TECHNICAL MEMORANDUM

DATE: **April 2, 2015**
TO: **Boston Region Metropolitan Planning Organization (MPO)**
FROM: **Seth Asante, MPO Staff**
RE: **Low-Cost Improvements to Express-Highway Bottleneck Locations**
Selection of Study Locations

1 BACKGROUND

This memorandum presents the results of Task 2 of the work program for Low-Cost Improvements to Express-Highway Bottleneck Locations: FFY 2015.[1] MPO staff indicated in Task 2—screen bottleneck locations and select locations for analysis—that we will present the results to the MPO for discussion.

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]

In the past, MPO staff analyzed several express-highway bottleneck locations in two consecutive studies, Low-Cost Improvements to Bottlenecks Phase I and Phase II, which were very well received by the Massachusetts Department of Transportation (MassDOT) and FHWA.[3,4] Previous study locations included sections of I-95 in Weston and Burlington and sections of Route 3 in Braintree.

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[1] Karl H Quackenbush, CTPS Executive Director, work program to the Boston Region Metropolitan Organization, "Low-Cost Improvements to Express-Highway Bottleneck Locations: FFY 2015," November 20, 2014.

[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.

[3] 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, Phase I," June 2, 2011.

[4] 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.

Some of the recommendations from those studies have been executed, such as the I-95 northbound subtract-a-lane at Interchange 24 in Weston; and FHWA has interviewed MPO staff about their successful implementation.

The cause and duration of highway bottlenecks vary. In general, recurring bottlenecks, the subject of this work program, 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.
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.

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:

- 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
- Consultations with MassDOT Highway Division
- Input from MPO members

The inventory process yielded five bottleneck locations for screening:

1. I-93 southbound between I-95 and Montvale Avenue in Stoneham and Woburn
2. I-93 southbound at the lane drop near Sullivan Square in Somerville/Charlestown
3. I-95 southbound at I-90 Interchange in Weston
4. Route 2 Concord Rotary
5. I-95 northbound, lane drop at interchange 37 in Reading, Stoneham, and Wakefield

2.2 Screening Candidate Locations

MPO staff selected two bottleneck locations for analysis. After consulting with MassDOT Highway Division, staff determined that these two locations likely could be corrected with low-cost mitigation strategies, whereas the other bottlenecks likely could not be correctible in a low-cost manner. 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 inherent in the location the cause of the bottleneck? Examples of these are:
    - 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 driver mode choice. Examples of low-cost operational and geometric improvements are:
    - 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 1 and 3 for study. Below are staff's rationale for not selecting Locations 2, 4, and 5:

Location 2: I-93 Southbound at the Lane Drop near Sullivan Square in Somerville/Charlestown

This section of highway is frequently congested because of a lane drop and intensive merging and diverging activities, especially during the AM peak period. During that period, the on-ramp carries between 1,300-and-1,700 vehicles per hour in an auxiliary lane; and the off-ramp to Leverett Circle, Exit 26, carries between 1,200-and-1,600 vehicles per hour.[5] The merging and diverging activities of these vehicles slow down mainline traffic and seriously affect traffic on the upstream section on I-93. The distance between the two ramps is about 0.4 miles long. The reasons for not selecting this location are:

- Removing the lane drop would require widening the I-93 bridge over Alfred Lombardi Street to provide a new auxiliary lane for the on-ramp traffic or converting the existing auxiliary lane to an acceleration lane.
- Widening the I-93 Bridge could be expensive.
- Converting the existing auxiliary lane to an acceleration lane might create a queue backup on the ramp that might affect traffic on Route 38 (Mystic Avenue) and the collector-distributor roads. In addition, there might not be enough space to provide sufficient acceleration distance because of the I-93 bridge over Alfred Lombardi Bridge.

Location 4: Route 2 Concord Rotary

This rotary, the intersection of Concord Turnpike (Route 2), Commonwealth Avenue, Barretts Mill Road, and Great Road (Route 119) is frequently congested because of high traffic volume and inadequate capacity during the AM and PM peak periods. The rotary is a challenge to navigate during these periods, and drivers often use local streets to avoid congestion. MassDOT Highway Division is planning to replace the rotary with an overpass for safer and more efficient operation, and to minimize environmental impacts. The Highway Division also is exploring opportunities to improve neighborhood connections, incorporate the Bruce Freeman Rail Trail and wildlife corridors, improve water and air quality, and enhance the area's design aesthetics to the extent possible.

Although this site is a major bottleneck, staff did not select this location because:

- Low-cost solutions at this location likely would not be feasible. MassDOT and MPO staff already studied the Route 2 Concord Rotary

[5] Express-Highway Traffic Volumes, I-93 Southbound 2010 Balanced Traffic Volumes, Estimated by CTPS.

to examine potential short- and long-term improvement alternatives for the rotary.[6,7]

- The project was removed from the funded portion of the MPO's Long Range Transportation Plan (LRTP) in August 2009 and currently is on hold.

Location 5: I-95 Northbound, Lane Drop at Interchange 37 in Reading, Stoneham, and Wakefield

This section of highway frequently is congested because of a lane drop and intensive merging and diverging activities, especially during the PM peak period, which slows down mainline traffic. During that time, the Exit 37 off-ramps carry about 3,200 vehicles per hour and the Exit 37 on-ramps carry about 2,300 vehicles per hour.[8] Adding an auxiliary lane northbound on I-95 would provide more room for the merging and diverging activities and reduce disturbance to mainline traffic. Staff did not select this location because an auxiliary lane would need to be extended for a long distance (about three-to-four interchanges downstream) to reduce congestion and queue, which could be expensive.

3 SELECTED BOTTLENECK LOCATIONS FOR STUDY

Location 1: I-93 Southbound Between I-95 and Montvale Avenue in Stoneham and Woburn

This section of highway, about two miles long, frequently is congested because of merging and diverging activities, especially during the AM and PM peak periods. The southbound off- and on-ramps connect to and from Montvale Avenue. During peak periods, I-93 southbound carries about 8,000 vehicles per hour; the on-ramp from I-95 northbound carries about 2,000 vehicles per hour; and about 900 vehicles per hour exit to Montvale Avenue at Exit 36. In addition, about 800 vehicles per hour enter I-93 southbound from Montvale Avenue during the same period.[9] The merging and diverging activities of these vehicles slow down I-93 southbound mainline traffic upstream of the Montvale Avenue interchange. In addition, these activities affect traffic entering I-93 southbound from I-95 northbound.

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[6] Chen-Yuan Wang, Route 2 Improvements from Route 111 in Acton to Baker Avenue in Concord: A Feasibility Study, report produced by the Central Transportation Planning Staff for the Massachusetts Department of Transportation, February 2003.

[7] Route 2 Reconstruction at the Concord Rotary, Concord Board of Selectmen Presentation, November 24, 2008.

[8] Express-Highway Traffic Volumes, I-95 Northbound 2007 Balanced Traffic Volumes, Estimated by CTPS.

[9] Express-Highway Traffic Volumes, I-93 Southbound 2010 Balanced Traffic Volumes, estimated by CTPS.

Location 3: I-95 Southbound at I-90 Interchange in Weston

This bottleneck is located on I-95 southbound at the point where traffic from I-90 and Route 30 merges onto I-95. During peak periods, between 2,000-to-2,600 vehicles per hour exit I-95 southbound to I-90 and Route 30. Further downstream about the same volume of traffic enters I-95 from the same roads. However, the four I-95 southbound lanes in that section are not allocated efficiently to serve demand. As a result, during peak periods a long traffic queue forms on the I-90 and Route 30 connector ramps heading southbound on I-95.

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. MPO staff will seek input from MassDOT Highway Division staff that are familiar with the region's express-highway system operations.

This study addresses the MPO's goal of reducing congestion and increasing safety on the region's highway system. MPO staff will submit this proposal to the MPO for discussion and approval. 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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