to further define improvements included in the project. In addition, a Road Safety Audit (RSA) for this intersection was held on Thursday, September 21, 2017 at the Brockton Area Transit office located at 155 Court Street, Brockton. The RSA was facilitated by OCPC staff. The RSA resulted in a number of findings and recommendations including constructing a modern roundabout or installing traffic signals at the intersection.

2.7 Study Area Characteristics – The Built Environment

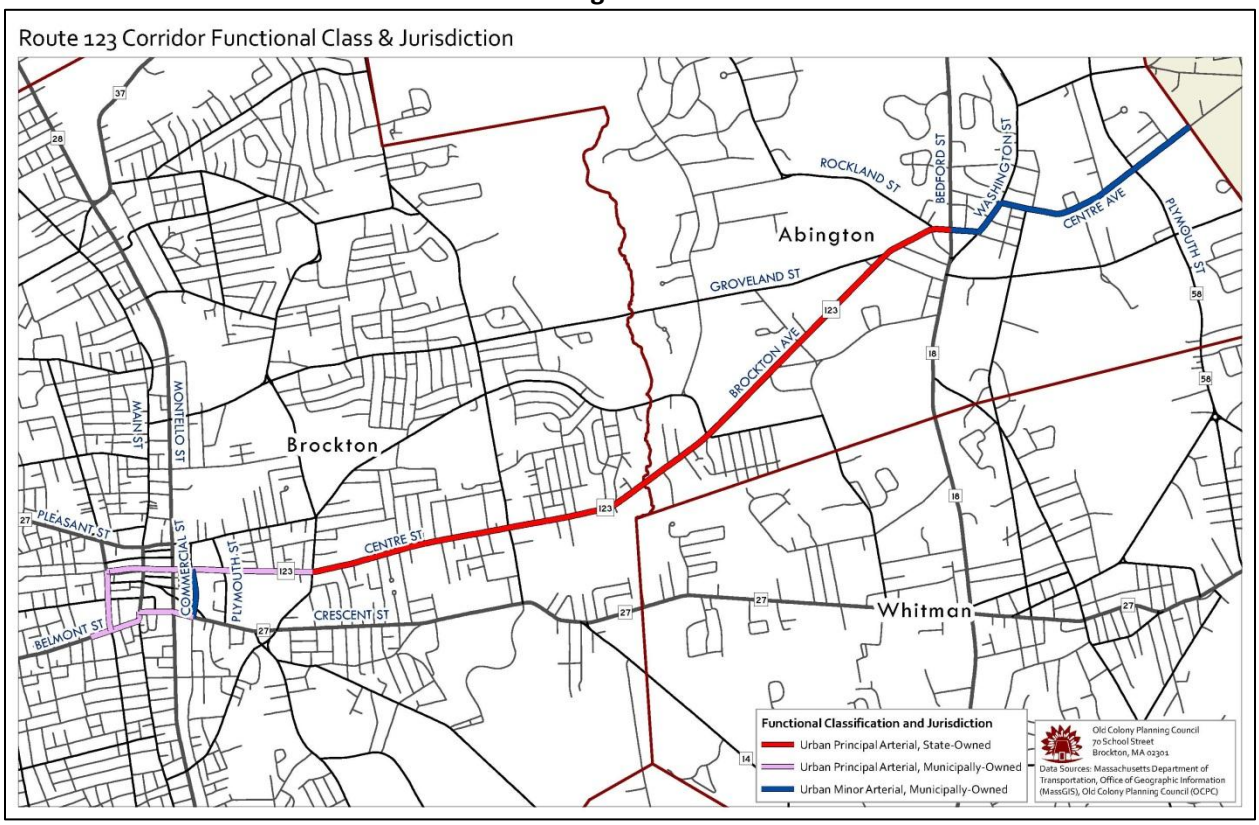
Route 123 is a major state numbered east west corridor highway in southeastern Massachusetts. It runs northeasterly from the Rhode Island state line through Attleboro, with an interchange at I-495, through Brockton and Abington to Route 3, and terminates at Route 3A in Scituate.

It is functionally classified as an Urban Principal Arterial in Brockton, and is under Brockton jurisdiction in Brockton downtown and under state jurisdiction from Lyman and Cary Streets east to the Abington line. In Abington, it is an Urban Principal Arterial under state jurisdiction from the Brockton line east to Bedford Street (Route 18). East of Bedford Street, it is an Urban Minor Arterial under Abington jurisdiction. As an arterial road, Route 123 is eligible for federal funding under the federal highway funding statute Fixing America's Surface Transportation Act (FAST-act).

The speed limits vary between 40 and 45 miles per hour. The Route 123 corridor is mostly a two-lane facility, with four lane sections in Abington in the vicinity of the Wal-Mart, and in the vicinity of the Stop and Shop Supermarket Drive in Abington near the Rockland line. There is also a four-lane section between Commercial Street and Plymouth Street in Brockton. There are mostly commercial and residential uses along Route 123, interspersed with institutional and educational uses including Signature Health Care, the Brockton Neighborhood Health Center, and the East Middle School in Brockton. In Abington, Route 123 runs through the small town center in Abington, intersecting Washington Street. Figure 11 shows the functional classification of the Route 123 corridor and the jurisdiction.

Route 123 provides access to and from the MBTA passenger rail and the BAT Centre in Brockton, as well the MBTA passenger rail station in Abington. There is a substantial volume of heavy peak hour vehicle traffic within the corridor due to commuting and due to modest retail/commercial areas and school related traffic. Route 123 has sidewalks on both sides throughout Brockton; however, sidewalks are provided sporadically in sections of the corridor in Abington. The width of Route 123 varies. In Brockton east of Plymouth Street, Centre Street (Route 123) is approximately 35 feet wide with two twelve foot travel lanes and five foot shoulders on each side for bicycle accommodations. There are sidewalks on both sides of the road in this section of the Route 123 corridor. Centre Street (Route 123) west of Plymouth Street to Commercial Street is a four lane cross section, approximately 60 feet in width, with wide shoulders of approximately eight feet. Centre Street (Route 123 westbound) continues on from Commercial Street as a two lane facility, which passes beneath the Historic Stone Arch Railroad Bridge, to Main Street. Although the apex of the bridge arch is 14 feet, which is adequate for most trucks (Massachusetts requires 13 feet 6 inches for most height requirements), the height of the entire arch actually varies between 11 feet six inches and 14 feet at its center. Many trucks cross the center yellow line to get their vehicles away from the lowest points of the arch and beneath the arches highest points in the center. Route 123 westbound continues on as Legion Parkway west of Main Street to Warren Avenue.

Figure 11



Legion Parkway (Route 123 westbound) is approximately 115 feet wide with a 15 foot median that separates eastbound and westbound traffic. There is angular parking on both sides of the street and at the median. There are approximately 70 spaces on both sides of the median, an additional 29 spaces on the westbound side and 27 spaces on the eastbound side for a total of 126 parking spaces. The time limit for parking on Legion Parkway is posted at two hours. The angular parking helps to keep prevailing speeds down. Sidewalks on both sides of Legion Parkway are 15 feet wide. Legion Parkway offers excellent pedestrian accommodation and parking, although some improvements, such as signage and crosswalks to help with visibility for motorists, are warranted. More ease of access for pedestrians crossing between the south side of Legion Parkway and the north side of the street will create a safer and more pedestrian friendly environment. The Brockton Neighborhood Health Center is located on Legion Parkway at the corner of Main Street, which attracts pedestrian traffic. There are also banks and businesses on the south side as well as small shops on the north side of Legion Parkway.

In order to continue on Route 123 westbound, vehicles turn left onto Warren Avenue from Legion Parkway. The rear wheels of tractor trailer trucks often run up over the curb and onto the median as they make this left turn to continue on Route 123 westbound. Warren Avenue is a one-way street running south to Belmont Street where vehicles turn right on Belmont Street to continue on Route 123 westbound. Warren Avenue has two lanes and sidewalks on both sides. There are no shoulders for bicycles. The turning radii at Belmont Street for vehicles turning right from Warren Avenue are also inadequate for large trucks, resulting in the rear wheels of trucks running onto the sidewalk at the corner of Warren Avenue and Belmont Street. Figure 12 shows the historic stone arch bridge on Centre Avenue (Route 123). Figure 13 shows the results of heavy vehicles driving on the median at the Legion Parkway (Route 123 westbound)/Warren Avenue intersection due to lack of adequate turning radii for

left turns. Figure 14 shows the results of heavy vehicles driving on the sidewalk at the Warren Avenue/Belmont Street intersection due to a lack of adequate turning radii for right turns.

Figure 12

Centre Avenue (Route 123) looking eastbound toward the Historic Stone Arch Bridge

Figure 13

Broken sidewalk at the Legion Parkway/Warren Avenue intersection from truck wheels jumping the curb onto the center median (from left turns).

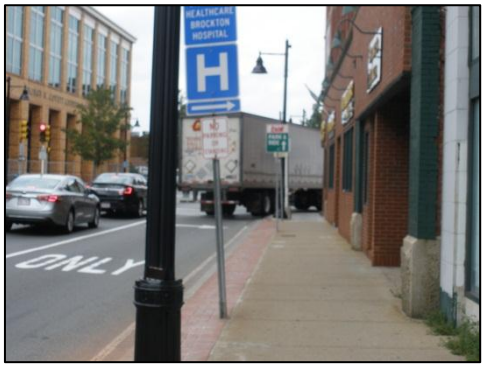
Figure 14

Broken sidewalk at the Warren Avenue/Belmont Street intersection from truck wheels jumping the curb onto the sidewalk (from right turns).

Belmont Street (Route 123 eastbound), from Warren Avenue to Main Street is a one-way street with two lanes and parking allowed on one side. Route 123 continues for a short distance on Main Street, which is a two lane one-way street, as traffic turns left onto Main Street from Belmont Street. From Main Street, traffic continues on Route 123 eastbound via Crescent Street. The Main Street/Crescent Street intersection is another location that has insufficient turning radii for trucks. Trucks turning right from Main Street to Crescent Street to follow Route 123 eastbound often have their rear tires roll over the curb and onto the sidewalk. Crescent Street between Main Street and Montello Street is a two-way street. It is 40 feet in width with parking allowed on the eastbound side. It becomes one-way with two lanes east of Montello Street to Commercial Street, where it runs beneath the Historic Stone Arch Bridge. Although the bridge is fifteen feet six inches at its highest point, it is only twelve feet high at the edge of the road, so trucks, which are normally twelve to thirteen feet high have to be careful to travel directly beneath the center of the arch to avoid its lowest points. Route 123 eastbound continues on

Commercial Street north to Centre Street. Commercial Street to Centre Street is two-lanes and approximately 46 feet wide. There is some parking on Commercial Street in front of the Post Office.

Figure 15

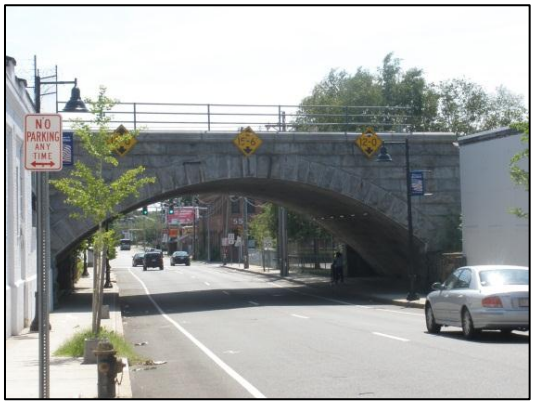


The back wheels of a truck jumping the curb onto the sidewalk at the Main Street/Crescent Street intersection.

Figure 16

Truck tire marks on sidewalk at the Main Street/Crescent Street intersection from truck wheels jumping the curb onto the center median (from right turns).

Figure 17



Crescent Avenue (Route 123) looking eastbound toward the Historic Stone Arch Bridge

Centre Street (Route123) in Brockton is called Brockton Avenue in Abington. Brockton Avenue (Route 123) in Abington is approximately 34 feet wide with two travel lanes, (east and west travel), and two four to five foot shoulders for bicycle accommodation. Sidewalks along the road are intermittent. Brockton Avenue (Route 123) provides a four-lane cross-section for approximately ¼ mile just east of the Brockton Avenue (Route 123)/Mill Street/Green Street intersection in the vicinity of the Wal-Mart. The road is approximately 48 feet wide with little or no shoulders for bicycle use. There is a sidewalk on the south side of the road (along the eastbound side). East of the Wal-Mart, Brockton Avenue continues as a two-lane facility of approximately 34 feet in width with two five foot shoulders on each side of the road. Brockton Avenue ends at Washington Street and Route 123 continues on Washington Street through Abington Town Center. Washington Street is approximately 44 feet wide with sidewalks on both sides of the street. There are no shoulders or designated bicycle lanes on Washington Street, although the road is wide enough to accommodate bicycles. There is some on-street parking on Washington Street on the westbound side. At the Washington Street/Centre Avenue intersection, Route 123 follows Centre Avenue east to the Rockland line. Centre Avenue (Route 123) in Abington is a

two lane road with sidewalks on both sides of the road. The road is approximately 34 feet wide with five foot shoulders on both sides of the road. East of its intersection with Route 58, Centre Avenue (Route 123) opens to a four lane cross section to the Rockland line.

2.8 Community Health

According to the National Academy of Arts and Sciences, a Health Impact Assessment (HIA) supports the decision-making process with information that is used by decision makers to shape improvements and recommendations so that adverse effects to public health are minimized and beneficial ones are optimized.[1] As part of this transportation planning study, the HIA can assist in the process for developing recommendations, especially for non-motorized modes including walking and bicycling.

The components of an HIA include:

- Screening - This establishes the need for and value of conducting an HIA.
- Scoping - Identifies the populations that might be affected, determines the health effects evaluated, identifies research questions and plans to address them, identifies the data and methods to be used and alternatives to be assessed, and establishes the HIA team and a plan for stakeholder participation throughout the HIA process.
- Assessment - Involves describing the baseline health status of affected populations and characterizing the expected effects on health (and its determinants) of the proposed improvements and alternatives under consideration.
- Recommendations - Identify alternatives to the proposal or specific actions that could be taken to avoid, minimize, or mitigate adverse effects or to take advantage of opportunities for a proposal to improve health.
- Reporting - This is the communication of findings and recommendations to decision makers, the public, and other stakeholders.
- Monitoring - This consists of tracking the adoption and implementation of recommendations.

This section of this report will utilize some of the guidelines of the HIA; however, its scope will not be as broad as a full HIA report.

Public health improvement focuses on the promotion of good health and the prevention of accident and disease through changes in the built environment as well as through education and awareness training for at-risk populations. The improvement of the public health in a community or neighborhood requires that resources be focused on specific populations as opposed to health care treatment, which focuses mainly on the health of an individual. Improvements to the public health impact life expectancy as well as the quality of life as both behavior and the environment (and how people interact with the environment), influence health outcomes. Studies show that social, environmental, and behavioral factors make up 60 percent of the determinants of health, with genetics making up 20 percent, and access to healthcare making up 20 percent. Transportation facilities and systems (such as sidewalks, access to transit, safe bicycle paths, and safe street crossings) can influence the social, environmental, and behavioral factors that determine the quality of health.

[1] Improving Health in the U.S.; The Role of Health Impact Assessment, National Academy of Arts and Sciences, Page 5.

There are two major health providers within the Route 123 corridor, both located in Brockton, including Signature Health Care (Brockton Hospital) located at 680 Centre Street (Route 123), and Brockton Neighborhood Health Center (BNHC), located at 63 Main Street in Brockton Downtown.

Brockton Neighborhood Health Center

BNHC's primary target populations are as follows[2]:

- Low-income residents of Brockton, especially the seven census tracts designated as a Medically Underserved Area (MUA). MUA Census tracts 5103, 5104, 5108, 5109, 5110, 5114, and 5115.
- Individuals without health insurance or who are publicly insured through Medicaid, Health Care Reform plans, Medicare, Healthy Start and Children's Medical Security Plan.
- Multi-cultural populations, especially individuals who face barriers to care in other settings because they do not speak English.
- Individuals who are currently seeking primary care services through local emergency rooms.
- Low-income, diverse, and non-English speaking patients from towns surrounding Brockton. Some of these towns, especially those on the fringes of BNHC's service area, are also served by other community health centers. To account for this, target population estimates were adjusted to reflect BNHC's market share compared to the market share of other comparable community health centers (CHC).

According to the BNHC Needs Assessment, BNHC operates three locations in Brockton, within the MUA, with the main location located on Legion Parkway (Route 123). The transportation system within Brockton provides buses throughout the City; however, according to the needs assessment, transportation is time consuming for residents who seek care outside the City and BNHC is the only community health center in a radius of several towns. Other providers in the service area serve the Medicaid population; however, BNHC serves the uninsured. Many private primary care providers in Brockton are closed to new patients and most have little or no language capacity. The closest health center site outside Brockton that serves the general population is Manet CHC's in Quincy, drive time is calculated at 45 minutes and time for public transportation would be 67 minutes. Other health care providers are numerous and are spread throughout the Brockton area; however, according to the needs assessment, these are not accessible to the population that BNHC serves. Most of these are part of two hospital-owned groups, Signature Medical Group and Steward Medical Group, and include the Brockton Hospital located on Centre Street (Route 123) in Brockton.

The following is a summary of need in for the BNHC target population:

- Need for increased primary care capacity. BNHC has made an impact in improving access to primary care services. Although there are many primary care providers in Brockton, only two outside of BNHC will care for uninsured patients.
- Need for increase dental capacity, especially for adults.
- Mental health—Need for increased services for uninsured and non-English speaking patients.
- Substance abuse—Need for increased Medication Assisted Treatment.
- Language—Approximately 48 percent of BNHC patients do not speak English well enough to communicate with their primary care providers. They depend on BNHC's for access to linguistically accessible services.

[2] Based on BNHC Federal Grant Needs Assessment.

- Cultural beliefs and practices - BNHC staff compiled a list of cultural beliefs and practices that impact care. These include prayer, herbs, and voodoo. In addition, many of the patients did not seek preventive care in their countries so they do not seek it here. Many cultures the patients come from do not place the same emphasis on keeping timed appointments so patients often face difficulties accessing care because they are habitually late for appointments.
- Geography and transportation - These issues are not significant in Brockton due to BNHC's location in the heart of downtown and a good bus system. However, BNHC is the only health center in a radius of several towns so BNHC's presence in Brockton is essential to maintaining access.

Signature Health Care (Brockton Hospital)

Signature Health Care took part in a joint Health Needs Assessment for the Greater Brockton Community Health Network Area in 2011, (which includes ten communities including Abington and Brockton). The assessment was required by the Massachusetts Department of Public Health (DPH) Determination of Need program. The results of the demographic profile for the assessment show that 46.3 percent of Brockton's population is minority non-white, while only 8 percent of the remaining 9 communities in the health assessment is minority non-white. The demographic profile also showed that 28% of people age five and older in the City of Brockton, 18% in Stoughton, and 10% in Bridgewater speak a language other than English in the home. The top three languages spoken in Brockton other than English were Portuguese or Cape Verdean Creole, French Creole (Haitian), and Spanish or Spanish Creole. Brockton also has a higher percentage of families and individuals below the poverty level than the other nine communities in the health assessment area and the State of Massachusetts by more than double.

Residents of Brockton identified a number of issues associated with health care access:

- Inability to afford health insurance or having insurance with high copayments for visits and/or medications
- People do not want to spend money on copayments for sick visits; they would rather spend their money on food for children
- Many people such as workers of minimum minimum-wage jobs and seniors are unable to qualify for services due to being just above the income guidelines.

Residents in towns outside of Brockton identified the following issues with access to health care:

- High copayments (even though kids have insurance)
- Services that Medicare and Medicaid won't cover
- People not getting insurance because the tax penalty is cheaper than insurance coverage
- Difficulty navigating the health care system
- Cuts to health education and other preventive programs due to budget shortfalls
- Lack of dental insurance or dentists who accept MassHealth
- Lack of well-care clinic due to funding cuts
- Lack of access to public transportation

The focus continues on two key community benefit priorities, based on the data and conclusions of the study: Obesity and Diabetes. The findings for the needs assessment concerning Obesity and Diabetes include a continual need for education. The study shows that students in the school districts in the study

area, which included Brockton, have obesity rates over 25%, while 59% of adults are obese. This assessment included the latest data as well as information from key informant interviews and focus groups. Individuals discussed barriers they face when trying to lead a healthy lifestyle, including a lack of education and understanding of how to shop in a healthy manner, how to prepare produce properly, and how to choose the appropriate portion size. Physical activity was also an important issue and was included in the previous 2010 assessment as well. The study cited that people in the study area are unable to be active due to lack of sidewalks and poor lighting.

There is evidence that adverse health effects associated with transportation disproportionately affect Environmental Justice populations, such as those residing in the neighborhoods adjacent to the Route 123 Corridor throughout Brockton, (as shown in Figure 3, Environmental Justice Areas), and this contributes to persistent racial, ethnic, and socioeconomic disparities in health.[3] These effects include heavy traffic volumes and truck volumes, which result in a disproportional amount of air pollution and particulates, resulting in high rates of asthma in these neighborhoods. The percentage of heavy vehicles within the Route 123 corridor varies from 5.1 percent to 11.3 percent. Other key facts regarding Environmental Justice populations include:

- Households in poverty spend a higher proportion of their income on transportation expenses and are disproportionately represented by race/ethnicity with African-Americans and Hispanics experiencing the highest poverty rates. Limited vehicle availability and fewer affordable transportation options afflict this cost-sensitive group.
- Households in poverty are limited to a shorter radius of travel compared to higher income households. They have the lowest rates of single occupancy vehicle use and the highest usage of less costly travel modes: carpool, transit, bike and walk.
- Households in poverty have lower vehicle ownership rates, which has led to an increased use of alternative modes of transportation and higher vehicle occupancy rates.
- The pedestrian fatality rate for Latinos is over 60 percent higher than for whites, and for African Americans it is almost 75 percent higher than whites (nationally).
- The pedestrian fatality rate for low income counties is more than 80% higher than the national average.
- Children of color are more likely to live in communities with poor air quality and suffer from asthma.
- Families without cars depend on transit, pedestrian, and bicycle infrastructure to make it to work, school, and medical appointments safely and on time.
- Low-income children in urban areas are more likely to walk or bike to school and depend on safe and complete streets.[4]

These facts show that the modes that are alternative to the single occupancy vehicle, including walking, mass transit (including buses), and bicycling, are important to the community and neighborhoods adjacent to Route 123, and therefore, this population is sensitive to the physical condition of the built environment, the availability of mass transit, sidewalk availability (as well as safe street crossings), and safe bicycle routes. These transportation facilities and services have a substantial impact on the quality of life of the people in adjacent Route 123 neighborhoods in both Brockton and Abington.

[3] Improving Health in the U.S.; The Role of Health Impact Assessment, National Academy of Sciences, Page 28.

[4] "What is Public Health and How Does it Impact other Sectors?" Massachusetts Public Health Association, Community Health Training Institute.

The findings, conclusions, and potential recommended improvements of this study will be described in more detail in subsequent sections; however, based on the existing conditions physical conditions, there are a number of general improvements necessary in the corridor that can be made for safe pedestrian travel. Although the physical conditions of the built environment are old, the patterns of development and the location of two passenger rail stations (one in Brockton and one in Abington), as well as the BAT Intermodal Centre within the study area are amenities that are advantageous to the adjacent neighborhoods. The key is to keep up with maintenance of infrastructure, (sidewalks, safe crossings, and traffic control), and to enhance infrastructure where necessary. Studies show that improved pedestrian infrastructure not only enhances safety and health, but improves access to mass transit and helps increase mass transit ridership. Necessary improvements include fixing broken sidewalks, upgrading pedestrian signals (as well as traffic signals), adding new technology such as Rapid Rectangular Flashing Beacons for safe crossing (especially for safe crossings at the playgrounds and schools), and adding bus shelters where it is strategically feasible along BAT routes.

2.9 Livability and Sustainability

The Old Colony Regional Transportation Plan includes 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 October of 2016, the Brockton City Council adopted a Complete Streets ordinance. The purpose of the ordinance is to recognize that projects, including new construction, maintenance, or reconstruction, are opportunities to expand and improve the road network to accommodate for all road users regardless of ability or age. This ordinance is consistent with MassDOT’s Healthy Transportation Directive, which commits to maintaining a transportation network that serves all mode choices. In addition, Massachusetts has allocated $12.5 million for two years beginning in 2016 for Complete Streets Policy development and implementation. The Massachusetts Complete Streets Program presents an opportunity for funding and implementing livability principles and sustainable practices. The City is currently working on a Complete Streets Prioritization Plan as part of the eligibility requirements for the state’s Complete Streets funding program.

2.10 Public Transportation

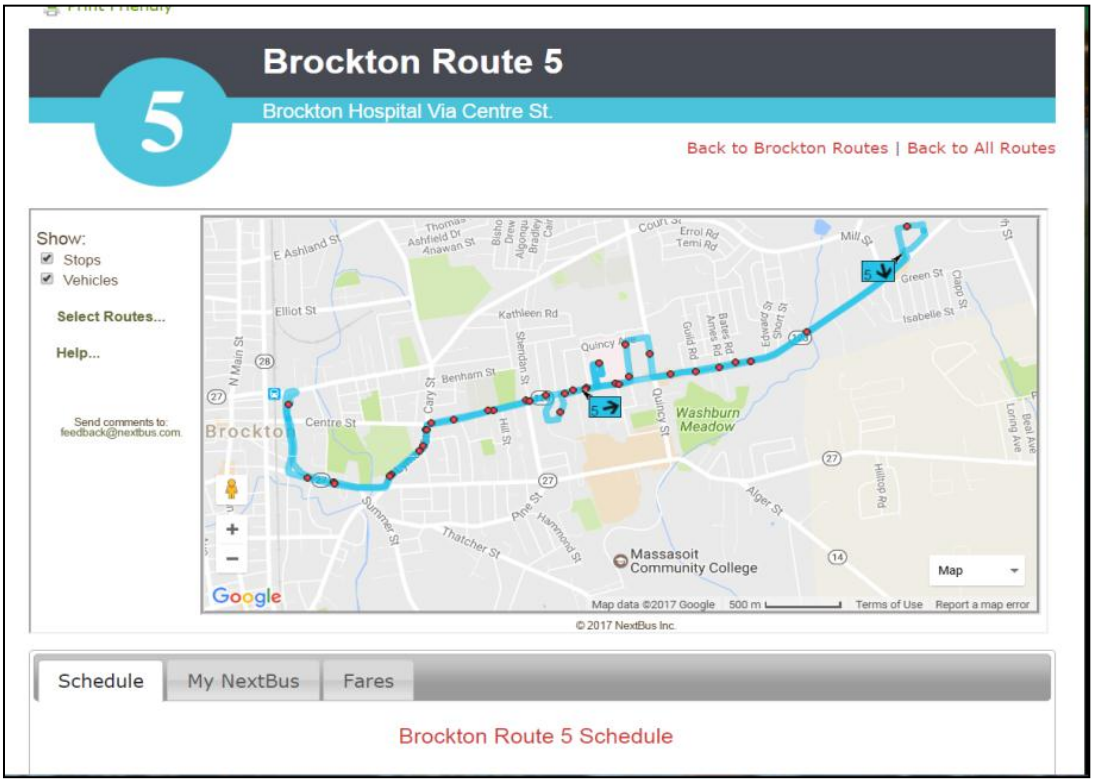
The Route 123 corridor is served mostly directly by Brockton Area Transit (BAT) fixed route bus service, (Route 5). Route 5 serves the fixed route service between the BAT Centre in Brockton Downtown and Wal-Mart in Abington. Brockton Area Transit has instituted the "Next Bus" smart phone app, which allows users to observe bus movements along the bus route in real time via GPS monitoring. In this way, riders can know approximately how long the wait will be for the next bus at any given bus stop along the route. BAT also provides an extension of BAT Route 5 from Signature Health Care and the Abington Wal-Mart through Abington to Rockland. The Rockland Flex-Ride Extension serves the Stop and Shop and Target in Abington and Rockland Community Center and Ocean State Job Lot in Rockland.

In addition to BAT Bus Route 5, Brockton Downtown passenger rail station and the BAT parking garage, (which is utilized by passenger rail commuters) is located on Centre Street (Route 123) at the intersection of Commercial Street. The BAT garage provides 264 parking spaces available for passenger rail commuters and bus transit users. The Brockton Downtown passenger rail station is part of the Middleborough/Lakeville line, which serves from Middleborough to South Station.

Figure 18

Centre Street (Route 123) with BAT Garage to the right and Brockton Downtown Passenger rail platform in the center background (behind the police station).

Figure 19



BAT Route 5 with "Next Bus" smartphone app showing bus stops and real time location of buses en route.

The entrance to the Abington passenger rail station is located on Centre Avenue (Route 123) in Abington just west of the Route 123/Route 58 intersection. The Abington station is part of the Plymouth/Kingston line, which runs between Plymouth and Kingston and South Station. The Abington station has 394 spaces available for passenger rail commuters. OCPC staff measure the usage of commuter rail lots in the region at least twice per year for its congestion management process. The Abington station lot is usually more than 80 percent full each day, which brings it to at or near capacity. The BAT Garage in Brockton Downtown was found to be approximately 50 percent full during the congestion management measurements, and usually has additional capacity available for commuters during the work week.

2.11 Review of Existing Route 123 Land Use Conditions and Zoning

In order to discern the potential for future travel demand, as well as safety needs, whether by passenger car, truck, transit, or by walking, a review of the present and potential development, (and the development controls), is necessary. The review of land use and land use controls includes mostly properties fronting on Route 123, and also those with back land to the north and south of the corridor.

Land uses along Route 123 include mixed moderate residential dwellings, local businesses, with some specialized region-serving commercial uses in the downtown areas, and a few commercial uses interspersed along the corridor, such as supermarket and big box retail. Overall, land uses in the Route 123 corridor are a mixture of commercial, residential, and institutional uses.

2.11.1 Land Uses on Route 123 in Abington and Brockton

Abington

Abington has a small concentration of commercial uses in its small town center including retail, bank, coffee and lunch places, and medical services. The town center includes Brockton Avenue (Route 123) from Bedford Street to Washington Street, Washington Street (Route 123) from Brockton Avenue to the Centre Avenue (Route 123)/Orange Street intersection. To the east of the town center, Centre Avenue (Route 123) is mostly residential with a concentration of commercial uses beginning at the Centre Avenue (Route 123)/Plymouth Street (Route 53) intersection to the Rockland line. The Centre Avenue (Route 123)/Plymouth Street (Route 53) intersection has fast food or coffee shops on all four corners of the intersection. In addition, the signalized Target/Stop and Shop grocery entrance is located approximately 900 feet east of the intersection.

To the west of Abington Town Center, there are small commercial shops, used car sales, coffee shops, and intermittent residential uses along Route 123. Wal-Mart is located just east of the Mill Street/Green Street intersection. In addition, there is a small commercial plaza located across from the Wal-Mart.

Brockton

On Route 123, west of the Abington line, there are commercial uses including used car sales and self-storage, with residential uses. In Brockton, there are institutional uses including Signature Health Care (Brockton Hospital) located just west of the Route 123/Quincy Street intersection. The East Junior High School is located further west on Route 123 with adjacent playgrounds. The Route 123/Plymouth Street intersection presents a gateway to Brockton Downtown. The BAT garage and BAT Centre are located west of Plymouth Street, with condos (SOCO Lofts) across from the garage on the south side of the Route 123 corridor. Public housing is located on the southwest quadrant of the Route 123/Plymouth Street intersection. The corporate headquarters for W.B. Mason is located on Centre Avenue (Route 123) west of Montello.

The Enterprise Block Project is located on Centre Avenue (Route 123 westbound) opposite W.B. Mason. The Enterprise Block devlopment project (Trinity Financial Real Estate) is representative of the un-tapped potential for Brockton's Downtown. Phase I of the project was recently completed. The Enterprise Block, which includes a number of buildings was once used to house the Brockton Enterprise Newspaper. Some of the buildings on the block were rehabed, while others were razed and replaced. The block is bordered by Montello Street (Route 28) on the east, Main Street on the west, Petronelli Way on the north and Centre Street (Route 123) to the south.

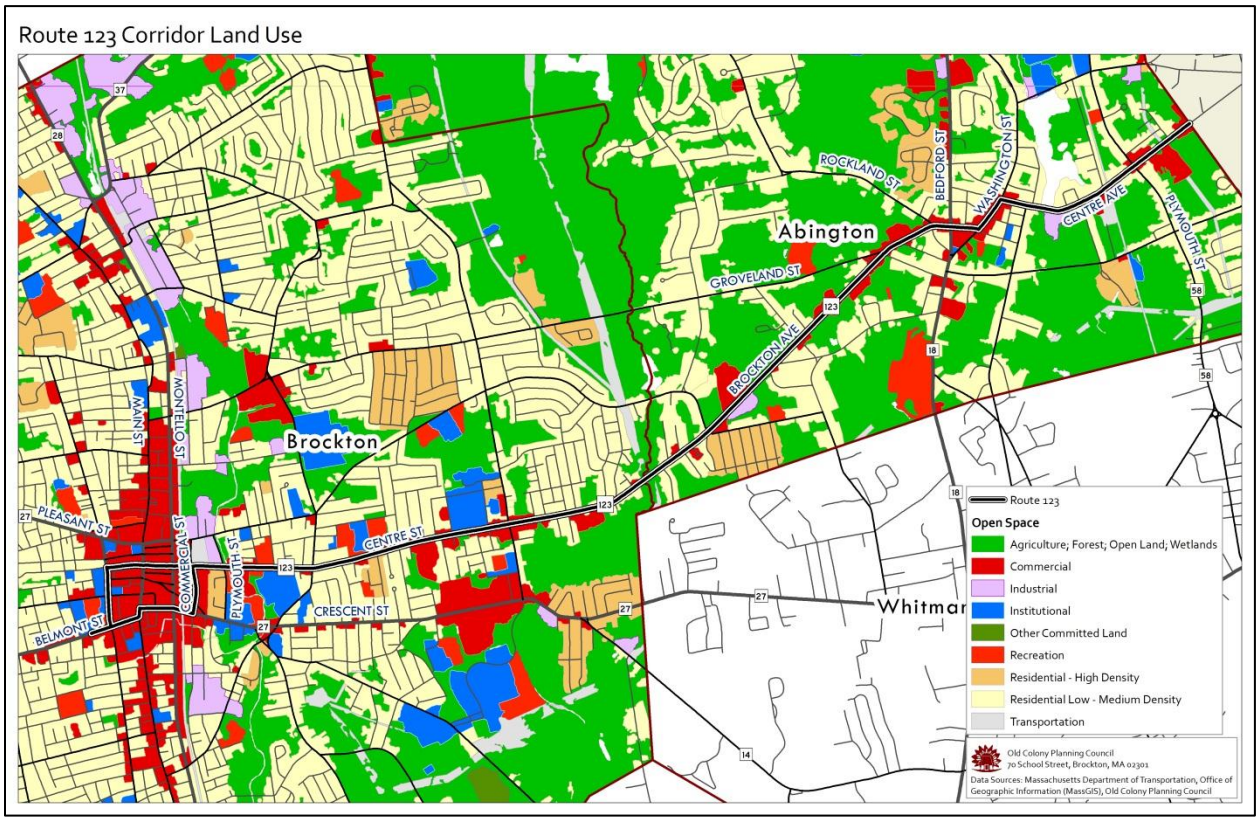
The Enterprise Block project is a mixed-use, transit oriented development within walking distance of Brockton's Downtown Commuter Rail Station and BAT Intermodal Centre (surface bus system). It is also adjacent to the city center as it borders Main Street on the west. The development is being constructed by Trinity Financial Real Estate in two phases with Phase I already being completed. Several historic buildings were restored for retail, commercial, and housing uses.

The first phase of development consisted of 113 units of housing in a rehabilitated historic building as well as new construction along Centre Street. The historic Gardner Building includes 42 artist live work units affordable to artists earning up to 60% of the Area Median Income (AMI). The remaining 71 units include a mix of affordable and market rate units. In addition to the housing there is ground floor retail, artist gallery space, green space, and parking. The rehabilitation of the Enterprise Building creates 55,000 square feet of new commercial and office space. The second phase of development will consist

of 102 units of housing of affordable and market rate units, as well as a parking garage and additional green space. The project is designed to comply with the goals of the Downtown Brockton Smart Growth Overlay District (DBSGOD) and was permitted using the Commonwealth's 40R Permitting Process. The project is funded using Historic Tax Credits, Low Income Housing Tax Credits, private tax credit equity and other public and private resources.

West of Main Street, Route 123 continues on Legion Parkway. Land uses on Legion Parkway include the Brockton Neighborhood Health Center as well as small downtown shops and banks. As Route 123 transitions to Warren Avenue, the adjacent land use consists of residences as well as churches and the Brockton Alternative High School (the former Senior Brockton High School). Belmont Street and Main Street (Route 123 eastbound) also contain small downtown shops and banks, as well as the Covett Plymouth County Courthouse. Crescent Street has two prominent facilities including the parking garage and the Brockton Public Schools administrative offices. Figure 20 shows the land uses along the Route 123 corridor in Abington and Brockton.

Figure 20 - Route 123 Land Use



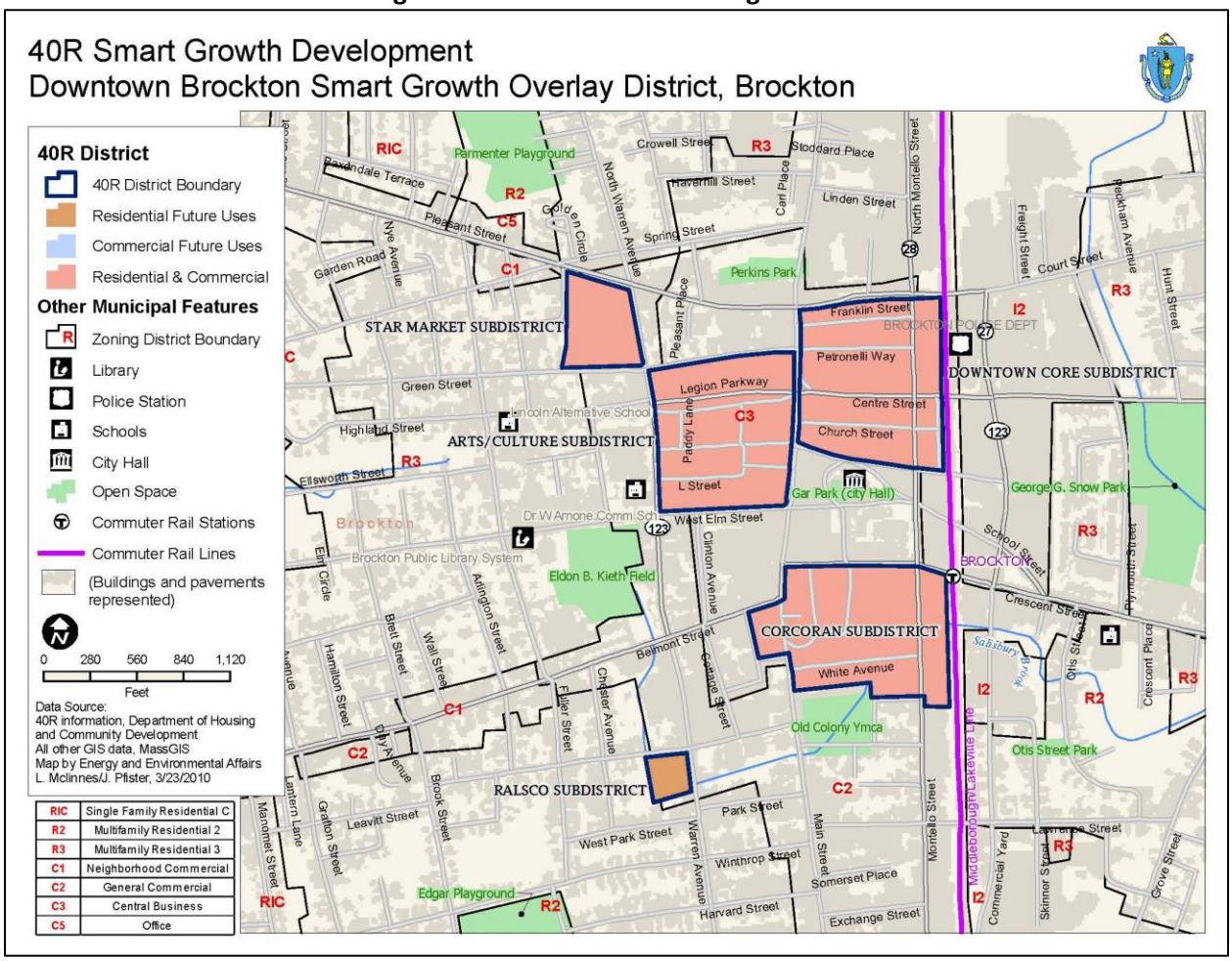
2.11.2 Downtown Brockton Smart Growth Overlay District (40R)

According to the Massachusetts Executive Office of Housing and Economic Development, the Smart Growth Zoning Overlay District Act, (Chapter 149 of the Acts of 2004, codified as Massachusetts General Laws chapter 40R), encourages communities to create dense residential or mixed-use smart growth zoning districts, including a high percentage of affordable housing units, located near transit stations, in areas of concentrated development such as existing city and town centers, and in other highly suitable locations.

Projects must be developable under the community's smart growth zoning adopted under Chapter 40R, either as-of-right or through a limited plan review process akin to site plan review. Upon state review and approval of a local overlay district, communities become eligible for payments from a Smart Growth Housing Trust Fund, as well as other financial incentives.

The City of Brockton established the 40R district in Brockton Downtown adopting design standards in July of 2007. Figure 21 shows the Smart Growth Zoning District.

Figure 21 - Smart Growth Zoning District



The City of Brockton has also proposed amendments to the existing 40R Downtown Brockton Smart Growth Overlay District. This district, adopted in 2007, allows mixed-use and residential development as a matter of right (with locations, densities and building heights, etc., as specified in the District Ordinance). The proposed amendments, currently on file with DHCD (pursuant to Massachusetts General Law Chapter 40R) and pending consideration within a public hearing of the City Council, would expand the boundaries of the current 40R Sub-Districts to cover all of the "downtown" area (including all of the proposed Urban Revitalization District), and would increase the allowable residential densities in some locations. The amendments would also amend the 40R parking requirements to limit surface parking lots and to encourage payment of funds in lieu of parking spaces in order to support a new public parking garage. The intent of these amendments is to allow developers to meet their parking

needs in a way that supports a new public garage that is expected to unlock greater development potential across downtown.

3 Existing Traffic and Operational Conditions

3.1 Average Daily Traffic, Prevailing Speeds, and Heavy Vehicles

OCPC utilized automatic traffic recorders placed at various points along the Route 123 corridor and on side streets to determine the average daily traffic (ADT) within the study area. The traffic recorders were installed for a minimum 48-hour period and recorded traffic for both directions of travel in fifteen minute intervals. In addition, 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. Table 10 shows the average daily traffic (Vehicles Per Day, VPD), 24-hour total for both directions of travel on Route 123, as well as the prevailing 85th percentile speeds (Miles Per Hour, MPH), and the percentage of heavy vehicles in the traffic flow for Route 123 in Brockton. Table 10 also shows the average daily traffic, the prevailing 85th percentile speeds, and the percentage of heavy vehicles for side streets intersecting Route 123 in Brockton. Table 11 shows the average daily traffic, 24-hour total for both directions of travel as well as the prevailing 85th percentile speeds, and the percentage of heavy vehicles for side streets intersecting Route 123 for Abington. The automatic traffic recorder count reports are included in the appendix to this study.

Table 10 – Automatic Traffic Recorder Counts on Route 123 in Brockton

	Location	Year	ADT	85th %	Trucks
1	Belmont Street (Route 123) west of Warren Avenue – Brockton	2016	13,320	30 MPH	5.1%
2	Belmont Street (Route 123 eastbound) west of Main Street – Brockton	2016	10,484	30 MPH	7.7%
3	Crescent Street (Route 123 eastbound) east of Main Street – Brockton	2015	8,993	26 MPH	10.8%
4	Crescent Street (Route 123 eastbound) east of Montello Street – Brockton	2015	7,767	27 MPH	7.5%
5	Commercial Street (Route 123 eastbound) north of School Street – Brockton	2015	9,546	NA	NA
6	Centre Street (Route 123 westbound) east of Montello Street (Route 28) – Brockton	2015	9,964	26 MPH	5.3%
7	Centre Street (Route 123 westbound) east of Main w of Montello Street – Brockton	2015	8,799	26 MPH	8.9%
8	Legion Parkway (Route 123 westbound) west of Main Street – Brockton	2016	9,772	NA	NA
9	Warren Avenue (Route 123 westbound) south of West Elm Street – Brockton	2014	9,965	NA	NA
10	Centre Street (Route 123) west of Plymouth Street – Brockton	2014	12,169	NA	NA
11	Centre Street (Route 123) east of Plymouth Street – Brockton	2014	13,147	37 MPH	6.6%
12	Plymouth Street south of Court Street – Brockton	2014	4,154	28 MPH	7.2%
13	Plymouth Street south of Centre Street – Brockton	2015	4,764	30 MPH	10.1%
14	Centre Street (Route 123) east of Lyman Street and Cary Street – Brockton	2016	16,567	34 MPH	5.8%
15	Centre Street (Route 123) west of Quincy Street – Brockton	2016	15,045	32 MPH	8.4%
16	Libby Street north of Centre Street (Route 123) – Brockton	2016	937	29 MPH	7.4%
17	Crosby Street south of Centre Street (Route 123) – Brockton	2016	142	29 MPH	8.3%
18	Brockton Avenue (Route 123) at Brockton/Abington C/L – Brockton	2015	12,887	NA	NA

The heaviest daily traffic volumes on Route 123 in Brockton were recorded on Centre Street (Route 123) east of Lyman Street and Cary Street with 16,567 vehicles per day (VPD). Other locations in Brockton that experienced high daily traffic volumes include Centre Street (Route 123) west of Quincy Street with 15,045 VPD, Belmont Street (Route 123) west of Warren Avenue with 13,320 VPD, and Centre Street (Route 123) east of Plymouth Street with 13,147 VPD. In Downtown Brockton, the traffic volume on Legion Parkway is 9,772 VPD, and it is 9,965 VPD on Warren Avenue, and 8,799 VPD on Centre Street (Route 123) east of Main Street.

The 85th Percentile Speed (the speed at which the prevailing traffic is at or below) was the highest at the Centre Street (Route 123) east of Plymouth Street location at 37 MPH. The 85th Percentile Speed on Route 123 in Brockton was lowest on Centre Street east of Montello Street, Centre Street east of Main Street, and Crescent Street east of Main Street at 26 miles per hour.

The percentage of heavy vehicles in the traffic flow within the Route 123 corridor in Brockton varies between 5.1 percent and 10.8 percent as shown in Table 10. Route 123 is a state designated truck route. The highest percentage of trucks on Route 123 Brockton was recorded on Crescent Street (Route 123) east of Main Street with trucks and heavy vehicles making up 10.8 percent of the traffic flow. Other locations with high truck traffic in Brockton include Centre Street (Route 123 westbound) east of Main Street (west of Montello Street) with 8.9 percent trucks, Centre Street (Route 123) west of Quincy Street with 8.4 percent trucks, and Belmont Street (Route 123 eastbound) west of Main Street with 7.7 percent trucks.

Table 11 – Automatic Traffic Recorder Counts on Route 123 in Abington

	Location	Year	ADT	85th %	Trucks
19	Green Street south of Brockton Avenue (Route 123) – Abington	2016	1,955	40 MPH	11.0%
20	Mill Street north of Brockton Avenue (Route 123) – Abington	2016	2,933	36 MPH	3.6%
21	Brockton Avenue (Route 123) west of Ashland Street – Abington	2016	15,388	42 MPH	7.5%
22	Ashland Street south of Brockton Avenue (Route 123) – Abington	2016	1,087	37 MPH	5.7%
23	High Street south of Brockton Avenue (Route 123) – Abington	2016	1,744	30 MPH	7.6%
24	High Street north of Brockton Avenue (Route 123) – Abington	2016	1,538	37 MPH	11.2%
25	Brockton Avenue (Route 123) west of High Street – Abington	2016	14,917	43 MPH	5.8%
26	Brockton Avenue (Route 123) east of High Street – Abington	2016	15,577	44 MPH	6.1%
27	Brockton Avenue (Route 123) west of Rockland Street and Elm Street – Abington	2016	19,724	37 MPH	5.7%
28	Brockton Avenue (Route 123) west of Bedford Street (Route 18) – Abington	2016	18,569	30 MPH	11.3%
29	Brockton Avenue (Route 123) east of Bedford Street (Route 18) – Abington	2014	12,932	NA	NA
30	Rockland Street north of Brockton Avenue (Route 123) – Abington	2016	5,216	39 MPH	3.7%
31	Bedford Street (Route 18) north of Brockton Avenue (Route 123) – Abington	2014	22,871	NA	NA
32	Bedford Street (Route 18) south of Brockton Avenue (Route 123) – Abington	2016	15,428	38 MPH	9.2%
33	Washington Street south of Centre Avenue (Route 123) – Abington	2016	16,732	30 MPH	9.7%
34	Centre Avenue (Route 123) east of Washington Street – Abington	2016	10,776	37 MPH	7.4%
35	Walnut Street south of Centre Avenue (Route 123) – Abington	2016	2,313	32 MPH	7.4%
36	Centre Avenue (Route 123) east of Walnut Street – Abington	2016	12,070	41 MPH	11.1%
37	Centre Avenue (Route 123) at Rockland T/L - Abington	2014	13,176	NA	NA

Table 11 shows that the heaviest Route 123 traffic volumes in Abington occurred at the Brockton Avenue (Route 123) west of Rockland Street and Elm Street location with 19,724 VPD. Heavy volumes on Brockton Avenue (Route 123) were also recorded west of Bedford Street (Route 18) with 18,569 VPD. Within Abington center, the average daily traffic was recorded at 16,731 VPD at the Washington Street (Route 123) location south of Centre Avenue. East of Abington center, on Centre Avenue (Route 123) east of Washington Street, the average daily traffic was recorded at 10,776 VPD, and the average daily traffic at the Abington/Rockland line on Centre Street (Route 123) was recorded at 13,176 VPD.

The highest 85th Percentile Speed in Abington on Route 123 (the speeds at which the prevailing traffic is at or below) was recorded at the Brockton Avenue (Route 123) east of High Street location at 44 MPH. Other high speed locations in Abington included Brockton Avenue (Route 123) west of High Street, 43 MPH, Brockton Avenue (Route 123) west of Ashland Street, 42 MPH, and Centre Avenue (Route 123) east of Walnut Street, 41 MPH. The speeds on Route 123 in Abington were lowest on Brockton Avenue

(Route 123) west of Bedford Street (Route 18), 30 MPH, and Washington Street (Route 123) south of Centre Avenue, 30 MPH, both in Abington center.

Within the Route 123 corridor in Abington, the percentage of heavy vehicles in the traffic flow varies between 5.7 percent and 11.3 percent as shown in Table 11. As a state designated truck route, the percentages of heavy vehicles in the traffic flow are significant. The highest percentage of trucks on Route 123 in Abington was recorded on Brockton Avenue (Route 123) west of Bedford Street (Route 18). 11.3 percent. Other locations with high truck traffic in Abington include Centre Avenue (Route 123) east of Walnut Street, 11.1 percent, and Washington Street south of Centre Avenue (Route 123), 9.7 percent.

3.2 Intersection Peak Hour Levels-of-Service (LOS)

This study includes analysis at twenty-eight intersections (twenty-one signalized and seven un-signalized) in the Route 123 corridor study area. 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. It 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. Level-of-service “F” represents forced flow or bottleneck conditions. The following, from the *Highway Capacity Manual*, 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 12 shows the delay criteria for each level-of-service for both un-signalized and signalized intersections.

Table 12 - 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

Source: Highway Capacity Manual

Table 13 summarizes the signalized and unsignalized levels-of-service for the study area intersections under existing peak hour conditions in Brockton and Table 14 summarizes the signalized and unsignalized levels-of-service for the study area intersections under the existing peak hour conditions in Abington. The analysis includes the morning a.m. peak hour and the p.m. peak hour. Failed traffic operations at intersections in Tables 13 and 14 (LOS "E" and "F") are shown in shaded blocks. Level-of-Service "D" represents long delays and back-ups with volumes approaching congestion.

Table 13 – Route 123 Intersection Existing Peak Hour Level-of-Service Brockton

	Intersection	Community	Traffic Control	2017 AM LOS	2017 PM LOS
1	Belmont Street (Route 123) at Warren Avenue	Brockton	Signal	C	C
2	Belmont Street (Route 123 EB) at Main Street	Brockton	Signal	B	B
3	Main Street (Route 123 EB) at Crescent Street (Route 123 EB)	Brockton	Signal	A	B
4	Crescent Street (Route 123 EB) at Montello Street (Route 28)	Brockton	Signal	B	B
5	Crescent Street (Route 123 EB) at Commercial Street	Brockton	Signal	B	C
6	Commercial Street (Route 123 EB) at School Street	Brockton	Signal	B	B
7	Commercial Street (Route 123 EB) at Centre Street (Route 123)	Brockton	Signal	B	B
8	Centre Street (Route 123 WB) at Montello Street (Route 28)	Brockton	Signal	C	C
9	Centre Street (Route 123 WB) at Main Street/Legion Parkway	Brockton	Signal	B	B
10	Legion Parkway (Route 123 WB) at Warren Avenue	Brockton	Signal	C	C
11	Warren Avenue (Route 123 WB) at Frederick Douglass	Brockton	Signal	A	B
12	Warren Avenue (Route 123 WB) at West Elm Street	Brockton	Signal	B	A
13	Centre Street (Route 123) at Plymouth Street	Brockton	Stop	--	--
	Plymouth Street northbound all moves			F	E
	Plymouth Street southbound all moves			F	F
	Centre Street eastbound westbound left turns			A	A
14	Centre Street (Route 123) at Cary Street/Lyman Street	Brockton	Signal	D	E
15	Centre Street (Route 123) at Libby Street and Crosby Road	Brockton	Stop	--	--
	Libby Street southbound all moves			F	F
	Crosby Street Northbound all moves			E	F
	Centre Street eastbound left turns			A	A
	Centre Street westbound left turns			A	A
16	Centre Street (Route 123) at Quincy Street	Brockton	Signal	C	C

The summary of the existing signalized peak hour level-of-service (LOS) analysis in Tables 13 and 14 show that the forced-flow failed levels-of-service (LOS "F") occurred mostly at the side streets at unsignalized intersections as there is a lack of sufficient safe gaps in the Route 123 peak hour traffic flow that the side street traffic can utilize to make safe, efficient turning movements. Although most of the signalized intersections have overall peak hour levels-of-service that are in the acceptable range, the LOS on specific lanes and approaches can be lower than the overall LOS. Therefore, there are long delays on some of the lanes and approaches of signalized intersections that show levels-of-service higher than "E" and "F", especially in the "D" and "C" range. Table 13 shows that the side street approaches at the Centre Street (Route 123)/Plymouth Street intersection and the Centre Street (Route 123)/Crosby Street/Libby Street intersection experience LOS "E" very long delays and LOS "F" forced flow during the morning and afternoon peak hours. The signalized Centre Street (Route 123) at Cary Street/Lyman Street intersection experiences LOS "E" very long delays during the afternoon peak hour.

Table 14 – Route 123 Intersection Existing Peak Hour Level-of-Service Abington

	Intersection	Community	Traffic Control	2017 AM LOS	2017 PM LOS
17	Brockton Avenue (Route 123) at Mill Street/Green Street/Martin Street	Abington	Stop	--	--
	Southbound all moves			F	F
	Northbound all moves			D	E
	Centre Street eastbound left turns			A	A
	Centre Street westbound left turns			A	A
18	Brockton Avenue (Route 123) at Wal-Mart	Abington	Signal	B	B
19	Brockton Avenue (Route 123) at Ashland Street	Abington	Stop	--	--
	Ashland Street northbound all moves			E	D
	Brockton Ave WB left turns			A	A
20	Brockton Avenue (Route 123) at High Street	Abington	Stop	--	--
	High Street northbound all movements			F	E
	High Street souththbound all movements			F	F
	Brockton Ave EB and WB left turns			A	A
21	Brockton Avenue (Route 123) at Vernon Street and Groveland Street	Abington	Signal	D	B
22	Brockton Avenue (Route 123) at Rockland Street/Elm Street	Abington	Stop	--	--
	Rockland Street southbound all moves			F	F
	Brockton Ave EB and WB left turns			A	A
23	Brockton Avenue (Route 123) at Bedford Street (Route 18)	Abington	Signal	D	D
24	Brockton Avenue (Route 123) at Washington Street/Thaxter Avenue	Abington	Signal	B	B
25	Washington Street (Route 123) at Centre Avenue (Route 123)	Abington	Signal	B	B
26	Centre Avenue (Route 123) at Walnut Street	Abington	Stop	--	--
	Walnut Street northbound left and right turns			D	C
	Centre Avenue (Route 123) left turns			A	A
27	Centre Avenue (Route 123) at Plymouth Street (Route 58)	Abington	Signal	E	E
28	Centre Avenue (Route 123) at Stop and Shop Plaza	Abington	Signal	B	C

Table 14 shows a number of unsignalized intersections that experience LOS "E" and "F" on the side street approaches during the morning and afternoon peak hours in Abington. These include Brockton Avenue (Route 123) at Mill Street/Green Street/Martin Street, Brockton Avenue (Route 123) at Ashland Street, Brockton Avenue (Route 123) at High Street, and Brockton Avenue (Route 123) at Rockland Street/Elm Street. In addition, the signalized Centre Avenue (Route 123) at Plymouth Street (Route 58)

intersection experiences LOS "E" long delays during the morning and afternoon peak hours. Traffic operations at this intersection are further hindered due to the excessive number of turning movements at curb cuts to businesses (coffee shops and fast food) located at the four quadrants of the intersection. The Brockton Avenue (Route 123) at Bedford Street (Route 18) intersection experiences LOS "D" conditions during the morning and afternoon peak hours. Although the overall delays are not as long as LOS "E" conditions, this intersection experiences long back-ups on Brockton Avenue (Route 123) eastbound creating queues that extend back through the Brockton Avenue (Route 123)/Rockland Street intersection, preventing vehicles on Rockland Avenue from entering the Rockland Avenue (Route 123) traffic flow.

3.3 Intersection Crash Experience

Crash data for the study area intersections within the Route 123 corridor study area was obtained for the latest available three-year period (2013-2014-2015) from the Massachusetts Department of Transportation (MassDOT). The data is made available by the Massachusetts Registry of Motor Vehicles and then compiled by MassDOT. The data was analyzed by OCPC 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 Massachusetts 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 0.77 MEV for signalized intersections and 0.58 MEV for un-signalized intersections. The MassDOT District 5 average crash rates are 0.76 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 15 summarizes the number of crashes and corresponding crash rates for the study area corridor intersections for the three year history 2013, 2014, and 2015. Crash rates that exceed the statewide and District 5 crash rate averages are shaded in Table 15.

Table 15 - Intersection Crashes and Crash Rates (2013, 2014, 2015)

	Intersection	Property Damage Only	Injury	Fatal	Total	Crash Rate
1	Belmont Street (Route 123) at Warren Avenue – Brockton (Signal)	12	11	0	23	0.99
2	Belmont Street (Route 123 EB) at Main Street – Brockton (Signal)	9	13	0	22	1.34
3	Main Street (Route 123 EB) at Crescent Street (Route 123 EB) – Brockton (Signal)	2	2	0	4	0.30
4	Crescent Street (Route 123 EB) at Montello Street (Route 28) – Brockton (Signal)	7	11	0	18	0.99
5	Crescent Street (Route 123 EB) at Commercial Street – Brockton (Signal)	4	5	0	9	0.53
6	Commercial Street (Route 123 EB) at School Street – Brockton (Signal)	3	4	0	7	0.48
7	Commercial Street (Route 123 EB) at Centre Street (Route 123) – Brockton (Signal)	13	6	0	19	0.86
8	Centre Street (Route 123 WB) at Montello Street (Route 28) – Brockton (Signal)	19	6	0	25	1.20
9	Centre Street (Route 123 WB) at Main Street/Legion Parkway – Brockton (Signal)	24	28	1	53	2.77
10	Legion Parkway (Route 123 WB) at Warren Avenue – Brockton (Signal)	6	6	0	12	0.62
11	Warren Avenue (Route 123 WB) at Frederick Douglass – Brockton (Signal)	7	3	0	10	0.62
12	Warren Avenue (Route 123 WB) at West Elm Street – Brockton (Signal)	20	23	0	43	2.22
13	Centre Street (Route 123) at Plymouth Street – Brockton (Stop)	26	15	0	41	2.62
14	Centre Street (Route 123) at Cary Street – Brockton (Signal)	21	12	0	33	1.32
15	Centre Street (Route 123) at Libby Street and Crosby Road – Brockton (Stop)	2	3	0	5	0.30
16	Centre Street (Route 123) at Quincy Street – Brockton (Signal)	19	12	0	31	1.11
17	Brockton Avenue (Route 123) at Mill Street/Green Street/Martin Street – Abington (Stop)	7	4	0	11	0.59
18	Brockton Avenue (Route 123) at Wal-Mart – Abington (Signal)	0	1	0	1	0.07
19	Brockton Avenue (Route 123) at Ashland Street – Abington (Stop)	1	0	0	1	0.06
20	Brockton Avenue (Route 123) at High Street – Abington (Stop)	4	13	1	18	1.07
21	Brockton Avenue (Route 123) at Vernon Street and Groveland Street – Abington (Signal)	11	1	0	12	0.47
22	Brockton Avenue (Route 123) at Rockland Street/Elm Street – Abington (Stop)	27	4	0	31	1.33
23	Brockton Avenue (Route 123) at Bedford Street (Route 18) – Abington (Signal)	38	11	1	50	1.40
24	Brockton Avenue (Route 123) at Washington Street/Thaxter Avenue – Abington (Signal)	10	0	0	10	0.51
25	Washington Street (Route 123) at Centre Avenue (Route 123) – Abington (Signal)	16	3	0	19	0.90
26	Centre Avenue (Route 123) at Walnut Street	2	0	0	2	0.15
27	Centre Avenue (Route 123) at Plymouth Street (Route 58) – Abington (Signal)	47	8	0	55	3.52
28	Centre Avenue (Route 123) at Stop and Shop Plaza – Abington (Signal)	8	5	0	13	0.66

Table 15 shows that three fatalities occurred during the three year study period. These occurred at three different intersections including Centre Street (Route 123) at Legion Parkway and Main Street in Brockton (a signalized intersection), Brockton Avenue (Route 123) at High Street in Abington (a stop sign controlled intersection), and Brockton Avenue (Route 123) at Bedford Street (Route 18) in Abington, (a signalized intersection). The Centre Avenue (Route 123)/Plymouth Street (Route 58) intersection in Brockton had the highest number of crashes with 55, followed by the Centre Street (Route 123 WB) at Main Street/Legion Parkway in Brockton with 53 crashes. The Brockton Avenue (Route 123) at Bedford Street (Route 18) had the third highest number of crashes with 51. Other intersections with high numbers of crashes include Centre Street (Route 123) at Plymouth Street in Brockton with 41, Warren Avenue (Route 123 WB) at West Elm Street in Brockton with 43, and Centre Street (Route 123) at Cary Street in Brockton and Brockton Avenue (Route 123) at Rockland Street/Elm Street in Abington, both with 31 crashes.

Table 15 shows a number of the Route 123 study area intersections meet or exceed both the statewide average and the District 5 average for signalized and unsignalized crash rates. The Centre Avenue (Route 123) at Plymouth Street (Route 58) in Abington had the highest crash rate with 3.52 crashes per million entering vehicles, (MEV). Other intersections with high crash rates include the Centre Street (Route 123) at Plymouth Street intersection in Brockton with 2.62 MEV, the Centre Street (Route 123 WB) at Main Street/Legion Parkway intersection in Brockton with 2.77 MEV, and the Warren Avenue (Route 123 WB) at West Elm Street intersection in Brockton with 2.22 MEV.

MassDOT issues the *Top High Crash Locations Report* each year. The current report includes the top 200 high crash intersection locations using crash data obtained from the Massachusetts Registry of Motor Vehicles. This report includes the weighted (by crash severity) highest frequency motor vehicle crash locations and also the highest frequency bicycle-motor vehicle and pedestrian-motor vehicle crash locations. Within the Route 123 corridor, there are three intersections, all located in Brockton, that are included on the top 200 high crash intersection location list in the latest MassDOT report. These include Centre Street (Route 123 WB) at Main Street/Legion Parkway, Centre Street (Route 123) at Plymouth Street, and Warren Avenue (Route 123 WB) at West Elm Street.

In addition, the MassDOT maintains an interactive map showing the top crash locations within each regional planning agency region for motor vehicle crashes, pedestrian crashes, and bicycle crashes (the top five percent crash locations within a region eligible for the Highway Safety Improvement Program, HSIP). There are seven Route 123 study area intersections in Brockton that are within the top five percent crash clusters (HSIP eligible) including Crescent Street (Route 123 EB) at Montello Street (Route 28), Centre Street (Route 123 WB) at Montello Street (Route 28), Belmont Street (Route 123) at Warren Avenue, Belmont Street (Route 123 EB) at Main Street, Main Street (Route 123 EB) at Crescent Street (Route 123 EB), Centre Street (Route 123) at Cary Street, and Centre Street (Route 123) at Quincy Street. There are five Route 123 study area intersections in Abington that are within the top 5 percent crash clusters (HSIP eligible) including Brockton Avenue (Route 123) at High Street, Brockton Avenue (Route 123) at Rockland Street/Elm Street, Brockton Avenue (Route 123) at Bedford Street (Route 18), Washington Street (Route 123) at Centre Avenue (Route 123), and Centre Avenue (Route 123) at Plymouth Street (Route 58).

The MassDOT interactive map also shows the top five percent pedestrian crash clusters and bicycle crash clusters. The top five percent pedestrian crash clusters on Route 123 occur in Brockton at Legion Parkway, including the Centre Street (Route 123 WB) at Main Street/Legion Parkway intersection and the Legion Parkway (Route 123 WB) at Warren Avenue intersection as well as the Belmont Street (Route 123 EB) at Main Street intersection, the Main Street (Route 123 EB) at Crescent Street (Route 123 EB) intersection, and the Centre Street (Route 123) at Plymouth Street intersection. The top five percent bicycle crash clusters on Route 123 occur at the Belmont Street (Route 123 EB) at Main Street intersection and the Main Street (Route 123 EB) at Crescent Street (Route 123 EB) intersection. Maps of all of the 5 percent crash clusters (vehicle, pedestrian, and bicycle) as well as the Top 200 High Crash Locations are shown in the appendix to this report.

3.4 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. The field survey evaluations are based on the severity and extent of specific surface condition criteria including: potholes and patching, alligator cracking, distortion, rutting, weathering and block cracking, transverse and longitudinal cracking, bleeding and polished aggregate, surface wear and raveling, corrugations, shoving, and slippage. The PMS software calculates Pavement Condition Index (PCI) scores for the surveyed road segments, as a deduction is assigned for each distress as well as the extent of the distress. Each road or road segment is placed in a condition category based on the calculated PCI. These categories include "POOR" (PCI = 0 to 60), "DEFICIENT" (PCI = 61 to 72), "FAIR" (PCI = 73 to 85), "GOOD" (PCI 86 to 92), and "EXCELLENT (PCI = 93 to 100). The software recommends a repair and associated cost for each road and/or road segment. The PMS repair and maintenance strategies fall under five general default strategies. These include:

1. Base Reconstruction – This is recommended for road segments with a PCI between 0 and 60. This is recommended for roads in need of base improvement. Typical repairs include full depth reconstruction and reclamation.
2. Structural Improvement (Rehabilitation) – This is recommended for road segments with a PCI between 61 and 72. This is recommended when the pavement surface structure is in need of added strength for existing traffic. Typical repairs may include overlay with or without milling.
3. Preventive Maintenance – This is recommended for road segments with a PCI between 73 and 85. The pavement surface may be in need of surface sealing, full depth patch and/or crack sealing. This could include minor leveling, as well as surface treatments such as chip seals, micro-surfacing, and thin overlays.
4. Routine Maintenance – This is recommended for road segments with a PCI between 86 and 92. This is recommended when the surface may be in need of crack sealing or minor localized repair. This work may include crack sealing and pothole and full depth patching.
5. No Immediate Maintenance or Repair – This category is for road segments with a PCI between 93 and 100, and the surface is considered in excellent condition. OCPC conducted a windshield survey of the Route 123 corridor in Abington and Brockton.

OCPC's region-wide pavement management system includes all roads eligible for federal aid, including Route 123 in Abington and Brockton. Table 16 summarizes the results of the Route 123 pavement management analysis in Abington and Brockton. Table 16 shows that the Pavement Condition Index (PCI), (which characterizes the surface condition). Figure 22 shows the Route 123 pavement conditions and the potential recommendations.

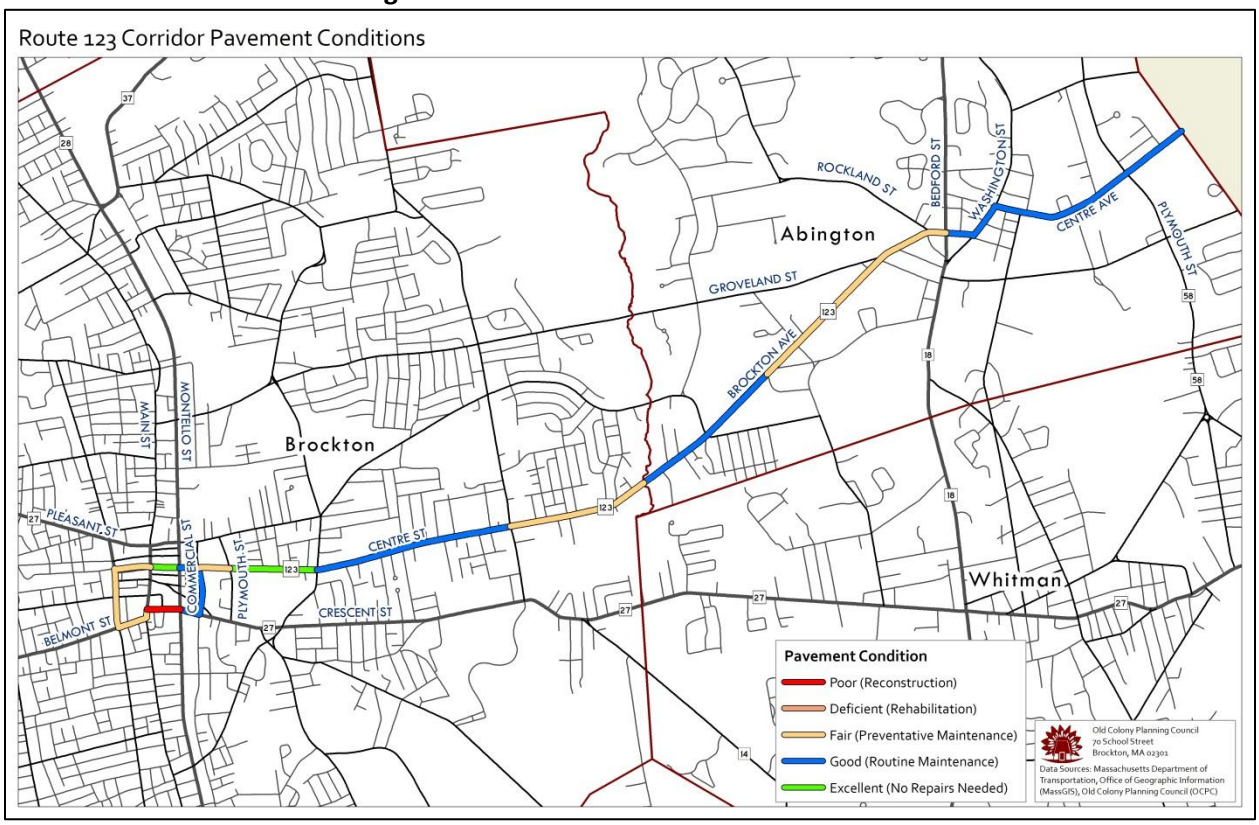
Most of Route 123 requires Preventative or Routine Maintenance, except for a section of Crescent Street between Main Street and Montello Street, which is in "Poor" condition and requires Base Reconstruction. The section of Route 123, Centre Street, between Plymouth Street and Cary and Lyman Streets has a PCI above 93, which puts it in the "Excellent" category, requiring no improvements. In Brockton Downtown, Centre Street, Legion Parkway, Warren Avenue, and Belmont Street are in "Fair" condition and in need of Preventative Maintenance. Centre Avenue between Cary and Lyman Streets (in the vicinity of Signature Health Care) and Quincy Street is in "Good" condition and in need of Routine Maintenance. East of Quincy Street, Centre Street is in "Fair" condition and in need of Preventative maintenance.

In Abington, Route 123 is in "Good" condition in need of Routine Maintenance, except for the section between Constitution Avenue and Bedford Street, which is in "Fair" condition and in need of Preventative Maintenance.

Table 16 – Pavement Condition Index (PCI)

ROUTE 123 STREET NAME	COMMUNITY	FROM	TO	LENGTH (FEET)	ROAD CLASS	RECOMMENDED REPAIR	ESTIMATED COST	CURRENT PCI
Belmont Street	Brockton	Warren Avenue	Main Street	717.4	Principal Arterial	Preventive Maintenance	$9,197.37	78
Main Street	Brockton	Belmont Street	Crescent Street	196.6	Principal Arterial	Preventive Maintenance	$2,520.60	88
Crescent Street	Brockton	Main Street	Montello Street	807.2	Principal Arterial	Base Rehabilitation	$93,136.89	57
Crescent Street	Brockton	Montello Street	Commercial Street	479.0	Principal Arterial	Routine Maintenance	$1,228.10	90
Commercial Street	Brockton	Crescent Street	Centre Street	1,134.1	Minor Arterial	Routine Maintenance	$4,362.14	87
Centre Street	Brockton	Commercial Street	Montello Street	463.7	Principal Arterial	Routine Maintenance	$1,189.02	87
Centre Street	Brockton	Montello Street	Main Street/Legion Parkway	708.9	Principal Arterial	None	$0	100
Legion Parkway Westbound	Brockton	Centre Street/Main Street	Warren Avenue	879.9	Principal Arterial	Preventive Maintenance	$20,579.22	78
Legion Parkway Eastbound	Brockton	Warren Avenue	Centre Street/Main Street	873.8	Principal Arterial	Preventive Maintenance	$21,472.01	78
Warren Avenue	Brockton	Legion Parkway	Belmont Street	1,427.5	Principal Arterial	Preventive Maintenance	$19,827.43	79
Centre Street	Brockton	Commercial Street	Plymouth Street	747.5	Principal Arterial	Preventive Maintenance	$9,583.98	76
Centre Street	Brockton	Plymouth Street	Cary Street/ Lyman Street	2,119.04	Principal Arterial	None	$0	94
Centre Street	Brockton	Cary Street/ Lyman Street	Quincy Street	1,444.82	Principal Arterial	Routine Maintenance	$3,229.54	86
Centre Street	Brockton	Quincy Street	Abington Line	3,450.6	Principal Arterial	Preventive Maintenance	$44,239.05	84
Brockton Avenue	Abington	Brockton Line	Constitution Avenue	3,991.84	Principal Arterial	Routine Maintenance	$13,104.07	86
Brockton Avenue	Abington	Constitution Avenue	Bedford Street	5,662.65	Principal Arterial	Preventive Maintenance	$72,599.97	81
Brockton Avenue	Abington	Bedford Street	Washington Street	672.00	Minor Arterial	Routine Maintenance	$1,723.08	90
Washington Street	Abington	Brockton Avenue	Centre Avenue	848.84	Minor Arterial	Routine Maintenance	$3,246.87	88
Centre Avenue	Abington	Washington Street	Norwood Line	5,155.98	Minor Arterial	Routine Maintenance	$13,118.45	86
Total				31,072.47			$334357.79	

Figure 22 - Route 123 Pavement Conditions



3.5 Environmental Issues

Any improvements to improve safety and/or relieve congestion should take into account the diversity of environmental features in a particular area. The study area along Route 123 is urban and well-developed. The roads were laid out in the early part of Abington and Brockton's history and through the Industrial Revolution and post-World War II era (19th and 20th Centuries). Drainage issues can be a concern especially within specific areas within the study area. There are a number of streams and brooks that intersect the Route 123 corridor, and these are sometimes not usually visible from the road. In Abington, Island Grove Pond is visible from the road as it is adjacent to Route 123, with the Shumatuscacaunt River running beneath. A brook runs beneath Route 123 just west of its intersection with Rockland Street, and Beaver Brook Runs beneath Route 123 at the Abington and Brockton Line.

In Brockton, Trout Brook runs beneath Route 123 just east of Plymouth Street, parallel to Plymouth Street and into George G. Snow Park. This stream presents a potential constraint in the redesign and reconstruction of the Centre Street (Route 123)/Plymouth Street intersection.

4 Future Conditions and Operations

4.1 Future Traffic Analysis

A five-year time horizon (Year 2022) 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 2017 traffic to approximate future 2022 No-Build conditions. The average annual growth rate was derived from the overall regional growth for roads and arterials similar to the study area based on previous traffic counts in the OCPC region and archived by OCPC in its automatic traffic count program. These archived traffic counts are included in the appendix

to this report. In addition, the estimated trips from the Signature Health Care expansion were added to the Route 123 morning and afternoon peak hour traffic turning at the intersections that are in close proximity and impacted the most by the project. These include the Centre Street (Route 123)/Libby Street/Crosby Street intersection and the Centre Street (Route 123)/Quincy Street intersection.

No-Build conditions assume there are no improvements made to the intersection within the next five years. Intersection peak hour levels-of-service for the morning and afternoon peak hours were performed for the future morning and afternoon peak hour turning movement traffic estimates. Table 17 summarizes the intersection levels-of-service for the study area intersections under No-Build peak hour conditions for the study area intersections in Brockton and Table 18 summarizes the levels-of-service for the study area intersections under No-Build peak hour conditions for the study area intersections in Abington. Failed traffic operations at intersections in Tables 18 and 18 (LOS "E" and "F") are shown in shaded blocks. Level-of-Service "D" represents long delays and back-ups with volumes approaching congestion.

Table 17 - No-Build 2022 Route 123 Intersection Levels-of-Service Brockton

	Intersection	Community	Traffic Control	Existing AM LOS	Existing PM LOS	2022 No-Build AM LOS	2022 No-Build PM LOS
1	Belmont Street (Route 123) at Warren Avenue	Brockton	Signal	C	C	C	C
2	Belmont Street (Route 123 EB) at Main Street	Brockton	Signal	B	B	B	B
3	Main Street (Route 123 EB) at Crescent Street (Route 123 EB)	Brockton	Signal	A	B	A	B
4	Crescent Street (Route 123 EB) at Montello Street (Route 28)	Brockton	Signal	B	B	B	B
5	Crescent Street (Route 123 EB) at Commercial Street	Brockton	Signal	B	C	B	D
6	Commercial Street (Route 123 EB) at School Street	Brockton	Signal	B	B	B	B
7	Commercial Street (Route 123 EB) at Centre Street (Route 123)	Brockton	Signal	B	B	C	B
8	Centre Street (Route 123 WB) at Montello Street (Route 28)	Brockton	Signal	C	C	C	C
9	Centre Street (Route 123 WB) at Main Street/Legion Parkway	Brockton	Signal	B	B	B	B
10	Legion Parkway (Route 123 WB) at Warren Avenue	Brockton	Signal	C	C	C	C
11	Warren Avenue (Route 123 WB) at Frederick Douglass	Brockton	Signal	A	B	B	B
12	Warren Avenue (Route 123 WB) at West Elm Street	Brockton	Signal	B	A	B	A
13	Centre Street (Route 123) at Plymouth Street	Brockton	Stop	--	--	--	--
	Plymouth Street northbound all moves			F	E	F	E
	Plymouth Street southbound all moves			F	F	F	F
	Centre Street eastbound westbound left turns			A	A	A	A
14	Centre Street (Route 123) at Cary Street	Brockton	Signal	D	E	E	F
15	Centre Street (Route 123) at Libby Street and Crosby Road	Brockton	Stop	--	--	--	--
	Libby Street southbound all moves			F	F	F	F
	Crosby Street Northbound all moves			E	F	F	F
	Centre Street eastbound left turns			A	A	A	A
	Centre Street westbound left turns			A	A	A	A
16	Centre Street (Route 123) at Quincy Street	Brockton	Signal	C	C	C	C

Table 18 - No-Build 2022 Route 123 Intersection Levels-of-Service Abington

	Intersection	Community	Traffic Control	Existing AM LOS	Existing PM LOS	2022 No-Build AM LOS	2022 No-Build PM LOS
17	Brockton Avenue (Route 123) at Mill Street/Green Street/Martin Street	Abington	Stop	--	--	--	--
	Southbound all moves			F	F	F	F
	Northbound all moves			D	E	E	F
	Centre Street eastbound left turns			A	A	A	A
	Centre Street westbound left turns			A	A	A	A
18	Brockton Avenue (Route 123) at Wal-Mart	Abington	Signal	B	B	B	B
19	Brockton Avenue (Route 123) at Ashland Street	Abington	Stop	--	--	--	--
	Ashland Street northbound all moves			E	D	E	D
	Brockton Ave WB left turns			A	A	A	A
20	Brockton Avenue (Route 123) at High Street	Abington	Stop	--	--	--	--
	High Street northbound all movements			F	E	F	F
	High Street souththbound all movements			F	F	F	F
	Brockton Ave EB and WB left turns			A	A	A	A
21	Brockton Avenue (Route 123) at Vernon Street and Groveland Street	Abington	Signal	D	B	D	B
22	Brockton Avenue (Route 123) at Rockland Street/Elm Street	Abington	Stop	--	--	--	--
	Rockland Street southbound all moves			F	F	F	F
	Brockton Ave EB and WB left turns			A	A	A	A
23	Brockton Avenue (Route 123) at Bedford Street (Route 18)	Abington	Signal	D	D	E	D
24	Brockton Avenue (Route 123) at Washington Street/Thaxter Avenue	Abington	Signal	B	B	B	B
25	Washington Street (Route 123) at Centre Avenue (Route 123)	Abington	Signal	B	B	B	B
26	Centre Avenue (Route 123) at Walnut Street	Abington	Stop	--	--	--	--
	Walnut Street northbound left and right turns			D	C	D	C
	Centre Avenue (Route 123) left turns			A	A	A	A
27	Centre Avenue (Route 123) at Plymouth Street (Route 58)	Abington	Signal	E	E	E	F
28	Centre Avenue (Route 123) at Stop and Shop Plaza	Abington	Signal	B	C	B	C

Table 17 shows that most of the Route 123 intersections in Brockton are expected to operate under acceptable conditions during the AM and PM peak hours under future "No-Build" conditions, except for three intersections, the Centre Street (Route 123)/Plymouth Street intersection (unsignalized), the Centre Street (Route 123)/Cary Street intersection (signalized), and the Centre Street (Route 123)/Cosby Street/Libby Street intersection (unsignalized). The signalized Centre Street (Route 123)/Cary Street intersection is expected to be at overall LOS "E" during the morning 2022 peak hour and LOS "F" during the afternoon 2022 peak hour. The unsignalized Centre Street (Route 123)/Plymouth Street intersection and Centre Street (Route 123)/Cosby Street/Libby Street intersection (entrance to Signature Healthcare), will experience LOS "E" and "F" during the morning and afternoon peak hours on the side street approaches under future 2022 "No-Build" conditions. The City of Brockton has already submitted a Project Notification Form (PNF) for federal-aid funding for possible signalization and other improvements at the Centre Street (Route 123)/Plymouth Street intersection.

There are several intersections in Abington that are expected to operate under "E" and "F" under 2022 peak hour conditions. Most of these intersections are unsignalized with the minor street movements experiencing very long delays and forced flow due to a lack of sufficient gaps in the mainstream Route 123 traffic. These include Brockton Avenue (Route 123) at Mill Street/Green Street/Martin Street, Brockton Avenue (Route 123) at Ashland Street, Brockton Avenue (Route 123) at High Street, and Brockton Avenue (Route 123) at Rockland Street/Elm Street. In addition, there are two signalized intersections in Abington that are expected to operate under LOS "E" and "F" conditions under future 2022 peak hour conditions. These include the Brockton Avenue (Route 123) at Bedford Street (Route 18) intersection (2022 morning peak hour only), and the Centre Avenue (Route 123) at Plymouth Street (Route 58) intersection.

4.2 Brockton Future 2022 Two-Way Conversion LOS Analysis

Intersection peak-hour levels-of-service (LOS) for the future "Build" conditions (year 2022) with the assumption that the Brockton Planning Department's one-way proposal is in place were completed by OCPC. The planning department's proposal in the Brockton Urban Revitalization Plan assumed that Main Street and Warren Avenue were converted back to two-way traffic (for north and south travel) and Fredrick Douglass and School Street and West Elm Street were also converted back to two-way travel. The average annual growth rate of 1.0 percent was used as a background growth rate to increase 2017 traffic to approximate future 2022 No-Build conditions. OCPC utilized traffic and trip distribution and circulation for this analysis based on the traffic distribution for the two-way conversion in the 2007 Downtown Brockton Traffic Study Update completed by a traffic consultant for the City of Brockton. The trip distribution is shown in the appendix to this report. Table 19 summarizes the levels-of-service for the Route 123 study area intersections in Brockton downtown under two-way "Build" peak hour conditions.

Table 19 - Build 2022 Route 123 Intersection LOS Two-way Conversion Brockton Downtown

	Brockton Downtown Intersections	Community	Traffic Control	Existing AM LOS	Existing PM LOS	2022 Build Two-way AM LOS	2022 Build Two-way PM LOS
1	Belmont Street (Route 123) at Warren Avenue	Brockton	Signal	C	C	C	C
2	Belmont Street (Route 123 EB) at Main Street	Brockton	Signal	B	B	B	B
3	Main Street (Route 123 EB) at Crescent Street (Route 123 EB)	Brockton	Signal	A	B	A	A
4	Crescent Street (Route 123 EB) at Montello Street (Route 28)	Brockton	Signal	B	B	B	B
5	Crescent Street (Route 123 EB) at Commercial Street	Brockton	Signal	B	C	B	D
6	Commercial Street (Route 123 EB) at School Street	Brockton	Signal	B	B	B	B
7	Commercial Street (Route 123 EB) at Centre Street (Route 123)	Brockton	Signal	B	B	C	C
8	Centre Street (Route 123 WB) at Montello Street (Route 28)	Brockton	Signal	C	C	C	C
9	Centre Street (Route 123 WB) at Main Street/Legion Parkway	Brockton	Signal	B	B	C	C
10	Legion Parkway (Route 123 WB) at Warren Avenue	Brockton	Signal	C	C	C	C
11	Warren Avenue (Route 123 WB) at Frederick Douglass	Brockton	Signal	A	B	B	C
12	Warren Avenue (Route 123 WB) at West Elm Street	Brockton	Signal	B	A	C	E

Table 19 shows that the two-way conversion in the Brockton downtown could have mixed results for some of the intersections, although most of the intersections will still maintain acceptable levels-of-service. The Crescent Street (Route 123) at Commercial Street intersection will see a drop in LOS from "C" to "D" during the afternoon peak hour. The Centre Street (Route 123)/Main Street/Legion Parkway

intersection will see a drop from LOS "B" during the morning and afternoon peak hours to LOS "C". The Warren Avenue (Route 123 WB)/Frederick Douglass intersection will go from LOS "A" during the morning peak hour to a LOS "B", and from LOS "B" to LOS "C" during the afternoon peak hour under the two-way conversion. The most dramatic change is expected at the Warren Avenue (Route 123 WB)/West Elm Street intersection, which will drop from a LOS "B" to LOS "C" during the morning peak hour and LOS "A" to LOS "E" during the afternoon peak hour as a result of the two-way conversion.

5 Conclusions and Recommendations

A number of alternative recommendations are considered in this study based on the public outreach program, which included stakeholder meetings and public workshops. OCPC conducted a broad based comprehensive outreach program, which included reaching out to local public officials in Brockton and Abington for interviews and meetings regarding their vision for the corridor. 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. In addition, improvement techniques and best practices presented as alternative solutions for consideration were derived from 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.) The study goal is to identify and develop short-term and long-term actions and specific improvements that will enhance circulation and traffic flow, improve safety, improve bicycle and pedestrian accommodation, and reduce gaps to essential services. In addition, OCPC analysis efforts were undertaken to enhance safety and protect regional mobility, which is a stated goal in the *Old Colony Regional Transportation Plan*. Build peak hour levels-of-service were performed using the No-Build volumes under Build conditions. Build conditions assume the potential improvements are in place.

5.1 Corridor Wide Issues and Recommendations

Heavy peak period traffic volumes within the Route 123 corridor combined with limited availability of dedicated turning lanes results in traffic congestion and vehicle queuing along the corridor, especially within the morning and afternoon peak hours. In addition, vehicles attempting to enter Route 123 from the side streets or driveways, especially during the peak hours, experience frustration due to the lack of sufficient gaps in the Route 123 traffic stream. This creates "forced flow" conditions on the unsignalized side roads where vehicles force their way to the main Route 123 traffic flow creating unsafe turning movements.

Field observations indicate that pavement markings in specific locations within the corridor are faded or missing, and signage is in poor condition, especially in Brockton downtown. Locations where striping is important in the downtown include Warren Avenue (Route 123 westbound) at the Boys and Girls Club, Belmont Street (Route 123 eastbound) at the Superior Court, and Crescent Street (Route 123 eastbound) at the Brockton Parking Authority Parking Garage.

The traffic signal equipment on many of the intersections is in poor condition or outdated. This adds to the poor signal phasing and timing, as well as the lack of coordination of signals, especially in the Brockton downtown. In addition, much of the outdated signal equipment consists of post mounted signals. Overhead signals (mast arm or wire mounted) provide better signal head visibility for drivers.

Corridor-wide improvements include restriping faded lines and pavement markings, replacing faded signs and updating retro-reflectivity of signs to the latest MUTCD standards, updating signal-timing and

phasing, including signal coordination, and updating antiquated signal equipment including overhead signal facing.

Abington and Brockton should work with state agencies and developers to implement short-term and long-term improvements to the overall safety, physical conditions, and traffic operations within the Route 123 corridor for motor vehicle traffic, transit, and non-motorized users. MassDOT typically categorizes short-term (<1 year), midterm (1 to 3 years), or long-term (typically >3 years). Long-term improvements are typically considered to be substantial improvements with an expected time frame for implementation greater than 3 years. The costs are categorized as low (<$10,000), medium ($10,001 to $50,000), or high (>$50,000).

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), and improved markings for bicycle lanes.
- Re-evaluate crosswalk locations and strategic use of the Rapid Rectangular Flashing Beacon (RRFB).
- Evaluate potential changes in lane usage.
- New and revised signing upgraded to meet MUTCD reflectivity standards.
- Replace missing or damaged signs and or post legal limit signs where none exist.
- Post signs for shared use bicycle paths where feasible.
- Improve lighting along the road and at intersections.
- Construct, reconstruct, and replace sidewalks and add curb ramps in conformance with the Americans with Disabilities Act.
- Enhance speed management by providing immediate and strict speed enforcement.
- Traffic signal updates and modifications (improvements to equipment, coordination, and timing and phasing).
- Enhance street lighting in the corridor.

Overall long-term improvements:

- Continue to utilize pavement management system.
- Request that OCPC routinely monitor traffic conditions as part of its regional growth monitoring efforts.
- Continue to equip signalized intersections with ITS Signal Green Time Extension for BAT bus routes, especially in the Brockton downtown.
- Abington and Brockton should continue to participate in the Joint Transportation Committee (JTC) and Metropolitan Planning Organization (MPO) meetings.

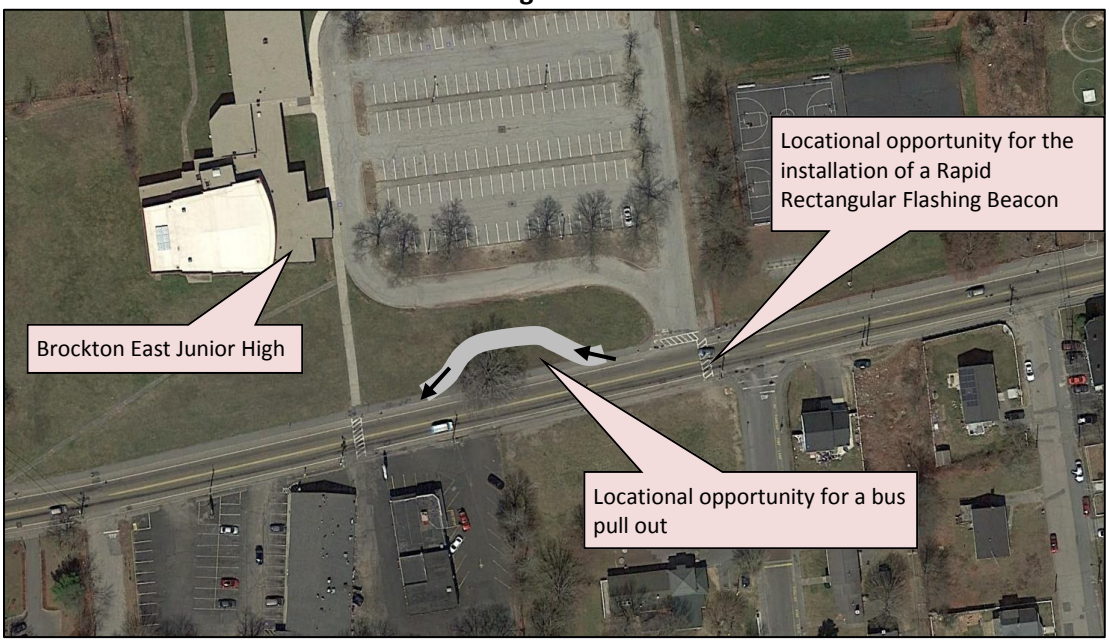
5.1.1 Transit Improvements for Consideration

The BAT bus route operating within the Route 123 corridor can benefit from the Intelligent Transportation System (ITS) strategy “Green Time Extension”, to improve bus on-time service, in addition to other corridor wide improvements for vehicle traffic flow, safety, and pedestrian circulation and access. The transit signal priority or “Green Time Extension” at signalized intersections is used to extend the green interval by a preset value if a transit vehicle is approaching an intersection. Detectors are located so that any transit vehicle that would just miss the green light (the specified maximum green

time) would get an extension of the green to be able to clear the intersection rather than waiting through an additional entire red interval. Green Time Extension only provides a benefit to those that arrive during a short window of time after the maximum green; however, the reduction in delay for the buses that do reach the intersection within that specified time just after the maximum green is substantial, which often varies approximately between 30 and 75 seconds. Currently, there are three intersections within the Route 123 corridor in Brockton downtown that have this technology. These include: Centre Street (Route 123) at Main Street/Legion Parkway, Centre Street (Route 123) at Montello Street (Route 28), and Centre Street (Route 123) at Commercial Street. There are two other intersections in the downtown that are not in the Route 123 corridor study area that have this technology. These include Court Street at Montello Street (Route 123) and Court Street at Commercial Street.

Physical improvements to sidewalks and street crossings help improve safety and convenience for bus ridership and should be considered for corridor-wide improvements on Route 123. According to the FHWA, transit customers are pedestrians for some part of their journey to the bus or train; therefore, safe and convenient pedestrian amenities enhance transit access. An extensive and convenient sidewalk system, with safe street crossings helps maximize transit ridership and customer satisfaction. In addition, opportunities to include more bus turn-outs should be identified and explored within the corridor. The area in front of the East Junior High School on Centre Street (Route 123) presents an opportunity for the creation of a bus turnout. Figure 23 shows this potential recommendation.

Figure 23



The East Junior High School in Brockton is located on Centre Street (Route 123) approximately one-quarter mile east of the Centre Street (Route 123)/Lyman Street/Cary Street intersection. There are post mounted flashing beacons on the eastbound and westbound side of Centre Street (Route 123) that denote a school zone with a 20 mile per hour speed limit during the morning and afternoon when school is in session. According to the Massachusetts Amendments to the MUTCD, the flashing beacons are in effect only for, “The hour(s) children are walking to school, the hour(s) children are leaving school, or during the school noon hour if children are allowed to leave the school property.” This means that once

school has dismissed classes in the afternoon, and the children have been given time to exit the school, (approximately an hour), the 20 MPH limit is not in effect; however, there is still a lot of pedestrian activity at the playground adjacent to the school. In addition, there is also substantial pedestrian activity at the playground on the weekends and during the summer. The mid-block crosswalk in front of the school parking lot, just south of Hill Street, is the point at which most students cross Centre Street to go into the school or to the playground. This presents an opportunity to add a Rapid Rectangular Flashing Beacon to enhance safety for pedestrians crossing Centre Street (Route 123). In addition, the public outreach interview with Brockton Area Transit identified the area in front of the east Junior High School as a potential location for a bus turnout.

Transit improvements within the Route 123 corridor in this study are focused primarily on improving traffic flow and efficiency of bus movement within the corridor. This includes improvements to the physical geometrics for bus turning movements as well as traffic signal optimization and the addition of green time extension priority at signalized intersections. Route 123 corridor is served directly by Brockton Area Transit (BAT) fixed route bus service, Centre Street, Brockton Hospital Route 5. According to the 2016 BAT Ridership report, Route 5 carries 4.6 percent of BAT's daily average ridership with an average of 443 passengers per day. It serves the fixed route service between the BAT Centre in Brockton Downtown and Wal-Mart in Abington. In addition, the BAT Rockland flex route serves Abington and Rockland beyond the Wal-Mart in Abington. It is recommended that the enhancement of convenience and safety for pedestrians as well as bus flow be continued in the corridor via improvements to sidewalks and crossings as well as through the use of IT in the application of signalization.

5.1.2 Bicycle Improvements for Consideration

Most of the Route 123 corridor is a two lane facility that varies in width between 32 to 40 feet. In Brockton east of Plymouth Street, Centre Street (Route 123) is approximately 35 feet wide with two twelve foot travel lanes and five foot shoulders on each side for bicycle accommodations. Bicyclists utilize the corridor for bike riding despite the high traffic volumes and speeds (speed limit varies between 40 and 45 miles per hour. In Brockton east of Plymouth Street, Centre Street (Route 123) is approximately 35 feet wide with two twelve foot travel lanes and five foot shoulders on each side for bicycle accommodations.

The *2014 Bikeability Assessment for Brockton* recommendations are included as part of the bicycle improvements for consideration in this report. The study area included the following corridors:

- School Street
- Main Street (Route 123 Eastbound between Belmont Street and Crescent Street)
- Warren Avenue (Route 123 Westbound)
- Legion Parkway (Route 123 Westbound)
- Belmont Street (Route 123 Eastbound)
- Crescent Street (Route 123 Eastbound)

According to the assessment, the streets were selected based on the high rates of bicyclists using the segments. The purpose of the assessment was to create a network of north/south and east/west corridors in the downtown. There are no on-road bicycle facilities within the study area. MassBike also focused on the following intersections:

- School Street at Lincoln Street
- School Street at Main Street
- Main Street at Belmont Street (Route 123 Eastbound)

- Main Street at Crescent Street (Route 123 Eastbound)
- Main Street at Elm/West Elm Street
- Main Street at Legion Parkway/Centre Street (Route 123 Westbound)
- Main Street at Pleasant Street
- Pleasant Street at Warren Avenue
- Warren Avenue at Legion Parkway (Route 123 Westbound)
- Warren Avenue at West Elm Street (Route 123 Westbound)
- Warren Avenue at Belmont Street (Route 123)
- Crescent Street at Montello Street (Route 123 Eastbound)

The study resulted in a number of short-term and long-term general recommendations. General short-term recommendations include:

- Evaluate the potential for striping bike lanes where appropriate.
- Conduct a parking study to see about the feasibility of removing parking on some segments.
- Consider adding more bike parking in commercial districts.
- Consider incorporating wayfinding signage for bicyclists connecting them to points of interest.

General long-term recommendations include:

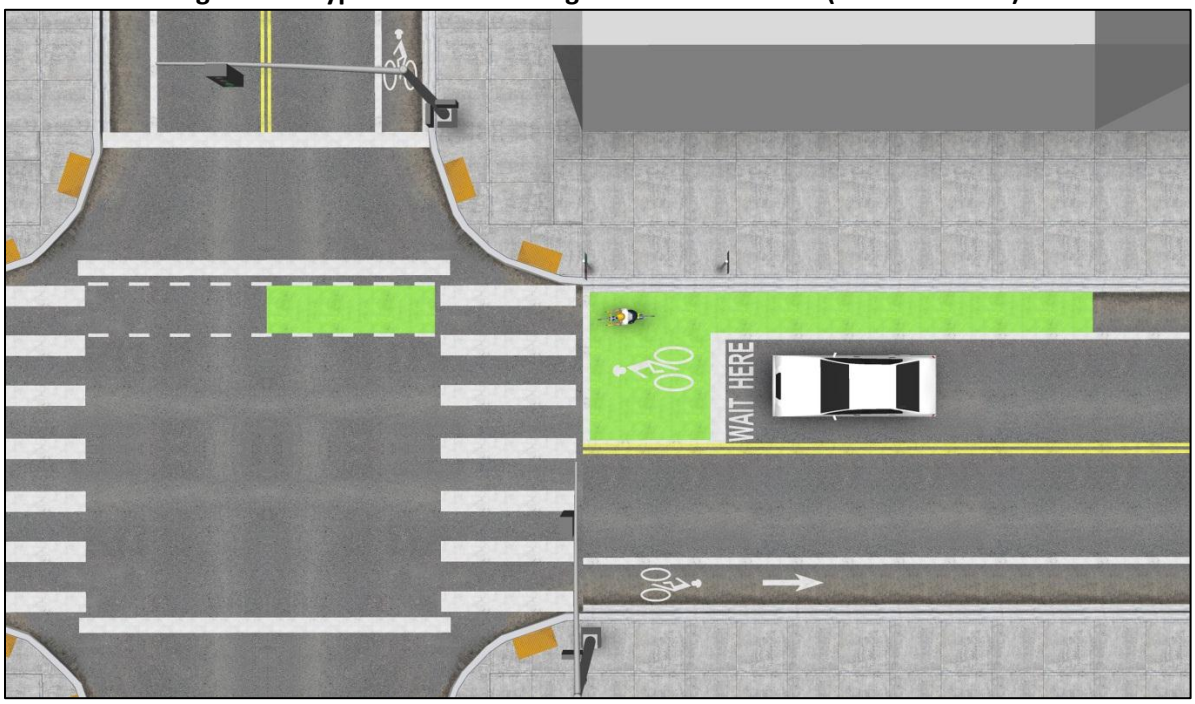
- Consider streetscape redesigns that incorporate Complete Streets policy.
- Consider road diets and narrowing travel lanes for all segments.
- Conduct a feasibility study about turning Main Street back into a two-way street for its entirety.
- Consider implementing contra-flow bike lanes where appropriate

Main Street - Brockton

The study has a number of short-term recommendations for Main Street, which impacts the Route 123 corridor (Main Street between Belmont Street and Crescent Street), these include, evaluating the potential for implementing bike lanes on Main Street, considering adding bike boxes and dashed bike lanes at the Main Street and Belmont Street Intersection, (the bike box and dashed bike lane will delineate a place for cyclists as they make left turns), considering adding wayfinding signage for bicyclists giving directions to points of interest by time rather than distance, and considering adding more bike parking on the east side of Main Street.

The study has a number of long-term recommendations for Main Street, which impacts the Route 123 corridor, these including considering curb extensions at the Main Street and Crescent Street intersection and the Main Street and Centre Street intersection to slow traffic down. In addition, the study recommended considering an intersection redesign at the Main Street and Legion Parkway/Centre Street intersection. This could include extending and widening the pedestrian median at the intersection of Main Street and Legion Parkway and implementing raised crosswalks. If Main Street is turned back to a two-way street, the study recommended an engineering study to investigate the feasibility for the implementation of protected bike lanes on both sides of Main Street and adding additional bike parking on the west side of the street. Figure 24 shows a typical bike box at a signalized intersection based on National Association of City Transportation Officials (NACTO) standards.

Figure 24 - Typical Bike Box at Signalized Intersection (Source NACTO)



Legion Parkway (Route 123 Westbound) - Brockton

For short-term recommendations, the study recommended considering a pilot of reverse-angle parking on Legion Parkway. This type of parking can be used as a traffic calming mechanism which helps reduce the speeds of motorists. The study also recommended considering striping bike lanes on both sides of Legion Parkway as well as adding more bike parking.

There were a number of long-term recommendations for Legion Parkway (Route 123 Westbound) in the study. These included considering a streetscape redesign that includes extending, widening, and landscaping the pedestrian median at both the Main Street and Warren Avenue intersections, adding speed tables at pedestrian crossings to calm traffic, reconfiguring the left turn lane on Main Street to align with the entrance to Legion Parkway, and conducting an engineering study to evaluate the potential for implementing bulb-outs at both the Warren Avenue and Legion Parkway intersection and the Main Street and Legion Parkway intersection.

Warren Avenue (Route 123 Westbound) - Brockton

The short-term recommendations for Warren Avenue in the study included repaving the roadway, painting sharrows on the road, adding a contra-flow bike lane onto Warren Avenue, and consider narrowing travel lanes.[5] The long-term recommendations included considering adding curb extensions to slow fast-turning traffic at the Warren Avenue/Legion Parkway intersection and the Warren Avenue/Belmont Street intersection. In addition, the long-term improvements included considering bus stop redesigns such as bulb-outs to calm traffic and provide dedicated space for buses on Warren Avenue.

[5] Note: Based on public outreach with Brockton Area Transit, narrowing travel lanes less than 12 feet has a negative impact on bus safety as BAT buses require the full 12 foot travel lanes to accommodate vehicles from mirror to mirror.

Belmont Street (Route 123 Eastbound) from Warren Avenue to Main Street - Brockton

The short-term recommendations for this section of Belmont Street in the study included considering determining the potential removal of parking on the street and considering narrowing travel lane widths. Other recommendations included a feasibility study to evaluate the potential implementation of a bike lane on the segment, the consideration of adding a green bike box with directional arrows at the intersection of Belmont Street and Main Street and adding dashed bike lanes at this intersection to delineate cyclists' road position. The long-term recommendation included considering the implementation of a two-way protected bike lane if there is enough space on the roadway.

Crescent Street (Route 123 Eastbound from Main Street to Commercial Street - Brockton

The short-term recommendations for Crescent Street included considering narrowing travel lanes and striping bike lanes on both sides of the street (see previous foot note regarding lane width requirements for buses), and considering adding Crescent Street to the scope of the proposed parking study to assess the needs for on-street parking, (there is a surface parking lot on the left side of the street at the intersection with Montello Street).

The Crescent Street and Montello Street Intersection - Brockton

For a long-tern recommendation at this intersection, the study recommended considering adding a bike box at the intersection of Crescent Street and Montello Street to help cyclists establish road position at the traffic light.

5.2 Potential Recommendations Summary

Table 20 summarizes the study findings, recommended improvements, and estimated implementation periods for the study area corridor and intersections.

Table 20 – Potential Recommendations Summary

Location	Findings	Potential Recommendations	Future Plans
Legion Parkway - Brockton	There is heavy pedestrian traffic on Legion Parkway during the day and during the AM and PM Peak hours. There are not enough crosswalks and other safety amenities for pedestrians crossing Legion Parkway.	Re-design, upgrade, and modernize Legion Parkway for improved Pedestrian and Bicycle accommodation. Add signage, crosswalks, and a Rapid rectangular Flashing Beacon for crossing Legion Parkway. Add wheelchair ramps on the island refuse for wheelchair crossing. Improve turning radii for trucks, left turns to Warren Avenue, (possible mountable curb). Coordinate Main Street traffic signals, Coordinate Warren Avenue Traffic signals.	
Centre Street (Route 123 westbound)/Montello Street Intersection - Brockton	This intersection is in the top 5 percent crash clusters for the OCPC region. There are long queues on the Montello Street northbound and southbound approaches during the peak hour.	Including this intersection in a coordinated signal system.	The City of Brockton has received a MassWorks grant for improvements to this intersection and a section of Centre Street from Montello Street (Route 28) to Main Street. The scope of work includes all of the Centre Street (Route 123 westbound)/Montello Street (Route 28) intersection and Centre Street west to Main Street (not including the Centre Street/Main Street intersection). The project includes replacing and upgrading traffic signal controller and equipment, improved signal timing and phasing, emergency preemption, adding an exclusive left turn lane on the Montello Street southbound lane, video detection, new sidewalks, and improved pavement markings (including bicycle sharrows and new crosswalks). The project includes new improved lighting, new traffic signs and directional signs. All sidewalks will be ADA compliant.
Centre Street (Route 123 westbound) from Montello Street to Main Street			Centre Street (Route 123 westbound) from Montello Street to Main Street is included in the Centre Street (Route 123 westbound)/Montello Street Roadway Improvement Project. Construction is currently underway July 2017. It includes roadway full depth reconstruction, sidewalk reconstruction (full ADA compliance), new lighting, improved traffic control and directional signage, and five foot bicycle lanes on both sides of the road.

Table 20 – Potential Recommendations Summary (continued)

Location	Findings	Potential Recommendations	Future Plans
Main Street at Crescent Street (Route 123 eastbound)	Red light running on the northbound approach problematic.	Enforcement	Overhead signals could improve signal visibility on the Main Street northbound approach.
Centre Street (Route 123/Plymouth Street - Brockton	This intersection is on the DOT Top 200 list. The LOS is at E and F during the peak hours on Plymouth Street approaches. There is heavy pedestrian traffic and school traffic due to the close proximity of the Ploufe School. There is limited sight distance on the Plymouth Street Southbound approach.		Re-align and redesign the intersection. Signalize or construct a roundabout. The City has submitted a PNF, and a Road Safety Audit will be scheduled for this location.
Centre Street (Route 123) at Cary Street/Lyman Street			
Centre Street (Route 123) at the East Junior High School – Brockton	This section of Route 123 is under state jurisdiction. There is heavy pedestrian traffic, (varies depending upon the time of year), crossing Route 123 from the neighborhoods on the south side of Route 123 and the north side, which has playgrounds next to the junior high school.		The installation of a Rapid Rectangular Flashing Beacon at this location will enhance pedestrian safety.
Brockton Avenue (Route 123) at Mill Street/Green Street/Martin Street – Abington	This is a five-way intersection. A crash cluster exists just east of the intersection, between this intersection and the Brockton Avenue (Route 123)/Wal-Mart intersection.		If Martin Street is closed off to Brockton Avenue (Route 123), access is still available via Green Street to Allen Street to Isabelle Street. This would make the intersection a four-way and reduce turning movement confusion at the intersection.
Brockton Avenue (Route 123) between Mill Street and Wal-Mart – Abington	There is a worn path due to heavy pedestrian volumes from the neighborhoods west of the Wal-Mart along the north side of Route 123 to the Wal-Mart.		Construct a sidewalk along the north side of Route 123 from Mill Street to the Wal-Mart.
Brockton Avenue (Route 123) at Wal-Mart – Abington	Lacks pedestrian signals for crossing Brockton Avenue safely.		Add pedestrian signals and crosswalks for safely crossing Route 123 at the intersection.
Brockton Avenue (Route 123) at High Street - Abington	There has been a fatality at this location. Route 123 lacks sufficient safe gaps in the mainstream traffic especially during the peak hours as vehicles experience long delays to turn from the High Street side street to the main flow on Route 123.	This intersection satisfies Warrant 1 eight hour volume, Warrant 2, Four hour vehicular volume, and Warrant 3, peak hour volume for traffic signals.	Signalize the intersection.

5.2.1 Legion Parkway - Brockton

Legion Parkway is located at Brockton's traditional downtown. An historic wooden traffic control stand where police officers were stationed to direct traffic before traffic signals were installed is located at the intersection of Main Street and Legion Parkway (Route 123). Legion Parkway (Route 123 westbound), from Main Street and Centre Street to Warren Avenue, is approximately 110 feet wide with a twelve foot median in the center. There is angled head in parking along Legion Parkway and along the median. Parking is not metered and limited to two hours.

The sidewalks along both sides of Legion Parkway are twelve feet wide. There are numerous shops (fast food, barber shops, clothing), and banking along Legion Parkway although economic viability is strained resulting in some vacant storefronts. The addition of the Brockton Neighborhood Health Center on Main Street at the corner of Legion Parkway has attracted and generated a substantial increase in pedestrian traffic to the area. According to its mission statement, the health center is a"…multicultural organization that collaborates with community agencies and residents to provide high quality comprehensive health care…and is linguistically, culturally and financially accessible...committed to health promotion and disease prevention." In addition, the Neighborhood Health Center opened up a branch office on Pleasant Street next to Warren Avenue. This new office along with Vicente's Grocery Store, which moved in next door, has contributed to the substantial increase foot traffic on Legion Parkway as many pedestrians cross Warren Avenue between the plaza and Legion Parkway. Legion Parkway has a number of amenities that promote walking, including:

- Ample free public parking (two hour limit)
- Wide sidewalks (approximately 12 feet wide)
- Pedestrian median refuge for pedestrians crossing the street
- The angled parking along legion Parkway slows traffic speeds
- Convenient BAT bus service (in front of the Neighborhood Health Center), and easy walking distance of Brockton's Downtown passenger rail service promote pedestrian traffic

Figure 25

Historic police traffic control stand at Main Street and Legion Parkway

Figure 26

Median and curb at Warren Avenue and Legion Parkway broken due to truck turns

Figure 27

Wide sidewalks on Legion Parkway

Figure 28

Ample parking and median refuge on Legion Parkway

Legion Parkway serves a dual purpose as both a destination and as a state numbered east west route through Brockton. There are 9,722 vehicles per day (eastbound and westbound) on Legion Parkway (Route 123). The percentage of truck traffic on Legion Parkway (Route 123) was not documented in the traffic count; however, the percentage of truck traffic on Route 123 just east of Main Street and Legion Parkway was recorded at 8.9 percent. In addition, field observation shows that Legion Parkway (Route 123) is a major east west truck route through Brockton downtown, and the turning radii at the Warren Avenue/Legion Parkway intersection is inadequate for trucks turning left from Legion Parkway (Route 123 westbound) to Warren Avenue to continue on Route 123 westbound. The trucks turning left often jump the curb on the Legion Parkway median, resulting in a broken curb and a hazard for pedestrians using the median for refuge. Figure 29 conceptualizes the potential improvements to Legion Parkway (Route 123 westbound).

Currently, angled parking along Legion Parkway is head-in parking only. The MassDOT Project Development and Design Guidebook calls for angled parking to be back-in parking only. According to the guidelines: "Where angle parking is created or retained, the designer should consider back-in angle parking as an alternative to traditional head-in angle parking. Accessible parking should be provided with an adjacent five foot to eight foot access aisle. Eight foot acceptable aisles can accommodate vans with lifts.[6] Back-in angle parking (also called "reverse-angle" parking) is a 90-degree opposite of traditional head-in angle parking, which is often seen on main streets. Although head-in parking is easy to enter, it is so dangerous for motorists to back out into the roadway. Motorists whose vehicles are parked back-in have better lines of sight when re-entering the roadway, the car door's swing directs children and passengers to the curb, and the trunk is conveniently curbside for loading. In addition, back-in parking eliminates problems such as blind reversing into traffic and the "dooring" of bicyclists. Back-in angle parking has been in use for decades in large cities such as Indianapolis, Philadelphia, and San Francisco, as well as in small cities like Birmingham, Syracuse, and Missoula. Locally, it has been in use in Union Square in Somerville, Massachusetts with positive results.

[6] MassDOT Project Development and Design Guidebook (Chapter 5 – Cross Section and Roadside Elements: 5.3.3.2 On-Street Parking).

Potential improvements to Legion Parkway include:

- Re-design, upgrade, and modernize Legion Parkway for improved Pedestrian and Bicycle safety, circulation, and access and accommodation
- Keep angled parking, but change "head-in" parking to "back-in" parking
- Add three textured sidewalks across Legion Parkway for better access between the north and south sides of the street (consider raised crosswalks if feasible)
- Add bicycle "sharrows" or painted bicycle paths if feasible
- Improve turning radii for trucks (Left to Warren Avenue from Legion Parkway westbound)
- Coordinate Main Street traffic signals
- Coordinate Warren Avenue Traffic signals

Figure 29 Potential Improvements to Legion Parkway

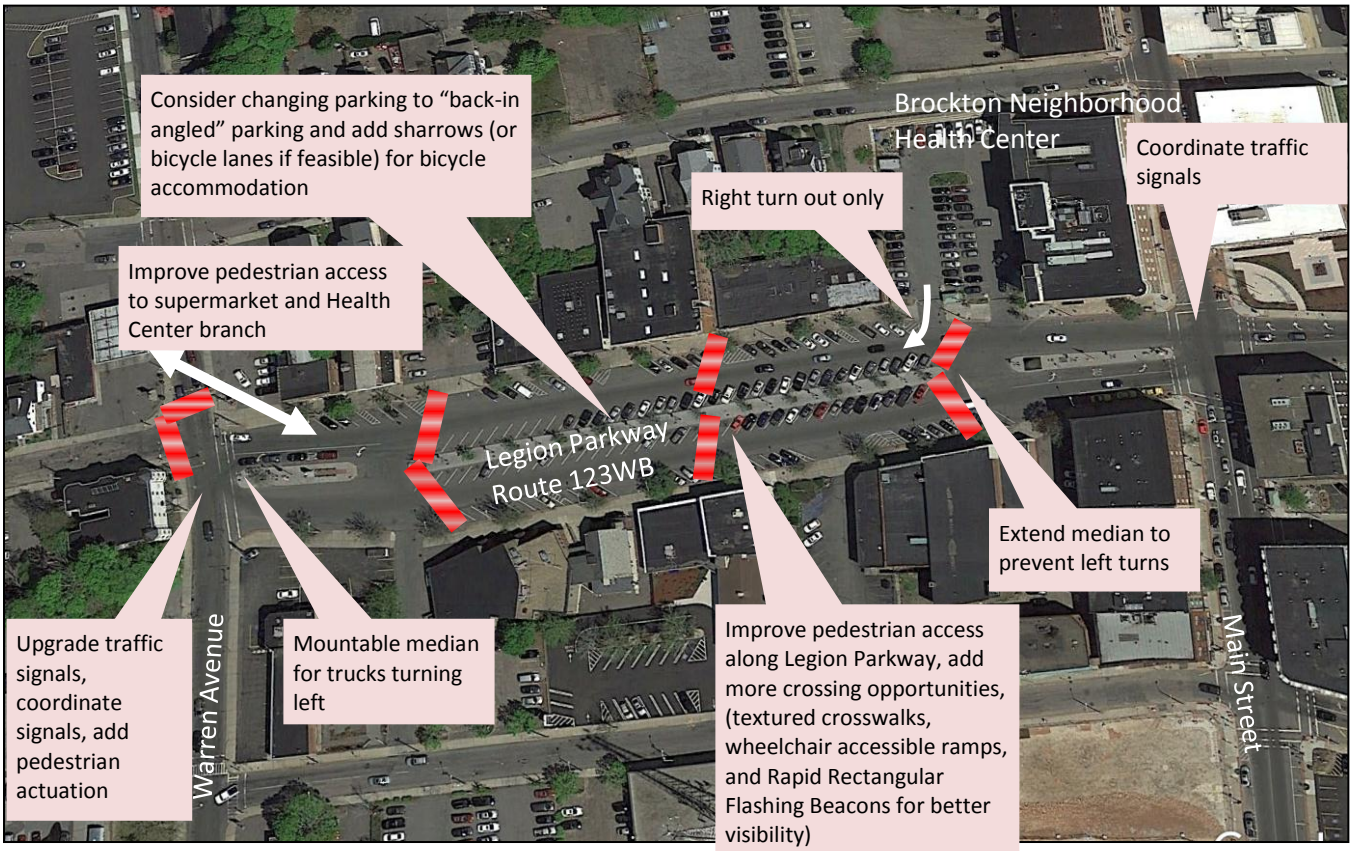


Figure 30

Rapid Rectangular Flashing Beacon

Figure 31

Sharrows for Bicycle Accommodation

5.2.2 Centre Street (Route 123 Westbound) from Montello Street to Main Street

Centre Street reconstruction between Montello Street and Main Street began in July of 2017. The project is funded utilizing a MassWorks grant to the City of Brockton. A copy of the design plans is included in the appendix to this report. The scope of the project includes the Centre Street (Route 123)/Montello Street (Route 28) intersection and Centre Street (Route 123) east from Montello Street to Main Street. A summary of the roadway improvements includes:

- Reconstruction and repaving of the Centre Street (Route 123)
- Improvements to the Montello Street (Route 28) and Centre Street (Route 123) intersection (signal upgrade, timing and phasing upgrades at intersections, pavement markings upgrade, new ADA compliant sidewalks and ramps, and new signage)
- Reconstruction of the sidewalks on the south side of Centre Street (the sidewalks on the north side of the street were reconstructed with the completion of the Trinity Development)
- Bicycle lanes on both sides of Centre Street (Route 123)
- The reconstruction and resurfacing of the roadway, including removing the old streetcar rails

Figure 32

The Reconstruction of Centre Street (Route 123 westbound) with new road base and reconstruction of sidewalk

5.2.3 Legion Parkway (Route 123 Westbound)/Warren Avenue/Highland Avenue Intersection – Brockton

The Legion Parkway (Route 123 Westbound)/Warren Avenue Intersection in Brockton downtown is a signalized four-way intersection with Warren Avenue one-way in the southbound direction. The intersection is included in a Top 5 Percent Pedestrian Crash Cluster for the OCPC region. Warren Avenue provides two twelve-foot travel lanes southbound. Legion Parkway (Route 123 Westbound) provides an exclusive left turn lane for vehicles turning left from Legion Parkway to Warren Avenue southbound, and a through lane from Legion Parkway to Highland Street. This left turn lacks proper turning radii for trucks as many tractor trailers jump the curb and end up on the island. The surface of the island is cracked due to heavy vehicles constantly being driven over the curb. The Highland Street eastbound approach provides a shared left turn, though, and right turn lane. Through traffic between Highland Street and Legion Parkway is at a jog due to the poor alignment of Highland Street. Although crosswalks are provided across the southbound Warren Avenue approach, the Highland Street approach, and Legion Parkway, there are no pedestrian signals or push button activation. The crosswalks and pavement markings are faded and the traffic signal antiquated. Pedestrian traffic has increased greatly at this intersection with the redevelopment of the commercial plaza on Pleasant Street and the addition of Vicente's Grocery Store and the Brockton Neighborhood Health Center branch. These abut Warren Avenue and are within easy walking distance of Legion Parkway. Recommendations for this intersection include:

- Upgrading traffic signal equipment to include signal coordination with other signalized Warren Avenue intersections, including Warren Avenue at Pleasant Street and Warren Avenue at Frederick Douglass
- Upgrade traffic signals to include pedestrian signals, push button actuation, and a pedestrian phase
- Restripe faded crosswalks and pavement markings
- Consider a mountable curb for the Legion Parkway island on the Legion Parkway westbound approach

Figure 33

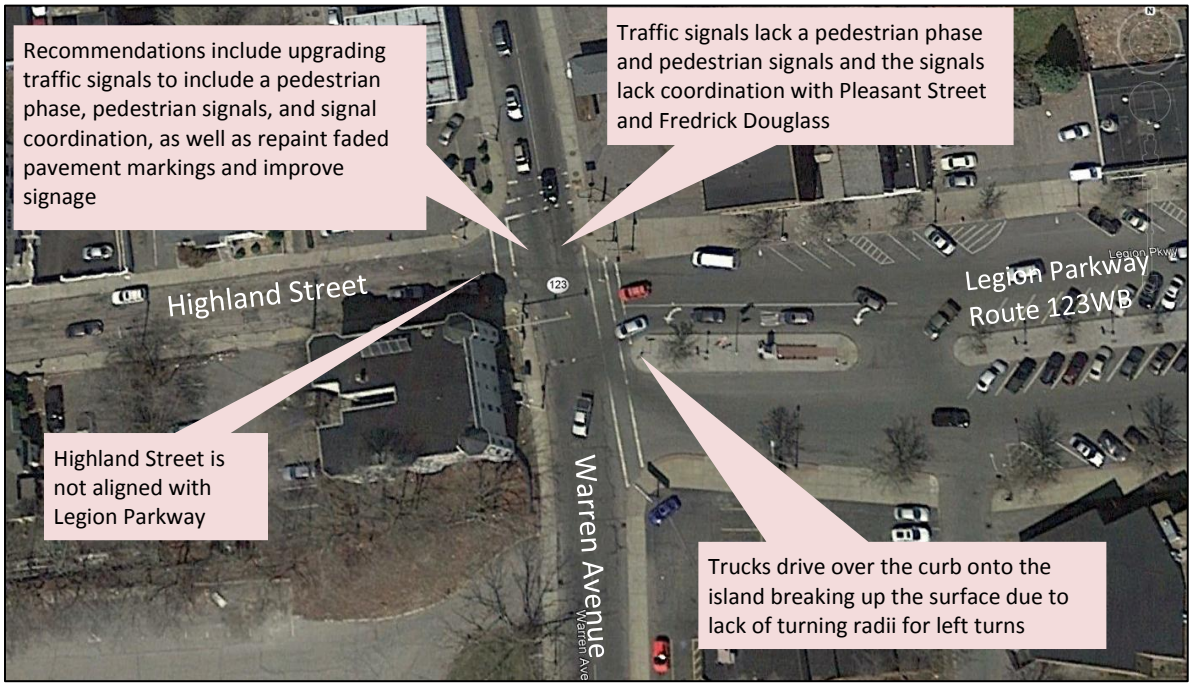


Table 21 - Centre Street (Route 123 Westbound)/Warren Avenue/Highland Street Intersection - Brockton

Jurisdiction	AM Peak Overall LOS	PM Peak Overall LOS	No-Build 2022 AM LOS	No-Build 2022 PM LOS	Crash Rate	Number of Crashes (3 Years)
Brockton	C	C	C	C	0.88	17

5.2.4 Centre Street (Route 123 Westbound)/Montello Street Intersection - Brockton

The City of Brockton has received a MassWorks grant for improvements to this intersection and a section of Centre Street from Montello Street (Route 28) to Main Street. The design plans call for new sidewalks, pavement markings, signal equipment, and signage. The pavement markings design plan includes painted bicycle lanes for Centre Street west of Montello Street and sharrows on the Montello Street approaches. The design plans also include new signage designation for Montello Street, which is Route 28, and on Centre Street, which is Route 123. The plans call for the implementation of Intelligent Transportation Systems including video detection and emergency vehicle pre-emption, as well as conduit for future hard-wire signal coordination connections.

Improvements to this intersection, based on the design plans, include adding an exclusive left turn lane on the Montello Street (Route 28) southbound lane as well as a revision of the timing and phasing of the signal. Table 22 summarizes the existing conditions, and future "No-Build' and "Build" conditions, including the level-of-service and crash rates, for the Centre Street (Route 123 Westbound)/Montello Street East Main Street intersection. As shown in Table 22, existing and future "No-Build" and "Build"

LOS are characterized by LOS "C". The crash rate at this intersection is the same as the District 5 average (0.77 Crashes per Million Entering Vehicles).

Table 22 - Centre Street (Route 123 Westbound)/Montello Street - Brockton

Jurisdiction	AM Peak Overall LOS	PM Peak Overall LOS	No-Build 2022 AM LOS	No-Build 2022 PM LOS	Build 2022 AM LOS (Signal)	Build 2022 PM LOS (Signal)	Crash Rate	Number of Crashes (3 Years)
Brockton	C	C	C	C	C	C	0.77	26

The design plans are included in the appendix to the report. A summary of the intersection improvements includes:

- Reconstruction and repaving the Centre Street (Route 123)/Montello Street (Route 28) intersection
- Improvements to the intersection include new traffic signals, timing and phasing upgrades, an addition of an exclusive left turn lane on the southbound approach, pavement markings upgrade, new ADA compliant sidewalks and ramps, and new signage
- Bicycle lanes on both sides on Centre Street (Route 123) west of the intersection and sharrows on the Route 28 northbound and southbound approaches to the roadway

Figure 33

The Reconstruction of the Centre Street (Route 123)/Montello Street (Route 28) intersection

5.2.5 Main Street at Crescent Street (Route 123 eastbound)

Main Street and Crescent Street form a "T" type intersection in Brockton downtown. Main Street is one-way northbound and contains three approach lanes, two through lanes and an exclusive right turn lane. Crescent Street has one approach lane, which is for right turns only as Main Street is one-way northbound.

Route 123 is not a straight, direct east-west corridor through the downtown. Route 123 eastbound enters the downtown via Belmont Street. Belmont Street ends at Main Street and Route 123 eastbound transitions to Main Street (northbound for about 200 feet) and then eastward again via Crescent Street.

Trucks headed east on Route 123 turn left from Belmont Street to Main Street and then, within a short 200 feet distance, take a right turn from Main Street onto Crescent Street. This right turn lacks the proper turning radii for large trailer tractors, and the back wheels of many of the trucks end up driving over the sidewalk at the southeast corner of Main Street and Crescent Street. Some trucks take a wider turn at this location and cross the double yellow line encroaching on Crescent Street traffic headed into the intersection in the opposite direction (right turns only to Main Street). Red light running on the northbound Main Street approach is problematic. This intersection does not have overhead signal heads and visibility is difficult as vehicles weave between the Main Street through lane and the exclusive right turn lane to Crescent Street.

This intersection is included in the MassDOT's Highway Safety Improvement Program (HSIP) Top Five Percent Crash Clusters for the OCPC region for pedestrian crashes and bicycle crashes. This intersection has a right turn green arrow on the Main Street northbound approach as the right turn only Crescent Street green phase is turned on. Often the through traffic on the Main Street northbound approach waiting at the red will block the vision of right turning vehicles (which have a green right arrow) as pedestrians cross Main Street. In addition, these right turning vehicles sight lines for detecting pedestrians crossing Crescent Street at the intersection blocked by the building on the corner. The recommendations for improvements to this intersection include replacing the pole mounted signal heads with overhead signals for better motorist visibility to prevent red light running, and signage warning pedestrians to actuate the pedestrian phase for an all red to cross the intersection.

Figure 34

The Main Street/Crescent Street (Route 123) intersection showing two through lanes, exclusive northbound right turn (green arrow), and lack of overhead signal heads

5.2.6 Centre Street (Route 123/Plymouth Street - Brockton

The Centre Street (Route 123)/Plymouth Street intersection is a four-leg intersection (stop-controlled on the Plymouth Street northbound and southbound minor street approaches), located just east of the downtown. Its location, at the edge of the downtown and just across Trout Brook from residential streets, makes this intersection a gateway to Brockton's downtown. Plymouth Street is a collector road that functions as a bypass between Court Street and Crescent Street (Route 27), with the Plouffe School located at the corner of Crescent Street (Route 27) and Plymouth Street. In addition, the BAT Centre and BAT Garage are about 600 feet to the west at Centre Street and Commercial Street. George Snow Park is located off of the south side of Centre Street to the east of the intersection as well as the

O'Donnell playground on the north side of Centre Street across from Snow Park. The Salvation Army is located next to the intersection, (east of Plymouth Street across from Trout Brook). The Crescent Court Apartments, a residential development, is located on Plymouth Street, southwest of the intersection.

Although the minor street northbound and southbound Plymouth Street approaches provide one shared through, left turn, and right turn lane, both of these approaches are wide enough so that a de-facto right turn lane occurs as vehicles turning right go around vehicles waiting to turn left. The Centre Street (Route 123) westbound approach into the intersection provides a single shared right turn, through, and left turn lane. The Centre Street (Route 123) eastbound approach into the intersection provides a shared through left turn lane and an exclusive right turn lane. This eastbound approach has a four lane cross-section and is approximately 65 feet in width, which presents a long, hazardous crossing for pedestrians. There are four twelve foot lanes plus two eight foot shoulders used for parking on Centre Street (Route 123) west of the intersection. Some motorists use the south side of the eastbound Centre Street approach for commuter rail parking. The time restrictions are posted across from the BAT Garage near Commercial Street, but are not posted on Centre Street (Route 123) near the Centre Street (Route 123)/Plymouth Street intersection (near the Crescent Court Apartments). In addition, some motorists park on the west side of Plymouth Street, near the Crescent Court Apartments, south of the intersection which also provides an eight foot shoulder.

Traffic operations are impacted by the limited sight distance on the southbound Plymouth Street approach to the intersection. Vehicles pulling up to the stop sign on this approach often inch forward in order to have clear sight lines to the east at vehicles approaching from the east headed westbound on Centre Street (Route 123). Thirty of the forty-one crashes at this intersection were "angle" type crashes, which involved vehicles on the southbound or northbound approach not properly stopping and yielding the right of way to Centre Street traffic. This intersection is on the Massachusetts Top 200 Hazardous Intersection list. It has a crash rate of 2.62 crashes per million entering vehicles (MEV), which is three times higher than the state and District 5 DOT averages.

The existing levels-of-service for the critical minor street movements (northbound and southbound through and left turns) are LOS "F" characterized by very long delays and forced flow movements. Potential improvements include signalizing the intersection or constructing a modern roundabout as an alternative. Both of these fixes should result in lower crashes, especially the cross movement "angle" type crashes, and improved LOS with lower delays for vehicles traveling through the intersection. Table 23 summarizes the morning and afternoon peak hour LOS for existing and future scenarios. Table 23 shows that the LOS will greatly improve to LOS "B" for the morning and afternoon peak hours with signalization or the construction of a roundabout.

Figure 35 – Centre Street (Route 123) at Plymouth Street

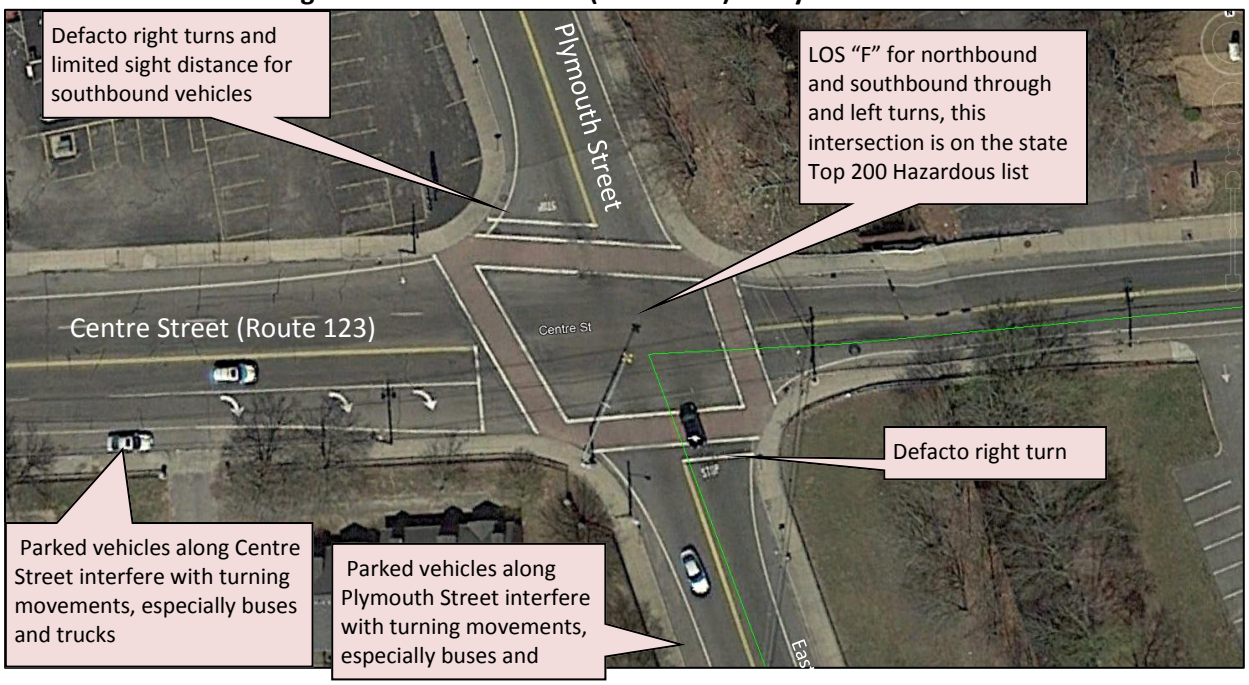


Table 23 – Centre Street (Route 123)/Plymouth Street

Jurisdiction	AM Peak LOS (Minor Street)	PM Peak LOS (Minor Street)	No-Build 2022 AM (Minor Street)LOS	No-Build 2022 PM (Minor Street)LOS	Build 2022 AM LOS (Signal)	Build 2022 PM LOS (Signal)	Build 2022 AM LOS Roundabout	Build 2022 PM LOS Roundabout	Crash Rate	Number of Crashes (3 Years)
Brockton	F	F	F	F	B	B	B	B	2.62	41

The City of Brockton has submitted a Project Notification Form (PNF) to MassDOT initiating the federal-aid process and for adding an improvement project for this intersection to the Transportation Improvement Program, (TIP). The results of signal warrant analyses show that the intersection meets the warrants of the MUTCD for Warrant 1, Eight Hour Vehicular Volume, and warrant 2, Four Hour Vehicular Volume. A Road Safety Project was scheduled for this intersection for September 21, 2017.

5.2.7 Centre Street (Route 123) at Cary Street/Lyman Street

Centre Street (Route 123) forms a four-way signalized intersection with Cary Street as the northern leg and Lyman Street as the southern leg of the intersection. MassDOT has jurisdiction over Route 123 east of the intersection and into Abington. Centre Street (Route 123) is a two lane cross-section and the eastbound and westbound approaches to the intersection have a single shared right turn, through, left turn lane. Cary Street and Lyman Street also have a two lane cross section. The Cary Street southbound approach has a shared right turn, through, left turn lane and the Lyman Street northbound approach has a shared right turn, through, left turn lane. The traffic signal equipment is antiquated and post mounted. The signal posts, because of their locations on the corners of the intersection, are knocked over often due to a lack of turning radii for trucks, which sometimes end up on the sidewalks. The potential improvements at this intersection include relocating the signal posts and installing new signal equipment with overhead signal faces for better visibility.

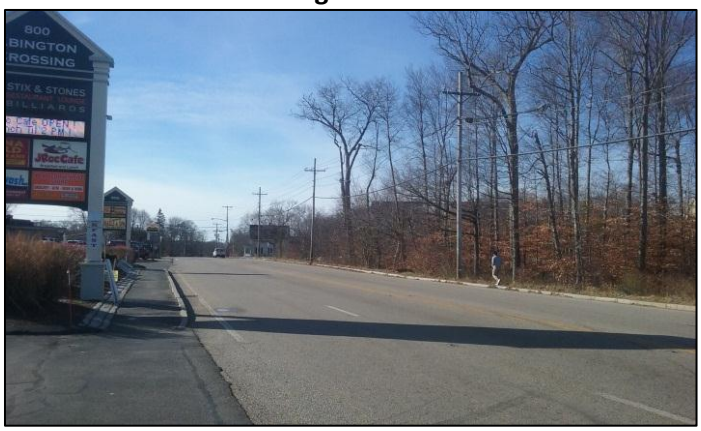
Table 24 Centre Street (Route 123)/Cary Street/Lyman Street Intersection

Jurisdiction	AM Peak LOS (Overall)	PM Peak LOS (Overall)	No-Build 2022 AM LOS (Overall)	No-Build 2022 PM LOS (Overall)	Crash Rate	Number of Crashes (3 Years)
MassDOT	D	E	E	F	1.31	33

5.2.8 Brockton Avenue (Route 123) between Mill Street and Wal-Mart – Abington

The section of Brockton Avenue (Route 123) in Abington between Mill Street and the Wal-Mart is included in the Five Percent Crash Clusters (HSIP eligible) for the OCPC region. Brockton Avenue (Route 123) transitions from a two-lane cross-section to a four lane cross section east of Mill Street, and vehicles tend to speed up within the four lane section. There is a lane drop from two lanes to one lane on the westbound side of Brockton Avenue (Route 123) as it approaches the Mill Street intersection. In addition, there is a commercial plaza on the south side of Brockton Avenue with two open curb cuts. One of the curb cuts is located at the westbound lane merge. These curb cuts create conflicts as vehicles enter and exit the plaza to and from Brockton Avenue (Route 123). There were 42 crashes within this crash cluster, although fourteen have been identified as taking place within the parking lot of the commercial plaza. There was one fatal crash, which resulted from a pedestrian being hit by a vehicle as he tried to cross Route 123 at this location. The crashes are summarized in the appendix to this report. On the north side of Brockton Avenue (Route 123) there is a worn path on the side of the road where pedestrians walk. The recommendations for this location include constructing a sidewalk on the north side of Brockton Avenue (Route 123) and adding warning signs for the lane drop.

Figure 36



Brockton Avenue (Route 123) between Mill Street and Wal-Mart in Abington showing lane drop Route 123 westbound, the commercial plaza curb (on left), and a pedestrian walking along the north side of Brockton Avenue (Route 123).

5.2.9 Brockton Avenue (Route 123) at Wal-Mart – Abington

The access drive to the Wal-Mart in Abington at Brockton Avenue (Route 123) forms a signalized four-way intersection with a liquor store driveway making up the northbound leg of the intersection opposite the Wal-Mart Driveway. Brockton Avenue is a four-lane cross-section at this location, with a shared left turn-through lane and shared right turn-through lane on the eastbound and westbound approaches to

the intersection. The Wal-Mart approach provides an exclusive right turn only lane and a shared left turn-through lane. The Brockton Avenue (Route 123) eastbound approach has a protected lead phase for left turns into the Wal-Mart, and then a combined eastbound westbound lag phase. This intersection lacks crosswalks, pedestrian actuation, and pedestrian signals, although field observations and the worn path along the north side of Brockton Avenue show that there is pedestrian activity. There were some pedestrians counted during the turning movement count for the intersection, although there is not heavy pedestrian traffic. The levels-of-service for this intersection are LOS "B" for the existing morning and afternoon peak hours and for the future "No-Build" peak hours. The addition of the pedestrian phase would have minimal impact on the peak hour as it is expected that pedestrians would interrupt the timing and phasing only two to three times during the peak hour with an actuated pedestrian phase.

5.2.10 Brockton Avenue (Route 123) at High Street - Abington

Brockton Avenue (Route 123) and High Street form a four-way unsignalized intersection in Abington. Brockton Avenue (Route 123) at this intersection is a two-lane cross-section with a single shared left turn, through, right turn lane on the eastbound and westbound approaches. High Street has a stop sign on the northbound and southbound approaches, which have a shared left turn, through, right turn lane. There was one fatal crash (head-on) within the three year crash period and the LOS for the existing morning and afternoon peak hours is "F" forced flow for the morning peak hour and LOS "E" for the afternoon peak hour for the High Street minor street approaches. Route 123 lacks sufficient safe gaps in the mainstream traffic especially during the peak hours as vehicles experience long delays to turn from the High Street side street to the main flow on Route 123. The future "No-Build" is LOS "F" for the minor street northbound and southbound approaches. This intersection satisfies Warrant 1 eight hour volume, Warrant 2, Four hour vehicular volume, and Warrant 3, peak hour volume for traffic signals. Table 25 summarizes the LOS and the crash data for the intersection. Table 25 shows that the intersection would operate under LOS "B" conditions if a signal was installed at the intersection.

Table 25 Brockton Avenue (Route 123)/High Street Intersection

Jurisdiction	AM Peak LOS (Minor Street)	PM Peak LOS (Minor Street)	No-Build 2022 AM (Minor Street)LOS	No-Build 2022 PM (Minor Street)LOS	Build 2022 AM LOS (Signal)	Build 2022 PM LOS (Signal)	Crash Rate	Number of Crashes (3 Years)
MassDOT	F	F	F	F	B	B	1.07	18

6 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:** This 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:** This program 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:** This 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):** This 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.
- **Highway Safety Improvement Program (HSIP):** This program is a core Federal-aid program with the objective of achieving a significant reduction in traffic fatalities and injuries.
- **National Highway System (NHS):** This 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):** This program 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.
- **Surface Transportation Program (STP):** This 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 Alternative Program (TAP):** The TAP program provides Federal-aid funding for programs and projects defined as transportation alternatives, including on and off road pedestrian and bicycle facilities, infrastructure projects for improving non-driver access to public transportation and enhanced mobility, community improvement activities, and environmental mitigation; recreational trail program projects; safe routes to school projects; and projects for planning, designing, or constructing boulevards and other roadways largely in the right-of-way of former Interstate System routes or other divided highways.
- **Transportation Bond Bill (TBB):** This 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:** These allocate federal funding for federal aid eligible projects.
- **Massachusetts Complete Streets Program:** This program provides $12.5 million dollars for two years beginning in 2016 to municipalities to implement Complete Streets projects. Municipalities must adopt Complete Streets policies and send staff for training for eligibility.
- **MassWorks Infrastructure Program**: 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 Turning Movement Counts
OCPC Intersection Levels-of-Service
Signal Warrant Analysis
OCPC Intersection Crash Rate Calculation
Public Meeting Flyers and Sign-up Sheets
MassDOT Project Need Form
MassDOT Project Initiation Form