

Memo

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Project: MBTA Bus Stop Accessibility and Safety Improvements

To: Bin Zou, MBTA Project Manager, Capital Delivery

From: Deborah A. Finnigan, PE
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Subject: Medford City Council Rectangular Rapid-Flashing Beacon Requests:
Review and Recommendations

Introduction

The MBTA has requested HDR to review five intersections and six sets of Rectangular Rapid-Flashing Beacons (RRFB) that the Medford City Council (See attached City Council meeting minutes (March 23, 2023) in Appendix A) requested be installed by the MBTA as part of their bus stop improvements plan. This memorandum will review the requested RRFBs, which are pedestrian-actuated visual enhancements combined with pedestrian warning signs to improve safety at *uncontrolled*, marked crosswalks.

The use of the RRFBs is not currently included in the Manual of Uniform Traffic Control Devices (MUTCD); however, the Federal Highway Administration (FHWA) Interim Approval 21 (IA-21) approves the optional use of RRFBs. One of the requirements in the IA-21 is that State and local agencies must request and receive permission to install an RRFB. The interim approval states that RRFB shall not be used for crosswalks across approaches controlled by yield or stop signs, traffic control signals, or pedestrian hybrid beacons. Another guide used to evaluate the installation of RRFB is the PEDSAFE – Pedestrian Safety Guide and Countermeasure Selection System. It recommends reserving the RRFB for locations with significant pedestrian safety issues, as overusing RRFB treatments may diminish their effectiveness.

The FHWA's Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations provides an application matrix for various countermeasures related to pedestrian safety (See Appendix B for the matrix used). The matrix considers the posted speed limit, roadway AADT, lane configuration, and median presence when determining an effective countermeasure. The factors above were collected for each proposed RRFB location (See Appendix C).

Data Collection

The 2022 AADT was collected using the MassDOT Transportation Data Management System and grown to 2023 using the count station's recorded growth rate for 2022. AADT was unavailable in the Transportation Data Management System and was received from the City of Medford. The other data required for the analysis was collected using aerial and street-view imagery from Google Maps.

Analysis

The FHWA provides guidance for crash countermeasures (see Appendix B for the countermeasure matrix). The countermeasures descriptions are as follows and are used in Table 1 below:

1. High-visibility crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning signs
2. Raised crosswalk
3. Advance “Yield Here To (Stop Here for)” pedestrian sign and yield (stop) line
4. In-street pedestrian crossing sign
5. Curb extension
6. Pedestrian refuge island
7. Rectangular Rapid-Flashing Beacon (RRFB)
8. Road Diet
9. Pedestrian Hybrid Beacon (PHB)

Based on the FHWA countermeasures matrix analysis, the five locations not currently under stop control were evaluated, and the potential candidate treatments can be found in Table 1. Countermeasures 1, 4, 5, and/or 6 could be used to improve safety at each of the five locations. Countermeasure 1 is a simple and cost-effective safety measure that can be implemented at all locations. Improvements to the existing roadway and/or curbs are required for Countermeasures 4, 5, and 6. Countermeasures 7 and 9 are potential recommendations for three locations that meet AADT thresholds.

Table 1: Potential Safety Countermeasures

Plan	Bus Stop ID/ Community	Intersection		FHWA Recommendation
		Street for Safety Improvement	Int. Street	
MED-G-1	6960/9102 Medford	Winthrop Street	Robinson Road	1* 4 5 6
MED-G-3	2418/3513 Medford	High Street	Boston Avenue	1* 4 5 6 7 9
MED-G-3	2418/3513 Medford	Boston Avenue	High Street	Under Stop Control
MED-G-7	5321/5287 Medford	Salem Street	Hadley Place	1* 4 5 6
MED-G-8	9050/9037 Medford	Highland Avenue	Middlesex Avenue	1* 4 5 6 7 9
MED-G-9	15061/5088 Medford	Highland Avenue	Tucker Street	1* 4 5 6 7 9

(i.e., 1, 4, 5, etc.) This signifies that the countermeasure is a candidate for treatment at a marked, uncontrolled crossing location.

* Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked, uncontrolled crossing location

Location Evaluation

RRFB Analysis was performed based on the FHWA guidelines in Table 1 and Appendix B. The AADTs for the locations evaluated below can be found in Appendix C.

1. Bus Stop # 6960/9102 (MED-G-1): Winthrop Street (Local) at Robinson Road (Local)

This intersection is along a residential street, with midblock crossings 500 feet to the south and 900 feet to the north. At this location, Winthrop Street is a 2-lane road (1 lane in each direction) with a posted speed limit of 30 mph. *The FHWA criteria does not show this as an appropriate treatment based on the data.*

2. Bus Stop # 2418/3513 (MED-G-3): High Street (Local) at Boston Avenue (Local)

This four-leg, offset intersection is located within a primarily residential area. At this location, High Street is a 2-lane road with a posted speed limit of 25 mph. *An RRFB at this location is a considered treatment under FHWA guidelines.* The existing intersection geometry/wide travel lanes, large curb radii, and the locations of the utility poles, manholes and curb ramps make it challenging to place the RRFBs in an area that would meet ADA criteria and be seen by vehicles.

3. Bus Stop # 2418/3513 (MED-G-3): Boston Avenue (Local) at High Street (Local)

This four-leg, offset intersection is located within a primarily residential area. At this location, Boston Avenue is under stop condition with a small median, and it is a 2-lane roadway. The FHWA guidelines state that RRFB shall not be used for crosswalks across approaches controlled by stop signs and, *therefore, is not recommended at this location.*

4. Bus Stop # 5321/5287 (MED-G-7): Salem Street (Local) at Hadley Place (Local)

This intersection is adjacent to the elevated roundabout interchange (Exit 23) at I-93 and Salem Street. At this location, Salem Street is a 2-lane road with a posted speed limit of 25 mph, an existing in-street pedestrian crossing sign, and existing post-mounted pedestrian crossing signs. *The FHWA criteria does not show this as an appropriate treatment based on the data.*

5. Bus Stop # 9050/9037 (MED-G-8): Middlesex Avenue (MassDOT) at Dunkin' Donuts

This crossing is in front of a large commercial lot, which includes restaurants, businesses, and a gym. The Highland Avenue/Middlesex Avenue roadway is 2-lanes with a posted speed limit of 25 mph. *An RRFB at this location is a considered treatment under FHWA guidelines.*

6. Bus Stop # 15061/5088 (MED-G-9): Highland Avenue (DCR) at Waddel Street/Tucker Street (Local)

This intersection is on a residential road with multiple existing marked crosswalks and RRFBs along the corridor. The nearest existing RRFB to the requested one is 800 feet to the north. At this location, Highland Avenue is a 2-lane road with marked bicycle lanes, a posted speed

limit of 25 mph, and several existing RRFBs along this corridor. *An RRFB at this location is a considered treatment under FHWA guidelines.*

Recommendations

The FHWA table in Appendix B, engineering judgment, and current constructability were used to develop the following recommendations, as shown below in Table 2.

HDR's current project scope doesn't include the following bus stops: 6960/9102 (MED-G-1), 2418/3513 (MED-G-3 on High Street), and 9050/9037 (MED-G-8). Bus stop 2418/3513 (MED-G-3 on Boston Avenue) does not meet the criteria as it is under stop control, and RRFBs shall not be used for crosswalks controlled by stop signs. The project will not be recommending RRFBs at the locations above.

The bus stop 15061/5088 (MED-G-9) is on a DCR-owned roadway and can be considered at this location. Several existing RRFBs are on the road. However, overuse of the RRFB treatment may diminish its effectiveness. The project will not be recommending RRFBs at this location.

Bus stops 5321/5287 (MED-G-7) are located on Salem Street at Hadley Place/Allen Court, which is under local jurisdiction. The analysis showed that this location did not meet the criteria for an RRFB, as the minimum AADT volume and posted speed for an RRFB were not met. However, after analyzing the additional countermeasures in Table 2, HDR recommends implementing Countermeasure 1 (high-visibility crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning signs) at this location.

Table 2: RRFB Recommendations

Plan	Bus Stop ID/ Community	Intersection		FHWA Recommendation	HDR Recommendation
		RRFB Street	Intersecting Street		
MED-G-1	6960/9102 Medford	Winthrop Street	Robinson Road	Not Appropriate	(a)
MED-G-3	2418/3513 Medford	High Street	Boston Avenue	Consider	(a)
MED-G-3	2418/3513 Medford	Boston Avenue	High Street	Under Stop Control	Not Recommended
MED-G-7	5321/5287 Medford	Salem Street	Hadley Place	Not Appropriate	Not Recommended
MED-G-8	9050/9037 Medford	Middlesex Avenue	Dunkin Donuts	Consider	(a)
MED-G-9	15061/5088 Medford	Highland Avenue	Tucker Street	Consider	Not Recommended

- a. This location is not in HDR's current scope of services for the MBTA.



Appendix A

Meeting Minutes

Medford City Council Meeting Minutes - March 23, 2023

(Only Pages Related to the MBTA PATI Project are Attached: Pages 128 - 131)

The minutes from the Thursday, November 2nd, 2023, meeting:

1. Bus Stop # 6960/9102 (MED-G-1): Winthrop Street (MassDOT) at Robinson Road (Local)
 - a. Service planning removed northern Winthrop at Robinson (HDR designed)
 - b. Winford Way was kept (there is not a design plan)
 - i. It needs a survey to design to ADA standards
 - ii. It is the stop closest to the crest curve
 - c. MassDOT roadways are not advancing in the current project.
 - d. MBTA cannot buy or negotiate on behalf of MassDOT.
2. Bus Stop # 5321/5287 (MED-G-3): On High Street (MassDOT) at Boston Avenue (Local)
 - a. Residents are bringing up safety at this location/Sagamore Avenue
 - b. This is in close proximity to two roundabouts and the Mystic Valley Parkway
 - c. Review this location for a RRFB
 - d. MassDOT roadways are not advancing in the current project.
 - e. MBTA cannot buy or negotiate on behalf of MassDOT.
3. Bus Stop # 5321/5287 (MED-G-3): On Boston Avenue (Local) at High Street (MassDOT)
 - a. This is a signalized intersection, and RRFB can't be placed here
 - b. MassDOT roadways are not advancing in the current project.
 - c. MBTA cannot buy or negotiate on behalf of MassDOT.

The minutes from the December 6th meeting:

4. Bus Stop # 5321/5287 (MED-G-7): Salem Street (Local) at Hadley Place/Allen Court (Local)
 - a. Filbert Yee: MassDOT PM for SRTS project already awarded and in design, but this intersection was removed in subsequent scoping for funding and design
 - i. Maybe have a conversation with him; Could he contribute funding for the buying of the RRFB equipment
 1. If MassDOT buys the equipment and then it will be installed by the MBTA project
 - ii. DOT questioned whether they or the City could build; they may buy it and give it to the community; maybe DOT could buy it, give it to Medford, and then MBTA to install it
 - b. This intersection is in very close proximity to the east of I-93 and a large rotary
 - c. There is a speed issue
 - d. There is a sight distance issue coming from the rotary
 - e. Review this location for a RRFB
5. Bus Stop # 9050/9037 (MED-G-8): Middlesex Avenue (MassDOT) at Dunkin Donuts
 - a. Medford met with MassDOT concerning the signalization of this midblock to improve safety
 - b. This is a state-owned roadway
 - c. The City can't share costs with the MassDOT for improvements
 - d. Hmark has been reviewed and approved already; the City can't ask them for anything additional at this location due to this
 - e. The City would like to see a RRFB at this location
6. Bus Stop # 15061/5088 (MED-G-9): Highland Avenue (DCR) at Benmor St/Tucker St/Waddel Street (Local)
 - a. There are stops 850' and 1500' on the other side of the crest curve near East Boarder Rd; these stops are to the north of this location
 - b. Review this location as there are several others along this corridor
 - c. Traffic Volume is near 20,000 vehicles per day
 - d. DCR roadways are not advancing in the current project.
 - e. MBTA cannot buy or negotiate on behalf of the DCR.

Appendix B

FHWA Application of Pedestrian Crash Countermeasures by Roadway Feature

Table 1. Application of pedestrian crash countermeasures by roadway feature.

Roadway Configuration	Posted Speed Limit and AADT								
	Vehicle AADT <9,000			Vehicle AADT 9,000–15,000			Vehicle AADT >15,000		
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph
2 lanes (1 lane in each direction)	① 2 4 5 6	① 5 6 7 9	① 5 6 ⑦ ⑨	① 4 5 6 7 9	① 5 6 7 9	① 5 6 ⑦ ⑨	① 4 5 6 7 9	① 5 6 7 9	① 5 6 ⑨
3 lanes with raised median (1 lane in each direction)	① 2 3 4 5	① ③ 5 7 9	① ③ 5 ⑦ ⑨	① 3 4 5 7 9	① ③ 5 ⑦ ⑨	① ③ 5 ⑦ ⑨	① ③ 4 5 7 9	① ③ 5 ⑦ ⑨	① ③ 5 ⑨
3 lanes w/o raised median (1 lane in each direction with a two-way left-turn lane)	① 2 3 4 5 6 7 9	① ③ 5 6 7 9	① ③ 5 6 ⑨	① 3 4 5 6 7 9	① ③ 5 6 ⑦ ⑨	① ③ 5 6 ⑨	① ③ 4 5 6 7 9	① ③ 5 6 ⑨	① ③ 5 6 ⑨
4+ lanes with raised median (2 or more lanes in each direction)	① ③ 5 7 8 9	① ③ 5 7 8 9	① ③ 5 8 ⑨	① ③ 5 7 8 9	① ③ 5 ⑦ 8 ⑨	① ③ 5 8 ⑨	① ③ 5 ⑦ 8 ⑨	① ③ 5 8 ⑨	① ③ 5 8 ⑨
4+ lanes w/o raised median (2 or more lanes in each direction)	① ③ 5 6 7 8 9	① ③ 5 ⑥ 7 8 9	① ③ 5 ⑥ 8 ⑨	① ③ 5 ⑥ 7 8 9	① ③ 5 ⑥ ⑦ 8 ⑨	① ③ 5 ⑥ 8 ⑨	① ③ 5 ⑥ ⑦ 8 ⑨	① ③ 5 ⑥ 8 ⑨	① ③ 5 ⑥ 8 ⑨
<p>Given the set of conditions in a cell,</p> <p># Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.</p> <p>● Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.</p> <p>○ Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*</p> <p>The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.</p> <p>1 High-visibility crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning signs</p> <p>2 Raised crosswalk</p> <p>3 Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line</p> <p>4 In-Street Pedestrian Crossing sign</p> <p>5 Curb extension</p> <p>6 Pedestrian refuge island</p> <p>7 Rectangular Rapid-Flashing Beacon (RRFB)**</p> <p>8 Road Diet</p> <p>9 Pedestrian Hybrid Beacon (PHB)**</p>									

*Refer to Chapter 4, Tables 1 and 2, for additional information about when to use countermeasures.

APPENDIX C

STREET DATA