

ACTON, MASSACHUSETTS

# Hayward Road

## Safety Improvement Report

Prepared for  
**Town of Acton**

Prepared by  
**Howard Stein Hudson**

**June 2019**



**HOWARD STEIN HUDSON**

Engineers + Planners





# Table of Contents

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<b>Introduction</b> .....	<b>1</b>
<b>Existing Conditions</b> .....	<b>3</b>
Roadway Descriptions .....	3
Intersection Descriptions .....	5
Existing Safety Issues and Road Safety Audit RSA.....	10
<b>Town and Public Input</b> .....	<b>13</b>
Public Information Meeting .....	13
<b>Hayward Road Corridor Recommendations</b> .....	<b>14</b>
Short-Term Improvements.....	14
Long Term Improvements.....	19
Summary of Short-Term and Long-Term Improvements.....	23
<b>Order of Implementation</b> .....	<b>24</b>
<b>Signal Warrant Analysis</b> .....	<b>24</b>
Traffic Data Collection.....	25
<b>Hayward Road at Main Street Recommendation</b> .....	<b>29</b>

# List of Figures

---

<b>Figure 1. Locus Map</b> .....	<b>2</b>
<b>Figure 2. Hayward Road at Arlington Street</b> .....	<b>5</b>
<b>Figure 3. Hayward Road at Joseph Reed Lane and Hutchinson Way</b> .....	<b>6</b>
<b>Figure 4. Hayward Road at Charter Road</b> .....	<b>7</b>



Figure 5.	Hayward Road at Jefferson Drive .....	8
Figure 6.	Hayward Road at Main Street (Route 27).....	9
Figure 7.	Short-term Improvements – Arlington Street to 102 Hayward Road.....	16
Figure 8.	Short-term Improvements – 102 Hayward Road to Route 2 Bridge .....	17
Figure 9.	Short-term Improvements – Route 2 Bridge to Main Street .....	18
Figure 10.	Long-term improvements – Arlington Street to 102 Hayward Road .....	20
Figure 11.	Long-term improvements – 102 Hayward Road to Route 2 Bridge .....	21
Figure 12.	Long-term improvements – Route 2 Bridge to Main Street.....	22
Figure 13.	Existing (2019) Condition Volumes, a.m. and p.m. Peak Hours.....	26

## List of Tables

---

Table 1.	Summary of Study Area Crashes.....	12
Table 2.	Estimated Time Frame and Costs Breakdown .....	23
Table 3.	Short-term and Long-term Improvements Summary .....	23
Table 4.	2009 MUTCD Traffic Signal Warrants .....	28
Table 5.	Warrant Analysis for Existing Conditions (2019) .....	29

## List of Appendices

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Appendix A – RSA Site Walk Photographs

Appendix B – Crash Summary Table

Appendix C – Public Information Meeting Notes



**Appendix D – Turning Movement Counts**

**Appendix E – Signal Warrant Analysis**



# Introduction

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The Town of Acton has contracted with *Howard Stein Hudson (HSH)* to evaluate existing conditions along the Hayward Road corridor, from Arlington Street to Main Street (Route 27), identify potential safety issues, and conduct a signal warrant analysis. The main concerns are vehicle speeds on Hayward Road and safety at existing crosswalks along the Hayward Road corridor as it relates to their use by the students of the Acton-Boxborough Regional High School (ABRHS), located south of the Hayward Road and Charter Road intersection and everyone else living close by and uses these crosswalks.

HSH used speed data provided by the Town, crash data collected from the Massachusetts Department of Transportation (MassDOT) Crash Portal, observations made during a Road Safety Audit (RSA) conducted on May 9, 2019, and concerns voiced during a Public Information Meeting held on June 6, 2019 to identify safety issues and determine any feasible ways to help resolve them.

A locus map provided in **Figure 1** shows the limits of the study area corridor as well as the intersections investigated. This report documents the existing conditions of the corridor and intersections and summarizes the RSA observations and concerns voiced during the Public Information Meeting. The report provides both low- and high-cost recommendations to optimize the efficiency and safety of the intersections, reduce speeds, and improve accommodations and safety for pedestrians and cyclists.



Figure 1. *Locus Map*





# Existing Conditions

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## Roadway Descriptions

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*Hayward Road* is a two-way urban collector under Town of Acton jurisdiction. Hayward Road runs in an east-west direction from Arlington Street in the west to Route 27 (Main Street) in the east. The curb-to-curb width of the roadway, as well as the travel lanes, varies between 24 feet and 36 feet throughout the entire corridor with no shoulders. Within the study area, a hot mix asphalt sidewalk with asphalt berm in fair condition is provided on the north side (from Arlington Street to ABRHS Driveway #1) and on the south side (from ABRHS Driveway #1 to Main Street) of Hayward Road. There are short sections where the sidewalk is separated from the berm by a varying width grass strip, and sections where the sidewalk is made from concrete (bridge going over Route 2, and at both ABRHS driveways). The posted speed limit on Hayward Road within the project area is 30 mph, aside from the school zone located on Hayward Road where the speed limit reduces to 20 mph. Though no parking restrictions are posted along the roadway, vehicles have not been observed to park on Hayward Road.

*Arlington Street* is a two-way urban collector under Town of Acton jurisdiction. Arlington Street runs in a north-south direction from Newtown Road in the north to Summer Street in the south. The curb-to-curb width of the roadway is 24 feet with 12-foot travel lanes and no shoulders. Within the study area, a hot mix asphalt sidewalk with asphalt berm in fair condition is provided on both sides of the roadway. The posted speed limit is 35 mph. Though no parking restrictions are posted along the roadway, vehicles have not been observed to park on Arlington Street.

*Joseph Reed Lane* is a local roadway under Town of Acton jurisdiction. Joseph Reed Lane runs in a north-south direction from Hayward Road in the north to Deacon Hunt Drive in the south. The curb-to-curb width of the roadway is 24 feet wide and provides no pavement markings but allows two-way travel for its whole length. The posted speed limit is 25 mph. Though no parking restrictions are posted along the roadway, vehicles have not been observed to park on Joseph Reed Lane.

*Hutchinson Way* is a private way that runs in a north-south direction, from Hayward Road in the south to the end of the way, approximately 400 feet north of its intersection with Hayward Road. It is approximately 20 feet wide and allows for two-way traffic. Neither pavement markings nor sidewalks are provided on Hutchinson way. There is no posted speed limit; however, Hutchinson Way is considered a common drive and has a maximum design speed of 25 mph per Town of Acton Bylaws. A common drive is a roadway that provides vehicular and non-vehicular access only to the lots built around the common drive and is not a through-way. Given the design speed set by the Town on such roadways, and the nature of the roadway, it is safe to assume that Hutchinson Way



has a prima facie speed limit of 30 mph per Massachusetts General Law, Part I, Title 15, Chapter 90, Section 17. Though no parking restrictions are posted along the roadway, vehicles have not been observed to park on Hutchinson Way.

*Charter Road* is a local roadway under Town of Acton jurisdiction. Charter Road runs in a north-south direction from Arlington Street in the north to Hayward Street in the south. Within the study area, Charter Road is approximately 20 feet wide, provides no pavement markings, but allows two-way travel for its whole length. The posted speed limit is 25 mph. Within the study area, there is an asphalt sidewalk along the east side of Charter Road, separated from the roadway by a grass buffer, that varies in width, and an asphalt berm. Though no parking restrictions are posted along the roadway, vehicles have not been observed to park on Charter Road.

*Jefferson Drive* is a local roadway under Town of Acton jurisdiction. Jefferson Drive runs in a north-south direction from Musket Drive in the north to Hayward Road in the south. Within the study area, Jefferson Drive is approximately 25 feet wide and provides no pavement markings but allows two-way travel for its whole length. There is no posted speed limit; therefore, a prima facie speed limit of 30 mph is assumed for this roadway. Though no parking restrictions are posted along the roadway, vehicles have not been observed to park on Jefferson Drive.

*Main Street (Route 27)* is a local roadway under Town of Acton jurisdiction. Main Street (Route 27) runs in a north-south direction from the Acton/Carlisle Town line in the north to the Acton/Maynard Town Line in the south. Within the study area, the curb-to-curb width of the roadway is approximately 27 feet with 12.5-foot lanes and one-foot shoulders. A hot mix asphalt sidewalk is provided on both sides of the roadway, which is separated from the roadway by a varying width grass buffer and granite curb. The posted speed limit on Main Street is 35 mph. Though no parking restrictions are posted along the roadway, vehicles have not been observed to park on Main Street.



## Intersection Descriptions

*Hayward Road at Arlington Street* is an unsignalized intersection with three approaches. The Hayward Road westbound approach consists of an approximately 12-foot general use lane that widens to 17 feet at the stop line. The Arlington Street northbound approach consists of an approximately 12-foot shared through/right turn lane. The Arlington Street southbound approach consists of an approximately 12-foot shared through/left-turn lane. A crosswalk is provided only across the Hayward Road leg of the intersection and is connected by wheelchair ramps that don't appear to be ADA-compliant, nor do they provide detectable warning panels. No cyclist facilities are provided at the intersection. **Figure 2** shows an aerial view of the intersection.

*Figure 2. Hayward Road at Arlington Street*





*Hayward Road at Joseph Reed Lane and Hutchinson Way* is an unsignalized intersection with four approaches. The Hayward Road eastbound approach consists of an approximately 12-foot general use lane. The Hayward Road westbound approach consists of an approximately 12-foot general use lane. The Joseph Reed Lane northbound approach consists of an approximately 12-foot general use lane that widens to 17 feet at the stop line. The Hutchinson Way southbound approach consists of an approximately 12-foot general use lane. A crosswalk is provided only across the Hayward Road eastern leg of the intersection and is connected by wheelchair ramps that don't appear to be ADA-compliant, nor do they provide detectable warning panels. No cyclist facilities are provided at the intersection. **Figure 3** shows an aerial view of the intersection.

**Figure 3.** *Hayward Road at Joseph Reed Lane and Hutchinson Way*





*Hayward at Charter Road and ABRHS Driveway #2* is an unsignalized intersection with four approaches. The Hayward Road eastbound approach consists of an approximately 12-foot general use lane. The Hayward Road westbound approach consists of an approximately 12-foot general use lane. The Charter Road southbound approach consists of an approximately 10-foot general use lane that widens to 14 feet at the stop line. The ABRHS driveway northbound approach consists of an approximately 22-foot general use lane that widens to 30 feet at the stop line. A crosswalk is provided only across the Hayward Road eastern leg of the intersection and is connected by wheelchair ramps that don't appear to be ADA-compliant, nor do they provide detectable warning panels. No cyclist facilities are provided at the intersection. **Figure 4** shows an aerial view of the intersection.

*Figure 4. Hayward Road at Charter Road*





*Hayward Road at Jefferson Drive* is an unsignalized intersection with three approaches. The Hayward Road eastbound and westbound approaches consist of approximately 12-foot general use lanes. The Jefferson Drive southbound approach consists of an approximately 12-foot general use lane that widens to 17 feet at the stop line. A crosswalk is provided only across the Hayward Road western leg of the intersection and is connected by wheelchair ramps that don't appear to be ADA-compliant, nor do they provide detectable warning panels. No cyclist facilities are provided at the intersection. **Figure 5** shows an aerial view of the intersection.

*Figure 5. Hayward Road at Jefferson Drive*





*Hayward Road at Main Street (Route 27)* is an unsignalized intersection with three approaches. The Hayward Road eastbound approach consists of an approximately 12-foot exclusive left-turn lane that widens to 24 feet at the stop line, and an approximately 12-foot exclusive right-turn lane. The Main Street (Route 27) northbound approach consists of an approximately 12-foot general use lane. The Main Street (Route 27) southbound approach consists of an approximately 11-foot left-turn/thru lane and an approximately 10-foot exclusive right-turn lane. A crosswalk is provided across the Hayward Road western leg and the Main Street southern leg of the intersection. Both crosswalks are connected by wheelchair ramps that appear to be ADA-compliant and provide detectable warning panels. The crosswalk across the Main Street southern leg is provided with a Rectangular Rapid Flashing Beacons (RRFB). No cyclist facilities are provided at the intersection. **Figure 6** shows an aerial view of the intersection.

*Figure 6. Hayward Road at Main Street (Route 27)*





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## Existing Safety Issues and Road Safety Audit RSA

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On May 9, 2019, HSH conducted an RSA to discuss safety issues along Hayward Road between Arlington Street and Jefferson Drive and potential solutions to those hazards. The sections that follow, discuss in detail the safety issues that were observed during the RSA site walk and the meeting that followed the site walk. Pictures of the RSA site walk are provided in **Appendix A**.

### ROADWAY GEOMETRY AND SIGHT DISTANCE

The Hayward Road corridor contains two horizontal and two vertical curves that may reduce the available sight distance around such curves. Furthermore, trees and their branches abut either side of Hayward Road, making it even harder to see around them and the curves.

One of the horizontal curves on Hayward Road is located at its intersection with Joseph Reed Lane and Hutchison Lane. The intersection is located at the apex of the horizontal curve, as is the crosswalk across the westbound Hayward Road approach. Due to its location, a pedestrian waiting to cross from the south side of Hayward Road to the north side isn't easily noticeable by eastbound vehicles due to trees and their branches on the south side of Hayward Road.

The second horizontal curve on Hayward Road is located immediately to the east of its intersection with Jefferson Drive, with its apex at approximately 300 feet from the intersection. There is concern that the westbound traffic may not be able to see the crosswalk located at the Hayward Road and Jefferson Drive intersection because of this curve. Furthermore, there have been reports that the westbound traffic gets solar glare when approaching the crosswalk, as the trees around the crosswalk start thinning out and there is a clear skyline.

When it comes to the vertical curves, the first vertical curve is located to the west of the ABRHS, and it is a crest curve (a curve that connects inclined sections of roadway). This curve ends near the western ABRHS crosswalk, which is a crosswalk used a lot by the students of the ABRHS. In addition, the trees on the south side of Hayward Road continue right behind the wheelchair ramp and sidewalk at the western corner of the ABRHS driveway. This adds to limiting the visibility of pedestrians attempting to use this crosswalk.

Finally, the second vertical curve, which is also a crest, is located on the Hayward Road bridge over Route 2. The concern here is that the crosswalk may be located too close to the peak of the crest curve, thus reducing the time to see a pedestrian on the Hayward Road and Jefferson Drive intersection crosswalk and come to a stop.

### SPEEDING

There have been reports of speeding on Hayward Road, in front of the ABRHS, and at the Hayward Road and Jefferson Road intersection. The Town conducted a speed study in November 2018 to



determine the speeds vehicles are traveling at in this area. The Town placed Automatic Traffic Recorders (ATR) to the west of the Hayward Road and Jefferson Drive intersection to collect speeds. The speed study found that westbound vehicles were traveling at 29 mph, and eastbound vehicles were traveling at 32 mph. Furthermore, there is school zone signage on Hayward Road, located approximately 300 feet to the west of the ABRHS, which warns drivers of the 20-mph speed limit during school hours. However, there is no school zone signage on the east side of ABRHS. Finally, there is only one speed limit sign posted throughout the entire length of Hayward Road, and is located approximately 200 feet west of the Main Street intersection.

## PEDESTRIAN AND BIKE ACCOMMODATIONS

ABRHS and residential neighborhoods create significant pedestrian traffic volumes. Hayward Road provides some pedestrian accommodations along the corridor, but no bicycle accommodations. Sidewalks along the corridor range in size and condition but are not ADA accessible for most of the study area. Crosswalks are striped in select locations, but provide no wheelchair ramps, detectable warning panels, or pedestrian signals. Signage to indicate pedestrian accommodations to vehicle drivers is sparse in the study area. Most crosswalks along the corridor have no warning signage. The only crosswalks with pedestrian crossing warning signs are the ones at the Hayward Road intersections with Jefferson Drive and Main Street.

## CRASH HISTORY

During both the RSA and the public meeting, crashes along Hayward Road, or the potential for them, were not brought up as a concern. There was mention of a pedestrian crash that occurred sometime before the public meeting at Hayward Road and Main Street intersection, but no other crashes were noted for the other intersections. HSH checked the MassDOT Crash Portal for the most recent three years of available crash data to determine the number of reported crashes along the Hayward Road corridor, and its intersections. **Table 1** shows HSH's findings.



**Table 1. Summary of Study Area Crashes**

Scenario	Hayward Road/ Arlington Street	Hayward Road/ Joseph Reed Lane	Hayward Road/ Charter Road	Hayward Road/ Jefferson Drive	Hayward Road/ Main Street
<b>Year</b>					
2015	1	1	-	-	3
2016	-	-	1	-	4
2017	1	1	-	2	7
<b>Type</b>					
Head on	-	-	-	-	2
Angle	1	-	-	-	5
Rear-end	-	-	-	2	3
Single Vehicle	1	2	1	-	3
Sideswipe	-	-	-	-	1
Unknown	-	-	-	-	-
<b>Severity</b>					
Property Damage	1	2	1	2	10
Personal Injury	1	-	-	-	4
Fatality	-	-	-	-	-
Hit and Run	-	-	-	-	-
Unknown	-	-	-	-	-
<b>Total</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>14</b>

As can be seen in **Table 1**, in the recent three years of available crash data, very few crashes occurred at four of the five study area intersections. However, as 2018 and any 2019 crashes aren't available on the MassDOT Crash Portal at this time, it doesn't mean that additional crashes haven't occurred at these intersections.

Hayward Road at Main Street saw the highest number of reported crashes, with 14 crashes reported within the three-year period that was studied for this report. Half of the crashes (50%) occurred in 2017 and a little over a third of the crashes (36%) were angle crashes. The considerable amount of angle crashes may indicate the difficulty drivers are experiencing attempting to turn left from Main Street northbound onto Hayward Road westbound, and from Hayward Road eastbound to Main Street northbound.

Additional information on these crashes, such as the date and time they occurred and light and road conditions, can be found in **Appendix B**. As the MassDOT Crash Portal doesn't provide police report narratives, that information was not included in the table and crash diagrams weren't created at this time.



# Town and Public Input

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## Public Information Meeting

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On Thursday, June 6, 2018, HSH conducted a Public Information Meeting regarding the existing safety issues along Hayward Road as well as potential solutions for these issues. The meeting was held at the Acton Town Hall and seven people attended. Safety issues identified during the presentation included the same topics discussed in this report. Following the presentation, the attending public was encouraged to provide their input and ask questions. Some specific concerns, observations, and opinions voiced by residents included the following:

- How long would it take to implement any proposed improvements;
- Pedestrian safety as it relates to the crosswalks near the ABRHS, at Hayward Road and Jefferson Drive intersection, and the Hayward Road and Main Street intersection. During the meeting two pedestrian-related crashes were mentioned at the Hayward Road intersections with Jefferson Drive and Main Street;
- Speeding vehicles through the ABRHS area outside of regular school operating hours, as it relates to after-school extracurricular activities;
- Feasibility of expanding the existing school zone established by the Town on Hayward Road to include the Hayward Road and Jefferson Drive intersection and crosswalk;
- Hayward Road being used as a cut-through roadway as it provides access from Main Street (Route 27) to Massachusetts Avenue (Route 111), via Arlington Street, and vice versa;
- Regular maintenance and clearing of trees and invasive species on either side of Hayward Road, as it relates to limited sight distance; and
- Concern about signaling the Hayward Road at Main Street intersection, as it may promote traffic flow and higher speeds and reduce the safety of pedestrians attempting to cross the intersection.

Minutes from the meeting can be found online at Acton's Town website and in **Appendix C** of this report.



# Hayward Road Corridor Recommendations

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After consideration of comments made both during the RSA and the Public Information Meeting, and after the evaluation of the data provided to HSH by the Town, HSH developed short- and long-term recommendations to help mitigate the safety issues mentioned in this report. The following sections discuss these recommendations, which are also presented in **Figure 7** through **Figure 12** later in this report.

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## Short-Term Improvements

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### ROADWAY GEOMETRY

The northbound right turn radius from Arlington Street northbound to Hayward Road eastbound is large and can allow for a high-speed turning maneuver. This condition is considered unsafe since there is a crosswalk across Hayward Road at Arlington Street, and approximately 300 feet to the east of the intersection. It is recommended that a mountable curb extension is built at this corner to slow down turning vehicles, while still allowing for larger trucks to complete the maneuver, helping reduce the crossing distance for pedestrians, and increasing the safety of the crosswalk.

### SIGNAGE

Hayward Road provides minimal signage along its entire length; there is one posted speed limit sign approximately 200 feet to the west of the Hayward Road and Main Street intersection and for the westbound direction, a lane use sign at the same location but in the opposite direction, street name signs at every intersection, few pedestrian crossing signs, and school zone signs only to the west of ABRHS.

It is recommended to install advanced warning signs indicating intersections and curves and provide recommended speed limits around curves. Bicycle-related signage and additional speed limit signs along Hayward Road are also recommended. Furthermore, pedestrian signage at all crosswalk locations and school zone signs near the ABRHS area are recommended, especially to the east of the school as there are no school zone signs there today. Finally, the recommended pedestrian signage, specifically at the Hayward Road intersections with Arlington Street and Joseph Reed Road, are recommended to be retrofitted with Light Emitting Diodes (LED) along their perimeter to enhance their visibility by drivers. The rest of the pedestrian signs will be part of an RRFB assembly as explained below in the Pedestrian and Bicycle Accommodations section.



## PAVEMENT MARKINGS

A double yellow centerline is provided along the entire length of the Hayward Road corridor. Shoulder lines on either side of the road are recommended to mark 11-foot wide lanes and provide a shoulder on either side of the road to encourage bicycle use. The edge of pavement to edge of pavement width on Hayward Road is not sufficient to mark five-foot wide bicycle lanes on both sides of the road; therefore, bicycle sharrows will be provided for most of the length of the corridor, except for approximately 400 feet on either side of the Hayward Road bridge and on the bridge over Route 2. The road widens to approximately 36 feet in this area, which provides enough room to fit two 11-foot wide vehicle lanes and two seven-foot wide bicycle lanes. Crosswalk markings along Hayward Road are recommended to be repainted to be perpendicular to the direction of travel (they are skewed today).

## SIGHT LINE IMPROVEMENTS

Utility poles, trees, shrubs, and stone walls reduce sight lines at locations along the corridor especially at curves and intersections. It is recommended to clear shrubbery and trees throughout the corridor, where appropriate, particularly around curves, intersections, and near driveways. At locations of curves, and where appropriate, it is recommended to add parabolic mirrors so drivers may see oncoming traffic around the curve. This will particularly aid larger vehicles, such as school buses, that cannot make tight turns without traversing into the on-coming traffic travel lane. Locations of parabolic mirrors require further sight distance evaluation.

## PEDESTRIAN AND BICYCLE ACCOMMODATIONS

With the ABRHS having direct access to Hayward Road, and both the RSA and public meeting pointing out that children are biking on Hayward Road between their homes, the ABRHS, and the Lower Fields skating park to the east of ABRHS, signage warning drivers of bicycles on the road are recommended. Signage advising vehicles that bicycles “may use full lane” should be placed at either end of the Hayward Road corridor, near Arlington Street and Main Street, and at either end of the recommended bicycle lanes on the Hayward Road bridge over Route 2.

When it comes to pedestrians, the repainted crosswalks mentioned above can be supplemented with a stamped asphalt texture colored red to make them more visible by drivers. Furthermore, the ramps at all crosswalk locations are recommended to be upgraded to ADA-compliant wheelchair ramps. Finally, the crosswalks adjacent to the ABRHS and at the Hayward Road and Jefferson Road intersection are recommended to be provided with RRFB's. This will increase compliance by vehicles with yielding to crossing pedestrians, and it will increase the safety of these crosswalks.

See **Figure 7**, **Figure 8**, and **Figure 9** for a graphic showing all these recommended short-term improvements.



Figure 7. Short-term Improvements – Arlington Street to 102 Hayward Road

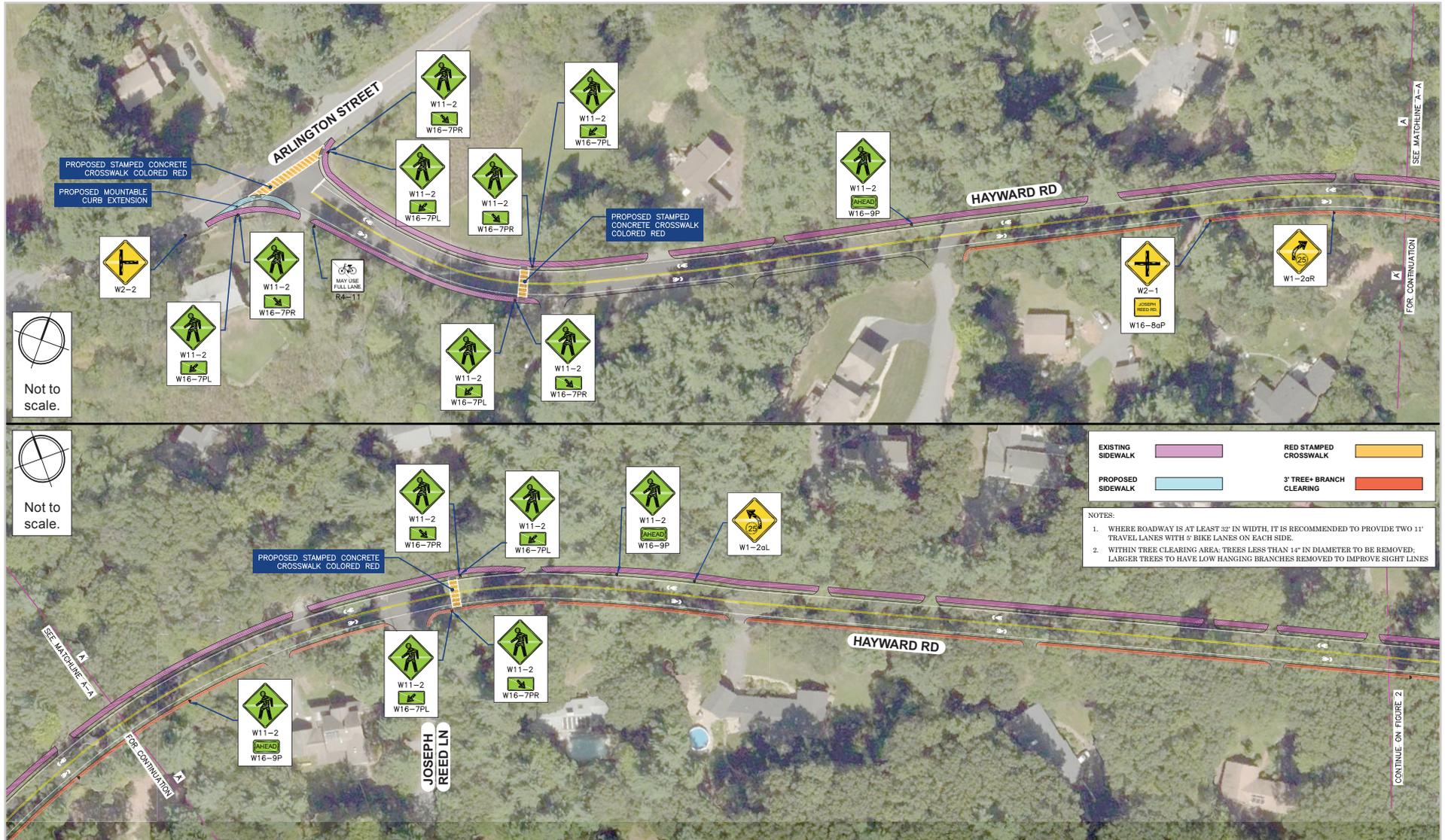






Figure 9. Short-term Improvements – Route 2 Bridge to Main Street





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## Long Term Improvements

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### BICYCLE ACCOMMODATIONS

A recommended long-term improvement for bicycles involves roadway widening to provide consistent five-foot wide bicycle lanes along the entire corridor of Hayward Road, while maintaining 11-foot wide vehicle lanes. This improvement would be dependent on the available Right of Way (ROW) and the ability to remove some of the rock walls on what may be private (ROW), if needed and if they are not of a historic nature. Both constraints are very important as this improvement would require enough width for the following:

- Two 11-foot wide vehicle lanes;
- Two five-foot wide bicycle lanes;
- A 5.5-foot sidewalk on only one side of the road, consistent with existing conditions; and
- An additional foot or two behind the sidewalk to place the utility poles and maybe signage.

All these requirements add up to approximately 40 feet of ROW to be built. As mentioned at the start of this report, the edge of pavement to edge of pavement width of Hayward Road varies between 24 feet and 32 feet, meaning an additional eight feet to 16 feet would be needed to provide this improvement. See **Figure 10**, **Figure 11**, and **Figure 12** for recommended long-term improvements.



Figure 10. Long-term improvements – Arlington Street to 102 Hayward Road

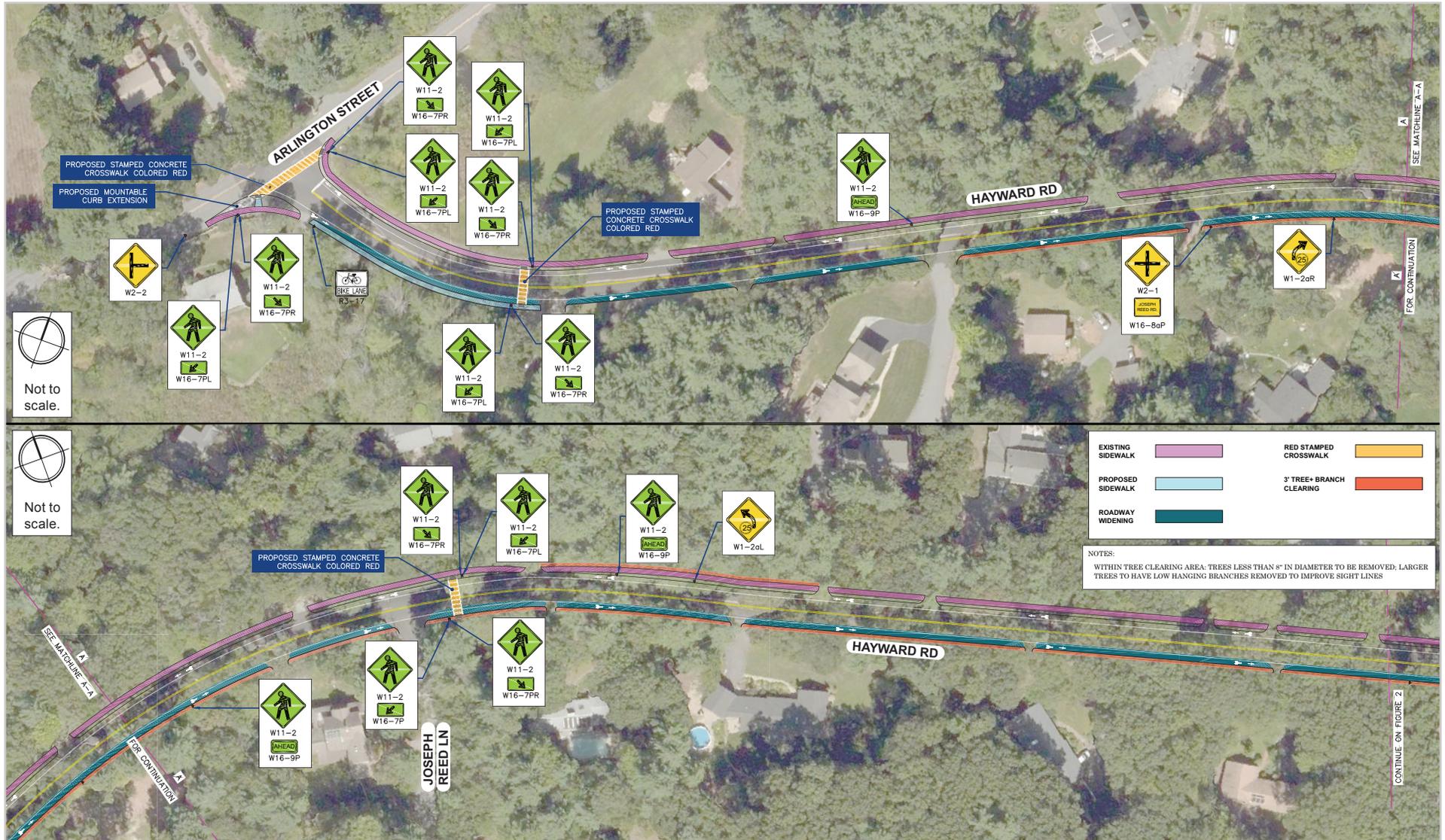




Figure 11. Long-term improvements – 102 Hayward Road to Route 2 Bridge

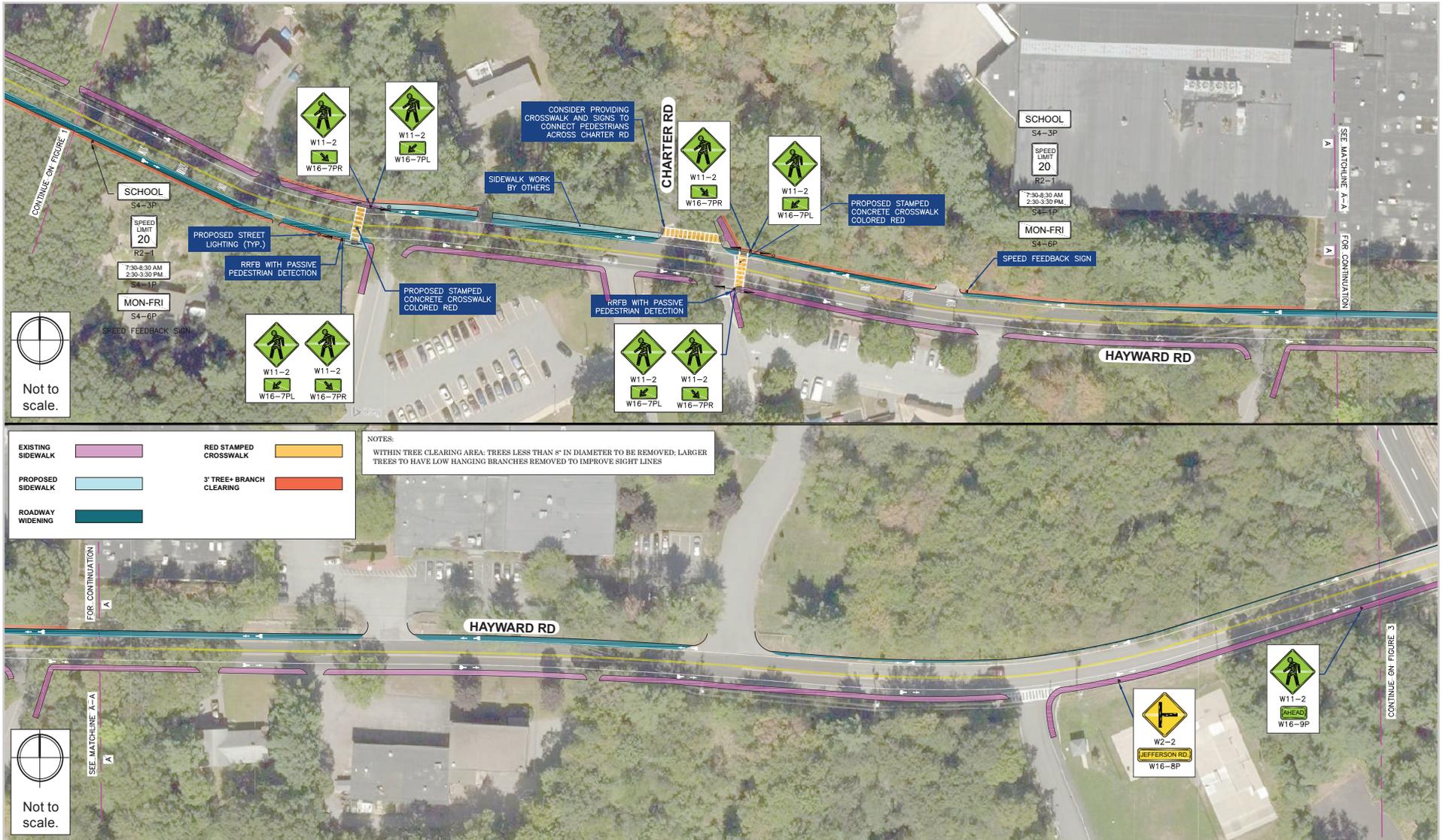
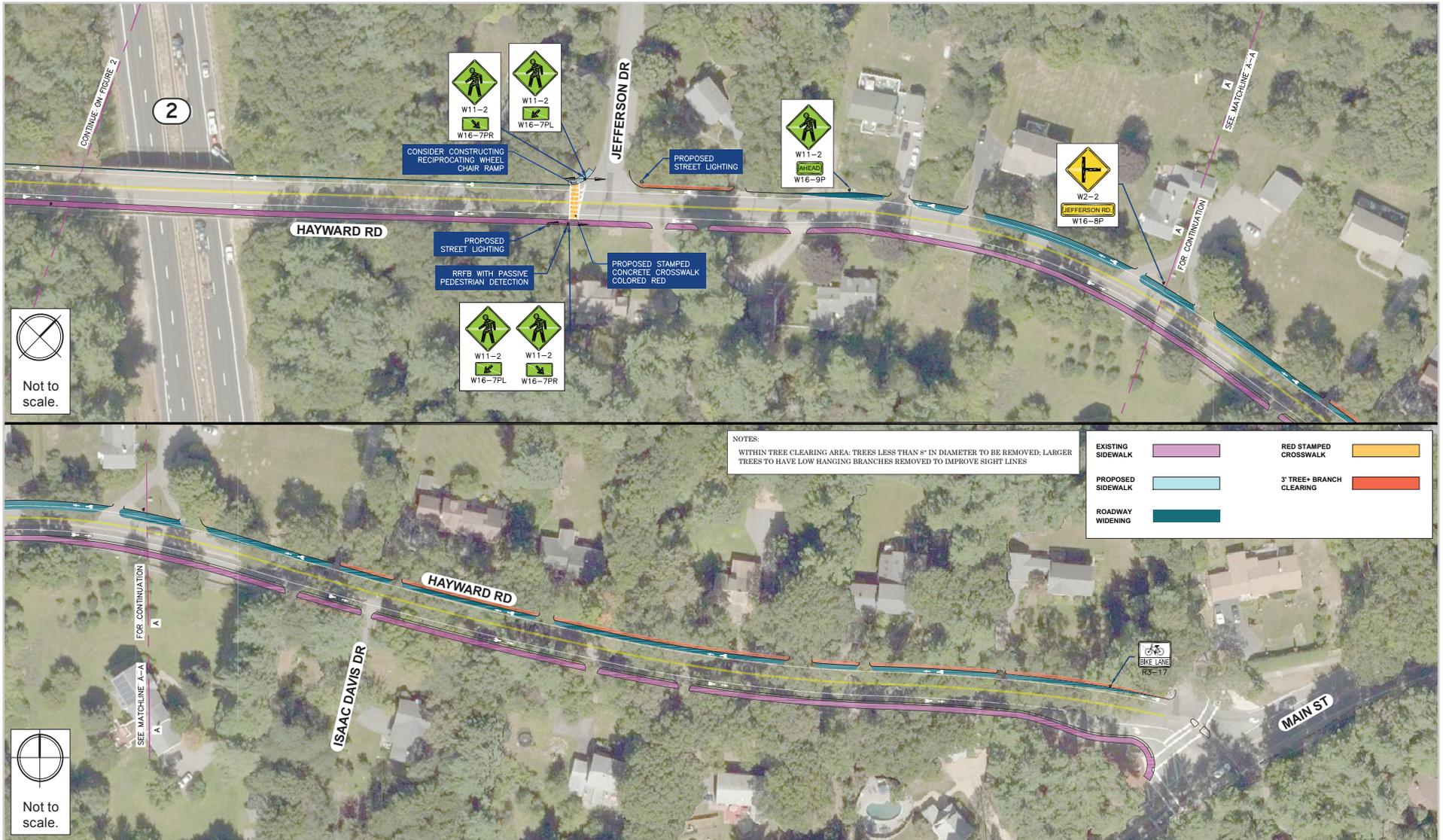




Figure 12. Long-term improvements – Route 2 Bridge to Main Street





## Summary of Short-Term and Long-Term Improvements

Improvements considered short-term are assumed to require up to a year to implement, whereas those considered long-term are assumed to need more than one year. **Table 2** and **Table 3** below provide cost ranges for improvements that are considered low, medium, or high cost, and the ranking of each proposed improvement, respectively.

**Table 2. Estimated Time Frame and Costs Breakdown**

Cost Range	
Low	<\$10,000
Medium	\$10,001-\$50,000
High	>\$50,000

**Table 3. Short-term and Long-term Improvements Summary**

Safety Issue	Potential Safety Enhancement	Safety Payoff	Time Frame	Cost
<b>Geometry</b>	Mountable Curb Extension	High	Short-Term	Medium
<b>Pavement Markings and Signage</b>	Install advanced warning and advisory signs	Medium	Short-Term	Low
	Install dynamic speed feedback signs	High	Short-Term	Medium
	Realign crosswalk markings	High	Short-Term	Low
	Install white paint for roadway shoulders, effectively narrowing travel lanes to 11 feet.	High	Short-Term	Medium
<b>Sight Line Improvements</b>	Clear vegetation	Medium	Short-Term	Medium
	Install parabolic mirrors	Medium	Short-Term	Low
	Relocate utility poles	High	Long-Term	N/A*
	Remove small trees (diameter <14 in.)	High	Short-Term	Medium
	Remove large trees (diameter >14 in.)	High	Long-Term	High
<b>Pedestrian and Bicycle Accommodations</b>	Install stamped asphalt with red color within crosswalk markings	High	Short-Term	Medium
	Install sharrows	Low	Short-Term	Low
	Install “Bicycles May Use Full Lane” and bicycle warning signs	Low	Short-Term	Low
	Widen roadway to provide consistent 5-foot wide bicycle lanes	High	Long-Term	High

\*Utility pole relocation cost would be the responsibility of the utility owner.



## Order of Implementation

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As **Table 3** shows, there are several short-term improvements that the Town can implement in the near future, which can provide an immediate safety benefit to the community. It is HSH's recommendation that the shoulder lines, bicycle sharrows, realigned crosswalks, and static signs be installed first throughout the corridor. Depending on funding availability, the stamped asphalt with red color within the crosswalk markings can be installed at the same time the crosswalks are realigned. Also depending on funding availability, clearing vegetation should occur at the same time as the pavement marking and sign installation to avoid branches blocking the newly provided signs, and gain the increased sight distance throughout the corridor.

The mountable curb extension at the southern corner of the Hayward Road and Arlington Street intersection should also be installed at the same time with the pavement markings and signs, as it would reduce the crosswalk length across Hayward Road, and will require additional pavement markings to guide traffic (except trucks) around it. The dynamic speed feedback signs can be installed next, to supplement the school zone speed limit signs.

The widening of the roadway to provide consistent five-foot wide bicycle lanes throughout Hayward Road requires further discussion with the Town. As mentioned in previous sections, there are constraints to its feasibility as it relates to available ROW and moving rock walls that may be in private property and may be historic.

## Signal Warrant Analysis

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As part of this report, the Town asked HSH to collect Turning movement counts (TMCs) at the intersection of Hayward Road and Main Street (Route 27) and use those volumes to complete a signal warrant analysis using the *2009 Manual of Uniform Traffic Control Devices* (MUTCD) procedures. HSH conducted a similar study in January 2008 for several intersections along Main Street (Route 27), which included the Hayward Road at Main Street intersection.



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## Traffic Data Collection

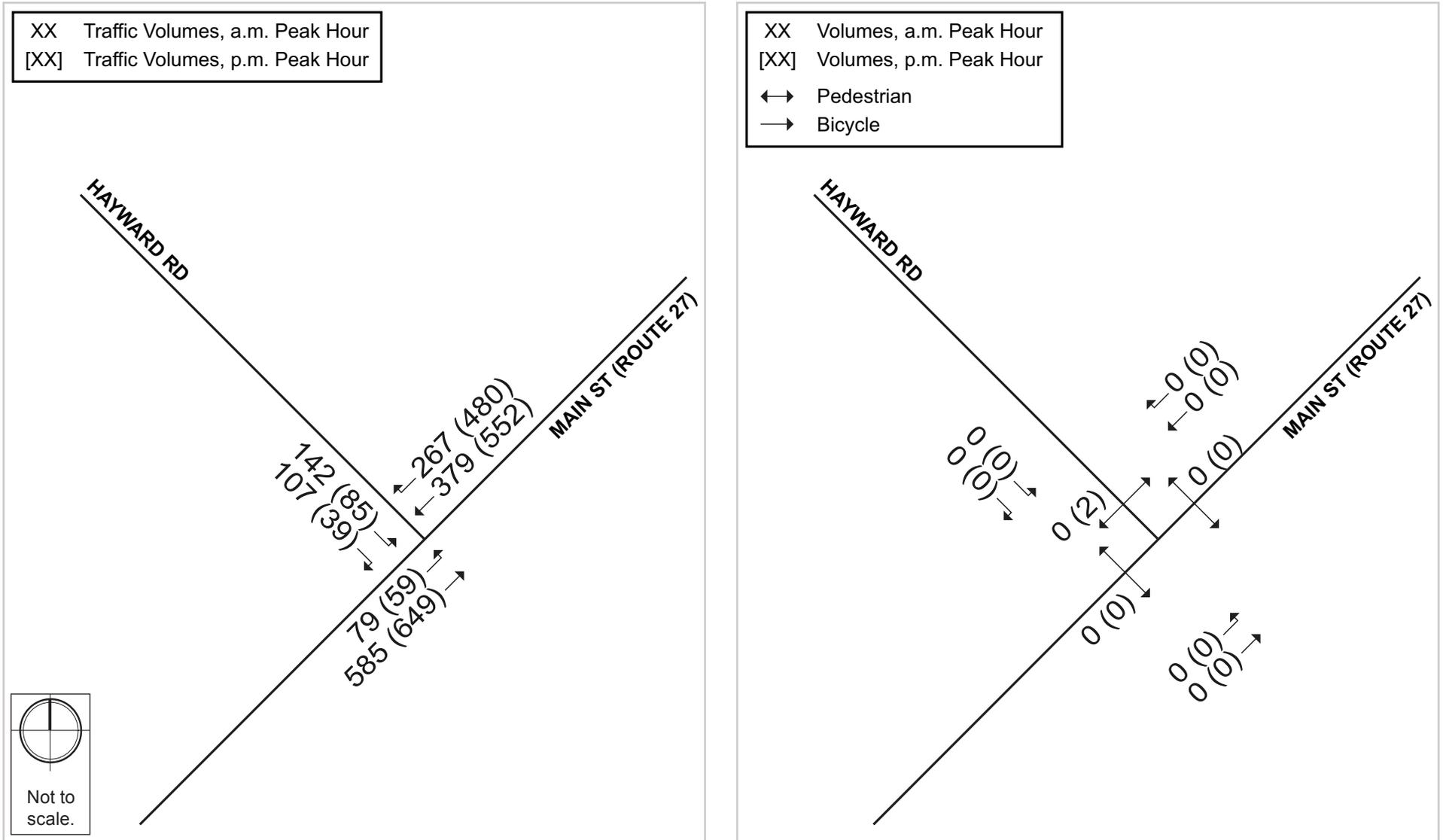
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### TURNING MOVEMENT COUNTS (TMCS)

TMCs were recorded from 7:00 a.m. to 6:00 p.m. on Tuesday, March 9, 2019. The TMCs include vehicle, bicycle, and pedestrian counts at the study area intersections. The results of the counts indicate that the morning peak hour occurs between 7:30 – 8:30 a.m. and the evening peak hour is between 4:30 – 5:30 p.m. **Figure 13** shows the existing traffic, pedestrian, and bicycle volumes during the morning and evening peak hours. Complete peak hour traffic count data are provided in **Appendix D**.



Figure 13. Existing (2019) Condition Volumes, a.m. and p.m. Peak Hours





## 2008 HAYWARD ROAD AT MAIN STREET (ROUTE 27) INTERSECTION STUDY

As mentioned above, this study included several Main Street intersections, one of which was the Hayward Road at Main Street intersection. The study focused on analysis of the existing conditions and future conditions (no changes to its geometry or traffic control) volumes at the intersection, as well as on traffic signal warrant analysis using the 2003 MUTCD guidelines (study completed before the 2009 MUTCD was published). The Hayward Road and Main Street intersection part of the study did the following:

- Showed that Hayward Road experienced long delays attempting to turn left or right onto Main Street (Route 27) due to the heavy traffic on Main Street. This condition would continue onto the future (2017) year analyzed in the study;
- While studying crash records between 2002 and 2007, the study found that Hayward Road at Main Street saw 21 crashes, with 48% of those crashes being angle crashes; and
- Proposed five alternatives, which included various roadway widening options, while maintaining Hayward Road under stop control, a traffic signal, and a roundabout.

HSH recommended, at that time, doing one of the roadway-widening options as a first step toward resolving some of the issues at the intersection. HSH also suggested further study and community-inclusive workshops on the roundabout which could help alleviate the operational and safety issues experienced at the Hayward Road and Main Street intersection. The signal option was not a preferred option at the time, as the consensus was that it would create more problems than it would solve. For example, it could introduce queues that would block both the northern Public Safety Facility driveway and Musket Drive connections to Main Street at certain times of the day.

## HAYWARD ROAD AT MAIN STREET SIGNAL WARRANT ANALYSIS

The 2009 MUTCD establishes nine (9) warrants or criteria to evaluate a location for the installation or retention of a traffic control signal. At least one of the nine warrants should be satisfied; however, satisfaction of a warrant in and of itself does not necessarily indicate that implementation of traffic signal control is the best traffic control solution. An engineering evaluation of the location in question should conclude that establishment of traffic signal control will improve the overall safety and/or operation of the intersection. **Table 4** lists the nine warrants used to evaluate an intersection for traffic signal control as presented in the MUTCD.



**Table 4. 2009 MUTCD Traffic Signal Warrants**

Warrant		Description
1	8-hour vehicular volume	Traffic volumes for 8 hours of an average day exceed the threshold given in MUTCD 2009 (Section 4C.02, Table 4C-1, pages 437-438).
2	4-hour vehicular volume	Traffic volumes for 4 hours of an average day exceed the threshold given in MUTCD 2009 (Section 4C.03, Figure 4C-1, pages 439-440).
3	Peak-hour	Traffic volumes for 1 hour of an average day exceed the threshold given in MUTCD 2009 (Section 4C.04, Figure 4C-3, pages 439-441)).
4	Pedestrian volume	Pedestrian volume exceeds the threshold given in MUTCD 2009 (Section 4C.05, Figure 4C-5 to Figure 4C—8, page 442-444).
5	School crossing	School children cross the major street (Section 4C.06, pages 442 -445).
6	Coordinated signal	Insuring progressive movement in a coordinated signal system (Section 4C.07, page 445).
7	Crash experience	Severity and frequency of crashes exceed the threshold given in MUTCD 2009 (Section 4C.08, page 445).
8	Roadway network	Encourages concentration and organization of traffic flow on a roadway network (Section 4C.09, page 446).
9	Grade Crossing	Intersection near at-grade rail crossing (Section 4C.10, pages 446-448).

HSH evaluated two warrants under existing conditions at the intersection of Hayward Road and Main Street (Route 27):

### **WARRANT 1, 8-HOUR VEHICULAR VOLUME**

The Minimum Vehicular Volume, Condition A, is intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal. The Interruption of Continuous Traffic, Condition B, is intended for application at locations where Condition A is not satisfied and where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

### **WARRANT 2, 4-HOUR VEHICULAR VOLUME**

The 4-hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal. Using the TMCs collected in March 2019, HSH conducted a signal warrant analysis using Warrant 1 and Warrant 2 of the MUTCD (see Sections 4C.02 and 4C.03, 2009 MUTCD), as was done in the 2008 study, for comparison. **Table 5** summarizes the results of the two traffic signal warrant analyses that were completed. Detailed analysis worksheets and supporting materials are included in **Appendix E**.



**Table 5. Warrant Analysis for Existing Conditions (2019)**

Time of Day	Main Street Major Street Total Volume Both Approaches	Hayward Rd. Minor Street Higher Volume Approach	Warrant 1: 8-hour Vehicular Volume	Warrant 2: 4-hour Vehicular Volume
7:00–8:00 a.m.	810	154	Yes	Yes
8:00–9:00 a.m.	1013	242	Yes	Yes
9:00–10:00 a.m.	811	202	Yes	No
10:00–11:00 a.m.	657	148	Yes	No
11:00 a.m.–Noon	811	120	Yes	Yes
Noon–1:00 p.m.	881	123	Yes	Yes
1:00–2:00 p.m.	920	124	Yes	Yes
2:00–3:00 p.m.	911	203	Yes	Yes
3:00–4:00 p.m.	1025	261	Yes	Yes
4:00–5:00 p.m.	1137	245	Yes	Yes
5:00–6:00 p.m.	1145	164	Yes	Yes
			Warrant SATISFIED	Warrant SATISFIED

As can be seen in **Table 5** above, Hayward Road at Main Street still meets Warrant 1 and Warrant 2 for a traffic signal, similarly to the study conducted in January 2008.

## Hayward Road at Main Street Recommendation

Even though the signal warrant analysis has shown that the traffic signal is warranted, HSH recommends that further study and coordination with the Town and the community be conducted, if the Town decides to move forward with the signal. As past coordination and discussion with the community has shown, the signal option is still not fully supported by all members of the community. Discussions and workshops on signals and roundabouts may be needed to present to the community and help them understand the advantages and disadvantages of each option – signal and roundabout – in the hopes of garnering support for one of the two options. As past and recent



## SAFETY IMPROVEMENTS REPORT

Acton – Hayward Road  
June 2019

crash records have shown, safety at this intersection is a major concern, especially since there have been reports of pedestrians being hit at this intersection. Choosing an option that would improve the safety of the intersection, and for all users independent of mode of transportation should be a priority.



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## **Appendix A**

### RSA Site Walk Photographs



*Photo 1. Hayward Road at Joseph Reed Lane and Hutchinson Way – Looking East on Hayward Road*

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*Photo 2. Hayward Road at Joseph Reed Lane and Hutchinson Way – Looking West on Hayward Road*

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*Photo 3. Hayward Road at ABRHS Driveway #1 – Looking West on Hayward Road*

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*Photo 4. Hayward Road at ABRHS Driveway #1 – Looking East on Hayward Road*

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*Photo 5. Hayward Road at ABRHS Driveway #2 – Looking East on Hayward Road*



*Photo 6. Hayward Road at ABRHS Driveway #2 – Looking West on Hayward Road*





*Photo 7. Hayward Road at Jefferson Drive – Looking West on Hayward Road*



*Photo 8. Hayward Road at ABRHS Driveway #2 – Looking West on Hayward Road*





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## Appendix B

### Crash Summary Table

**Crash Data Summary Table**  
Route 20 Corridor Shrewsbury Phase 2  
January 2014-December 2016

Crash #	ID #	Severity	Crash Date	Crash Day	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	Ages			Comments <sup>(1)</sup>
1	4017542	Property Damage Only	1/24/2015	Saturday	1:05 PM	Single vehicle crash	Daylight	Snow	Snow	Driving too fast for conditions	16-20			Hayward at Main
2	4007859	Property Damage Only	2/3/2015	Tuesday	8:10 AM	Angle	Daylight	Clear	Snow	No improper driving	21-24	25-34		Hayward at Arlington
3	4034490	Property Damage Only	4/10/2015	Friday	2:34 PM	Angle	Daylight	Cloudy	Dry	Failed to yield right of way	16-20	16-20		Hayward near ABRHS Driveway #1
4	4099329	Non-fatal injury	7/27/2015	Monday	10:00 AM	Rear-end	Daylight	Clear	Dry	Followed too closely	55-64	65-74		Hayward at Main
5	4115749	Property Damage Only	9/15/2015	Tuesday	11:18 AM	Single vehicle crash	Daylight	Clear	Dry	Inattention	45-54			Hayward at Joseph Reed
6	4140965	Non-fatal injury	11/5/2015	Thursday	12:07 PM	Rear-end	Daylight	Clear	Dry	No improper driving	55-64	65-74		Hayward at Main
7	4170504	Property Damage Only	1/13/2016	Wednesday	7:10 AM	Rear-end	Daylight	Clear	Snow	Driving too fast for conditions	16-20	21-24		Hayward near Route 2 Bridge
8	4175231	Property Damage Only	1/29/2016	Friday	2:30 PM	Angle	Daylight	Cloudy	Dry	Failed to yield right of way	16-20	45-54		Hayward near Haartz eastern Driveway
9	4153768	Property Damage Only	2/5/2016	Friday	12:27 PM	Single vehicle crash	Daylight	Snow	Snow	No improper driving	35-44			Hayward at Main
10	4178563	Property Damage Only	2/25/2016	Thursday	6:01 PM	Single vehicle crash	Dark - lighted roadway	Clear	Dry	No improper driving	35-44	35-44		Hayward at Charter
11	4195956	Property Damage Only	5/7/2016	Saturday	11:40 AM	Rear-end	Daylight	Cloudy	Dry	Followed too closely, Inattention	16-20	55-64		Hayward at Main
12	4206877	Property Damage Only	6/10/2016	Friday	6:41 PM	Angle	Daylight	Clear	Dry	Failed to yield right of way	16-20	45-54		Hayward at Main
13	4286738	Property Damage Only	11/10/2016	Thursday	7:23 AM	Rear-end	Daylight	Clear	Dry	Followed too closely	16-20	45-54		Hayward near ABRHS Driveway #1
14	4292822	Property Damage Only	11/15/2016	Tuesday	11:17 AM	Sideswipe, same direction	Daylight	Cloudy	Dry	No improper driving	16-20	55-64		Hayward at Main
15	4349682	Non-fatal injury	2/28/2017	Tuesday	7:10 AM	Angle	Daylight	Clear	Dry	No improper driving	16-20	16-20		Hayward at Main
16	4349778	Property Damage Only	4/1/2017	Saturday	8:51 AM	Single vehicle crash	Daylight	Snow	Snow	Driving too fast for conditions	16-20			Hayward at Joseph Reed
17	4367270	Non-fatal injury	5/5/2017	Friday	7:17 AM	Head-on	Daylight	Rain/Cloudy	Wet	Over-correcting/over-steering	16-20	35-44		Hayward at Main
18	4369662	Property Damage Only	5/16/2017	Tuesday	9:02 AM	Rear-end	Daylight	Clear	Dry	Inattention	16-20	45-54		Hayward at Jefferson
19	4373451	Property Damage Only	5/19/2017	Friday	7:00 AM	Angle	Daylight	Clear	Dry	Inattention	16-20	25-34		Hayward at Main
20	4375014	Property Damage Only	5/19/2017	Friday	7:20 AM	Single vehicle crash	Daylight	Clear	Dry	No improper driving	45-54			Hayward at Main
21	4406401	Property Damage Only	7/19/2017	Wednesday	4:59 PM	Head-on	Daylight	Clear	Dry	Failure to keep in proper lane or running off road	55-64	75-84		Hayward at Main
22	4451722	Property Damage Only	9/9/2017	Saturday	10:48 AM	Angle	Daylight	Clear	Dry	Failed to yield right of way	45-54	55-64		Hayward at Main
23	4467381	Property Damage Only	11/6/2017	Monday	7:16 PM	Angle	Dark - lighted roadway	Rain/Cloudy	Wet	No improper driving	16-20	65-74		Hayward at Main
24	4492994	Property Damage Only	11/13/2017	Monday	2:38 PM	Rear-end	Dark - unknown roadway lighting	Rain	Wet	Inattention	16-20	25-34		Hayward at Jefferson
25	4476423	Non-fatal injury	12/9/2017	Saturday	4:17 PM	Single vehicle crash	Dusk	Snow	Snow	Unknown	21-24			Hayward at Arlington

<sup>(1)</sup>The locations mentioned in this column are approximate and based of the locations shown in the MassDOT Crash Portal. No crash records were consulted on the location of each crash at this time.



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## **Appendix C**

### Public Information Meeting Notes




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To: Paul Campbell  
Town Engineer

Date: June 06, 2019

From: Taylor Miller  
Howard Stein Hudson

HSH Project No.: 19034

Subject: Town of Acton  
Hayward Road Safety Improvements, Acton, MA  
June 06, 2019

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# Overview

On Thursday, June 06, 2019, the Town of Acton held a public meeting at Town Hall concerning a study that is currently underway of potential safety improvements on the Hayward Road corridor between Arlington Street and Main Street. The purpose of the meeting was to provide members of the public with information about potential safety improvements and solicit feedback from the public.

Bob Stathopoulos, Traffic Engineer with the consulting firm Howard Stein Hudson, began the meeting by providing an overview of the study area, and the known safety issues along Hayward Road and at the intersections of Musket Drive and Main Street. Safety improvement measures were then presented. Bob Stathopoulos concluded the presentation by outlining the project’s next steps.

Following the presentation, Paul Campbell, Town Engineer for the Town of Acton, and Bob Stathopoulos facilitated a discussion with meeting attendees. During the discussion, attendees shared their thoughts on the various safety improvement measures highlighted in the presentation, and they provided information on other safety issues along the corridor and on adjacent roads.

# Agenda

- I. **Presentation** ..... Error! Bookmark not defined.
- II. **Discussion** ..... Error! Bookmark not defined.

# Detailed Meeting Minutes<sup>1</sup>

## Presentation

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**C: Bob Stathopoulos:** Good evening everyone, my name is Bob Stathopoulos, Project Manager for this specific study, also Senior Traffic Engineer for Howard Stein Hudson. I brought with me Taylor Miller from our office, she is involved in the Public Involvement Section, and she will be taking notes for tonight.

We're here tonight to discuss the Hayward Road corridor, from Arlington Street to Main Street. We were contacted by the town and told about some safety issues along the corridor. At this meeting we present what we've seen ourselves and what we were told by the town, but we also want to hear from you of any issues that you may know that we haven't presented here.

First, we will talk about the existing issues. We were contacted to check the speed limit of the corridor; safety at the four crosswalks, one near Arlington, two by the school, and one by Jefferson Road; and there were concerns about the accessibility of those crosswalks. We will talk about possible improvements, those we have come up with and any that are brought up tonight. Then we will talk about what the next steps after this meeting are. At the end, we will open the meeting up to feedback and provide an email for attendees to send more feedback to.

This slide shows the project corridor. The difference in colors indicates two project areas. The area at Hayward Road and Main Street will be studied to see if it warrants a signal to be installed. There is an area along Hayward road that needs attention as it is a point where a lot of children cross back and forth and walk along the sidewalks.

Existing issues were compiled by driving and walking this area and discussing it with persons from town. One thing we noticed is roadway geometry, some of it is curvy. There is a vertical curve that leads down to the bridge over Route 2. There is the speeding issue that was mentioned. And for pedestrian and bicycle accommodations, there is some sidewalks and crosswalks that present good connectivity for the low-volume road that it is, but more things could be done specially to warn motorists that people on bicycles are sharing the road and that pedestrians are crossing.

We will talk first about speeding. A device was installed on the West side of Jefferson Road to record drivers' speeds. It recorded drivers driving 32 MPH towards Main Street and 29 MPH

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towards Hayward Road. In this specific spot, it did not seem like speeds were tremendously high, but if you're a pedestrian or cyclist I can understand how it can seem high, especially if you are a child crossing Jefferson Road.

Next, we will talk about roadway geometry, and I will walk you through some photos that were taken in the field. The first photo shows the road curving around Joseph Reed Lane. Looking East you see the crosswalk. Due to the curve and some of the trees, it is hard to see from the crosswalk if cars are coming, and it is hard for cars to see pedestrians. Looking West the curve and some big trees cause similar problems. I took the photos on the next slide while going down the hill to determine how visible students and pedestrians would be at the crosswalk in front of the high school. Visibility isn't much of an issue, but if you're driving fast and it's nighttime, the current signs indicating a school crossing ahead and a 20 MPH speed limit might not be enough. A sign informing drivers of pedestrians and indicating where pedestrians will be crossing would be very helpful. We recommend installing that additional sign.

The other crosswalk is located on the East side of Charter Road. Things are clear from the crosswalk looking East towards Main Street and looking West; it should be easy for drivers to see any pedestrians. We are missing signs that tell drivers that pedestrians cross in this area.

At Jefferson Drive, there are brand new fluorescent yellow signs and crosswalk that tell drivers that pedestrians cross in this area. There is a problem with the curve leading to the bridge going over Route 2. When driving down the curve, the road is wide, and drivers may feel like they can go faster. People have also mentioned that there is a solar glare as they drive towards the bridge. It affects their ability to see pedestrians in the crosswalk. A resident was concerned about her own child crossing in the area. She is concerned about fast-moving cars as her child uses a wheelchair and crosses very slowly. We recommend there being something more than signs there.

On the map on the next slide, major roadway curves that we have noticed are indicated. The first curve is in the Joseph Reed area, the second is past Jefferson Road, and the third is on the bridge over Route 2. The map also shows that there are four crosswalks that need attention. And sidewalk continuity is also indicated; you can see that it starts on one side of the road and then crosses over to the other side on Main Street. Other things to pay attention to along this corridor are utilities along the road, trees and plants that block some visibility, schools where students cross the road for, the solar glare blocking some visibility, and areas along the sidewalk where ramps can be updated to comply with ADA code.

Next, we will talk about the possible improvements that can happen along the corridor. A cross sign can be placed along the road to inform drivers that they are approaching intersections. Similarly, a sign that shows a curved arrow can inform drivers that they are approaching curves in the road. Adding an advised speed limit to a curved arrow sign will advise drivers to reduce their speed to a safer speed as they drive around the curve.

**C: No Name Given:** I don't think 35 MPH is safe on any part of that road.

**A: Bob Stathopoulos:** 35 MPH is just an example. This is the image from the manual, I just didn't change the numbers. The speed on Hayward Road should be lower because there are tight curves and less visibility in some areas, and we have to worry about the pedestrians who are trying to cross. The advised speed will not be 35 MPH that's for sure.

**C: Bob Stathopoulos:** There are digital feedback signs that flash 'Your Speed' as you drive past. Some of those signs could be useful in this area, especially where the school is at. These inverted mirrors are also useful for drivers who have a hard time seeing around curves and trees.

Next, we're going to look at pavement markings. We have double-yellow center lines along the whole road, but we are thinking about some of the accommodations that can be made for bicyclists. When we were out there, we noticed that a lot of cyclists were children. They were on the sidewalk, and that's good if that is where they feel safe, but if they are there because drivers are moving too fast and children don't feel like they can be on the road by themselves, then maybe pavement marking should be implemented to designate cyclists using the shoulder. This would narrow the lanes and make drivers slow down. "Sharrows" are becoming popular as pavement markings that tell drivers that cyclists can bike on the roadway. The last image on this slide is of brick pavers that can be used to make crosswalks more visible to drivers.

Next, we're going to look at signs for pedestrian crosswalks. Pedestrian signs with LED lights can be placed at crosswalks to make them more visible to drivers, especially at night. Another option is a Rectangular Rapid Flashing Beacons (RRFB). Flashing beacons indicate to drivers where pedestrians are crossing. This would be very useful at the Jefferson Road crosswalk near the school, but there is no limitation to where this can be used.

Hayward Road already has a School sign that says 20 MPH. Another sign that could be added is a digital sign that shows you your speed and tells you to slow down if you are driving too fast.

**C: No Name Given:** I saw a sign like that once that if you drove the right speed, it would give you a smiley face.

**C: Bob Stathopoulos:** I've been seeing a lot of new things with these digital signs, but I'm not sure it should be detracting attention from the road! But those signs are very useful, you look at it and you notice it.

On this slide are the most up-to-date signs that inform drivers that they are approaching schools and should drive slower. There are signs that indicate in advance that a school crosswalk is approaching and there are signs that point to where the crosswalk is. "School" can be written on the pavement in one lane or across the whole roadway. It can tell drivers to slow their speed, it can be painted in white or yellow.

One thing that was mentioned while we were walking along the area was an extension of the sidewalk along Charter Road and Hayward Road. Something that was proposed was moving the crosswalk on Hayward Road farther East, towards Charter Road, more towards the straighter part of the roadway and away from the downhill to give it more visibility. Plus, there is a big tree near the crosswalk's current location, adding to its obstruction.

The crosswalk near Jefferson Road should have its ramp updated to better comply with ADA code. The sidewalk should also be extended, building a reciprocating ramp into Jefferson road to further improve its accessibility. It is also recommended that an RRFB sign be installed at the crosswalk near Jefferson Road. We have also heard that at this intersection, drivers will go around cars that have stopped, even though there is only one lane in each direction. This maneuver makes the intersection less safe for pedestrians. With this in mind, we will try to provide additional safety for pedestrians.

This slide lays out the project's next steps. At this time, we would like to hear of the concerns and comments that you have about anything we presented or any other trouble you know of in the area. Then, we will be moving into a kind of conceptual design phase where we produce what we think the corridor should look like, with signs, locations where wheelchair ramps should be updated, where flashing beacons make sense, pavement markers for the school and cyclists, and if possible, how the sidewalk can be kept on one side to keep pedestrians from having to cross the street. It will also include what was talked about in the safety audit. If you have any questions or comments, please let me know. On this slide is an email you can send any comments after tonight. If you know of anyone who could not be here and has comments, please share with them this email.

## Discussion

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**C: No Name Given:** I have loved what I've seen. My only comment is that I feel like it takes too long to get to this point, too much effort by residents complaining. I lived in Newbury Port for a while, and they basically sought out people in wheelchairs and asked them "Where do you go?" and they made sure everything was up to date for them. I thought that was proactive, and I really thank you guys for putting this together and I hope that we can do more of this because it was really responsive.

**C: Bob Stathopoulos:** Thank you very much for your comment.

**C: Danny Factor:** My name is Danny Factor. I live here in Acton on Davis Road, and I am here to represent the Council on Disabilities here tonight. I am so glad that you mentioned the issue of accessibility. We were contacted by a resident representing other residents on the matter of Hayward Road and Jefferson Drive and the experience of children with disabilities living in the neighborhood. Many people in the town know that there were two significant accidents involving school children. One at the intersection of Hayward Road and Main Street and another at Hayward Road and Jefferson Drive. I am personally very impressed with what you are talking about, and I really like that the focus is on pedestrian safety and accessibility. Making things easier for pedestrians as opposed to making things easier for cars.

Our statement mainly has to do with Jefferson Drive and the existence of children with disabilities. Our commission has issued an advisory opinion about a safety matter of particular concern for residents with disabilities. At the beginning of the school year, a pedestrian accident occurred at the intersection Hayward Road and Jefferson Drive in which a student was severely injured. There is a strong feeling among neighbors that flashing lights at the intersection is needed to make the intersection safer. This is not the first incident that has occurred in this area. Our commission was contacted by residents in this area. Parents of children with disabilities are particularly concerned about the crossing of Hayward Road and Jefferson Drive. They see this as a crucial matter especially since the location of the school campus means a large amount of students crossing the street, with or without disabilities. Our commission here by advises the town to purchase and install flashing light equipment as soon as possible. We've been told that the cost is reasonable, within the range of \$25,000 and can be paid for out of the existing discretionary funds. That is the statement that we've made, and it sounds pretty consistent with what you're talking about.

**Q: Danny Factor:** My final question has to do with the speed, how fast do you think that the types of things you're talking about can be implemented?

**A: Bob Stathopoulos:** Thank you very much for the statement and your question as well. We're looking at the whole corridor. But something like that for a specific location doesn't have to take that long. As long as funds can be secured to install it.

**C: Paul Campbell:** Cory agrees that that area is where flashing beacons should go.

**C: Danny Factor:** This neighborhood group was so concerned about this issue; they were talking about raising the money themselves for it! And we told them no, that this is a service that their town provides. Our master plan states that we want safe, quality streets.

**C: Bob Stathopoulos:** The school is right there, and we saw the kids use both sidewalks and they use bicycles and play in the fields, so it just makes sense. The area you mention seems like a higher priority location.

**C: Anupam Mishra:** My name is Anupam Mishra, I live on Charter Road. I specifically wanted to highlight the cross section of Charter Road and Hayward Road. That is a crosswalk that kids use to go to and come back from school. When school is on, drivers are careful about it, but when school is off people just drive very fast. But kids are still at school doing different clubs and sports when school is out. Six months back, my daughter was crossing, and a car came so fast. There is no good signage there. And because kids are always coming from school or from sports grounds, there needs to be a flashing light, especially in the winter when at 4:30 it's dark. And even in the morning it's dark.

**C: Bob Stathopoulos:** That's why I showed those signs. Pavement markings can get lost in the snow with plowing. A flashing beacon is not out of the question, especially if there is whole day use of the school grounds. We will keep this in mind.

**C: Dean Charter:** My name is Dean Charter; I live on Charter Road. There are a couple of spots on Hayward Road that I think need some improvements as far as road shoulders, providing a flatter surface, and providing maintenance of some vegetation. Specifically, from Hayward Road to Charter Road down to Haartz Corporation, on the North Side of Hayward Road. There is a ledge where a lot of invasive species grows, and the area is so abrupt that it can't be mowed. SO, smoothing off those areas so it can be mowed and maintained would help open the visibility pulling out of Charter Road looking towards Main Street.

Further down, starting on the opposite side of Hayward Road, from the metal fabricator's driveway to the driveway into the skatepark, on the right-hand side is a very steep slope with a little bit of wetland with invasive species. This area is difficult to maintain, so I think some shoulder improvements would make maintenance and visibility a lot easier.

**C: Bob Stathopoulos:** Thank you very much for the comment. That is definitely something we want to do in a place where trees and invasive species are so close to the road, and removing them would help to improve the visibility.

**Q: No Name Given:** Can the school zone be expanded to include the Jefferson area, and expand the time of the school zone? Because kids will be crossing the street as they go to these activities.

**A: Bob Stathopoulos:** It's something we can definitely investigate. As was mentioned, on the main road, a school child got hit there. So, if that is another area that school children are using, I could see expanding additional signage out that way. We will check into it and see what can be done to make sure people are actually moving slowly through the areas.

**Q: No Name Given:** It's my understanding that with a double yellow line, drivers recognize it as a highway, and they speed. But when there is one line, drivers slow down because they recognize it as a residential area.

**A: Bob Stathopoulos:** Actually, one yellow line is not allowed anymore. A double line just delineates the roadway and tells you it's a two-way roadway and you can't use the whole roadway for yourself. Speed-wise, I think that people just choose how fast they go.

**C: Danny Factor:** I think one thing to note about Hayward Road is that it is known in town as a shortcut. There is almost a hypotenuse of a triangle formed by Route 27 and Route 111. The conflict is when people drive through a short cut they are driving faster. The worst place for a short cut is near a school. This argument for reducing the speed limit to discourage people from using Hayward Road like that may be worthwhile.

**C: Bob Stathopoulos:** Yes, that is something we can investigate.

**C: Danny Factor:** And GPS' have made it worse! It knows the Hayward Road short cut and advises people to use it all the time. Reducing the speed limit might make the GPS app not recognize it as a shortcut anymore.

**C: Bob Stathopoulos:** I'm not sure about the apps so much, but I think we can get drivers to slow down. As long as there is stop and go traffic on one route and movement on the other, the GPS

app will direct drivers to that route. But we can employ additional measures to reduce speed in the area.

**C: Paul Campbell:** The speed there right now is 30 MPH, I think we can get it down to 25 MPH.

**C: Bob Stathopoulos:** I think there is a Massachusetts statute that allows the speed to be lowered to 25 MPH.

**C: No Name Given:** If it's declared a Safety Zone.

**C: Chris Prehl:** That is the adopted law that has to go through Town Meeting. It has to be adopted by the entire town.

**Q: No Name Given:** This seems to make a lot of sense as a non-road engineer. It's sound reasoning: the equipment, the painting, the crosswalks. My question is what are the likely steps to get the ball rolling, and what is the timing on that? The school year is done two-weeks from yesterday, but is it possible to implement these things by the next fall school year?

**A: Paul Campbell:** Yes, it's possible. At the Town Meeting they passed funding for traffic and complete streets. It's not like the Safe Routes to School Program that we tried to use to fund sidewalks; I understand that the schools have to initiate it. But there's opportunity to get this done before the next school year.

**Q: No Name Given:** There is thousands of dollars left over at the end of this budget year, so I think we should take some money out of that. But my last question is, you mentioned something about lights on Main Street. I am very much about accommodating pedestrians and bicycles and not cars. So I would like to understand what you are planning for that light.

**A: Bob Stathopoulos:** Well the traffic signal would be to that effect. As vehicles come off of Hayward Road the signal would improve safety, especially when cars take left turns and create small gaps between cars that are potentials for crashes. Right now, there is one of those flashing beacons on Main Street but there isn't one on Hayward Road. And since there was a very recent crash right there, a signal makes drivers pay more attention to the lights and to pedestrians crossing.

**C: Chris Prehl:** And that crash was caused by another vehicle coming South bound on Main Street where a girl came out between two cars. That was the problem, the girl never stopped as she came out from between two cars that were stopped.

**Q: No Name Given:** So, there is a flashing beacon on Main Street but none on Hayward Road. We can have both?

**A: Bob Stathopoulos:** We can have both, but I think since Main Street has a higher speed it's better there.

**Q: No Name Given:** I see. So, if I push the button for a flasher on Main Street, then the others have to stop too?

**A: Bob Stathopoulos:** Right now, the way it's set up, it's only Main Street that stops, Hayward doesn't stop. If I went to a full traffic signal, it would stop all traffic and let pedestrians cross.

**C: No Name Given:** I feel like if we add these traffic signals, the people would go faster, and we'd have more problems. I want to see flashing lights everywhere, I want to accommodate for pedestrians.

**C: No Name Given:** I think that the traffic signal would accommodate for pedestrians' safety at the intersection.

**Q: No Name Given:** Well, I very much would be against a traffic signal, and I would like a heads up if the town is planning on that. Were you asked to study that?

**A: Bob Stathopoulos:** Yes, just to check if the traffic numbers that go through this intersection is so heavy that people can't make any turns to access Hayward Road. A traffic signal could be installed there, but it is not definite. It is a basic engineering judgement that it would be useful. But this was just looking at the numbers, we would also need to look at the safety of putting a light up that tells drivers they have to stop. It makes it easier for pedestrians because when drivers see a red light, they have to stop for a pedestrian crossing.

**Q: No Name Given:** So, the numbers indicate that we could put a light in if we wanted to accommodate more traffic?

**A: Bob Stathopoulos:** No, not more traffic. A signal would be installed to make the intersection safer for all movements to happen. Right now, the only movement that's safer is the through movement on the main road. Anyone trying to come from Hayward Road is delayed for a minute. It can be the same thing even for a pedestrian because if a vehicle doesn't stop, they can't cross.

**C: No Name Given:** Yes, they can. They can press the button and the car has to stop.

**C: Bob Stathopoulos:** With the flashing signal, drivers are just getting a warning that somebody is supposed to cross the road. Vehicles are supposed to stop, but it's not a red light where they have to stop.

**C: Anupam Mishra:** I agree, Hayward Road and Main Street is a big problem, even on Saturdays. If you are on Hayward trying to turn onto Main Street, it takes five minutes.

**C: Paul Campbell:** The town studied this in 2008 and a signal was warranted. The option you see out there is what got built. I have gotten emails from students, some happy about it some not. Howard Stein Hudson did this study in 2008, so we just need to dust off the study, look at new traffic numbers, determine if it still warrants a signal, and figure out what to do after that.

**C: Anupam Mishra:** I'm sure volume has increased.

**C: No Name Given:** Speaking as a private citizen, I think it is important to keep our goals focused. Once you get into mixed motives, then you have potential for conflict. There is a difference between accommodating pedestrian safety and making driving easier for cars. Sometimes you have a win-win situation, and maybe this is it. But to me, this is a forum that has the word "safety" in it, as in pedestrian safety, so let's keep the focus on that.

**C: Bob Stathopoulos:** I don't disagree with that. Without the signal for the past 10 years, traffic went up more. And traffic flow is suffering because people can't move when it's very busy, in the morning and afternoon. Adding a signal does not mean we have one thousand cars going through there right now and then we can have five thousand. Not at all. A signal provides appropriate right of way to any movements, pedestrian or vehicle or bicycle. Today, many vehicles are having trouble and having accidents because they cannot access the main road because people are going too fast, they can't find safe gaps to enter into, so we want to give them safe passage to make their turns. We are not making it easier for more vehicles to come through this intersection by any means. One way to do that is to add more lanes, but a traffic signal won't do that. The signal makes all movements for all modes of transportation safer, as long as people listen to the law.

**C: No Name Given:** I would just like to back up what my neighbor said about how horrible the intersection of Hayward Road and Main Street is. I've lived in my neighborhood for 60 years, and it has only gotten worse. The modifications that were done 20 years ago at that intersection have helped a little bit, but frankly I'm not concerned with traffic volume, I'm concerned with safety. I have personally tried to pull out onto Main Street, especially making a left turn in the afternoon especially. You might be there for five minutes, people have to cut each other off, the traffic gets stacked up so long that when school gets out, the police department need to send a cruiser down

there to facilitate the flow of traffic off of Hayward Road, otherwise all the school buses would be back up.

Another thing that's happening is people are waiting at the intersection after trying to sneak around Jefferson Drive and Musket Drive to avoid the intersection of Hayward Road and Main Street. So I think certainly the improvements at Charter Road and the school complex is certainly important, but the impact on everybody's safety, having a decent traffic signal on Hayward Road and Main Street, is the gold standard we should be heading for.

For the foreseeable future, the mode of transportation in this town is going to be by automobile. So we have to make sure that if we're not going to make it convenient, we have to make sure that it's safe.

**C: Anupam Mishra:** I heard people say that we want to make it easier for pedestrians and not cars, but these are not two different people. I am the pedestrian when I'm crossing and I'm the car when driving to work. So we're not making it easier for the pedestrian and not the car, we are the same people. I don't like this thing about not caring about the car.

**C: Bob Stathopoulos:** Either way, pedestrian safety is the number one priority if we put a signal there. As we said, we want to make it safer for everybody. If we put a signal there, there will be signs telling advancing drivers to reduce their speeds for safety for everybody.

**C: Name Not Given:** I think that something at that intersection is needed because there's also a crosswalk and that crosswalk does go to the other side of Hayward Road which is often stacked up with people's cars parked there. It's not a dedicated, safe intersection. That crosswalk across Hayward Road is very concerning to me.

**C: Name Not Given:** If you're talking about safety along the Route 27 corridor, one intersection that we've been waiting four years to have improved is Newtown and Concord Road. Anything you do with Hayward Road, you have to consider the town center. The town center is still not fixed, it's a nightmare and it's getting worse. Pedestrian safety is horrendous, drivers ignore the lights and pedestrians have to press the button three or four times to get the light, I have to wait five or ten minutes to cross Route 27. Both intersections are so horrible, and you can't do one without the other because they affect one another.

**C: Paul Campbell:** So, there is actually an Acton center traffic study, and now there is an engineering firm putting out a design. Once they're done with the design, we'll put out a cost

estimate. The plan is to realign Newtown Road and then a portion of Concord will become a one-way road. And there will be a new turn-around on the other end.

**C: Bob Stathopoulos:** The presentation tonight is on Hayward Road.

**C: No Name Given:** All the comments I heard are about wanting people in the neighborhood to be safe, whether you're a pedestrian or whether you're in a car. So, automotive safety is just as important as pedestrian safety. But I do want to make the distinction between automotive safety and automotive convenience. Sometimes to make something safe you have to make another thing inconvenient.

**C: No Name Given:** What I don't like to do is use vulnerable people as a pawn. Convenience is not a right, but pedestrian safety is a right. I want to focus on that and not how long it takes to get somewhere.

**C: Bob Stathopoulos:** If there are no other comments, then thank you very much for attending. This is the email for any other thoughts and comments that you have. Similar to the Strawberry Hill project, we will have another design prepared hopefully by the end of this month.

## Next Steps

HSH to produce conceptual design plans that would include all feasible countermeasures discussed during the Road Safety Audit and Public Information Meeting. HSH will also produce a report discussing what was talked about during both meetings and what are HSH's recommendations showcasing the conceptual design plans. Report and drawings are due to the Town by June 28, 2019.



**HOWARD STEIN HUDSON**

Engineers + Planners

## **Appendix D**

### Turning Movement Counts

Client: Haralampos Stathopoulos, PE, PTOE  
 Project #: 353\_C19\_HSH  
 BTD #: Location 1  
 Location: Acton, MA  
 Street 1: Main Street  
 Street 2: Hayward Road  
 Count Date: 3/19/2019  
 Day of Week: Tuesday  
 Weather: Sunny, 40°F



**PASSENGER CARS & HEAVY VEHICLES COMBINED**

Start Time	Main Street Northbound				Main Street Southbound				Hayward Road Eastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	9	112	0	0	0	61	19	0	8	0	8	0	0	0	0
7:15 AM	0	20	117	0	0	0	63	22	0	18	0	13	0	0	0	0
7:30 AM	0	31	120	0	0	0	108	58	0	27	0	18	0	0	0	0
7:45 AM	0	22	142	0	0	0	87	106	0	35	0	27	0	0	0	0
8:00 AM	0	12	161	0	0	0	89	65	0	43	0	35	0	0	0	0
8:15 AM	0	14	162	0	0	0	95	38	0	37	0	27	0	0	0	0
8:30 AM	0	15	164	0	0	0	96	34	0	30	0	18	0	0	0	0
8:45 AM	0	16	153	0	0	0	93	29	0	33	0	19	0	0	0	0
9:00 AM	0	14	139	0	0	0	92	23	0	35	0	20	0	0	0	0
9:15 AM	0	13	124	0	0	0	91	17	0	30	0	22	0	0	0	0
9:30 AM	0	11	107	0	0	0	86	16	0	24	0	24	0	0	0	0
9:45 AM	0	9	90	0	0	0	82	15	0	19	0	28	0	0	0	0
10:00 AM	0	7	71	0	0	0	78	13	0	14	0	31	0	0	0	0
10:15 AM	0	8	82	0	0	0	73	12	0	16	0	24	0	0	0	0
10:30 AM	0	8	92	0	0	0	76	15	0	15	0	17	0	0	0	0
10:45 AM	0	9	105	0	0	0	80	17	0	17	0	14	0	0	0	0
11:00 AM	0	10	116	0	0	0	84	20	0	14	0	11	0	0	0	0
11:15 AM	0	11	112	0	0	0	89	23	0	16	0	13	0	0	0	0
11:30 AM	0	10	114	0	0	0	91	25	0	17	0	14	0	0	0	0
11:45 AM	0	11	117	0	0	0	88	22	0	19	0	16	0	0	0	0
12:00 PM	0	11	118	0	0	0	90	21	0	20	0	17	0	0	0	0
12:15 PM	0	12	126	0	0	0	89	24	0	18	0	15	0	0	0	0
12:30 PM	0	10	132	0	0	0	92	23	0	16	0	12	0	0	0	0
12:45 PM	0	10	140	0	0	0	94	22	0	15	0	10	0	0	0	0
1:00 PM	0	9	145	0	0	0	97	23	0	14	0	8	0	0	0	0
1:15 PM	0	10	135	0	0	0	101	20	0	19	0	9	0	0	0	0
1:30 PM	0	10	122	0	0	0	103	22	0	23	0	10	0	0	0	0
1:45 PM	0	11	111	0	0	0	106	24	0	29	0	12	0	0	0	0
2:00 PM	0	11	97	0	0	0	108	25	0	34	0	13	0	0	0	0
2:15 PM	0	12	112	0	0	0	111	29	0	33	0	16	0	0	0	0
2:30 PM	0	13	125	0	0	0	109	27	0	32	0	19	0	0	0	0
2:45 PM	0	14	135	0	0	0	114	31	0	33	0	23	0	0	0	0
3:00 PM	0	15	142	0	0	0	120	29	0	34	0	27	0	0	0	0
3:15 PM	0	16	136	0	0	0	118	33	0	36	0	28	0	0	0	0
3:30 PM	0	14	128	0	0	0	124	32	0	37	0	29	0	0	0	0
3:45 PM	0	15	127	0	0	0	130	35	0	39	0	31	0	0	0	0
4:00 PM	0	14	123	0	0	0	138	36	0	41	0	33	0	0	0	0
4:15 PM	0	14	136	0	0	0	147	38	0	37	0	29	0	0	0	0
4:30 PM	0	13	146	0	0	0	143	41	0	32	0	24	0	0	0	0
4:45 PM	0	15	163	0	0	0	141	44	0	28	0	21	0	0	0	0
5:00 PM	0	14	177	0	0	0	136	46	0	24	0	17	0	0	0	0
5:15 PM	0	17	163	0	0	0	132	49	0	25	0	18	0	0	0	0
5:30 PM	0	20	145	0	0	0	129	47	0	23	0	19	0	0	0	0
5:45 PM	0	18	136	0	0	0	127	45	0	21	0	17	0	0	0	0

AM PEAK HOUR 7:30 AM to 8:30 AM	Main Street Northbound				Main Street Southbound				Hayward Road Eastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	79	585	0	0	0	379	267	0	142	0	107	0	0	0	0
PHF	0.94				0.84				0.80				0.00			
HV %	0.0%	5.1%	1.2%	0.0%	0.0%	0.0%	4.0%	0.7%	0.0%	6.3%	0.0%	5.6%	0.0%	0.0%	0.0%	0.0%

MID PEAK HOUR 1:00 PM to 2:00 PM	Main Street Northbound				Main Street Southbound				Hayward Road Eastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	40	513	0	0	0	407	89	0	85	0	39	0	0	0	0
PHF	0.90				0.95				0.76				0.00			
HV %	0.0%	2.5%	1.2%	0.0%	0.0%	0.0%	1.7%	1.1%	0.0%	3.5%	0.0%	7.7%	0.0%	0.0%	0.0%	0.0%

PM PEAK HOUR 4:30 PM to 5:30 PM	Main Street Northbound				Main Street Southbound				Hayward Road Eastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	59	649	0	0	0	552	180	0	109	0	80	0	0	0	0
PHF	0.93				0.99				0.84				0.00			
HV %	0.0%	1.7%	0.8%	0.0%	0.0%	0.0%	0.9%	0.0%	0.0%	1.8%	0.0%	2.5%	0.0%	0.0%	0.0%	0.0%

Client: Haralampos Stathopoulos, PE, PTOE  
 Project #: 353\_C19\_HSH  
 BTM #: Location 1  
 Location: Acton, MA  
 Street 1: Main Street  
 Street 2: Hayward Road  
 Count Date: 3/19/2019  
 Day of Week: Tuesday  
 Weather: Sunny, 40°F



**HEAVY VEHICLES**

Start Time	Main Street Northbound				Main Street Southbound				Hayward Road Eastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
7:00 AM	0	1	1	0	0	0	2	1	0	0	0	0	0	0	0	0
7:15 AM	0	2	5	0	0	0	3	0	0	1	0	0	0	0	0	0
7:30 AM	0	2	2	0	0	0	12	0	0	5	0	2	0	0	0	0
7:45 AM	0	1	3	0	0	0	3	0	0	3	0	2	0	0	0	0
8:00 AM	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0
8:15 AM	0	1	1	0	0	0	0	2	0	0	0	1	0	0	0	0
8:30 AM	0	2	8	0	0	0	3	4	0	2	0	3	0	0	0	0
8:45 AM	0	2	10	0	0	0	0	0	0	5	0	3	0	0	0	0
9:00 AM	0	1	3	0	0	0	2	1	0	3	0	0	0	0	0	0
9:15 AM	0	0	1	0	0	0	4	0	0	0	0	1	0	0	0	0
9:30 AM	0	0	2	0	0	0	3	0	0	0	0	0	0	0	0	0
9:45 AM	0	1	2	0	0	0	1	1	0	1	0	1	0	0	0	0
10:00 AM	0	2	0	0	0	0	2	0	0	1	0	1	0	0	0	0
10:15 AM	0	2	1	0	0	0	3	0	0	0	0	0	0	0	0	0
10:30 AM	0	1	3	0	0	0	1	0	0	0	0	1	0	0	0	0
10:45 AM	0	1	2	0	0	0	2	1	0	1	0	0	0	0	0	0
11:00 AM	0	1	1	0	0	0	2	0	0	2	0	1	0	0	0	0
11:15 AM	0	3	1	0	0	0	2	0	0	0	0	0	0	0	0	0
11:30 AM	0	0	1	0	0	0	4	2	0	0	0	1	0	0	0	0
11:45 AM	0	1	2	0	0	0	1	0	0	0	0	1	0	0	0	0
12:00 PM	0	3	4	0	0	0	2	0	0	1	0	0	0	0	0	0
12:15 PM	0	1	1	0	0	0	1	0	0	0	0	2	0	0	0	0
12:30 PM	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0
12:45 PM	0	1	3	0	0	0	1	0	0	1	0	1	0	0	0	0
1:00 PM	0	0	1	0	0	0	2	0	0	2	0	0	0	0	0	0
1:15 PM	0	0	1	0	0	0	3	0	0	0	0	1	0	0	0	0
1:30 PM	0	0	3	0	0	0	1	1	0	1	0	0	0	0	0	0
1:45 PM	0	1	1	0	0	0	1	0	0	0	0	2	0	0	0	0
2:00 PM	0	0	4	0	0	0	3	0	0	1	0	1	0	0	0	0
2:15 PM	0	1	2	0	0	0	17	0	0	0	0	0	0	0	0	0
2:30 PM	0	0	1	0	0	0	4	1	0	2	0	1	0	0	0	0
2:45 PM	0	1	2	0	0	0	2	0	0	11	0	4	0	0	0	0
3:00 PM	0	0	2	0	0	0	2	0	0	4	0	0	0	0	0	0
3:15 PM	0	1	5	0	0	0	3	1	0	3	0	3	0	0	0	0
3:30 PM	0	0	11	0	0	0	1	0	0	6	0	1	0	0	0	0
3:45 PM	0	1	2	0	0	0	0	0	0	2	0	0	0	0	0	0
4:00 PM	0	1	4	0	0	0	1	0	0	2	0	0	0	0	0	0
4:15 PM	0	0	4	0	0	0	4	0	0	0	0	1	0	0	0	0
4:30 PM	0	1	3	0	0	0	1	0	0	1	0	0	0	0	0	0
4:45 PM	0	0	1	0	0	0	2	0	0	0	0	1	0	0	0	0
5:00 PM	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
5:30 PM	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0

AM PEAK HOUR 8:30 AM to 9:30 AM PHF	Main Street Northbound				Main Street Southbound				Hayward Road Eastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	5	22	0	0	0	9	5	0	10	0	7	0	0	0	0
	0.56				0.50				0.53				0.00			

MID PEAK HOUR 11:15 AM to 12:15 PM PHF	Main Street Northbound				Main Street Southbound				Hayward Road Eastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	7	8	0	0	0	9	2	0	1	0	2	0	0	0	0
	0.54				0.46				0.75				0.00			

PM PEAK HOUR 2:45 PM to 3:45 PM PHF	Main Street Northbound				Main Street Southbound				Hayward Road Eastbound				Westbound			
	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right	U-Turn	Left	Thru	Right
	0	2	20	0	0	0	8	1	0	24	0	8	0	0	0	0
	0.50				0.56				0.53				0.00			

Client: Haralampos Stathopoulos, PE, PTOE  
 Project #: 353\_C19\_HSH  
 BTD #: Location 1  
 Location: Acton, MA  
 Street 1: Main Street  
 Street 2: Hayward Road  
 Count Date: 3/19/2019  
 Day of Week: Tuesday  
 Weather: Sunny, 40°F

# BOSTON TRAFFIC DATA

PO BOX 1723, Framingham, MA 01701  
 Office: 978-746-1259  
 DataRequest@BostonTrafficData.com  
 www.BostonTrafficData.com

## PEDESTRIANS & BICYCLES

Start Time	Main Street Northbound				Main Street Southbound				Hayward Road Eastbound				Westbound			
	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:30 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
9:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:15 AM	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
10:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:45 PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
3:00 PM	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3:45 PM	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

AM PEAK HOUR 7:30 AM to 8:30 AM	Main Street Northbound				Main Street Southbound				Hayward Road Eastbound				Westbound			
	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

MID PEAK HOUR 1:00 PM to 2:00 PM	Main Street Northbound				Main Street Southbound				Hayward Road Eastbound				Westbound			
	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PM PEAK HOUR 4:30 PM to 5:30 PM	Main Street Northbound				Main Street Southbound				Hayward Road Eastbound				Westbound			
	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED	Left	Thru	Right	PED
	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0

NOTE: Peak hour summaries here correspond to peak hours identified for passenger car and heavy vehicles combined.



HOWARD STEIN HUDSON

Engineers + Planners

## Appendix E

### Signal Warrant Analysis

**STUDY AND ANALYSIS INFORMATION**

Municipality: Acton  
 County:  
 Engineering District: 3

Analysis Date: 5/16/2019  
 Conducted By: HS  
 Agency/Company Name: HSH

**Analysis Information**

Data Collection Date: 3/9/2019  
 Day of the Week: Tuesday

Is the intersection in a built-up area of an isolated community of <10,000 population? No

**Major Street Information**

Major Street Name and Route Number: Main Street/Rte 27  
 Major Street Approach #1 Direction: N-Bound  
 Major Street Approach #2 Direction: S-Bound

Number of Lanes for Moving Traffic on Each Major Street Approach: 1 LANE(S)  
 Speed Limit or 85th Percentile Speed on the Major Street: 35 MPH

**Minor Street Information**

Minor Street Name and Route Number: Hayward Road  
 Minor Street Approach #1 Direction: E-Bound  
 Minor Street Approach #2 Direction: N/A

Number of Lanes for Moving Traffic on Each Minor Street Approach: 1 LANE(S)

**TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS**

	Applicable?	Warrant Met?
Warrant 1, Eight-Hour Vehicular Volume	Yes	Yes
Warrant 2, Four-Hour Vehicular Volume	Yes	Yes
Warrant 3, Peak Hour	Yes	Yes
Warrant 4, Pedestrian Volume	No	N/A
Warrant 5, School Crossing	No	N/A
Warrant 6, Coordinated Signal System	No	N/A
Warrant 7, Crash Experience	No	N/A
Warrant 8, Roadway Network	No	N/A
Warrant 9, Intersection Near a Grade Crossing	No	N/A

ENTER VOLUME DATA PER 15 MINUTE INTERVAL, PER APPROACH						
Time Interval		Major Street Approach #1 (N-Bound)	Major Street Approach #2 (S-Bound)	Major Street Combined	Minor Street Approach #1 (E-Bound)	Minor Street Approach #2 (N/A)
Begin At	End Of	Volume	Volume	Total Volume	Volume	Volume
12:00 AM	12:14 AM			0		
12:15 AM	12:29 AM			0		
12:30 AM	12:44 AM			0		
12:45 AM	12:59 AM			0		
1:00 AM	1:14 AM			0		
1:15 AM	1:29 AM			0		
1:30 AM	1:44 AM			0		
1:45 AM	1:59 AM			0		
2:00 AM	2:14 AM			0		
2:15 AM	2:29 AM			0		
2:30 AM	2:44 AM			0		
2:45 AM	2:59 AM			0		
3:00 AM	3:14 AM			0		
3:15 AM	3:29 AM			0		
3:30 AM	3:44 AM			0		
3:45 AM	3:59 AM			0		
4:00 AM	4:14 AM			0		
4:15 AM	4:29 AM			0		
4:30 AM	4:44 AM			0		
4:45 AM	4:59 AM			0		
5:00 AM	5:14 AM			0		
5:15 AM	5:29 AM			0		
5:30 AM	5:44 AM			0		
5:45 AM	5:59 AM			0		
6:00 AM	6:14 AM			0		
6:15 AM	6:29 AM			0		
6:30 AM	6:44 AM			0		
6:45 AM	6:59 AM			0		
7:00 AM	7:14 AM	121	80	201	16	
7:15 AM	7:29 AM	137	85	222	31	
7:30 AM	7:44 AM	151	166	317	45	
7:45 AM	7:59 AM	164	193	357	62	
8:00 AM	8:14 AM	173	154	327	78	
8:15 AM	8:29 AM	176	133	309	64	
8:30 AM	8:44 AM	179	130	309	48	
8:45 AM	8:59 AM	169	122	291	52	
9:00 AM	9:14 AM	153	115	268	55	
9:15 AM	9:29 AM	137	108	245	52	
9:30 AM	9:44 AM	118	102	220	48	
9:45 AM	9:59 AM	99	97	196	47	
10:00 AM	10:14 AM	78	91	169	45	
10:15 AM	10:29 AM	90	85	175	40	
10:30 AM	10:44 AM	100	91	191	32	
10:45 AM	10:59 AM	114	97	211	31	
11:00 AM	11:14 AM	126	104	230	25	
11:15 AM	11:29 AM	123	112	235	29	
11:30 AM	11:44 AM	124	116	240	31	
11:45 AM	11:59 AM	128	110	238	35	

ENTER VOLUME DATA PER 15 MINUTE INTERVAL, PER APPROACH						
Time Interval		Major Street Approach #1 (N-Bound)	Major Street Approach #2 (S-Bound)	Major Street Combined	Minor Street Approach #1 (E-Bound)	Minor Street Approach #2 (N/A)
Begin At	End Of	Volume	Volume	Total Volume	Volume	Volume
12:00 PM	12:14 PM	129	111	240	37	
12:15 PM	12:29 PM	138	113	251	33	
12:30 PM	12:44 PM	142	115	257	28	
12:45 PM	12:59 PM	150	116	266	25	
1:00 PM	1:14 PM	154	120	274	22	
1:15 PM	1:29 PM	145	121	266	28	
1:30 PM	1:44 PM	132	125	257	33	
1:45 PM	1:59 PM	122	130	252	41	
2:00 PM	2:14 PM	108	133	241	47	
2:15 PM	2:29 PM	124	140	264	49	
2:30 PM	2:44 PM	138	136	274	51	
2:45 PM	2:59 PM	149	145	294	56	
3:00 PM	3:14 PM	157	149	306	61	
3:15 PM	3:29 PM	152	151	303	64	
3:30 PM	3:44 PM	142	156	298	66	
3:45 PM	3:59 PM	142	165	307	70	
4:00 PM	4:14 PM	137	174	311	74	
4:15 PM	4:29 PM	150	185	335	66	
4:30 PM	4:44 PM	159	184	343	56	
4:45 PM	4:59 PM	178	185	363	49	
5:00 PM	5:14 PM	191	182	373	41	
5:15 PM	5:29 PM	180	181	361	43	
5:30 PM	5:44 PM	165	176	341	42	
5:45 PM	5:59 PM	154	172	326	38	
6:00 PM	6:14 PM			0		
6:15 PM	6:29 PM			0		
6:30 PM	6:44 PM			0		
6:45 PM	6:59 PM			0		
7:00 PM	7:14 PM			0		
7:15 PM	7:29 PM			0		
7:30 PM	7:44 PM			0		
7:45 PM	7:59 PM			0		
8:00 PM	8:14 PM			0		
8:15 PM	8:29 PM			0		
8:30 PM	8:44 PM			0		
8:45 PM	8:59 PM			0		
9:00 PM	9:14 PM			0		
9:15 PM	9:29 PM			0		
9:30 PM	9:44 PM			0		
9:45 PM	9:59 PM			0		
10:00 PM	10:14 PM			0		
10:15 PM	10:29 PM			0		
10:30 PM	10:44 PM			0		
10:45 PM	10:59 PM			0		
11:00 PM	11:14 PM			0		
11:15 PM	11:29 PM			0		
11:30 PM	11:44 PM			0		
11:45 PM	11:59 PM			0		
<b>Approach Totals:</b>		6198	5856	12054	1986	0

**MUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME**

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	1 Lane
Minor Street:	1 Lane

Built-up Isolated Community With Less Than 10,000 Population or Above 40 MPH on Major Street?	No
---	----

Combination of Conditions A and B Necessary?\*: No

*\*Only applicable for Warrant 1 if after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems. See Section 4C.02 of the 2009 MUTCD for application.*

Condition A - Minimum Vehicular Volume									
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor street approach (one direction only)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	500	400	350	280	150	120	105	84
2 or More	1	600	480	420	336	150	120	105	84
2 or More	2 or More	600	480	420	336	200	160	140	112
1	2 or More	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic									
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor street approach (one direction only)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	750	600	525	420	75	60	53	42
2 or More	1	900	720	630	504	75	60	53	42
2 or More	2 or More	900	720	630	504	100	80	70	56
1	2 or More	750	600	525	420	100	80	70	56

**Condition A Evaluation**

Number of Unique Hours Met: 7 Condition A Satisfied? No

**Condition B Evaluation**

Number of Unique Hours Met: 11 Condition B Satisfied? Yes

**Combination of Condition A and Condition B Evaluation**

Number of Unique Hours Met for Condition A: N/A

Number of Unique Hours Met for Condition B: N/A

Combination of Condition A and Condition B Satisfied? N/A

**MUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME**

Number of Lanes for Moving Traffic on Each Approach	
Major Street:	1 Lane
Minor Street:	1 Lane

Total Number of Unique Hours Met On Figure 4C-1
<b>10</b>

Built-up Isolated Community With Less Than 10,000 Population or Above 40 MPH on Major Street?
No

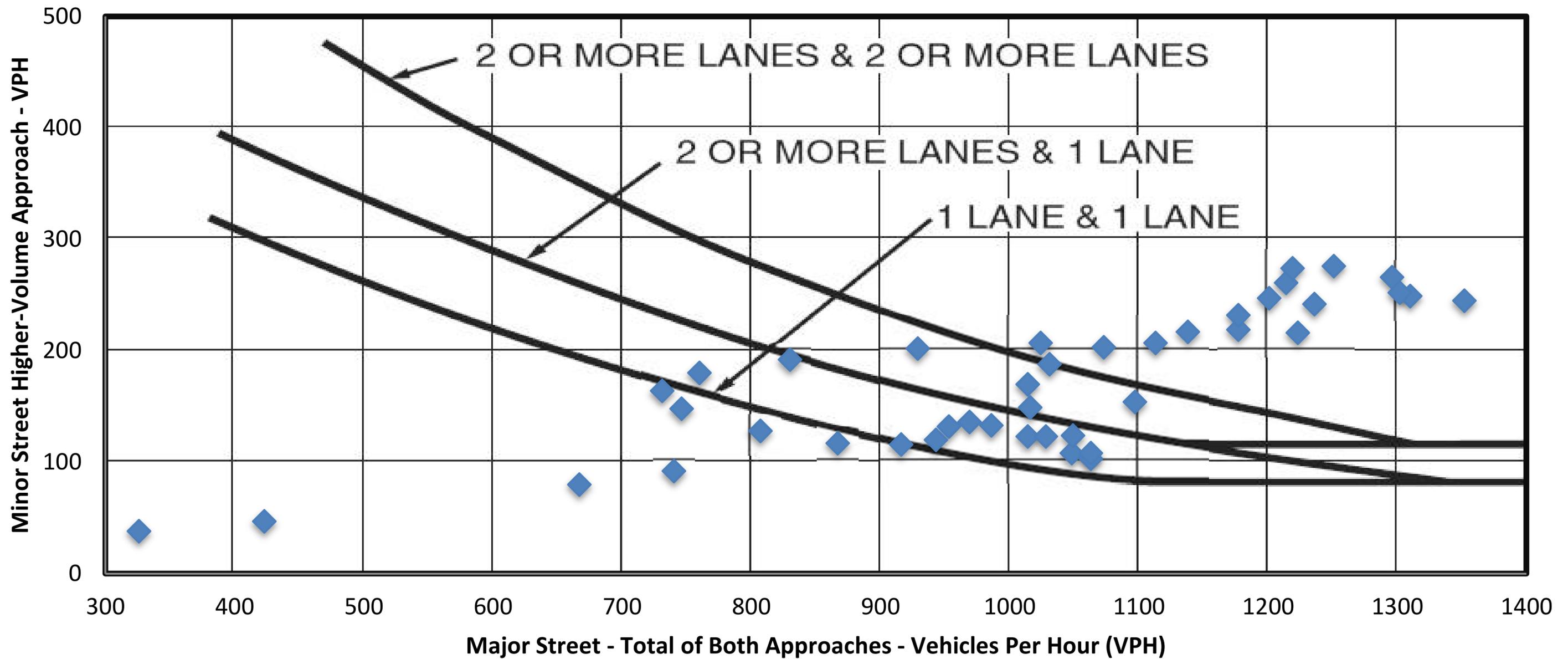
Hourly Vehicular Volume			
Hour Interval	Major Street Combined	Highest Minor Street Approach	Hour Met?
Beginning At	Vehicles Per Hour (VPH)	Vehicles Per Hour (VPH)	
12:00 AM	0	0	
12:15 AM	0	0	
12:30 AM	0	0	
12:45 AM	0	0	
1:00 AM	0	0	
1:15 AM	0	0	
1:30 AM	0	0	
1:45 AM	0	0	
2:00 AM	0	0	
2:15 AM	0	0	
2:30 AM	0	0	
2:45 AM	0	0	
3:00 AM	0	0	
3:15 AM	0	0	
3:30 AM	0	0	
3:45 AM	0	0	
4:00 AM	0	0	
4:15 AM	0	0	
4:30 AM	0	0	
4:45 AM	0	0	
5:00 AM	0	0	
5:15 AM	0	0	
5:30 AM	0	0	
5:45 AM	0	0	
6:00 AM	0	0	
6:15 AM	201	16	
6:30 AM	423	47	
6:45 AM	740	92	
7:00 AM	1097	154	Met
7:15 AM	1223	216	Met
7:30 AM	1310	249	Met
7:45 AM	1302	252	Met
8:00 AM	1236	242	Met
8:15 AM	1177	219	Met
8:30 AM	1113	207	Met
8:45 AM	1024	207	Met
9:00 AM	929	202	Met
9:15 AM	830	192	Met
9:30 AM	760	180	Met
9:45 AM	731	164	
10:00 AM	746	148	
10:15 AM	807	128	
10:30 AM	867	117	

# Traffic Signal Warrant Analysis Workbook

6/20/2019

Hourly Vehicular Volume			
Hour Interval	Major Street Combined	Highest Minor Street Approach	Hour Met?
Beginning At	Vehicles Per Hour (VPH)	Vehicles Per Hour (VPH)	
10:45 AM	916	116	
11:00 AM	943	120	Met
11:15 AM	953	132	Met
11:30 AM	969	136	Met
11:45 AM	986	133	Met
12:00 PM	1014	123	Met
12:15 PM	1048	108	Met
12:30 PM	1063	103	Met
12:45 PM	1063	108	Met
1:00 PM	1049	124	Met
1:15 PM	1016	149	Met
1:30 PM	1014	170	Met
1:45 PM	1031	188	Met
2:00 PM	1073	203	Met
2:15 PM	1138	217	Met
2:30 PM	1177	232	Met
2:45 PM	1201	247	Met
3:00 PM	1214	261	Met
3:15 PM	1219	274	Met
3:30 PM	1251	276	Met
3:45 PM	1296	266	Met
4:00 PM	1352	245	Met
4:15 PM	1414	212	Met
4:30 PM	1440	189	Met
4:45 PM	1438	175	Met
5:00 PM	1401	164	Met
5:15 PM	1028	123	Met
5:30 PM	667	80	
5:45 PM	326	38	
6:00 PM	0	0	
6:15 PM	0	0	
6:30 PM	0	0	
6:45 PM	0	0	
7:00 PM	0	0	
7:15 PM	0	0	
7:30 PM	0	0	
7:45 PM	0	0	
8:00 PM	0	0	
8:15 PM	0	0	
8:30 PM	0	0	
8:45 PM	0	0	
9:00 PM	0	0	
9:15 PM	0	0	
9:30 PM	0	0	
9:45 PM	0	0	
10:00 PM	0	0	
10:15 PM	0	0	
10:30 PM	0	0	
10:45 PM	0	0	
11:00 PM	0	0	

MUTCD Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume





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