BOSTON REGION METROPOLITAN PLANNING ORGANIZATION

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

TECHNICAL MEMORANDUM

DATE: **December 20, 2018**
TO: **Boston Region Metropolitan Planning Organization (MPO)**
FROM: **Seth Asante, MPO Staff**
RE: **Federal Fiscal Year 2019 Express-Highway Bottleneck Study Locations**

This memorandum presents the process used to select the bottleneck study locations. MPO staff will submit this proposal to the MPO for discussion and approval

1 BACKGROUND

In Task 2 of the work program for the "Low-Cost Improvements to Express-Highway Bottleneck Locations: FFY 2019," MPO staff indicated in Task 2—screen bottleneck locations and select locations for analysis—that staff will present the results to the MPO for discussion.[1]

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."[2]

The cause and duration of highway bottlenecks vary. In general, recurring bottlenecks, the subject of this study, are influenced by the design or operation present at the point where the bottleneck begins, for example, merges, diverges, lane drops, traffic weaving, abrupt changes in highway alignment, low-clearance structures, lane narrowing, intended disruption of traffic for management purposes, and less-than-optimal express-highway design.

[1] Work Program to the Boston Region Metropolitan Planning Organization, "Low-Cost Improvements to Express-Highway Bottleneck Locations: FFY 2019," September 20, 2018.
[2] 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.

MPO staff analyzed several express-highway bottleneck locations in four previous studies; they were very well received by the Massachusetts Department of Transportation (MassDOT) and the FHWA.[3,4,5,6] Previous study locations included sections of Interstate 95 (I-95) in Burlington, Lexington, Waltham, and Weston; I-93 in Reading and Woburn; 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 that have been implemented by the MassDOT Highway Division, or currently are in design status, range between $10,000 and $1 million.

2 SELECTION OF STUDY LOCATIONS

Selection of study locations was a two-stage process that comprised inventorying and screening candidate locations.

2.1 Inventorying Candidate Locations

MPO staff developed an initial list of candidate locations in the MPO region based on the following parameters:

- Consultations with MassDOT Highway Division
- Staff knowledge of bottleneck locations in the Boston MPO region
- Review of congestion management process (CMP) monitoring data, and recent MPO and other planning studies

The inventory process yielded nine bottleneck locations for screening, which are presented in the following table. All nine of the locations are in the Boston Region MPO area.

2.2 Screening Candidate Locations

MPO staff selected two bottleneck locations for analysis in federal fiscal year (FFY) 2019. After consulting with the MassDOT Highway Division, staff determined that these two locations likely could be corrected with low-cost mitigation strategies. The other bottlenecks in the Boston Region MPO area also

[3] 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.

[4] 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.

[5] Seth Asante, MPO staff, memorandum to the Boston Region Metropolitan Planning Organization, "Low-Cost Improvements to Bottleneck Locations," December 3, 2015.

[6] Seth Asante, MPO staff, "Low-Cost Improvements to Bottleneck Locations," Boston Region Metropolitan Planning Organization, January 2018.

could be corrected in a low-cost manner, but were not selected because of funding resources—these locations would be considered in future bottleneck studies.

Table 1
Inventory of Express-Highway Locations for Screening

Location Number	City/Town	MassDOT District	Express-Highway Section	Problem
1	Wilmington	4	I-93 northbound between Exit 40 (Route 62) and Exit 41 (Route 125)	Merge and diverge
2	Quincy and Braintree	6	I-93 southbound at the end of the HOV Zipper lane	Merge and weave during the PM commute
3	Medford	4	I-93 southbound between Route 16 on-ramp and Exit 31 (Route 16 off-ramp)	Weave
4	Reading	4	I-95 northbound between Exit 37 (I-93) and Exit 38 (Route 28)	Weave
5	Boston	6	I-93 northbound at the end of the HOV Zipper lane in Savin Hill	Merge during the AM commute
6	Boston	6	I-90 westbound and eastbound (just west of Ted Williams Tunnel Portal)	Westbound—diverge; Eastbound—merge
7	Canton and Randolph	6	I-93 northbound between Exit 1 (I-95) and Exit 4 (Route 24)	Merge, diverge, and weave
8	Canton and Randolph	6	I-93 southbound between Exit 1 (I-95) and Exit 4 (Route 24)	Merge, diverge, and weave
9	Newton	6	I-90 eastbound in Newton between Exit 16 and Exit 17	Merge, diverge, and weave

HOV = High occupancy vehicle. MassDOT = Massachusetts Department of Transportation.
Note: Shading indicates locations selected for study
Source: Central Transportation Planning Staff

MPO staff used the following criteria to screen the bottleneck locations:

- Does the location qualify as a bottleneck? A long traffic queue upstream trailing free-flowing traffic downstream usually characterizes the location as a bottleneck. In addition, the upstream congestion must be recurring—in other words, the location experiences routine and predictable congestion because traffic volume exceeds the available capacity at that location.
- Is a physical design constraint or operational conflict that is inherent in the location the cause of the bottleneck? Examples of these may include the following situations:
    - Lane drop—one or more travel lanes are lost, requiring traffic to merge

    - Weaving area—drivers must merge across one or more lanes in order to access an entry or exit ramp
    - Merge area—on-ramp traffic merges with mainline traffic in order to enter the freeway
    - Major interchanges—high-volume traffic is directed from one freeway to another
    - Horizontal curves—abrupt changes in highway alignment force drivers to slow down because of safety concerns
- Can the bottleneck be fixed with low-cost operational and geometric improvements? These would exclude costly long-term solutions such as expansion and major transit investments that alter drivers' mode choice. Examples of low-cost operational and geometric improvements may include the following:
    - Using a short section of shoulder as an additional travel lane, an auxiliary lane, or for lengthening an acceleration or deceleration lane
    - Restriping merge and diverge areas to better serve traffic demand
    - Providing better traveler information to allow drivers to respond to temporary changes in lane assignment, such as using a shoulder as an additional travel lane during peak periods
    - Providing all-purpose reversible lanes
    - Changing or adding signs and striping

Based on the screening criteria and consultations with MassDOT Highway Division officials, MPO staff selected locations one and two for study. Below is staff's rationale for not selecting locations three through nine.

Locations 3, 4, 5, 6, 7, and 8

These bottleneck locations may be correctible with low-cost improvements but were not selected because of funding. While the work program for this study assumed that "as many as three" locations would be selected, the MPO staff does not propose studying a third location because the two locations are complex and would require considerable resources for evaluating low-cost improvement plans. MPO staff may consider these locations in the next round of bottleneck studies.

Location 9

This bottleneck location was screened but was not considered in the selection process because a proposed project would address the bottleneck. MassDOT is

initiating a project to make improvements to traffic signals, signage, and pavement markings on the rotary around Newton Corner in order to improve traffic flow and safety, and to reduce the likelihood of the ramps backing up onto I-90. The project would also look at the feasibility of either restriping, or restriping with minor widening, the eastbound off-ramp in order to facilitate a second lane on the exit. These improvements would have positive impacts on the bottleneck.

3 SELECTED BOTTLENECK LOCATIONS FOR STUDY

3.1 Location 1: I-93 Northbound Between Exit 40 (Route 62) and Exit 41 (Route 125) in Wilmington

This segment of highway, about two miles long, with four travel lanes, frequently is congested because of merging and diverging activities, especially during the AM and PM peak periods. In the segment, there are two exit ramps and three entry ramps connecting Routes 62 and 125 to I-93. The ramps are heavily used because of office and industrial parks located off of Route 125. As a result, weekday rush hour congestion at the ramp-arterial junctions and queuing on the exit ramps are not uncommon.

At both exits, the northbound ramps have approximately 1,000 vehicles per hour (vph) exiting I-93 northbound to Routes 62 and 125 during the AM peak period and 1,500 vph during the PM peak period. During the same time periods, the entry ramps from Routes 62 and 125 to I-93 northbound receive about 700 vph during the AM period and 1,300 vph during the PM peak period.

This entering and exiting traffic interacts with about 5,700 vph on the mainline during the AM peak period and 7,600 vph during the PM peak period. The merging and diverging maneuvers in the vicinity creates a bottleneck that backs up traffic on the mainline.

3.2 Location 2: I-93 Southbound at the End of the High Occupancy Vehicle (HOV) Zipper Lane in Quincy and Braintree

This bottleneck is located on I-93 southbound at the end of the Zipper lane, where traffic diverges, merges, and weaves in order to continue onto I-93 southbound or Route 3 southbound. The bottleneck occurs only during PM peak periods when the southbound HOV lane is in operation.

At the bottleneck, traffic from six lanes (four on the mainline, one on the temporary HOV lane, and one from high-volume entry ramp from Furnace Brook Parkway) is forced onto four travel lanes in a short segment, about 0.5 miles long. The reduction in number of lanes dramatically reduces capacity in the segment creating a bottleneck. In addition, a significant amount of lane-changing maneuvers (weaving and diverging) and merging take place within the segment

to disperse traffic to continue on I-93 southbound or head to Route 3 southbound.

During the PM peak period, the entry ramp from Furnace Brook Parkway carries about 800 vph, and upstream of the bottleneck, the mainline and HOV lane carry 5,500 vph and 700 vph, respectively. Consequently, the traffic demand at the bottleneck greatly exceeds the capacity at the bottleneck. As a result, there are long traffic queues on the mainline and in the HOV lane, which extend five miles to Columbia Avenue in Dorchester.

4 SUMMARY

By identifying and evaluating a comprehensive list of potential improvements at the two locations, MPO staff will rely on their technical expertise and judgment regarding the nature of bottlenecks. In addition, MPO staff will seek input from MassDOT Highway Division staff that are familiar with the operations of the region's express-highway system.

This study addresses the MPO's goal of increasing safety on the region's highway system, capacity management and mobility, and system preservation. MPO staff will submit this proposal to the MPO for discussion. If the MPO approves this selection, staff will meet with officials from MassDOT and discuss the study specifics, conduct field visits, collect data, and perform various analyses.

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