



## BOSTON REGION METROPOLITAN PLANNING ORGANIZATION

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Stephanie Pollack, MassDOT Secretary and CEO and MPO Chair  
Karl H. Quackenbush, Executive Director, MPO Staff

### *MEMORANDUM*

**DATE** December 15, 2016  
**TO** Boston Region Metropolitan Planning Organization  
**FROM** Karl H. Quackenbush, Executive Director  
**RE** Work Program for: Low-Cost Improvements to Express-Highway  
Bottleneck Locations: FFY 2017

#### **Action Required**

Review and approval

#### **Proposed Motion**

That the Boston Region Metropolitan Planning Organization vote to approve the work program for Low-Cost Improvements to Express-Highway Bottleneck Locations: federal fiscal year (FFY) 2017, presented in this memorandum

#### **Project Identification**

##### **Unified Planning Work Program Classification**

Planning Studies

##### **CTPS Project Number**

13275

##### **Client**

Boston Region Metropolitan Planning Organization

##### **CTPS Project Supervisors**

*Principal:* Mark Abbott

*Manager:* Seth Asante

##### **Funding**

MPO Planning Contract #95411

## Impact on MPO Work

This is MPO work and will be carried out in conformance with the priorities established by the MPO.

## 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 Massachusetts Division office of the FHWA 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 three previous studies; they were very well received by MassDOT and the FHWA.<sup>2,3,4</sup> Previous study locations included sections of I-95 in Weston and Burlington and sections of Route 3 in Braintree and near the Hingham-Weymouth town line. 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 that have been implemented by MassDOT Highway Division, or currently are in design status, range between \$100,000 and \$1,000,000.

The causes and durations of highway chokepoints or bottlenecks vary. Recurring bottlenecks, the subject of this work program, are usually influenced by the design or operation at the point where the bottleneck begins, including: merges, diverges, lane drops, traffic weaving, 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 Programing 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 Programing 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.”

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

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. However, bottlenecks usually:

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

Low-cost bottleneck improvement strategies include:

- 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 this region’s express-highway system. The benefits of localized low-cost bottleneck improvements:

- Result in less disruption to the physical and human travel environment than the disruption from major-investment highway improvements
- Can result in significant safety benefits
- Address existing problems quickly, thereby producing immediate improvements that are visible to stakeholders
- Produce benefits that often end up being the long-term solution.

## Objectives

There are two objectives of this study:

1. 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 the worst may not be correctible with low-cost improvements.

2. 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 analysis 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

To meet the above-cited objectives, MPO staff will perform the following tasks:

### Task 1 Inventory the Candidate Locations for Bottleneck Study

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 identify the initial list of bottleneck locations as follows:

- Contact MassDOT for bottleneck locations to study. This will include communicating with MassDOT Highway District Offices in the MPO region, the MassDOT Highway Division's Traffic and Safety Engineering Section, and MassDOT 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 who frequently drive through bottlenecks.

The identified locations will not necessarily be the worst bottleneck locations. Instead, the main criteria will be that the bottleneck is caused by an operational characteristic, such as those listed in the background section of this memorandum, and that they 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 in Initial List 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 impacted, safety), ease of implementation (available right-of-way, 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 could not be corrected in a low-cost manner. Staff will document the rationale for selecting or not selecting a location for study; and will present the initial list and selected locations to the MPO for discussion.

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

A memorandum discussing the selection process and criteria and the bottlenecks selected for analysis. This memorandum and selected locations will be presented to the MPO

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

As the bottleneck locations will have been selected with seemingly suitable improvements in mind, in some cases, there may be more than one strategy to consider. In compiling a comprehensive list of potential improvements, staff will rely mainly on their technical expertise and judgment regarding the nature of bottlenecks. However, staff also 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 may involve applying a microsimulation model, or methodologies from the Highway Capacity Manual that pertain to analyzing express-highway merges, weaving, ramps, and lane drops. This analysis would include conceptual designs of existing conditions and 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, analysis of existing conditions, considered improvements, and the impact and conceptual designs of the recommended improvements.

***Product of Task 4***

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

**Estimated Schedule**

It is estimated that this project will be completed nine months after work commences. The proposed schedule, by task, is shown in Exhibit 1.

**Estimated Cost**

The total cost of this project is estimated to be \$50,000. This includes the cost of 14.8 person-weeks of staff time, overhead at the rate of 1.027 percent, printing, travel, equipment, consultants, and other direct costs. A detailed breakdown of estimated costs is presented in Exhibit 2.

KQ/MSA/msa

**Exhibit 1**

**ESTIMATED SCHEDULE**

**Low-Cost Improvements to Express-Highway Bottleneck Locations - FFY 2017**

| Task   | Month |   |   |   |   |   |   |   |   |
|--|-------|---|---|---|---|---|---|---|---|
|  | 1     | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1. Inventory the Candidate Locations           | █     |   |   |   |   |   |   |   |   |
| 2. Screen and Select Bottleneck Locations      |       | █ |   |   |   |   |   |   |   |
| 3. Identify and Evaluate Low-Cost Improvements |       |   | █ | █ | █ | █ | █ |   |   |
| 4. Document the Results                        |       |   |   | █ | █ | █ | █ | █ | █ |

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**Exhibit 2****ESTIMATED COST****Low-Cost Improvements to Express-Highway Bottleneck Locations - FFY 2017**

| <b>Direct Salary and Overhead</b>              |              |     |     |     |     |      |       |               |                    |            | <b>\$49,881</b> |
|--|--------------|-----|-----|-----|-----|------|-------|---------------|--------------------|------------|-----------------|
| Task   | Person-Weeks |     |     |     |     |      |       | Direct Salary | Overhead (102.70%) | Total Cost |                 |
|  | M-1          | P-5 | P-4 | P-2 | P-1 | Temp | Total |               |                    |            |                 |
| 1. Inventory the Candidate Locations           | 0.2          | 2.0 | 0.0 | 0.0 | 0.0 | 0.0  | 2.2   | \$4,080       | \$4,190            | \$8,269    |                 |
| 2. Screen and Select Bottleneck Locations      | 0.2          | 2.0 | 0.2 | 0.0 | 0.0 | 0.3  | 2.7   | \$4,502       | \$4,623            | \$9,125    |                 |
| 3. Identify and Evaluate Low-Cost Improvements | 0.6          | 2.0 | 0.6 | 0.0 | 0.2 | 0.0  | 3.4   | \$5,777       | \$5,933            | \$11,709   |                 |
| 4. Document the Results                        | 2.0          | 2.0 | 1.1 | 1.4 | 0.0 | 0.0  | 6.4   | \$10,251      | \$10,527           | \$20,778   |                 |
| Total  | 3.0          | 8.0 | 1.9 | 1.4 | 0.2 | 0.3  | 14.8  | \$24,608      | \$25,273           | \$49,881   |                 |
| <b>Other Direct Costs</b>                      |              |     |     |     |     |      |       |               |                    |            | <b>\$119</b>    |
| Travel   |              |     |     |     |     |      |       |               |                    | \$119      |                 |
| <b>TOTAL COST</b>                              |              |     |     |     |     |      |       |               |                    |            | <b>\$50,000</b> |

**Funding**

MPO Planning Contract #95411