



## BOSTON REGION METROPOLITAN PLANNING ORGANIZATION

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Jamey Tesler, Acting MassDOT Secretary and CEO and MPO Chair  
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### **WORK PROGRAM**

## **LOW-COST IMPROVEMENTS TO EXPRESS-HIGHWAY BOTTLENECK LOCATIONS**

**FFY 2021**

APRIL 8, 2021

### **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** 13621

#### **Client**

Boston Region MPO

#### **Project Supervisors**

*Principal:* Mark Abbott

*Manager:* Chen-Yuan Wang

#### **Funding Source**

MPO Planning Contract 112310

### **Schedule and Budget**

**Schedule:** 6 months after work commences

**Budget:** \$64,500

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) 2021. 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, and economic vitality.

## Background

According to the Federal Highway Administration (FHWA), “Much of recurring congestion is due to physical bottlenecks—potentially correctible points on the highway system where traffic flow is restricted. While many of the nation’s bottlenecks can only be addressed through costly major construction projects, there is a significant opportunity for the application of operational and low-cost infrastructure solutions to bring about relief at these chokepoints.”<sup>1</sup> Consistent with this guidance, the FHWA’s Massachusetts Division Office has advised the MPO to identify bottlenecks in the region that can be mitigated with low-cost improvements, and develop recommendations for such improvements at these locations.

MPO staff analyzed several express-highway bottleneck locations in four previous studies, and the studies were very well received by the Massachusetts Department of Transportation (MassDOT) and the FHWA.<sup>2,3,4,5</sup> Previous study locations included sections of Interstate 95 in Weston and Burlington, sections of Interstate 93 in Quincy and Willington, and sections of Route 24 in Randolph and Canton. Some of the recommendations from those studies have been implemented; and FHWA consultants have interviewed MPO staff about these successful implementations. Cost estimates for low-cost bottleneck improvements implemented by the MassDOT Highway Division or that are currently in design status, range between \$10,000 and \$1 million.

The causes of highway chokepoints or bottlenecks and the duration of traffic delays at these locations vary. Recurring bottlenecks, the subject of this work program, are usually influenced by the design or operation at the point where the bottleneck begins. Bottlenecks might occur where traffic merges, diverges, or weaves, or because of lane drops or narrowing of lanes, abrupt changes in highway alignment, low-clearance

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<sup>1</sup> Federal Highway Administration, *Recurring Traffic Bottlenecks: A Primer: Focus on Low-Cost Operations Improvements*, US Department of Transportation, Federal Highway Administration, June 2009, p. 1.

<sup>2</sup> Seth Asante, MPO staff, memorandum to the Transportation Planning and Programming Committee of the Boston Region Metropolitan Planning Organization, “Low-Cost Improvements to Bottleneck Locations,” June 2, 2011.

<sup>3</sup> Chen-Yuan Wang, MPO staff, memorandum to the Transportation Planning and Programming Committee of the Boston Region Metropolitan Planning Organization, “Low-Cost Improvements to Bottleneck Locations, Phase II,” March 12, 2012.

<sup>4</sup> Seth Asante, MPO staff, memorandum to the Boston Region Metropolitan Planning Organization, “Low-Cost Improvements to Bottleneck Locations,” December 3, 2015.”

<sup>5</sup> Seth Asante and Chen-Yuan Wang, MPO staff, memorandum to the Boston Region Metropolitan Planning Organization, “Low-Cost Improvements to Bottleneck Locations,” February 2020.”

structures, intended disruption of traffic for management purposes, and in general, less-than-optimal express-highway design.

However, there is an important distinction between “bottlenecks” and “congestion.” Congestion can result from causes other than bottlenecks, such as traffic incidents, work zones, bad weather, special events, and poor signal timing; congestion generally is considered the result of an imbalance between supply and demand. Bottlenecks usually have the following characteristics:

- a defined point where they occur and the traffic queue begins
- a traffic queue upstream and better flow conditions downstream
- predictable and recurring (occurring at approximately the same time and place on the same days of the week)
- traffic volumes that exceed the highway point or segment’s capacity to process traffic

Low-cost strategies to improve bottlenecks include the following:

- reallocation and restriping of lanes
- modification of ramps and weaving areas
- reduction of lane width in order to accommodate additional lanes
- conversion of shoulders into travel lanes
- application of access management principles
- provision of traveler information

There are opportunities to implement low-cost bottleneck improvements in the Boston region’s express-highway system. These are the beneficial results of localized low-cost bottleneck improvements:

- Less disruption to the physical and human travel environment than the disruption from major-investment highway improvements.
- Potentially significant safety benefits.
- Existing problems are addressed quickly, thereby producing immediate improvements that are visible to stakeholders.
- Benefits that often end up being the long-term solution.

## **Objective(s)**

There are two objectives of this study:

- Identify as many as three express-highway bottleneck segments or points for study. The identified bottlenecks may not be the worst in the region, as it might not be possible to correct the worst bottleneck locations by implementing low-cost improvements alone.
- Recommend low-cost improvements for the selected bottleneck locations. MPO staff will research and evaluate possible low-cost improvements for the selected locations. The recommendations will be based on analyses of traffic volumes and other data, field observations, express-highway geometric designs, and the projected service performance associated with the potential improvements at each location.

## Work Description

### Task 1 Inventory the Candidate Locations

MPO staff will develop an initial list of as many as six bottleneck locations in the region's express-highway system as candidates for study. As in previous bottleneck studies, staff will take the following steps to identify the initial list of bottleneck locations:

- Contact MassDOT for suggestions about bottleneck locations to study. This will include communicating with MassDOT Highway District Offices in the MPO region, the Highway Division's Traffic and Safety Engineering Section, and the Office of Transportation Planning.
- Review monitoring data from the express-highway Congestion Management Process and recent MPO (and other) planning studies for bottleneck locations.
- Consult with MPO board and staff members to get suggestions about bottleneck locations to study.

As noted previously, the identified locations will not necessarily be the worst bottleneck locations. Instead, the main criteria for selecting locations will be that the bottlenecks are caused by operational characteristics, such as those listed in the background section of this memorandum, and that the locations seemingly can be corrected with low-cost improvements (similar to those listed in the background section).

#### ***Product of Task 1***

An initial list of bottleneck locations, including associated characteristics

### Task 2 Screen Bottleneck Locations and Select Locations for Analysis

Candidates from the initial list will be evaluated in order to select as many as three locations for final analysis. The candidate locations will be screened based on the existing problems (queue length, volume of traffic affected, and safety), ease of

implementing solutions (available right-of-way, and available capacity from nearby or opposing streams of traffic), and cost considerations. Through the selection process, MPO staff will determine the locations that likely could be corrected with low-cost mitigation strategies and those that probably would not be considered low cost. Staff will document the rationale for selecting or rejecting a location for study. Then staff will present a memorandum with the initial list and selected locations to the MPO for discussion.

### ***Product of Task 2***

A memorandum discussing the selection process, criteria and the bottlenecks selected for analysis

### **Task 3 Identify and Evaluate Low-Cost Improvements**

As the bottleneck locations will be selected with seemingly suitable improvements in mind, in some cases there may be more than one strategy to consider. When compiling a comprehensive list of potential improvements, staff will rely on technical expertise and judgment regarding the nature of bottlenecks. However, staff will seek input from MassDOT Highway Division staff, who are familiar with the region's express-highway system operation, and from MPO staff members who frequently travel through the identified bottleneck locations.

Analysis of the potential improvements will be both qualitative and quantitative. The qualitative assessment will consider existing conditions, reasons for the bottleneck, length of the bottleneck, characteristics of the mitigation strategy, amount of available right-of-way and other space requirements, and other factors. Depending on the availability of data and the level of complexity of the bottleneck, staff may perform a quantitative assessment of the bottleneck location. This assessment may involve applying a microsimulation model or methodologies from the Highway Capacity Manual that pertain to analyzing express-highway traffic merge and weaving locations, ramps, and lane drops. This analysis would evaluate existing conditions and conceptual designs of the proposed improvements.

### ***Products of Task 3***

- List of possible improvements
- Analysis results of tested improvements, including conceptual designs for each improvement

### **Task 4 Document the Results**

Staff will write a report documenting the process of selecting study locations, characteristics of the locations, analyses of existing conditions, considered improvements, and conceptual designs of the recommended improvements.

***Products of Task 4***

A report documenting the analyses, results, recommendations, and possible implementation plan

The Boston Region Metropolitan Planning Organization (MPO) operates its programs, services, and activities in compliance with federal nondiscrimination laws including Title VI of the Civil Rights Act of 1964 (Title VI), the Civil Rights Restoration Act of 1987, and related statutes and regulations. Title VI prohibits discrimination in federally assisted programs and requires that no person in the United States of America shall, on the grounds of race, color, or national origin (including limited English proficiency), be excluded from participation in, denied the benefits of, or be otherwise subjected to discrimination under any program or activity that receives federal assistance. Related federal nondiscrimination laws administered by the Federal Highway Administration, Federal Transit Administration, or both, prohibit discrimination on the basis of age, sex, and disability. The Boston Region MPO considers these protected populations in its Title VI Programs, consistent with federal interpretation and administration. In addition, the Boston Region MPO provides meaningful access to its programs, services, and activities to individuals with limited English proficiency, in compliance with U.S. Department of Transportation policy and guidance on federal Executive Order 13166.

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A complaint form and additional information can be obtained by contacting the MPO or at [http://www.bostonmpo.org/mpo\\_non\\_discrimination](http://www.bostonmpo.org/mpo_non_discrimination). To request this information in a different language or in an accessible format, please contact

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[civilrights@ctps.org](mailto:civilrights@ctps.org)  
857.702.3700 (voice)  
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**Exhibit 1**  
**ESTIMATED SCHEDULE**  
**Low-Cost Improvements to Express-Highway Bottleneck Locations FFY 2021**

Task	Month					
	1	2	3	4	5	6
1. Inventory the Candidate Locations	A					
2. Screen Bottleneck Locations and Select Locations for Analysis	B					
3. Identify and Evaluate Low-Cost Improvements						
4. Documents the Results	C					

**Products/Milestones**

- A: List of bottleneck locations
- B: Memorandum discussing selection process
- C: Study technical memorandum



**Exhibit 2**  
**ESTIMATED COST**  
**Low-Cost Improvements to Express-Highway Bottleneck Locations FFY 2021**

<b>Direct Salary and Overhead</b>	<b>\$64,247</b>
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Task	Person-Weeks				Direct Salary	Overhea (106%)	Total Cost
	M-1	P-5	P-2	Total			
1. Inventory the Candidate Locations	0.2	2.0	0.6	2.8	\$4,747	\$5,032	\$9,779
2. Screen Bottleneck Locations and Select Locations for Analysis	0.2	2.0	1.0	3.2	\$5,217	\$5,530	\$10,748
3. Identify and Evaluate Low-Cost Improvements	0.6	3.0	2.0	5.6	\$8,785	\$9,312	\$18,096
4. Documents the Results	3.0	2.6	2.1	7.7	\$12,439	\$13,185	\$25,624
Total	4.0	9.6	5.7	19.3	\$31,188	\$33,059	\$64,247

<b>Other Direct Costs</b>	<b>\$253</b>
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Travel	\$253
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<b>TOTAL COST</b>	<b>\$64,500</b>
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**Funding**  
MPO Planning Contract #112310