

MAIN STREET BROCKTON CORRIDOR STUDY

Old Colony Planning Council
70 School Street
Brockton, MA 02301

Prepared under MassDOT Contract #108210

November 2020

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The preparation of this report has been financed in part through grant[s] from the Federal Highway Administration, U.S. Department of Transportation, under the State Planning and Research Program, Section 505 [or Metropolitan Planning Program, Section 104(f)] of Title 23, U.S. Code.

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Main Street Brockton Corridor Study

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1 Introduction

1.1 Study Purpose and Scope

The purpose of Main Street Brockton Corridor Study is to study transportation and safety operations within the corridor (approximately 5.2 miles), and to develop short term and long-term recommended improvements. The recommendations will include improvements and strategies to improve circulation, traffic flow, safety, and bicycle and pedestrian accommodation. The Main Street corridor study area begins at the Brockton City Line/West Bridgewater Town Line, and concludes on North Main Street at the Brockton City Line/Avon Town Line. The study has public participation outreach as part of the process, including public presentations, stakeholder interviews, and public workshops.

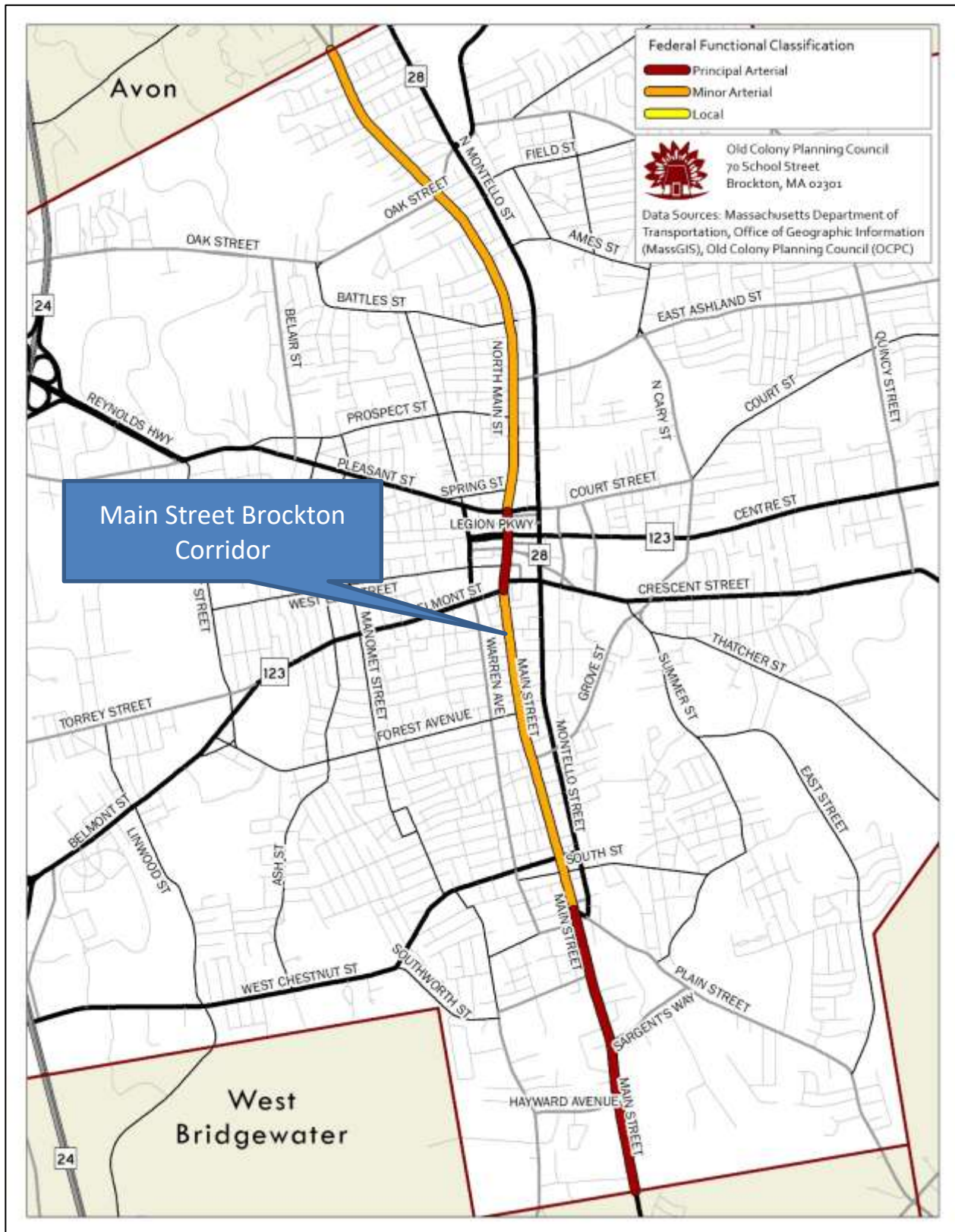
The goals of this study include identifying, addressing, and alleviating transportation deficiencies in the corridor thereby enhancing the movement of people and goods, improving circulation and traffic flow efficiency, improving safety and bicycle and pedestrian accommodation, and reducing gaps to essential services. This study was completed in cooperation with the City of Brockton and the public outreach component includes meetings with state public officials, local officials, as well as with the business community and neighborhood community groups. 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 and future 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), bus routes and transit accommodation, pedestrian accommodations, 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. The study includes the potential impact of economic improvement plans for the downtown and the planned two-way street conversion for Main Street in the Brockton Downtown.

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. 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) to discern the need for signal installation. 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).

The “Complete Streets” concept (designing roads to accommodate all road users), traffic calming, access management, and review of local and state plans were discussed in the public outreach meetings to develop specific improvement projects and to define a long term vision for the study area corridor and intersection locations. Improvements for pedestrians have been proposed to support transit use (where applicable), and to ensure mobility, safety, and access for all users.

Figure 1 – Main Street Corridor Study Area and Classification



1.2 Public Outreach

The study process requires a public outreach program for the identification of transportation issues important to 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 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.

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 as well as conducting an on-line survey. The website page provides an overview of the project, notices of public meetings, survey link, and the conclusions and improvements resulting from the study. The study included presentations of existing conditions and potential improvements. OCPC's meetings are held at local 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 On-Line Survey

OCPC developed a questionnaire survey to help identify and prioritize problems and improvement strategies within the Main Street Brockton corridor study area. The survey was made available on-line via web-link on OCPC's web page, and was also distributed at events, presentations, and meeting via hard copy (pen and paper), to gather as many samples as possible. 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, which received 142 responses, was available electronically via a link on OCPC's website through Survey Monkey. Eighty-one percent of the respondents were from Brockton. The remaining respondents were from towns in close proximity. The results of the survey are shown in the following tables:

Question 1: Where do you Live?

Table 1 – Question 1 Responses

Response	Percent Responses
Brockton	81 %
East Bridgewater	4 %
Easton	4 %
Bridgewater	2 %
Taunton	2 %
Mansfield	2 %
Sharon	2 %
Carver	2 %
Other	1 %

Question 2: What is your primary choice of Transportation?

Table 2 - Question 2 Responses

Response	Percent Responses
Vehicle	95.5 %
Walking	3.5 %
Biking	0 %
Bus	1 %
Train	0 %
Rode hail app (Uber, Lyft, etc.)	0 %

Question 3: Do you use a mobile assistance device (walker, scooter, wheelchair, etc.)?

Table 3 - Question 3 Responses

Response	Percent Responses
Yes	3.5 %
No	96.5 %

Question 4: At what intersection or location do you experience the worst congestion or delays with the Main Street Brockton corridor?

Table 4 - Question 4 Responses

Response	Percent Responses
Main Street at Legion Parkway/Centre Street - DOWNTOWN	26%
Main Street at Pleasant Street - DOWNTOWN	28%
Downtown from Belmont Street to Pleasant/Court Street - DOWNTOWN	16%
Main Street at Belmont Street - DOWNTOWN	6%
Main Street at Grove to Main at Forest (Vicente's Grocery)	4%
North Main Street at Oak Street	10%
Other	10%

Question 5: How much delay do you usually experience at this location?

Table 5 - Question 5 Responses

Response	Percent Response
Short wait	26%
Five minutes	48%
Fifteen minutes	17%
20 minutes or more	10%

Question 6: What time of day does the congestion occur?

Table 6 - Question 6 Responses

Response	Percent Responses
Morning	20%
School Hours	10%
Afternoon	38%
Night	9%
All Day	17%
Other	6%

Table 7 - Question 7 Responses

Question 7: What time of year does the congestion occur?

Response	Percent Responses
Summer	3%
Fall	2%
Winter	1%
All year	78%
School Year	16%

Question 8: What do you believe is the root cause for congestion and delay?

Table 8 - Question 8 Responses

Response	Percentage Response
Poor Signal Timing and/or lack of signal coordination	28%
Lack of capacity in the road network for the demand	27%
The one-way circulation downtown causes problems	12%
Poor driver behavior and lack of enforcement/education	11%
Poor Geometry and road infrastructure	10%
Other	12%

Question 9: Do you combine different modes of transportation on your commute?

Table 9 - Question 9 Responses:

Response	Percentage Response
Walking	11%
Walking/Train	4%
Walking/Bus	8%
Walking/Train/Bus/Ride Hail	1%
Train/Bus	1%
Train	2%
Bus	1%
Do not combine modes	71%

Question 10: What obstacles do you face while commuting (Example; sidewalk conditions, potholes, traffic, bicycling conditions, bus delays, etc.)?

Table 10 - Question 10 Responses:

Response	Percent Response
Congestion and Traffic	32%
Potholes and road surface conditions	32%
Bus Delays	7%
Poor sidewalk conditions and walking conditions	12%
Speeding reckless driving	6%
Pedestrians jaywalking	3%
Other	8%

Question 11: What improvements for safety and convenience do you think should be made in the study area for better mobility conditions (Example: Bicycle lanes, bus lanes, bus shelters, police enforcement, better sidewalks, better lighting, etc.)?

Table 11 – Question 11 Responses:

Response	Percentage Responses
More police enforcement	18%
Better Lighting and visibility of pavement markings and traffic control	10%
Improve sidewalks, infrastructure, and crossings	21%
Add signals, improve signal timing/phasing, and/or coordination	8%
Implement two-way system in the Downtown	10%
Add bicycle lanes, improve bike infrastructure (bicycle tracks, bike parking)	13%
Add bus lanes, more bus service	7%
Education	4%
Other	9%

Question 12: Additional Comments.

Table 12 - Question 12 Responses:

Response	Percent Responses
Implement better access management	2%
More traffic enforcement, red light running/distracted driving	35%
More public education	21%
Implement the two-way Main street conversion	14%
Address safety concerns at Main Street and Legion Parkway	2%
Eliminate bus fare at the farebox	2%
Need more signal coordination/visibility downtown	12%
Improve timing/phasing at North Main Street and Oak, add left turn phase	2%
Other	9%

1.2.2 Public Outreach and Meetings

OCPC held meetings 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. Stakeholder identification and outreach was a proactive process, involving visits to downtown businesses and agencies, as well as a coordinated campaign with the City of Brockton, local agencies, businesses, and interested groups. Stakeholder outreach included regular updates to the Old Colony Metropolitan Planning Organization (MPO) and Joint Transportation Committee (JTC).

In addition to the stakeholder meetings, OCPC scheduled a public workshop to garner input from the public on the public’s priority issues concerning transportation within the Main Street Brockton corridor. The meeting took place on February 18, 2020 (Existing Conditions Public Meeting), at the Brockton Public Library on Main Street in Brockton at 6:00 PM.

OCPC staff also met with and interviewed a number of stakeholders, which included local elected officials and representatives of agencies to discern the transportation priorities for the Main Street Brockton Corridor.

Main Street Brockton Corridor Study Public Meeting Workshop February 2020

OCPC held a public meeting workshop focusing on existing conditions in the Main Street corridor on February 18, 2020 at the Brockton Public Library. The meeting was advertised on community access cable as well as on OCPC’s web site. Flyers announcing the meeting were sent to stakeholders and interested parties. In addition, OCPC distributed flyers to downtown businesses. A list of Main Street businesses and stakeholders visited for flyer distribution is included in the appendix to this report. The sign-up sheet for the meeting is also included in the appendix to this report.

The meeting presentation covered the geographic scope of the study as well as the study scope including existing conditions, the built environment, a review of the land use, and a review of planned improvements.



Main Street Brockton Corridor Study public meeting February 18, 2020

The Brockton Parking Authority

A meeting with the Brockton Parking Authority on 1/24/2020 resulted in a discussion of the following issues:

- The Brockton Parking Authority has recently replaced all meters in the downtown with new “Smart” meters.
- All metered spaces in Downtown Brockton are priced at one dollar per hour.
- Data on parking turnover and use are retrieved in a central location remotely and electronically via the “Smart” metering system.
- Changes to the meters can be achieved remotely and electronically via the “Smart” metering system in a central location.
- Time limits on metered spaces have been eliminated.
- The opening of the new 414 parking space Carpenter Garage on Campanelli Street will occur in March 2020 based on final building inspections.

Brockton Area Transit (BAT)

A number of Main Street issues were discussed with BAT officials at a meeting with the Brockton Area Transit (December 4, 2019). These included the need for enhanced pedestrian safety for pick-ups and drop-offs of BAT riders on the fixed route bus lines along Main Street. These include safer crossings as well as bus shelters and ADA accessible ramps at intersections. Separate raised bicycle paths are preferable for Main Street to avoid conflicts with buses along the corridor. This also helps to keep vehicles from parking in bicycle lanes that are separated from the travel way with only a white painted line.

Other issues included a need for adequate turning radii for buses in any redesign of intersections as well as the need for extended green at signalized intersections, especially in the downtown, for buses, as signal pre-emption along the corridor is inconsistent. BAT will hire an engineering consultant to evaluate the proposed two-way downtown conversion for impacts to bus service and operation along Main Street.

Downtown Brockton Association, January 29, 2020

At its regular meeting of the Brockton Downtown Association on January 29, 2020, OCPC introduced the scope of the Main Street Corridor Study, a review of the existing conditions, and facilitated a discussion of the issues regarding safety and congestion in the corridor. The discussion focused around safety in the corridor, particularly for pedestrian safety and circulation. Other issues included the need for better visibility of signal faces for two downtown intersections, the Main Street/Crescent Street intersection and the Main Street/Legion Parkway/Centre Street intersection. The lack of defined signal visibility on Main Street, coupled with an increase in distracted driving have likely precipitated a spike in crashes in the downtown.

Plymouth District Attorney's Office

On February 4, 2020 Attorney Joseph Janazic of the District Attorney's Office provided comment and insight to the Main Street Corridor and areas of public safety concern. Attorney Janazic also described the vehicular speeding issues on Main Street. The District Attorney's office is located on 166 Main Street Brockton, MA across from the Trial Court which is also a high foot traffic location. The Old Colony Planning Council and the D.A.'s office discussed sharing GIS information regarding issues in the corridor and discussed areas for improvement where Old Colony Planning Council can assist in planning and community place making, creating obstacles for speeding and crime in the community, and strengthen cross agency communication.

Campello Business Association February 25, 2020

At a regular meeting of the Campello Business Association held at the Cape Cod Café on Main Street in Brockton on February 5, 2020, OCPC staff presented a review of the existing conditions, and facilitated a discussion of the issues regarding safety and congestion in the corridor. The review consisted of study timeline and process, and the existing conditions and issues regarding delay and safety in the corridor.

The responses from the audience included:

- Adding a traffic signal to the Main Street at Forest Avenue/Martin Place intersection to relieve congestion in the corridor.
- Restripe faded pavements markings including crosswalks and lines in the corridor.
- Improve walkability in the Campello area through safer pedestrian crossings.
- Update the traffic signal equipment at the Main Street/Perkins Street/South Street intersection including adding pedestrian button actuation.
- Improve lighting throughout the corridor for better pedestrian visibility at night, not just street lighting, but also lighting lower to the streets and sidewalk for better visibility of pedestrians.
- Improve safety with the corridor utilizing the "Four E's", including Engineering, Education, Enforcement, and Emergency.

Brockton Ward 2 and Ward 5 Meeting (Combined), February 27, 2020

Staff presented the study to the residents in Brockton's Ward 2 and Ward 5 in a combined constituent's meeting on February 27, 2020. Surveys and material were passed out to community members and elected officials. Participants were able to provide comments and feedback. Poster boards were also posted around the room to provide the opportunity for residents to place dots on the map identifying high priority locations that might be a priority for safety or congested (red, yellow, and green dots in a priority order with red having the most priority). Brockton Cable Access (BCA) aired the meeting on local cable channels and the BCA YouTube channel.

Comprehensive Economic Development Strategy March 2, 2020

OCPC staff presented an overview of the Main Street Corridor Study at a regular meeting of the Comprehensive Economic Development Strategy meeting on March 2, 2020. The overview included the study scope, timeline, traffic operating conditions, and safety conditions. Staff garnered input from the audience regarding transportation issues impacting economic development in the region. Maps of the Main Street Corridor were available for participants to place dots on the maps to depict areas of concern (red dots were placed on places of high concern and priority, yellow for medium concern, and green for lowest priority).

The Metro South Chamber of Commerce Multi-Cultural Business Forum

The Metro South Chamber of Commerce Multi-Cultural Business Forum, which was held on March 5, 2020 at the Fuller Craft Museum in Brockton, presents an opportunity for potential and existing entrepreneurs to learn from helpful resources, network with local businesses, and hear from entrepreneurs who have successful businesses. OCPC staff presented the components of the Main Street Corridor Study at the forum and surveyed a number of the participants utilizing the corridor questionnaire (hard copies and on-line via laptop).



CEDS meeting March 2, 2020

Internet – Old Colony Website and Social Media

The OCPC web site included a page for the Main Street Corridor Study, in addition, regular updates for the Main Street Brockton Corridor Study were regular included on OCPC’s website.

1.2.3 Environmental Justice

Environmental Justice Populations in the OCPC region are 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.

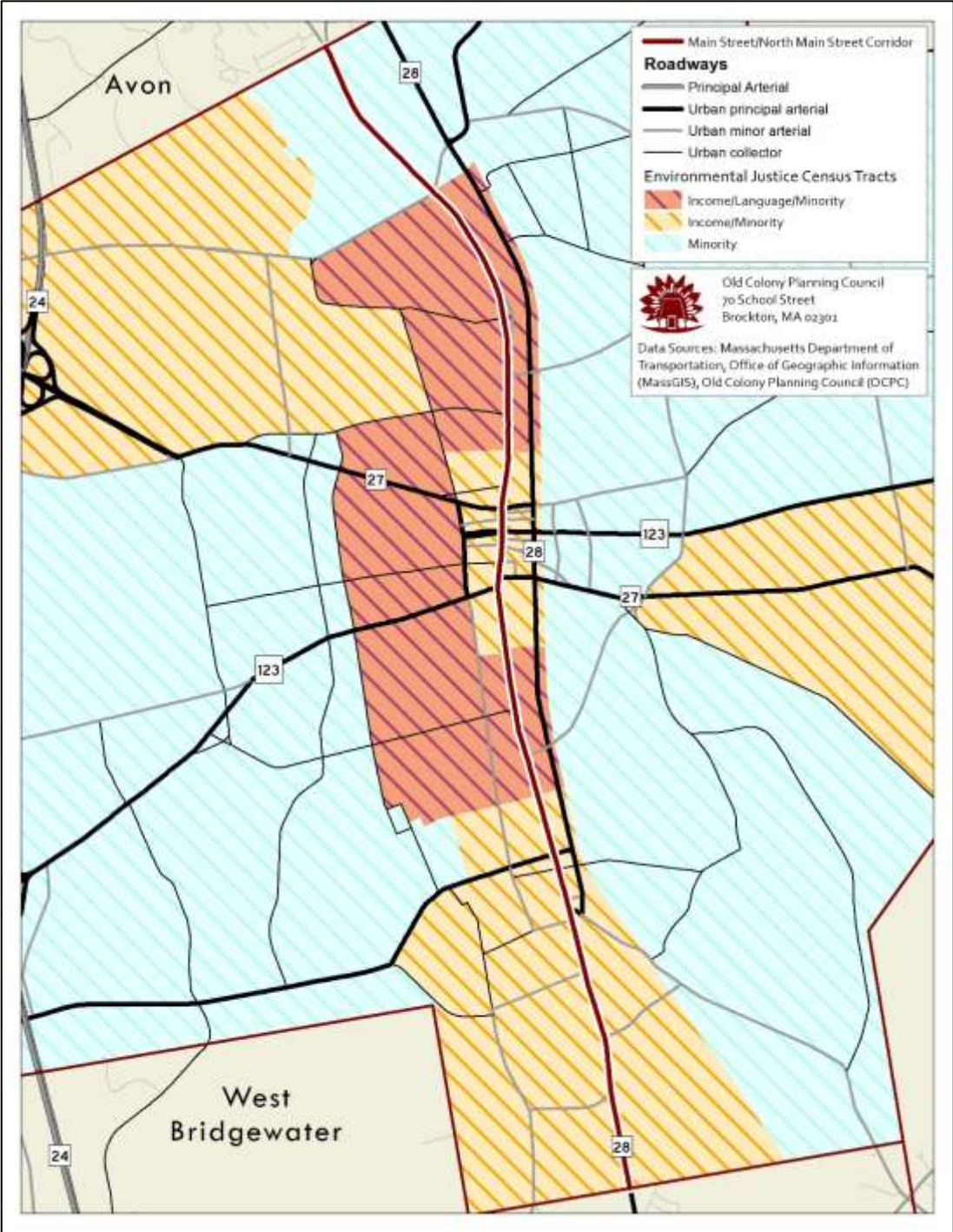
There are three fundamental Environmental Justice principles:

- 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.

The entire scope of the Main Street study area is included in the Region's Environmental Justice Areas, from the West Bridgewater line north through the Avon line (5.2 miles). Figure 2 shows Environmental Justice areas in Brockton and the Main Street corridor study area.

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 provided input to all stakeholders, including those residing in Environmental Justice Areas.

Figure 2 – Environmental Justice Areas



2 Previous Studies and Improvements

2.1 City of Brockton Downtown Traffic Study

The City of Brockton hired a traffic engineering consultant in 2018 to undertake a study of the two-way conversion for Brockton’s downtown. The study goals included: the development of conceptual alternative safety, mobility, and traffic improvements (for all transportation users), the utilization of Complete Streets Guidelines to Improve bicycle, pedestrian and transit accommodations, accessibility, and implementing infrastructure improvements to support economic growth and downtown revitalization. The study included preliminary traffic analysis, development of conceptual cross layouts for downtown streets, and property layout determination. The consultant included consultations with stakeholders including: The Brockton Fire Department (for signalization and emergency pre-emption at signals), Old Colony Planning Council (for bicycle route networks, traffic growth rates, and physical geometric restrictions), and Brockton Area Transit (for bus stop location, transit signal priority, pedestrian amenities, and protected bicycle lanes). In addition to updating traffic counts (intersection turning movements and automatic traffic recorder counts), the study included a license plate survey and a field inventory of existing physical conditions (the existing roadway, lane use, and sidewalk widths).

The Brockton downtown two-way conversion proposes that the following streets, which are currently one-way, instead be converted to accommodate two-way traffic:

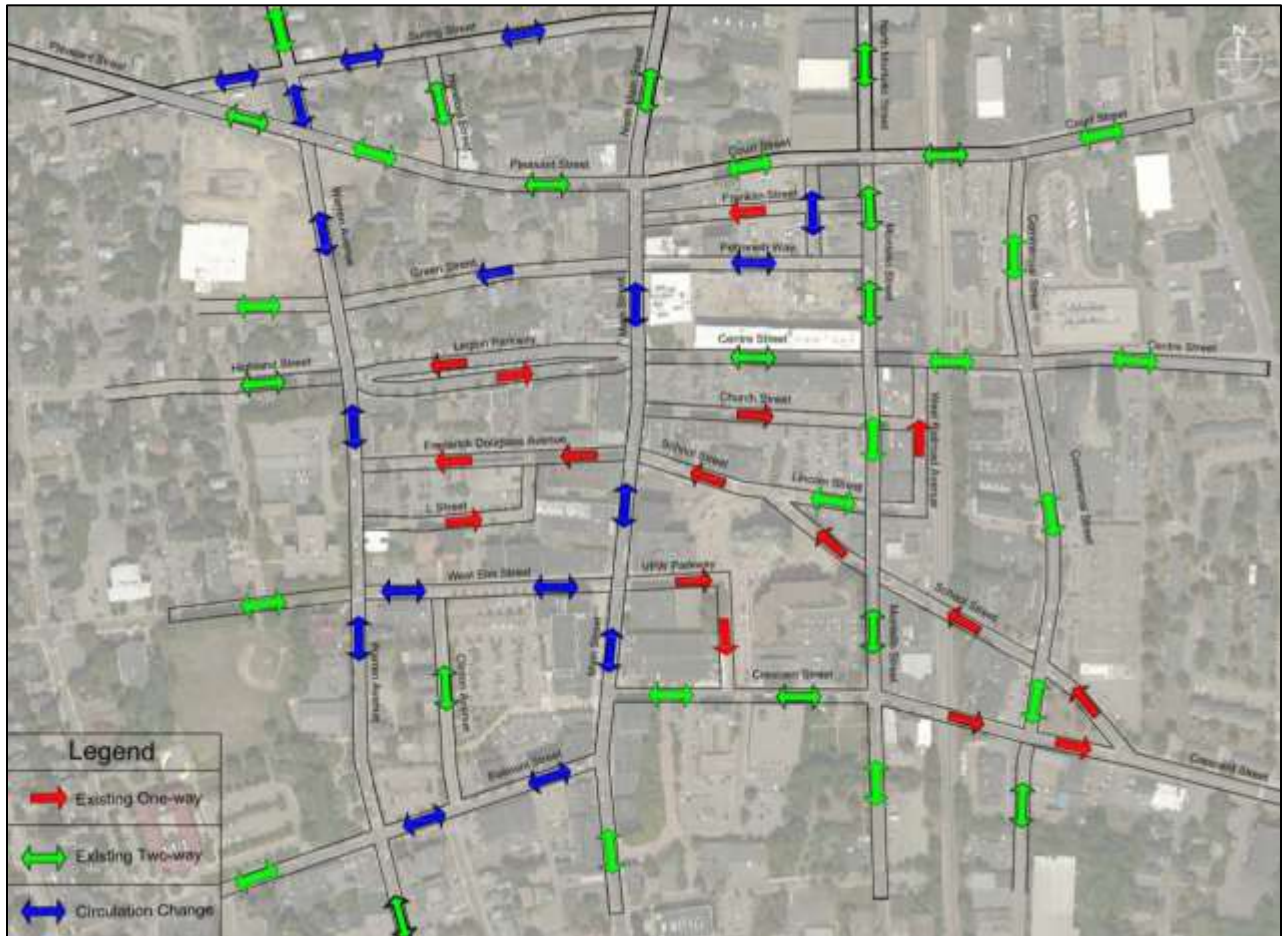
- Main Street – Belmont Street to Pleasant Street
- Warren Avenue – Belmont Street to Spring Street
- Belmont Street – Warren Avenue to Main Street
- West Elm Street – Warren Avenue to Main Street
- Petronelli Way – Main Street to Montello Street

In addition, Green Street, which intersects Main Street opposite of Petronelli Way, is currently one-way eastbound, between Warren Avenue and Main Street. The proposed two-way conversion circulation reverses the one-way on Green Street from the current eastbound direction (from Warren Avenue to Main Street, to one-way in the westbound direction from Main Street to Warren Avenue). Also, a new road is proposed connecting between Petronelli Way and Green Street to Court Street. Figure 3 compares the existing one-way circulation in the downtown and the proposed two-way conversion (also, Spring Street north of the downtown is proposed to be converted from one-way westbound to two way between North Main Street and Pleasant Street).

The proposal included a bicycle lane on Main Street in the downtown in the northbound and southbound direction. The southbound travel lane on Main Street between Crescent Street and Belmont Street would contain “sharrows” for shared bicycle and vehicle travel. Vehicle parking will not be allowed on the northbound and southbound side of Main Street along the curb; however, a 400-space parking garage off of Frederick Douglass would make up for the lost parking.

The Downtown Traffic Study estimated future traffic trips and trip assignment and circulation in order to conduct level-of-service analysis for the future proposed two-way conversion scenario. The trip assignments and circulation were based on a number of assumptions, including existing traffic volumes, license plate survey data, and the location of proposed development and parking

Figure 3 – Preferred Two-Way Conversion Alternative



According to the Brockton Downtown Traffic Study, the two-way conversion will result in a drop in the peak hour levels-of-service for some of the Main Street downtown signalized intersections. The study showed that the LOS for the morning and afternoon peak hours for the Main Street at Pleasant Street/Court Street intersection is at LOS “B” under current conditions but will drop to LOS “C” under the two-way conversion scenario. The LOS will also drop from LOS “B” to LOS “C” at the Main Street Legion Parkway/Centre Street intersection during the afternoon peak hour conditions from the current one-way configuration to the two-way scenario. The LOS will drop from LOS “A” during the current morning peak hour and LOS “B” during the current afternoon peak hour to LOS “B” during the morning and LOS “C” during the afternoon peak hour at the Main Street/Legion Parkway/Centre Street intersection from the current one-way conditions to the two-way scenario. At the Main Street/School Street/Frederick Douglass intersection, the LOS drops from LOS “A” to LOS “B” during the morning peak hour and LOS “B” to LOS “C” during the afternoon peak hour under the two-way conversion scenario. The Main Street/Elm Street intersection experiences a drop in LOS from LOS “A” in the morning and “B” during the afternoon peak hour to LOS “D” in the morning and “C” during the afternoon under the two-way conversion scenario. At the Main Street/Crescent Street intersection, the LOS drops only during the morning peak hour from LOS “A” to LOS “B” under the two-way conversion. At the Main Street/Belmont Street intersection, the LOS drops from LOS “A” to LOS “C” in the morning and LOS “A” to LOS “B” during the afternoon under the two-way conversion scenario.

The City has submitted a Project Needs Form (PNF) to the Massachusetts Department of Transportation (MassDOT) to initiate the planning process to convert Main Street and Warren Avenue to two-way traffic. The PNF was accepted and MassDOT has requested the City submit a Project Information Form (PIF). The proposed two-way preliminary conceptual design for Main Street is included in the appendix to this report.

3 Study Area Built Environment, Zoning, and Land Use

Main Street is a major north south corridor in Brockton and passes through the geographic center of the city in a north south direction. It is designated as Route 28 within a short section from the West Bridgewater town line north to the Main Street/Plain Street/Keith Avenue intersection. Route 28 designation continues on Plain Street for a short distance and then north on Montello Street and North Montello Street, which parallels Main Street in Brockton. Some of the earliest development in the city occurred on Main Street in the vicinity of the downtown, based on the streetcar and walking modes, with later development focused on motor vehicle orientation occurring furthest away from the downtown in the south part of Brockton near the West Bridgewater town line. Main Street also functions as a regional connector connecting Middleborough, Bridgewater, and West Bridgewater to the south to Brockton, Avon, and points north.

Main Street in Brockton is a two-lane facility, except for the section between the West Bridgewater line and a point 650 feet north of Skyview Drive, where it is a four-lane cross section. Main Street, from the West Bridgewater line north to a point 300 feet south of the Sargent's Way intersection, is classified as an Urban Principal Arterial. This section of Main Street is designated as Route 28 and is under the jurisdiction MassDOT. The speed limit is posted at 35 miles per hour on both the northbound and southbound side of the road. There is a sidewalk on the west side of the road within this section of Main Street.

Main Street, from a point 300 feet south of the Sargent's Way intersection north to the Main Street/Plain Street/Keith Avenue intersection, is a two-lane facility. The road is also designated as Route 28 (up to the Plain Street/Keith Avenue intersection) and is classified as an Urban Principal Arterial under the jurisdiction of the City of Brockton. The speed limit is posted at 30 miles per hour on the northbound side in this section just south of the Brookside Avenue intersection. No parking is posted on both sides of the road within this section of Main Street. There are sidewalks on both side of the road within this section of Main Street except south of Sargent's Street, which has a sidewalk on the west side of Main Street only.

Main Street north of the Plain Street/Keith Avenue intersection to the Belmont Street intersection in the downtown is a two-lane road with parking allowed on both sides of the road. Parking limitations and time restrictions vary on Main Street; however, in general, parking is allowed on both sides of the street from the Main Street/Plain Street/Keith Avenue intersection north through the downtown to Avon. Main Street is classified as an Urban Minor Arterial under the jurisdiction of the City of Brockton beginning at a point 300 feet south of the Sargent's Way intersection north Belmont Street. Beginning at Belmont Street, Main Street through the downtown is classified as an Urban Principal Arterial under the jurisdiction of the City of Brockton. The street becomes one-way in the northbound direction from Belmont Street through the downtown to the Pleasant Street/Court Street intersection. Parking is allowed on both sides of the road within Brockton Downtown and sidewalks are provided on both sides of the road.

3.1 Main Street Brockton Corridor Zoning

The City of Brockton Planning Department maintains an unofficial zoning map of the city for illustrative purposes. The Planning Department directs the public to confirm the legal zoning status of parcels with the city's legal department. The city's unofficial zoning map is shown in Figure 4.

Figure 4 – City of Brockton Zoning

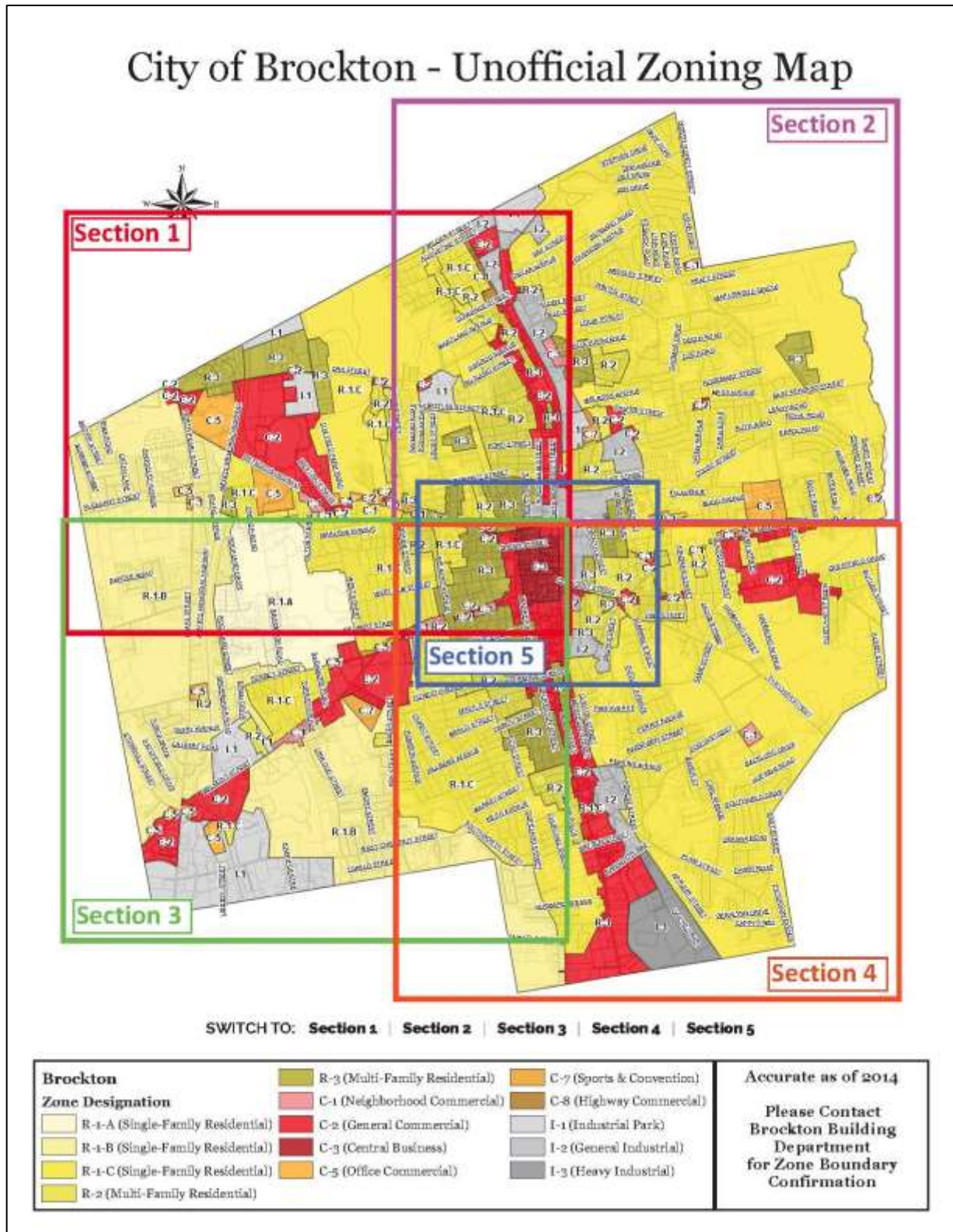


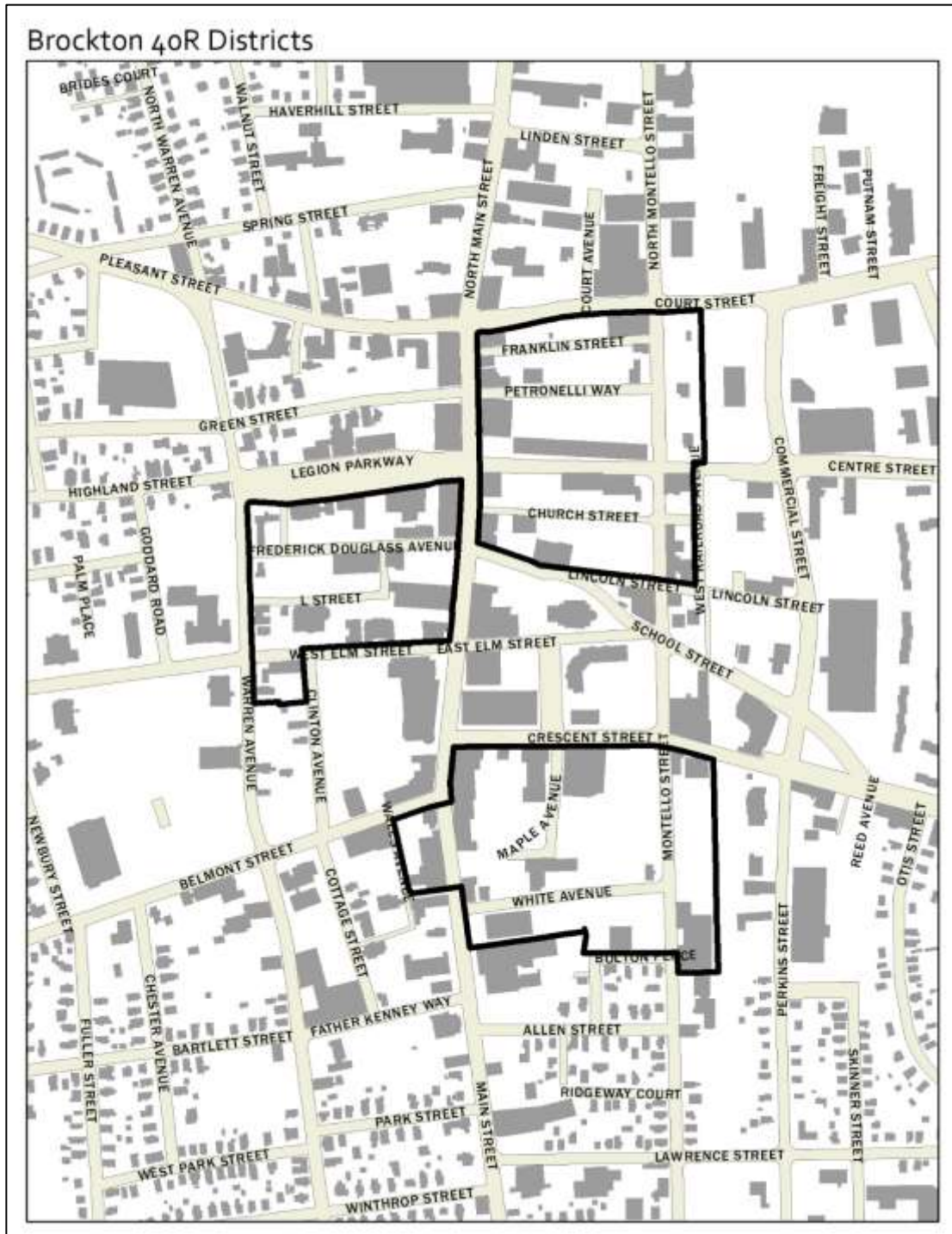
Figure 4 City of Brockton Unofficial Zoning Map shows that the Main Street corridor runs through the geographic center of the city in a north to south direction. Most of the parcels that abut the Main Street corridor are zoned as C-2, General Commercial and C-3 Central Business. North of the Main Street/Oak Street/Howard Street (Route 37) intersection to the Avon town line, the zoning along Main Street is residential, (R-2 Multi-Family Residential, and R-1-C Single Family Residential). There is also a small section of North Main Street between Linden Street and Wyman Street that is zoned as I-2 General Industry. Although the corridor is mostly zoned as commercial, residential zoning is in close vicinity of the Main Street corridor. Much of Main Street is within easy walking and bicycling distance from adjacent residential neighborhoods. This gives Main Street a mostly multi-modal character, with accessibility via walking, bicycle, transit (bus), and commuter rail, as well as motor vehicles, especially between the Plain Street intersection through the downtown and north to the North main Street/Oak Street/Howard Street intersection.

3.1.1 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 districts in Brockton Downtown adopting design standards in July of 2007. Figure 5 shows the Smart Growth Zoning Districts.

Figure 5 – Brockton Downtown Smart Growth Zoning Districts



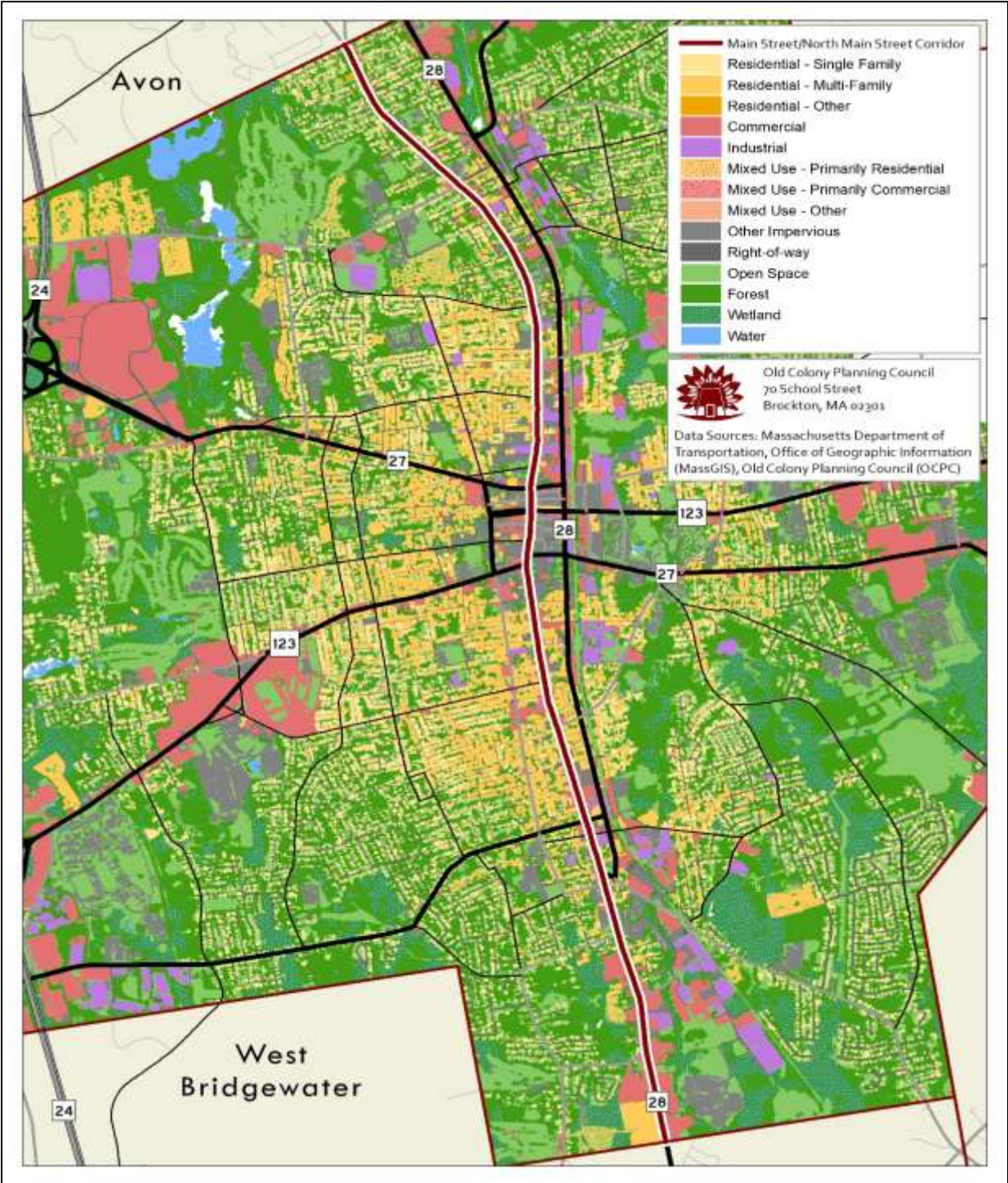
The City of Brockton has also proposed amendments to the existing 40R Downtown Brockton Smart Growth Overlay District. This district, adopted in 2007, allows mixed-use and residential development as a matter of right (with locations, densities and building heights, etc., as specified in the District 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.

3.2 Main Street Brockton Land Use

The City of Brockton, through its Department of Planning and Economic Development and in cooperation with MassDevelopment, is currently developing economic and redevelopment initiatives for a number of study areas in Brockton. The existing land use in the corridor is a mix of commercial and residential uses. Figure 6 shows the existing land use in the corridor.

Figure 6 – Brockton Land Use



3.2.1 Opportunity Areas

The City of Brockton, in its Comprehensive Master Plan (2017), identified eight specific areas of opportunity within the city. These areas are locations of concentrated activity that have the potential for growth where the city can focus its efforts of revitalization. Figure 7 shows these eight locations in Brockton. Four of the eight opportunity areas are located within the Main Street corridor. These include (from south to north):

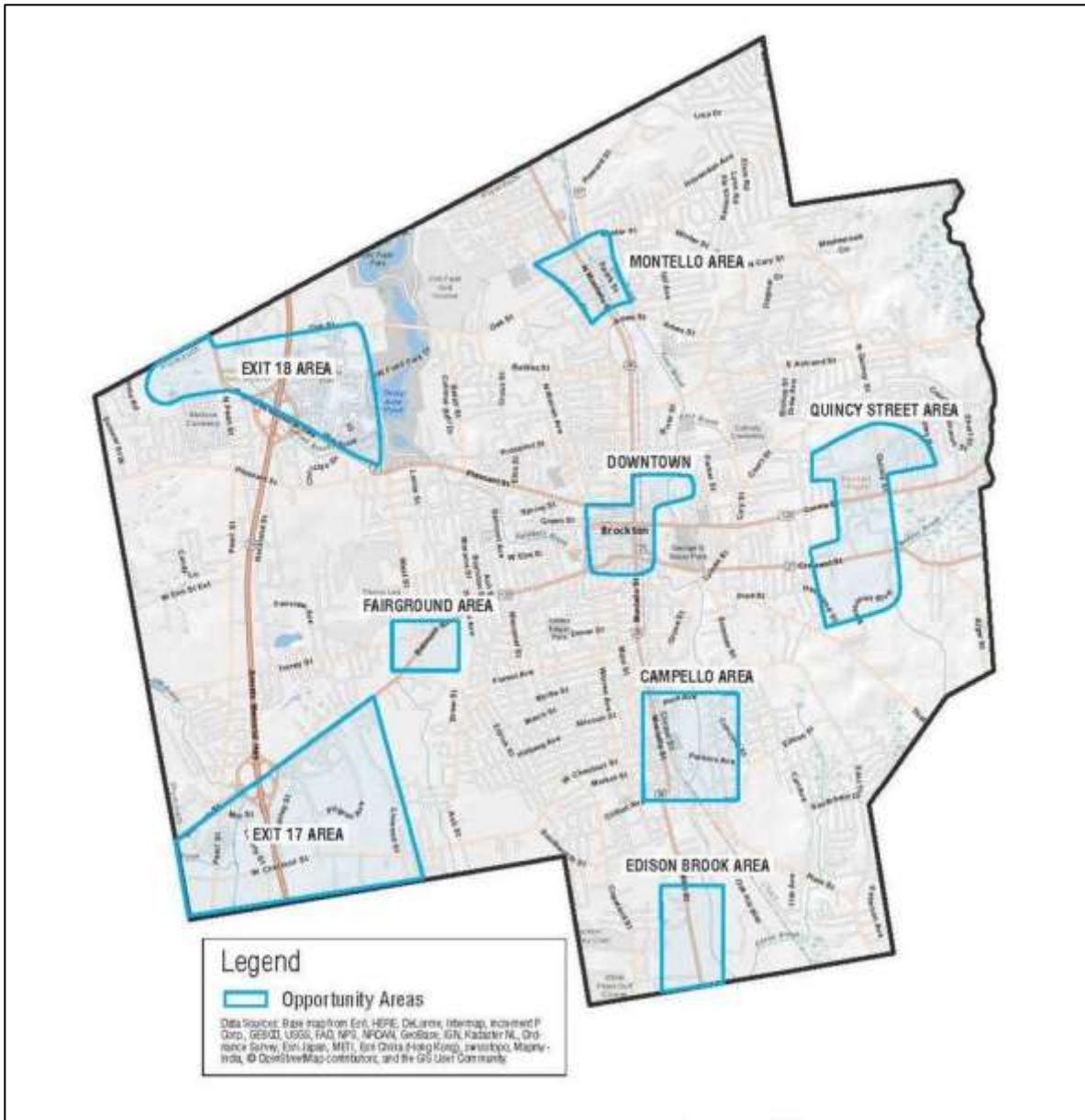
- Edison Brook Area – Main Street in this section is a four lane cross-section with adjacent land use concentrated on commercial uses, almost exclusively auto-oriented (although it is served by BAT fixed route bus service), such as department stores/grocery stores, shopping plazas, car dealerships, and restaurants. There is some intermittent residential development.
- Campello Area – This area includes Keith Park as well as the Campello passenger rail station. There is no parking along Main Street in this section of the corridor, which is a two-lane cross section. This section has a mix of auto, walking, bicycling, as well as BAT fixed route service. This section of Main Street, which extends north of Plain Street, includes a concentration of small shops, restaurants, and churches and residents, centers around the intersections of Main Street at East Nilsson Street/Nilsson Street and Main Street at Perkins Avenue and South Street. This area has parking on both sides of Main Street (north of Plain Street) and although vehicle traffic is still high, speeds are lower as this area is more multi-modal within easy walking distance of neighborhood residential streets.
- Downtown Brockton – The city continues its efforts to improve the downtown with the completion of a new 414 space parking garage on Campanelli Street as well as two new mixed use residential developments, one located just west of Main Street on West Elm Street and the other on Main Street at the corner of Main Street and Frederick Douglass Boulevard. Downtown Brockton is a multi-modal center, with several designated “40R” Transit Oriented Development overlay districts. It is serviced by BAT fixed route bus service to points east and west along arterials as well as north and south on Main Street and is within five minutes walking distance to the downtown passenger rail station.
- Montello Area – The Montello Area centers around the Main Street at Oak Street/Howard Street (Route 37) intersection and the Montello Street passenger rail station. This intersection is a major crossroads in the northern portion of the city and peak hour traffic volumes through this intersection are heavy. This section of Main Street is within easy walking distance to the Montello passenger rail station and adjacent land use consists of a mix of commercial (small shops, banks, and restaurants), residential, and institutional (schools). Main Street is serviced with several BAT fixed-route lines including the Ashmont Line, which operates between Downtown Brockton and the MBTA Red Line in Dorchester.

The City of Brockton developed the opportunity areas to focus planning activities and leveraging infrastructure investment. These efforts include:

- Promoting and encouraging transit-oriented development in those areas around existing commuter rail stations.
- Unlocking large parcels for additional development, (one of the largest potential parcels includes the CSX property, which is located just northeast of the downtown between Court Street and Eliot Street). This also includes repurposing municipal land, working with property owners, updating and improving zoning, and utilizing financing and funding tools (such as Tax Incremental Financing, TIF).
- Utilizing appropriate areas for increased economic development with actions that include market-driven planning, public/private partnerships, and zoning.

- Balancing new development with preservation of neighborhoods, (creating appealing places).
- Focusing on municipal services and amenities distributed throughout these areas.
- Promoting the development of underutilized sites, especially the downtown as a mixed-use district with uses and amenities that meet market demands.
- Promoting the redevelopment of auto-oriented corridors with new use development patterns that are consistent and compatible with the nearby neighborhoods by creating innovative zoning adapted to new uses and accompanied by streetscape and circulation changes.
- Providing and promoting training and education programs that will enhance the skills and employment opportunities for Brockton residents through expanding the programs offered through the school system, adding new institutional and corporate partners, and advocating for additional programs and funding through state and federal sources.

Figure 7 - Brockton Opportunity Areas



3.2.2 Downtown

The most intense development along Main Street in Brockton is in the downtown, which contains some unoccupied or under-utilized buildings. These unoccupied parcels represent opportunity for investors and developers. The downtown is proposed for more intensive use under the City’s Brockton Downtown Action Strategy. Rather than being cleared for larger buildings, many underutilized buildings are being reused for activities that fit their present dimensions and configurations. Three factory buildings were converted to housing including the SoCo lofts and Station Lofts, and the Scheibe building, has been converted from un-intensive manufacturing and storage use to nearly fully occupied, professional, and mental health-related office space. There are several other underutilized buildings including the former Etonic plant which may have similar potentials according to the Brockton Downtown Action Strategy.

The Enterprise Block development project 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 used to house the Brockton Enterprise Newspaper. Some of the buildings on the block were rehabilitated, 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 the 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 completed. Several historic buildings were restored for retail, commercial, and housing uses.

The first phase of development consists 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 rehab 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 414-space 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. The 414-parking space Downtown Mayor Carpenter Garage was opened in March of 2020.

South of downtown from Lawrence Street to Pine Street there are mixed residential and commercial uses. In addition, there is the inactive LeBaron Foundry site south of Lawrence Street and just east of the railroad tracks. South of Pine street, uses are mainly commercial except for the Emanuel House senior residence and some housing around Keith Park and north and south of Plain Street, including the Watson Street/Meadow Lane neighborhood. There is extensive commercial space, partly in shopping centers, which fronts on the rest of Route 28 to the West Bridgewater line; however, some of the stores are vacant or nearly inactive.

Main Street and Route 28 (Montello Street) run parallel in the north south direction. The effect of the many connecting short streets between Main Street and Montello Street is such that either one can relieve the other during times of congestion. Similarly, significant development in either corridor can impact the other with significant traffic generation.

Figure 8 - CSX Rail Site



The CSX site is shown in Figure 8. The City of Brockton is currently working with the owner to market the site for reuse. A preliminary market assessment for the CSX Rail Site in Brockton, which was completed for the Metro South Chamber of Commerce by the UMass Donahue Institute, developed a number of potential future development scenarios. These include:

1. Small Support Rail yard – The UMass Donahue report concluded that the site will not likely be used as a major rail terminal in the future but that it does have significant strengths to be used as a small support rail yard. Its strengths include its large size, direct rail access, and zoning (industrial). Its weaknesses include poor truck to highway connections, contaminated environmental conditions, and surrounding incompatible residential uses. Although the site is located adjacent to the Route 28 corridor, truck access to the site is achieved via Elliot Street beneath the historic stone arch bridge, which lacks sufficient height for heavy vehicles.
2. Residential – There were a number of inquiries for the site from residential developers, (focusing on the less contaminated eastern part of the site) to develop it as residential. Its strengths include that it is within walking distance of Brockton Downtown and the MBTA commuter rail station and BAT Centre.
3. Sports/recreation business venture – This scenario requires environmental clean-up, better multi-modal access points for parking
4. Multi-tenant industrial park – This would be a small, multi-tenant industrial park focusing redevelopment with less daily truck moves.

5. Solar farm – A market study could evaluate the power and revenue generation potential of clearing the site for a farm of solar panels.

3.2.3 Brockton’s District Improvement Financing

Municipalities can pledge all or a portion of tax increments to fund district improvements over time by utilizing District Improvement Financing (DIF). The DIF is authorized by Massachusetts General Law (MGL) 40Q and its implementing regulations 402 CMR 3.00. DIF is new to Massachusetts, although it has been implemented in other states with success. A municipality wishing to utilize DIF must designate a development district and a corresponding development program. The district and program must then be certified by the State Economic Assistance Coordinating Council (EACC). The district can be in effect for a maximum of 30 years. Each district must have a unique development program to spell out the goals of the district and the means to achieve them. The DIF program identifies the following:

- Existing uses and current zoning,
- Proposed uses and any needed zoning changes
- Any planned construction or renovations
- Current and planned infrastructure
- The financial plan

Once a district and program have been certified, the city or town has the ability to use various tools to implement the program. These include acquiring land, constructing or reconstructing improvements (such as buildings, roads, schools and parks), incurring indebtedness and pledging tax increments and other project revenues for repayment of these debts. Initial funding for these activities is usually accessed through the posting of a bond by the city or town. The DIF also allows for public/private development partnerships.

According to the *Downtown Brockton Revitalization Plan*, in 2015, the Brockton City Council approved creation of a District Improvement Financing (DIF) District. According to the plan, this established the Original Assessed Values (as defined at Mass. General Law Chapter 40Q) within Brockton Downtown, which provides for future DIF Tax Increment to support of downtown infrastructure and other investments. The plan proposed the Brockton Downtown Urban Revitalization District, which encompasses 65.8 acres bounded to the west by Warren Avenue, to the north by Pleasant Street, to the east by Commercial Street and the MBTA Commuter Rail railroad right-of-way, and to the south by West Elm Street and Crescent Street. This district is heavily urbanized and fully developed with some paved open space from prior demolition. The district is zoned commercial and mixed commercial-residential.

3.3 Livability and Sustainability

The 2020-2040 Old Colony Long Range 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.

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.”

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.

MassDOT’s Healthy Transportation Directive 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. OCPC provides support for member communities who participate in the state’s Complete Streets funding program. Based on information from MassDOT, West Bridgewater, Easton, and Stoughton have formally participated in the Massachusetts Complete Streets Funding Program, although the Transportation Committees in Halifax and Kingston have both discussed adopting a Complete Streets policy, and therefore achieve eligibility for the program.

3.3.1 The Brockton Complete Streets Prioritization Plan

The Massachusetts Department of Transportation (MassDOT) Complete Streets Funding Program was created by legislative authorization in 2014 (2014 Transportation Bond Bill). The intent of the program is to encourage and reward municipalities that demonstrate a commitment to instituting Complete Streets in policy and practice. The Massachusetts Department of Transportation (MassDOT) Complete Streets Funding Program provides technical assistance and construction funding to eligible municipalities. In order to be eligible, a municipality is required to institute a Complete Streets Policy through its decision-making body (town council or city council) and also develop a Complete Streets Prioritization Plan. The funding through this program can be used by the municipality for technical assistance to analyze their community needs (through the development of a Complete Streets Prioritization Plan) and for construction of Complete Streets infrastructure projects.

The City of Brockton completed their Complete Streets Prioritization Plan through a consultant contract. The plan was completed in June 2020 and contains 30 projects of which eight projects are on Main Street or close enough to Main Street and North Main Street to facilitate improvement in the corridor. These include the following Complete Streets Projects:

Table 13

Location	Description	Cost
Pleasant Street east of Main Street and North Main Street	At mid-block crossing of Pleasant Street between Main Street and Warren Street, restripe crosswalk to ladder striping, install ADA-compliant curb ramps with detectable warning strips, and install pedestrian crossing signage with RRFB.	\$65,000
Existing mid-block crossing of Main Street at the Campello Highrise at 1380 Main Street.	At mid-block crossing of Main Street at Campello Highrise (1380 Main Street), restripe crosswalk to ladder striping, install ADA-compliant curb ramps with detectable warning strips, and install pedestrian crossing signage with RRFB.	\$55,000
Downtown Brockton, northwesterly most point at intersection of Spring Street and Warren Avenue, southeasterly most point at intersection of Crescent Street and Lyman Street	Although this project provides bike lanes that are not on Main Street or North Main Street, it provides bicycle connections in the downtown that enhances bicycle safety and circulation on Warren Avenue, West Elm Street, Legion Parkway, Crescent Street, School Street, Commercial Street, and Centre Street.	\$250,000
Eliot Street northerly side from North Main Street to North Cary Street, including pedestrian signage with crossings of North Main Street at Eliot Street.	Update Elliot Street sidewalks, install ADA facilities. Add crosswalks across North Cary Street, Riverside Street, Brides Place, Emmet Street, Mulberry Street and North Main Street. Update crossings across N Montello Street and across Elliot Street at N Montello Street with ladder striping. Include pedestrian signage with crossings of North Main Street at Elliot Street. Add mid-block crossing of Elliot Street with pedestrian signage and RRFBs between Brides Place and Riverside Street, at future potential location of Trout Brook Path.	\$300,000
Main Street at Hayward Avenue, eastbound and northbound approaches	Extend curb along northerly side of Hayward Avenue to remove the right turn channel from Main onto Hayward, thus reducing the turning radius and shortening the crossing distance. Install crosswalk across Main Street as part of signal. Restripe crossing of Hayward Avenue to ladder striping. Install pedestrian signals at crossings.	\$400,000
Legion Parkway between Warren Avenue and Main Street	Provide dedicated bus pull-out area for BAT bus stops along Legion Parkway. This would likely require removal of parking spaces along Legion Parkway.	\$50,000
Brockton Downtown	Install Bus Shelters at key locations.	\$150,000

3.3.2 Brockton Area Transit (BAT)

The Main Street corridor in Brockton is served by a number of fixed route bus routes operated by the Brockton Area Transit (BAT). It is served mainly and directly by three of BAT’s bus routes including Route 1, Route 2, and Route 12. While BAT Route 1 and BAT Route 2 serve locally, mainly Main Street in the downtown, south of the downtown and North Main Street north of the downtown (into Avon), BAT Route 12 serves regionally including the downtown, North Main Street, and to and from the Ashmont MBTA Station in Dorchester.

BAT Route 1

Route 1 runs between the BAT Center and Wal-Mart in Avon and goes through Brockton Downtown and along North Main Street. According to the *Brockton Area Transit Authority*



BAT Bus shelter on Main Street at West Chestnut Street, BAT Route 2

Comprehensive Regional Transportation Plan, (CRTP) which was completed by the Old Colony Planning Council in 2015, BAT's Route 1 operates primarily within the City of Brockton. Route 1 operates Monday through Friday from 6 a.m. to 5:40 p.m., Saturday from 7:20 a.m. to 9:15 p.m., and then Sunday from 11:20 a.m. to 6:25 p.m. Between Monday through Friday, after the 5:40 p.m. bus departure of Route 1 from the BAT Centre, the Route 12 Ashmont bus service substitutes for Route 1 along North Main Street until the end of the service day. Route 1 has an average of 562 riders per day making up 5.69 percent of BAT's total daily ridership, according to the *Fiscal Year 2019 BAT Ridership Report*, completed by OCPC. Figure 9 shows a map of BAT Route 1. Figure 10 shows the BAT bus Route 1 ridership during the week.

Figure 9 – BAT Bus Route 1

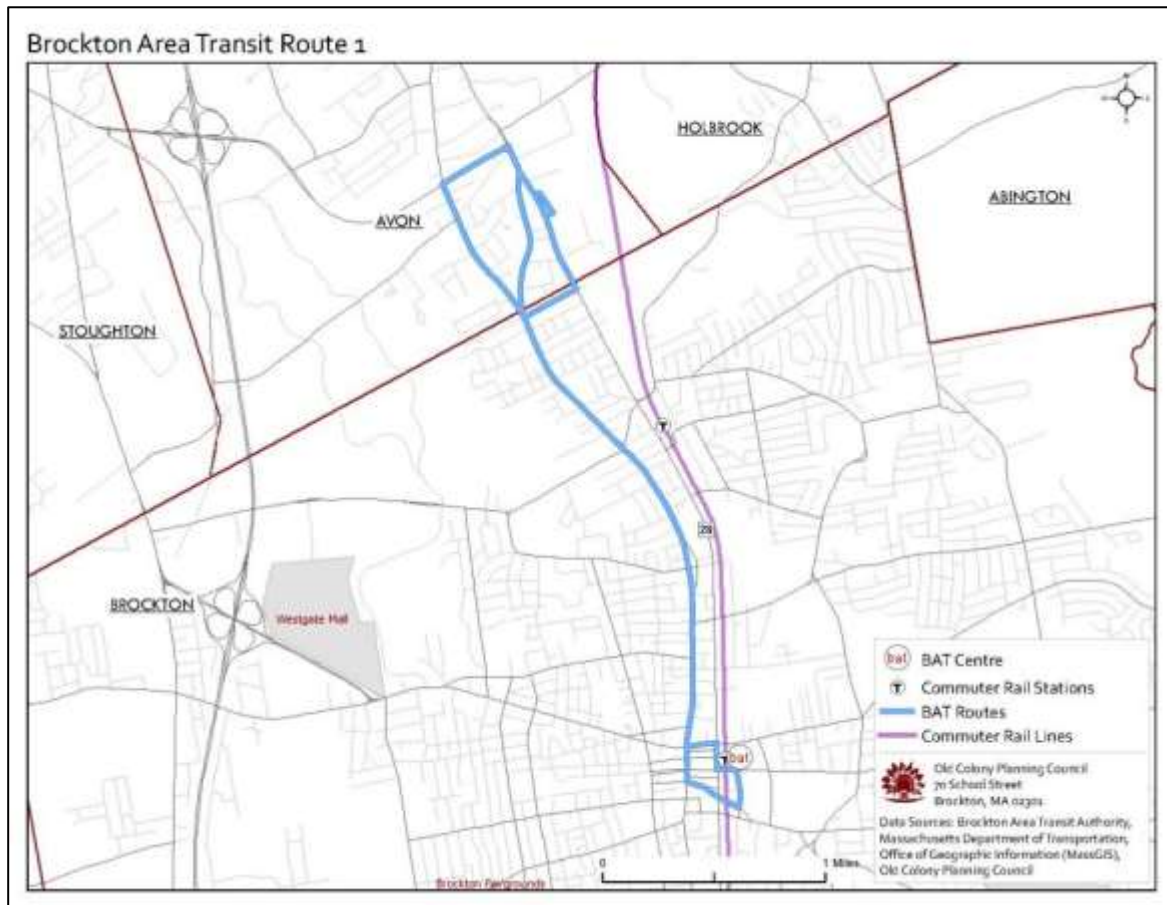


Figure 10

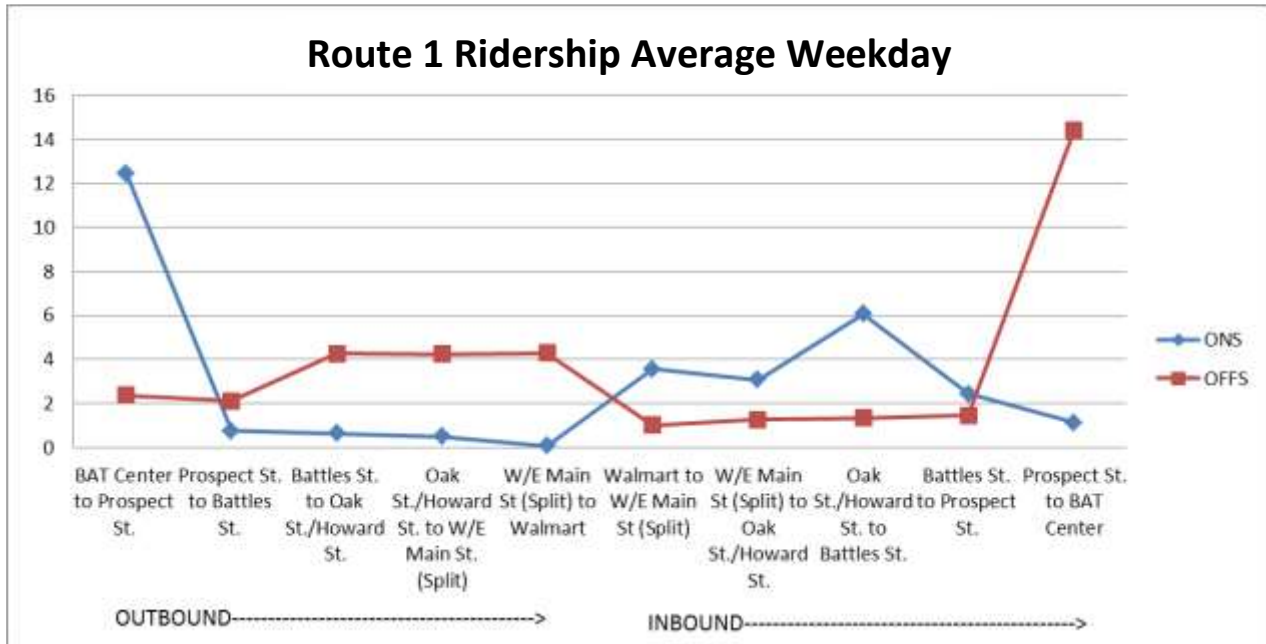
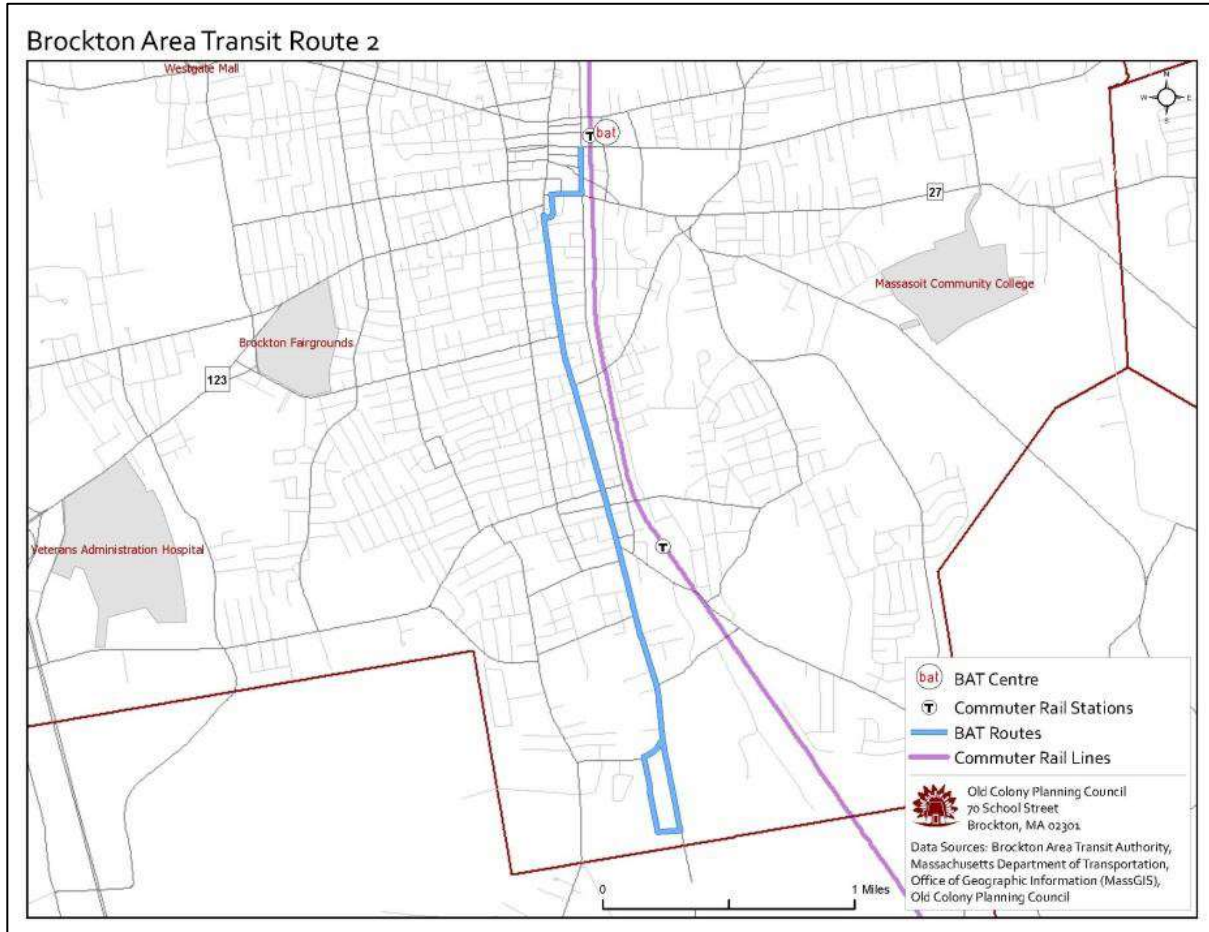


Figure 10 shows that passenger boarding and alighting is distributed evenly along the BAT Route 1 route line, with the exception of the BAT Centre, which has the most boarding and alighting due to the pulse nature of the BAT fixed route system. During the route segment sampling periods, on average no more than one person boarded the route on the outbound direction after the BAT Centre, and most activity was alightings with an average of four to five passengers getting off the bus. On the inbound direction the most passenger activity was boarding, with an average of four to six. The majority of boarding taking place inbound along the Oak Street to Battles Street segment. This segment tends to be a big boarding area because passengers walk up from the Montello train station after getting off the MBTA’s 230 bus to access the BAT bus, and also because of the presence of a high concentration of multi-family dwellings around the area particularly clustered near the intersection of Oak Street and Main Street.

BAT Route 2

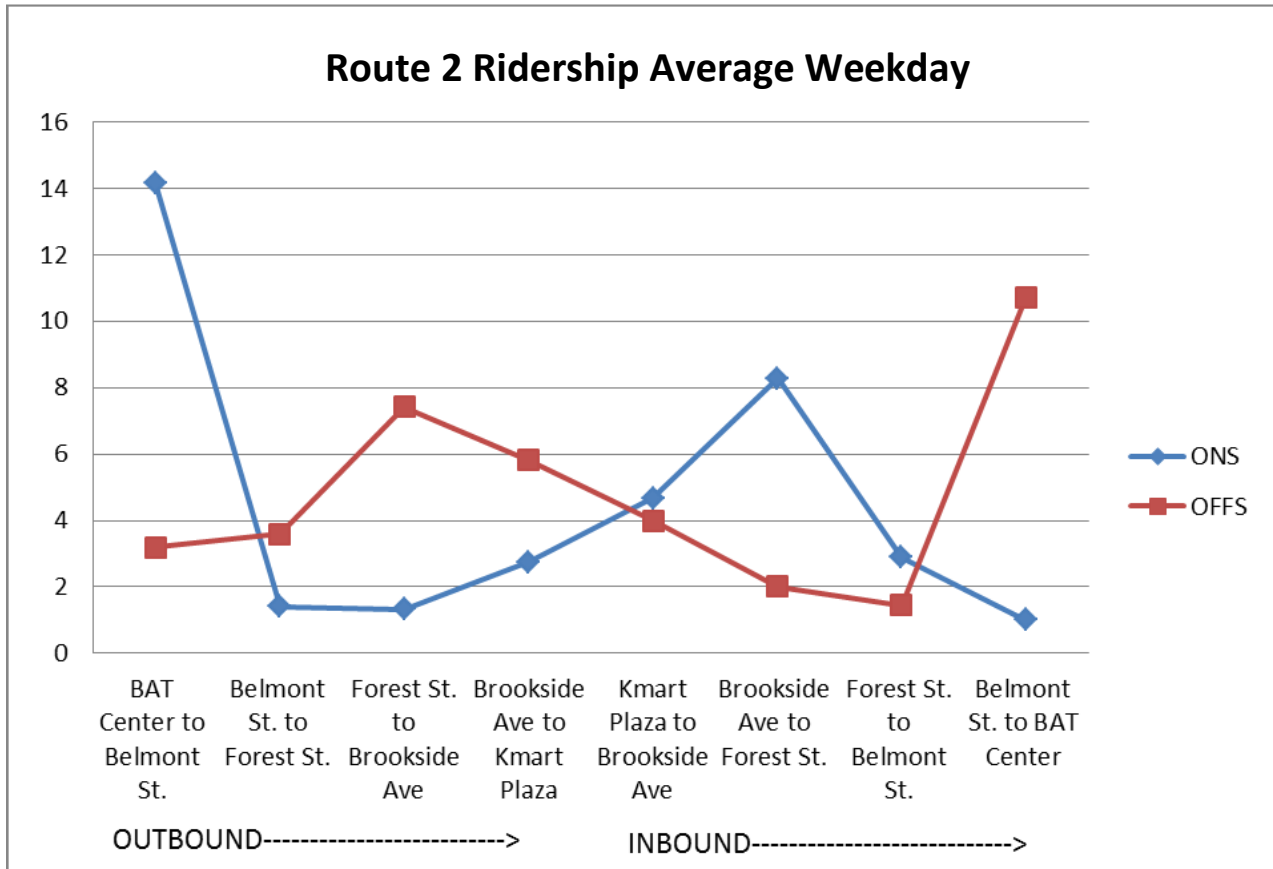
Route 2 serves Main Street from the BAT Centre to the retail plaza on Main Street (Route 28) just north of the West Bridgewater Line. Route 2 operates entirely within the City of Brockton along a very densely settled Main Street corridor. According to the BAT CRTP, Route 2 goes through Downtown Brockton to Main Street, after departing the BAT Centre, and then operates south on Main Street terminating at the K-Mart Plaza on Brockton’s far south side. The Route 28 Bridgewater University bus route also operates at the K-Mart Plaza. This bus route meet-up allows Brockton residents access to Bridgewater State University and the Town of Bridgewater, while also providing Bridgewater State University students access to the City of Brockton and the Greater Brockton Area via the BAT system. This line operates Monday through Friday from 6:00am to 9:05pm, on Saturdays from 7:15am to 9:15pm, and on Sundays from 11:20am to 6:25pm. Figure 11 shows a map of BAT Route 2. Figure 12 shows the BAT Route 2 ridership during the week.

Figure 11



According to the BAT CRTP, the BAT Centre has the largest portion of boardings and alightings due to the pulse nature of the fixed route system, as passengers from various parts of Brockton transfer from other lines to BAT Route 2 for access to Main Street in the south part of the city. The next segment on Main Street on BAT Route 2 that experiences significant portions of boarding and alighting of passengers is between Forest Street and Brookside Avenue. Along this segment, there are many small mom-and-pop stores along with a major ethnic grocery store that see high patronage. In addition to these operations, there is a large number of multi-family dwellings along Main Street and adjacent streets, with a public housing complex near Brookside Avenue. After Brookside Avenue, alightings tend to decline as the housing density is less and economic activity on the southern portion of the line (south of Brookside Avenue) is auto oriented.

Figure 12



3.3.3 Passenger Rail

Brockton is served by three passenger rail stations, in addition to the BAT fixed route bus service. All of these passenger rail stations are within walking distance of the Main Street corridor in Brockton. This puts the Montello Passenger Rail Station in the north of the city within convenient walking distance of BAT Routes 1 and 12, and the Campello Passenger Rail Station in the south of the city convenient to BAT Route 2. In addition, the BAT Centre is located on Commercial Street, across the street from the Brockton Downtown Passenger Rail Station, giving access to all of Brockton’s fixed bus routes.

The three passenger rail stations in Brockton have convenient parking. The BAT Garage provides parking for the Brockton Downtown Station and the BAT Centre. Pedestrian access directly to the Montello Station platform can be achieved directly via Livingston Street crossing North Montello (Route 28). The Montello Station parking lot is accessed via Spark Street, which is parallel to Route 28 and Main Street. Campello is located just east of Route 28 at its intersection with Plain Street. Parking for Campello is accessed via Plain Street and via Riverside Street. Although ample parking is available at all three passenger rail stations in Brockton, and many people either park on site or are dropped off, the stations are convenient for walking to and from surrounding neighborhoods. Safe, convenient pedestrian access from the neighborhoods to and from passenger rail is essential for ridership. Figures 13, 14, and 15 show the locations of passenger rail stations in Brockton.

Figure 13 - Montello Station

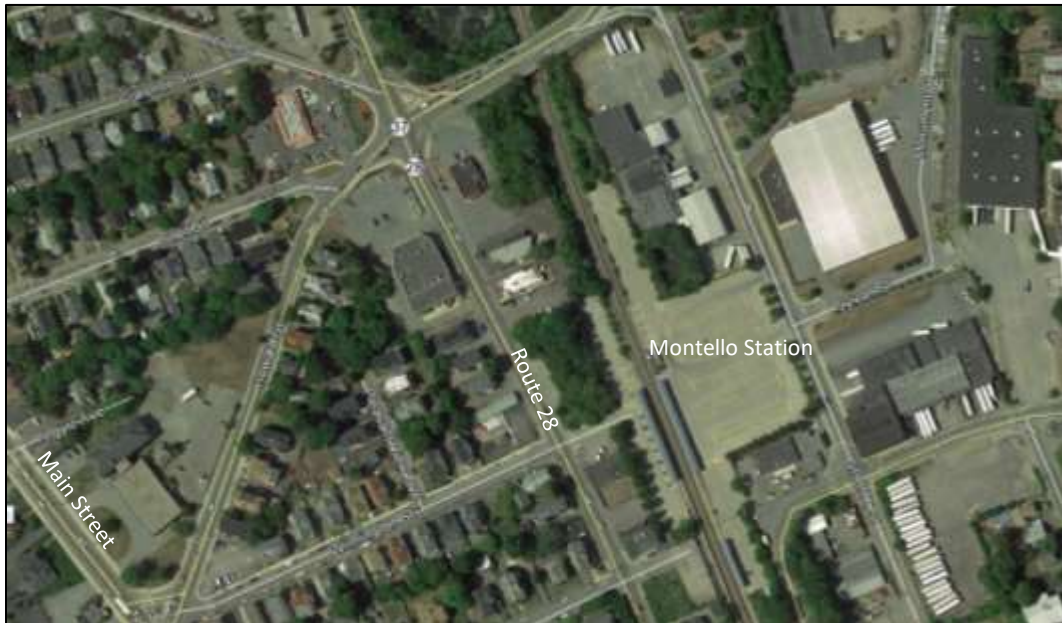


Figure 14 - Brockton Downtown Station

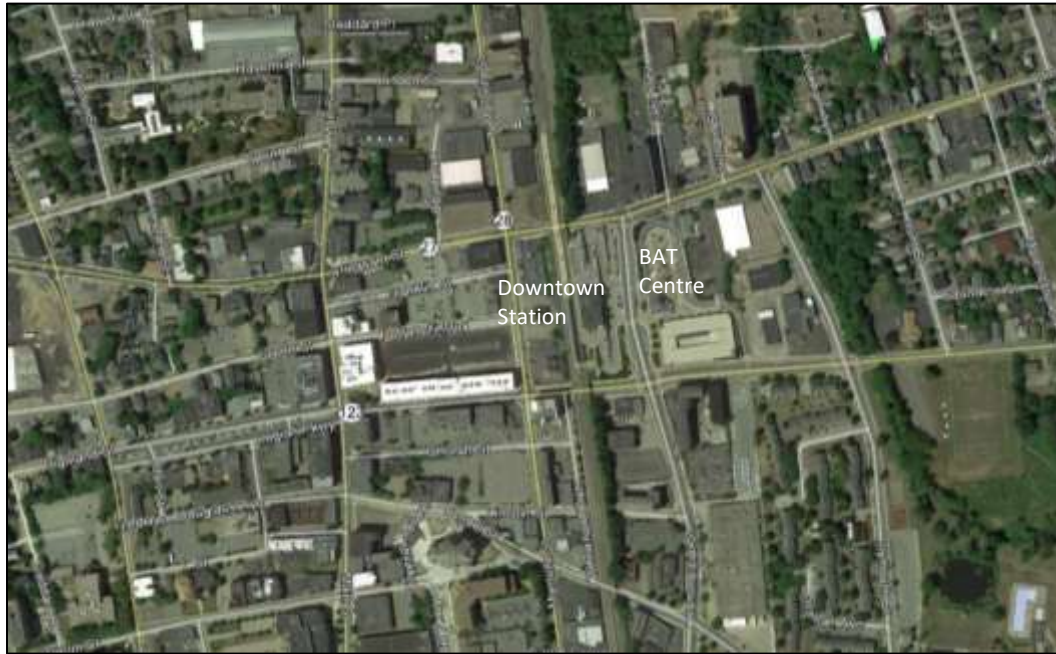
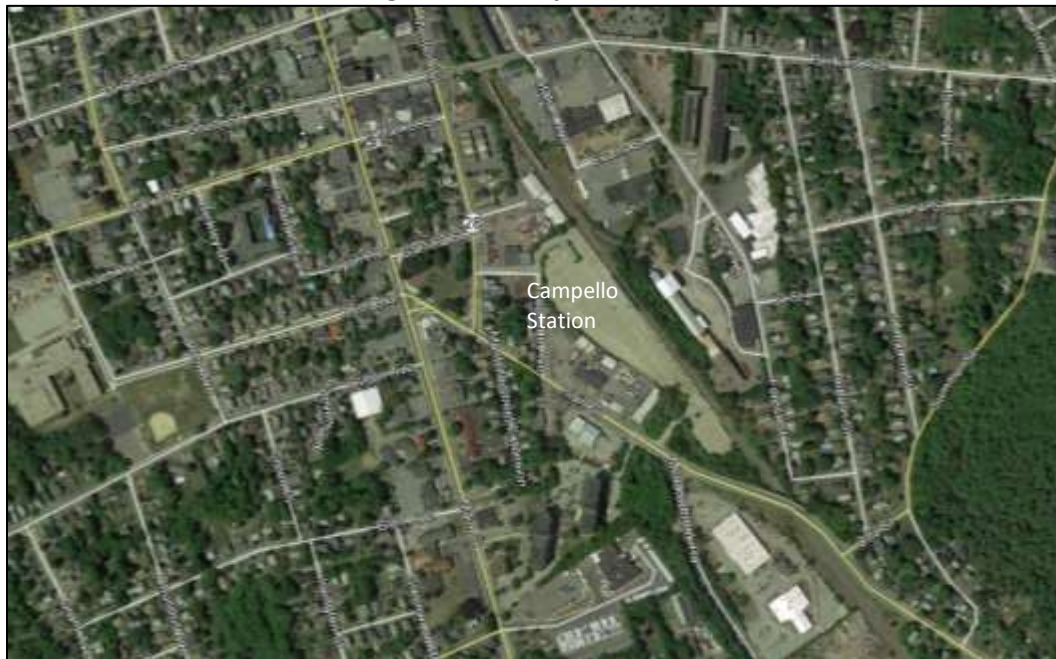


Figure 15 - Campello Station



4 Existing Traffic and Operational Conditions

4.1 Average Daily Traffic, Prevailing Speeds, and Heavy Vehicles

OCPD utilized automatic traffic recorders placed at various points along the Main Street corridor and on important intersecting 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 14 shows the average daily traffic (Vehicles Per Day, VPD), 24-hour total for both directions of travel on the Main Street corridor, as well as the prevailing 85th percentile speeds (Miles Per Hour, MPH), and the percentage of heavy vehicles in the traffic flow. Table 14 also shows the average daily traffic, the prevailing 85th percentile speeds, and the percentage of heavy vehicles for intersecting streets and on Route 106. The automatic traffic recorder count reports are included in the appendix to this study.

Table 14 – Automatic Traffic Recorder Counts - Brockton

	Location	Year of count	ADT	85th %	Trucks
1	Main Street (Route 28) at the Brockton and West Bridgewater Line	2020	8,228	44 MPH	9.9%
2	Main Street (Route 28) north of Skyview Drive	2014	14,139	38 MPH	9.8%
3	Hayward Avenue west on Main Street (Route 28)	2019	6,866	39 MPH	7.9%
4	Main Street (Route 28) north of Hayward Avenue	2019	16,187	36 MPH	8.3%
5	Main Street south of Grove Street	2020	12,878	30 MPH	8.5%
6	Grove Street east of Main Street	2020	5,468	29 MPH	6.1%
7	Main Street south of Nilsson Street	2020	10,707	31 MPH	8.9%
8	Nilsson Street west of Main Street	2020	3,074	30 MPH	5.2%
9	Main Street south of Forest Avenue	2019	12,780	30 MPH	6.0%
10	Main Street north of Forest Avenue	2019	12,876	30 MPH	5.9%
11	Forest Avenue west of Main Street	2020	7,426	30 MPH	6.1%
12	Main Street north of Belmont Street (downtown northbound one-way)*	2018	11,427	NA	NA
13	Main Street north of Legion Parkway (downtown northbound one-way)*	2018	8,152	NA	NA
14	North Main Street north of Spring Street	2020	11,839	30 MPH	8.3%
15	Eliot Street east of North Main Street	2020	2,819	29 MPH	8.5%
16	North Main Street south of Prospect Street	2019	14,956	31 MPH	8.7%
17	North Main Street north of Prospect Street	2019	14,712	31 MPH	8.3%
18	Prospect Street west of North Main Street	2019	5,125	29 MPH	6.0%
19	North Main Street at the Avon Town Line	2020	16,205	39 MPH	4.3 %

*Counts taken from consultant downtown Two-Way Conversion Study

The heaviest daily traffic volumes with the Main Street corridor study occurs at the Avon Town Line. This location on Main Street carries 16,205 vehicles per day (VPD). Other locations on Main Street that experienced high daily traffic volumes include Main Street north of Hayward Avenue with 16,187 VPD, North Main Street south of Prospect Street with 14,956 VPD, North Main Street north of Prospect Street with 14,712 VPD, and Main Street north of Skyview Drive with 14,139 VPD. The downtown experienced volumes of 11,427 VPD north of Belmont Street and 8,152 VPD north of Legion Parkway.

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

This study includes peak hour turning movement counts (morning 7 to 9 AM, and afternoon 4 to 6 PM), and the peak hour level-of-analyses for 25 key intersections, (fourteen signalized and eleven un-signalized) in the Main Street Brockton corridor study area. The level-of-service analyses (LOS) were conducted 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 15 shows the delay criteria for each level-of-service for both un-signalized and signalized intersections.

Table 15 - 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 16 summarizes the signalized and un-signalized levels-of-service for the study area intersections under existing peak hour conditions in the study area. The analysis includes the morning a.m. peak hour and the p.m. peak hour. Failed traffic operations at intersections in Table 16 (LOS “E” and “F”) are shown in shaded blocks. Level-of-Service “D” represents long delays and back-ups with volumes approaching congestion.

Table 16 – Main Street Brockton Intersection Existing Peak Hour Level-of-Service

	Intersection	Traffic Control	Existing AM LOS	Existing PM LOS
1	Main Street (Route 28) at Skyview Drive	Stop Sign		
	Skyview eastbound left and right turns	---	B	B
	Main Street northbound left turns	---	A	A
2	Main Street (Route 28) at Hayward Avenue	Stop Sign		
	Hayward Avenue left and right turns	---	F	F
	Main Street northbound left turns	---	A	A
3	Main Street (Route 28) at Sargent's Way/Sylvia Avenue	Signal	C	B
4	Main Street (Route 28) at Brookside Avenue	Signal	C	C
5	Main Street (Route 28) at Keith Avenue and Plain Street (Route 28)	Signal	B	B
6	Main Street at Market Street	Stop Sign		
	Market Street eastbound left, through, right turns	---	D	E
	Main Street southbound left turns	---	A	A
7	Main Street at Perkins Avenue and South Street	Signal	B	B
8	Main Street at East and West Chestnut Street	Stop Sign		
	West Chestnut Street westbound left, through, right turns	---	D	F
	Main Street southbound left turns	---	A	A
9	Main Street at East Nilsson Street and Nilsson Street	Stop Sign		
	Nilsson Street eastbound left, through, right turns	---	D	F
	East Nilsson Street westbound left, through, right turns	---	C	E
	Main Street northbound left turns	---	A	A
	Main Street southbound left turns	---	A	A
10	Main Street at Grove Street	Stop Sign		
	Grove Street left and right turns	---	F	F
	Main Street southbound left turns	---	A	A
11	Main Street at Forest Avenue and Martin Place	Stop Sign		
	Forest Street eastbound left, through, right turns	---	F	F
	Martin Place westbound left, through, right turns	---	C	E
	Main Street northbound left turns	---	A	A
	Main Street southbound left turns	---	A	A
12	Main Street at Lawrence Street	Stop Sign		
	Lawrence Street westbound left and right turns	---	E	F
	Main Street southbound left turns	---	A	A

Table 16 – Main Street Brockton Intersection Existing Peak Hour Level-of-Service (continued)

	Intersection	Traffic Control	Existing AM LOS	Existing PM LOS
13	Main Street at Belmont Street	Signal	B	B
14	Main Street at Crescent Street	Signal	A	A
15	Main Street at East and West Elm Street	Signal	B	B
16	Main Street at School Street and Frederick Douglass	Signal	B	B
17	Main Street at Legion Parkway and Centre Street	Signal	B	B
18	Main Street at Court Street at Pleasant Street	Signal	C	C
19	North Main Street at Prospect Street	Stop Sign		
	Prospect Street eastbound left and right turns	---	E	F
	North Main Street northbound left turns	---	A	A
20	North Main Street at Eliot Street/Waverley Street	Stop Sign		
	Waverley Street eastbound left, through, and right turns	---	D	F
	Eliot Street westbound left, through, and right turns	---	D	F
	North Main Street northbound left turns	---	A	A
	North Main Street southbound left turns	---	A	A
21	North Main Street at East and West Ashland Street	Signal	C	C
22	North Main Street at East and West Battles Street	Signal	B	B
23	North Main Street at Ames Street	Signal	A	B
24	North Main Street at Oak Street and Howard Street (Route 37)	Signals	C	E
25	North Main Street at West Main Street/East Main Street	Stop Sign		
	East Main Street westbound left and right turns	---	C	E
	East Main Street southbound left turns	---	A	A

Table 16 shows that there are a number of intersections within the Main Street corridor that experience excessive delays operating at LOS “E” and/or “F” during the morning and afternoon peak hour. Level-of-service “E” and “F” are considered at capacity and beyond capacity. These intersections, except for the North Main Street at Oak Street/Howard Street intersections are stop sign controlled. The LOS “E” and “F” conditions are on the minor street approaches to the stop sign controlled intersections and the poor levels-of-service are due to the lack of sufficient gaps in the major street, Main Street, traffic flow during the morning and afternoon peak hours. Vehicles entering Main Street on the stop sign controlled approaches therefore have to force their way into the Main Street traffic flow creating unsafe conditions. The North Main Street at Oak Street and Howard Street (Route 37) intersection is the only signal controlled intersection that experiences failed peak hour operating conditions with LOS “E” during the afternoon peak hour.

4.3 Intersection Crash Experience

Crash data for the study area intersections within the Main Street corridor study area was obtained for the latest available three-year period (2017-2018-2019) 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 0.78 MEV for signalized

intersections and 0.57 MEV for un-signalized intersections. The MassDOT District 5 average crash rates are 0.75 MEV for signalized intersections and 0.57 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 crash 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 17 summarizes the number of crashes and corresponding crash rates for the study area corridor intersections for the three-year history 2017, 2018, and 2019. Crash rates that exceed the statewide and District 5 crash rate averages are shaded in Table 17.

Table 17 - Intersection Crashes and Crash Rates (2017, 2018, 2019)

	Intersection	Traffic Control	Property Damage Only	Injury Crashes	Fatal	Total	Crash Rate
1	Main Street (Route 28) at Skyview Drive	Stop Sign	1	1	0	2	0.21
2	Main Street (Route 28) at Hayward Avenue	Stop Sign	5	4	0	9	0.46
3	Main Street (Route 28) at Sargent's Way/Sylvia Avenue	Signal	6	1	0	7	0.35
4	Main Street (Route 28) at Brookside Avenue	Signal	10	2	0	12	0.75
5	Main Street (Route 28) at Keith Avenue and Plain Street (Route 28)	Signal	5	3	0	8	0.43
6	Main Street at Market Street	Stop Sign	4	2	0	6	0.49
7	Main Street at Perkins Avenue and South Street	Signal	13	16	1	30	2.41
8	Main Street at East and West Chestnut Street	Stop Sign	3	4	0	7	0.54
9	Main Street at East Nilsson Street and Nilsson Street	Stop Sign	15	18	0	33	2.34
10	Main Street at Grove Street	Stop Sign	6	4	0	10	0.63
11	Main Street at Forest Avenue and Martin Place	Stop Sign	4	6	0	10	0.66
12	Main Street at Lawrence Street	Stop Sign	3	2	0	5	0.28
13	Main Street at Belmont Street	Signal	7	6	0	13	0.79
14	Main Street at Crescent Street	Signal	5	2	0	7	0.45
15	Main Street at East and West Elm Street	Signal	2	1	0	3	0.22
16	Main Street at School Street and Frederick Douglass	Signal	5	5	0	10	0.62
17	Main Street at Legion Parkway and Centre Street	Signal	28	20	1	49	2.66
18	Main Street at Court Street at Pleasant Street	Signal	15	23	0	38	1.57
19	North Main Street at Prospect Street	Stop Sign	4	2	0	6	0.30
20	North Main Street at Eliot Street/Waverley Street	Stop Sign	6	2	0	8	0.37
21	North Main Street at East and West Ashland Street	Signal	3	5	0	8	0.37
22	North Main Street at East and West Battles Street	Signal	5	9	0	14	0.76
23	North Main Street at Ames Street	Signal	2	7	1	10	0.69
24	North Main Street at Oak Street and Howard Street (Route 37)	Signals	24	17	0	41	1.33
25	North Main Street at West Main Street/East Main Street	Stop Sign	1	0	0	1	0.06

Table 17 shows that three fatalities occurred during the three-year study period. These occurred at three different intersections including Main Street at Perkins Avenue/South Street, Main Street at Legion Parkway and Centre Street, and Main Street at Ames Street.

Table 17 shows that the highest number of crashes within the Main Street corridor occurred at the Main Street/Legion Parkway/Centre Street intersection with 49 crashes. The North Main Street at Oak Street and Howard Street (Route 37) had the second highest number of crashes with 41 in three years.

Other intersections with a high number of crashes included the Main Street at Court Street at Pleasant Street with 38 crashes, The Main Street at East Nilsson Street and Nilsson Street intersection with 33 crashes, and the Main Street at Perkins Avenue and South Street with 30 crashes.

The Main Street at Legion Parkway and Centre Street intersection had the highest crash rate at 2.66 crashes per million entering vehicles (MEV) with the Main Street at Perkins Avenue and South Street intersection second highest with a 2.47 MEV rate. Other intersections with elevated crash rates (over 1.00 MEV) include the Main Street at East Nilsson Street and Nilsson Street intersection (2.34 MEV), the Main Street at Court Street at Pleasant Street (1.57 MEV), and the North Main Street at Oak Street and Howard Street (Route 37) intersection (1.33 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. 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 are eligible for the Highway Safety Improvement Program, HSIP). There were four intersections within the Main Street Brockton corridor that are included in the top 200 high crash intersection list. These include The Main Street at Nilsson Street/East Nilsson Street intersection, the Main Street at Legion Parkway/Centre Street intersection, the Main Street at Pleasant Street/Court Street intersection, and the Main Street at Oak Street/Howard Street (Route 37) intersection.

There are also number of intersections that are included in the top five percent crash locations for pedestrian and bicycles within the OCPC Region. This crash cluster extends from the main Street at Nilsson Street/east Nilsson Street intersection northward through the Downtown Brockton to the Main Street at Battles Street/east Battles Street intersection.

4.4 Crash Severity Compared to Other Gateway Cities in Massachusetts

OCPC completed analysis to see how Brockton compares to other Gateway Cities in terms of crash severity. OCPC sampled data from 2017, 2018, and 2019 that included the crashes that either had a confirmed fatality, or a confirmed severe (incapacitating) injury. The percentage of all crashes that resulted in a fatality or severe injury in each city was compare across all Gateway Cities. Excluded were crashes where the driver or passenger was deceased but could not be determined if it was due to crash.

Based on the data, the only other Gateway City that had a higher rate of fatal or severe injury crashes was Revere. Table 18 shows the Gateway City Crash comparison.

Table 18

Gateway City	Pop.	2017			2018			2019			Fatal Crashes 2017 - 2019	% Crashes Fatal or injury 2017 - 2019
		Total Crashes	Injury Reported	Fatal	Total Crashes	Injury Reported	Fatal	Total Crashes	Injury Reported	Fatal		
Revere	53,993	793	42	2	829	20	0	843	16	4	6	3.41%
Brockton	95,672	2,440	74	6	2,478	65	13	2,471	54	7	26	2.96%
Taunton	57,139	1,359	40	2	1,308	29	4	1,301	27	2	8	2.62%
Attleboro	44,950	1,235	30	2	1,150	34	2	1,212	24	2	6	2.61%
Barnstable	44,163	1,255	23	5	1,320	28	2	1,268	27	3	10	2.29%
Westfield	41,700	786	15	4	776	18	2	671	11	0	6	2.24%
Lynn	94,063	3,156	54	2	2,829	50	1	2,150	73	1	4	2.22%
Quincy	94,166	2,282	47	6	2,430	53	7	2,252	36	3	16	2.18%
Everett	46,324	503	16	0	472	7	0	446	6	1	1	2.11%
Chelsea	40,227	901	23	2	924	16	0	873	15	0	2	2.08%
Springfield	154,758	4,664	138	11	4,716	51	14	4,872	58	17	42	2.03%
Salem	41,654	655	17	0	732	12	1	706	1	9	10	1.91%
Malden	61,246	945	18	2	1,014	17	1	977	13	2	5	1.81%
Lawrence	80,162	1,710	33	4	1,853	33	1	1,811	25	1	6	1.80%
Leominster	41,615	1,405	23	2	1,320	15	2	1,193	25	3	7	1.79%
Chicopee	55,915	1,908	26	6	1,990	35	2	1,943	24	2	10	1.63%
Haverhill	63,639	2,012	23	1	1,920	29	3	1,908	31	7	11	1.61%
New Bedford	95,120	3,153	62	6	3,657	48	2	3,620	40	5	13	1.56%
Lowell	111,346	3,423	40	1	3,543	49	2	3,325	54	3	6	1.45%
Worcester	185,677	5,759	76	9	5,732	60	7	5,757	79	13	29	1.41%
Holyoke	40,341	1,783	25	4	1,837	23	1	1,956	23	1	6	1.38%
Fall River	89,420	2,779	28	9	2,760	33	5	2,805	35	4	18	1.37%
Methuen	50,259	1,521	15	4	1,452	15	4	1,532	14	0	8	1.15%
Pittsfield	42,591	851	5	1	1,039	7	1	797	11	1	3	0.97%
Fitchburg	40,793	1,356	11	1	1,306	11	4	1,435	7	0	5	0.83%
Peabody	52,987	1,493	18	3	1,377	5	1	1,284	2	2	6	0.75%

4.5 Pavement Conditions

OCPC uses pavement management software (PMS) to maintain a region-wide data base of pavement surface conditions for federal aid roads. The PMS includes a data base that documents the severity and extent of pavement deterioration and the implications for cost of maintenance and repair. The severity and extent of pavement surface deterioration is obtained via a windshield survey of roads and then entered into the PMS. The software calculates Pavement Condition Index (PCI) scores for the surveyed road segments. 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 Main Street corridor in Brockton. The windshield survey results were documented and added to the PMS software database. Potential improvement recommendations, along with associated estimated costs, were matched with the segments of the corridor.

OCPC’s region-wide Pavement Management System includes all roads eligible for federal aid, including Main Street. Figure 16 shows the pavement surface conditions for the Main Street corridor, and Figure 17 shows the potential recommendations associated with the existing surface conditions based on the pavement management system output.

Figure 16 – Main Street Brockton Pavement Conditions



Figure 17 – Main Street Brockton Pavement Recommendations

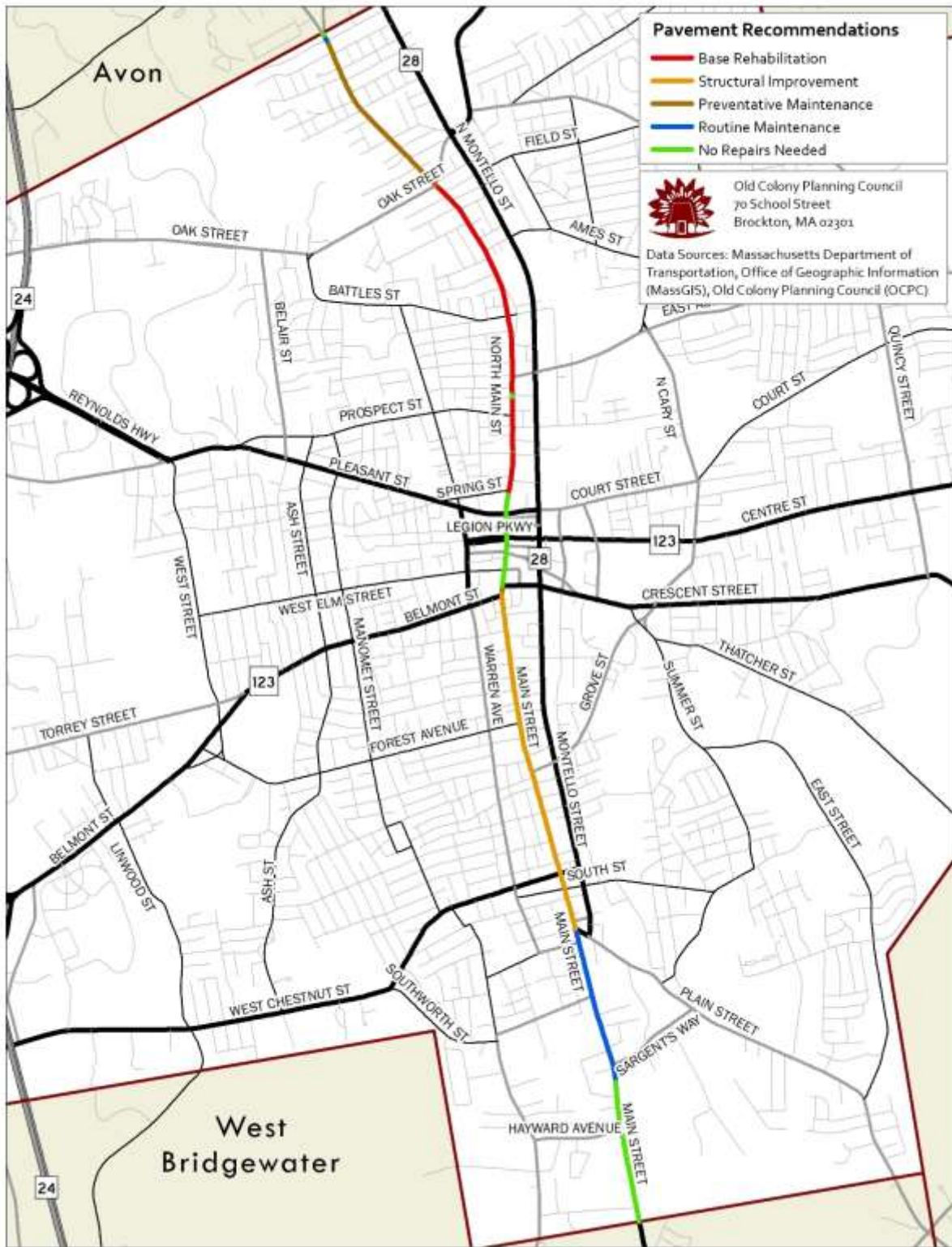


Figure 16 shows that North Main Street, from Spring Street to Oak Street is in “Poor” condition, and north of Oak Street to the Avon Town Line, North Main Street is in “Fair” condition. Main Street south of Spring Street to Belmont Street in the downtown is in “Good” condition. South of Belmont Street, Main Street to Plain Street, south of the downtown, is in “Deficient” condition and requires structural improvement. Main Street south of Plain Street to the West Bridgewater Town Line is in “Excellent” to “Good” condition. Figure 17 shows that base improvements are recommended for North Main Street between Spring Street and Oak Street, preventative maintenance from Oak Street to the Avon Town Line, and structural improvements are required from Plain Street to Belmont Street on Main Street south of Downtown Brockton. Table 19 summarizes the estimated costs for the recommended pavement repairs in the corridor.

Table 19

MAIN STREET SEGMENT	FROM	TO	LENGTH (FEET)	ROAD CLASS	RECOMMENDED REPAIR	ESTIMATED COST	CURRENT PCI
Main Street (Route 28)	West Bridgewater Line	Sylvia Way	2,500	Principal Arterial	None	\$0.0	99
Main Street (Route 28)	Sylvia Way	Plain Street	3,945	Principal Arterial	Routine Maintenance	\$78,374.84	87
Main Street	Plain Street	Belmont Street	7,353	Minor Arterial	Structural Improvement	\$541,078.20	61
Main Street	Belmont Street	Crescent Street	200	Minor Arterial	Preventative Maintenance	\$2,214.20	85
Main Street	Crescent Street	Pleasant/Court Street	1,800	Principal Arterial	None	\$0.0	99
North Main Street	Pleasant/Court Street	Spring Street	520	Minor Arterial	None	\$0.0	99
North Main Street	Spring Street	Oak Street	6,980	Minor Arterial	Base Rehabilitation	\$1,208,331.00	58
North Main Street	Oak Street	East Main Street	4,070	Minor Arterial	Preventative Maintenance	\$78,843.03	81
North Main Street	East Main Street	Avon Town Line	100	Minor Arterial	None	\$0.0	99

4.6 Environmental Issues

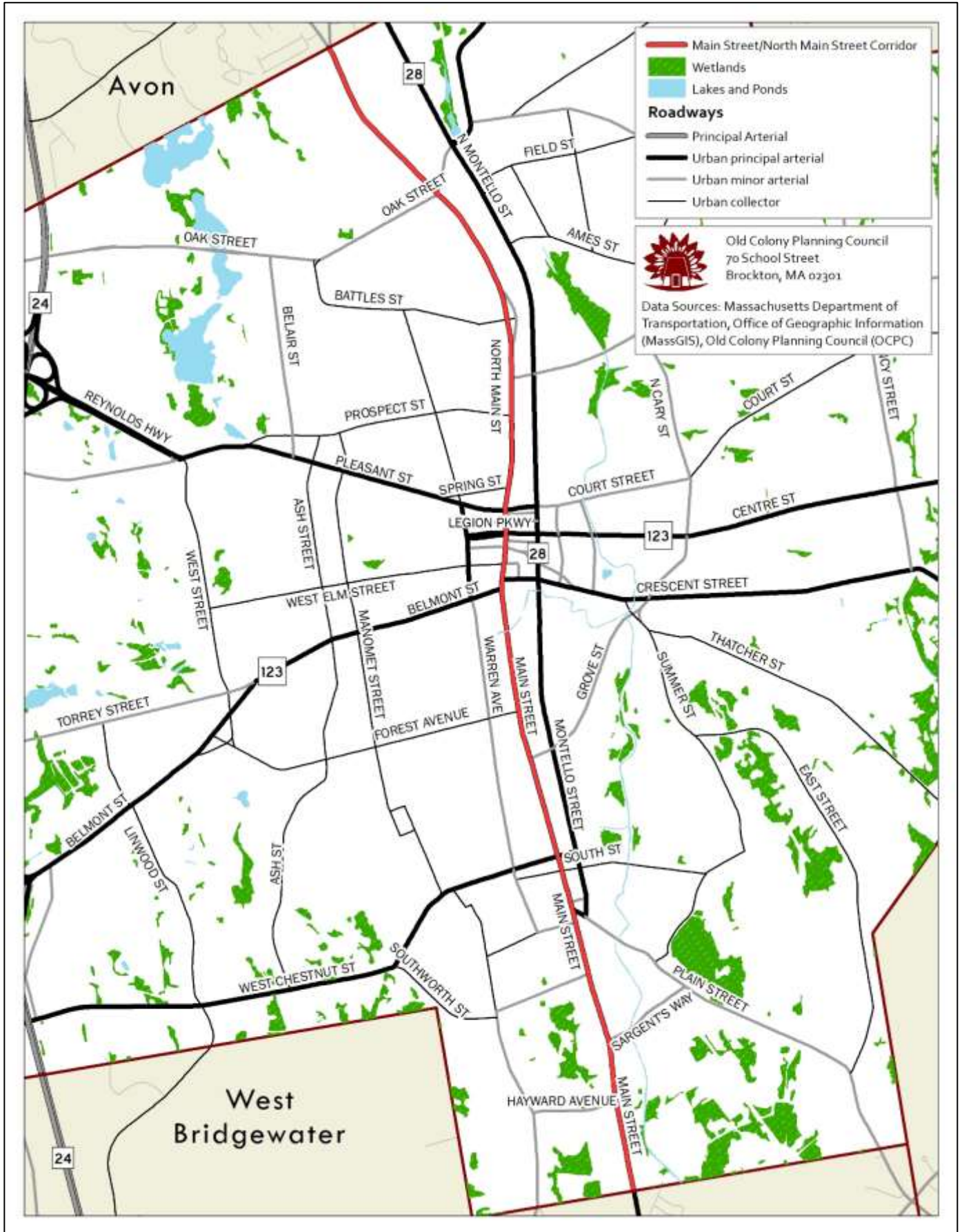
Any improvements for safety and/or to relieve congestion should take into account the diversity of environmental features in a particular area. The study area along Main Street in Brockton is urban and developed. Nevertheless, drainage issues can be a concern especially within specific areas within the study area. Figure 18 shows the wetland areas along the Main Street corridor in Brockton. One of the areas that has reoccurring draining issues is located on the west side of Main Street (Route 28) just north of the West Bridgewater Town Line. This area is within the Salisbury River plain and is subject to sporadic flooding. This area is along the corridor in front of an existing commercial shopping plaza. At one time, a storm water quality improvement project for this area was included in the Old Colony Transportation Improvement Program (TIP); however, due to a lack of interest in the project from the abutting landowners, the project is not being pursued by MassDOT and therefore no longer on the TIP. The purpose of the project was to capture and treat drainage along the west side of Main Street (Route 28) in front of the retail plaza. Figure 18 shows extensive wetlands to the east and west of the Main Street (Route 28) corridor in the south of Brockton south of the Plain Street intersection.

There are a number of streams and brooks that intersect Main Street, as well as ponds and wetlands along the corridor. These are not usually visible from the road. Closer to the downtown, the Salisbury Brook

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crosses beneath Main Street just south of Crescent Street. In the north of Brockton, the Trout Brook is adjacent to Montello Street east of North Main Street, and the Brockton Reservoir in D.W. Field Park west of Main Street. These water bodies do not; however, cross North Main Street.

Figure 18 – Wetland Areas in Brockton



5 Future Conditions and Operations

5.1 Future Traffic Analysis (NO-BUILD)

A five-year time horizon (Year 2025) has been chosen for analysis of future conditions, which is consistent with MassDOT guidelines for traffic studies. An average annual growth rate of 1.0 percent per year was used as a background growth rate to increase 2020 traffic to approximate future 2025 No-Build conditions. The average annual growth rate was derived from the rate of growth of traffic within the Main Street corridor based on historic traffic count data compiled by MassDOT and also from counts compiled by OCPC in the *Old Colony Traffic Volumes Report*. The background volume data is included in the Appendix to this report.

No-Build conditions assume there are no improvements made to the intersections 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 20 summarizes the intersection levels-of-service for the study area intersections under No-Build peak hour conditions for the study area intersections.

Table 20 shows that the levels-of-service (LOS) from existing to the future No-Build LOS at the study area intersections will remain mostly the same. This means that the intersections that are congested under existing conditions will remain that way in five years. This is mostly at the un-signalized intersections, where the minor street approaches are at LOS “F”, failed conditions due to the peak hour flows on the Main Street, which do not have adequate gaps in the traffic for the vehicles from the minor street to enter Main Street safely. The level-of-service at the signalized intersections is expected to remain the same under “No-Build” peak hour conditions as under existing conditions with two exceptions. The LOS will drop from LOS “C” to LOS “D” at the Main Street/Court Street/Pleasant Street intersection for the morning peak hour. In addition, the LOS will drop from LOS “E” to LOS “F” for the North Main Street at Oak Street and Howard Street intersection for the afternoon peak hour.

Table 20 - No-Build 2025 Intersection Levels-of-Service

	Intersection	Traffic Control	Existing AM LOS	Existing PM LOS	2025 No-Build AM LOS	2025 No-Build PM LOS
1	Main Street (Route 28) at Skyview Drive	Stop Sign				
	Skyview eastbound left and right turns	---	B	B	B	B
	Main Street northbound left turns	---	A	A	A	A
2	Main Street (Route 28) at Hayward Avenue	Stop Sign				
	Hayward Avenue left and right turns	---	F	F	F	F
	Main Street northbound left turns	---	A	A	A	A
3	Main Street (Route 28) at Sargent's Way/Sylvia Avenue	Signal	C	B	C	B
4	Main Street (Route 28) at Brookside Avenue	Signal	C	C	C	C
5	Main Street (Route 28) at Keith Avenue and Plain Street (Route 28)	Signal	B	B	B	B
6	Main Street at Market Street	Stop Sign				
	Market Street eastbound left, through, right turns	---	D	E	D	F
	Main Street southbound left turns	---	A	A	A	A
7	Main Street at Perkins Avenue and South Street	Signal	B	B	C	B
8	Main Street at East and West Chestnut Street	Stop Sign				
	West Chestnut Street westbound left, through, right turns	---	D	F	D	F
	Main Street southbound left turns	---	A	A	A	A
9	Main Street at East Nilsson Street and Nilsson Street	Stop Sign				
	Nilsson Street eastbound left, through, right turns	---	D	F	D	F
	East Nilsson Street westbound left, through, right turns	---	C	E	C	F
	Main Street northbound left turns	---	A	A	A	A
	Main Street southbound left turns	---	A	A	A	A
10	Main Street at Grove Street	Stop Sign				
	Grove Street left and right turns	---	F	F	F	F
	Main Street southbound left turns	---	A	A	A	A
11	Main Street at Forest Avenue and Martin Place	Stop Sign				
	Forest Street eastbound left, through, right turns	---	F	F	F	F
	Martin Place westbound left, through, right turns	---	C	E	C	E
	Main Street northbound left turns	---	A	A	A	A
	Main Street southbound left turns	---	A	A	A	A
12	Main Street at Lawrence Street	Stop Sign				
	Lawrence Street westbound left and right turns	---	E	F	F	F
	Main Street southbound left turns	---	A	A	A	A

Table 20 - No-Build 2025 Intersection Levels-of-Service (continued)

	Intersection	Traffic Control	Existing AM LOS	Existing PM LOS	2025 No-Build AM LOS	2025 No-Build PM LOS
13	Main Street at Belmont Street	Signal	B	B	B	B
14	Main Street at Crescent Street	Signal	A	A	A	A
15	Main Street at East and West Elm Street	Signal	B	B	B	B
16	Main Street at School Street and Frederick Douglass	Signal	B	B	B	B
17	Main Street at Legion Parkway and Centre Street	Signal	B	B	B	B
18	Main Street at Court Street at Pleasant Street	Signal	C	C	D	C
19	North Main Street at Prospect Street	Stop Sign				
	Prospect Street eastbound left and right turns	---	E	F	F	F
	North Main Street northbound left turns	---	A	A	A	B
20	North Main Street at Eliot Street/Waverley Street	Stop Sign				
	Waverley Street eastbound left, through, and right turns	---	D	F	D	F
	Eliot Street westbound left, through, and right turns	---	D	F	D	F
	North Main Street northbound left turns	---	A	A	A	A
	North Main Street southbound left turns	---	A	A	A	A
21	North Main Street at East and West Ashland Street	Signal	C	C	C	C
22	North Main Street at East and West Battles Street	Signal	B	B	B	C
23	North Main Street at Ames Street	Signal	A	B	A	B
24	North Main Street at Oak Street and Howard Street (Route 37)	Signals	C	E	D	F
25	North Main Street at West Main Street/East Main Street	Stop Sign				
	East Main Street westbound left and right turns	---	C	E	D	F
	East Main Street southbound left turns	---	A	A	A	A

5.2 Build Conditions

Build conditions assume there are improvements made to the intersections within the next five years. Build conditions assume traffic increases due background increases, as under No-Build, but also assume increases in traffic specifically due to new development identified along the corridor, as well as in the general area.

The Brockton Redevelopment Authority lists a number of potential projects that will be impacting transportation operations within the Main Street corridor, and in particular, the downtown. The following projects in Brockton are located on Main Street or in close proximity with the potential to impact traffic and transportation operations on Main Street:

Mayor Bill Carpenter Garage

The City of Brockton has constructed a 414-parking space public parking garage in downtown Brockton located on Petronelli Way between Main Street and Montello Street. The city is also proposing a circulation improvement that includes the construction of a new street connecting Petronelli Way and Court Street. Petronelli Way will be converted from a one-way street eastbound to two-way traffic to accommodate the new parking garage. The garage opened on March 1, 2020. The spaces are to be utilized as follows: 200 commercial spaces are for both new and existing downtown businesses; 55 residential spaces are for residential units at the Enterprise Center; and 159 public spaces are for daily parkers patronizing downtown businesses. The proposed new street between Petronelli Way and Court Street along with the two-way Petronelli conversion, will be part of the Main Street two-way conversion project. In addition, a proposed shared use parking agreement will allow for spaces in the garage to be utilized during non-business hours for restaurants, arts, and entertainment venues in the downtown.

Nineteen Main Street

The building at 19 Main Street, which is currently unoccupied, is called the “First Parish Building”, and is located at the corner of Main Street and Green Street in downtown Brockton. The building contains central staircases to the upper floors, as well as skylights, which give it potential for reuse and rehabilitation. The ground floor provides opportunity for retail and/or restaurant spaces opening out onto Main Street. Although the building lacks parking, the newly built Carpenter Garage is located across Main Street on Petronelli Way within 250 feet. In addition, Main Street offers parking in front of the building and on both sides of the street. The rehabilitation of this building will result in 20 residential units and a commercial use on the ground floor facing Main Street.

The Sycamore (Formerly the site of the “Kresge” Building)

The Sycamore project is located on Main Street at the corner of Main Street and Frederick Douglass Way. This parcel is the location of a building known as the “Kresge” Building, which has been demolished. It consists of 48-unit rental units and is 100 percent affordable housing. This project is considered an infill and smart growth project and contains a ground floor commercial component. The building is currently under construction.

Lincoln School

The City of Brockton designated NeighborWorks Housing Solutions (NHS) to redevelop the currently vacant Lincoln School property located at 70 Highland Street in Brockton. It is located approximately one-third of a mile from Main Street. The property will be redeveloped into 39 units of senior housing. Three of the units will be studios and 36 units will be one-bedroom apartments.

The US Congress authorized the National Housing Trust Fund (NHTF) to address the critical shortage of rental housing units affordable to Extremely Low Income (ELI) households, which is defined as households with incomes between zero to thirty percent of Area Median Income (AMI). The expansion of NHTF’s rental housing is designed to benefit people with significant disabilities and whose income, as a national average, is equal to less than 30 percent of area median income. At least 16 of the Lincoln Street units will be reserved for ELI households and formerly homeless households will make up at least four of these reserved ELI households. The remaining 23 units will serve 60 percent AMI households.

Forty-seven West Elm Street

This project is located on two parcels (total 13,460 square feet of land). The project consists of the demolition of a building, which had been unoccupied for over a decade, with the construction of a new five story, residential building with parking on the basement floor. This building is located within 500 feet of Main Street and is expected to increase pedestrian traffic in the downtown. The construction of this building will add 45 residential units to the downtown. The building is currently under construction.

Ninety-three Centre Street (Sometimes called the “Furniture Building”)

The plans for the rehabilitation of the building located at 93 Centre, on the corner of Montello Street and Centre Street, is to create approximately 60 rental apartments and 3,821 square feet of commercial space on the ground floor. As a requirement of the city’s Chapter 40R zoning, twenty percent of the apartments will be affordable to people earning up to eighty percent of the local area median income. A new surface parking lot in the rear of the building will be provided for a total of 18 parking spaces, with two spaces ADA accessible. Other parking located nearby owned by the Brockton Parking Authority will be potentially utilized by building tenants.

Proposed Public Safety Campus

This proposed project is a Public Safety Campus at the site of the former high school on Warren Avenue. The campus would consist of a 110,000 square foot facility. This proposal includes an extension of Legion Parkway from Warren avenue east to Goddard Street.

Proposed Municipal 400 Space Garage

The City is proposing a new 400 space parking garage on Frederick Douglass at L Street. The garage would make up for the loss of on street parking on Main Street and Legion Parkways as a result of the two-way Main Street conversion. It would also replace the existing surface parking around the Stadleman Garage and provide the required parking for approximately 250 residential units west of Main Street and south of Frederick Douglass. The garage is expected to be completed at the same time as the public safety campus.

For analysis purposes, the potential impact of five of the projects were assumed to impact Build conditions for this study, since only these projects are under construction and/or have the potential to be completed within the horizon years. It is likely that the other projects will not be built within the five-year horizon of this study, although the city has set a goal to add more residential units to the Downtown within the next five years. Table 21 shows the projects and the expected trip generation.

Table 21 – Estimated Trip Generation for Potential Projects

Facility	AM Peak Hour	PM Peak Hour	Daily Trips
Mayor Carpenter Garage	207	207	331*
Sycamore (Formerly Kresge Building)	14	17	165
Forty-Seven West Elm Street	14	16	155
Proposed Public Safety Campus	228	205	2,228
Frederick Douglass Street Garage	200	200	320*

*Assumes garages are used at 80 percent capacity.

Trips to and from parking garages are generated by the uses for which the parking area is constructed. The garages in Downtown Brockton are used by a number of different land uses, including, government, retail, restaurant, medical, and residential. According to the *Brockton Downtown Parking Study, 2019*, conducted by a consultant for the City, the existing Adams Garage in the Downtown is 60 to 80 percent filled during an average weekday. The parking demand at the Adams garage begins to drop after Noon (12:00 PM). Parking garage trip rates are not available in the *ITE Trip Generation Manual*. For analysis purposes for this study, a trip generation rate of 0.5 trips per parking space was used as a default standard to estimate the AM and PM peak hour trip generation at the two new Brockton Downtown garages shown in Table 21 (the Carpenter Garage was constructed in 2020, and Frederick Douglass Street Garage is proposed). The Sycamore Development and the residential development at 47 West Elm Street are currently under construction. The proposed Public Safety Campus is located at the site of the old Brockton High School, which is currently in use as an alternative high school in the Brockton public school system.

For analysis purposes, two alternative Build scenarios are included for the Brockton Downtown. The first alternative assumes that the City of Brockton has not implemented the two-way Downtown conversion. The second Build alternative assumes that the City has implemented the two-way Downtown alternative.

5.2.1 Future Traffic Analysis Alternative 1, Without Two-way Downtown Conversion

Morning and afternoon peak hour level-of-service analysis (LOS) was conducted for the six Brockton Downtown signalized intersections assuming that the Main Street northbound direction one-way is still in place over the next five years. The “Build” Alternative 1 Scenario assumes a background growth rate of one percent per year plus the additional trips from Table 21 assigned to the Main Street network in the Downtown. Table 22 summarizes the AM and PM peak hour LOS for the Brockton Downtown for this alternative.

Table 22 - Build Intersection LOS Brockton Downtown One-Way

Brockton Downtown Intersections	Traffic Control	Existing AM LOS	Existing PM LOS	No-Build AM Peak	No-Build PM LOS	Build one-way AM LOS	Build one-way PM LOS
Main Street at Belmont Street (Route 123)	Signal	B	B	B	B	C	B
Main Street at Crescent Street (Route 123)	Signal	A	A	A	A	A	A
Main Street at West Elm Street	Signal	B	B	B	B	B	C
Main Street at School Street/Fred Douglass	Signal	B	B	B	B	B	B
Main Street at Legion Parkway/Centre Street	Signal	B	B	B	B	B	B
Main Street at Pleasant Street/Court Street	Signal	C	C	D	C	E	D

Table 22 shows that three intersections in Downtown Brockton will likely be impacted by the “Build” scenario 1. The AM peak hour LOS at the Main Street at Belmont Street intersection will go from LOS “B” under “No-Build” to LOS “C”, the PM Peak hour LOS at the Main Street at West Elm Street intersection will drop from LOS “B” to “C”, and the AM and PM LOS at the Main Street/Pleasant Street/Court Street intersection will both go from LOS “D” to “E” for the AM peak and from LOS “C” to “D” for the PM peak hour.

5.2.2 Brockton Future Two-Way Conversion LOS Analysis, Downton Alternative 2

Intersection peak-hour levels-of-service (LOS) for the future “Build” conditions with the assumption that the City of Brockton’s two-way proposal is in place were completed in 2019 by an engineering consultant for the City. The purpose of the study was to develop alternatives to improve safety and mobility for the two-way alternative and to improve safety and mobility for all road users. The study utilized Complete Streets Guidelines to improve bicycle, pedestrian, and transit accommodations and accessibility. The conceptual designs of the cross-section of Main Street in the Downtown are included in the appendix.

The study intent was to implement infrastructure improvements to support economic growth and the revitalization of the downtown. In addition, the study purpose was to confirm and establish the right -of -way in the downtown area.

The study analysis for future “Build” conditions 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 future “Build traffic included the estimated trip generation of a number of proposed developments for Downtown Brockton including:

- Furniture Building, 93 Centre Street, mixed use development.
- Kresge Building, 121 Main Street, mixed use development.
- First Parish Building, 19 Main Street, mixed use development.

- Petronelli Building, 28 Petronelli Way, mixed use development.
- 47 West Elm Street, Residential Development.
- Northwest corner of Montello and Petronelli Way, mixed use.
- Restaurant incubator, 11 – 15 Frederick Douglass Avenue, commercial.
- Enterprise Block, Phase II, Residential.
- Carpenter Parking Garage, 414 spaces.
- Pharmacy at the corner of Montello and Court Street.
- Grayson renovation, 28 Frederick Douglass Ave., residential.
- Montello Street mixed use between Centre and Court Streets.
- Warren and Pleasant Street, two vacant parcels, mixed use.
- Shawmut Bank Building, 90 Main Street, mixed use.
- Police Station Relocation, 7 Commercial Street, mixed use.
- Fire Station relocation, 42 – 52 Pleasant Street, mixed use.
- Legion Parkway gas station acquisition, 76, 81 Warren Ave., mixed use.
- Vacant or 121 and 137 Main Street, commercial.

Table 23 summarizes the levels-of-service for the Brockton downtown under two-way “Build” peak hour conditions alternative.

Table 23 - Build Intersection LOS Two-Way Conversion Brockton Downtown

Brockton Downtown Intersections	Traffic Control	Existing AM LOS	Existing PM LOS	No-Build AM Peak	No-Build PM LOS	Build Two-way AM LOS	Build Two-way PM LOS
Main Street at Belmont Street (Route 123)	Signal	B	B	B	B	C	B
Main Street at Crescent Street (Route 123)	Signal	A	A	A	A	C	A
Main Street at West Elm Street	Signal	B	B	B	B	D	B
Main Street at School Street/Fred Douglass	Signal	B	B	B	B	C	B
Main Street at Legion Parkway/Centre Street	Signal	B	B	B	B	C	B
Main Street at Pleasant Street/Court Street	Signal	C	C	D	C	C	C

Table 23 shows that the two-way conversion in the Brockton Downtown is expected to result in lower levels-of-service during the morning peak hour over the No-Build conditions at all the Brockton Downtown signalized intersections, except for the Main Street at Pleasant Street/Court Street intersection, which is expected to improve over the AM peak hour No-Build from LOS “D” to LOS “C”. All of the Downtown intersections are expected to operate at LOS “C” or better under the two-way Build alternative, except for the Main Street at West Elm Street intersection, which is expected to operate at LOS “D” during the AM peak under the two-way Build alternative. The Brockton Downtown intersections are expected to operate at the same LOS under the PM peak hour conditions under the two-way Build alternative as under the PM peak No-Build scenario.

6 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 the study area communities 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.

6.1 Corridor Wide Issues and Recommendations

Heavy peak period traffic volumes within the Main Street corridor, especially within those four Opportunity Areas, which have high levels of vehicle, transit, bicycle, and pedestrian activity, 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. This occurs mainly at un-signalized intersections on the stop sign minor approaches as traffic attempting to enter Route 106 from the side streets or driveways, especially during the peak hours, experience frustration due to the lack of sufficient gaps in the Main Street traffic stream. This creates “forced flow” conditions at most of the un-signalized intersections where vehicles force their way through the intersection creating unsafe turning movements.

Corridor-wide improvements include re-evaluating lighting along the corridor for better visibility of pedestrians at night, based on the crash experience as well as the comments from the public outreach program. Other 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 (especially in the downtown).

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 regard to traffic, pedestrian, and bicyclist safety and operation:

Overall short-term improvements:

- Enhanced street lighting along the corridor and at intersections for pedestrians, especially in the four Opportunity Areas
- 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).
- New and revised signing upgraded to meet MUTCD reflectivity standards.
- Replace missing or damaged signs.
- Post signs for shared use bicycle paths where feasible.
- 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), and overhead facing signals to improve visibility and reduce red light running.

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.

6.2 Bicycle Accommodations and Recommendations

6.2.1 Existing Bicycle Conditions

The roadway layout of streets within the City of Brockton is such that it is not always possible to travel through the city without having to transition to different roads to complete the journey. Main Street is one of the roads upon which individuals can travel in and through the city unimpeded, as Main Street goes through the geographic center of the city in a mostly a straight line in a north south direction. As a result of this feature, there is significant travel along Main Street by all modes of transportation, as Main Street functions as an arterial roadway, providing access across the city as well as providing access regionally.

Main Street for historical reasons and its close proximity to the three commuter rail stations in Brockton has been one of the prominent corridors for investment usage, businesses, and social services provided by the City of Brockton and the Commonwealth of Massachusetts, and because of these intensities of uses along the Main Street corridor, many individuals travel by automobile, on foot (Main Street is within walking distance local neighborhoods), by bicycle, public transportation, and Ride Hail app services. In addition, the traffic is enhanced due to truck and heavy commercial vehicle traffic as well as buses.

Land-uses along Main Street also vary depending on location and they influence what happens on the street. Along the corridor, there are multi-story mixed-use buildings and some single-family homes. Due to the varying density along Main Street and the types of building usage, traffic congestion and pedestrian and bicycle activity also vary. It is this concentration of services and housing along Main Street, which in-turn generates much vehicular traffic to and from the corridor, that makes it challenging for bicycle travel. Bicycle travel sometimes becomes a non-option for those bicyclists on Main Street (or in the City of Brockton overall) who are too intimidated by the volume and speed of traffic, unless there is safer bicycle transportation infrastructure available.

Since the Main Street Corridor varies in width depending on location, there is no one size fits all for bicycle accommodations corridor wide. Bicycle accommodations on the Main Street corridor will vary based on context and location. The City of Brockton should utilize accommodations that provide the highest degree of safety for bicyclists because bicyclists are vulnerable road users. If needed, parking should be curtailed to accommodate bicycle transportation infrastructure.

6.2.2 Main Street (Route 28) from Plain Street south to the West Bridgewater Line

Traffic between Plain Street to the West Bridgewater Line is significant, and speeds tend to be higher in this section as Main Street transitions from a two-lane cross section to a four-lane cross section. There is no parking along this section of Main Street, which also transitions from local Brockton jurisdiction, to State jurisdiction. Due to a lack of parking along this section, there is a shoulder along both sides on the road. Lane markings can be restriped to allows for on-road bicycle lanes on both sides of the road in this section of Main Street. Within the roadway where widths are between 50 feet to 55 feet, and where the road has a four-lane cross section, a road diet can provide wider or protected bicycle lanes (cycle tracks). This improvement in bicycle transportation infrastructure could also spur greater economic activity in an area of

the city that needs it because of a lack of access to Route 24 and the low density of housing in this section of Brockton and the neighboring community of West Bridgewater.

Figure 19 – Protected Bicycle Lane



6.2.3 Plain Street to Nilsson Street

In this section of Main Street, the roadway width is approximately 40 feet wide. With two travel lanes and on-street parking on both sides, there is room for a 5-foot bicycle lane on the northbound side. An accompanying bicycle lane along Warren street should be installed in the southbound direction to be the counterflow to this proposed northbound Main Street bicycle lane in this section of the Main Street corridor.

6.2.4 Nilsson Street to Belmont Street

The roadway width along this section of Main Street varies depending on location. This section of the corridor is designated as a crash cluster for bicycle and pedestrian crashes based on MassDOT data (it is in the top 5 percent crash locations in the OCPC region for bicycle and pedestrian crashes). The road is approximately 37 to 40 feet wide in this section of Main Street. Due to the variability of width, bicycle transportation infrastructure will also vary on Main Street between Nilsson Street and Belmont Street. In the sections where there is 40 feet of roadway width, a conventional bicycle lane should be painted along the roadway adjacent to parked cars in the northbound direction with a southbound bicycle lane painted on Warren Avenue to be its counterpart. In the areas where the road width is 37 feet to 38 feet wide, parking can be removed on the northbound side to accommodate a protected bicycle lane or bicycle track with a southbound bicycle lane painted on Warren Avenue. If parking cannot be removed, a sharrow bordered by dotted lines on both sides of the marking should be painted to indicate where the bicyclist should position him/herself while traveling along this section of Main Street.

Figure 20 – Raised Cycle Track



6.2.5 Belmont Street to Pleasant Street/Court Street (Downtown Brockton)

With the recommendation provided through the Downtown Brockton Two-way Study, OCPC recommends going with Alternative 1 and Alternative 2 for bicycle transportation infrastructure. Alternative 1 and Alternative 2 of the recommendation provided by BSC Group provide the greatest level of safety for those traveling by bicycle along this section of Main Street because they utilize protected bicycle lanes which shield bicyclist from moving traffic producing a more comfortable riding environment.

6.2.6 Pleasant Street/Court Street (Downtown Brockton) to Oak Street/Howard Street

This section of Main Street is approximately 40 feet wide. Although the roadway in this section appears considered constrained, opportunities for bicycle infrastructure exist based on the principals of Complete Streets design. This section of Main Street contains two travel lanes with parking on both sides of the road. A conventional parking adjacent bicycle lane should be painted on the northbound side of Main Street and Sharrow with dotted lines on both sides of the symbol should be painted along the roadway on the sound bound direction, while maintaining parking on both sides of the road. The businesses along this section of Main Street, as well as the residents, utilize the available off-street parking along the road. Eliminating parking along this stretch of Main Street can free up room to allow for the installation of protected bike lanes or cycle tracks, which provide a greater level of safety compared to conventional painted bicycle lanes. Another alternative consists of maintaining on-street parking on the southbound side of the street and replacing northbound parking with a two-way protected bicycle lane on the northbound side of the street.

Figure 21 - Sharrow



6.2.7 Oak Street/Howard Street to Avon Town Line

This section of Main Street is heavily residential with few businesses and smaller multi-family homes on larger lots being the primary land-use. With few businesses and the prevalence of smaller multi-family housing units dominating Main Street along this section of corridor, the 40 feet of roadway width provides a opportunities to construct bicycle transportation infrastructure that would provide the highest degree of safety for those who bicycle in the city and, encourage additional individuals who might not currently bicycle because of safety concerns, to considering bicycling in Brockton. An aerial review of this section of the corridor shows that the commercial and residential properties have off-street parking, which results in little need for on-street parking in this area. The City of Brockton should consider installing protected bicycle lanes on each direction of the road or having one single bidirectional protected bicycle lane in the northbound direction.

6.2.8 Bicycle Amenities

Despite Main Street being a heavily commercialized corridor with an abundance of businesses, social services, and major public transportation facilities within easy walking distance, there is little bicycle parking along the whole of the corridor. The city should invest in a program of installing bicycle parking racks in all heavily commercialized sections of Main Street. Knowing there is a place where an individual can lock up their bicycle securely can be a catalyst for individuals to switch from a car trip into a bicycle trip instead, reducing congestion and freeing up automobile parking for those that have to drive to a particular area.

A park and pedal bicycle cage should be considered at City Hall or at the BAT Intermodal Centre. This facility will encourage cycling to the MBTA Commuter Rail or the BAT Intermodal Centre, and alleviate concerns over the bicycle security of a conventional bicycle rack.

6.3 Potential Recommendations Summary

Table 24 summarizes the study findings, recommended improvements, and estimated implementation periods for the study area corridor and intersections.

Table 24 – Potential Recommendations Summary

Location	Findings	Potential Recommendations	Future Plans
Main Street and corridor wide	Poor lighting, especially south of Main Street to Plain Street. Signage is old and faded in some locations. Pavement markings at some locations are faded.	Evaluate and improve lighting for vehicles, pedestrians, and bicycles. Replace signs with MUTCD compliant retro-reflective signs. Restripe faded pavement markings. Upgrade signal timing and phasing and coordinate signals where possible.	
Main Street and corridor wide	The corridor lacks bicycle amenities, except for Downtown Brockton.	Improve bicycle accommodations at specific locations, add striping for bike lanes, bicycle tracks, bicycle parking, and Sharrows where appropriate.	
Main Street (Route 28) at Skyview Drive	Skyview Drive is a private drive. Pavement markings, signs, and lines are faded.	Restripe pavement markings and lines and replace faded stop signs with retro-reflective (MUTCD compliant) signs.	
Main Street (Route 28) at Hayward Avenue	Poor intersection alignment and long delays (forced flow LOS “F”) on the Hayward Avenue stop sign approach.	Long term re-align the intersection and install traffic signals.	The intersection meets the MUTCD threshold for signal installation.
Main Street at Perkins Avenue and South Street	The traffic signals are antiquated with a fixed timing and phasing that includes a pedestrian phase indicated by a simultaneous red ball and yellow ball. The signals are post mounted.	The lack of pedestrian actuation creates a stop on all approaches on every cycle regardless if any pedestrians are present, thereby adding delay to the intersection. Overhead signals will also improve signal visibility for drivers.	
Main Street at Nilsson Street/East Nilsson Street	MassDOT Top 200 Crash location, failed LOS on the side street approaches, fatal crash 2012.	Signalize the intersection and improve lighting.	This intersection meets the MUTCD Threshold for signal installation and an all-way stop sign.
Main Street at Forest Avenue and Martin Place	Poor LOS on the minor street approaches.	Install traffic signals. Improve lighting.	This intersection meets the MUTCD Threshold for signal installation and an all-way stop sign.
Brockton Downtown Two-Way Conversion	The purpose of the two-way conversion is to improve safety and mobility for all road users as well as to utilize Complete Streets Guidelines to improve bicycle, pedestrian, and transit accessibility. This alternative implements infrastructure improvements to support economic growth and the revitalization of the downtown.	The City of Brockton is seeking funding to implement the two-way Main Street conversion. The plans include signal coordination and incorporate Complete Streets design, which includes infrastructure for all road users including walking, bicycling, and transit.	The City of Brockton is currently seeking funding to implement the two-way Main Street conversion.
Brockton Downtown Maintain one-way system	Main Street at Legion Parkway, and Main Street at Pleasant Street are high crash locations. Red light running at Main Street and Crescent Street and at Main Street at Legion Parkway.	Install overhead signals at Main Street and Crescent Street and at the Main Street/Legion Parkway intersection. Coordinate traffic signals. Install pre-emption for emergency vehicles, and extended green for buses.	
North Main Street at Oak Street/Howard Street	Poor LOS during the PM Peak hour. Parking and traffic entering exiting drives close to the intersection interfere with operations.	Revise the timing and phasing at the intersection, install pre-emption for emergency vehicles and extended green for buses. Prohibit left turns into driveways close to the intersection. Add left turn arrow on EB approach.	

6.3.1 Main Street (Route 28) at Hayward Avenue

Hayward Avenue is a local collector road in the south of Brockton that connects between Copeland Street and Main Street. Copeland Street connects south to West Bridgewater and Route 106. Hayward Avenue forms a “T” type un-signalized intersection with Main Street (Route 28). A recently reconstructed convenience store/gasoline station was built on the southwest corner of the intersection. Hayward Avenue and Main Street provide a single all-purpose lane on all approaches. Table 25 summarizes the existing and future AM and PM peak hour levels-of-service for the intersection, as well as the crash rate and number of three-year crashes. The existing LOS is “F”, failed conditions for both the morning and afternoon peak hours for the Hayward Avenue minor street approach. This is expected to continue under the future 2025 “No-Build” conditions. The peak hour LOS for the morning and afternoon peak hours is expected to improve to LOS “B” for the morning peak hour and LOS “C” for the afternoon peak hour under “Build” signalized conditions. Signal Warrant analysis was performed for the intersection and this intersection meets the thresholds for installation of a traffic signal in the *Manual on Uniform Traffic Control Devices (MUTCD)*, published by the Institute of Transportation Engineers (ITE). Figure 22 shows the Main Street at Hayward Avenue intersection.

Table 25 – LOS Summary Main Street at Hayward Avenue

Existing AM Peak LOS	Existing PM Peak LOS	No-Build 2025 AM LOS	No-Build 2025 PM LOS	Build (signal) 2025 AM LOS	Build (signal) 2025 PM LOS	Crash Rate	Crashes (3 Years)
F	F	F	F	B	C	0.46	9

Figure 22 - Main Street at Hayward Avenue Intersection



6.3.2 Main Street at Perkins Avenue and South Street

Perkins Avenue is a local road in the south of Brockton that connects between Main Street and Montello Street (Route 28). South Street is also a local road. It connects between Warren Avenue and Main Street. Perkins Avenue and South Street intersect Main Street to form a four-way signalized intersection. The signals are antiquated with a fixed timing and phasing that includes an all red and all yellow ball on all the approaches for a pedestrian phase, which occurs on every phase. The fixed pedestrian phase requires vehicles on all the approaches to stop on every phase regardless if pedestrians are present, thereby wasting time in the cycle, compared to push button pedestrian actuation, which calls the pedestrian phase in the cycle only when pedestrians push the button actuation. This intersection is a high crash location with 30 crashes occurring in the last three years and a crash rate of 2.41, which is more than four times the state and district average. The peak hour LOS for the morning and afternoon peak hours is expected to improve to LOS “B” for the morning peak hour and LOS “C” for the afternoon peak hour under “Build” signalized conditions. The recommendations for this intersection include upgrading the signal equipment as well as the timing and phasing and installing actuated buttons for the pedestrian phase. Signal pre-emption for emergency vehicles as well as extended green time for buses is also recommended. Table 26 summarizes the existing and future peak hour LOS and the crash rate and number of crashes. Figure 23 shows the Main Street at Perkins Avenue/South Street intersection.

Table 26 – LOS Summary Main Street at Perkins Avenue and South Street

Existing AM Peak LOS	Existing PM Peak LOS	No-Build 2025 AM LOS	No-Build 2025 PM LOS	Build 2025 AM LOS	Build 2025 PM LOS	Crash Rate	Crashes (3 Years)
B	B	C	B	A	A	2.41	30

Figure 23 – Main Street at Perkins Avenue/South Street



6.3.3 Main Street at Nilsson Street and East Nilsson Street

Main Street and Nilsson Street/East Nilsson Street form a four-way intersection in Brockton. Nilsson Street and East Nilsson Street are local roads. The intersection is stop controlled on the Nilsson Street eastbound and East Nilsson Street westbound approaches. The intersection has sidewalks on all the approaches and crosswalks on all the approaches but lacks ADA accessible ramps. The intersection crash rate is four times the state and MassDOT District 5 average at 2.34 crashes per MEV, this intersection is on the MassDOT top 200 crash list. In addition, this intersection experienced a fatal crash in 2012. There is a vacated gasoline station located on the south west corner of the intersection. Table 27 summarizes the existing crash and existing and future peak hour levels-of-service (LOS) for the intersection. The existing and future No-Build LOS (stop sign controlled) is at LOS “F” and the future signalized LOS is expected to be at LOS “B” for AM and PM peak hours. This intersection satisfies signal warrants as published in the FHWA’s *Manual On Uniform Traffic Control Devices*. The city can take Interim measures, as funds are secured for the installation of the traffic signals, which includes installation of a flashing overhead beacons at the intersection for better traffic control visibility. The options include a flashing red beacon on the Nilsson Street and East Nilsson Street minor street approaches and a yellow beacon on the Main Street northbound and southbound approaches, or an all way stop with flashing red beacons on all approaches.

Table 27 - LOS Summary Main Street at East Nilsson Street and Nilsson Street

Existing AM Peak LOS	Existing PM Peak LOS	No-Build 2025 AM LOS	No-Build 2025 PM LOS	Build (signal) 2025 AM LOS	Build (signal) 2025 PM LOS	Crash Rate	Crashes (3 Years)
Eastbound D Westbound C	Eastbound F Westbound E	Eastbound D Westbound C	Eastbound F Westbound F	A	A	2.34	9

Figure 24 - Main Street at East Nilsson and Nilsson Street



6.3.4 Main Street at Forest Avenue and Martin Place

This intersection is a four-way intersection; however, Martin Place is a dead-end street that services a parking lot and a few houses. The approach volumes on the Martin Place approach are small, while the major turning movements are on the Forest Avenue approach and the northbound and southbound Main Street approaches. Forest Avenue is a collector street that serves as an east-west corridor and connector between Belmont Street (Route 123), and the commercial activities along that route, and Main Street. This intersection is currently stop sign controlled on the minor streets (Forest Avenue and Martin Place). This intersection has a crash rate more than three times the District 5 and State average. Improvements to this intersection include signalization as well as installing pedestrian controls and ADA compliant ramps on all corners of the intersection.

Table 28 - LOS Summary Main Street at Forest Avenue and Martin Place

Existing AM Peak LOS	Existing PM Peak LOS	No-Build 2025 AM LOS	No-Build 2025 PM LOS	Build (signal) 2025 AM LOS	Build (signal) 2025 PM LOS	Crash Rate	Crashes (3 Years)
Eastbound F Westbound C	Eastbound F Westbound E	Eastbound F Westbound C	Eastbound F Westbound F	B	B	0.66	10

Figure 25 – Main Street at Forest Avenue



6.3.5 Main Street Brockton Downtown

There is a lack of coordination between traffic signals at signalized intersections within Brockton’s downtown. In the downtown, there are a series of signalized intersections within close proximity within the Main Street corridor. According to the FHWA’s *Traffic Signal Manual*, coordination between signalized

intersections provides the ability to synchronize the signal cycles at multiple intersections to enhance the operation of one or more directional movements in a system. Signal coordination is used primarily on arterial streets and downtown networks. Main Street is currently one-way northbound, Warren Street is one-way southbound. According to the *Traffic Signal Manual*, coordination is justified when signalized intersections are in close proximity and the coordinated streets carry high volumes of traffic. The *Manual on Uniform Traffic Control Devices*, (MUTCD), which provides guidance for implementation, states that traffic signals within 0.5 miles of each other along a corridor should be coordinated unless they operate on different cycle lengths. There are currently six signalized intersections in Brockton’s Downtown from the intersection of Main Street at Belmont Street to the intersection of Main Street at Pleasant Street and Court Street within the span of one-third of a mile. Figure 26 shows the signalized intersections in Brockton’s Downtown. Table 29 summarizes the crash types and potential mitigation based on the *Traffic Signal Manual*.

Table 29 - Summary of crash types and possible signal modifications to benefit safety¹

Signal Timing Change	Angle	Head-On	Rear-End	Sideswipe Same Dir.	Sideswipe Opposite	Hit Bicycle	Hit Pedestrian
Provide left turn phasing	*	*	*	*	*		
Optimize clearance intervals	*		*				
Restrict or eliminate turning maneuvers (including right turns of reds)	*	*	*	*		*	*
Employ signal coordination	*		*				*
Implement emergency vehicle pre-emption	*	*	*	*	*	*	*
Improve traffic control for pedestrians and bicycle			*			*	*
Remove unwarranted signal			*				
Provide/improve left turn lane channelization	*	*	*	*	*		
Provide/improve right turn lane channelization	*		*	*	*	*	*

Brockton Downtown experiences a high number of angle type crashes, as well as rear-end crashes and pedestrian crashes. Two of the Downtown intersections, Main Street at Legion Parkway/Centre Street and Main Street at Pleasant Street/Court Street are on the MassDOT’s Top 200 Crash location list. In addition, the Downtown is designated as a Crash Cluster for pedestrians and Bicycles for the OCPC Region. Table 29 shows that the Traffic Signal Manual recommends signal coordination and signal pre-emption for emergency vehicles for intersections with high angle crashes, high rear-end crashes, and high pedestrian crashes. In addition, left turn phasing and left turn and right turn channelization are recommended as well as restrictions on right turn on red maneuvers.

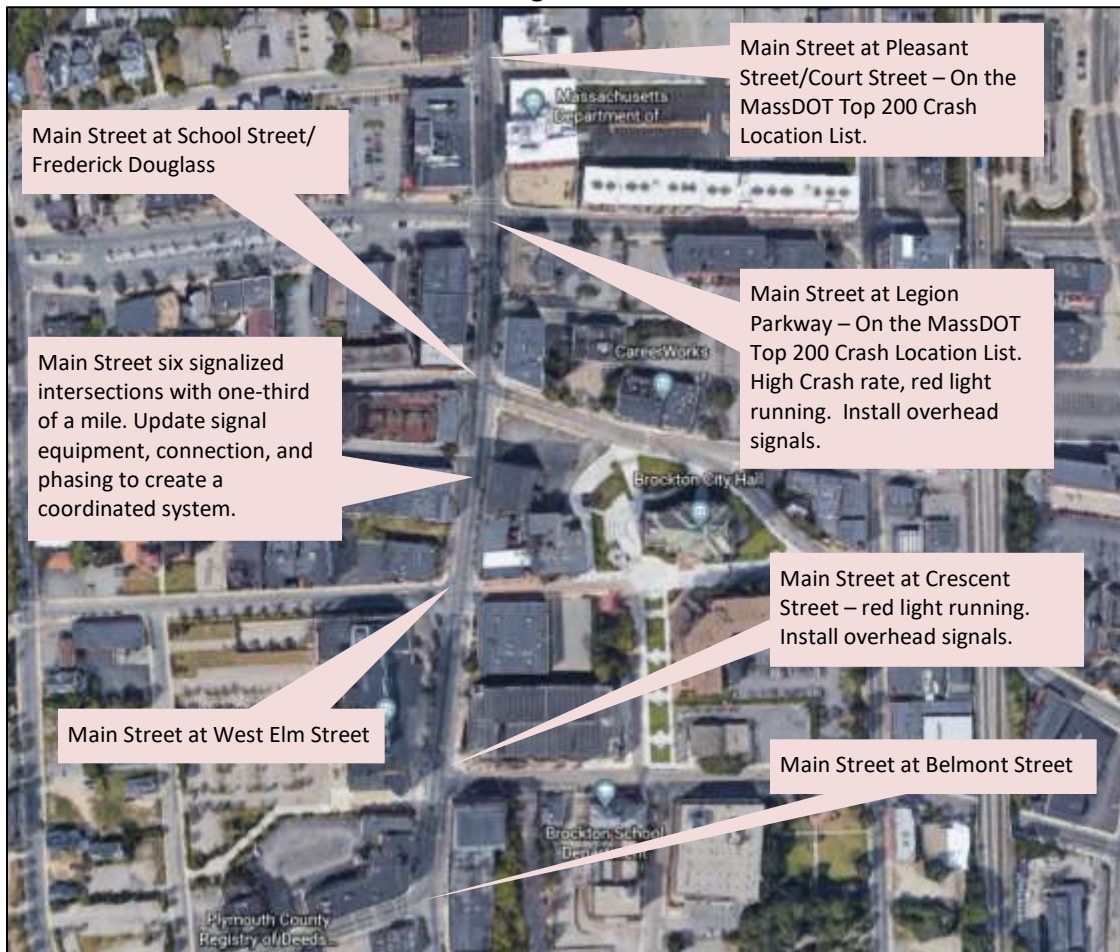
The purpose of implementing signal coordination is to provide smooth traffic flow along road corridors and to reduce travel times, stops, and delays. The continuous movement of a coordinated system within the

¹ *Traffic Signal Manual* FHWA Page 3-27

road network also reduces fuel consumption and improves air quality. Properly designed, timed, and implemented traffic signals result in a number of benefits:

1. Provide for the orderly and efficient movement of people
2. Effectively maximize the volume movements served at the intersection
3. Reduce the frequency and severity of certain types of crashes
4. Provide appropriate levels of accessibility for pedestrians and side street traffic

Figure 26



Traffic signal coordination is recommended for Downtown Brockton signals whether or not the City implements the two-way conversion. In addition, if the City does not implement the two-way conversion, it is recommended that all signals conform to the Manual on Uniform Traffic Control Devices (MUTCD), and overhead signals be installed at the Main Street/Crescent Street intersection and the Main Street/Legion Parkway/Crescent Street intersection.

6.3.6 North Main Street at Oak Street/Howard Street (Route 37)

North Main Street and Oak Street and Howard Street (Route 37) intersect as a four-way signalized intersection, but at a skewed angle. Oak Street is a major collector in the north of Brockton that connects between North Main Street and North Pearl Street in Brockton. Howard Street (Route 37) connects between North Main Street and North Montello Street (Route 28) and to points east. This intersection was the subject of a Road Safety Audit completed by OCPC in June 2019.

The land use along North Main Street is mixed residential and commercial with parking allowed on both sides of the street. Parking maneuvers and curb cuts to driveways along North Main Street conflict with through movements on North Main Street. The pavement width of Main Street is approximately 40 feet wide but varies. Sidewalks exist on both sides of North Main Street. There is an elementary school located on North Main Street approximately three-quarters of a mile south of the North Main Street/Oak Street/Howard Street intersection.

Oak Street is a two-lane cross section. It is classified as an urban minor arterial and under local Brockton jurisdiction. The pavement width of Oak Street is approximately 26 feet wide and sidewalks are provided on both sides of the road. Oak Street provides east west connection between North Main Street and North Pearl Street in North Brockton. The land use along Oak Street is also a mix of residential and commercial uses. There is an elementary school located on Oak Street approximately one-quarter of a mile west of the North Main Street/Oak Street/Howard Street intersection. There is no parking along Oak Street on both sides of the road.

Howard Street runs northeast from North Main Street into Holbrook and is state numbered Route 37 east of its intersection with North Montello Street (Route 28). The roadway width is 32 feet wide in Brockton east of the North Main Street and North Pearl Street. Sidewalks are provided along both sides of the street. Howard Street is under local Brockton jurisdiction and classified as an urban minor arterial road.

There are sidewalks on all the approaches to the intersection, as well as pedestrian signals for pedestrian crosswalks across all the approaches to the intersection. A local street, Wilmington Street, intersects Howard Street about 90 feet east of the intersection, which interferes with traffic operations at the North Main Street/Oak Street/Howard Street intersection. Wilmington Street is one-way eastbound away from the intersection, with no traffic exiting the road into the intersection so this intersecting street does not create a five-way intersection. Delivery trucks parked on Wilmington Street; however, often block traffic, which backs up into the intersection. There is a splitter island on the Howard Street southeast approach which channels traffic turning right from Howard Street (westbound) to North Main Street (northbound).

There are a number of curb cuts to local businesses in close proximity to the intersection that interfere with traffic operations. These include a bank on the northwest corner, with curb cuts on North Main Street and Oak Street, a bank on the southwest corner with curb cuts on North Main Street and Oak Street, and a hair stylist on the southeast corner with a curb cut onto North Main Street.

The turning movement counts show that there were heavy left turns from Oak Street eastbound to North Main Street during the morning peak hour and there were a high number of pedestrians crossing the Oak Street eastbound approach during the morning peak hour (during school hours a crossing guard is present at the intersection.) There were also heavy left turns on the North Main Street northbound approach during the morning peak hour.

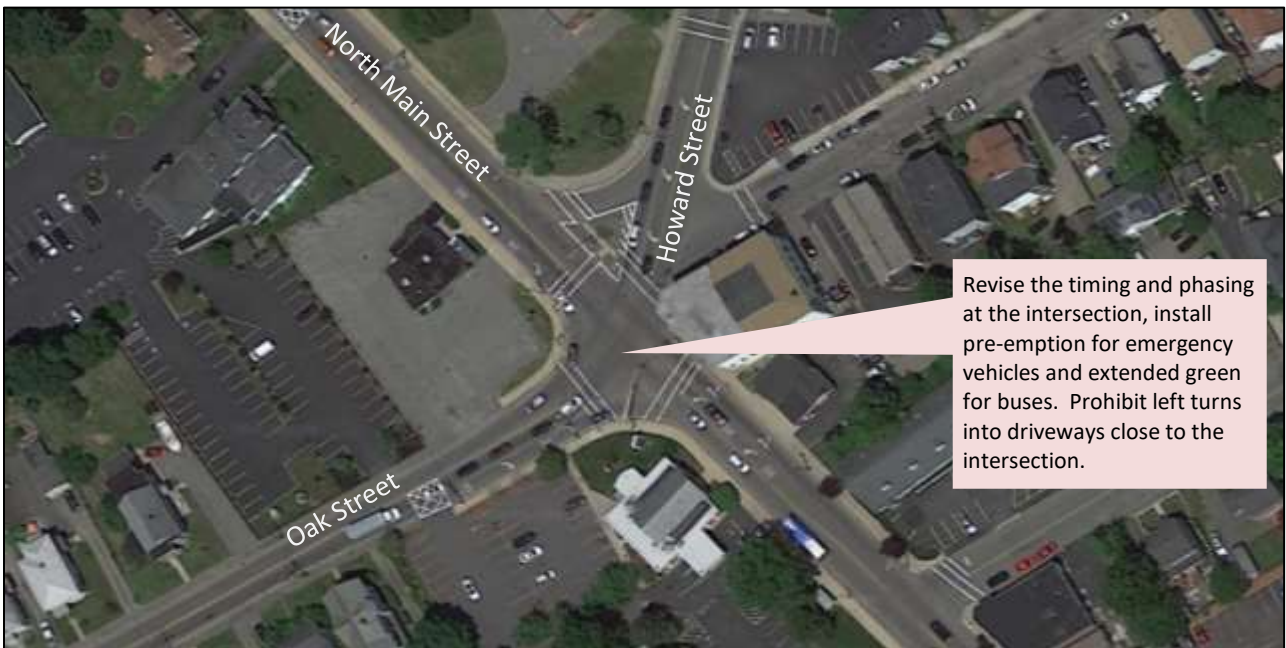
The existing peak hour level-of-service (LOS) is “C”, during the morning peak hour at the intersection and LOS “E” during the afternoon peak hour. The speed limit is posted at 30 miles per hour northbound on North Main Street north of the intersection. Table 30 shows the LOS, crash rate, and the number of crashes in the latest three-year period. Figure 27 shows the North Main Street/Oak Street/Howard Street intersection.

Table 30 - LOS Summary North Main Street at Oak Street and Howard Street

Existing AM Peak LOS	Existing PM Peak LOS	No-Build 2025 AM LOS	No-Build 2025 PM LOS	Build 2025 AM LOS	Build 2025 PM LOS	Crash Rate	Crashes (3 Years)
C	D	E	F	C	E	1.33	41

The North Main Street/Oak Street/Howard Street intersection is included in the Massachusetts Department of Transportation’s Top 200 Intersection List and is eligible for Highway Safety Improvement Program (HSIP) funding. The HSIP eligible locations are those locations in which the number of crashes within a three year period is within the top 200, or within the top 5% clusters in the region (the crash numbers are weighted based on the severity ten added for each fatal crash and five added for each crash resulting in personal injury).

Figure 27 – North Main Street/Oak Street/Howard Street Intersection



Recommended improvements include:

- Update traffic signal equipment, including new controller and install green/red arrows for left turning vehicles. Signal heads should be overhead mounted on all approaches. Add Opticon for emergency vehicle preemption and extended green times for buses.
- The signal timing and phasing should be evaluated to include a longer all red phase, along with enhanced enforcement.

- Install Accessible Pedestrian Signals across the entire westbound Howard Street approach including across the exclusive right turn lane. Pedestrian buttons should include countdown signals.
- Install a "Dog-House" Signal on the eastbound and westbound approaches. This will help to provide drivers with the critical information regarding when their movement goes from being protected to permissive.
- Post "No Right Turn on Red" sign on the North Main Street southbound approach to Oak Street.
- Consider reconstructing the intersection to realign the Oak Street eastbound approach and the Howard Street westbound approach (right of way takings are likely necessary). This would include an added exclusive left turn lane on the Oak Street eastbound approach.
- Install advanced warning signs for lane assignments on all approaches.
- Restripe the intersection to update faded pavement markings, including 3-D crosswalks, as well as hatched white guidelines through the intersection for left turning vehicles.
- Prohibit parking (about 20 feet to corner), on the southeast corner of the intersection in front of the convenience store and add a bump to better define Wilmington Street.
- Widen the Oak Street westbound receiving lane to accommodate vehicles going around left turning traffic into the bank.
- Implement access management by restricting driveways that are in close proximity to the intersection.

Figure 28 – "Dog-House" Traffic Signal



7 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 publication, *Project Development and Design Guide*, explains the project development process in Massachusetts and design standards for transportation projects.

MassDOT initiates new projects through a formal 3-step process using the Massachusetts Project Intake Tool (MaPIT). A GeoDOT account to log into MaPIT is needed to initiate new projects.

Step one – The proponent identifies the project need.

Step two – Using MaPIT, project proponent works with a MassDOT District Office (District 5) or other MassDOT Section to define project scope, costs, timeline, impacts and responsibilities.

Step Three – The District Office or other MassDOT Section submits project to the Project Review Committee for approval.

The MassDOT project development process includes the following:

- Problem/Need/Opportunity Identification
- Planning (A project planning report is completed)
- Project Initiation
 - ✓ Identification of Appropriate Funding
 - ✓ Definition of Appropriate Next Steps
 - ✓ Project Review Committee Action
- Environmental Design and Right of Way (ROW) Process (Includes Plans, Specifications, and Estimates, P, S, & E)
 - ✓ Environmental Studies and Permits
 - ✓ Right-of-Way Plans
 - ✓ Permits
- Programming (Old Colony TIP and State Transportation Improvement Program, STIP)
 - ✓ Programming of Funds
- Procurement (Construction bids and contractor selection)
- Construction
- Project Assessment

On sections of roadway owned and maintained by the municipality, the community typically initiates a project (utilizing MaPIT) and providing for project planning and design. Similarly, for state owned facilities, the MassDOT initiates projects, providing 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 Performance Program (NHPP):** This program provides support for the condition and performance of the National Highway System, (NHS), for the construction of new facilities on the NHS, and to ensure that investments of federal-aid funds in highway construction are directed to support progress toward the achievement of performance targets established in the State's asset management plan.
- **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 Block Grant Program (STBG):** 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, develop a priority plan, 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.

8 Appendices

Automatic Traffic Recorder Counts

Turning Movement Counts

Intersection Levels-of-Service

Signal Warrant Analysis

Intersection Crash Rate Calculation