BOSTON REGION METROPOLITAN PLANNING ORGANIZATION

Frank DePaola, Acting MassDOT Secretary and CEO and MPO Chairman
Karl H. Quackenbush, Executive Director, MPO Staff

MEMORANDUM

DATE November 20, 2014

TO Boston Region Metropolitan Planning Organization

FROM Karl H. Quackenbush
CTPS Executive Director

RE Work Program for: Low-Cost Improvements to Express-Highway Bottleneck Locations: FFY 2015

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: FFY 2015, presented in this memorandum

Project Identification

Unified Planning Work Program Classification

Planning Studies

CTPS Project Number

13268

Client

Boston Region Metropolitan Planning Organization

CTPS Project Supervisors

Principal: Mark Abbott
Manager: Seth Asante

Funding

MPO Planning Contract #84053

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, “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.”[1] Consistent with this guidance, the Massachusetts Division office of the Federal Highway Administration has recommended that the MPO identify bottlenecks in the region that can be mitigated with low-cost improvements and develop recommendations for such improvements at these locations.

In the past, MPO staff analyzed several express-highway bottleneck locations in two consecutive studies, Low-Cost Improvements to Bottlenecks Phases I and Phase II; they were very well received by MassDOT and the FHWA.[2,3] 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 already been implemented, and the MPO staff has been interviewed by FHWA consultants about the successful implementation.

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

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[1] 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.

[2] 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,” dated June 2, 2011.

[3] 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,” dated March 12, 2012.”

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; it is generally considered to be 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 capacity of the highway point or highway segment to process traffic

Low-cost bottleneck improvement strategies include:

- Restriping and lane reallocation
- 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 include:

- Result in less disruption to the physical and human travel environment than the disruption from major-investment highway improvements
- Have lower costs, allowing for more locations to be addressed
- Are very cost-effective
- Can result in significant safety benefits
- Address existing problems quickly, thereby producing immediate improvements that are visible to stakeholders
- May actually end up being the long-term solution required

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. MPO staff will research and evaluate possible low-cost improvements for the selected locations. The recommendations will be based on an 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 abovementioned 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 up to six candidate bottleneck locations in the express-highway system of the MPO region. To this end, staff will largely rely on their knowledge of congestion and bottleneck locations. In addition, staff will review Congestion Management Process express-highway monitoring data and recent MPO and other planning studies, consult with the MassDOT Highway Division, and meet with MPO staff members who frequently drive in traffic congestion. 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 can seemingly 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 impacted, safety), ease of implementation (available right-of-way, available capacity from nearby or opposing streams of traffic), and cost considerations. Staff will present the initial list and the locations selected for analysis to the MPO for review.

Product of Task 2

A memorandum discussing the selection process and criteria, and the bottlenecks selected for analysis and for development of low-cost improvements

Task 3 Identify Low-Cost Improvements and Perform Analyses

As the bottleneck locations will have been selected with seemingly suitable improvements in mind, it will not be difficult to identify mitigation strategies. In

some cases, there may be more than one strategy to consider. In compiling a comprehensive list of potential improvements, staff will mainly rely on their technical expertise and judgment regarding the nature of bottlenecks. However, in addition, staff will seek the input of MassDOT Highway Division staff who are familiar with the operation of the region's express-highway system and on input 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 include consideration of: 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 of the Highway Capacity Manual applicable to the analysis of express-highway merges, weaving, ramps, and lane drops. The analysis will include conceptual designs of existing conditions and of the proposed improvements.

Products of Task 3

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

Task 4 Document the Results

Staff will write a technical memorandum to document the process used to select locations for the study, characteristics of the locations, analysis of the existing conditions, the improvements considered, and the impact and conceptual designs of the recommended improvements.

Product of Task 4

A technical memorandum documenting the analysis, results, and recommendations

Estimated Schedule

It is estimated that this project will be completed 6.5 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 $40,000. This includes the cost of 14.3 person-weeks of staff time, overhead at the rate of 91.82 percent, and travel. A detailed breakdown of estimated costs is presented in Exhibit 2.

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Exhibit 1
ESTIMATED SCHEDULE
Low-Cost Improvements to Express-Highway Bottleneck Locations: FFY 2015

Task	Month						
	1	2	3	4	5	6	7
1. Inventory the Candidate Locations							
2. Screen and Select Bottleneck Locations		A					
3. Identify and Evaluate Possible Improvements							
4. Document the Results							B

Products/Milestones

A: Memorandum on bottleneck selection

B: Final memorandum

Exhibit 2
ESTIMATED COST
Low-Cost Improvements to Express-Highway Bottleneck Locations: FFY 2015

Direct Salary and Overhead	**$39,577**

Task	Person-Weeks					Direct Salary	Overhead (91.82%)	Total Cost
	M-1	P-5	P-4	P-2	Total			
1. Inventory the Candidate Locations	0.3	0.5	0.0	0.0	0.8	$1,405	$1,290	$2,694
2. Screen and Select Bottleneck Locations	0.2	0.5	0.4	1.2	2.3	$2,888	$2,652	$5,540
3. Identify and Evaluate Possible Improvements	0.6	2.0	0.0	2.0	4.6	$6,450	$5,922	$12,372
4. Document the Results	2.0	2.0	1.1	1.5	6.6	$9,890	$9,081	$18,971
Total	3.1	5.0	1.5	4.7	14.3	$20,632	$18,945	$39,577

Other Direct Costs	**$423**
Travel	$423

TOTAL COST	**$40,000**

Funding
MPO Planning Contract #84053