



BOSTON REGION METROPOLITAN PLANNING ORGANIZATION

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WORK PROGRAM

SAFETY AND OPERATIONS ANALYSIS AT SELECTED INTERSECTIONS

SEPTEMBER 19, 2019

Proposed Motion

The Boston Region Metropolitan Planning Organization (MPO) votes to approve this work program.

Project Identification

Unified Planning Work Program (UPWP) Classification

Boston Region MPO Planning Studies and Technical Analyses

Project Number 13720

Client

Boston Region MPO

Project Supervisors

Principal: Mark Abbott

Manager: Chen-Yuan Wang

Funding Source

MPO 3C Planning and §5303 Contract #108217

Schedule and Budget

Schedule: Twelve months after work commences

Budget: \$80,000

Schedule and budget details are shown in Exhibits 1 and 2, respectively.

Relationship to MPO Goals

The Boston Region MPO elected to fund this study with its federally allocated metropolitan planning funds during federal fiscal year (FFY) 2020. The work completed through this study will address the following goal area(s) established in the MPO's Long-Range Transportation Plan: safety, system preservation, capacity management and mobility, clean air and clean communities, and economic vitality.

Background

This study will build on recommendations generated by the MPO's Congestion Management Process (CMP), evaluation of crash data, and input from the MPO's outreach process to address safety and operations problems at intersections in the MPO region. Several similar studies from previous funding years have been completed and have received favorable responses from municipal administrators and directors of departments of public works.¹ Municipalities in the region are receptive to this type of study, as it gives them potential low-cost solutions and a head start on conceptual designs for intersections that need safety improvements and congestion mitigation.

Intersections affect the quality of flow along an arterial; therefore, when improvements are made to their operations and safety, vehicles can traverse the intersection more quickly and safely. Improvements can also eliminate the need for additional traffic lanes, result in fewer vehicle-hours of travel, reduce the "cut-through" use of neighborhood streets, and enhance the reliability of transit vehicles traversing the intersection. Most importantly, when intersections are managed and operated efficiently, overall safety improves.

The selected locations will be individual intersections or sets of two intersections that serve users of multiple transportation modes, including bus riders, bicyclists, and pedestrians. There are a number of factors that are considered when selecting the intersections to study, including crash history, travel times, and public concerns. Important bases of selection will be input from the Massachusetts Department of Transportation (MassDOT) Highway District and municipal officials, and other stakeholders' level of interest in implementing the recommendations from the study. Other criteria are described below, under Task 1.

For this study, as many as three high-crash or congested locations will be selected by reviewing the MPO's crash database, the CMP's travel-time information, and a list of problem intersections submitted through the MPO's outreach process.² Locations will be selected only if they are not currently under study by MPO staff, MassDOT, cities, and towns, or under design.

The recommendations for improvement would enhance the intersections' operations and safety for all transportation modes, including motor vehicles, transit service, bicycles, and pedestrians. The recommended improvements may or may not require

¹ Recently completed studies include intersections in Bellingham, Wenham, Chelsea, Peabody, Weymouth, Milford, Westwood, etc.

² The number of locations selected for study will depend on the complexity of the analysis required for the selected locations. For example, if one or more of the intersections with the highest priority for inclusion in the study requires particularly time-consuming analysis, the number of locations studied could be fewer than three.

right-of-way acquisition; however, this study will aim to minimize the impact of right-of-way acquisition.

Objective(s)

This study will identify improvements that address operational and safety problems at as many as three intersections in the Boston Region MPO area.

Work Description

Task 1 Select Intersection Locations

This task will initially identify as many as 10 intersection locations throughout the MPO region that experience poor transportation operations and high crash rates. MPO staff will generate a list of these intersections by:

- Reviewing the most recent crash data from MassDOT's Registry of Motor Vehicles Division
- Reviewing CMP travel-time and delay data for consecutive intersections that have spillover queues
- Reviewing transit travel-time CMP data for buses going through the locations identified via the CMP
- Reviewing Transportation Improvement Program (TIP) projects from the conceptual and pre-TIP categories
- Reviewing public feedback received via the MPO's outreach program
- Soliciting selection recommendations—in coordination with the Metropolitan Area Planning Council (MAPC)—from MAPC subregions and individual cities and towns that declare their commitment to shepherding the recommended improvements through to design and implementation

The intersections selected for consideration will be based on criteria in the following categories:

- Safety concerns
- Operations concerns
- Multimodal significance (supporting or needing to support transit, bicycle, pedestrian, or heavy vehicle activities)
- Implementation potential and support by the municipality and stakeholders for following up with implementation
- Regional equity (that the study locations would be distributed throughout the MAPC subregions over time)

The potential locations will be screened by safety measures, including equivalent property damage only (EPDO) crash-severity ratings, the number of crashes involving pedestrians or bicyclists, the intersection crash rates, and all conflicts at

the intersection involving vehicles, pedestrians, and bicyclists.³ Also, the locations will be evaluated based on the need for improvements (safety needs, delays in processing buses, intersection delays, and queue length); the potential for implementation (the possibility of increasing capacity through small-scale projects, such as signal retiming or upgrading, and the availability of right-of-way for minor geometry modifications); and cost considerations.

Locations that would potentially require major geometry redesigns, such as grade separation or adding travel lanes on an arterial roadway, will not be selected. However, both short- and long-term improvements will be considered for the selected intersections.

Finally, staff will discuss with municipal officials about their level of interest in following up with implementation of the study recommendations. This input will be in addition to the input solicited from municipalities during the process of selecting candidate locations.

Staff will then select as many as three intersections for detailed study. Both the list of intersections considered and the staff recommendations of which intersections to study will be presented to the MPO.

Products of Task 1

A summary of the selection process, including a table listing selected locations.⁴

Task 2 Collect Data

Once the locations have been selected, staff will collect detailed data pertaining to each location. This will involve visiting each site and creating an inventory of all relevant geometric, land use, and signal features. Data will include:

- Turning movement counts
- Bicycle and pedestrian counts
- Adjacent pedestrian and bicycle networks and their connectivity to the study sites
- Crash data and police crash reports

³ EPDO or equivalent property damage only is a method of combining the number of crashes with the severity of crashes based on a weighted scale, where a fatal crash is worth 10, an injury crash is worth 5, and a property damage only crash is worth 1. Since 2018, MassDOT applied a new EPDO method (where actual crash costs are factored in) to rank high-crash locations in the state. So as not to end up just chasing fatal crashes, all of the fatal and injury crashes were weighted together (about 30 percent of all crashes in Massachusetts). This resulted in any type of injury crash (including fatal, incapacitating, non-incapacitating and possible) having a weighting of 21 compared to a property damage only crash.

⁴ The table will include information explaining why the locations were chosen, based on safety concerns, the potential for improvement, and municipal interest in implementation. Staff will present the selection process and results to the MPO.

- Transit vehicle counts and performance
- Signal equipment and timing information
- Geometric data (lanes, curb cuts, sidewalks, crosswalks, transit amenities)
- Land use and zoning information
- Jurisdictional and administrative information
- Roadway speed and origin/destination data from INRIX/RITIS⁵

Products of Task 2

A summary of count, signal, and geometric data for the selected locations, as well as land use and jurisdictional information.

Task 3 Evaluate Selected Locations

Staff will evaluate each intersection using various types of analysis. First, the crash data for each intersection will be analyzed with regard to crash type, severity, and whether bicycles or pedestrians were involved in the crashes. Crash diagrams will be constructed for the intersections that have a crash rate that exceeds the MassDOT highway district average. Second, capacity analysis will be performed in order to determine the operational level of service at each intersection. Particular attention will be given to evaluating existing pedestrian signal phases (if any) or the need for them. Third, field observations will be performed to yield a complete understanding of safety levels and the operations of vehicles, bicycles, and pedestrians at each location. In addition to the analysis on safety and operations, this evaluation will be based on goals and principals of the statewide pedestrian and bicycle plans, and guidelines from the municipal resource guides for walkability and bikeability.^{6 7 8 9}

Products of Task 3

A summary of each selected location's frequency and type of crashes, its operational level of service, and an overall assessment of how safe or unsafe it is, and how well or poorly traffic proceeds through it.

⁵ INRIX is a private company that collects roadway travel times and origin-destination data for most roadways that are collectors, arterials, limited-access roadways or freeways. Regional Integrated Transportation Information System (RITIS) provides INRIX data to the Boston Region MPO through its web portal. The data is archived and provided to transportation planning organizations that use the data to monitor congestion through performance measures.

⁶ Massachusetts Pedestrian Transportation Plan, Massachusetts Department of Transportation, May 2019

⁷ Massachusetts Bicycle Transportation Plan, Massachusetts Department of Transportation, May 2019

⁸ Municipal Resource Guide for Walkability, Massachusetts Department of Transportation, May 2019

⁹ Municipal Resource Guide for Bikeability, Massachusetts Department of Transportation, May 2019

Task 4 Develop Improvement Alternatives

Based on the evaluation performed in Task 3, staff will develop potential improvement alternatives with a preliminary estimation of construction costs. Staff will contact MassDOT Office of Transportation Planning and the Highway Division's district office staff and municipal officials in each of the communities involved to discuss the intersection summaries, receive input on the analysis and findings, and discuss potential improvements. The combined comments of municipal and state officials will steer the development of all final recommended improvements.

Products of Task 4

A summary of discussions and other interactions with MassDOT Highway Division district office staff and municipal officials about potential improvement alternatives.

Task 5 Recommend Improvements

Based on the feedback of municipal and MassDOT Highway Division officials in Task 4, staff will revise the preferred alternatives, if necessary, and recommend short- and long-term strategies for improving operations and safety at the selected locations. The recommendations will include improvements for pedestrians, bicyclists, motorists, transit service, and trucking/freight movement (if this is a concern for the study intersection). The recommended improvements could include curb extensions, bus stop relocations, transit signal-priority options, shorter crosswalks, accessible pedestrian signals, bicycle-detection equipment and signs, signal retiming and coordination, and additional turn lanes.¹⁰ The cost of the measures will be estimated and the jurisdictional entity or entities responsible for implementation will be identified.

Products of Task 5

A summary of recommended operational and safety improvements for the selected locations.

Task 6 Document Methodology, Findings, and Recommendations

Staff will produce a technical memorandum for each of the municipalities involved in the study describing the analysis and recommendations for the intersection locations in that municipality. The draft memoranda will be made available for review by municipal officials, the MassDOT Highway Division, and the MassDOT Office of Transportation Planning.

¹⁰ Accessible pedestrian signals are devices that communicate the Walk and Don't Walk intervals at signalized intersections to pedestrians who are blind or who have low vision in nonvisual formats (for example, using audible tones and/or vibrotactile surfaces).

Products of Task 6

Draft technical memoranda, one for each municipality involved in the study, including documentation of correspondence with municipal officials.

Task 7 Finalize Study and Prepare for MPO Presentation

After receiving comments on the draft memoranda from municipal and officials, MPO staff will address these comments and finalize the study. The final study results will be presented to the MPO for approval at the next scheduled MPO meeting.

Products of Task 7

Final technical memoranda and MPO presentation.

Exhibit 2
ESTIMATED COST
Safety and Operations Analysis at Selected Intersections

Direct Salary and Overhead										\$79,144
Task	Person-Weeks						Direct Salary	Overhead (102.11%)	Total Cost	
	M-1	P-5	P-4	P-3	Temp	Total				
1. Select Intersection Locations	0.4	1.0	0.2	0.0	0.8	2.4	\$3,443	\$3,515	\$6,958	
2. Collect Data	0.0	0.8	0.0	0.0	1.0	1.8	\$2,118	\$2,163	\$4,281	
3. Evaluate Selected Locations	0.2	2.0	0.0	0.2	1.2	3.6	\$5,232	\$5,342	\$10,573	
4. Develop Improvement Alternatives	0.4	2.8	1.2	1.0	0.8	6.2	\$9,724	\$9,929	\$19,654	
5. Recommend Improvements	0.6	1.8	0.0	0.2	0.0	2.6	\$4,943	\$5,048	\$9,991	
6. Document Methodology, Findings, and Recommendations	1.2	4.0	0.2	0.4	0.2	6.0	\$11,077	\$11,310	\$22,387	
7. Finalize Study and Prepare for MPO Presentation	0.4	0.8	0.2	0.0	0.0	1.4	\$2,622	\$2,678	\$5,300	
Total	3.2	13.2	1.8	1.8	4.0	24.0	\$39,159	\$39,985	\$79,144	
Other Direct Costs										\$856
Travel										\$856
TOTAL COST										\$80,000

Funding
MPO 3C Planning and §5303 Contract #108217