CITY OF BROCKTON

SAFETY ACTION PLAN

April 2024

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City of Brockton Safety Action Plan

Brockton, MA

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Introduction

INTRODUCTION

Brockton is a vibrant and diverse city with a rich cultural and economic history. In recent years, Brockton has emerged as a Massachusetts community with a high number of fatal and serious injury crashes. Studying these transportation safety issues would be a transformative step for the city and its nearly 106,000 residents.

Between 2018 and 2022, 33 fatal crashes occurred in the city. In this same period, 286 serious injury crashes occurred, along with 4,511 minor injury crashes, 6,386 crashes where only property was damaged, and 541 crashes of an unknown severity. In total, Brockton experienced 11,757 crashes, one of the highest number of crashes of any Massachusetts community.

Each crash statistic represents a human life. Past fatal and serious injury crashes have affected families and communities across Brockton. The City of Brockton is acting now in response to Brockton's high number of fatal and serious injury crashes, starting with the Safety Action Plan.

Brockton's Safety Action Plan (the Plan) will be a road map to substantially reduce fatal and serious injury crashes on Brockton roads.

Brockton, MA

- **6th largest city** in Massachusetts
- **291** centerline miles of roadway
- **106,000** residents (2020 US Census)
- **100%** of Brockton residents live in environmental justice block groups (2020 Massachusetts EJ Populations)
- **63,600** residents (**70%**) live in historically disadvantaged census tracts (2023 USDOT Equitable Transportation Communities)
- Per National Results from the USDOT ETC explorer, Brockton ranks well above the 65th percentile for the following indicators:
  - High-volume roads proximity (73rd)
  - Individuals with limited English proficiency (84th)
  - Housing cost burden (76th)
  - Asthma (76th)
  - Poor mental health (69th)
  - High blood pressure (67th)
- One of Massachusetts "**Gateway Cities**"—a place that once played a critical role in the state's industrial economy and could again, with ingenuity and strategic investment, provide great opportunities to its residents.

WHAT IS A SAFETY ACTION PLAN?

A safety action plan is a community-specific framework for reducing traffic-related fatalities and serious injuries. Safety Action Plans establish a vision and goals for transportation safety, identify high-crash, high-risk intersections and streets through data analysis and community input, and then develop projects and strategies to address roadway safety issues.

To assist with implementation of projects and strategies, the Highway Safety Improvement Program (HSIP) and Safe Streets and Roads for All (SS4A) are Federal funding programs that support implementation of countermeasures that address road safety challenges on public roads.

To be eligible for HSIP funds in Massachusetts, projects and programs must be tied to a Massachusetts SHSP Strategy, address a Top 5% intersection crash cluster or segment, or be identified by a data-driven process in a region. A safety action plan can help establish project and program eligibility for HSIP. To

pursue federal SS4A funding, a local agency must have a safety action plan in place. Access to these funds can assist Brockton in funding engineering-related solutions that make its roads safer for all road users.

To be eligible for SS4A funding, Safety Action Plans must include eight key components. **Figure 1** outlines the how these elements are woven into the Safety Action Planning Process.

ALIGNMENT WITH STATEWIDE EFFORTS

The 2023 Strategic Highway Safety Plan (SHSP) is a statewide, coordinated safety plan that identifies key safety needs and helps direct funding to improvements that reduce highway fatalities and serious injuries on all public roads in Massachusetts.[1] It is a data-driven, strategic plan that integrates the four E's: engineering, education, enforcement, and emergency medical services (EMS) using the Safe System Approach.

The 2023 SHSP builds on Massachusetts' 14 emphasis areas, or areas that are the main topics for roadway safety in Massachusetts. These emphasis areas include:

- Lane Departure Crashes
- Impaired Driving
- Occupant Protection
- Speeding and Aggressive Driving
- Intersection Crashes
- Pedestrians
- Older Drivers
- Motorcycle Crashes
- Younger Drivers
- Large Truck-Involved Crashes
- Driver Distraction
- Bicyclists
- Safety of Persons Working on Roadways
- At-Grade Rail Crossings

The 2023 SHSP identifies six initiatives to create safer roadways across the Commonwealth:

- Adress Top-Risk Locations and Populations
- Implement Speed Management to Realize Safer Speeds
- Take an Active Role to Affect Change in Vehicle Design, Features, and Use
- Double Down on What Works
- Accelerate Research and Adoption of Technology
- Implement New Approaches to Public Education and Awareness

MassDOT also conducted a Vulnerable Road User (VRU) Safety Assessment in 2023 to understand the factors involved in pedestrian and bicyclist crashes and recommend strategies to address pedestrian and bicyclist safety statewide.[2]

Brockton's Safety Action Plan builds on the framework created by the SHSP by applying the Safe System Approach. It identifies projects and strategies that advance the six SHSP initiatives and align with statewide emphasis areas, including pedestrian and bicyclist safety.

[1] Commonwealth of Massachusetts. (2023). *Massachusetts 2023 Strategic Highway Safety Plan.* Massachusetts 2023 Strategic Highway Safety Plan (SHSP)

[2] MassDOT. (December 2023). *MassDOT Vulnerable Road User Safety Assessment.* MassDOT Vulnerable Road User Safety Assessment (arcgis.com)

Figure 1. The Safety Action Planning Process

THE SAFETY ACTION PLANNING PROCESS

This planning process follows the eight elements outlined in the 2024 SS4A Self-Certification Eligibility Worksheet. The process may happen sequentially, but this is not required.

1. Leadership Commitment and Goal Setting

- Publicly committing to Vision Zero.
- Developing goals to achieve Vision Zero.

2. Planning Structure

- Establishing a diverse working group to develop, implement, and monitor the plan.

3. Safety Analysis

- Identifying target crash types and crash risks.
- Confirming systemic and specific safety needs.
- Locating higher-risk locations.

4. Engagement and Collaboration

Collaborating with the community to:

- Ground-truth safety analysis.
- Raise awareness of traffic safety issues.
- Build support for implementation.

5. Equity Considerations

- Ensuring vulnerable and underserved communities are considered in plan development.

6. Policy and Process Changes

- Reviewing policies, plans, and standards to improve how existing processes prioritize safety.

7. Strategy and Project Selections

- Developing strategies and projects to address safety problems, including a timeline for implementation.

8. Progress and Transparency

- Measuring progress over time and adjusting strategies and projects as needed.

SAFE SYSTEM APPROACH

In January 2022, the United States Department of Transportation released its National Roadway Safety Strategy[3] that adopted the Safe System Approach as its core strategy (**Figure 2**). In 2023, Massachusetts adopted the Safe System Approach in its Strategic Highway Safety Plan. The Safe System Approach focuses on modifying transportation system design to anticipate human errors and lessen impact forces to reduce crash severity and save lives. In a Safe System, all stakeholders work together who include, but are not limited to, road users, transportation system managers, law enforcement, emergency responders, and vehicle manufacturers.

This timely adoption of the Safe System Approach will help the nation respond to traffic deaths that continue to be unacceptably high across the country. In 2022, there were 42,514 traffic-related fatalities in the United States.[4] In Massachusetts, there were 435 fatalities in 2022.[5] These numbers do not include serious injury crashes that also significantly change the lives of people involved and the communities they live in. The Safe System Approach aims to eliminate fatal and serious injuries on roadways and will require change in traffic safety culture, standards, practices, and partnerships.

There are three key components of the Safe System Approach to understand: the Safe System "**approach**," "**principles**," and "**elements**." In addition, the term "Safe System" is singular to depict an overall safe road system rather than individual elements that would be addressed in isolation.

Figure 2. The Safe System Approach (USDOT, FHWA)

The Safe System "**approach**" is the broadest term and describes all aspects of the Safe System.

Six Safe System "**principles**" encompass the fundamental beliefs that the approach is built on. A successful Safe System approach weaves together all six principles. The six principles are shown around the outside ring of the graphic.

Five Safe System "**elements**" are conduits through which the Safe System approach must be implemented. These promote a holistic approach to safety across the entire roadway system and acknowledge the shared responsibility principle. Making a commitment to zero deaths means addressing every aspect of crash risks through the five elements presented in the middle ring of the graphic.

[3] National Roadway Safety Strategy, United States Department of Transportation, January 2022
https://www.transportation.gov/sites/dot.gov/files/2022-02/USDOT-National-Roadway-Safety-Strategy.pdf

[4] National Highway Traffic Safety Administration Overview of Motor Vehicle Crashes in 2022.
https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813560

[5] MassDOT Crash Portal https://apps.impact.dot.state.ma.us/cdp/dashboard-view/2047

Roadway system managers in the Safe System Approach use a proactive approach to safety to try and address safety concerns before crashes occur, contrasting with traditional road safety practices that are reactive to when crashes occur. This involves using crash data, roadway design characteristics and employing a data-driven approach to identify crash patterns and trends associated with crash risk. Transportation system managers then systemically implement proven safety countermeasures at all locations matching those crash risk factors to mitigate against future crashes.

Finally, redundancy is key in reducing crash occurrence in a transportation system. All parts of the system should be strengthened so that if one part fails, other parts of the system still protect roadway users. A simple implementation of this would be rumble strips that protect people when their own ability to be safe road users is compromised by distractions or drowsiness.

While the Massachusetts SHSP focuses on statewide issues, Brockton's Safety Action Plan focuses on local challenges. The fundamental change to adopting the Safe System Approach locally is to use its elements and principles to help guide decisions and promote collaboration across different roadway responsibilities. Brockton's Safety Action Plan aligns with the principles and elements of the Safe Systems Approach, as delineated in **Table 1** and **Table 2**.

Ultimately, Brockton's Safety Action Plan adopts a Safe System Approach and encourages forward-thinking strategies, addressing the fact that historical approaches to traffic safety have not been effective enough in preventing fatal and serious injuries. Commitment from City staff and road safety partners to prioritize safety in their efforts and implement both proven and innovative ideas are key to the Plan being impactful and in line with recent commitments at the national and state level.

The vision, goals, supporting information, and actions for the Action Plan are documented in the following sections.

Table 1. Safe System Principles Alignment

Safe System Principle	Action Plan Recommendations
Death/Serious Injury is Unacceptable	■ Substantially reduce fatal and serious injury crashes
Humans Make Mistakes	■ Identify opportunities to improve the roadway network that allows human error to occur without resulting in a fatality or serious injury
Humans are Vulnerable	■ Remove severe conflict points ■ Reduce vehicle speeds ■ Prioritize safety over travel time
	■ Formalize a traffic safety task force or forum to meet regularly including partner agencies and organizations
Safety is Proactive	■ Include systemic countermeasures and strategies to proactively address safety ■ Implement proven countermeasures at locations with higher potential crash risk
Redundancy is Crucial	■ Overlap efforts between all roadway safety partners to create a culture of traffic safety

Table 2. Safe System Elements Alignment

Safe System Elements	Action Plan Recommendations
Safe Road Users	■ Identify engineering countermeasures to prioritize vulnerable roadway users ■ Support and develop public education materials and equitable enforcement efforts to address safety emphasis areas
Safe Vehicles	■ Support legislation and other implementation strategies to develop safe vehicle technologies
Safe Speeds	■ Support and implement countermeasures and strategies to reduce unsafe speeds including engineering roadway design, public education, and equitable enforcement efforts.
Safe Roads	■ Update policies, design standards, and decision-making processes to prioritize safe road design (e.g., apply the Safe System Road Design Hierarchy)
Post-Crash Care	■ Identify opportunities to reduce emergency medical times or improve access to crash sites or medical care ■ Support on-scene crash incident safety and medical training

Vision and Goals

VISION AND GOALS

VISION

Apply the Safe System Approach to substantially reduce fatal and serious injury crashes and crash risk in Brockton.

GOALS

1. **Use data-informed analysis and community input to identify and prioritize approaches to reduce crash risk.**

   Goal 1a: Establish a recurring process to identify locations for safety improvements using citywide crash and crash risk data, and community input.

   Goal 1b: Systemically implement proven safety countermeasures at intersections and streets with similar crash patterns, crash risks, and/or community concerns.

   Goal 1c: Reinforce engineering countermeasures through community-supported education and enforcement strategies.

2. **Advance equity-centered solutions to address the disproportionate impact of roadway fatalities and serious injuries on disadvantaged communities.**

   Goal 2a: Incorporate equity metrics into project identification, prioritization, and funding processes.

   Goal 2b: Collaborate with community partners to identify and implement community-supported education and enforcement strategies.

3. **Create a strong partnership between city agencies, organizations, and community groups to build a culture of roadway safety.**

   Goal 3a: Identify Lead Agency and Safety Action Plan coordinator within City of Brockton to facilitate the implementation of Safety Action Plan projects and strategies.

   Goal 3b: Establish multi-agency Safety Action Plan working group that meets on a quarterly basis to review data, community input, and action plan progress.

   Goal 3c: Use multidisciplinary partnerships, including community partners, to implement Safety Action Plan projects and strategies.

Planning Process

PLANNING PROCESS

The City of Brockton and its Study Working Group members, working alongside the Massachusetts Department of Transportation (MassDOT), created this Plan to provide information and direction on strategies and treatments most likely to improve roadway safety performance within the city. The Safety Action Plan was developed consistent with USDOT guidance on Safety Action Planning.[6]

The development of this plan was funded by MassDOT. The content of this plan was developed in collaboration with the City and its multidisciplinary partners in implementation. The plan supports Brockton's vision and goals specific to roadway safety performance by:

1. Establishing a study working group to develop, implement, and monitor the plan,
2. Using safety data to identify citywide safety patterns and trends,
3. Identifying proven countermeasures and strategies to address those trends, and
4. Prioritizing solutions for implementation

The plan establishes a basis for evaluating and informing roadway safety performance improvements over the next three to five years. It provides a method the City can use to update its list of high crash, high risk locations and produce projects and programs to improve safety in the future.

STUDY WORKING GROUP AND PUBLIC ENGAGEMENT

While data is an important and useful tool to help define safety issues, it can be incomplete for a variety of reasons. These might include inaccurate reporting, an inability to capture safety issues like near-misses, and difficulty pinpointing streets or areas people currently avoid because they feel unsafe. The Safety Action Plan took a data-informed approach to planning, using data analysis together with engagement with a Study Working Group and the public to highlight lived experience in addition to data to develop a more comprehensive view of the transportation safety issues in the city.

STUDY WORKING GROUP

The Study Working Group (SWG) was developed to include representatives from a broad cross section of community and government interests. Each person represents a unique set of experiences, needs, and views on the transportation system in Brockton that helped shape the Safety Action Plan. The following were represented in the Study Working Group:

- Brockton Area Transit Authority (BAT)
- Brockton Department of Finance
- Brockton Department of Public Works
- Brockton Department of Planning and Economic Development
- Brockton Fire Department
- Brockton Police Department
- Brockton Traffic Commission

[6] Comprehensive Safety Action Plans, United States Department of Transportation, Accessed March 2024 https://www.transportation.gov/grants/ss4a/comprehensive-safety-action-plans

- Family and Community Resources
- Haitian Community Partners
- Old Colony Planning Council (OCPC)
- MassDOT Headquarters
- Walk Massachusetts

Input Gathered

The Study Working Group met four times over the course of the Safety Action Plan's development, discussing certain topics as summarized below:

- Vision and Goals for the Safety Action Plan
- Existing and past efforts undertaken to improve roadway safety including specific projects and planning efforts.
- Data and analysis findings specific to crash and risk patterns and trends identified across the city and specific locations identified as higher priority for improvements.
- Specific countermeasures for use by the City on a systemic or widespread basis

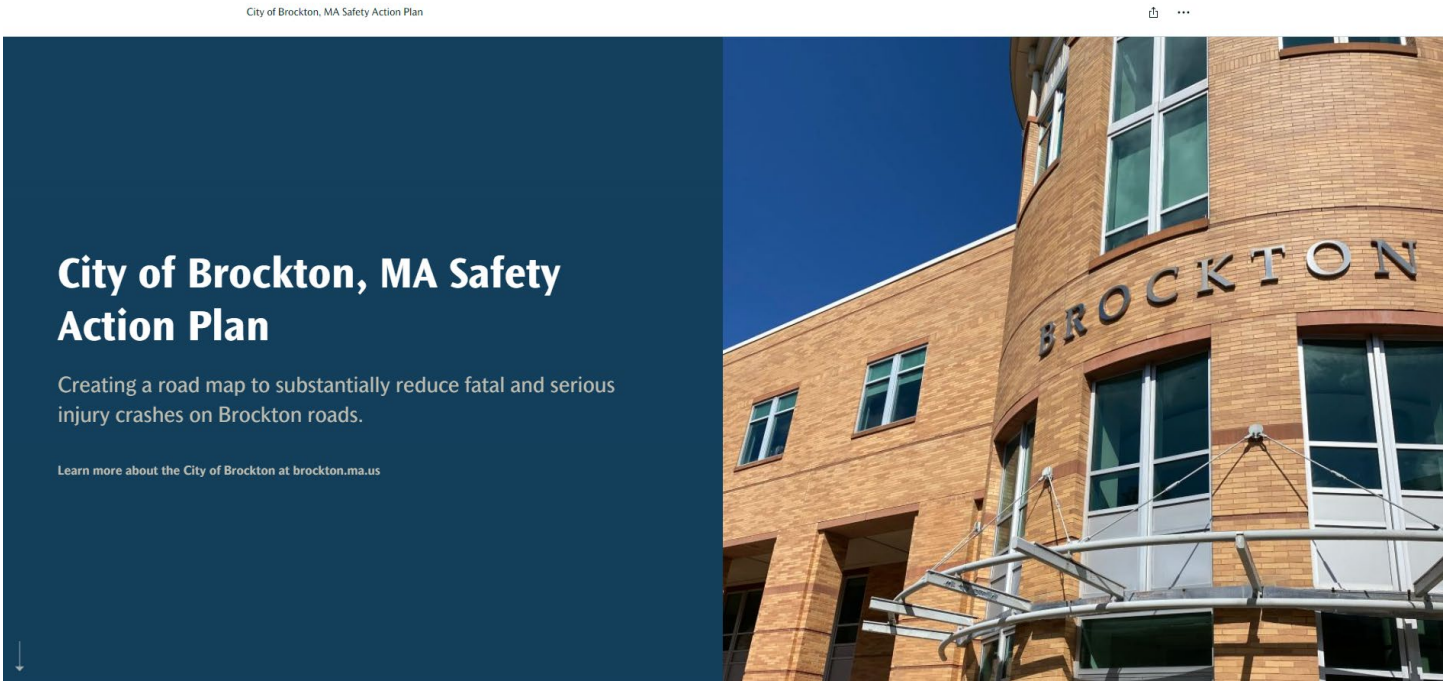
In addition to the topical areas above, members of the Study Working Group reviewed and provided comments on the draft Safety Action Plan and its recommendations.

STUDY WEBSITE

For use as an education and outreach tool, a website was developed for the Brockton Safety Action Plan with the ESRI ArcGIS Story Maps platform (displayed in **Figure 3**). The website can be accessed here: https://bit.ly/brocktonsafetyactionplan.

The website includes a summary of the Safe System Approach, project background information, maps and materials related to different planning process phases, an interactive mapping tool, and a public input survey. It also includes a document library with community outreach materials (e.g., flyers, frequently asked questions, social media toolkits) translated from English into four major languages/dialects spoken in Brockton (Cape Verdean Creole, Haitian Creole, Spanish, Portuguese).

Figure 3. Brockton Safety Action Plan Website



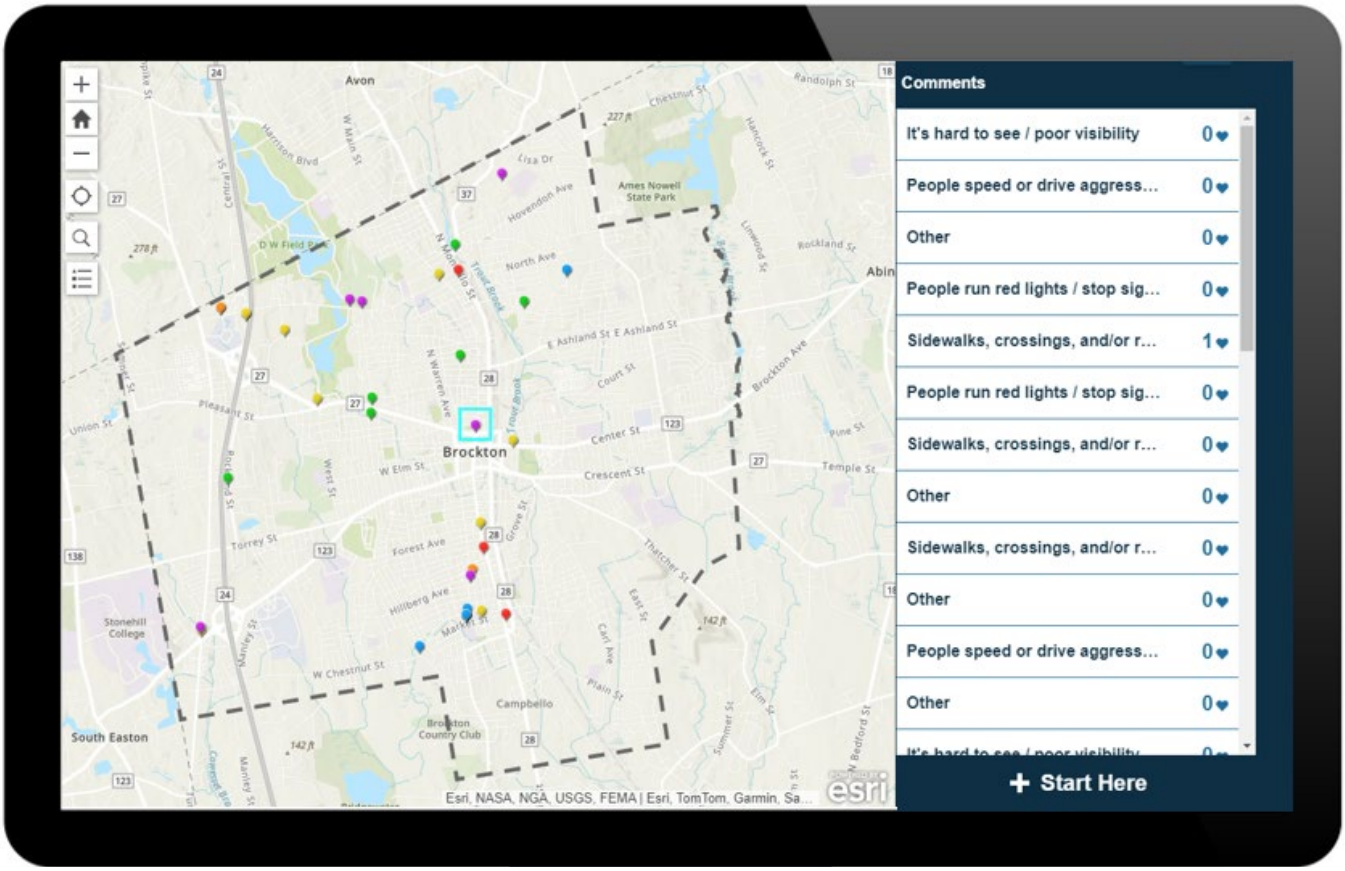
ONLINE INTERACTIVE MAPPING

As part of the *Existing Safety Conditions* analyses, the project team integrated an online interactive mapping tool within the overall study website (displayed in **Figure 4**). The tool allowed community members to provide feedback related to specific geographic locations. The map tool prompted community members to map specific locations where they have safety concerns. Respondents could select a predetermined comment type, add additional detailed comments, and like comments made by others. The map included five present comment types. **Table 3** summarizes the number of comments or likes received for each comment type. The comments and suggestions informed the safety analysis, and identification and prioritization of countermeasures and strategies.

Table 3. Online Interactive Map Comments (by Type)

Comment Type	Number of Comments/Votes
It's hard to see/poor visibility	3 (5.0%)
People speed or drive aggressively	16 (24.0%)
People run red lights / stop signs	15 (23.0%)
People don't yield	11 (17.0%)
Sidewalks, crossings, and/or ramps are missing	9 (14.0%)
Other	12 (18.0%)
Total	**66 (100%)**

Figure 4. Brockton Safety Action Plan Online Interactive Mapping Tool for Community Feedback



SAFETY TREATMENTS TOOLKIT AND SURVEY

The study website includes a safety treatments toolkit to educate the community about treatments that can help address Brockton's traffic safety issues. Safety treatments included in the toolkit were discussed and confirmed by the SWG based on three SHSP emphasis areas: driver behavior, including speeding and aggressive driving, pedestrian safety, and bicycle safety. A multilingual online survey accompanied the toolkit to solicit the community's feedback on the potential use of safety treatments in Brockton.

To supplement these digital efforts, a multilingual paper survey was developed and shared with SWG members to distribute throughout Brockton.

The online survey received 72 total responses. Key takeaways from the survey results include:

- Of the safety treatments that address driver behavior, "General Intersection Improvements" received the highest amount of support from survey respondents, at 81%.
  - Other top responses include "Traffic Signal Improvements" at 64%, "Speed Humps" at 64%, and "No Turn on Red" at 52%.
- Of the safety treatments that address pedestrian safety, "High Visibility Crosswalks" received the highest amount of support from survey respondents, at 82%, followed closely by Lighting at Crossings" at 75%.

  - Other top responses include "New, Repaired, or Wider Sidewalks" at 66%, "Rapid Rectangular Flashing Beacon" at 66%, and "Pedestrian Signal Timing Improvements" at 64%.
- Of the safety treatments that address bicyclist safety, "Shared Use Path" received the highest amount of support from survey respondents, at 63%.
  - Other top responses include "Raised Bike Lane" at 57%, "Bike Signals" at 51%, and "One-Way Separated Bike Lane" at 43%.

FUTURE OUTREACH

Community outreach and education around Brockton's traffic safety issues will not end with the initial Safety Action Planning process. Creating a culture of traffic safety in Brockton requires a long-term commitment from Brockton's safety partners (i.e., Study Working Group) to foster community awareness of traffic safety issues and build support for future implementation of safety projects.

Brockton is committed to coordinating future outreach and education with its safety partners. Brockton will take the following steps to ensure all community members feel included and invested in improving traffic safety outcomes:

- **Build technical capacity to coordinate safety projects with the broader community**
  The City of Brockton, together with community partners Brockton Area Transit (BAT) and Elvera's Café, is a 2022 recipient of federal Thriving Communities Program support. City staff will use this grant to grow Brockton's capacity to facilitate inclusive engagement processes.

- **Increase community awareness and interest through demonstration projects**
  The City of Brockton is a 2023 recipient of an SS4A Demonstration Grant award to pilot quick-build safety treatments at three key intersections along Main Street:
    - Main Street / East Nilsson Street
    - Main Street / Perkins Avenue
    - Main Street / East Chestnut Street

  Projects at these three locations will include quick-build curb extensions with flexible delineator posts and paint, high-visibility crosswalks, stop signs and intersection pavement markings, and pedestrian-level lighting, as depicted in **Figure 5**.

  Brockton will include public engagement in this pilot to raise awareness, educate the community about safety treatments and gather community feedback.

- **Directly involve the community in countermeasure and strategy implementation**
  Successful implementation of the safety countermeasures and strategies outlined in Section 5 will require interagency coordination and close collaboration with community partners. City staff will use inclusive public engagement practices to build awareness, understanding, and support for implementation.

- **Include the community in Safety Action Plan updates**
  As outlined in Section 6, Brockton's Safety Action Plan will require recurring updates. City staff will use inclusive engagement practices to involve the community in future updates to the Plan.

Figure 5. SS4A Demonstration Grant Project Rendering of Main Street and East Nilsson Street

Existing Safety Conditions

EXISTING SAFETY CONDITIONS

EXISTING SAFETY PRACTICE AND CULTURE

Brockton has been working with its regional partners to improve safety through planning efforts and capital projects. These efforts have informed the development of the Safety Action Plan and the strategies which were identified. A summary of relevant efforts is described here.

OLD COLONY – VISION 2050 LONG RANGE TRANSPORTATION PLAN (2023)[7]

The Old Colony Planning Council (OCPC) serves as the comprehensive planning agency for Brockton and 16 additional communities that make up the region. The Long Range Transportation Plan outlines a long-term vision for transportation and land use throughout the Old Colony region, in addition to establishing goals, analyzing existing and future conditions, and prioritizing projects for inclusion in the Transportation Improvement Program (TIP).

The Plan establishes the regional goal of Safety: "Strive for a safe transportation system that minimizes the risk of serious injury to motorized and vulnerable users of the system and helps the Region and Commonwealth move towards its Vision Zero goals." This goal is particularly relevant to Brockton, which the Long Range Transportation Plan identifies as having the second highest number of Crashes Per Mile (23.94) and the second highest number of Fatal Crashes (21) in the region. Brockton has 63 out of 100 of the Old Colony Top 100 Highest Equivalent to Property Damage Only (EPDO) values.

OLD COLONY PLANNING COUNCIL REGIONAL SAFETY ACTION PLAN (ONGOING)

The Old Colony Planning Council, together with its member communities, the Brockton Area Transit Authority (BAT), and the Greater Attleboro and Taunton Regional Transit Authority (GARTA) received an FY22 SS4A Planning & Demonstration Grant Award to develop a Regional Safety Action Plan (RSAP). Like Brockton's Safety Action Plan, OCPC's Regional Safety Action Plan will incorporate eight key components of a Safety Action Plan. The planning process for the Regional Safety Action Plan is expected to occur between January 1, 2024 and June 30, 2025.

Through the coordinated effort of key Study Working Group representatives, including MassDOT, OCPC and the City of Brockton, it is anticipated that Brockton's Safety Action Plan will be incorporated into the larger Regional Safety Action Plan.

OLD COLONY PLANNING COUNCIL ROAD SAFETY AUDITS[8]

In support of the Strategic Highway Safety Plan's target of zero deaths and serious injuries on Massachusetts roads, between 2007 and 2023 the OCPC prepared 38 Roadway Safety Audits, 10 of which have been conducted in Brockton.

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[7] Old Colony Planning Council (September 2023). *Old Colony Metropolitan Planning Organization Vision 2050 Old Colony Long-Range Transportation Plan (LRTP)*. https://oldcolonyplanning.org/wp-content/uploads/2023/09/Vision-2050-Old-Colony-LRTP-Endorsed-September-2023.pdf

[8] MassDOT. *Road Safety Audits.* Road Safety Audits (state.ma.us)

BROCKTON COMPLETE STREETS POLICY (2016) AND PRIORITIZATION PLAN (2020)[9,10]

To qualify for MassDOT Complete Streets Funding Program grants, the City of Brockton developed a Complete Streets Prioritization Plan (CSPP) to identify projects that support its Complete Streets Policy. The City adopted its Complete Streets Policy in 2016 and it was approved by MassDOT in the same year. The City's latest CSPP includes 28 projects to address safety concerns, 17 projects to improve ADA accessibility, and 11 to expand pedestrian mobility.

BLUEPRINT FOR BROCKTON: FINAL COMPREHENSIVE MASTER PLAN (2017)[11]

The City of Brockton created its Comprehensive Master Plan to enhance its appeal as a place to live, work, and visit, with a focus on Transit Oriented Development and an emphasis on reducing traffic congestion by encouraging transit, walking, and bicycling. Key goals related to transportation include implementing Complete Streets by developing pedestrian and bicycle transportation plans and increasing sidewalk repair and construction. The plan also aims to maintain regional connections while creating a sense of place for live, work, and play. Recommendations include reducing reliance on cars, investing in pedestrian facilities like sidewalks and crosswalks, narrowing vehicle lanes to expand shoulders in areas without sidewalks, and extending bicycle lanes to link new trails to open spaces and parks.

DOWNTOWN BROCKTON TRAFFIC STUDY (2020)[12]

This study was conducted to update and expand upon previous studies to determine the feasibility and optimal design of a two-way street network in Downtown Brockton. It includes an existing conditions analysis of the Downtown street network and proposes converting several one-way streets into two-way roadways to create more direct routes and distribute traffic throughout Downtown Brockton. The findings and recommendations of this traffic study influenced the development of the Downtown Brockton Infrastructure Improvement Project.

DOWNTOWN BROCKTON INFRASTRUCTURE IMPROVEMENT PROJECT (ONGOING)

The City of Brockton was awarded $7.8M in RAISE grant funding for the Downtown Brockton Infrastructure Project in FFY2023. The project was based on the goals of the 2017 Blueprint for Brockton Comprehensive Master Plan and the recommendations of the 2020 Downtown Brockton Traffic Study. The project will reconstruct 20 roadways in downtown Brockton, replace traffic signals, convert one-way roadways into

[9] City of Brockton. (July 2016). *An Ordinance Amending Chapter 20 Streets and Sidewalks of the Revised Ordinance of the City of Brockton*. https://gis.massdot.state.ma.us/completestreets/PublicDownload.ashx?aWQ9MzMzJnRpZXJJZD0x

[10] City of Brockton. (May 2020). *Complete Streets Prioritization Plan.* https://gis.massdot.state.ma.us/completestreets/PublicDownload.ashx?aWQ9OTEwJnRpZXJJZD0y

[11] City of Brockton. (October 2017). *A Blueprint for Brockton: Final Comprehensive Master Plan.* Brockton-Master-Plan-Comprehensive-FINAL.pdf

[12] City of Brockton. (May 2020). *Downtown Traffic Study.* https://brockton.ma.us/wp-content/uploads/2020/06/Downtown-Brockton-Traffic-Study-Report-Final-051520.pdf

two-way traffic, replace water and sewer lines, replace storm drain systems, and install 5 miles of fiber optics within project limits. The funding was awarded in December 2023.

BROCKTON SAFE ROUTES TO SCHOOL (ONGOING)

Brockton's participation in the State's Safe Routes to School Program creates regular opportunities to provide road safety education to children. Today, 26 Brockton schools are involved in the SRTS Program as Partner Schools. Two local organizations are involved in the program as Safe Routes to School Alliance Partners: Boys and Girls Club – Brockton Clubhouse and Old Colony YMCA – Brockton Branch.

SAFETY ANALYSIS AND RESULTS

This section describes the methods and results for the citywide safety analyses performed to understand citywide crash patterns and systemically evaluate and identify priority locations to target safety treatments. The crash patterns and trends analysis was conducted to identify behavioral and roadway patterns associated with fatal and injury crashes in Brockton. The systemic evaluation was conducted to identify high-crash, high-risk locations for systemic safety improvements – and to prioritize these locations in Brockton's High Priority Network.

Findings from these analyses inform the countermeasures and strategies described in later sections of this plan.

SAFETY DATA ANALYZED

This section documents the data assembled for analysis.

Crash Data

Kittelson worked with the Study Working Group to assemble crash data for Brockton, including:

- **2018 – 2022 Crashes**: MassDOT dataset including five complete years of reported crashes, representing January 1, 2018, through December 31, 2022.
- **Highway Safety Improvement Program (HSIP) Clusters**: MassDOT dataset including the top locations in the state where reported crashes occurred at intersections. Kittelson assembled the four most recent HSIP cluster datasets, including:
  - HSIP Clusters 2015 – 2017
  - HSIP Clusters 2016 – 2018
  - HSIP Clusters 2017 – 2019
  - HSIP Clusters 2018 – 2020
- **Top 200 HSIP Clusters**: MassDOT dataset showing the Top 200 at grade crash intersection locations. The analysis uses crashes from a three-year period and is updated on a regular basis. Kittelson assembled the five most recent Top 200 HSIP cluster datasets, including:
  - Top 200 HSIP Clusters 2014 – 2016
  - Top 200 HSIP Clusters 2015 – 2017
  - Top 200 HSIP Clusters 2016 – 2018
  - Top 200 HSIP Clusters 2017 – 2019
  - Top 200 HSIP Clusters 2018 – 2020

- **2011 – 2020 Pedestrian Crash Clusters**: MassDOT dataset showing the top locations where reported crashes occurred between pedestrians and motor vehicles. Due to the relatively small number of reported pedestrian crashes in the state's crash data files, the analysis used crashed from the ten-year period from 2011 – 2020.
- **2011 – 2020 Bicycle Crash Clusters**: MassDOT dataset showing the top locations where reported crashes occurred between bicyclists and motor vehicles. Due to the relatively small number of reported bicycle crashes in the state's crash data files, the analysis used crashed from the ten-year period from 2011 – 2020.
- **2013 – 2017 Excess Expected Fatal and Serious Injury Crashes MPO Ranking**: MassDOT dataset showing crash-based network screening data for roads in the state. The analysis used the latest available 5 years of closed geocoded crashes (2013-2017). Road segments were ranked from most to least excess crash frequency, calculated as the difference between expected and predicted average fatal and serious injury crash frequency on the MPO level. The dataset identifies sites in the Top 5% and then Next 10% of all segments by MPO.

Risk Data

Kittelson worked with the Study Working Group to assemble risk data for Brockton, including:

- **2013 – 2017 Strategic Highway Safety Plan Emphasis Area Safety Risk Statewide Ranking**: MassDOT dataset showing risk-based network screening data for roads in the state. The risk-based network screening data is based on crash risk factors identified for many of the emphasis areas of the Strategic Highway Safety Plan, including:
    - Distracted Driver
    - Bicycle
    - Impaired Driver
    - Large Truck
    - Motorcycle
    - Occupant Protection
    - Older Driver
    - Roadway Departure
    - Pedestrian
    - Speed Aggressive Driving
    - Young Driver

  A variety of statistical methods were used to identify the crash risk factors for each of the emphasis areas. The datasets identify primary and secondary risk sites by emphasis area for all segments statewide.

Community Data

Kittelson worked with the Study Working Group to assemble community factors data for Brockton, including:

- **2020 Environmental Justice Populations**: Massachusetts environmental justice population data, based upon demographic criteria developed by the state's Executive Office of Energy and Environmental Affairs.

- **Brockton Area Transit (BAT) Stops**: Massachusetts Regional Transit Authority bus stop data, updated in 2020.
- **Schools**: Locations of Pre-K through 12 schools in Massachusetts, updated in 2022.

CITYWIDE CRASH PATTERNS AND TRENDS

This section presents citywide crash patterns and trends. The analysis focuses on identifying behavioral and roadway patterns associated with fatal and injury crashes. By analyzing reported crashes together, systemic trends across locations can be identified. Findings from this analysis helped inform the systemic evaluation and countermeasure considerations discussed later in the plan.

Kittelson analyzed reported crashes in Brockton between based on the following crash attributes:

- Crash severity;
- Crash type;
- Crashes involving vulnerable road users;
- Driver contributing circumstances; and
- Light conditions

Reported Crashes
Car crashes that are reported to the Massachusetts Registry of Motor Vehicles. Since some crash types like bicycle and pedestrian crashes are underreported, reported crashes do not represent total crashes. All crash data in this section is based on reported crashes.

Overrepresented Crash Attributes
Crash attribute (e.g., crash type) that has a higher proportion of crashes in Brockton than in a comparison group (e.g., Statewide).

Crash Severity

MassDOT classifies crashes by severity based on the most severe outcome associated with the reported crash. **Table 4** presents crashes by severity. From January 2018 to December 2022, 33 fatal crashes and 286 serious injury crashes occurred in Brockton.

Table 4. Brockton Crashes by Severity (January 2018 - December 2022)

Maximum Severity	Number of Crashes	Percent of Total Crashes
Fatal Injury (K)	33	0.3%
Suspected Serious Injury (A)	286	2.4%
Suspected Minor Injury (B)	1,807	15.4%
Possible Injury (C)	2,704	23%
Property Damage Only (O)	6,386	54.3%
Not Reported, Other	541	4.6%
Total	**11,757**	**100%**

Crash Type

Figure 6 presents all crashes by reported crash type. Compared to crashes in the state, angle and head-on crashes are overrepresented in Brockton.

Figure 6. Brockton Crashes by Crash Type (January 2018 - December 2022)

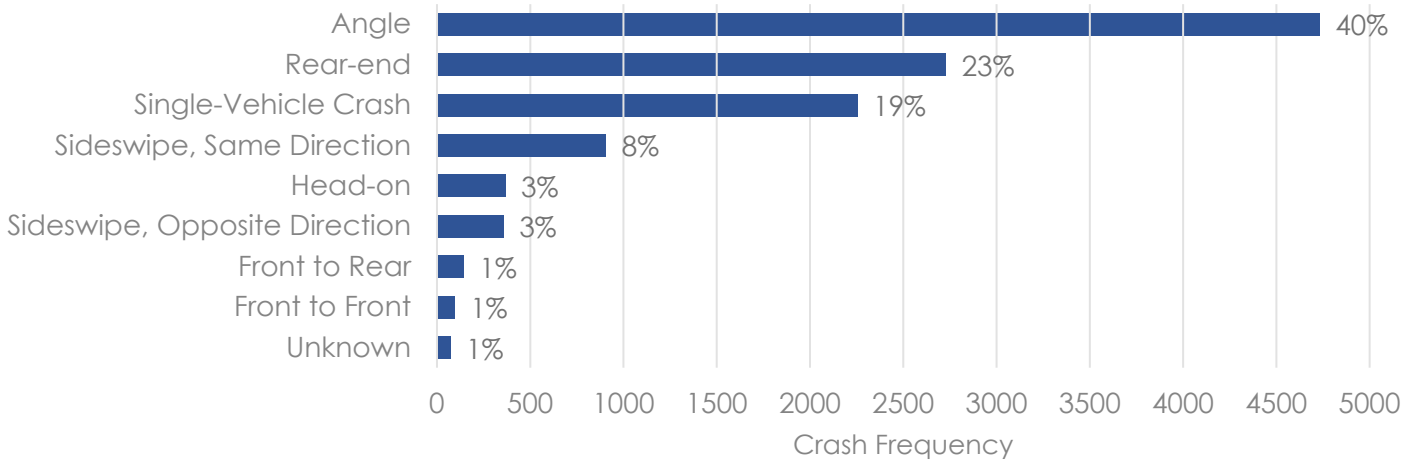
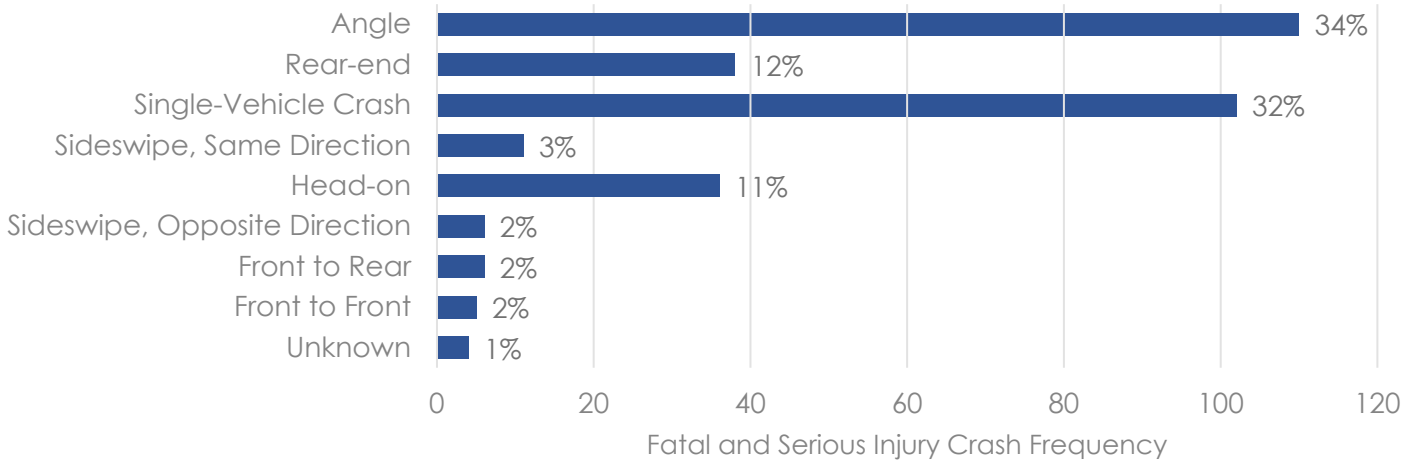


Figure 7 presents fatal and serious injury crashes by reported crash type. The figure demonstrates that Brockton's fatal and serious injury crash rate deviates from the total reported crash share by crash type. Single vehicle crashes are nearly twice as likely to result in a fatal or serious injury crash compared to total crashes (32% of FI crashes – 19% of total reported crashes). Head-on crashes are nearly four times as likely to results in a fatal or serious injury crash compared to total crashes (11% of FI crashes – 3% of total reported crashes).

Crashes that are much less likely to result in a fatal or serious injury crash include rear-end crashes (12% of FI crashes – 23% of total reported crashes) and sideswipe, same direction crashes (3% of FI crashes – 8% of total reported crashes).

Figure 7. Brockton Fatal and Serious Injury Crashes by Crash Type (January 2018 - December 2022)



- The three most frequent crash types for fatal and serious injury crashes were:
  - Angle (34%)
  - Single vehicle crash (32%)
  - Rear end (12%)

These three crash types account for 78% of fatal and serious injury crashes in Brockton.

Pedestrian and Bicycle Crashes

MassDOT identifies crashes involving bicycle and pedestrian crashes through a *First Harmful Event* dataset. **Table 5** summarizes bicycle and pedestrian crashes in Brockton by severity.

- Compared to all crashes in the state, pedestrian crashes are overrepresented in Brockton.
- Bicycle crashes are over three times as likely to result in a fatal or serious injury crash compared to total crashes (2.5% of fatal and injury crashes – 0.7% of total reported crashes).
- Pedestrian crashes are over six times as likely to result in a fatal or serious injury crash compared to total crashes (16.9% of fatal and injury crashes – 2.6% of total reported crashes).

Table 5. Brockton Bicycle and Pedestrian Crashes (January 2018 - December 2022)

Crash Type	All Crashes		Fatal and Serious Injury Crashes	
Pedestrian	311	2.6%	54	
Bicycle	78	0.7%	8	2.5%

Driver Contributing Circumstances

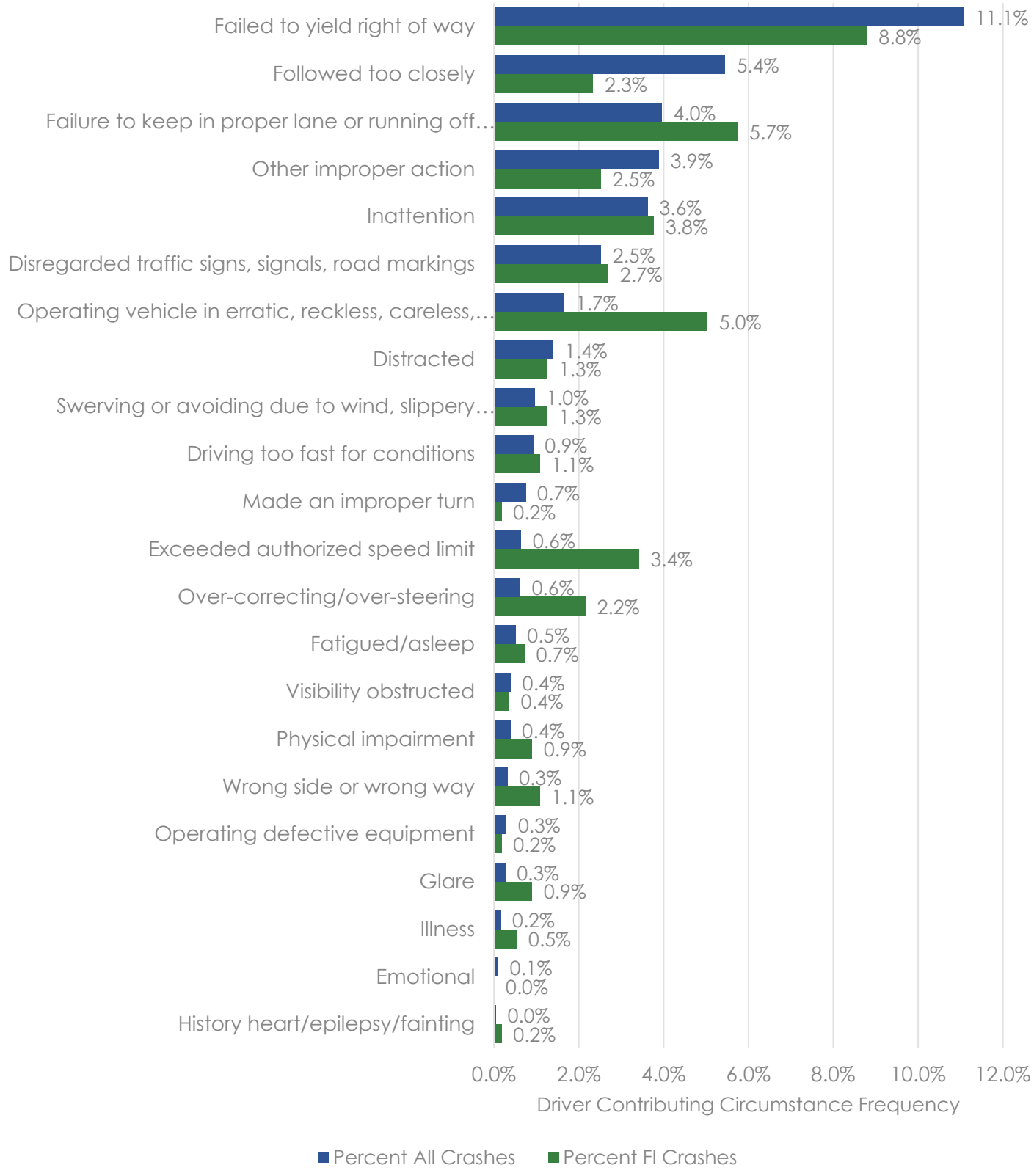
MassDOT maintains data for each crash that identifies a contributing circumstance to the crash. These circumstances either impact or are the action of the driver of a motor vehicle. **Figure 8** compares driver contributing circumstances associated with all crashes to driver contributing circumstances associated with fatal and serious injury crashes.

Driver contributing circumstances that occurred more frequently for ***total*** reported crashes include "failed to yield right of way", "followed too closely". Driver contributing circumstances that occurred more frequently for **fatal and serious injury crashes** include "failure to keep in proper lane", "operating vehicle in erratic, reckless, careless, negligent or aggressive manner", "exceeded authorized speed limit", and "over-correcting/over-steering".

Compared to crashes in the state, four driver contributing circumstances are overrepresented in Brockton crashes:

- Disregarded traffic signs, signals, and road markings
- Failed to yield right of way
- Failure to keep in proper lane or running off road
- Other improper action

Figure 8. Brockton Driver Contributing Circumstances (January 2018 - December 2022)



Low Light Crashes

Figure 9 presents all crashes reported by light condition. Compared to crashes in the state, crashes that occur at night on lit roadways are overrepresented in Brockton (31% of crashes by light condition in Brockton, 21% of crashes by light condition statewide).

Figure 9. Brockton Crashes by Light Conditions (January 2018 - December 2022)

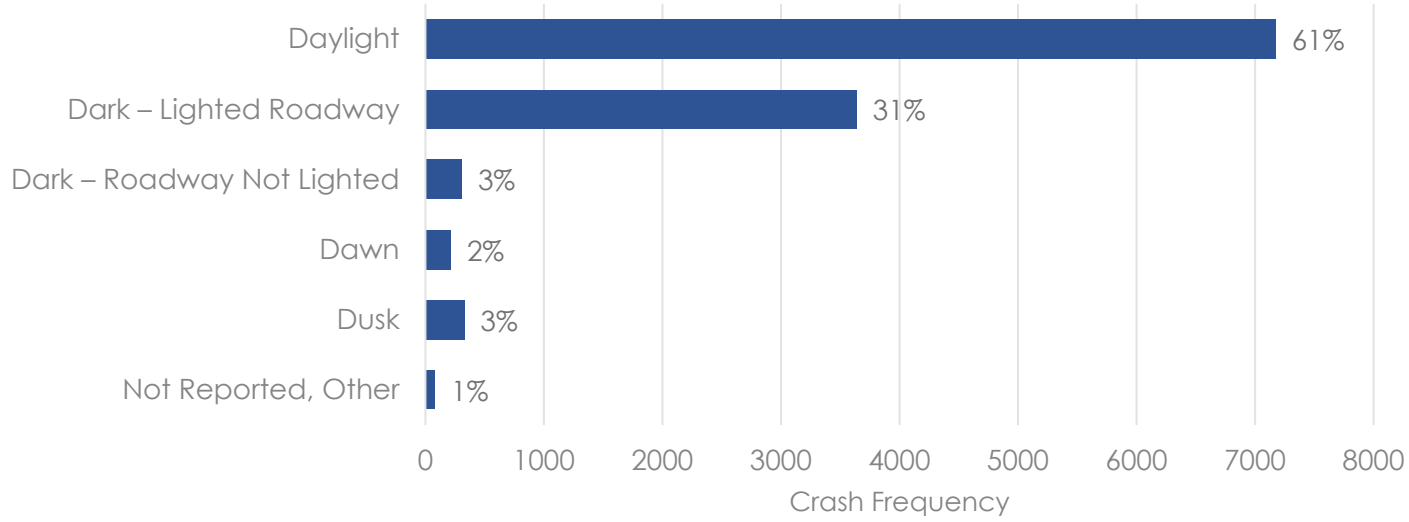
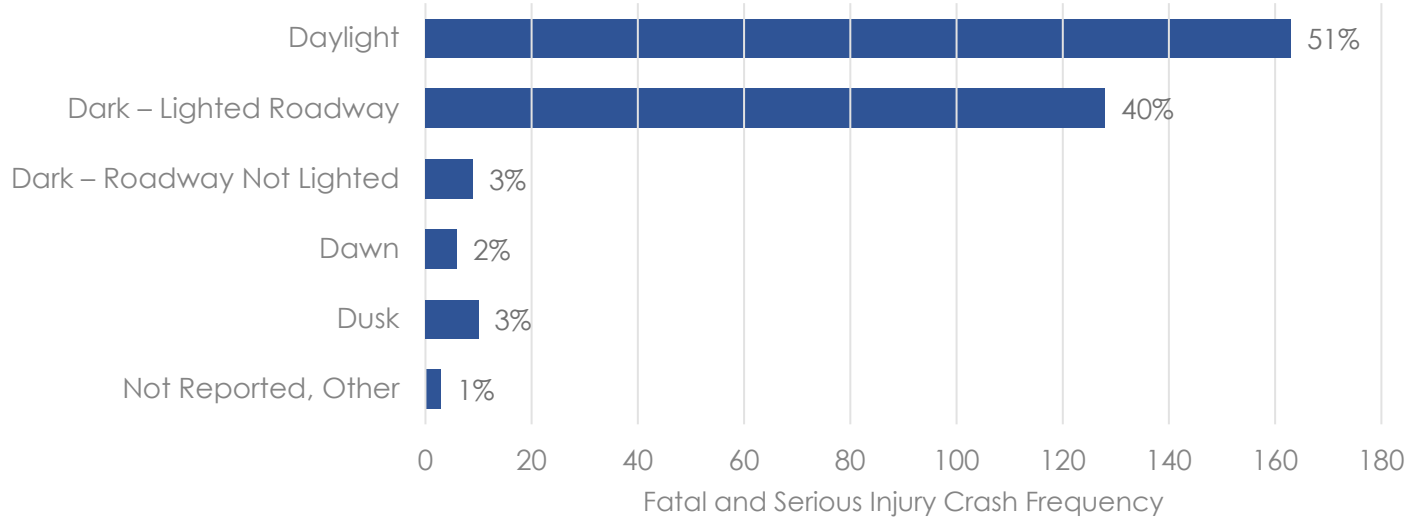


Figure 10 presents fatal and serious injury crashes reported by light conditions. This data demonstrates crashes that occur at night on lit roadways make up a higher percentage of fatal and serious injury crashes compared to all crashes. Compared to fatal and serious injury crashes in the state, fatal and serious injury crashes that occur at night on lit roadways are also overrepresented in Brockton (40% of FI crashes by light condition in Brockton, 27% of FI crashes by light condition statewide).

Figure 10. Brockton Fatal and Serious Injury Crashes by Light Conditions (January 2018 - December 2022)



NETWORK ANALYSIS AND SYSTEMIC FINDINGS

This section describes the network analysis and systemic evaluation of the Brockton roadway network. The project team built on MassDOT's crash- and risk-based network screening tools to identify intersections and segments with the highest crash severity and crash risk in Brockton. MassDOT uses both crash-based and risk-based network screening to help identify locations that can be improved to best help reduce the occurrent of fatal and serious injury crashes.

MassDOT's **crash-based network screening** helps focus on individual locations with higher numbers of fatal and serious injury crashes. MassDOT's **risk-based network screening** highlights locations where higher risk roadway features correlate with specific fatal and serious injury crash types.

MassDOT's Highway Division provides detailed information on the methodology and development of the crash- and risk-based network screenings.[13]

Intersection Analysis & Results

Method

Kittelson conducted a GIS-based evaluation that ranked Brockton intersections based on crash data and community factors data. The analysis method was reviewed and approved by the Study Working Group, and included the following steps:

The project team used the 2017 – 2019 HSIP Clusters layer to create a base layer of intersections for the analysis.

After setting up the base intersection layer, the project team assigned 'points' to each intersection based on its proximity to the following crash and community factors:

- **For the HSIP Clusters**, 1 point per intersecting clusters, with a maximum possible score of 4.
- **For the five Top 200 HSIP Clusters**, 1 point per intersecting clusters, with a maximum possible score of 5.
- **For the Pedestrian Crash Clusters**, each intersection that coincided with a Pedestrian Cluster was assigned a score of 4.
- **For the Bicycle Crash Clusters**, each intersection that coincided with a Bicycle Cluster was assigned a score of 4.
- **Massachusetts Environmental Justice Populations**: Each intersection within an EJ community was assigned a score of 4.

Since MassDOT's risk-based network screening for intersection crashes is under development, the intersection analysis for this Safety Action Plan used existing crash data, the presence of Massachusetts EJ populations, and the presence of multimodal generators such as transit stops and school.

More dense areas of Brockton where people are more likely to walk and bike to reach these destinations (e.g. Downtown Brockton) have more multimodal generators and have experienced more fatal and serious injury crashes. Consequently, many of the Priority Intersections are in or near Brockton's denser urban core.

Future updates to this Plan will apply MassDOT's risk-based network screening for intersection crashes.

[13] MassDOT. (2022). *Network Screening Methodology Reports*. https://www.mass.gov/lists/network-screening-methodology-reports#reports-

- **Schools**: A 0.25-mile search radius around each school location was used to identify intersections near schools. Each intersection that was within 0.25 mi of a school was assigned a score of 4.
- **Brockton Area Transit (BAT) Bus Stop**s: A 0.10-mile search radius around each bus stop was used to identify intersections near bus stops. Each intersection that was within 0.10 mi of a bus stop was assigned a score of 4.

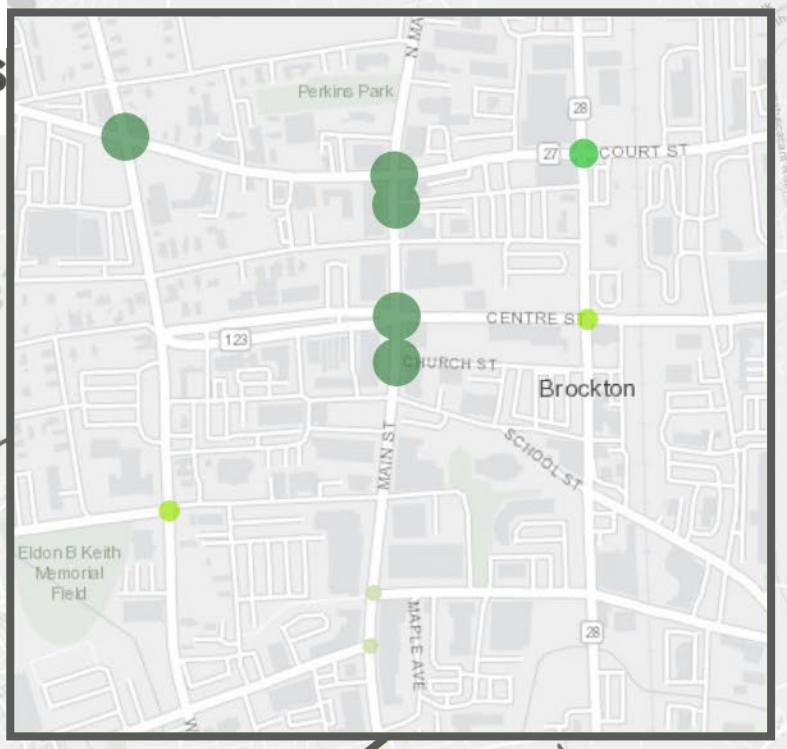
Results

The maximum possible score was 29. Total intersection scores ranged from 28 to 9. The intersection scores were grouped by quantile, with the top quantile symbolized as Tier I Priority Intersections and the second highest quantile symbolized as Tier II priority intersections (**Figure 11**).

The Study Working Group reviewed and provided feedback on draft priority intersections. The evaluation resulted in 8 Tier I Priority Intersections and 7 Tier II Priority Intersections. These intersections are shown in **Table 6** and displayed in **Figure 14** as part of Brockton's High Priority Network.

Figure 11.

Priority Intersection Analysis



Intersections - Analysis Results

Top 25%

Bottom 25%

0 0.3 0.5 1 Miles

Table 6. Intersection Analysis Results

Rank	Intersection	HSIP Cluster 15 17	HSIP Cluster 16 18	HSIP Cluster 17 19	HSIP Cluster 18 20	HSIP Top 200 14 16	HSIP Top 200 15 17	HSIP Top 200 16 18	HSIP Top 200 17 19	HSIP Top 200 18 20	Ped Crash Cluster 11 20	Bike Crash Cluster 11 20	EJ Population, 2020	Transit	School	Score
Tier I Priority Intersections																
1	Main St / Legion Pkwy / Centre St	1	1	1	1	0	1	1	1	1	4	4	4	4	4	28
2	Route 27 / Pleasant St / N Warren Ave	1	1	1	1	0	1	1	1	1	4	4	4	4	4	28
3	Main St / Church St	1	1	1	1	0	1	1	1	1	4	4	4	4	4	28
4	Main St / Perkins Ave	1	1	1	1	0	1	1	1	1	4	0	4	4	4	24
5	Main St / Pleasant St / Route 27 / Court St	1	1	1	1	0	1	1	1	1	4	4	4	4	0	24
6	Main St / E Nilsson St	1	1	1	1	0	1	1	1	1	4	0	4	4	4	24
7	Warren Ave / Forest Ave	1	1	1	1	0	1	1	1	1	4	0	4	4	4	24
8	Main St / Franklin St	1	1	1	1	0	1	1	1	1	4	4	4	4	0	24

Rank	Intersection	HSIP Cluster 15 17	HSIP Cluster 16 18	HSIP Cluster 17 19	HSIP Cluster 18 20	HSIP Top 200 14 16	HSIP Top 200 15 17	HSIP Top 200 16 18	HSIP Top 200 17 19	HSIP Top 200 18 20	Ped Crash Cluster 11 20	Bike Crash Cluster 11 20	EJ Population, 2020	Transit	School	Score
Tier II Priority Intersections																
9	N Main St / Oak St / Howard St / Wilmington St	1	1	1	1	0	1	1	1	1	4	0	4	4	0	20
10	Montello St / Route 28 / Court St	1	1	1	1	0	1	1	1	1	4	0	4	4	0	20
11	Montello St / Route 28 / E Nilsson St	1	1	1	1	0	1	1	1	1	0	0	4	4	4	20
12	Warren Ave / Market St	1	1	1	1	0	1	1	1	1	0	0	4	4	4	20
13	N Cary St / Court St / Provost St	1	1	1	1	0	1	1	1	1	0	0	4	4	4	20
14	N Cary St / Lyman St / Centre St	1	1	1	1	0	1	1	1	1	0	0	4	4	4	20
15	Lyman St / Crescent St / Route 27	1	1	1	1	0	1	1	1	1	0	0	4	4	4	20

Corridor Analysis & Results

Method

The project team conducted a GIS-based evaluation that ranked Brockton roadways based on crash and risk data. The analysis method was reviewed and approved by the Study Working Group, and included the following steps:

MassDOT maintains risk-based network screening data for eleven emphasis areas of the Strategic Highway Safety Plan. Following a review of citywide crash patterns and trends, a visual scan of the eleven risk-based datasets, and discussion with the Study Working Group, the project team selected three risk-based network screening datasets for analysis:

- 2013 – 2017 Strategic Highway Safety Plan – Pedestrian Safety Risk Statewide Ranking
- 2013 – 2017 Strategic Highway Safety Plan – Bicycle Safety Risk Statewide Ranking
- 2013 – 2017 Strategic Highway Safety Plan – Speeding and Aggressive Driving Safety Risk Statewide Ranking

Using the MassDOT Roads Inventory layer, a linear referencing system (LRS) was created for Brockton's roads, which served as the base layer for the analysis.

After setting up the base layer, the project team overlaid the four crash and risk datasets over the base and assigned points to the resulting roadway segments based on the following factors:

- **2013 – 2017 Excess Expected Fatal Serious Injury Crashes MPO Ranking:** 2 points per "Next 10" and 4 points per "Top 5" segment, with a maximum possible score of 4.
- **2013 – 2017 Strategic Highway Safety Plan Bicycle Safety Risk Statewide Ranking:** 2 points per "secondary risk" and 4 points per "primary risk" segment, with a maximum possible score of 4.
- **2013 – 2017 Strategic Highway Safety Plan Pedestrian Safety Risk Statewide Ranking:** 2 points per "secondary risk" and 4 points per "primary risk" segment, with a maximum possible score of 4.
- **2013 – 2017 Strategic Highway Safety Plan Speed Aggressive Driving Safety Risk Statewide Ranking:** 2 points per "secondary risk" and 4 points per "primary risk" segment, with a maximum possible score of 4.

Results

The project team calculated a combined total score for each segment in the analysis layer. Scores ranged from 0 to 16 per segment. The segments were symbolized by quantile to visually identify corridors comprised of multiple high-scoring segments, as displayed in **Figure 12**.

The project team then summed the scores for the segments that comprised each corridor and divided the new total scores by corridor length to determine a scope per mile for each corridor. The top scoring corridors were grouped into Tier I Priority Corridors and Tier II Priority Corridors.

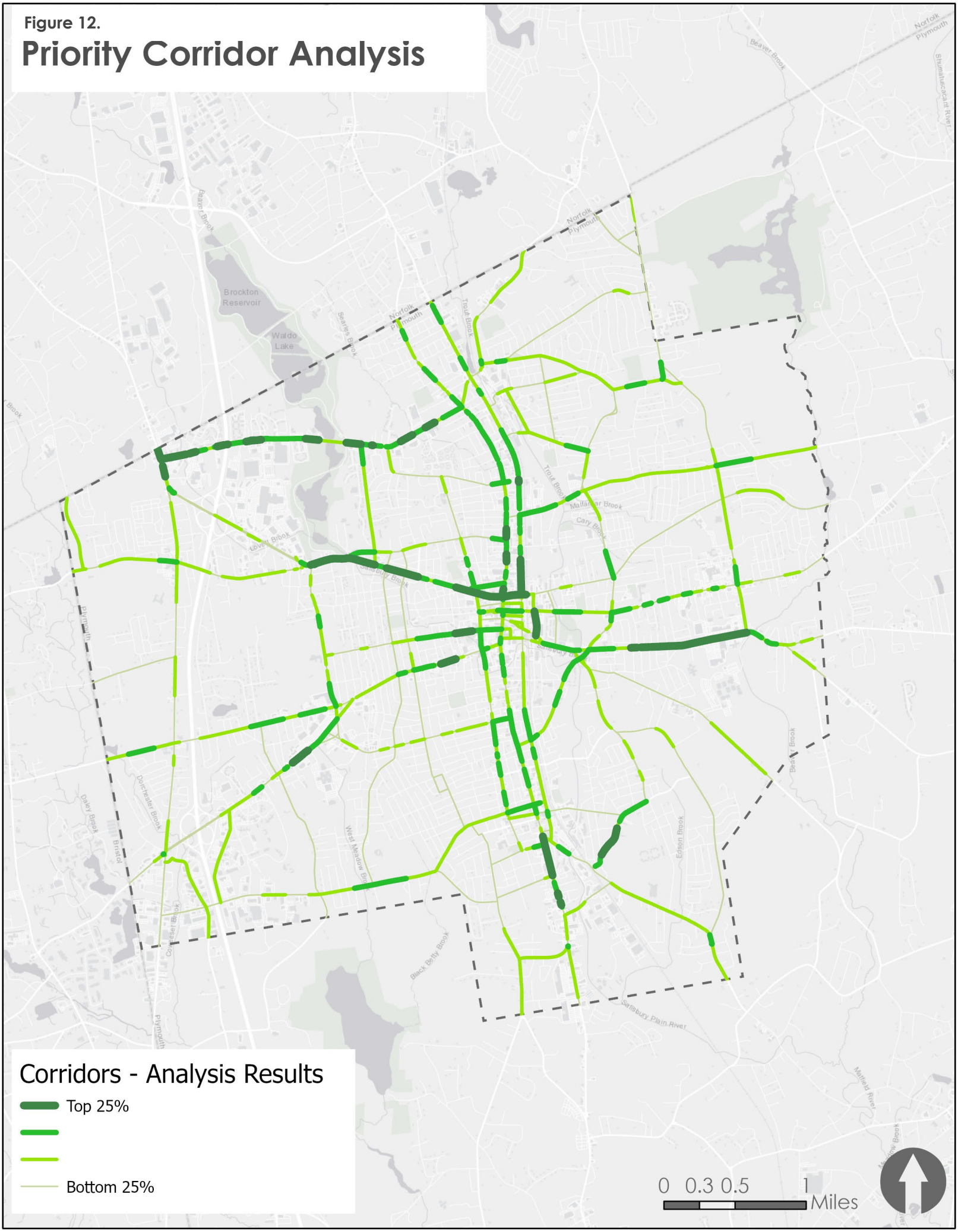
These corridors were reviewed with the Study Working Group, and both the score per mile and feedback received were used to rank the Priority Corridors. The evaluation resulted in 10 Tier I Priority Corridors and 11 Tier II Priority Corridors. These intersections are shown in **Table 7** and displayed in **Figure 14** as part of Brockton's High Priority Network

Table 7. Corridor Analysis Results

Rank	Corridor	Score	Length (mi)	Score per Mile
Tier I Priority Corridors				
2	Pleasant Street, West Street – Montello Street	360	1.53	236
3	Oak Street, N Pearl Street – N Main Street	508	2.21	230
4	N Main Street, Howard Street – Court Street	290	1.43	203
5	Crescent Street, School Street – Alger Street	294	1.76	167
6	W Elm Street, Elm Avenue – Main Street	88	0.61	144
7	Commercial Street, Centre Street – School Street	24	0.17	138
8	N Montello Street, Ames Street – Court Street	126	1.13	111
9	Route 123, Linwood Street – Newton Street	162	1.54	105
10	Summer Street, Plain Street – Carl Avenue	64	0.64	100
Tier II Priority Corridors				
12	Grove Street, Main Street – Centre Street	128	1.20	107
13	N Main Street, Howard Street – City Limits	66	0.78	85
14	Torrey Street, City Limits – Belmont Street	138	1.77	78
15	N Montello Street, Ames Street – City Limits	78	1.09	72
16	Warren Avenue, W Elm Street – Clifton Avenue	96	1.59	61
17	Montello Street, Court Street – Plain Street	98	1.75	56
18	E Ashland Street, Main Street – City Limits	124	2.26	55
19	West Street, Pleasant Street – Belmont Street	64	1.16	55
20	Centre Street, Warren Avenue – City Limits	130	2.66	49
21	W Chestnut Street, Pearl Street – Montello Street	70	2.93	24

Figure 12.

Priority Corridor Analysis



BROCKTON'S HIGH PRIORITY NETWORK

High-crash and high-risk intersections and corridors that have a history of safety issues, are near community destinations such as schools and bus stops and are in Massachusetts Environmental Justice areas were prioritized to form a ranked list of draft priority locations for safety interventions. **Figure 13** summarizes the data-driven process described in previous sections. **Figure 14** shows the Brockton High Priority Network.

Figure 13. High Priority Network Development Process

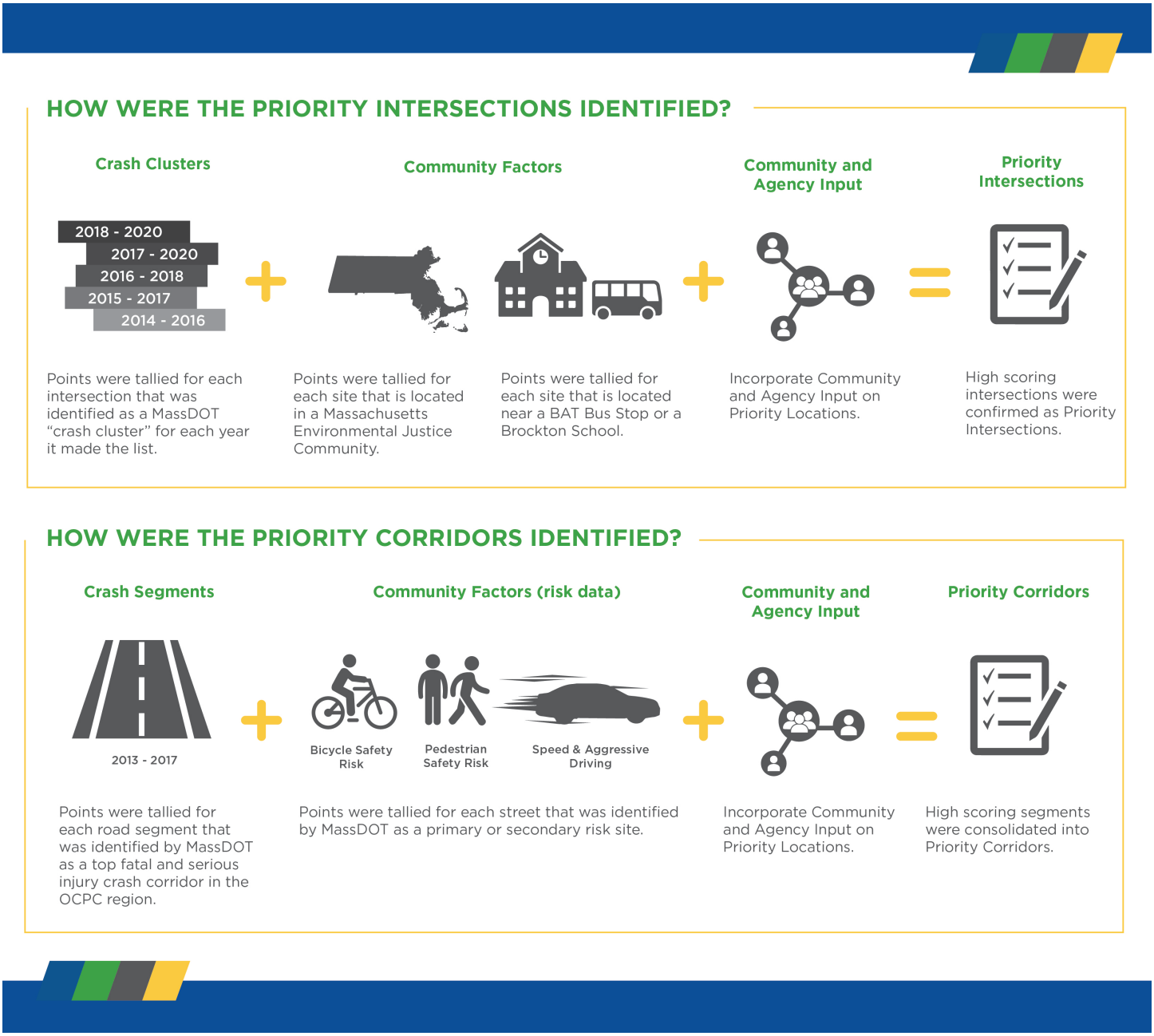
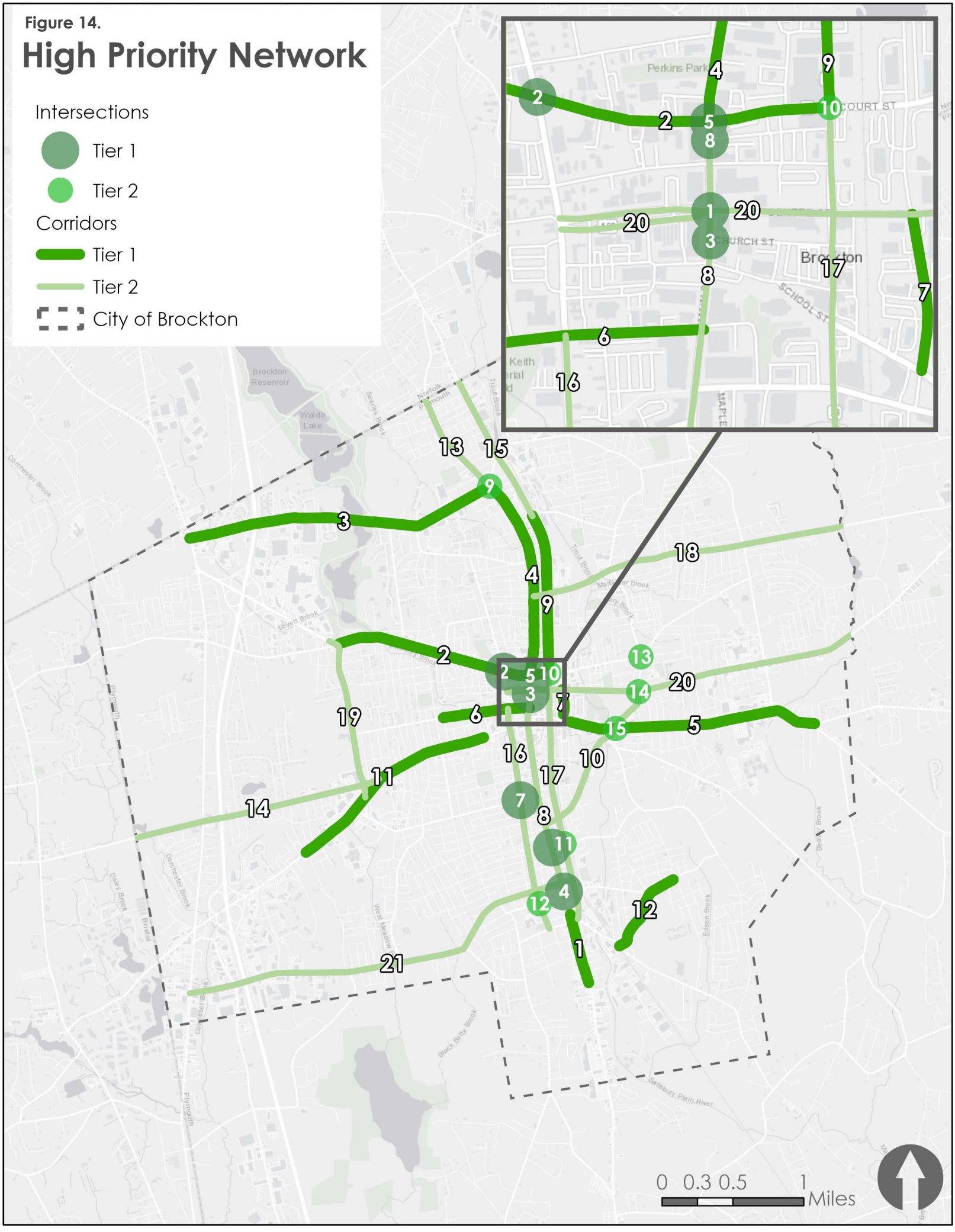


Figure 14.

High Priority Network



Equity Areas & the High Priority Network

In accordance with the Justice40 Initiative, Safety Action Plans, through the Safe Streets and Roads for All Program, are a key component in the USDOT's efforts to confront and address decades of underinvestment. When decision makers at all levels have the tools to understand how a community is experiencing disadvantage and can identify projects that create benefits that will reverse or mitigate those causes, the result is a higher quality of life and economic prosperity in communities across the country, including in Brockton.

To support the equitable distribution of resources, the USDOT created an interactive web application that uses 2020 Census Tracts and data to explore the cumulative burden communities experience because of underinvestment in transportation, called the Equitable Transportation Community (ETC) Explorer.[14] This dynamic tool provides a snapshot of data points across five components:

- **Transportation Insecurity** occurs when people are unable to get to where they need to go to meet the needs of their daily life regularly, reliably, and safely. A growing body of research indicates that transportation insecurity is a significant factor in persistent poverty. This component includes metrics that measure transportation access, cost burden, and safety.
- **Climate and Disaster Risk Burden** reflects sea level rise, changes in precipitation, extreme weather, and heat which pose risks to the transportation system. These hazards may affect system performance, safety, and reliability. As a result, people may have trouble getting to their homes, schools, stores, and medical appointments.
- **Environmental Burden** includes variables measuring factors such as pollution, hazardous facility exposure, water pollution and the built environment. These environmental burdens can have far-reaching consequences such as health disparities, negative educational outcomes, and economic hardship.
- **Health Vulnerability** assesses the increased frequency of health conditions that may result from exposure to air, noise, and water pollution, as well as lifestyle factors such as poor walkability, car dependency, and long commute times.
- **Social Vulnerability** is a measure of socioeconomic indicators that have a direct impact on quality of life. This set of indicators measure lack of employment, educational attainment, poverty, housing tenure, access to broadband, and housing cost burden as well as identifying household characteristics such as age, disability status and English proficiency.

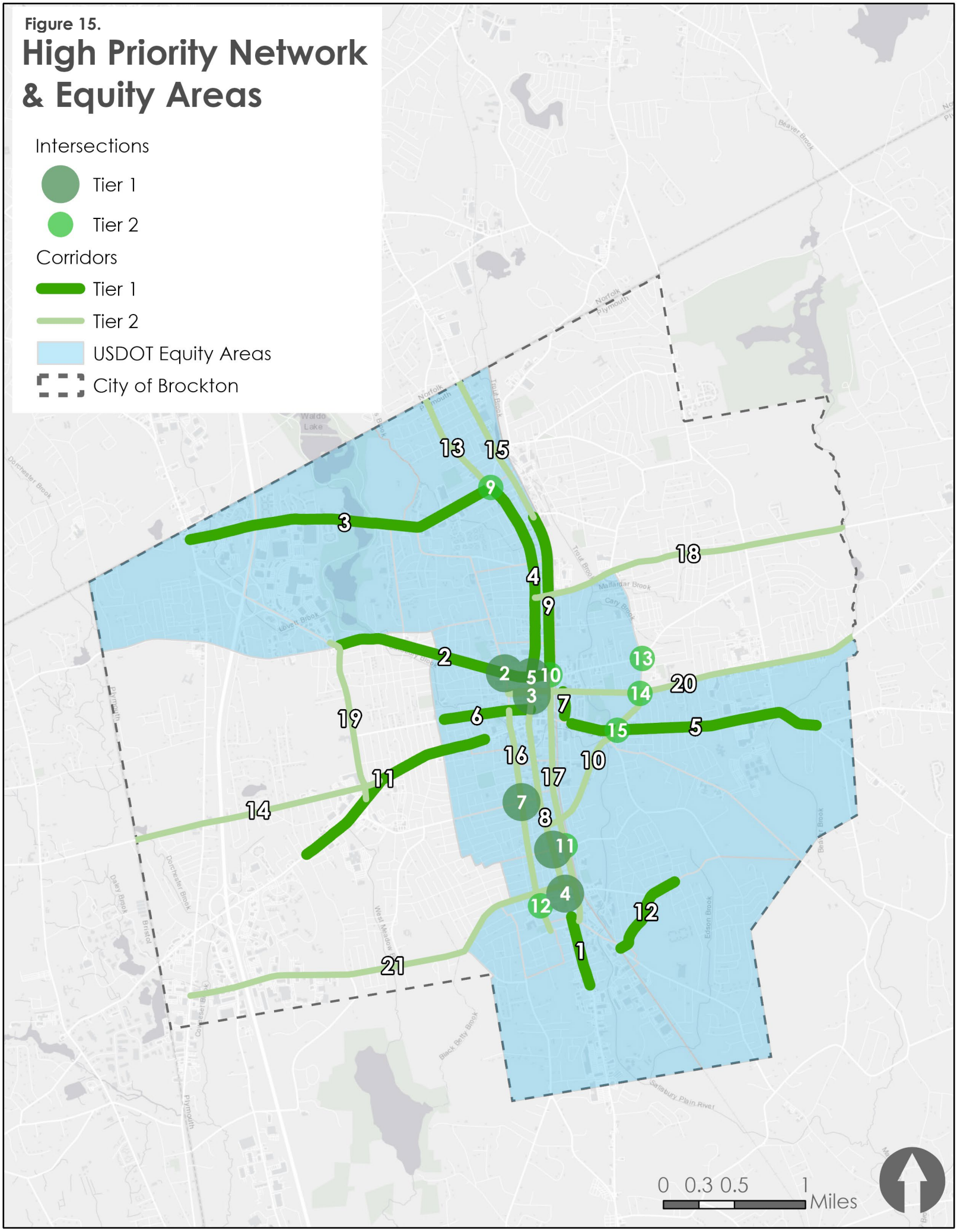
The ETC Explorer provides insights into how communities like Brockton are experiencing burdens that transportation investments can mitigate or reverse. The results of the equity analysis are combined with the High Priority Network to understand the impact of safety on disadvantaged communities. The USDOT ETC Explorer tallies the total Brockton population at 147,800, with a total disadvantaged population of 63,600, or 47%. As a community, Brockton scores above the 65th percentile for Climate & Disaster Risk Burden (66%), Environmental Burden (68%), and Health Vulnerability (67%) when compared to National Results.

Figure 15 displays Brockton's High Priority Network and the Census Tracts identified by the USDOT ETC Explorer as transportation disadvantaged.

[14] USDOT Equitable Transportation Community Explorer. https://experience.arcgis.com/experience/0920984aa80a4362b8778d779b090723/page/ETC-Explorer---Homepage/

Figure 15.

High Priority Network & Equity Areas



Strategies and Recommendations

COUNTERMEASURES, STRATEGIES, & POLICIES

Improving roadway safety in Brockton will take a coordinated effort from various partners and viewpoints. This section presents multidisciplinary recommendations for Brockton to consider as they make investments and advancements in improving roadway safety across the region.

The recommendations are based on the crash and crash risk patterns and trends described in the previous section. They are organized into three safety treatment categories:

- **Countermeasures:** A term used for engineering infrastructure improvements that can be implemented to reduce the risk of crashes.
- **Strategies:** A term used for non-engineering practices that address traffic safety – often related to behavior or components of a Safe System that build a culture of safety.
- **Policies:** A term used for non-engineering practices that address traffic safety and are often related to government documents that form a basis for decision-making.

COUNTERMEASURES

The project team compiled a list of engineering countermeasures with the following considerations:

- **Crash reduction potential.** Countermeasures that address Brockton's High Priority Network and fall reduce risk of serious and fatal injury crashes by removing severe conflicts, reducing vehicle speeds, managing conflicts in time, and increasing attentiveness and awareness.[15]
- **Potential for systemic application.** Countermeasures that can be applied systemically throughout the city. The project team focused on systemic countermeasures that can address Brockton's three chosen SHSP emphasis areas: bicycle, pedestrian, and speeding/aggressive driving.
- **Cost/resource alignment.** Countermeasures that can be implemented using existing or expected resources.
- **Community input.** Countermeasures that will resonate with the community and meet the community's needs.

These countermeasures are generally organized into three categories:

- Bicycle Treatments
- Pedestrian Treatments
- Roadway Treatments

Each of the treatments are discussed in more detail below, including general benefits, constraints, typical applications, and design considerations.

[15] USDOT. (January 2024). Safe System Road Design Hierarchy: Engineering and Infrastructure-related Countermeasures to Effectively Reduce Roadway Fatalities and Serious Injuries. Safe System Roadway Design Hierarchy: Engineering and Infrastructure-related Countermeasures to Effectively Reduce Roadway Fatalities and Serious Injuries (dot.gov)

BICYCLE TREATMENTS

Shared Use Path

Source: MassTrails Shared Use Path Planning Primer

A shared use path is an off-road infrastructure that is physically separated from motorized vehicle traffic and designed for use by people of all ages and abilities biking and walking.

Benefits
- Combines facility for bicyclists and pedestrians
- Provides separation from vehicle traffic
- Designed for all ages and abilities

Constraints
- Requires substantial buffer to separate from roadways
- Unlit paths may not be comfortable for users
- Potential conflicts with vehicle or other crossings

Typical Applications
- Links between communities that also serve as recreational facilities
- Parallel alternative route to roads in areas where sidewalks or on-street facilities are not provided

Design Considerations
- Best for areas where crossings can be minimized, and apply high-visibility treatments where there are crossings
- Generally should be designed with a width of 10 feet

Raised Bike Lane

Source: NACTO, Raised Cycle Tracks

A raised bike lane, also known as a raised cycle track, is a bicycle facility located at sidewalk level instead of within the roadway.

Benefits
- Separates bikes from vehicle traffic, which can attract bicyclists
- Better for winter maintenance and plowing

Constraints
- Existing right-of-way width
- Additional construction may be required to move curbs

Typical Applications
- Links with adequate right-of-way and/or where curb reconstruction is being done
- Critical bike network segments where additional protection is warranted

Design Considerations
- Intersections should be designed for visibility of bicyclists and may warrant separate signal phasing depending on context.
- Buffer type varies depending on application, presence of parking, and available right-of-way

One-Way Separated Bike Lane

Source: Boston Transportation Department

A one-way separated bike lane, also known as a one-way protected cycle track, is a bicycle facility within the street right-of-way separated from vehicle traffic by a physical barrier such as planters, flexible posts, parked cars, or curb.

Benefits
- Separates bikes from vehicle traffic, which can attract bicyclists
- Less chance of "dooring", opening a door into a bicyclist, when parked cars are present

Constraints
- Winter maintenance and plowing
- Existing roadway width

Typical Applications
- Links with adequate right-of-way or where a road diet can be implemented
- Critical bike network segments where additional protection is warranted

Design Considerations
- Intersections should be designed for visibility of bicyclists and may warrant separate signal phasing depending on context.
- Buffer type varies depending on application, presence of parking, and available right-of-way

Two-Way Separated Bike Lane

Source: NACTO, Raised Cycle Tracks

A two-way separated bike lane, also known as a two-way protected cycle track, is a bicycle facility within the street right-of-way separated from vehicle traffic by a physical barrier such as planters, flexible posts, parked cars, or curb. Two-way separated bike lanes serve bidirectional bicycle travel on one side of the street.

Benefits
- Combines right-of-way need compared to a one-way separated bike lane
- Provides separation from vehicle traffic
- Less chance of "dooring", opening a door into a bicyclist, when parked cars are present

Constraints
- May be less intuitive for users with "wrong way" travel on one side of street
- Potential conflicts with vehicle or other crossings
- Planters or curbs can increase construction costs compared to a standard bike lane

Typical Applications
- Connections between shared use paths
- Critical bike network segments where additional protection is warranted

Design Considerations
- Buffer type varies depending on application, presence of parking, and available right-of-way

Buffered Bike Lane

Source: NACTO, Buffered Bike Lanes

Buffered bike lanes are on-street lanes that include and additional striped buffer of typically 2-3 feet.

Benefits
- Less chance of "dooring", opening a door into a bicyclist, when parked cars are present
- Added separation from vehicles

Constraints
- Does not provide physical protection
- Vehicles may use additional buffer width as parking or standing zone

Typical Applications
- Links with moderate vehicle speeds or volumes
- Streets with adequate right-of-way to provide a buffer
- Important links within and between communities

Design Considerations
- Buffer may consist of diagonal striping or rumble strips to deter vehicles from using the buffer space

Standard Bike Lane

Source: Kittelson

A standard bike lane is an on-street facility that provides space reserved for bicyclists, delineated with pavement markings.

Benefits
- Provides a designated space for people biking
- Increases visibility for people biking
- Inexpensive treatment when width is available

Constraints
- Greater chance of "dooring", opening a door into a bicyclist
- Does not provide physical protection
- Vehicles may use additional buffer width as parking or standing zones

Typical Applications
- Streets without sufficient right-of-way or pavement width to provide buffered or separated bike lanes

Design Considerations
- Bike lane width is typically 6 feet, but can be reduced to 4 feet in constrained locations where parking is not present
- Striping can add visibility and awareness at intersections

Pavement Markings Through Intersections

Source: NACTO, Intersection Crossing Markings

Pavement markings through intersections are green paint that can be used in "conflict zones" where vehicles and bicycles may cross. This is an additional treatment for bike lanes.

Benefits
- Increases driver awareness of people biking
- Aids bicyclists in knowing where to cross

Constraints
- May require additional maintenance due to vehicles crossing pavement markings more frequently

Typical Applications
- Intersections and conflict zones

Design Considerations
- White dashed lines should be used at a minimum to extend a bike lane through an intersection or across a conflict zone
- Dashed green pavement can enhance driver awareness and bicyclist visibility

Bike Signals

Source: Kittelson

Bicycle signals can be used at intersections to clarify when bicyclists can enter an intersection.

Benefits
- Minimizes delays experienced by bicyclists
- Provides separation from vehicle movements

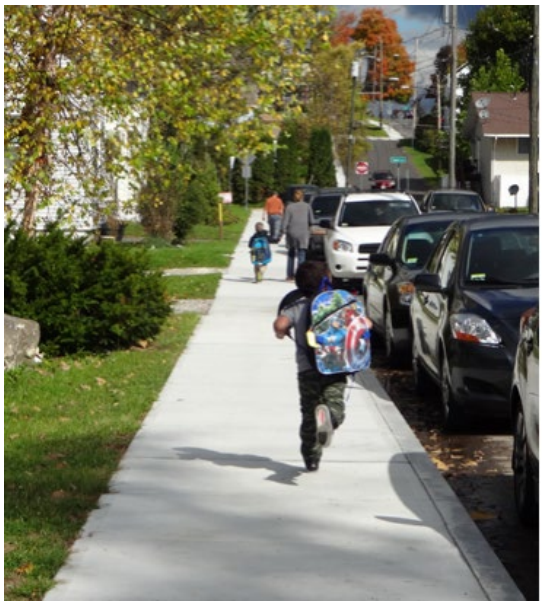
Constraints
- Requires signal timing considerations for bicycle phasing
- Requires additional signal equipment

Typical Applications
- Where a stand-alone bike path or shared use path crosses a street
- At intersections near schools, locations with high number of bicycle and motor vehicle crashes, complex intersections

Design Considerations
- Needs to be placed in a location clearly visible to oncoming bicyclists
- Adequate clearance interval needs to be provided for bicyclists

PEDESTRIAN TREATMENTS

Sidewalk



Source: MassDOT Municipal Resources Guide for Walkability

A sidewalk is a dedicated pedestrian facility adjacent to the roadway and separated from traffic by a curb. Sidewalks may also have an additional buffer zone between the roadway and the walking area.

Benefits
- Provides separation from vehicle traffic
- Provides means of mobility for people using wheelchairs, strollers, or others who may not be able to travel on an unpaved surface

Constraints
- Retrofitting sidewalks onto facilities that do not currently have them may require additional right-of-way

Typical Applications
- Most streets, with the exception of limited access freeways
- Typically added to areas as redevelopment occurs

Design Considerations
- Widths may vary from 6 to 8 feet, with a minimum of 5 feet required
- Landscaped buffer or wider sidewalks may be desirable depending on surrounding land use context

High-Visibility Crosswalk

Source: NACTO, Conventional Crosswalks

High visibility crosswalks are reflective roadway markings that may be accompanied by signage at intersections and priority pedestrian crossing locations.

Benefits
- Provides awareness to drivers that people may be crossing
- Requires motorists to stop for people walking in crosswalk
- Relatively low cost

Constraints
- Compliance not as high at uncontrolled locations compared to other treatments
- Most effective with other types of traffic control

Typical Applications
- Intersections of vehicle facilities with moderate to high vehicle volumes and speeds
- Mid-block locations, particularly when implemented with other treatments

Design Considerations
- Minimum width is 6 feet, but wider crossings may be preferred in areas with a high number of people walking

Raised Crosswalk

Source: Boston Transportation Department

A raised crosswalk introduces a vertical element that raises the entire intersection and all crosswalks at grade with the sidewalk.

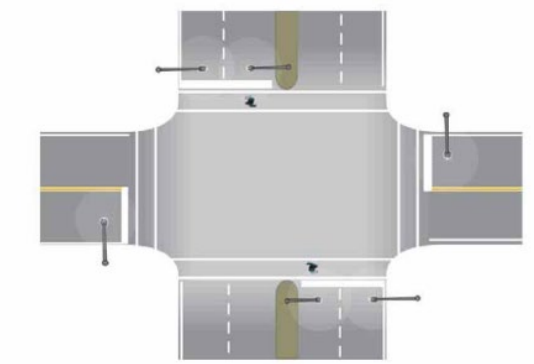
Benefits
- Reinforces slow motorist speeds
- Encourages motorists to yield to pedestrians at crosswalks
- Improve crossing comfort for people who use wheelchairs

Constraints
- Utility and drainage impacts related to implementation can result in a longer process to design and build raised crosswalks

Typical Applications
- Generally installed on a residential local street or a collector street (or on a low-speed arterial street through a commercial district)

Design Considerations
- Raised crosswalk designs are typically paired with curb extensions to keep motorists from parking too close to the crosswalk.
- Raised crosswalks may not be appropriate on streets with bus routes or high heavy vehicle traffic

Street Lighting



Source: FHWA Informational Report on Lighting Design for Midblock Crosswalks

Street lighting is additional illumination provided at locations to make drivers' more aware of the intersection surroundings, enhance drivers' available sight distances, and improve the visibility of non-motorists.

Benefits
- Improves the visibility of people walking and biking in crosswalks
- Enhances drivers' sight distance
- Encourages foot traffic and can make local establishments inviting

Constraints
- Requires space in potentially busy areas, such as sidewalks or intersections

Typical Applications
- Areas of high traffic for people biking and walking, such as bus stations, shopping centers, schools, and shared use paths
- Corridors with commercial activity

Design Considerations
- Lighting should not be placed to block entrances or inhibit pedestrian flow
- Size and type of light fixture may vary depending on the surrounding context and available space

Curb Extensions

Source: Boston Transportation Department

A curb extension is an extension of the sidewalk into the street, usually at an intersection, that narrows the vehicle traveled way, inhibits fast turns, and shortens the crossing distance for people walking.

Benefits
- Shortens crossing distances
- Reduces vehicular turning speeds
- Increases visibility between people driving and walking

Constraints
- Can only be used on streets with on-street parking
- Greater cost to install than standard crosswalks
- May conflict with dedicated transit lanes

Typical Applications
- Mid-block or intersection pedestrian crossings or transit stops
- Streets where on-street parking is provided

Design Considerations
- Design vehicle for determining radius
- Provide accessible curb ramps and detectable warnings

Rectangular Rapid Flashing Beacon

A Rapid Rectangular Flashing Beacon (RRFB) includes signs that have a pedestrian-activated flashing light to attract driver attention and provide awareness of people walking or biking crossing the roadway.

Benefits
- Provides a visible warning to drivers at eye level
- Increases driver yielding behavior at crossings
- Allows drivers to proceed after yielding

Constraints
- Must be activated by people walking
- Driver compliance may be lower than when compared with a traffic signal

Typical Applications
- Mid-block crossings with high pedestrian or bicycle demand and high traffic volumes
- Crossing treatment for shared use paths

Design Considerations
- Push button placement should be easily accessible to people walking, in wheelchairs, and bicycling
- Can be added in median island for multi-lane crossings

Pedestrian Hybrid Beacon

Source: MassDOT Municipal Resources Guide for Walkability

A pedestrian hybrid beacon (also called a HAWK signal) is a pedestrian-activated signal. It begins with a yellow light alerting drivers to slow, then displays a solid red light to allow people walking to cross the street. Flashing red indications signal to drivers that they may proceed after people have finished crossing.

Benefits
- High rate of driver yielding behavior
- Improves safety for people walking and reduces pedestrian crashes

Constraints
- Must be activated by people walking
- Can be more costly than other similar treatments

Typical Applications
- Mid-block crossings with high pedestrian or bicycle demand and high traffic volumes
- Crossing treatment for shared use paths

Design Considerations
- Push button placement should be easily accessible to people walking, in wheelchairs, and bicycling

Median Island for Pedestrian Crossing

Source: Boston Transportation Department

A median island for pedestrian crossing is a protected area in a middle of a crosswalk for people walking to stop while crossing the street.

Benefits
- Reduces exposure of people walking
- Requires shorter gaps in traffic to cross street
- Allows people to cross in two stages

Constraints
- Available right-of-way or existing pavement width may not provide adequate space to add a median island

Typical Applications
- Mid-block for areas with large distances between crossings
- Intersections with high traffic volumes or with a notable crash history

Design Considerations
- Must have 6 feet of clear width to accommodate people in wheelchairs
- Can be applied with other treatments

Pedestrian Countdown Signal Head

Source: FHWA Signalized Intersections Informational Guide

A pedestrian countdown signal head includes a standard pedestrian signal head with an added display showing the remaining crossing time.

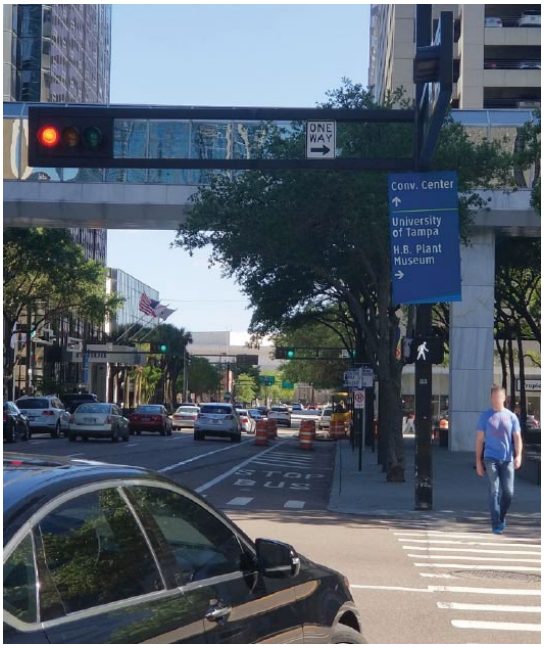
Benefits
- Instructs pedestrians when to cross
- Encourages more pedestrians to use push buttons

Constraints
- Only implemented at signalized intersections

Typical Applications
- Intersections with pedestrian activity or adjacent pedestrian-generating land uses
- Intersections where no pedestrian facilities are provided

Design Considerations
- Calculations for walk and flash don't walk intervals will be required
- May require retiming if existing signal phasing does not provide adequate time for crossing

Leading Pedestrian Interval



Source: FHWA Safety Evaluation of Leading Pedestrian Intervals on Pedestrian Safety

A leading pedestrian interval is a signal modification that allows pedestrians a head start to begin crossing during concurrent green phases with same-direction traffic. It is intended to reduce potential conflicts between vehicles and pedestrians.

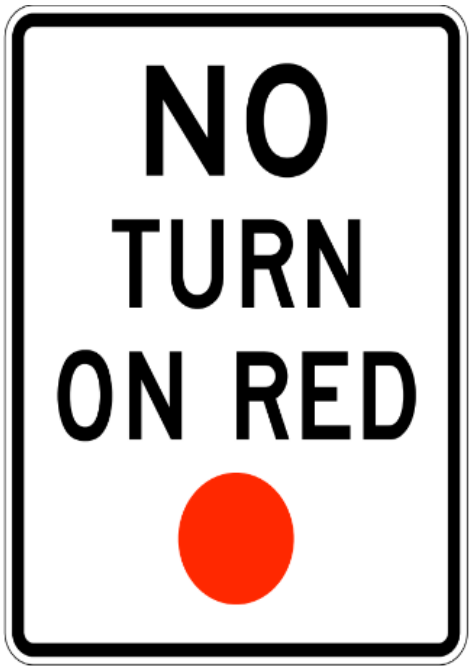
Benefits
- Reduces pedestrian crossing time
- Increases pedestrian visibility
- Reduces pedestrian-vehicle conflicts

Constraints
- Only implemented at signals with concurrent phasing
- Reduces green time for vehicles (LPIs)
- May add to delays for intersections at capacity

Typical Applications
- Intersections where right-turning vehicles do not yield to pedestrians
- Intersections with a crash history or higher crash-risk for vehicle pedestrian crashes
- Locations with particularly high elderly populations, or at school crosswalks

Design Considerations
- Pedestrian signal faces must be provided
- LPI Interval should be 3-7 seconds

No Right Turn on Red



Source: Manual on Uniform Traffic Control Devices (MUTCD)

No right turn on red is signage placed at a signalized intersection to restrict drivers from turning right during a red light.

Benefits
- Reduces conflicts between drivers and pedestrians

Constraints
- Can reduce capacity at intersections with high right-turn volumes
- Rates of compliance may vary and require enforcement

Typical Applications
- Signalized intersections with people walking
- Signalized intersections near pedestrian or bike-trip generating uses

Design Considerations
- Location of signage should be placed so it is easily visible to drivers

ROADWAY TREATMENTS – SIGNALIZED INTERSECTIONS

General Signalized Intersection Improvements

Source: NACTO

A general intersection improvement includes a number of measures such as repaving, new pavement markings to clarify travel through the intersection, signal retiming, equipment, and implementing automatic pedestrian recall.

Benefits
- Clarify the preferred path of travel through the intersection to help avoid potential conflicts
- Provides appropriate pedestrian signal timing

Constraints
- Signal retiming may have minimal benefits in over-saturated conditions
- Pavement markings may require regular maintenance, especially on roads with high traffic volumes

Typical Applications
- Highway Safety Improvement Program (HSIP) cluster intersections
- Roadways with high traffic volumes and/or pedestrian activity

Design Considerations
- Signal retiming should account for appropriate pedestrian crossing times
- Thermoplastic pavement markings are more durable

Improved Signal Hardware

Source: FHWA Proven Safety Countermeasures

Upgrading signal hardware can include a number of improvements to increase the visibility of the intersection. This can include adding retroreflective backplates, upgrading signal lens size, installing new signal heads, or adding yellow retroreflective sheeting to signal backplates.

Benefits
- Increases signal visibility
- Reduces driver confusion or noncompliance

Constraints
- Only limited to signalized intersections
- Provides limited benefits for modes other that vehicular

Typical Applications
- Intersections that have not been maintained or were not installed recently
- Intersections on corridors where there are high vehicular travel volumes

Design Considerations
- Consistency in types of improvement and look should be considered for long corridors
- Intersection skews may require additional improvements to ensure visibility for drivers

Convert Signals to Mast Arm

Source: Cambridge Systematics, Inc.

A mast mounted signal structure can improve visibility and aid driver perception in advance of the upcoming intersection, particularly when compared to signals mounted on pedestals or span wires.

Benefits
- Improve visibility of traffic signs and signals

Constraints
- Can be more expensive than other signal equipment

Typical Applications
- Signalized intersections in need of upgrades

Design Considerations
- New signals may also be required to place on the mast arms

ROADWAY TREATMENTS – UNSIGNALIZED INTERSECTIONS

General Unsignalized Intersection Improvements

This countermeasure focuses on systemic stop-control intersection improvements and can include installing or upgrading stop signs and other intersection warning or regulatory signs, upgrading pavement markings, and improving intersection sight distance.

Benefits
- Clarify the preferred path of travel through the intersection to help avoid potential conflicts
- Increase pedestrian visibility and driver awareness

Constraints
- Pavement markings may require regular maintenance, especially on roads with high traffic volumes

Typical Applications
- Highway Safety Improvement Program (HSIP) cluster intersections
- Roadways with high traffic volumes and/or pedestrian activity

Design Considerations
- Thermoplastic pavement markings are more durable

Roundabout

Source: Kittelson

A roundabout is a circular intersection without traffic signals or stop signs, where drivers travel counterclockwise around a center island. When entering the roundabout, drivers yield to existing traffic, then enter the circulatory roadway and exit in their desired direction. Roundabouts are designed to eliminate left turns conflicts by requiring traffic to traverse to the right around a central island.

Benefits
- Manages vehicular speeds
- Reduces turning conflicts
- Helps traffic flow efficiently

Constraints
- Higher cost, long-term countermeasure

Typical Applications
- Unsignalized intersections with a high frequency of reported crashes, traffic delays, complex geometry (more than four approach roads), frequent-left turns, and/or relatively balanced traffic flows

Design Considerations
- Roundabout costs range significantly depending on size, site conditions, and right-of-way acquisition needs

ROADWAY TREATMENTS – CORRIDOR CONSPICUITY

Upgrade Pavement Markings

Source: FHWA Proven Safety Countermeasures

This conspicuity treatment is aimed at making pavement markings clearer for drivers to see. This can include installing wider pavement markings or improving edgelines and/or centerlines.

Benefits
- Creates continuous delineation of travel lanes
- Clarify the edge of the roadway and lane boundaries

Constraints
- Limited benefits for people not driving
- More modest improvement in safety performance for vehicles

Typical Applications
- Signalized or unsignalized intersections
- Locations that require maintenance

Design Considerations
- Use of thermoplastic pavement markings will improve conspicuity
- Edge lines should not be considered on roadways that do not have centerlines

Install/Upgrade Signs with New Fluorescent Sheeting

This conspicuity treatment is aimed at making signage clearer for drivers to see. This involves upgrading signs with fluorescent sheeting.

Benefits
- Increase visibility of regulatory and warning signs

Constraints
- Limited benefits for people not driving
- More modest improvement in safety performance for vehicles

Typical Applications
- Signalized or unsignalized intersections
- Locations that require maintenance

Design Considerations
- Due to the low cost of new or upgraded signs, this conspicuity treatment may be easily implemented systemically in a single project or integrated with ongoing maintenance

ROADWAY TREATMENTS – SPEED MANAGEMENT

Install Dynamic Speed Feedback Signs

Source: FHWA MUTCD, 11th Edition

A speed feedback sign is designed to provide a message to drivers exceeding a certain speed limit. Other names for this treatment include dynamic warning sign, radar speed/message sign, and dynamic speed display sign.

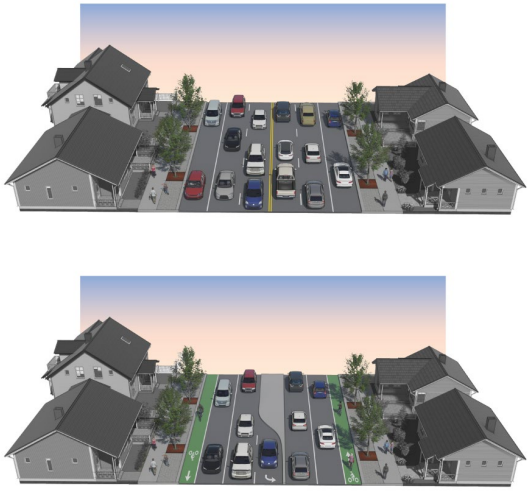
Benefits
- Makes drivers aware of their traveling speed versus the posted speed limit

Constraints
- This treatment is not self-enforcing
- This treatment may not be effective for longer stretches of roadway

Typical Applications
- High speed zones
- Areas with high pedestrian-related crash history

Design Considerations
- Generally considered when the 85th percentile speeds exceed the posted speed limit by 5 mph or more
- A speed study should first be conducted to determine if a change in speed limit is appropriate

Context-Based Road Diet to Provide Space for All Users



Source: Kittelson

A road diet reduces the number of vehicle travel lanes on a roadway to manage vehicle speeds, reduce risk of crashes, and provide additional multimodal facilities.

Benefits
- Calms vehicle speeds
- Reallocates space for bike lanes and pedestrian paths
- Provides vehicular access to commercial and business driveways

Constraints
- Depending on roadway capacity, may increase travel time
- Transit vehicles may block through traffic when stopped

Typical Applications
- Four-lane undivided roadways, which are converted to roadways with one lane in each direction and a two-way center left turn lane

Design Considerations
- Can be implemented with resurfacing projects to incorporate a road diet at minimal additional cost
- Roadway ADT less than 10,000 will typically perform with similar capacity

Traffic Calming

Traffic calming is the use of mainly physical roadway design measures to slow motor vehicles as they move through urban, commercial, and residential neighborhoods. Example traffic calming measures include speed humps, chicanes, raised crosswalks, and raised intersections.

Benefits
- Lower vehicle speeds
- Alter driver behavior
- Improve conditions for non-motorized street users
- May also help reduce cut-through traffic

Constraints
- Utility and drainage impacts related to implementation can result in a longer process to design and build some traffic calming treatments (e.g., raised crosswalks and intersections)

Typical Applications
- Residential neighborhoods and small commercial centers

Design Considerations
- Some treatments may impact existing roadway drainage and on-street parking
- These relatively low-cost implementations can be applied systemically or integrated with capital improvement projects

ROADWAY TREATMENTS – ACCESS MANAGEMENT

Raised Medians

Source: FHWA

This treatment consists of adding new raised new medians on roadways to control and restrict left-turn and u-turn movements to a few designated locations.

Benefits
- Reduce conflicts by restricting access-related movements to the roadway
- Separates opposing traffic

Constraints
- Safety benefits of raised medians should be balanced with restrictions to business access

Typical Applications
- Roadways with high-crash frequencies of head-on, left-turning vehicle, and other access-related crashes that may be affected by the number of vehicles that cross the centerline and by the speed of oncoming vehicles

Design Considerations
- This treatment may be considered after verifying there is enough space for wider sidewalks and bicycle facilities after installing the median
- Landscaping should not obstruct visibility between pedestrians and approaching vehicles

Reduce Driveway Density

Source: FHWA Proven Safety Countermeasures

Access Management is the design, application, and control of entry and exit points along a roadway. Typical measures include installing raised medians or reducing driveway density along corridors.

Benefits
- Enhance safety for all modes of travel
- Facilitate walking and biking with fewer driveway conflicts
- Reduce trip delay and congestion with fewer driveway turning movements

Constraints
- Business access and coordination between uses may make consolidating entrances difficult
- Adequate right-of-way may not be available to provide a raised median

Typical Applications
- Corridors with a high density of driveways and uses
- Intersections with driveways located within close proximity

Design Considerations
- Internal site design providing connections via one access point should be considered
- Vehicle turn restrictions may be appropriate

STRATEGIES

EDUCATION STRATEGIES

Education strategies are focused on teaching road users the principles of traffic safety. These strategies can be developed to include interactive activities, comprehensive teaching notes and information on road safety messages and concepts that can be taught at school or in other community spaces. Potential partners for implementation include:

- Brockton Board of Health
- Brockton Police Department
- Brockton Public Schools
- Community Based Organizations (e.g., Haitian Community Partners, Family and Community Resources)
- National Non-Profit Organizations (e.g., AARP, MADD)

Table 8 outlines the recommended education-related strategies identified for the City of Brockton.

Table 8. Education Strategies

Education Strategies	Brief Description
Road Safety Education to Children	Road safety education to children includes strategies such as safe routes to school, walking school bus, and bicycle trains that promote road safety to all users, particularly for pedestrians and bicyclists. These strategies or practices have shown communities and families that walking and biking can be a viable and safe transportation option, and thus can be incorporated into their own daily travel patterns. School-focused road safety education for drivers of all ages is an important complement to road safety education for children. Transportation safety campaigns scheduled at times when higher numbers of children may walk or bike to school (e.g., beginning of the school year, after Spring Vacation) can foster community awareness of a shared responsibility for road safety near schools.
Multilingual Transportation Safety Campaign	Designed to dovetail with community education efforts, transportation safety campaigns use strategic marketing, advertising, and engagement to foster community awareness of a shared responsibility for road safety. Successful messaging reaches audiences via a range of approaches, including a combination of print, digital, and radio advertising. Campaigns should be created in partnership with key community partners. Educational materials should be accessible in multiple key languages and/or dialects (e.g., Spanish, Haitian Creole, Portuguese, Cape Verdean Creole).

Education Strategies	Brief Description
Seat Belt Safety Campaign	A safety campaign to increase seat belt use may help improve safety throughout Brockton. Seat Belt Safety Campaigns may include strategies like targeted communication for low-belt-use groups, car seat checks to provide hands-on education for installing and using child car seats, increased publicizing of fines for seat belt law violations, and high-visibility seat belt law enforcement. These strategies inform residents of the risks of not using a seat belt and encourage them to use seat belts.
Speed Monitoring Awareness Radar Trailer	The speed trailer is an educational device that helps drivers become more aware of their speed in relation to the posted speed. This trailer is usually deployed in a street or neighborhood for a few days so the residents can monitor the speeds on their own streets and become aware of their own driving behaviors.
Conspicuity Enhancements and Education	The purpose of enhancing conspicuity for pedestrians is to increase the opportunity for drivers to see and avoid pedestrians, particularly when it is dark. Educating pedestrians to wear reflective clothing and walk in well-lit areas can be implemented as targeted campaigns. These campaigns can include giveaways of wearable lights and reflectors for people to use when traveling at night. MassDOT's 2023 SHSP includes a goal to expand existing programs to get more safety equipment into the hands of road users (e.g., bicycle lights, car seats).
Vulnerable Road User Education	Road safety education regarding vulnerable road users like pedestrians and bicyclists includes strategies involving education from police officers. If the driver encroaches into the bike lane or fails to yield to the pedestrian at the crossing, the police officer pulls the driver over and hands them a flyer that has the information for drivers to adapt their behavior towards all road users; this can be in addition to a citation.
High-Visibility Cell Phone and Text Messaging Media Campaign	The High Visibility Enforcement model combines dedicated law enforcement with paid and earned media supporting the enforcement activity. Paid media includes advertisements on TV, radio, online, and via billboards, while earned media includes things like press events and news releases covering the efforts. Both types of media support enforcement activity are needed to ensure the public is aware of the enforcement activity, and to create the impression that violators will be caught.
DUI Educational Programs	An educational program to reduce driving under the influence of drugs or alcohol may help improve safety throughout the county. A DUI program

Education Strategies	Brief Description
	may involve collaborating with community partners to identify opportunities to influence driving under the influence behaviors, as well as coordinating with enforcement to identify focus locations for enforcement activities and education opportunities. It may also be beneficial to implement educational programs with local school districts to target underage impaired driving.
Safe Vehicles Education	Another way to increase roadway safety is to ensure vehicles are performing as designed. This includes vehicles upkeep, maintenance, and record keeping. Brockton may consider producing media campaigns encouraging maintenance, provide programs to alleviate maintenance costs, and partner with local organizations, mechanics, and auto shops to promote upkeep.

EQUITABLE ENFORCEMENT STRATEGIES

Police enforcement can increase driver awareness and consequently reduce crashes. Any directed enforcement strategies should be undertaken with great care to avoid inequitable enforcement activities. The most effective enforcement strategies tend to be those that can be done **transparently, consistently, and in coordination with education or outreach campaigns** such as enforcement in school zones during school hours. Potential partners for implementation include:

- Brockton Police Department
- Education Strategy Partners

Table 9 outlines enforcement-related strategies identified for the City of Brockton.

Table 9. Enforcement Strategies

Enforcement Strategies	Brief Description
Progressive Ticketing	Progressive ticketing is a method for introducing ticketing through a three-staged process. Issuing tickets is the strongest strategy of an enforcement program and it is usually reserved for changing unsafe behaviors that other strategies failed to change or that pose a real threat to the safety of road users. There are three main steps of an effective progressive ticketing program: 1. ***Educating*** - Establish community awareness of the problem. The public needs to understand that drivers are speeding and the consequences of for road safety. Raising awareness about the

Enforcement Strategies	Brief Description
	problem will change some behaviors and create public support for the enforcement efforts to follow. 2. ***Warning*** - Announce what action will be taken and why. Give the public time to change behaviors before ticketing starts. Fliers, signs, newspaper stories and official warnings from officers can all serve as reminders. 3. ***Ticketing*** – After the "warning" period, hold a press conference announcing when and where the police operations will occur. If offenders continue their unsafe behaviors, police officers issue tickets.
Speed Enforcement in School Zones	Strict enforcement of speed laws in school zones is a law enforcement tool to address improve the safety for children walking and bicycling to school as well as drivers. Potential approaches include a 'zero tolerance' policy for speeding in school zones and increases in fines for drivers who violated the posted school zone speed limit.
Automated Speed Enforcement Technologies Pilot	Automated speed enforcement is a system that uses a camera and speed measurement device to enforce speed limits in identified areas. If a vehicle exceeds the posted speed limit in an automated speed enforcement area, the system captures an image which is then reviewed by enforcement officers who issue tickets. This may help to prevent drivers who are issued tickets from similar behavior in the future, as well as prevent all drivers who are aware that this system is in place from speeding. This enforcement approach is not currently legal in Massachusetts. However, MassDOT's 2023 SHSP includes a goal for MassDOT to work with municipal partners to develop pilots to test automated enforcement technologies for speed zones. Brockton can support implementation by participating in a pilot, which will inform recommendations for legislature approval.
High Visibility Saturation Patrols	A saturation patrol (also called a dedicated DWI patrol) consists of many law enforcement officers patrolling a specific area to look for drivers who may be impaired. These patrols usually take place at times and locations where impaired driving crashes commonly occur. Like publicized sobriety checkpoint programs, the primary purpose of publicized saturation patrol programs is to deter driving after drinking by increasing the perceived risk of arrest.

EMERGENCY RESPONSE STRATEGIES

Emergency response is critical in reducing the severity of injuries sustained from crashes. The effectiveness of emergency response is tied closely to the time it takes for a person injured in a crash to receive medical care. Research indicates there is a "golden hour"—if pre-hospital time is under 60 minutes, the patient is more likely to live. Potential partners for Implementation:

- Brockton Board of Health
- Brockton Fire Department
- Brockton Police Department
- Southeastern Massachusetts EMS Council

Table 10 outlines emergency response-related strategies identified for the City of Brockton.

Table 10. Emergency Response Strategies

Post Collision Care Strategies	Brief Description
Implementing New Technology	Technological developments are being applied to improve emergency response. Drones and roadway video are being explored to better understand the details of crashes in real-time to end proper care as soon as possible. This can also maximize resources used for care at the crash site.
Partner with Local Hospitals or Outreach Groups	Partnering with local hospitals or outreach groups can help provide bystander training courses to the public (i.e., train members of the public to respond to emergencies since they are sometimes the first on the scene at a crash. Opportunities for this strategy include: ■ Partner with hospitals offering public education courses ■ Promote the Community Emergency Response Team (CERT) program, which trains community members in first responder skills ■ Work with local groups, such as fire departments, to be trainers themselves and then offer training more frequently in their local community ■ Partner with local trauma centers which are required to provide injury prevention programs ■ Consider a collaborative media campaign to inform and educate motorists on how to help emergency vehicles move faster by slowing down and moving over

Post Collision Care Strategies	Brief Description
Work with Partners	The City can collaborate with partners such as emergency service groups to: ■ Maximize efficiency with urban response times through evidence-based techniques ■ Identify reasons for delay in transport for both ground EMS (using registry data and EMS records) ■ Identify equipment upgrades, training, or enhancements that would improve patient outcomes ■ Identify barriers if any to rapid transfer of patients from lower-acuity hospitals to nearby trauma centers

POLICIES

Policies establish guiding principles for decision-making. The following policy recommendations were identified for the City of Brockton.

- Opt-in to Ch90s17C of Massachusetts General Law to reduce the statutory speed limit from 30 mph to 25 mph on any or all city- or town-owned roadways within a thickly settled or business district.
- Update City design standards to align with state guidance on safe walking and biking facilities (e.g., MassDOT PDDG, MassDOT Separated Bike Lane Planning and Design Guide, MassDOT Roundabout Planning and Design Guide)
- Develop or revise development review guidelines to prioritize road user safety over driver delay in operations and design decisions in accordance with National and state guidance such as NCHRP Report 1036 and MassDOT PDDG.

PROJECT AND STRATEGY PRIORITIZATION

The Plan's recommended projects (i.e., countermeasures) and strategies were prioritized based on guidance from the Study Working Group. This section summarizes the prioritized projects and provides expected time ranges for project implementation.

RECOMMENDED PROJECTS

Building on the crash- and risk-based network analysis and systemic findings, the Study Working Group recommended implementing systemic safety treatments by Tier. The City will implement systemic treatments for Tier I corridors and intersections by 2029. The implementation process will include close consultation with affected community groups.

After systemic safety treatments are implemented at Tier I locations, the City will monitor results to determine whether implementation has improved safety outcomes. Lessons learned from Tier I implementation will be incorporated into Tier II implementation. The City will implement systemic treatments for Tier II corridors and intersections by 2034. Similar to Tier I implementation, the process will include close consultation with affected community groups.

RECOMMENDED STRATEGIES

The Study Working Group recommended piloting all non-engineering countermeasures by 2030. The implementation process will include close consultation with action plan study working group members and other implementation partners, with a focus on the equity implications of each strategy. The City will monitor results to determine whether implementation has improved safety outcomes. Lessons learned from pilot implementation will inform which non-engineering countermeasures will be maintained past 2030.

Table 11 summarizes all recommended projects and strategies and their implementation time frames.

Table 11. Project and Strategy Implementation Time Frames

Project/Strategy Name	Implementation Time Frame
Projects	
Tier I Corridor Treatments	2026 – 2029
Tier II Systemic Intersection Treatments	2032- 2033
Tier II Corridor Treatments	2032 - 2034
Strategies	
Education: Speed Monitoring Awareness Radar Trailer	2030+
Education: Conspicuity Enhancements and Education	2030+
Education: Vulnerable Road User Education	2030+
Education: High-Visibility Cell Phone and Text Messaging Media Campaign	2030+
Education: DUI Educational Programs	2030+
Education: Safe Vehicles Education	2030+
Education: Multilingual Transportation Safety Campaign	2030+
Equitable Enforcement: Progressive Ticketing	2030+
Equitable Enforcement: Speed Enforcement in School Zones	2030+
Equitable Enforcement: Automated Speed Enforcement Technologies Pilot	2030+
Equitable Enforcement: High Visibility Saturation Patrols	2030+
Emergency Response: Implementing New Technology	2030+
Emergency Response: Partner with Local Hospitals or Outreach Groups	2030+
Emergency Response: Work with Partners	2030+

Evaluation and Implementation

EVALUATION AND IMPLEMENATION

This section describes the steps that the City of Brockton can take to evaluate the success of this Safety Action Plan and steps needed to update the Plan in the future.

OUTCOME MEASURES

Measures that the City can use to evaluate its ongoing success in reducing fatal and serious injury crashes and crash risk include:

- Total number of fatal and serious injury crashes on city roads
- Number of fatal and serious injury crashes on city roads by the following categories:
    - Pedestrian-involved crashes
    - Bicycle-involved crashes
    - Speeding and aggressive driving-related crashes

Fatal and serious injury crashes may be reported annually, with performance evaluated within the context of the latest five-year annual average to normalize for random fluctuations in crashes on a year-over-year basis.

IMPLEMENTATION MEASURES

Measures that the City can use to evaluate progress in implementing the Safety Action Plan include:

- Number of Projects/Strategies implemented
- Number of Projects/Strategies continued from prior year
- Number of safety evaluations conducted at Tier I, Tier II or potential priority locations
- Frequency of communication with Action Plan Study Working Group
- Frequency of communication with Brockton community groups
- Number of changes to guidance, policies, practices, or standards to support the Safe System

UPDATING THE PLAN

The Safety Action Plan relies on crash data from January 1, 2018 – December 31, 2022. The City of Brockton should review crash data for key findings and performance measures to track progress annually. More substantial updates to the Safe Action Plan can occur at longer intervals (approximately every five years).

The City of Brockton, in conjunction with the Safety Action Plan Study Working Group, can assess the Plan, consider new trends and technologies, and determine if an update to the Plan is needed. As new strategies are identified, the Safety Action Plan Study Working Group may update goals and assign champions for specific projects and strategies.