

Montachusett Regional Planning Commission

Harvard Town Center Transportation Study

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Introduction and Overview

Purpose

The Town of Harvard requested the Montachusett Regional Planning Commission (MRPC) to conduct a study of the Town Center and Town Hall in order to address several areas of concern. As part of this study, the town created a Town Center Transportation Committee to assist, offer guidance and provide local knowledge that would contribute to a working document. The goal of this study is to assess the conditions and problems that may exist in the Town Common study area and offer alternatives, recommendations and avenues to address issues where necessary.

Study Organization

The study is organized both by geographic areas and by facilities. That is, the sections consider the areas around the Common and the Town Hall respectively; followed by pathways then parking, with bicycles discussed in the section concerning the area around the Common. But it should be stressed that the study is focused on developing, and the recommendations present, an integrated plan for Town Center traffic, pedestrians, bicyclist, parking and walkways. Although not every recommendation depends critically on every other one, they are explicitly intended to be consistent, and to present a plan for Town Center transportation infrastructure that will enable the Town of Harvard to maintain a vibrant, multi-use Town Center for decades into the future.

Town Committee

In May of 2015, the Town of Harvard created the “Town Center Transportation Committee” (TCTC) to assist in the development of this study. The TCTC received the following charge from the town:

The Town Center Transportation Committee shall investigate circulation issues in the Town Center and make recommendations for improvements to all matters within the public realm. These may include, but are not limited to, traffic flow, sidewalks/pedestrian paths, parking, right-of-way improvements, vehicular movement around the Town Hall/Hildreth House/Fire Station complex, bicycle safety, and signage. The Committee shall meet regularly with staff from the Montachusett Regional Planning Commission (MRPC) to review data and analysis and provide a sounding board for potential recommendations. The Committee shall assess MRPC’s final report to insure that it

provides an integrated strategy for improving the circulation system in the Town Center. The Committee may set priorities for action, including preparing engineering studies, applying for grant sources, seeking Town Meeting appropriations for low cost improvements, and other matters aimed at improving circulation in the Town Center.

Regular meetings were held between the MRPC and the TCTC to present data and options throughout the study process. The TCTC provided feedback and input that directed the development of the various alternatives compiled in this study. In addition, the TCTC directed their focus on the pedestrian, bicycle and parking issues prevalent in the Town Common/Town Hall study area.

Prior Studies and Reports

The town of Harvard provided the MRPC with several prior studies and maps dealing with the Town Center at the start of this process. These reports helped to lay some of the groundwork for this analysis as they document some of the current conditions present in the study area. In addition, they provided various recommendations related to the different modes present, i.e. vehicular, walking and bicycling, and their connections to each other.

The information provided included the following:

- Volumes & Crash Location Map - Draft Harvard Master Plan, 2014
- Safe Routes to School Study for Harvard Elementary School - September 2010
- Proposed Expansion of Pedestrian Network, Harvard Town Center - Draft Harvard Master Plan, 2014
- Traffic & Parking Section of the Harvard Town Center Action Plan by the Bluestone Planning Group
- Recreational Trails Proposal Figure - April 2005
- Safe Routes to School Conflicts Map - November 2007

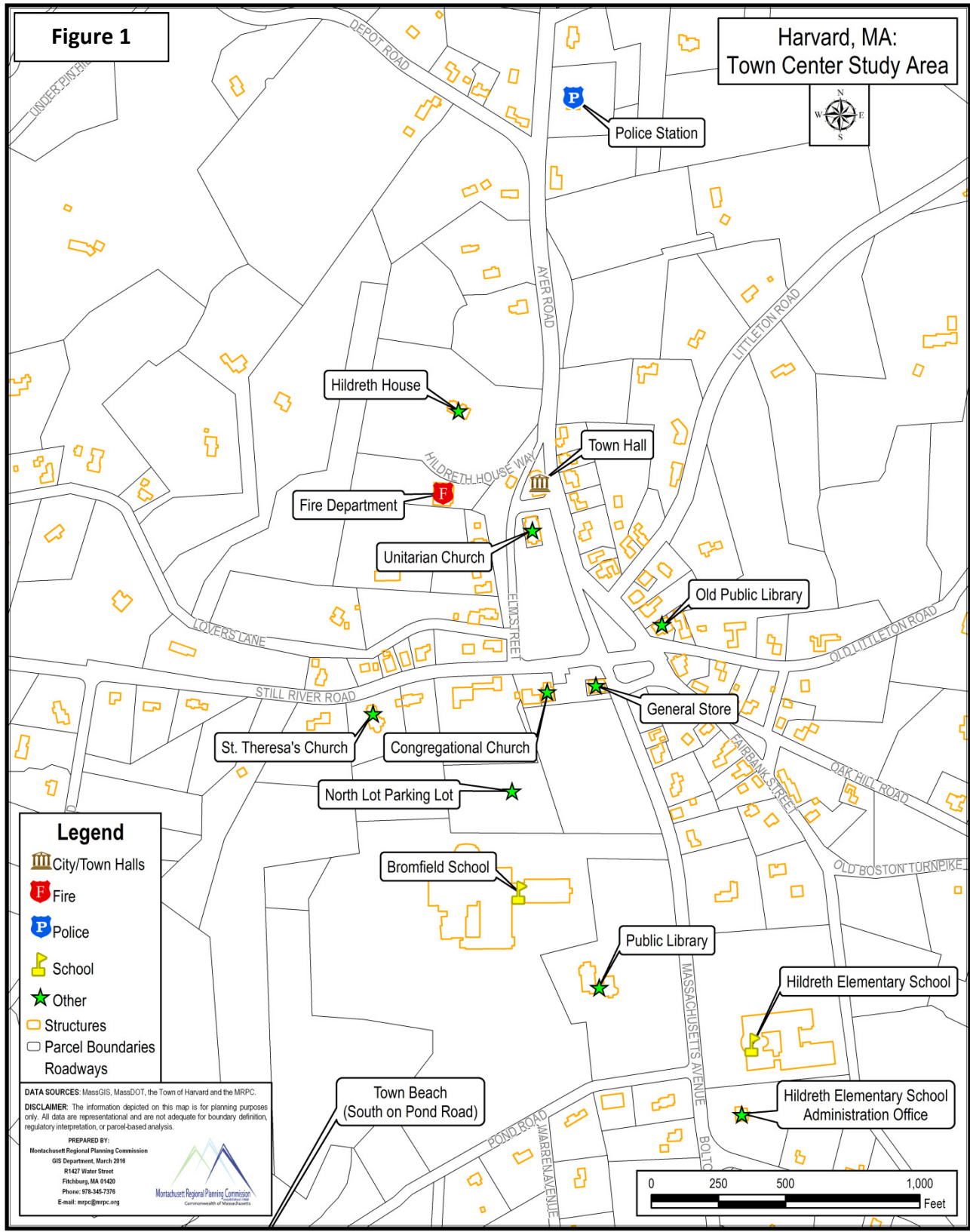
Throughout this report reference will be made to the studies, in particular the Harvard Town Center Action Plan (*Action Plan*).

Study Area

Harvard Center (Center) lies at the intersection of Route 110/111 (Ayer Rd)/Route 111 (Mass Ave) and Route 110 (Still River Rd)/Old Littleton Rd (see Figure 1). All through and turn movements are permitted at this intersection. Ayer Rd connects Harvard to Route 2 and

communities to the north while Mass Ave connects Harvard to I-495 and communities to the east. Still River Rd connects Harvard to communities to the south/southwest. Located just north of the intersection are the Harvard Town Hall and the Fire department, and further north on Ayer Rd, the Police Department. Located just south on the intersection on Mass Ave are the Bromfield School, the Hildreth Elementary School, the Harvard Public Library, and farther to the southwest is the Town Beach.

The other important intersection is the Fairbanks St and Old Littleton Rd intersection located just east of the Ayer Rd/Mass Ave and Still River Rd/Old Littleton Rd intersection. All through and turn movements are permitted. Old Littleton Rd connects Harvard to communities to the east/northeast while Fairbanks St provides access to Ayer Rd to the north and to the Hildreth School and Mass Ave to the south. Littleton Rd lies just north of the intersection and also connects Harvard to communities to the east/northeast. Elm St lies west of Ayer Rd and provides access to the Fire Department, Town Hall, and Hildreth House.



Town Center – Ayer Rd / Fairbanks St / Mass Ave / Still River Rd / Elm St Area

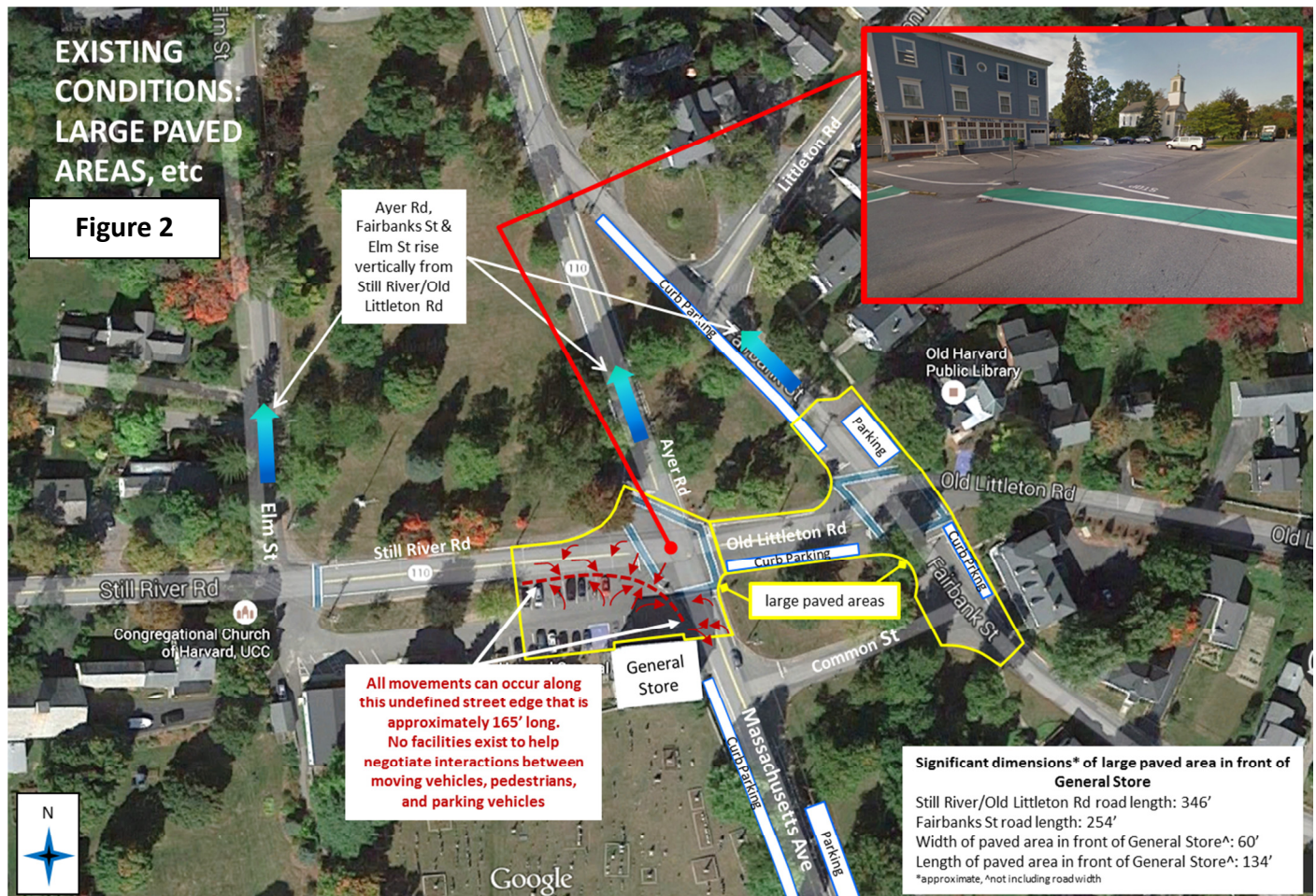
Existing Conditions

Large Paved Areas, etc.

The *Action Plan* describes the Ayer Rd/Mass Ave and Still River Rd/Old Littleton Rd intersection as an area of “...*undefined street edges with poor pedestrian crossings...*” The two improvements have been implemented since the completion of the *Action Plan* have been its conversion into a 4-way STOP controlled intersection and the crosswalk pavement markings are more clearly defined. The “*undefined street edges*” create a large paved area in front of the General Store (see Figure 2). Not including the road widths, the large paved area covers approximately 8,040 square feet (approximately 60’ by 134’). With the road widths (see *Existing Pavement Width* Figure 12), the area increases by 83% to approximately 14,740 square feet (approximately 91’ by 162’).

The undefined street edge along the paved area in front of the General Store allows entering and exiting motor vehicles, pedestrians, and bicyclist to use any point along the entire street edge to perform their desired movement. The length of this undefined street edge is approximately one-hundred and sixty-five feet (represented by maroon dotted line in Figure 2). This condition establishes a hazardous safety situation for other users whether the users are in motor vehicles, or are pedestrians or bicyclists as they do not know what direction an oncoming user is approaching from. There is the potential for crashes involving motor vehicles and pedestrians or bicyclists that increases the potential of high crash severity.

The other large paved area depicted in Figure 2 lies to the east of Ayer Rd/Mass Ave. The approximate pavement width and length of Old Littleton Rd in between Ayer Rd and Fairbanks St is thirty-six feet wide by one-hundred and thirty feet long. The approximate length of the large paved area on Fairbanks St is two-hundred and fifty-four feet while the approximate



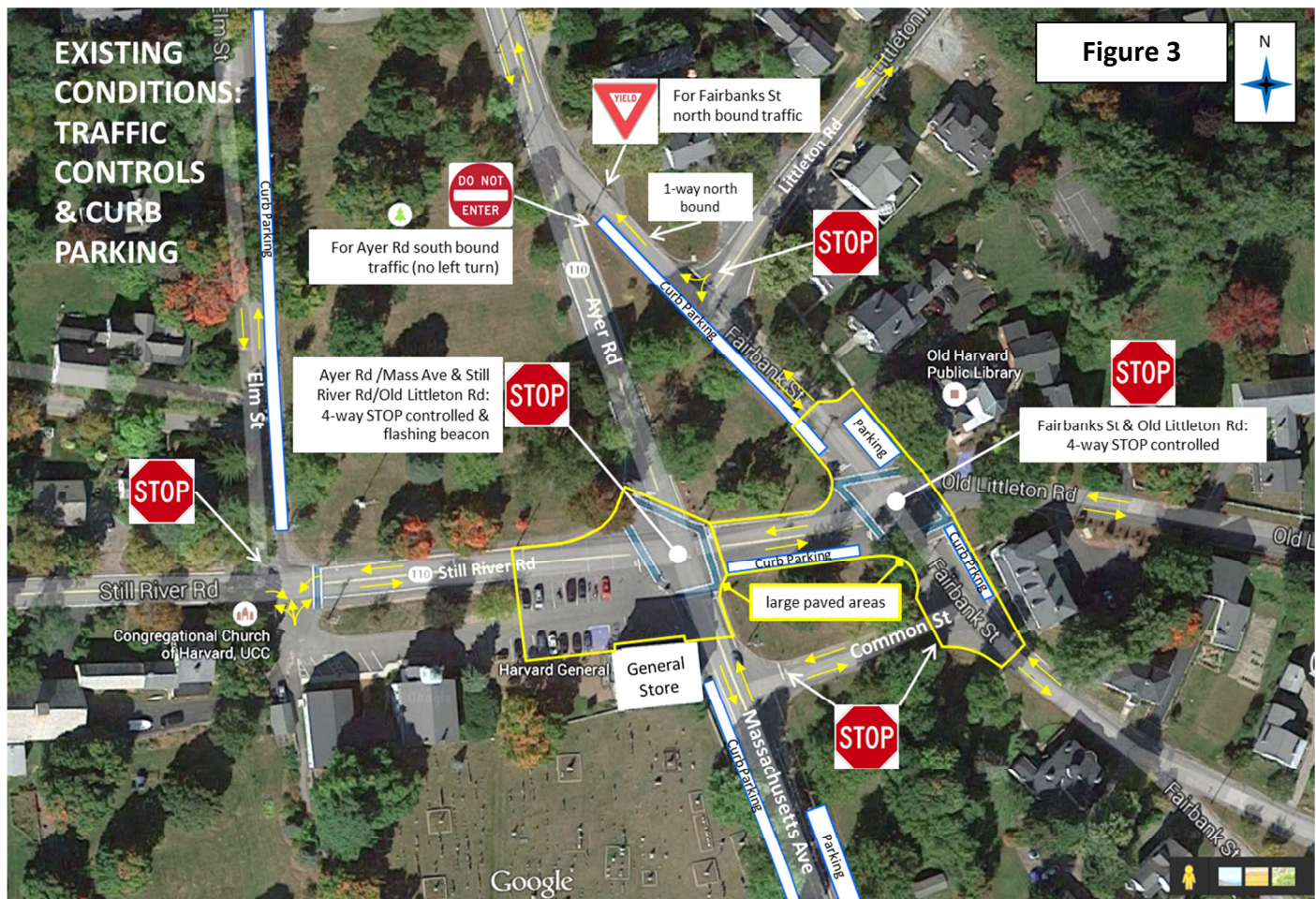
pavement width ranges from forty-eight feet to the south and fifty-three feet to the north of the Fairbanks St and Old Littleton Rd intersection.

All but one corner radii in the large paved areas are wide (see [Pavement Widths](#) section below for more). Ayer Rd, Fairbanks St, and Elm St gradually rise vertically from Still River/Old Littleton Rd to just beyond the Town Hall.

Traffic Controls and Curb Parking

The Ayer Rd/Mass Ave and Still River Rd/Old Littleton Rd intersection and the Fairbanks St and Old Littleton Rd intersection are both four-way STOP controlled intersections (see Figure 3).

The Ayer Rd/Mass Ave and Still River Rd/Old Littleton Rd intersection includes an overhead four-way STOP flashing beacon. Elm St, Littleton St, and Common St (at both ends) are STOP controlled. Fairbanks St, where it intersects with Ayer Rd, is YIELD controlled and a one-way road northbound that includes a DO NOT ENTER sign to alert southbound traffic on Ayer Rd to avoid entering Fairbanks St. Stop lines exist at all STOP controlled intersections. All other types of signage and pavement markings are lacking. This includes signage such as advanced warning signs and pavement markings such as a yield line.



Informal curb parking occurs along the southwest side of Fairbanks St north of the Fairbanks St and Old Littleton Rd intersection; on the south side of Old Littleton Rd in between Ayer Rd and Fairbanks St; on the west side of Mass Ave to Pond St; and along the east side of Elm St.

Informal perpendicular parking occurs along the east side of Mass Ave just south of Common St. The paved area in front of the General Store provides off-street parking for the General Store and the Congregational Church.

Traffic: All Motor Vehicle Traffic (including Truck & Bus), etc

The *Action Plan* described existing motor vehicle traffic volume (traffic volume) through the Center as relatively light, but increasing in recent years. A recent twenty-four hour traffic count

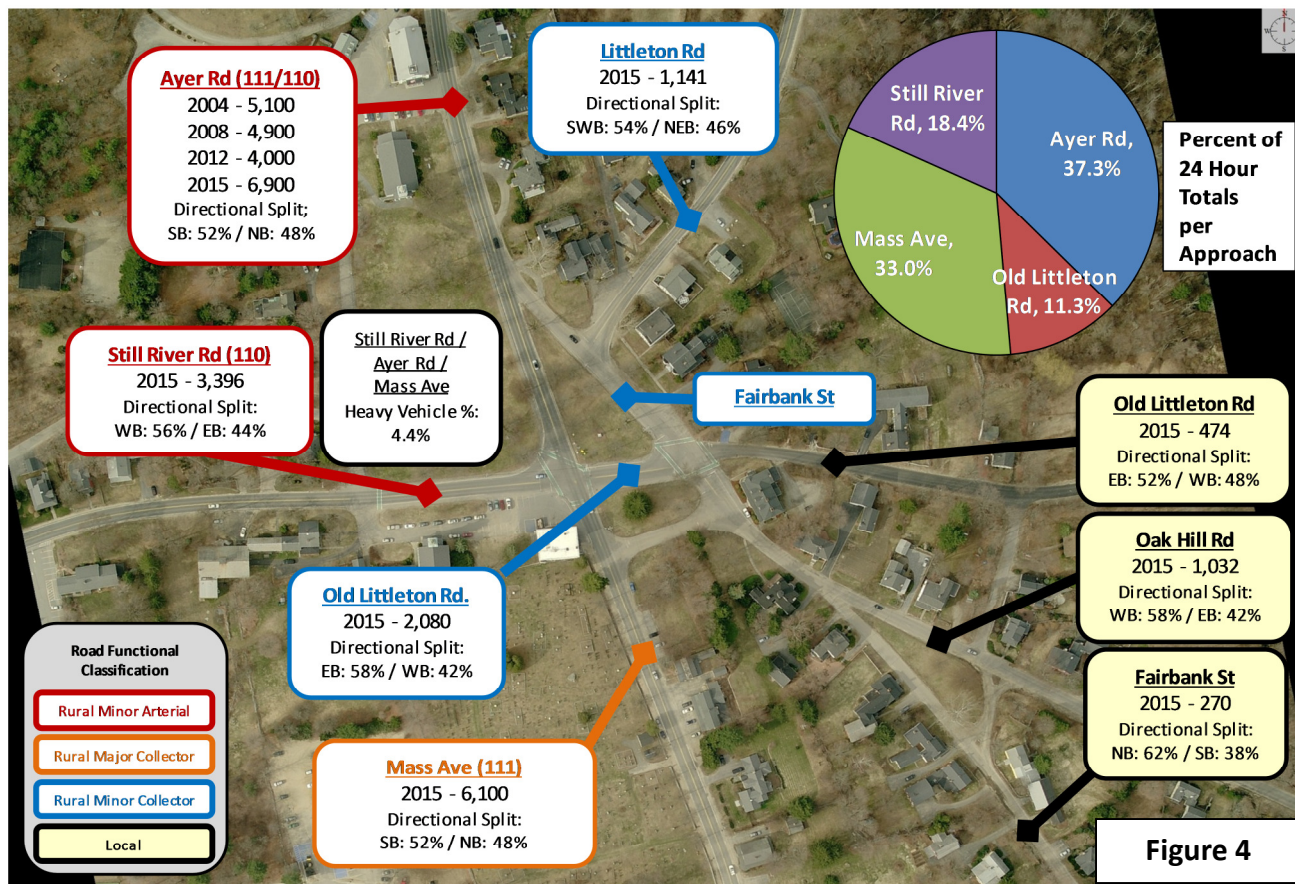


Figure 4

conducted on Ayer Rd confirms that traffic volume is light but has increased (see Figure 4) for at least Ayer Rd when compared to previous traffic counts taken at the same approximate location. Since 2004, traffic volume has increased by 1,800 motor vehicles for a 35% increase for a yearly growth rate of 3.2% over the eleven year period. Any increase in traffic volume is most likely the result of recent commercial and residential development that has occurred at Devens as well as other new developments that have occurred in surrounding communities.

Of the four streets that intersect at the Ayer Rd/Mass Ave and Still River Rd/Old Littleton Rd intersection, Ayer Rd (37%) and Mass Ave (33%) combined for 70% of the total traffic volume at the intersection indicating that traffic flows predominately north and south. Still River Rd handles 18% while Old Littleton Rd handles only 11% of the total traffic volume at the intersection. Traffic directional split on the Ayer Rd and Mass Ave north/south corridor is 52%

southbound (SB) and 48% northbound (NB). Directional split on Still River Rd is 56% westbound (WB) and 44% eastbound (EB) while on Old Littleton Rd it is 58% EB and 42% WB.

Of the remaining four streets depicted in Figure 4 where twenty-four hour motor vehicle traffic counts were conducted, only Littleton Rd and Oak Hill Rd experienced traffic volumes slightly over 1,000 motor vehicles. The heavy vehicle percentage of traffic volume (bus/2 axle, 6 tire vehicles or larger) on Still River Rd / Ayer Rd / Mass Ave was 4.4% while on Fairbanks St the percentage was 7.2% which was most likely due to bus traffic from the Hildreth Elementary School.

Intersection Turning Movement Count (TMC) & Intersection Level of Service (LOS)

An intersection TMC is conducted to quantify the movement of motor vehicles through an intersection. The movement of a motor vehicle after arriving at an intersection approach can typically be a straight through movement, a left turn movement, or a right turn movement. The counting and totaling in fifteen minute intervals of the number of motor vehicles making each movement from each approach is referred to as an intersection TMC. In this study, the TMCs for a twenty-four hour period are presented for the Ayer Rd/Mass Ave and Still River Rd/Old Littleton Rd intersection (Intersection). The AM and PM TMCs were used to determine the LOS for the Intersection (see Figure 5).

An intersection LOS quantifies the degree of delay and comfort drivers experience as they travel through it from each affected approach. LOS is used to assess the operation of an intersection.

LOS	LOS Four-way Stop-Controlled	
	Average Control Delay (seconds per vehicle)	Description
A	0-10	Little or no delay. Nearly all drivers experience freedom of movement
B	>10 – 15	Short traffic delays. Some drivers begin to experience and acceptable amount of delay
C	>15 – 25	Average traffic delays. More drivers begin to experience a restricted amount of delay
D	>25 – 35	Long traffic delays. Most drivers experience a restrictive amount of delay
E	>35 – 50	Very long traffic delays. Drivers experience a nearly intolerable level of delay
F	>50	Extreme traffic delays. Drivers experience an intolerable level of delay

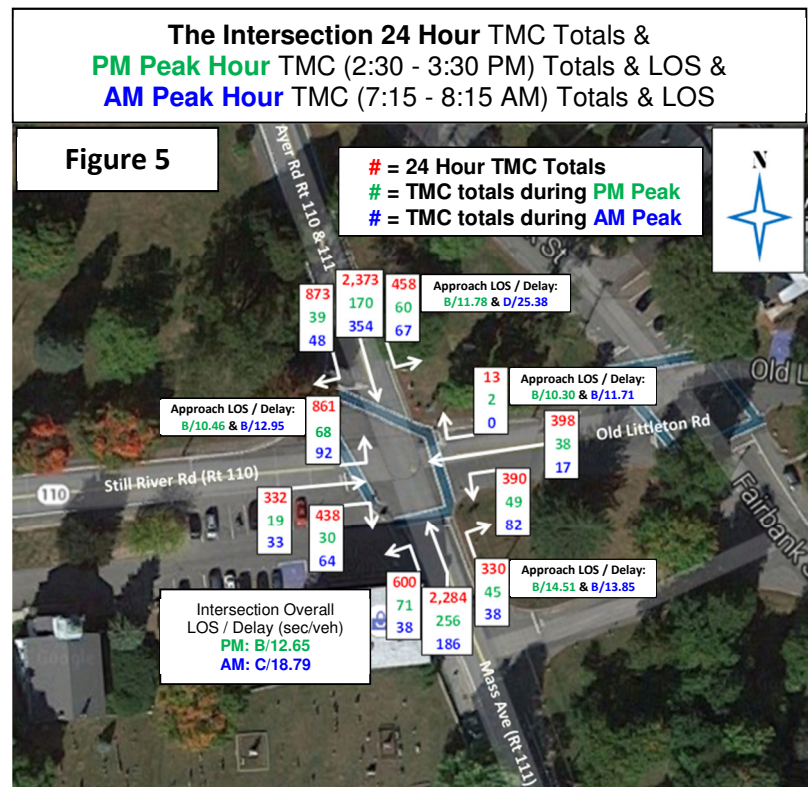
Since the Intersection is a four-way STOP controlled intersection, each driver must stop at each approach and their decision to proceed with their desired movement is affected by the traffic conditions on the other three approaches. As a result of this the LOS for each approach must be

determined (see Figure 5). The LOS criteria are divided into six letter grades (A – F) and are defined by the average amount of control delay (in seconds per vehicle) experienced by a vehicle stopped at an intersection approach due to the STOP sign. The LOS table above provides the LOS average control delay criteria for four-way STOP controlled intersections.

Intersection TMC Totals

At the Intersection over a 24-hour period a total of 9,350 motor vehicles moved through, turned right or turned left (see Figure 5).

- Ayer Rd NB received a 33.8% share of the total motor vehicles from 3 movements – the Mass Ave NB through movement (72.3% of the share), the Still River Rd NB left turn movement (27% of the share), and the **Old Littleton Rd NB right movement (.04% of the share)**. The most logical reason for the very low share of Old Littleton Rd NB right turn movement traffic is that most NB drivers at the Fairbanks St and Old Littleton Rd intersection are driving to the Ayer Rd and Fairbanks St intersection.



- Mass Ave SB received a 34.2% share of the total motor vehicles from three movements – the Ayer Rd SB through movement (74% of the share), the Old Littleton Rd SB left turn movement (12% of the share), and the Still River Rd EB right turn movement (14% of the share).
- Still River Rd WB received a 20% share of the total motor vehicles from three movements - the Ayer Rd SB right turn movement (46.7% of the share), the Old Littleton Rd WB through movement (21.3% of the share), and the Mass Ave NB left turn movement (32.1%).

- Old Littleton Rd EB received a 12% of the total motor vehicles from three movements - the Ayer Rd SB left turn movement (40.9% of the share), the Still River Rd EB through movement (29.6% of the share), and the Mass Ave NB right turn movement (29.5% of the share).

Intersection AM Peak and PM Peak Hours LOS

The Intersection LOS letter grade for the **AM Peak Hour** was **B** for the EB Old Littleton Rd approach, the NB Mass Ave approach, and the WB Still River Rd approach (see Figure 5). The sole exception was the SB Ayer Rd approach which received a **D** letter grade. The overall Intersection LOS letter grade was a **C**. The results of SB Ayer Rd approach can be explained as follows: 46.2% of the total traffic volume (469 of 1,016 motor vehicles) of the **AM Peak Hour** traversed the Intersection through the SB approach. SB drivers experienced long traffic delays as a result of a restrictive, but not intolerable, amount of average control delay of 25.4 seconds per vehicle. A distant second, the NB Mass Ave approach experienced 25.8% of the total traffic volume (262 of 1,016 motor vehicles) of the **AM Peak Hour**.

The Intersection LOS letter grade for the **PM Peak Hour** was **B** for all the approaches and thus a **B** LOS for the overall Intersection LOS. The results can be explained as follows: the total traffic volume (847 motor vehicles) of the **PM Peak Hour** was 16.6% lower (by 169 motor vehicles) than the **AM Peak Hour** (1,016 motor vehicles). Also, the approach with the highest total traffic volume for the **PM Peak Hour**, the NB Mass Ave approach, was 20.7% (or 97 motor vehicles) lower than the **AM Peak Hour** approach with the highest total traffic volume (469 to 372 motor vehicles). NB drivers experienced short traffic delays as a result of an acceptable amount of average control delay of 13.9 seconds per vehicle.

Pedestrian and Bicycle Facilities

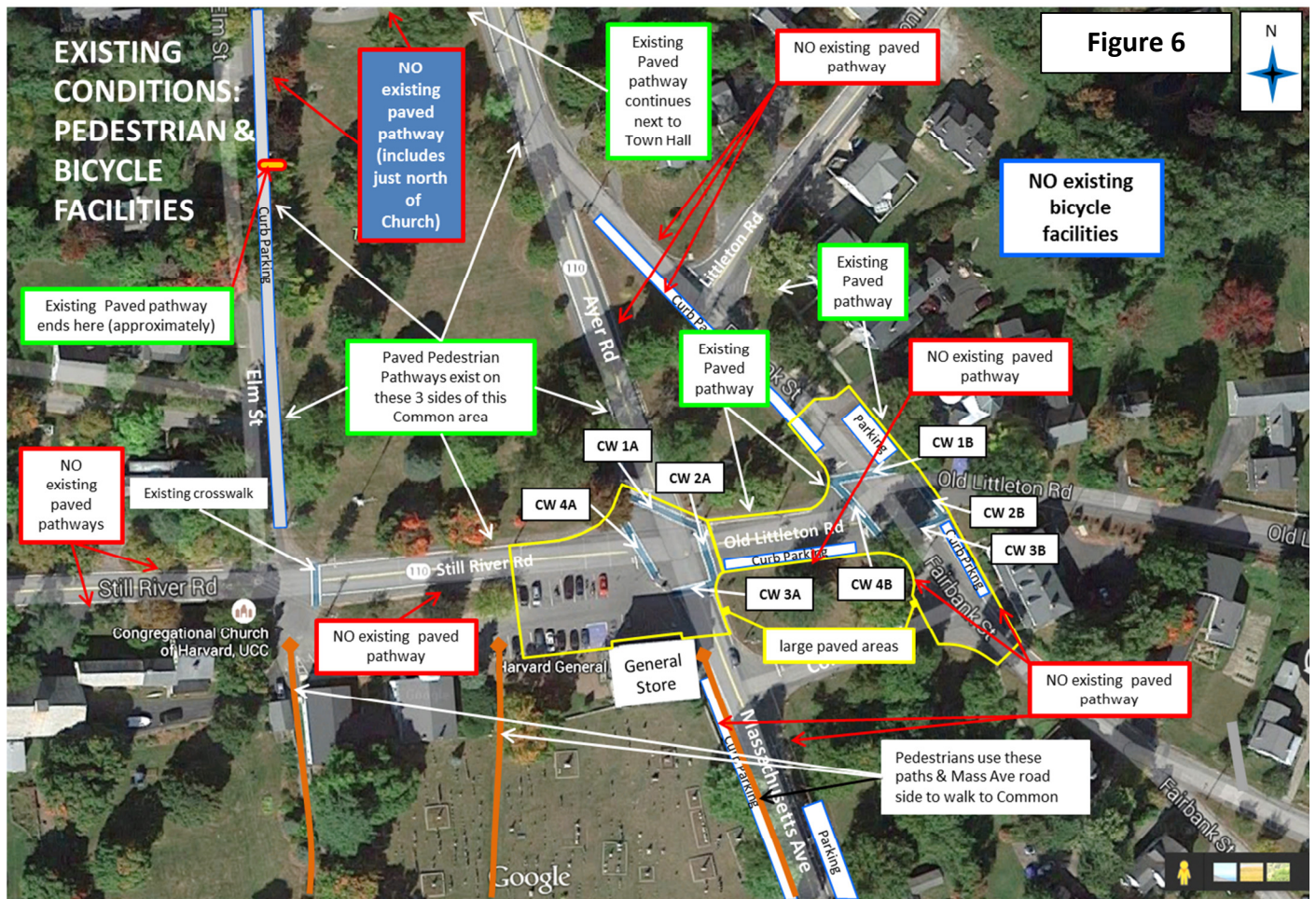
The Center lacks all types of bicycle facilities such as bike lanes and bike racks (see Figure 6).

The *Action Plan* describes the pedestrian facilities of the Center as having ill-defined curb edges and poorly designed crosswalks.

The current conditions of the existing pedestrian facilities of the Center are:

- Paved pedestrian pathways exist:
 - On the east and south sides of the large Common in between Elm St and Ayer Rd and south of indicated location on Elm St as depicted on Figure 6

- On the Ayer Rd side of the Town Hall
- On the south side of the small Common in between Ayer Rd and Fairbanks St
- On the east side of Fairbanks St in between Littleton Rd and Old Littleton Rd



However, the pathways are not accessible for persons with disabilities (or not ADA compliant)

- All existing crosswalks (with the exception of the Elm St intersection crosswalk) are excessively long which is largely the result of being located within large paved areas where the intersection approach road widths are wide, the skewed angle of some of the crosswalks, and the wide corner radii on all but one of the eight corners of both intersections. This results in pedestrian exposure to traffic for a maximum amount of time.

Crosswalk Length				
Ayer Rd/Mass Ave and Still River Rd/Old Littleton Rd intersection				
	CW 1A	CW 2A	CW 3A	CW 4A
Length	65'	46'	34'	69'
Fairbanks St and Old Littleton Rd intersection				
	CW 1B	CW 2B	CW 3B	CW 4B
Length	60'	45'	55'	68'

- Five of the eight crosswalks range in length from fifty-five to sixty-five feet (CW = crosswalk, see Figure 6 for corresponding CW#A and CW#B crosswalks)
- All crosswalk curb ramps are not accessible for persons with disabilities as the changes in level and grates located at crosswalks pose a hazard



- Pedestrians use two informal pathways on the south side of Still River Rd and the road side along Mass Ave to access locations in the Common, the Bromfield School, the Hildreth Elementary School, the Public Library, and other destinations to the south:
 - Pathway on the west side of the cemetery
 - Pathway through the approximate center of the cemetery
 - Both road sides along Mass Ave where no formal (paved) pedestrian facilities exist

However, the pathways are not accessible for persons with disabilities

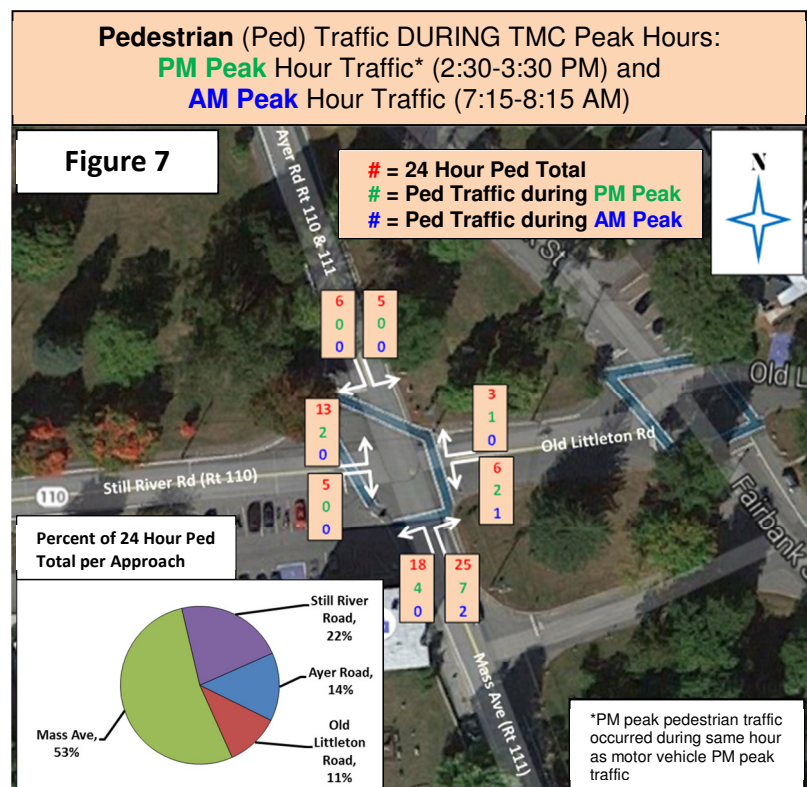
- No formal (paved) pedestrian facilities exist:
 - On Elm St north of indicated location on Figure 6 and north side of Unitarian Church
 - On south side of Still River Rd and Old Littleton Rd
 - On east side of Ayer Rd
 - On either side of Still River Rd west of Elm St
 - On west side of Fairbanks St & east side of Fairbanks St north of Littleton Rd
 - On east and west sides of Fairbanks St south of Old Littleton Rd

Pedestrian, Bicycle, Truck, Bus Traffic at the Intersection

This pedestrian, bicycle, truck, and bus traffic analysis finds the AM and PM peak hours of each mode. The analyses then compares the hours the AM and PM peak hours of when each mode occurred to when the AM and PM peak hours of motor vehicle traffic occurred to see if they coincide with each other.

A: Intersection Existing Pedestrian (Ped) Traffic during 24-hour TMC Period, during TMC AM and PM Peak Hours, Ped Traffic AM and PM Peak Hours

- A total of eighty-one Peds used the Intersection during the 24-hour period. The Mass Ave NB approach experienced the highest percentage at 53% followed by the Still River Rd EB approach at 22%. The Ayer Rd SB and Old Littleton Rd WB approaches experienced 14% and 11% respectively (see Figure 7).
- During the top **TMC Peak Hour** (AM hour from 7:15-8:15 AM), only 3.7% of the Ped total (3 of 81) used the Intersection. Only 22% (18 of 81) of the 24-hour



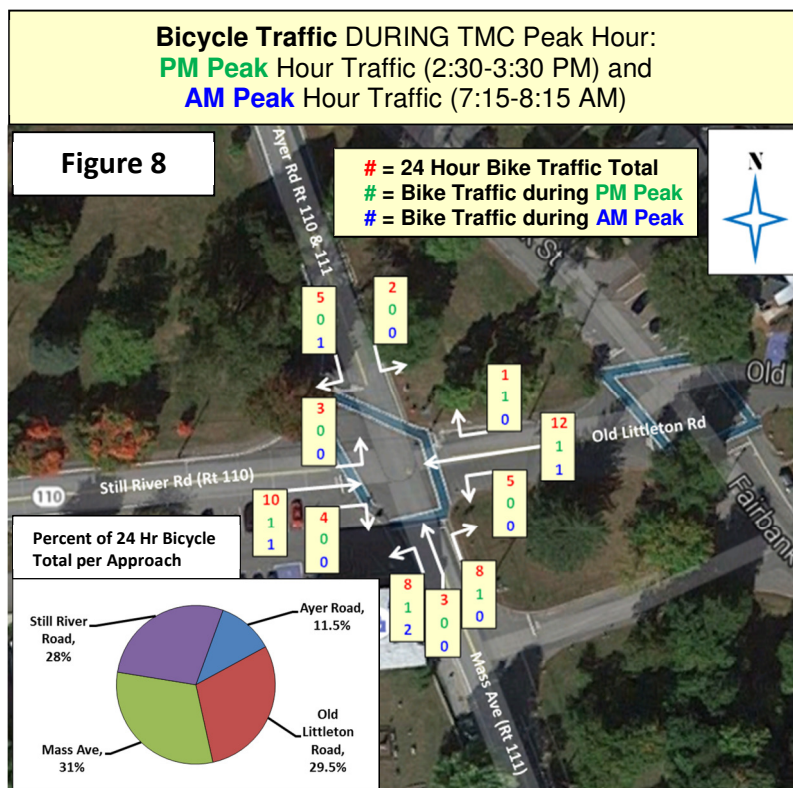
- Ped total used the Intersection during the AM twelve-hour period. Of the AM twelve-hour period, 100% of the AM Ped total used the Intersection from 6:00 – 12:00. The **Ped Traffic AM Peak Hour** occurred between 9:45 – 10:45 as 8.6% (7 of 81) of the Ped total used the Intersection.
- During the second highest **TMC Peak Hour** (PM hour from 2:30-3:30 PM), the top **Ped Traffic Peak Hour** also occurred as 20% (16 of 81) of the Ped total used the Intersection. 78% (63 of 81) of the 24-hour Ped total used the Intersection during the twelve-hour PM period. Of the PM twelve-hour period, only two hours (9:00 – 10:00 and 11:00 – 12:00) did not experience Ped usage.

Ped Traffic & TMC Peak Hours Analysis

These findings reveal that the hour the top traffic volume occurred and the hour the top pedestrian traffic volume occurred did not coincide during the same hour thereby potential incidents were minimized between motor vehicles and pedestrians for those time periods. The motor vehicle and pedestrian traffic volume data shows that the top **TMC Peak Hour** occurred during the AM twelve-hour period and the top **Ped Traffic Peak Hour** occurred during the PM twelve-hour period. However, since the **PM TMC Peak Hour** coincided with the top **Ped Traffic Peak Hour** potential incidents between motor vehicles and pedestrians were greatest from 2:30 to 3:30 PM primarily for pedestrians crossing the Mass Ave NB approach which was used by 69% (11 of 16) of the pedestrians during the **PM TMC Peak Hour**.

B: Intersection Existing Bicycle Traffic during 24-hour TMC Period, during TMC AM and PM Peak Hours, Bicycle Traffic AM and PM Peak Hours

- A total of sixty-one bicycles used the Intersection during the 24-hour period. The Mass Ave NB approach experienced the highest percentage at 31% followed closely by the Old Littleton Rd WB approach and the Still River Rd EB approach at 29.5% and 28% respectively. The Ayer Rd SB approach experienced 11.5% of the bicycle traffic (see Figure 8).
- During the top **TMC Peak Hour** (AM hour from 7:15-8:15 AM), only 8.2% of the bicycle total (5 of 61) used the Intersection. 42.6% (26 of 61) of the 24-hour bicycle total used the Intersection during the AM twelve-hour period. Of the AM twelve-hour period, 100% of the AM bicycle total used the Intersection from 6:00 – 12:00. The **Bicycle Traffic AM Peak Hour** occurred between 6:15 – 7:15 as 16.4% (10 of 61) of the bicycle total used the



Intersection. The **Bicycle Traffic AM Peak Hour** and **PM Peak Hour** achieved the identical level of bicycle usage.

- During the second highest **TMC Peak Hour** (PM hour from 2:30-3:30 PM), only 8.2% of the bicycle total (5 of 61) used the Intersection. However, 57.4% (35 of 61) of the 24-hour bicycle total used the Intersection during the PM twelve-hour period. Of the PM twelve-hour period, 100% of the PM bicycle total used the Intersection from 12:00 – 8:00. The **Bicycle Traffic PM Peak Hour** occurred between 12:00 – 1:00 as again 16.4% (10 of 61) of the bicycle total used the Intersection.

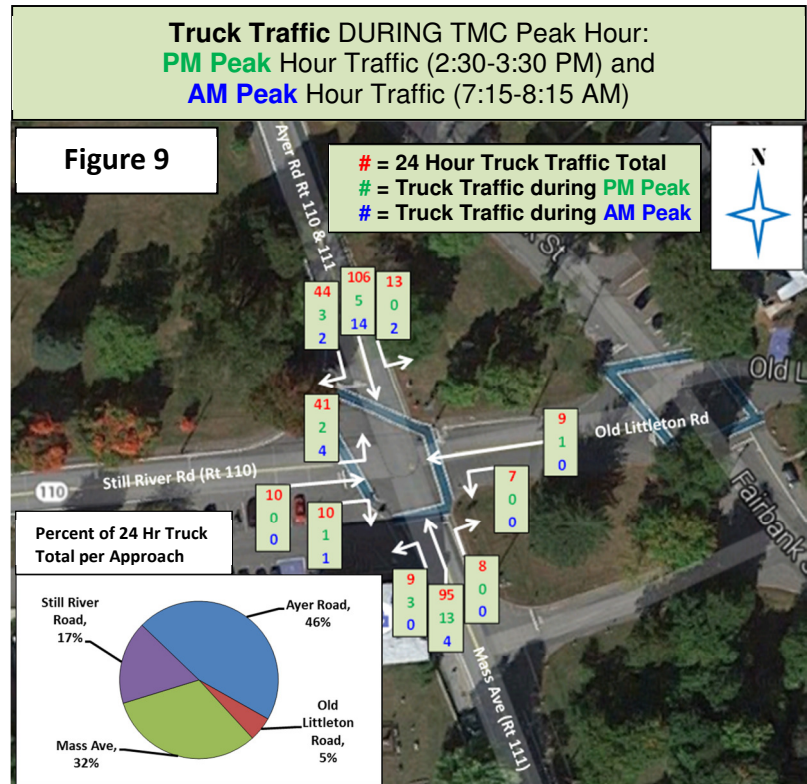
Bicycle Traffic & TMC Peak Hours Analysis

These findings reveal that the hours the AM and PM Peak Hour traffic volumes occurred and the hours the AM and PM Peak Hour bicycle traffic volumes occurred did not coincide during the same hours thereby potential incidents were minimized between motor vehicles and bicycles for those time periods. Potential incidents between motor vehicles and bicycles were greatest at the Mass Ave NB, the Still River Rd EB, and the Old Littleton Rd WB approaches to the Intersection where 88.5% of the total bicycle traffic occurred at this Intersection.

C: Intersection Existing Truck Traffic during 24-hour TMC Period, during TMC AM and PM Peak Hours, Truck Traffic AM and PM Peak Hours

- A total of three-hundred fifty-two trucks (2 axel 6 tire vehicles or larger, no buses) used the Intersection during the 24-hour period. The Ayer Rd SB approach experienced the highest percentage at 46% followed by Mass Ave at 32%. The Still River Rd EB and Old Littleton Rd WB approaches experienced 17% and 5% respectively (see Figure 9).
- During the top **TMC Peak Hour** (AM hour from 7:15-8:15 AM), only 7.7% of the truck total (27 of 352) used the Intersection. However, 56% (197 of 352) of the 24-hour truck total used the Intersection during the AM twelve-hour period. Of the AM twelve-hour period, 100% of the AM truck total used the Intersection from 3:15 – 12:00. The top truck Peak Hour traffic occurred during the **Truck Traffic AM Peak Hour** of 9:45 – 10:45 as 13.4% (47 of 352) of the truck total used the Intersection.

- During the second highest TMC **Peak Hour** (PM hour from 2:30-3:30 PM), only 8% of the truck total (28 of 352) used the Intersection. 44% (155 of 352) of the 24-hour truck total used the Intersection during the PM twelve-hour period. Of the PM twelve-hour period, only one hour (10:00 - 11:00) did not experience truck usage. The **Truck Traffic PM Peak Hour** occurred between 3:45 – 4:45 as 10.5% (37 of 352) of the truck total used the Intersection.



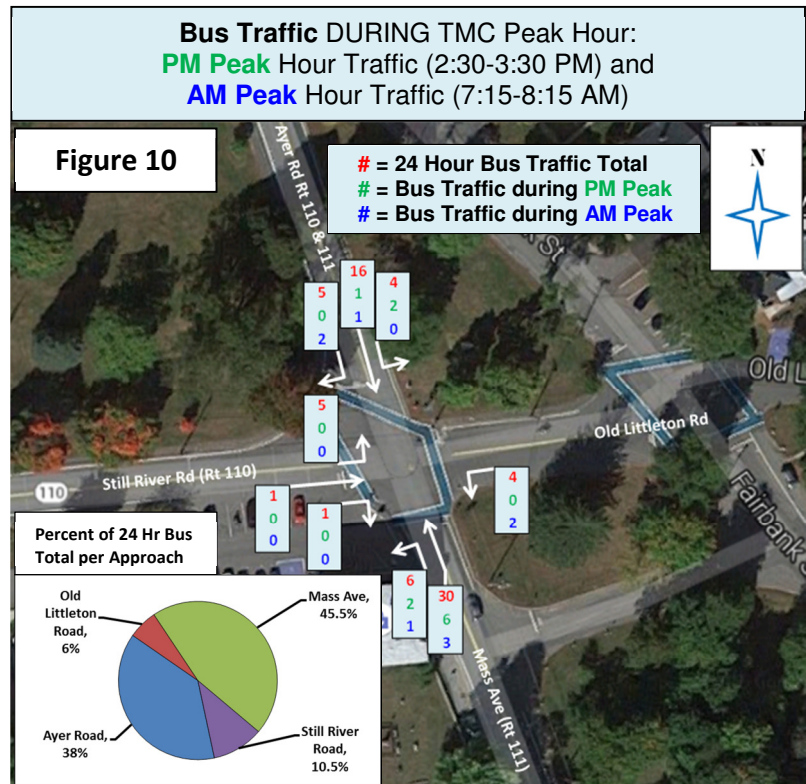
Truck Traffic & TMC Peak Hours Analysis

These findings reveal that the hours the AM and PM Peak Hour non-truck traffic volumes occurred and the hours the AM and PM Peak Hour truck traffic volumes occurred did not coincide during the same hours thereby potential incidents were minimized between non-truck motor vehicles and trucks for those time periods. Potential incidents between non-truck motor vehicles and trucks were greatest at the Mass Ave NB, the Still River Rd EB, and the Ayer Rd SB approaches to the Intersection where 95.5% of the total truck traffic occurred at this Intersection.

D: Intersection Existing Bus Traffic during 24-hour TMC Period, during TMC AM and PM Peak Hours, Bus Traffic AM and PM Peak Hours

- A total of sixty-six buses used the Intersection during the 24-hour period. The Mass Ave NB approach experienced the highest percentage at 45.5% followed distantly by the Ayer Rd SB approach at 24%. The Still River Rd EB and Old Littleton Rd WB approaches experienced 10.6% and 6% respectively (see Figure 10).

- During the top **TMC Peak Hour** (AM hour from 7:15-8:15 AM), 13.6% of the bus total (9 of 66) used the Intersection. 44% (29 of 66) of the 24-hour bus total used the Intersection during the AM twelve-hour period. Of the AM twelve-hour period, 100% of the AM bus total used the Intersection from 6:00 – 12:00. The top bus Peak Hour traffic occurred during the **Bus Traffic AM Peak Hour** of 8:00 – 9:00 as 21% (14 of 66) of the bus total used the Intersection. Also, the



- top bus Peak Hour traffic overlaps the top **TMC Peak Hour** from 8:00 – 8:15.
- During the second highest **TMC Peak Hour** (PM hour from 2:30-3:30 PM), the **Bus Traffic PM Peak Hour** also occurred as 16.7% (11 of 66) of the bus total used the Intersection. 56% (37 of 66) of the 24-hour bus total used the Intersection during the twelve-hour PM period. Of the PM twelve-hour period, 100% of the PM bus total used the Intersection from 12:00 – 6:15.

Bus Traffic & TMC Peak Hours Analysis

These findings reveal that the hour the top non-bus traffic volume occurred and the hour the top bus traffic volume occurred did not coincide during the same hour thereby potential incidents were minimized between motor vehicles and buses for those time periods. The motor vehicle and bus traffic volume data shows that the top **TMC Peak Hour** occurred during the AM twelve-hour period and the top **Bus Traffic Peak Hour** occurred during the PM twelve-hour period. However, since the **PM TMC Peak Hour** coincided with the top **Bus Traffic Peak Hour** potential incidents between motor vehicles and buses were greatest from 2:30 to 3:30 PM primarily for buses exiting and entering the Mass Ave NB approach.

Safety

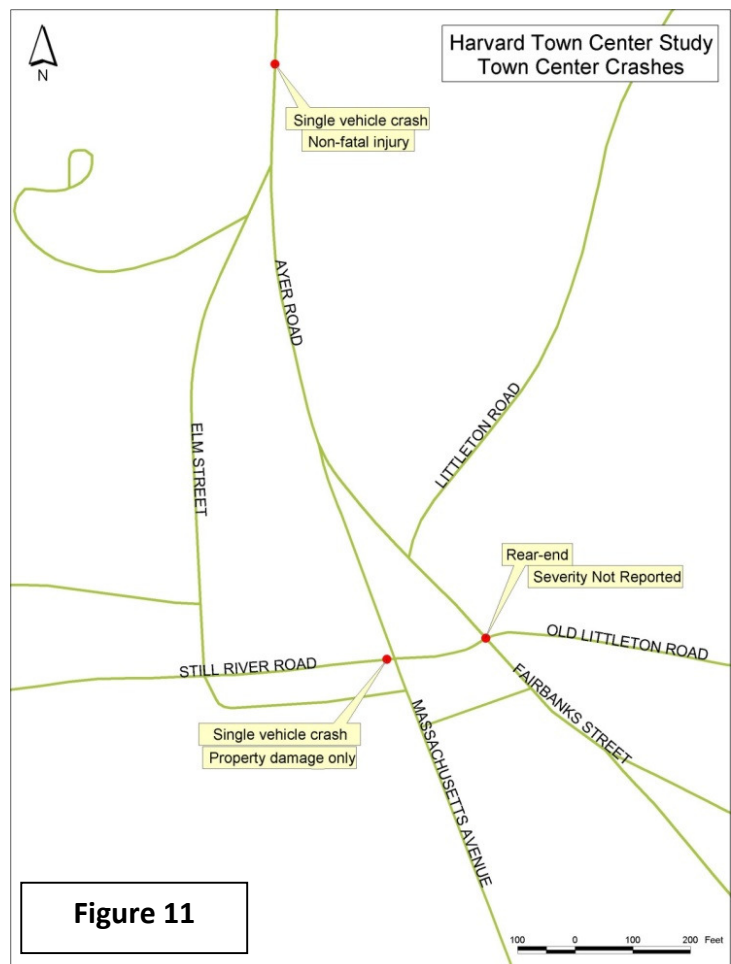
Although there appear to be several unsafe roadway conditions on the roads of the Center, crashes are a rare occurrence. According to MassDOT crash data, only three crashes occurred on the roads within the Center for the three-year period from 2010 to 2012. The crashes are depicted in Figure 11. No two crashes occurred at the same location and one of the crashes resulted in an injury. The three crashes are listed in the table below and are dated 5/15/10, 10/27/11, and 2/19/12.

Date	Time	Severity	# of Vehicles	Manner	Crash With	Location
05/15/2010	1:15 PM	PDO	1		Sign post	Fairbanks St & Old Littleton Rd
06/28/2010	11:45 AM	PDO	1			Mass Ave & Bolton Rd
01/04/2011	7:30 AM	PDO	2	RE	Another vehicle	Mass Ave & Pond Rd
01/18/2011	3:00 PM	PDO	1	SV		Mass Ave & Bolton Rd
10/27/2011	4:15 PM	PDO	1	SV		1 Still River Rd
02/19/2012	4:11 PM	Injury	1	SV	Tree	18 Ayer Rd

The remaining three crashes listed in the table occurred farther south and were property damage only (PDO) crashes.

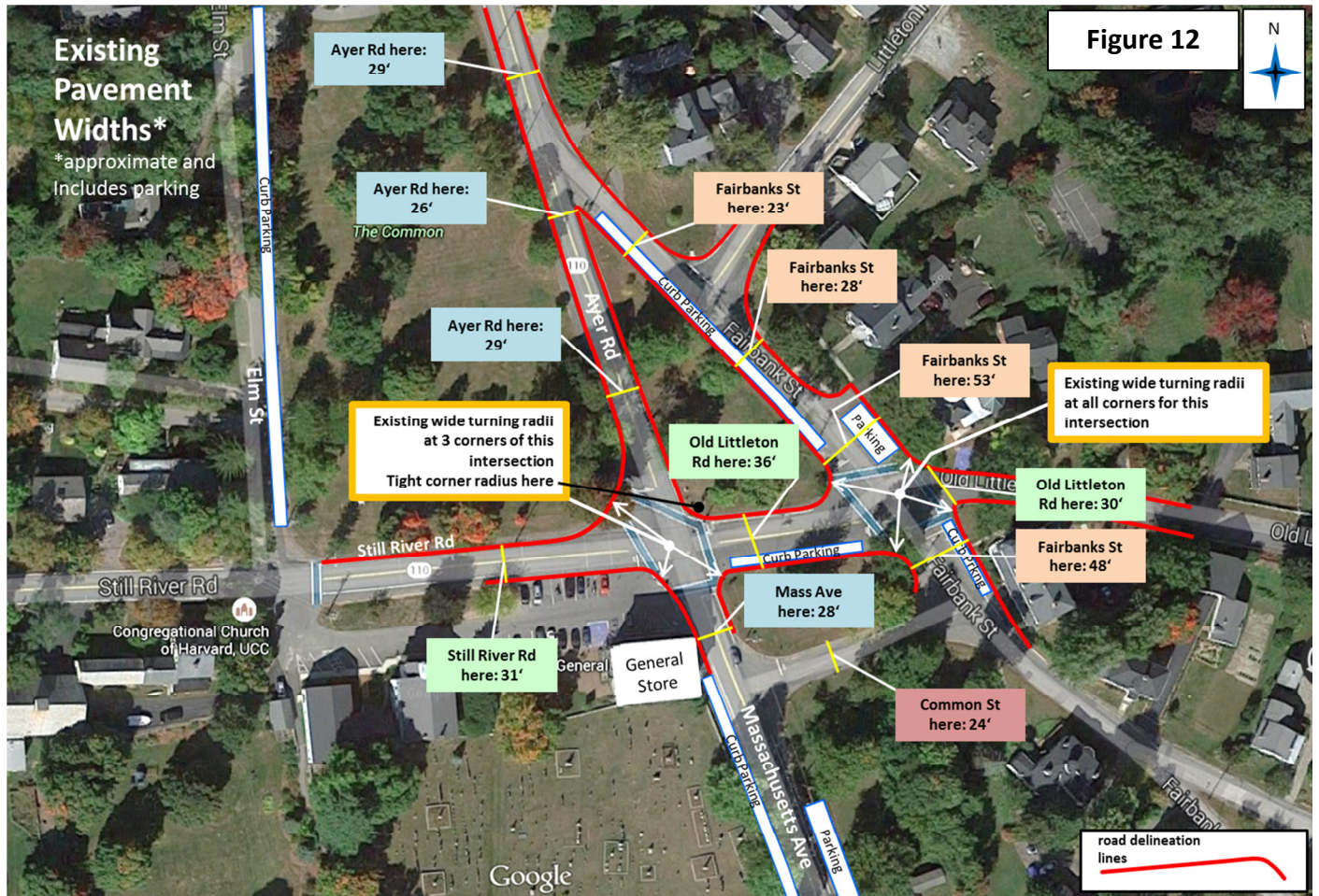
One crash occurred at the Mass Ave and Pond St intersection and two crashes occurred at the Mass Ave and Bolton Rd intersection. The three crashes are listed in the table below and are dated 6/28/10, 1/4/11, and 1/18/11.

Of the six total crashes, only one involved two vehicles. No crashes involved either bicycles or pedestrians.



Existing Pavement Widths

Figure 12 provides the pavement widths (PW) of the roads within the Center area. Fairbanks St has the widest PWs north and south of the Fairbanks St and Old Littleton Rd intersection at fifty-three feet and forty-eight feet wide respectively. Further north, Fairbanks St PW narrows significantly to twenty-three feet wide near the Ayer Rd intersection.



Old Littleton Rd PW in between Ayer Rd and Fairbanks St is thirty-six feet wide. Still River Rd PW is thirty-one feet wide just before the large paved area. Ayer Rd PW is largely twenty-nine feet wide but narrows slightly just south of the Fairbanks St. Mass Ave is twenty-eight feet wide next to the General Store.

All but one corner radii of the Intersection are wide but each corner has a different radius. The northeast corner of the Intersection has a tight corner radius. All corner radii of the Fairbanks St and Old Littleton Rd intersection are wide but each corner has a different radius.

Improvement Alternatives

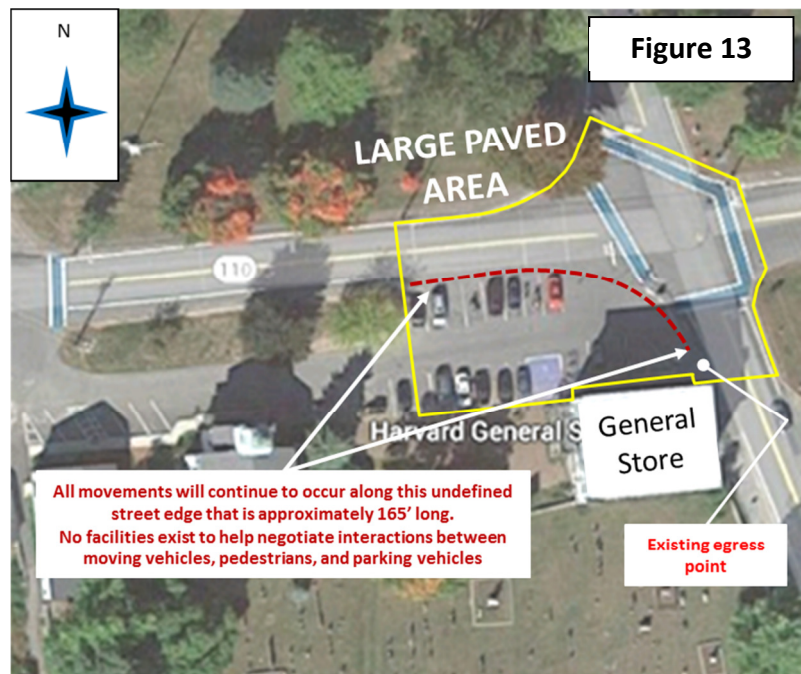
The goal of the MRPC is to provide conceptual low to moderate cost transportation improvement alternatives for the large paved areas, pedestrians, bicycles, and motor vehicles that will meet the overarching goal of the *Action Plan* which is to “...reconcile two seemingly contradictory desires – to move forward with those actions necessary to support and sustain the Center’s vitality and mix of activities while simultaneously preserving the center’s classic village character and imagery.” The improvements alternatives seek to retain the existing roadway geometry to the highest possible degree.

Undefined Street Edge in the Large Paved Area (west)

Alternative 1: No Changes

The undefined street edge will remain (see Figure 13):

- Entering and exiting motor vehicles, pedestrians, and bicyclist will continue to be allowed to use any point along the entire street edge to perform their desired movement
- A hazardous safety situation will continue for users whether they are in motor vehicles, or pedestrians, or bicyclists as they do not know what direction an oncoming user is approaching from. There is the potential for crashes involving motor vehicles / pedestrians / bicyclists that increases the potential of high crash severity
- Safety concerns related to the undefined street edge will most likely intensify when/if all types of traffic volumes increase



Alternative 2: Sidewalk to Define Street Edge & Motor Vehicle Access Point Locations

To address the undefined street edge:

- Define the street edge and provide pedestrian improvements by constructing a continuous ADA compliant sidewalk from the existing crosswalk at the Still River Rd & Elm St intersection to the egress point on Mass Ave (see Figure 14):
 - Sidewalk would abut travel lane
 - Sidewalk eliminates potential bike lane from the Congregational Church property line to the Intersection
 - Pedestrians would now have a defined safe access way



To address the numerous access points along the undefined street edge, limit motor vehicle access and STOP controlled egress points to two locations:

- Construct an access and egress point next to the property line with the Congregational Church as opposed to a location closer to the Intersection:
 - Placing the access and egress point next to the property line will place it approximately 110 feet away from the Intersection which will provide motor vehicles taking a left turn into the General Store from Still River Rd time to signal and warn trailing vehicles to slow down and come to a stop as needed
 - ❖ Any alternative point farther east will have the following possible impacts:
 - Points closer to the Intersection will provide motor vehicles taking a left turn into the General Store less time to signal and warn trailing vehicles to slow down and come to a stop as needed
 - Trailing vehicle queue behind the left turning vehicles into the General Store may back up into the Intersection

- Vehicle queues at the STOP controlled Still River Rd approach will delay the left turning vehicles
 - Results in possible loss of parking spaces east of the point
- Will decrease delay of right turning vehicles from Ayer Rd
- Significant decrease in the possibility of trailing vehicle queue backing up into Intersection
- The delay of left turning vehicles into the General Store caused by the stopped vehicle queue at the Still River Rd approach will be minimized
- Possible increase in the number of parking spaces east of the access and egress point next to the property line with the Congregational Church
- Retain the existing egress point on Mass Ave next to the General Store:
 - Permit right turn only to eliminate the possibility of left turning vehicles blocking SB traffic on Mass Ave

Alternative 3: Raised Curb Barrier to Define Street Edge

To address the undefined street edge from the potential access and egress point next to the property line with the Congregational Church to the crosswalk at the Still River Rd approach of the Intersection:

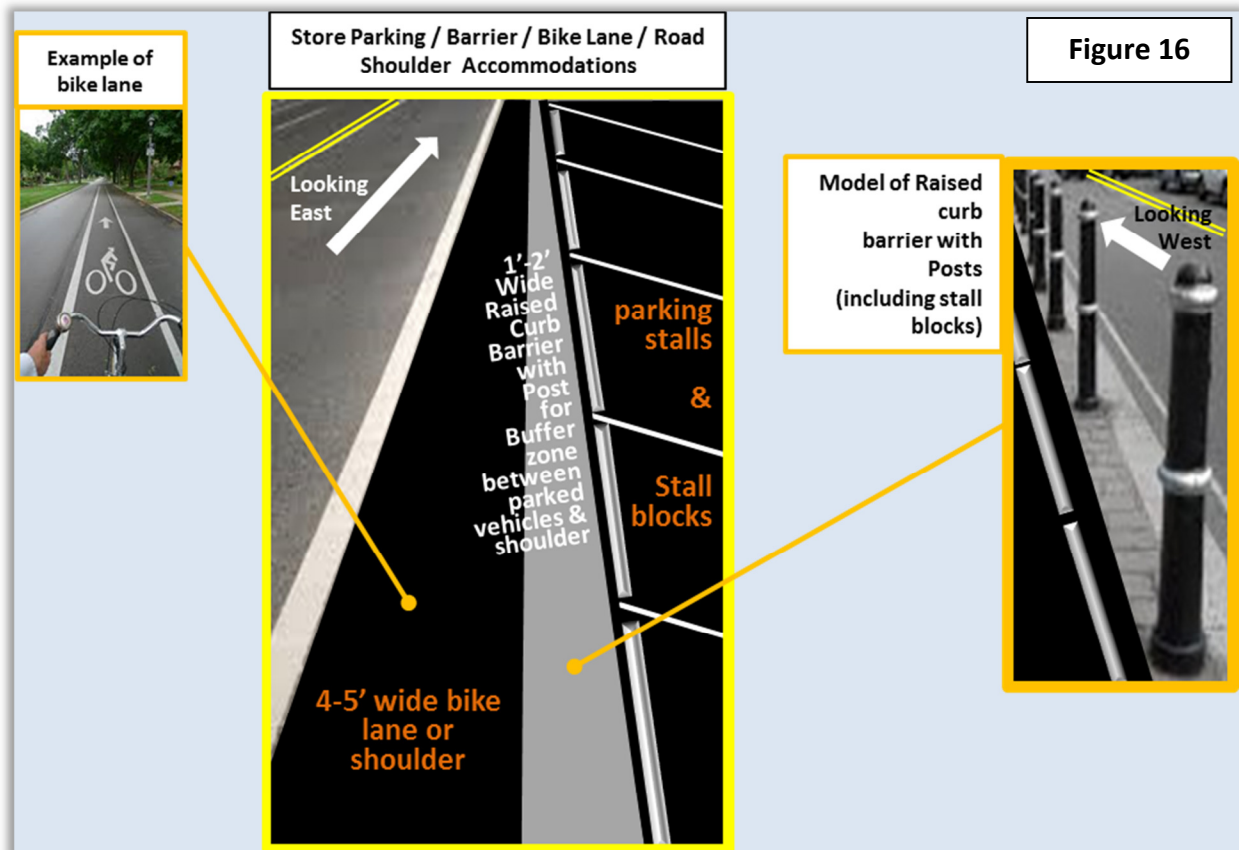
- Construct a raised curb barrier (Barrier) (see Figure 15) (see *Barrier Design Concept* below for more) to define the street edge:
 - Barrier would abut a potential 4 to 5 foot wide bike lane or shoulder
 - Barrier eliminates potential pedestrian facilities from the Congregational Church property line to the Intersection



NOTE: To learn about other pedestrian improvement alternatives for this large paved area please see *Pedestrian Accommodation Improvement Alternatives*.

Raised Curb Barrier (Barrier) Design Concept

- The one to two foot wide Barrier would define the street edge (see Figure 16)
- Barrier would abut a potential 4 to 5 foot wide bike lane or shoulder
- Mount on the Barrier (if 2 foot minimum) incrementally placed crash resistant posts (Posts). Parking stall blocks would be mounted on the south side of the Barrier



- Barrier and Posts would help to prevent parked motor vehicles in the General Store parking lot from encroaching into the potential bike lane or shoulder
- The design of the Posts should reflect the classic village character of the Town Center. One option would be to install granite posts

Town of Harvard Town Center Transportation Committee Preferred Improvement Alternatives for the Undefined Street Edge in the Large Paved Area (west):

- A. Members generally preferred Figure **14**
- B. Construct curb and sidewalk in front of the General Store parking area. Members did not favor the alternative of a shoulder for bicycling and a raised curb barrier as shown in the example on Figures **15** and **16**. Members felt the curb barrier would be damaged by vehicle parking movements
- C. Provide 2-way access into the lot on Still River Road as far from the intersection as possible, i.e. near the property line with the Church. This will entail removal of some of the landscaped island. Talks should occur with Church elders regarding coordination of traffic flow between the 2 parking areas (see Figure **14**)
- D. Retain the existing egress from the parking lot onto Mass. Ave. and sign for right turn only, i.e. southbound. Prohibit entry at this location, which will require vehicles to enter via the driveway off Still River Road (see Figure **14**)
- E. Add curb stops for parking stalls (see Figure **16**)
- F. Retain shared use area (see Figure **14**)

SOURCE: Harvard TCTC Review of MRPC's Town Center Alternatives

Pedestrian Accommodation Improvement Alternatives

Alternative 1: No Changes

- Existing paved and off road pedestrian pathways (see Figure 6) will continue to be inadequate for all users and will not be accessible for persons with disabilities (not ADA compliant)
- The excessive lengths of the existing crosswalks will continue to expose pedestrians to motor vehicle and bicycle traffic for a maximum amount of time
- The lack of pedestrian facilities at various locations will persist for all types of pedestrians that range from children to adults and to joggers
- All crosswalk curb ramps will continue to be inaccessible for persons with disabilities (not ADA compliant) as the changes in level and grates located at crosswalks pose a hazard for persons with disabilities
- Safety concerns related to the lack of adequate pedestrian facilities will most likely intensify when/if all types of traffic volumes increase



Alternative 2A: Improvements to Existing Pathways, Adding Sidewalks, Crosswalks to Eliminate

To address the lack of pedestrian sidewalks in the area of the *Undefined Street Edge in the Large Paved Area* (see Figures 14, 15, and 17):

- Construct an ADA compliant sidewalk beginning at the existing crosswalk at the Still River Rd & Elm St intersection and proceed east to the potential new access and egress point for the General Store parking lot, then proceed south along the property line with the Congregational Church and cross the two-way access point down to the end of the existing pavement, then take a left and proceed east to the General Store loading dock. The sidewalk would terminate at the loading dock (see Figure 15).
 - Reason for this potential sidewalk path instead of a continuous sidewalk along Still River Rd: per the discussion of improvement *Alternative 2* of the *Undefined Street Edge in the Large Paved Area* - a sidewalk there would eliminate a potential bike lane from the Congregational Church property line to the Intersection
 - Reason for no potential sidewalk abutting the front of the General Store: at a minimum, the new sidewalk width would most likely be 4 feet (without the curb)

which will most likely negatively impact parking availability in front of the General Store

- Construct an ADA compliant sidewalk beginning at the raised curb barrier end point located at the crosswalk on the Still River Rd approach of the Intersection to the existing egress point next to the General Store (see Figure 15).
 - The shared use area in front of the General Store would be designated as an area for all users (motor vehicles, pedestrians, bicycles)

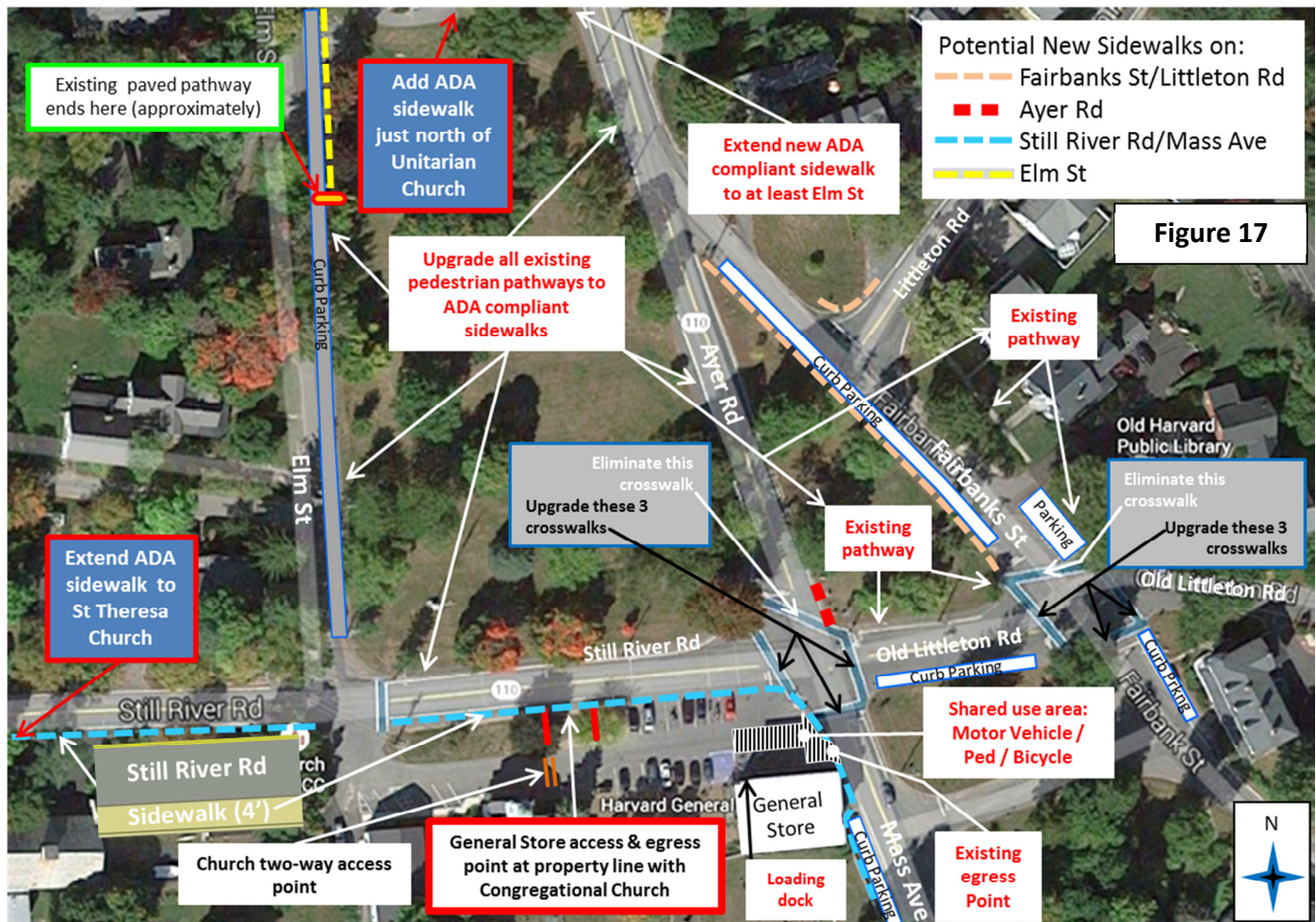


Figure 17

Upgrade the existing paved pedestrian pathways to ADA compliant sidewalks at the following locations:

- On the east and south sides of the large Common in between Elm St and Ayer Rd and south of *Existing paved pathway ends here* location on Elm St as depicted on Figure 17
- Extend upgraded sidewalk to at least the Elm St and Ayer Rd intersection
- On the south side of the small Common in between Ayer Rd and Fairbanks St

- On the east side of Fairbanks St in between Littleton Rd and Old Littleton Rd

Construct new ADA compliant sidewalks at the following locations as depicted on Figure 17:

- On Mass Ave south of the existing egress point next to the General Store
- North of the *Existing paved pathway ends here* location on Elm St
- On the north side of Unitarian Church facing the driveway
- On the south side of Still River Rd west of Elm St that extends to St Theresa Church
- On the east side of the small Common along Fairbanks St
- On the northern corner of the Fairbanks St and Littleton Rd intersection
- A short sidewalk on the east side of the SB Ayer Rd intersection approach

Eliminate or upgrade the following crosswalks as depicted on Figure 17:

- Eliminate two skewed crosswalks – 1) at the SB Ayer Rd intersection approach, and 2) at the SB Fairbanks St intersection approach
- Upgrade the six remaining crosswalks at the six intersection approaches indicated on Figure 17

Alternative 2B: Existing Geometric Features to Retain, Discontinue Right Turn, New Geometric Features, New Crosswalks

All improvement alternatives for this section are depicted on Figure 18.

Retain existing corner radii (with modifications) at all intersection corners with the following exceptions:

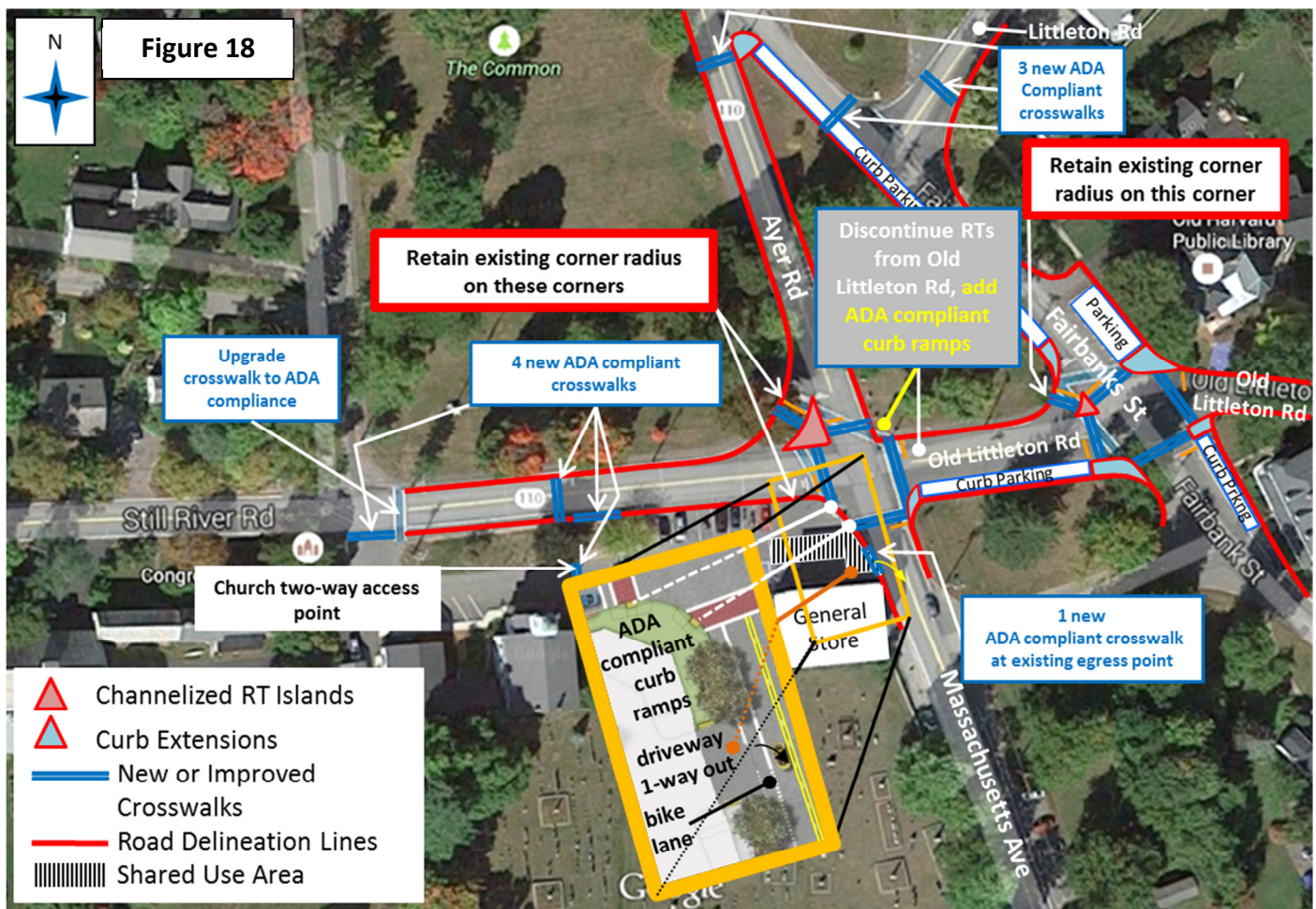
- The southeast corner of the Intersection
- The northeast, southeast, and southwest corners of the Fairbanks St and Old Littleton Rd intersection

Retain the wide pavement width (with modifications) of the intersection approaches of the Intersection and the Fairbanks St and Old Littleton Rd intersection. Retain all existing traffic controls at all the intersections.

It is advantageous for tractor trailer turn movement to retain the existing corner radii and pavement width as they will allow tractor trailers to continue to successfully take right turn movements as they always have. A tractor trailer right turn analysis was completed to demonstrate the ability of tractor trailers to complete right turns successfully at the Intersection and the Fairbanks St and Littleton Rd intersection. The analysis can be found below.

Discontinue the right turn movement from the Old Littleton Rd WB approach to the Intersection:

- Right turn motor vehicle traffic volume is very light. Currently it is approximately only thirteen motor vehicles per day
- There is an alternative route (Fairbanks St) that motor vehicles can take to go north on Ayer Rd
- There are most likely considerably more gaps in traffic at the Ayer Rd and Fairbanks St intersection than at the Intersection due to lower motor vehicle traffic volume



Add a channelized right turn lane and island to the:

- Ayer Rd SB approach to the Ayer Rd/Mass Ave and Still River Rd/Old Littleton Rd intersection
- Fairbanks St SB approach to the Fairbanks St and Littleton Rd intersection

Both channelized lanes would be STOP controlled with a stop bar pavement marking just before a crosswalk to help prevent encroachment into the crosswalk.

- ✓ Tractor trailers taking a left turn from Still River Rd or Old Littleton Rd will not be impacted by the channelized island. See the *Tractor Trailer Right Turn Analysis* below.

Add curb extensions to the:

- Ayer Rd and Fairbanks St intersection southern corner at the Fairbanks St NB approach
- Ayer Rd/Mass Ave and Still River Rd/Old Littleton Rd intersection southeast corner at the Old Littleton Rd WB approach
- Four approaches of the Fairbanks St and Littleton Rd intersection

Add ADA compliant crosswalks and curb ramps to the:

- Four approaches of the Ayer Rd/Mass Ave and Still River Rd/Old Littleton Rd intersection
- Four approaches of the Fairbanks St and Littleton Rd intersection

Upgrade The Elm St and Still River Rd intersection crosswalk to an ADA compliant crosswalk and curb ramps.

To connect the upgraded and new sidewalks, channelized right turn lanes and islands, and curb extensions, the following locations are provided for possible ADA compliant crosswalk and curb ramp installation:

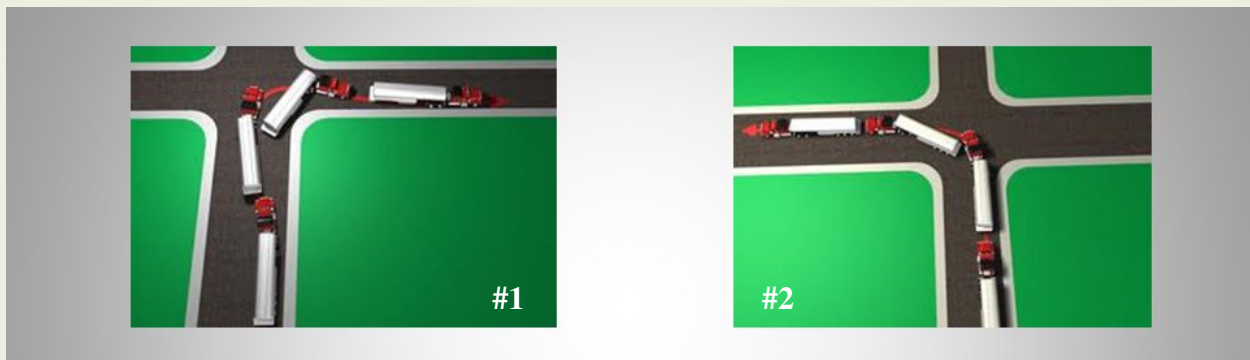
- The new access and egress point on Still River Rd for the General Store parking lot
- The Congregational Church access and egress point
- The existing egress point for the General Store on Mass Ave
- The two-way access point in between the Congregational Church and General Store parking lots
- On the Ayer Rd NB approach to the Ayer Rd and Fairbanks St intersection
- On the Fairbanks St SB approach to the Fairbanks St and Littleton Rd intersection
- On the Littleton Rd SB approach to the Fairbanks St and Littleton Rd intersection
- On Still River Rd on the west (or left) side of the new access and egress point to the General Store
- On the driveway in front of the Town Hall
- On the Elm St approach to the Ayer Rd and Elm St intersection

See below for channelized right turn lane and island, curb extension, and curb ramp improvement alternative benefits.

Tractor Trailer Right Turn Analysis (1 of 3)

In the majority of cases tractor trailers are longer and wider than any other type of vehicle and this means that their drivers must be careful when operating the large vehicles on all types of roadway facilities. This is especially true when taking a right turn at an intersection which more often than not has tight corner radii. A tractor trailer will most often need to encroach into the opposing left lane of the intersection approach to the right to complete the right turn which also exposes the tractor trailer to oncoming traffic.

Tractor trailers attempting to complete a left turn may also need to partially encroach into the opposing left lane but the corner radius usually is not a factor because it is farther away and they are exposed to opposing traffic usually to a much lesser extent. The figure below models tractor trailers as they progress through an intersection where the approach widths of the roads



are equal and all the corner radii are tight and equal. One is taking a right turn (#1) while the other is taking a left turn (#2). Notice how truck #1 needs to encroach into the opposing lane of two approaches to complete a right turn while truck #2 is only briefly in the opposing lane to complete a left turn.

The right turn pavement width analysis presented in the table below assumes a tight corner radius at all corners for both the Ayer Rd/Mass Ave and Still River Rd/Old Littleton Rd intersection and the Fairbanks St and Old Littleton Rd intersection. However, as discussed in

Road Widths & Requirements for Truck Right Turn (RT) Movement							RT WITHOUT PARKING, RT WITH PARKING						
Maximum Angle of Road	Minimum Road Width Requirements for 69' long, 18 wheel tractor trailer*	Ayer & Still River Rd Inters (clockwise)				Fairbanks & Old Littleton Rd Inters (clockwise)							
		RT on to Ayer Rd (1a)	RT on to Old Littleton (2a)	RT on to Mass Ave (3a)	RT on to Still River Rd (4a)	RT on to Fairbanks St (1b)	RT on to Old Littleton (2b)	RT on to Fairbanks St (3b)	RT on to Old Littleton (4b)				
		Road Widths^				Road Widths^							
		29'	36'	28'	28'	31'	53'	29'	30'	48'	40'	36'	28'
		Difference from Minimum Road Width Requirements				Difference from Minimum Road Width Requirements							
30°	16' 6"	12' 6"	19' 6"	11' 6"	11' 6"	14' 6"	36' 6"	12' 6"	#	31' 6"	23' 6"	#	#
60°	24' 6"	4' 6"	11' 6"	3' 6"	3' 6"	6' 6"	28' 6"	4' 6"	#	23' 6"	15' 6"	#	#
90°	27'	2'	9'	1'	1'	4'	26'	2'	#	21'	13'	#	#
120°	27'	#	#	#	#	#	#	#	3'	#	#	9'	1'
150°	35'	#	#	#	#	#	#	#	5'	#	#	1'	5'
180°	33'	#	#	#	#	#	#	#	3'	#	#	3'	7'
	*Source: Truckers Report	^assumes tight radius at all corners				red # = negative difference				# = not applicable			

*Source: Truckers Report

^assumes tight radius at all corners

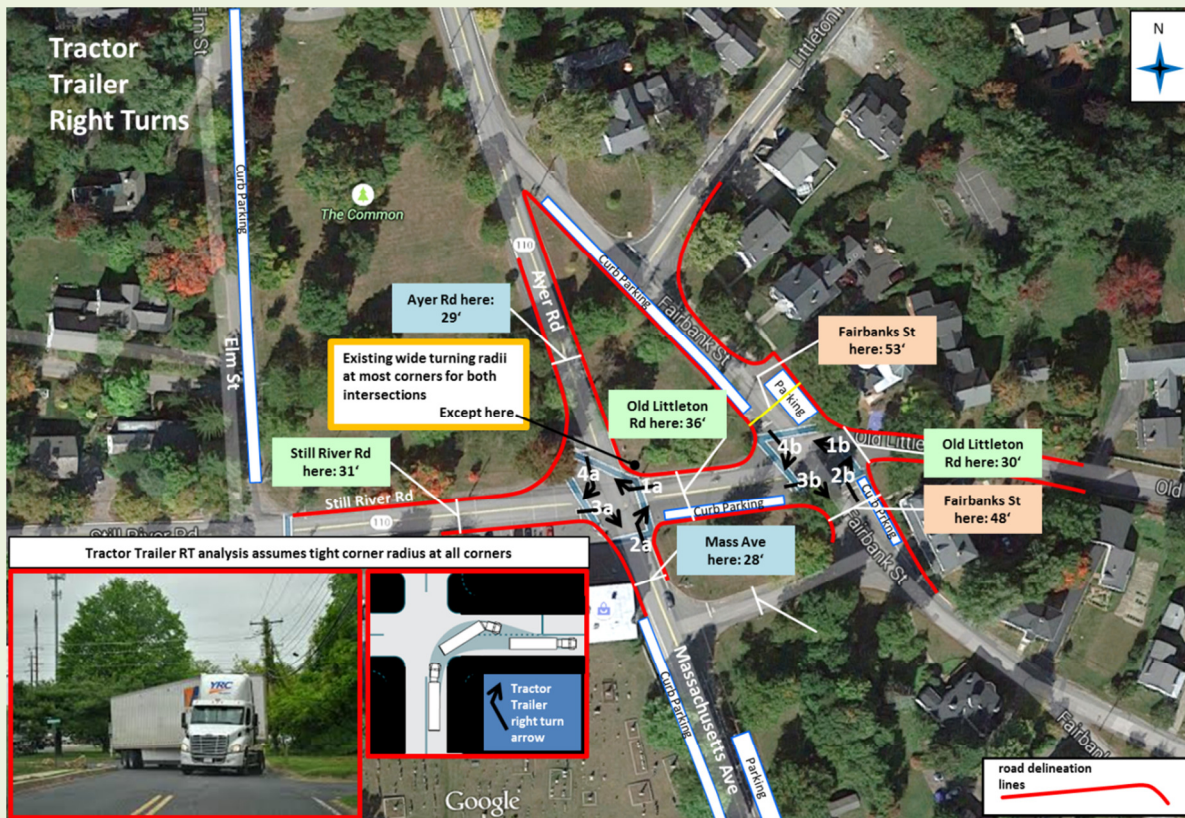
red # = negative difference

= not applicable

Tractor Trailer Right Turn Analysis (2 of 3)

the *Large Paved Areas* and *Existing Pavement Widths* sections above, all but one corner radii for both intersections are wide but each has a different radius. The figure below depicts the right turn movements.

The results of the analysis for the Ayer Rd/Mass Ave and Still River Rd/Old Littleton Rd intersection shows that there is adequate pavement width on all the approaches to the intersection for tractor trailers to conduct right turns *even if the corners had a tight radius*. The analysis assumes that all the approaches to this intersection are at, or very close to, a ninety degree angle (see **Maximum Angel of Road** column in the table). For example, on Mass Ave there would be an extra foot of pavement width for a tractor trailer to take right turn from Still River Rd on to Mass Ave (3a) *even if the radius was tight*. There would even be enough pavement width to take a right turn from Mass Ave on to Old Littleton Rd (2a) even when taking into consideration the possibility of a parked vehicle right at the corner of the south side of Old Littleton Rd.



The analysis for the Fairbanks St and Old Littleton Rd intersection assumes that the approaches to this intersection are either under or over a ninety degree angle. The SB right turn (4b) and the NB right turn (2b) movements from Fairbanks St are over ninety degrees while the EB right turn (3b) and the WB right turn (1b) movements from Old Littleton Rd are under ninety degrees. The results of the analysis presented in the table above shows that there is adequate

Tractor Trailer Right Turn Analysis (3 of 3)

pavement width for tractor trailers to conduct right turns from the EB right turn (3b) and the WB right turn (1b) movements from each Old Littleton Rd approach *even if the corners had a tight radius* and includes taking into consideration the parking that occurs on Fairbanks St and Old Littleton Rd. For example, on the SB Fairbanks St approach to the intersection there is an extra two feet of pavement width for a tractor trailer to take right turn from Old Littleton Rd on to Fairbanks St *even if the corner had a tight radius*. For the over ninety degrees SB right turn (4b) and the NB right turn (2b) movements from Fairbanks St on to each Old Littleton Rd approach there is adequate pavement width for tractor trailers to conduct right turns if the **Maximum Angel of (the) Road** is not over one-hundred and twenty degrees (red numbers for minimum road widths in the table above indicate inadequate road width). However, neither the SB right turn (4b) or the NB right turn (2b) movements appear to be over one-hundred and twenty degrees. Combine that probability with the wide corner radii at all but one corner and it becomes highly unlikely that tractor trailers have a significant problem conducting these right turns.

Channelized right turn lane and island, curb extension, curb ramp improvement alternative benefits:

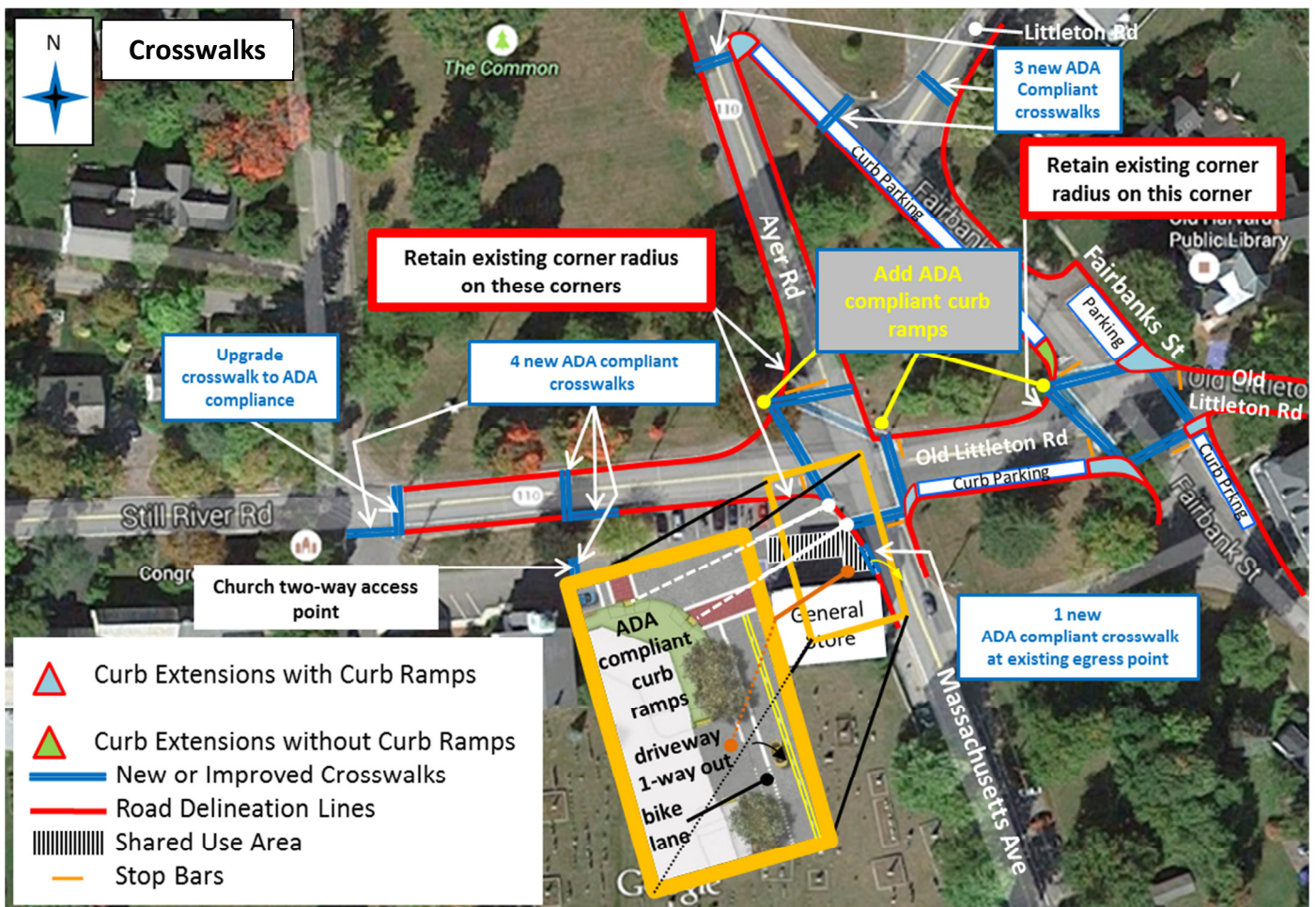
- Reduce crosswalk lengths thus reducing pedestrian exposure to potential conflicts with traffic
- Allow crosswalks to be placed at right angles to a roadway which improves pedestrian peripheral vision and reduces pedestrian exposure to potential conflicts with traffic
- Provide refuge for pedestrians thus reducing pedestrian exposure to potential conflicts with traffic
- Alert motorists of the potential of pedestrians entering the roadway
- If engineered properly, right turn lane islands provide enough turn lane width for tractor trailers to perform a right turn movement without riding the curb
- Curb ramps at crosswalks allow persons with disabilities to access the crosswalks

Note: Curb ramps are included on right turn lane islands and curb extensions

Town of Harvard Town Center Transportation Committee Preferred Improvement Alternatives for the Pedestrian Accommodation Improvement Alternatives:

- A. The consensus was to improve the paths noted on Figure 17 (and Figure 14) as needed to try to achieve ADA standards, if possible. This includes constructing a sidewalk in front of the General Store parking lot along Still River Road (see Figures 14 and 17), not the raised median shown in red on Figure 15 (and conceptualized on Figure 16)
- B. Add 3 new sidewalks as shown on Figure 17: 1) along the east side of the “Little Common” (Civil War Monument), i.e. on the left side (SB) of Fairbank St.; and 2) at the corner of Littleton Road and Fairbank St. The Little Common would then have sidewalks on 2 sides; 3) on the east side of the SB Ayer Rd intersection approach
- C. The sidewalk on the Common on the east side of Elm St. has a large outcrop at its northern end. Members discussed the cost/feasibility of blasting through the rock to continue the sidewalk, or having pedestrians enter the road to walk around it. The consensus was to blast through it if the cost is reasonable
- D. Improve the path between the North Parking Lot and Still River Road. Upgrading the path from the Congregational Church parking lot to the Town’s north parking lot is an important component of enhancing the transportation infrastructure in the Town Center, both for parking access and for pedestrians. It is now unilluminated, with an uneven dirt surface and no defined parking spaces, and has a large but messy catalpa tree in the center planted by Bromfield students decades ago. The School Department is proceeding with a project to fix up the (Town-owned) north lot. It will be paved and lighted, but the project does not address the path from the lot to the Center. The path upgrade should include signage to encourage awareness of the path, enhanced lighting, and work on the path course and surface to make it easier to traverse. We also suggest that the catalpa tree be replaced by less messy plantings; we note that the Garden Club has indicated willingness to participate in such a project, involving Bromfield students if possible, to preserve community involvement continuity with the tree being replaced (see Figure 25).
- E. Crosswalks (see figure below):
 - 1. Upgrade the crosswalk on Still River Road next to Elm St
 - 2. Add a mid-block crosswalk across Still River Road near the new parking lot entrance
 - 3. Add crosswalks to the Church driveway and the General Store on Still River Road

4. Add a crosswalk to the Church two-way access point
5. Members did not favor the pedestrian refuge islands at the Mass. Ave/Ayer Road intersection and Fairbank St/Old Littleton Rd. intersection as shown on Figure 18.
6. Retain the large corner radius for right turns by large trucks from Ayer Rd. SB to Still River Rd. WB
7. Add curb extensions as shown on the Figure below to shorten crossing distances and separate parallel parking lanes from through traffic



8. Add a crosswalk across the RT only driveway by the General Store (Mass. Ave. side)
9. Add 3 new crosswalks in the vicinity of Fairbank St., Ayer Rd., and Littleton Rd.
10. Realign the northern crosswalks of the Mass. Ave/Ayer Road intersection and Fairbank St/Old Littleton Rd. intersection and upgrade the remaining crosswalks

F. Retain the right turn movement from Old Littleton Rd. to Ayer Rd. NB

SOURCE: Harvard TCTC Review of MRPC's Town Center Alternatives

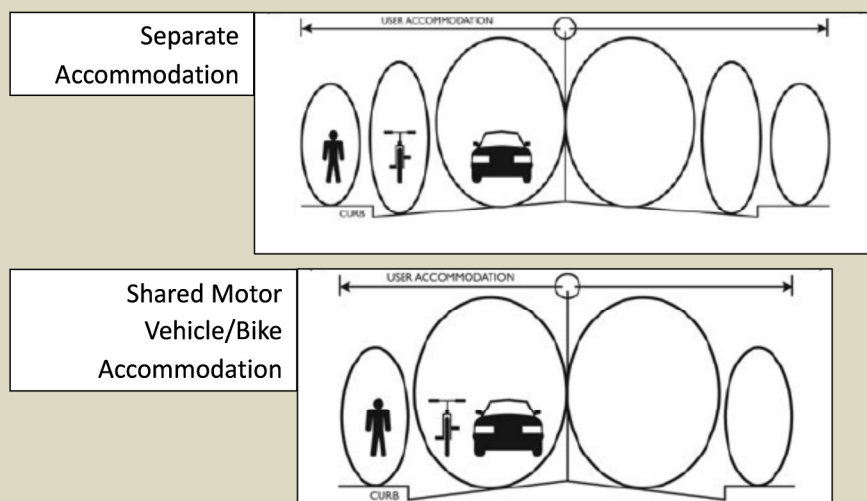
Bicycle Accommodation Improvement Alternatives

Alternative 1: No Changes

- The lack of existing designated bicycle accommodations throughout the Town Center (see Figure 6) will continue to provide no guidance for preferred bicycle movement and interaction with other modes as they travel through the Town Center
- The excessive lengths of the existing intersection approaches will continue to expose bicyclists to motor vehicle and pedestrian traffic for a maximum amount of time
- Safety concerns related to the total lack of bicycles facilities will most likely intensify when/if all types of traffic volumes increase

METHOD USED TO DEVELOP ALTERNATIVES

- 1) Bicycle accommodation improvement alternatives are limited by the existing pavement widths of the Town Center roads.
- 2) Bicycle accommodations on a roadway can be provided on the roads as:
 - Bike lanes (separate accommodation from motor vehicles. See diagram below)
 - Shared lanes (motor vehicle/bike. See diagram below)
 - Combination of Bike lanes & Shared lanes at various stages of road segments
- 3) MassDOT has set the minimum width for separate bicycle lanes at 4 feet although 5 foot bicycle lanes are preferred. Both are applied to the Town Center roads where applicable.



Alternative 2: Add All Roadways Shared Lanes Only and Possible Bicycle Circulation Pattern

Possible Bicycle Circulation Pattern

All bicycle through and turn movements would be permitted with the following exceptions:

- No Mass Ave NB movements at the Intersection and no bicycle travel on Ayer Rd NB due to vertical climb on Ayer Rd
- Mass Ave NB movements would take place by taking a right turn on to Common St
- No Ayer Rd SB left turns at the Intersection. Bicycles would proceed to the Mass Ave and Common St intersection to take a left turn
- No Still River Rd EB left turn movements due to vertical climb on Ayer Rd. EB through movements would continue or would take a right turn on to Mass Ave then proceed to the Common St to take a left turn
- Right turns into channelized right turn lanes would not be permitted due to possible conflict with motorized vehicle in the lane. Bicycles would proceed to the intersection to take a right turn after the channelized island

See Figures 19A & 19B for circulation pattern

Figure 19A

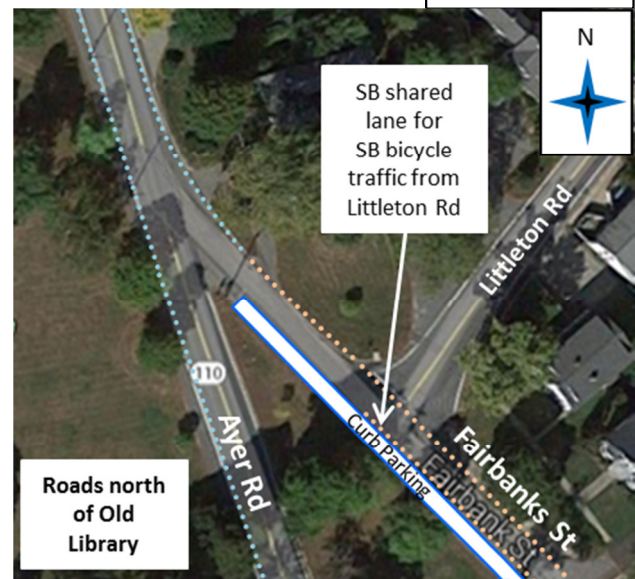
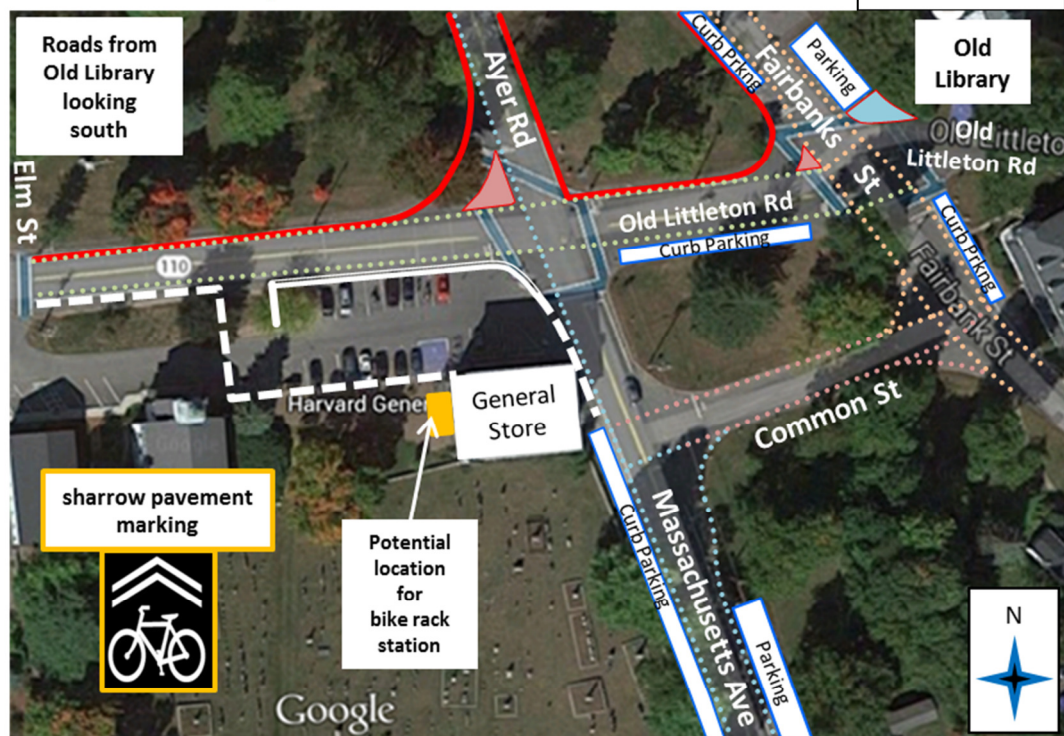


Figure 19B



All Roadways Shared Lanes Only

To address lack of existing designated bicycle accommodations, convert roadways to a shared lane environment for motor vehicles and bicycles and add at least one bike rack station (see Figures 19A & 19B). The shared lane environment can be accomplished by installing SHARROW (shared lane) pavement markings and SHARE THE ROAD signs to:

- Ayer Rd*
- Fairbanks St
- Common St
- Mass Ave
- Still River Rd
- Old Littleton Rd

Bike Accommodation by Road (Figures 20A & B)

- Ayer Rd/Mass Ave
- Fairbanks St
- Still River/Old Littleton Rd
- Common St

*SB only south of Ayer Rd and Fairbanks St intersection

Shared lanes facilitate bicyclists on roadways when there is insufficient pavement width to install bike lanes. Sharrows indicate the correct position of where bicyclists should be in a lane to both the bicyclists and motor vehicle drivers and that they should be mindful and respectful of each other. Shared lanes are most appropriate for lower volume, lower speed roads.

The benefits of designating shared lanes as described above are: may assist bicyclists with hazardous situations; offer directional guidance; may encourage bicyclists to cease riding on sidewalks.

However, applying shared lanes to the roadways throughout the Town Center may not be the more favorable improvement alternative as:

- They do not offer bicyclists a dedicated lane for their exclusive use
- Most of the roadways throughout the Town Center have sufficient pavement width to install bike lanes

Bike Rack Station(s)

Add a bike rack station (or stations) for the purpose of bicycle storage and security. This will allow bicyclists the freedom to spend time in the Town Center while knowing their bicycles are secure. Figure 19B provides two potential locations that are centrally located.

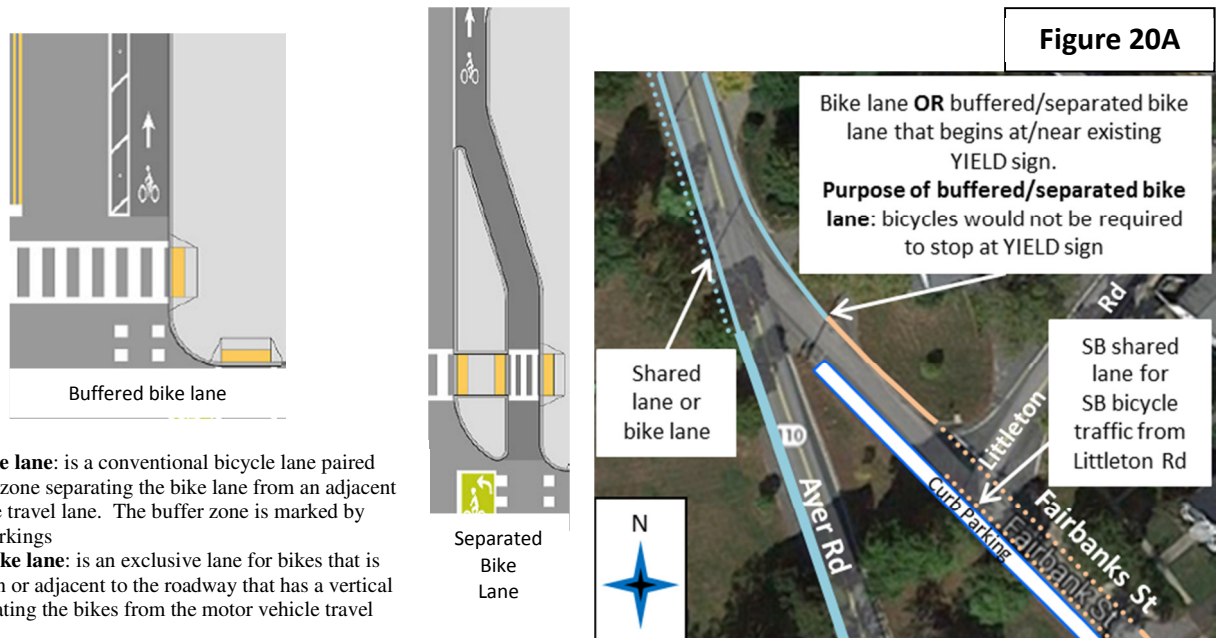
Mounted bike rack



Alternative 3: Add Bike Lanes & Shared Lanes Where Applicable

To address lack of existing designated bicycle accommodations on Town Center roadways, add bike lanes to most roadways while converting to a shared lane environment those roadways that do not have adequate pavement width for bike lanes.

Figures 20A & 20B illustrate where bike lanes or shared lanes would be applied. The associated tables provide details such as the road segment covered by the bike lane or shared lane; the remaining pavement width after subtracting for parking (if any); potential bike lane width; potential sidewalk width (if any); potential pavement width remaining; and the potential type of bike accommodation that would be applied.



Buffered bike lane: is a conventional bicycle lane paired with a buffer zone separating the bike lane from an adjacent motor vehicle travel lane. The buffer zone is marked by pavement markings
Separated bike lane: is an exclusive lane for bikes that is located within or adjacent to the roadway that has a vertical feature separating the bikes from the motor vehicle travel

Street Name	Road Segment	Remaining Pavement Width [^]	Potential Bike Lane width	Potential Sidewalk width [^]	Potential Remaining Pavement Width	Potential Bike Accommodation Option(s) (bike lane is represented by top border line color here & is identical to bike lane color on diagram)
Ayer Rd	from just north of the Town Hall to the Fairbanks St intersection	29	8	0	21	4' bike lanes each side; OR buffered/separated NB bike lane east side / SB shared lane west side
	At the Fairbanks St intersection to just south of the Fairbanks St intersection	26	5	0	21	5" SB bike lane west side / no NB bike lane east side due to vertical climb from stop
Fairbanks St	from the Ayer Rd intersection to the Littleton Rd intersection	15	4	0	11	4' bike lane east side only
	from the Littleton Rd intersection to north of old public library	20	0	0	20	Shared lane each side

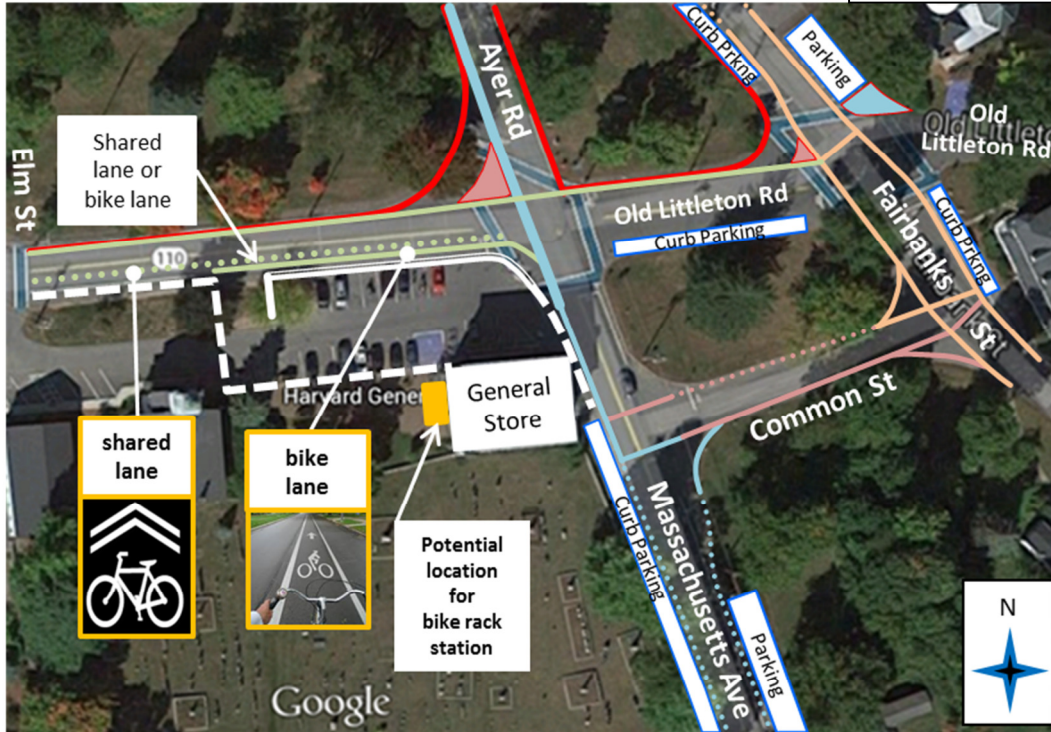
[^]after results from separate parking analysis

Bike Accommodation by Road

- Ayer Rd/Mass Ave
- Fairbanks St
- Still River/Old Littleton Rd
- Common St

- Potential 4 foot Bike Lane
- Potential 5 foot Bike Lane
- Potential Shared Lane (Bike/Motor Vehicle)

Figure 20B



Street Name	Road Segment	Remaining Pavement Width [^]	Potential Bike Lane width	Potential Sidewalk width [^]	Potential Remaining Pavement Width	Potential Bike Accommodation Option(s) (bike lane is represented by top border line color here & is identical to bike lane color on diagram)
Ayer Rd	from just south of the Fairbanks St intersection to the Still River Rd intersection	29	5	0	24	5' SB bike lane west side / no NB bike lane east side due to vertical climb from stop
Mass Ave	from the Still River Rd intersection to just south of the Common St intersection	28	4	0	24	4' SB bike lane west side OR shared lane / NB shared lane east side
Fairbanks St	from the south side of the Old Littleton Rd intersection to just north of old public library	29	8	0	21	4' bike lane each side
	from the south side of Old Littleton Rd intersection to the south side of the Common St intersection	40	8	0	32	
Still River Rd	from the Elm St intersection to the Ayer Rd intersection	31	4	4	23	4' WB bike lane north side / EB shared lane south side; OR : 4' bike lane south side - if raised curb barrier is preferred improvement alternative
Old Littleton Rd	from the Ayer Rd intersection to the Fairbanks St intersection	28	4	0	24	4' bike lane north side
Common St	from the Mass Ave intersection to the Fairbanks St intersection	24	4	0	20	4' bike lane south side / shared lane north side

[^]after results from separate parking analysis

Town of Harvard Town Center Transportation Committee Preferred Improvement Alternatives for the Bicycle Accommodation Improvement Alternatives:

- A. Add “shared lanes only” with the sharrow marking at locations noted on Figures **19A** and **19B**
- B. Add the parallel parking lane and shared bike lane symbol on the SB side of Fairbank St (see Figures **19A** and **19B**)
- C. Add bicycle racks as shown on Figure **19B**
- D. Paint STOP symbols on the pavement to remind bicyclists they must obey stop signs
- E. Due to the steep climb up Ayer Road (NB) from the intersection, direct bicyclists to Fairbank Street (see Figure **19B**)
- F. Members generally did not support the concepts of a buffered bike lane or a separated bike lane (see Figure **20A**). An exception may be on Ayer Rd. SB between Fairbank St. and the Still River Rd. intersection. Members did not spend a lot of time discussing other locations

SOURCE: Harvard TCTC Review of MRPC’s Town Center Alternatives

Town Center – Town Hall Area

MRPC Disclaimer as of 4/27/16: The MRPC is suspending further discussion of this section. The Town Hall area improvement planning process has been placed under the control of the BOS and the PB of Town of Harvard (Town). The improvement alternatives presented below may contribute to the universe of improvement alternatives the Town considers as it moves forward.

Improvement Alternatives

The goal of the MRPC is to provide conceptual low to moderate cost transportation improvement alternatives to improve roadway delineation and traffic circulation in the Town Hall area. The improvement alternatives will seek to improve access for the public to the Town Hall, the Fire Department, and Hildreth House that will meet the overarching goal of the *Action Plan* which is to “... reconcile two seemingly contradictory desires – to move forward with those actions necessary to support and sustain the Center’s vitality and mix of activities while simultaneously preserving the center’s classic village character and imagery.” The improvements alternatives seek to retain the existing roadway geometry to the highest possible degree.

Alternative 1: No Changes



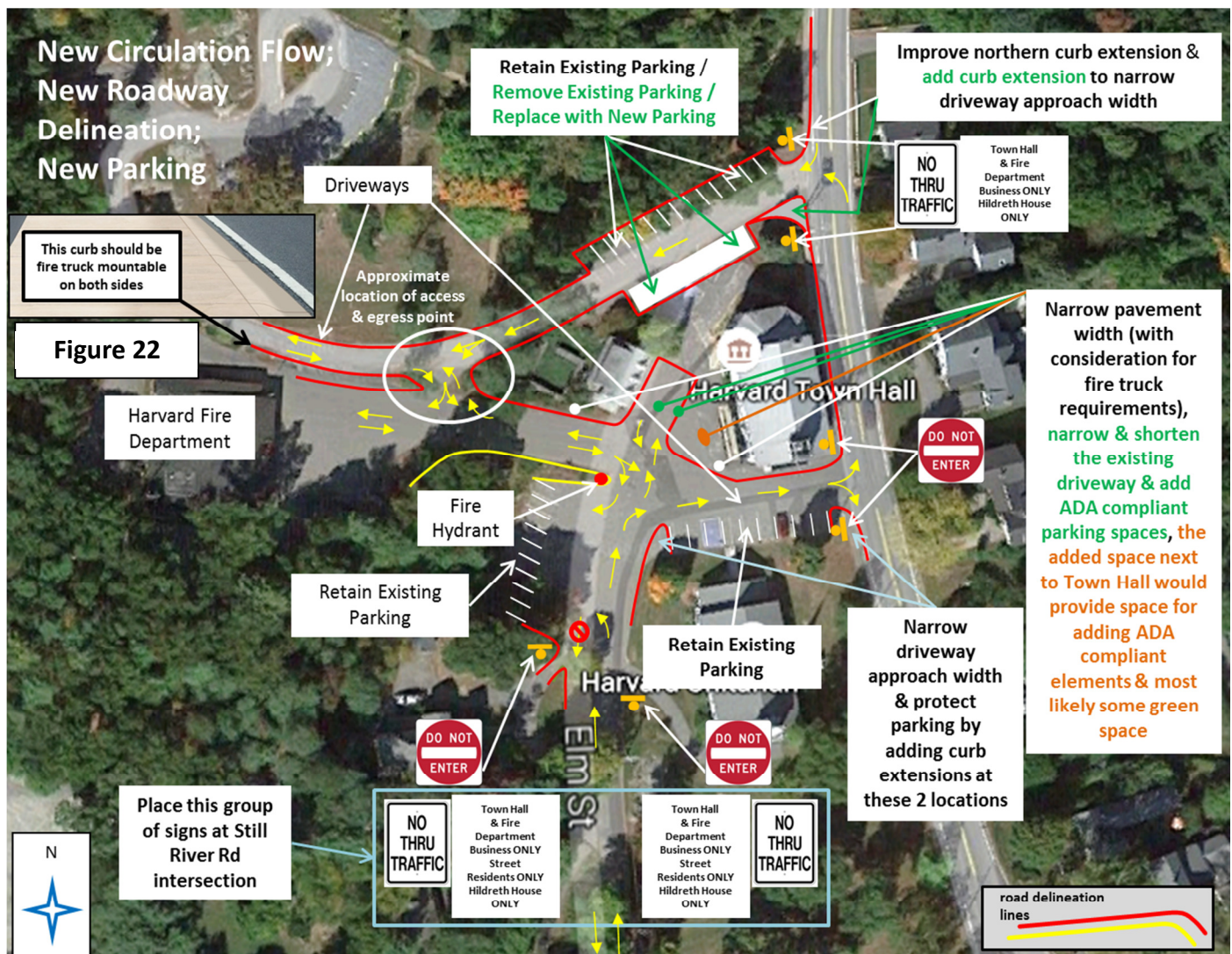
The combination of the following existing characteristics - undefined street edges; wide access and egress points; all movements permitted everywhere; lack of pavement markings and signage (including advanced warning signs); and large paved area next to the Town Hall will continue to provide the public with inadequate facilities to access important public services (see Figure 21).

Alternative 2: New Traffic Circulation Flow; Roadway Delineation; Add Parking

Potential motor vehicle traffic circulation flow would be as follows:

Elm St (at Ayer Rd) / Hildreth House driveway would be a two-way road. Road width may need to be widened to allow opposing vehicles to share the road (see Figure 22)

- Driveway in front of the Town Hall would be a one-way road EB. Motor vehicles would use this driveway to exit the Town Hall area



- Hildreth House driveway (road north of Town Hall) would be a one-way road WB
- Driveway in front of Fire Department would be a two-way road to Elm St
- SB motor vehicle travel on Elm St would be prohibited beyond the existing parking facility south of the fire hydrant. NB motor vehicle travel would be permitted to allow access to Town services from Still River Rd. Elm St south of the parking facility would remain two-way for Elm St resident access
- Access and egress for the Fire Department and Hildreth House in between the two driveways would be provided at one location
- Right and left turns into Elm St from Ayer Rd would be permitted
- Right and left turns from the driveway in front of the Town Hall would be permitted

Potential Roadway Delineation & Parking would be as follows:

The purpose of delineating roadways is to define the roadway operating area for the driver. The red lines (and one yellow line) depicted in Figure 22 seek to approximate the road edge to delineate the roadway. The lines approximate where the roadway should be narrowed or widened through the installation of curbing (preferably granite). Also, the roadway delineation would provide guidance as to where sidewalks could be installed.

To narrow the wide access and egress point at the driveway and Ayer Rd intersection and to protect parking that occurs in front of the Town Hall:

- Add a curb extension to each end of the existing parking stalls

To narrow the wide access and egress point at the Elm St and Ayer Rd intersection:

- Improve the northern curb extension and add a curb extension on the southern corner

Narrowing the driveway in front of the Fire department may be warranted:

- Fire truck road width requirements need to be considered

The large paved area in between the Town Hall and a small building to the west should be shortened and narrowed

- ADA compliant parking spaces would be added in the downsized paved area
- The existing parking to the north would be removed
- Perpendicular parking would be added along the Elm St (at Ayer Rd) / Hildreth House driveway

Roadway delineation for the Elm St (at Ayer Rd) / Hildreth House driveway would provide for a two-way road wide enough to allow opposing vehicles to share the road.

All other existing parking facilities would be retained.

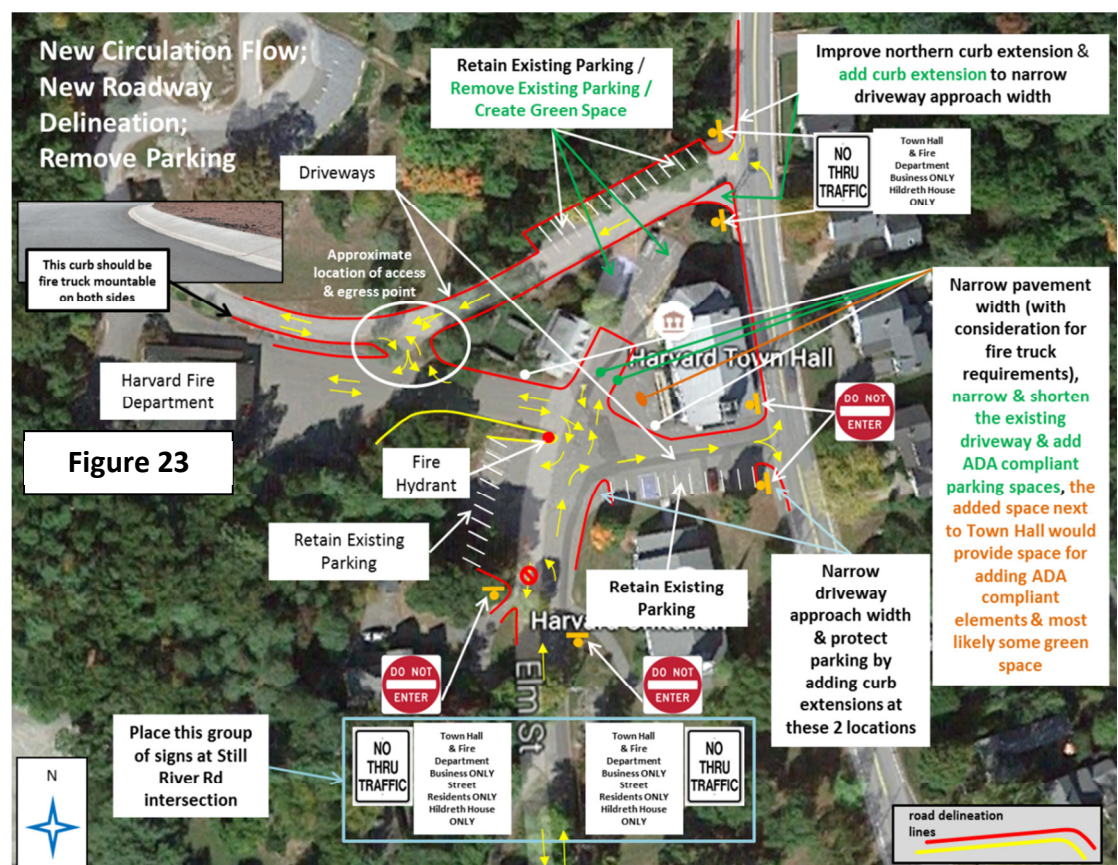
The roadway delineation for the access and egress point for the Fire Department and Hildreth House in between the two driveways would need to consider fire truck road width requirements.

The curbing for the roadway delineation between the Fire Department and Hildreth House should be mountable for fire trucks.

Add signage as depicted on Figure 22. Additional signage may be needed. Appropriate pavement markings should be included in the design and are a recognized roadway delineation method.

Alternative 3: New Traffic Circulation Flow; Roadway Delineation; Remove Parking

This Alternative (see Figure 23) differs from Alternative 2 only in that it removes parking entirely from the south side of the Elm St (at Ayer Rd) / Hildreth House driveway and creates green space.



Town of Harvard Town Center Transportation Committee Preferred Improvement Alternatives for Town Hall Area Improvement Alternatives:

- A. Members did not support the concept of a roundabout, either round or oval. The low amount of traffic would not seem to justify the need. The Fire Chief in particular felt it would interfere with fire truck movements
- B. Members are fine with the proposed signage and traffic pattern along Elm St (See Figure 22)
- C. Members favor the one-way exit-only movement onto Ayer Road at the south end and a one-way enter-only movement on the north end as shown on Figure 22. Make alignment changes as needed to ease turning movements. Members did not favor closing either driveway entrance
- D. Retain the 90 degree parking at the lower end of the Hildreth House driveway. Add the parking area on the opposite side as shown on Figure 22
- E. In front of Town Hall, retain 90 degree parking in its current location. Add curb extensions where appropriate as shown on Figure 22
- F. Retain 90 degree parking adjacent to the fire hydrant (see Figure 22)
- G. Continue with the opening between the Hildreth House driveway and the Fire Station. This is necessary to allow traffic coming up from Elm Street to access Hildreth House. The exact location, width and extent of curbing to be determined. Do not add other breaks in the Hildreth House driveway (see Figure 22)
- H. Remove the 2-3 spaces by the north end of Town Hall (see Figure 22)
- I. Members felt it would be wise to not consider parking and access changes by the Hildreth House at this time due to the early planning stages of a possible housing development adjacent to the House. Members agreed that the renovation of the upper meeting room in the Town Hall will generate the need for additional parking in the vicinity
- J. Add handicapped parking spaces on the west side of Town Hall (see Figure 22)

SOURCE: Harvard TCTC Review of MRPC's Town Center Alternatives

Pathways

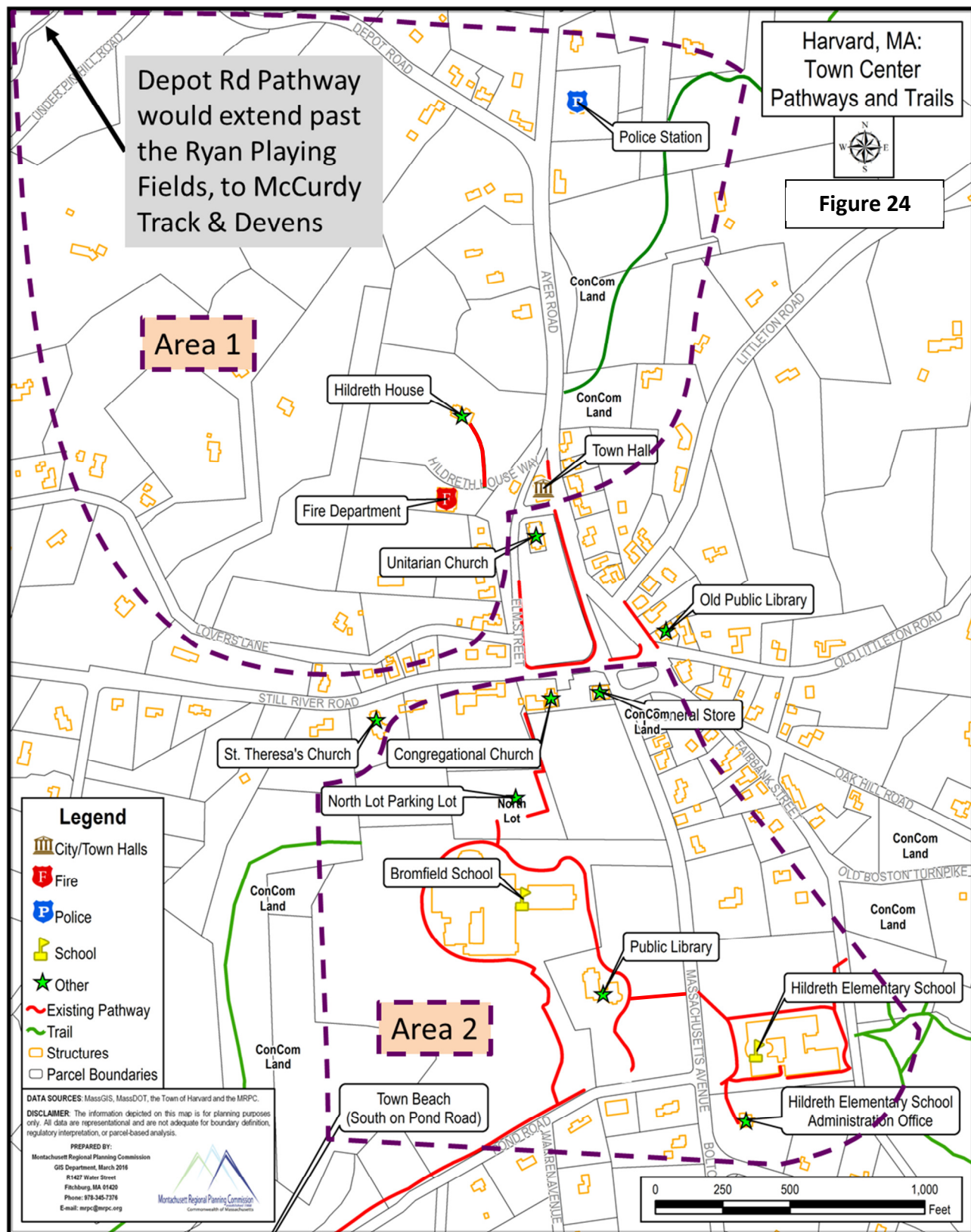
Existing Conditions

Many pedestrian improvement alternatives have been provided for the Town Center in the *Town Center – Ayer Rd / Fairbanks St / Mass Ave / Still River Rd / Elm St Area - Improvement Alternatives* section above. This section will seek to provide pedestrian improvement alternatives in the two areas depicted in Figure 24.

Area 1 provides very few pedestrian facilities. Area 1 covers the area in between the Ryan Playing Fields; Depot Rd; the Police Station; the Town Hall; and Lovers Lane. There is a non ADA compliant paved pathway next to the Town Hall on Ayer Rd, an off road trail behind the Town Hall, and an off road trail in behind the Police Station. There are no pedestrian facilities to the Ryan Playing Fields on Depot Rd.

Area 2 covers the area in between Still River Rd; the Hildreth Elementary School; the Bromfield School; and the area just west of Bromfield School. The Area 2 provides many pedestrian facilities but there are many gaps and upgrades to existing facilities are needed:

- The pathway around the Bromfield School does not provide formal links along the driveway to Mass Ave and links to Pond Rd need to be improved
- The pathway between the North Parking Lot and Still River Rd needs to be upgraded
- No pedestrian facilities exist along Mass Ave
- The pathways around the Hildreth Elementary School and the Mass Ave crosswalks need to be upgraded
- Links to off road trails need to be developed or upgraded



Improvement Alternatives

The Town Center pedestrian improvements would act as a hub to connect existing and potential pathways in Area 1 and Area 2 (see Figure 24).

Area 1 Pathway Improvement Alternatives

The Area 1 pathway improvement alternatives are based on those depicted on the *RECREATION TRAIL PROPOSAL* (April 2005) map (Map):

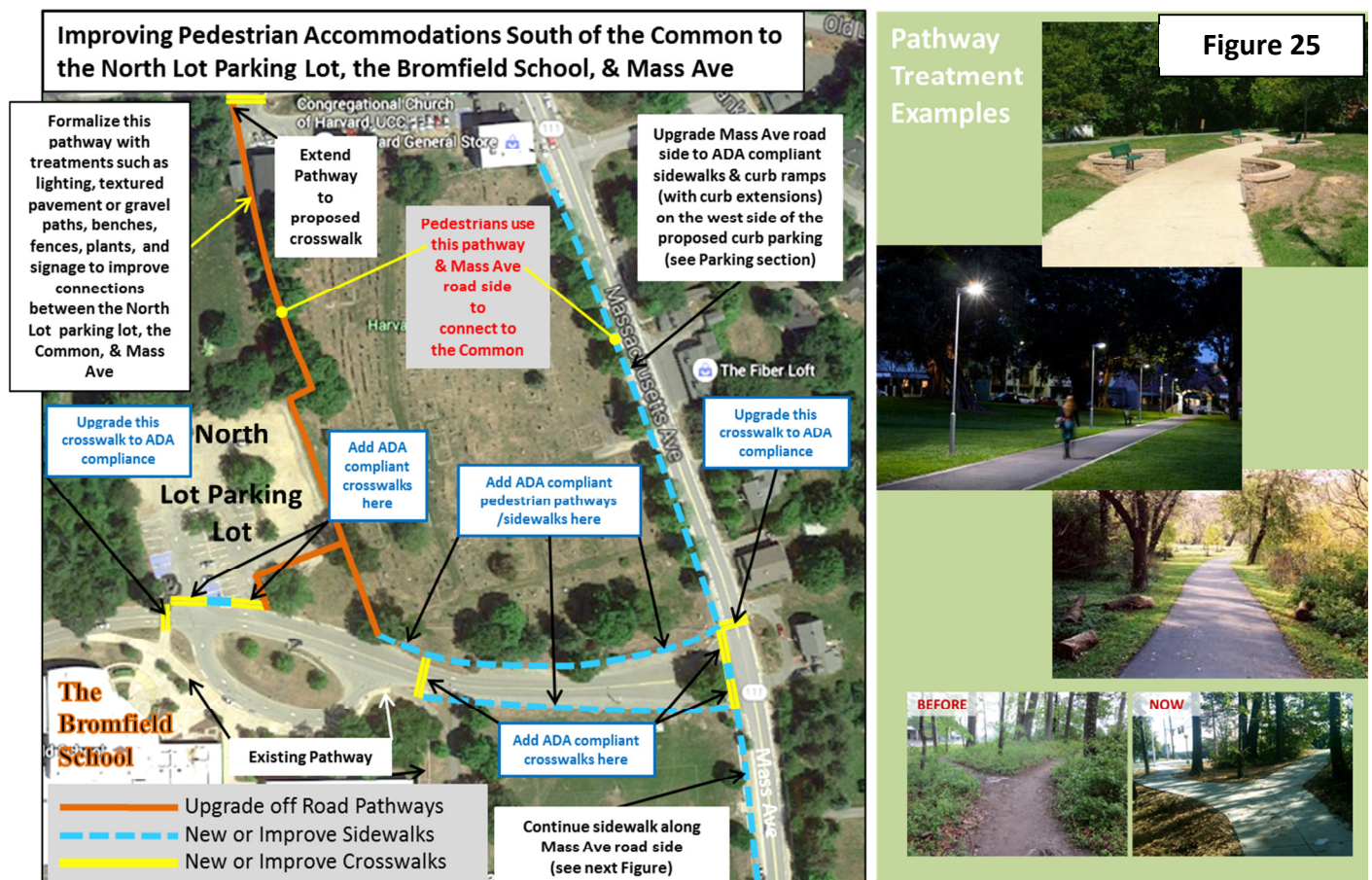
- Develop pathways similar to those depicted on the Map. The goals of the Map appear to seek pedestrian connections from the Town Beach to Devens and to provide connections between existing pathways. The pathways would be ADA compliant.
 - In this pathway improvement alternative the Proposed Pathway route begins next to the Town Hall:
 - The pathway would begin by upgrading the existing pathway next to the Town Hall on Ayer Rd and would conclude a short distance north of Elm St across from the conservation land on the east side of Ayer Rd
 - A crosswalk on Ayer Rd would bring pedestrians across Ayer Rd to the conservation land on the east side of Ayer Rd and connect to an existing roadside pathway on the conservation land that proceeds north
 - Where the pathway meets the northern most conservation land parcel, construct a new pathway to the northwest to as near as possible to the Depot Rd and Ayer Rd intersection
 - A crosswalk on Ayer Rd would lead to an roadside pathway on Depot Rd
 - A sidewalk would be installed on the east side of Ayer Rd beginning at the new crosswalk on Ayer Rd to the Police Station
 - A roadside pathway would be installed along Depot Rd all the way to Devens
 - The Map provides two Alternative Pathways:
 - The Under Pin Hill Route would begin at the Elm St and Lovers Lane intersection which would then proceed west on Lovers Lane to Under Pin Hill Rd and head north to conclude at Depot Rd

- The Woodland Route would begin at the Ayer Rd and Elm St (at Ayer Rd) / Hildreth House driveway intersection which would then proceed north west to conclude at Depot Rd

Area 2 Pathway Improvement Alternatives

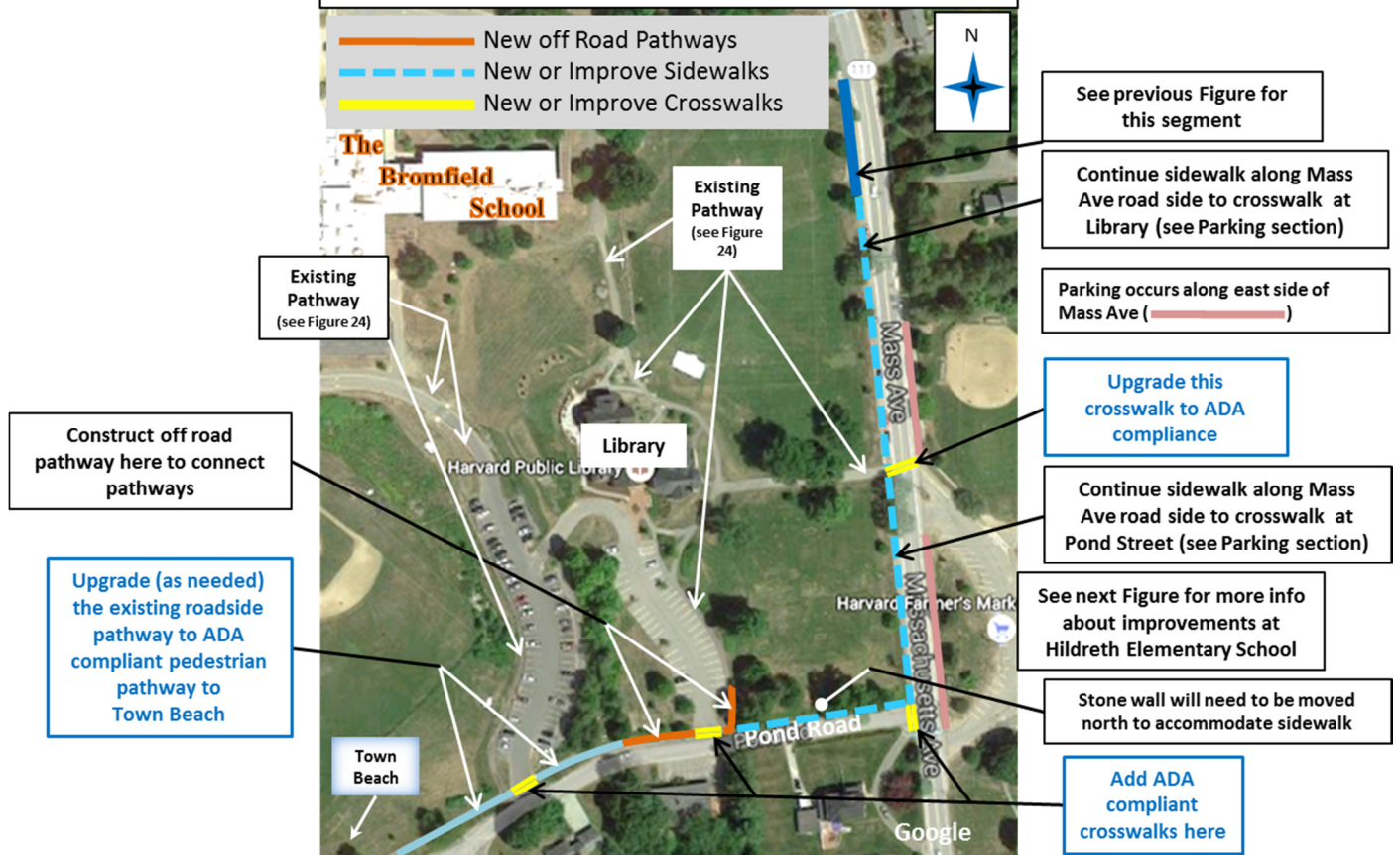
The Area 2 pathway improvement alternatives seek to make connections between existing pathways and trails while making improvements to them and adding new potential connections to encourage increased pedestrian activity. The pathway improvement alternatives include many of those proposed on the *Safe Routes to School* map (2007). The pathway improvement alternatives are depicted on the Figures 25 – 27 below. A right of way issue exist if the pathway from the Bromfield School to the Congregational Church is extended to Still River Rd. The extension does not need to be constructed of the same material as the pathway. Since the area in question is paved, pavement markings could delineate pedestrian activity.

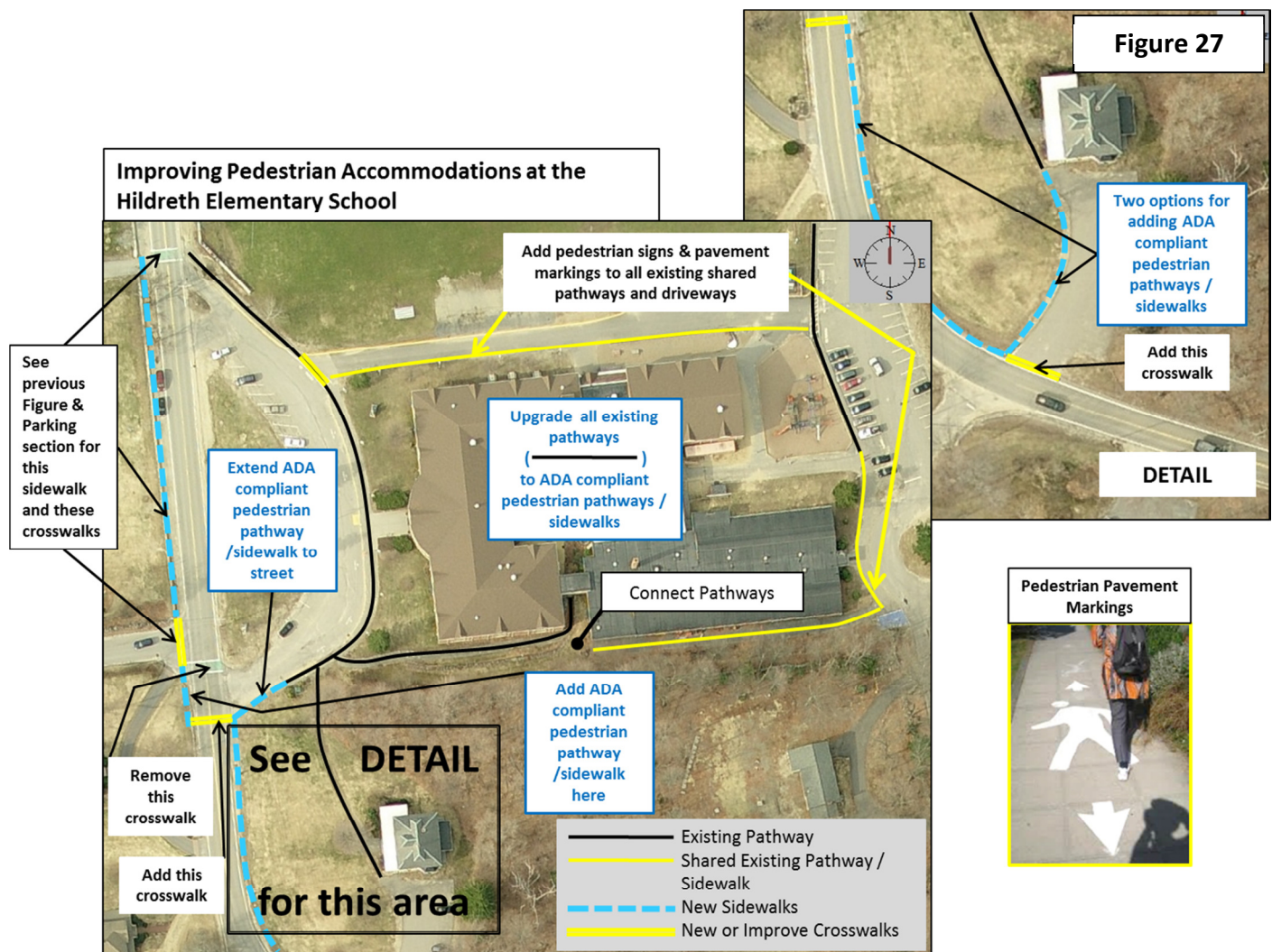
NOTE: the sidewalks improvements along Mass Ave would be on the left side, or west of, the curb parking along the west side of Mass Ave.



Improving Pedestrian Accommodations East, West & South of the Bromfield School & to the Town Beach on Pond Road

Figure 26





Parking Facilities

Existing Conditions

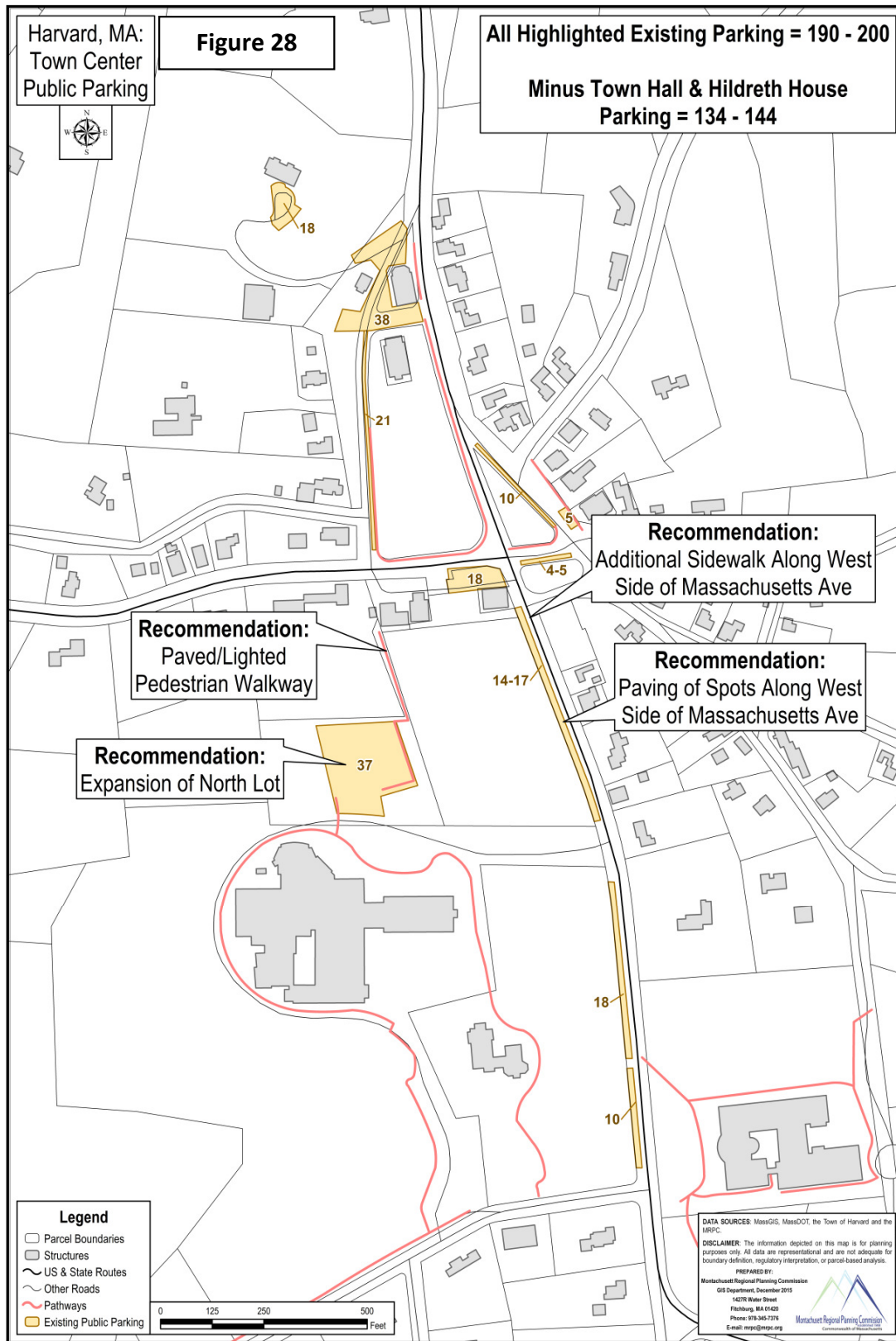
Existing parking can be seen in map *Town Center Public Parking*. Visitors to the town common utilize various locations throughout the study area. Although few spots are designated by pavement markings, it is estimated that total capacity of available public spots is between 190 and 200. Since attractions to the common are spread out and not always close walking distance to all available parking it is important to note what estimated parking is in each area of the common as indicated in the *Town Center Public Parking* map (see Figure 28). The Town facilities bookend the study area north and south - the Hildreth House and Town Hall are to the north while the Schools and Library are to the south. The center portion of the study area is comprised mostly of commercial and religious facilities as well as the open space of the town common itself. The planned expansion of the North Lot may add an additional 72 public spots within reasonably walking distance to all town common destinations.

The Institute of Transportation Engineers Parking Generation Manual was referenced when analyzing parking in the Common. This Manual utilizes information obtained from experiences of transportation engineering professionals and research throughout the country and makes recommendations based on parking needs pertaining to different uses. This guidance provided analysis for stand-alone lots only, or lots separated and designated for a particular use, not shared with any other uses or facilities. Harvard Town Common, where which the majority of parking is shared public parking, does not fit into analysis of this manual or any available and acceptable professional publication. However, the parking characteristics in the Common were observed and compared to this analysis. Below is a chart which compares existing conditions to recommendations in the Parking Generation Manual.

Venue	First Congregational Unitarian	Congregational Church of Harvard	Harvard General Store	Town Hall
Indicator	Square Feet	Square Feet	Square Feet	Employees
Existing Conditions	11,200	7,500	7,600	16
Recommended	8 - 13 Vehicles/1000 Sq. ft.	8 - 13 Vehicles/1000 Sq. ft.	3.5 - 3.75 Vehicles/1000 Sq. ft.	1.01 Vehicles Per Employee
Total Need	90 - 145	60 - 98	26 - 29	16
Total Available	*	*	18	38

* Both Churches have access to additional off-street private parking as well as what is available for public parking within reasonable parking distance.

The analysis above displays recommended capacity for venues in the Town Common. As noted above, the context of these recommendations do not mesh well with the characteristics of the study area, in which contains a large stock of public parking available to all Town Common visitors. Through observance and public input it was determined that current parking stock available in the common is adequate for typical use, although additional accommodations could be made to improve parking function in the study area. As mentioned in the pedestrian section, adequate sidewalks are important for the function of the common. Tying in designated parking areas with pedestrian facilities should be a priority.



Parking Accommodation Improvement Alternatives

Alternative 1: No Changes

The existing parking stock has been determined to be adequate for current town common use. Plans for an expansion of the North Lot would add an additional 72 public spots. Aside from improvement to the North Lot the cost would be zero with this alternative.

Alternative 2: Minor Improvements

The parking situation in the common could benefit from minor, low cost improvements. The addition of signage indicating where parking is available would inform those not familiar with the study area and provide the opportunity to add an aesthetic aspect to the common. In select spots pavement markings indicating where parking is available would keep users from parking too close to intersections and travel lanes.

- Addition of signage indicating where parking is available
- Pavement markings indicating where to park

Alternative 3: Extensive Improvements

In addition to improvements to the North Lot and minor improvements listed above a number of additional more in depth improvements could increase function and character of the town common parking. These improvements are more in depth and therefore more costly than those listed above.

Massachusetts Ave. Parking

- Paving of current spots allows for better plowing and utilizing these spots in winter months.
- Consider paving in front of Bromfield School. (possibly adding additional 650' for parking)
- Current right of way allows for parallel parking or diagonal parking
- Current use: 14 – 17
- Possible added spots: 28
- Add sidewalk to west side of Massachusetts Ave along parking areas

North Lot

- Expand lot and include lighted and paved walkway to Still River Road and sidewalk infrastructure to Massachusetts Ave

Bump Outs

- Addition of bump outs as indicated in pedestrian section to further define and add aesthetic aspect to parking and pedestrian facilities

Town of Harvard Town Center Transportation Committee Preferred Improvement Alternatives for the Parking Accommodation Improvement Alternatives:

- A. Members agree with the Minor Improvements described in Alternative 2
- B. Members agree with the proposed Mass. Ave. sidewalk and parking improvements where there is sufficient ROW to work with. The concept is shown on Figures **25, 26** and **28**.
This would formalize parallel parking on the west side of Mass. Ave. with pavement and striping. A new sidewalk would be placed along the old stone wall adjacent to the parking lane. Retain existing trees and add tree grates within the sidewalk for rainfall percolation.
- C. The key measured width of Mass. Ave. is the insufficient shoulder width from the crosswalk that connects the Library and Elementary School south to Pond Road. Permission from the Bromfield Trustees is required to move the existing stone wall.
- D. The Reuben Reed deed prohibits parking on the connector road (it is known by various names including No Name Road and Cemetery Road). It is shown on the sketches as Common St.) Apparently, this was originally a driveway to the house on the property, which burned down early in the 20th century. Members discussed the possibility of removing the road but did not come to an agreement.
- E. Members supported formalizing parking on the NB (east) side of Fairbank Street between the Old Library and Littleton Road. The preference is for angled parking if it can be accommodated; if not, add curbing and parallel parking. This requires further study and consultation with the two affected property owners. Retain and improve the sidewalk here.

Next Steps

MassDOT Healthy Trans Policy Directive (HTPD)

The Town of Harvard should seek the development of future road projects in the study area that are based on the HTPD. The HTPD formalizes MassDOT's commitment to the completion of a transportation network that serves all mode choices based on GreenDOT's visionary Mode Shift Goal (for more info see below) that began in 2012. The Goal seeks to increase walking, bicycling, and transit transportation modes. The HTPD was issued to ensure that MassDOT projects are designed and constructed to provide safe and healthy transportation choices that accommodate all users. For the complete HTPD go to the following link:

<http://www.massdot.state.ma.us/Portals/0/docs/GreenDOT/DirectiveHealthyTransportation.pdf>

Complete Street Concepts

The improvement alternatives presented in the study have been derived from Complete Street Concepts (Concepts). The Concepts provide the healthy, safe and accessible options for all travel modes. The modes include foot, bike, transit and automobile (includes parking). The Concepts include the idea that people of all ages and abilities, including disabilities, should have access to the roadway. The Concepts seek to increase the role of non-motorized and transit options by providing continuous sidewalks, public transit options, bicycle lanes, or wide shoulders to create a safe, accessible environment throughout the transportation network.

This increased role for pedestrians, bicyclist and transit in roadway design and operation standards are meant to ensure that safe travel options exist for all users. The MassDOT Project Development and Design Guide follows this approach to roadway design and provides guidance on how to implement the Concepts. For the complete MassDOT Project Development and Design Guide go to the following link:

<http://www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/ProjectDevelopmentDesignGuide.aspx>

The Town of Harvard should seek the development of these Concepts in the areas presented in this study for all future transportation projects whether they are funded through the Montachusett MPO (MMPO) Transportation Improvement Program (TIP) or through other funding sources.

Transit

Transit options need to be perceived as affordable, timely, provide convenient access to key locations, and be within walking distance. One of the potential benefits that public transit options provide is that they most likely could be operating well in advance of the other Concepts.



Intersection

The Concepts provide a community with the ability to improve transportation facilities which are unsafe and lacks adequate facilities for all users.



To transportation facilities that provide all users with:

- Adequate facilities
- A safe and organized environment
- Guidance



The Concepts provide improvement alternatives such as ADA compliant pedestrian ramps at crosswalks, signs (including advanced warning signs), bike lanes and pavement markings that provide a safe and organized environment with guidance for all users.

The modern roundabout is a Concept for intersections. The simplest description of a modern roundabout is that it is a circular intersection where traffic flows around a center island in a one-way direction. The benefits of a smartly designed modern roundabout are basically two fold. At intersections where they have been constructed, safety and traffic flow have improved significantly as a result of a design that:

- Slows traffic which decreases the number and severity of crashes;
- Decreases the wait time that occurs at a traffic signal or STOP sign especially when there is no conflicting traffic.

The performance record of a modern roundabout has resulted in them becoming widely accepted as a safety improvement alternative. Based on anecdotal evidence, safety appears to have significantly improved since the completion of the roundabout at the Ashby State Road (Route 31) and John Fitch Highway intersection in Fitchburg.

Roundabouts are safer for pedestrians. The splitter islands provide pedestrian refuge and slow traffic which allows pedestrians to cross one travel lane direction at a time.

Roadway

The Concepts provide a community with improvement alternatives that improve a disorganized roadway environment that lacks adequate facilities for all users.



Modern Roundabout



To a roadway that provides a safe and organized environment with guidance for all users. The most complete Concepts include separate accommodations for each transportation mode: travel lanes for motorized vehicles, bike lanes for bicycles, sidewalks for pedestrians.



Other Pedestrian

Other pedestrian accommodation improvements include off road paths, curb extensions and traffic islands for pedestrian refuge where road width is available, and ADA compliant crosswalk curb ramps (detectable) for disabled pedestrians. Stormwater runoff is also properly engineered and managed to protect the environment



Project Development Process Description

The Project Development Process is the steps that take a transportation improvement project from concept through construction. The first step to take for the Town of Harvard is to request a meeting with the MassDOT District 3 Office to review and discuss these final recommendations. See ***Further Comments on ...*** below for more information on possible topics to be discussed at this meeting.

Following the meeting with MassDOT the Town of Harvard will need to complete a Project Need Form (PNF). This officially begins the ***MassDOT Project Development Process*** of which there are eight steps (see flow chart below). Town of Harvard may choose to contact the MRPC with any questions about the PNF. This study contributes to fulfilling Step II.

Every year the Montachusett Region receives federal and state funds for projects to improve the transportation network in local communities. These funds and projects are prioritized through the MMPO, a regional advisory group that annually develops the Montachusett TIP. For a community to receive funds, the project must follow the ***MassDOT Project Development Process*** required by the MassDOT Highway Division.

Project proponents are also required to follow this process whenever the MassDOT Highway Division is involved in the decision-making process. The project development procedures are, therefore, applicable to any of the following situations:

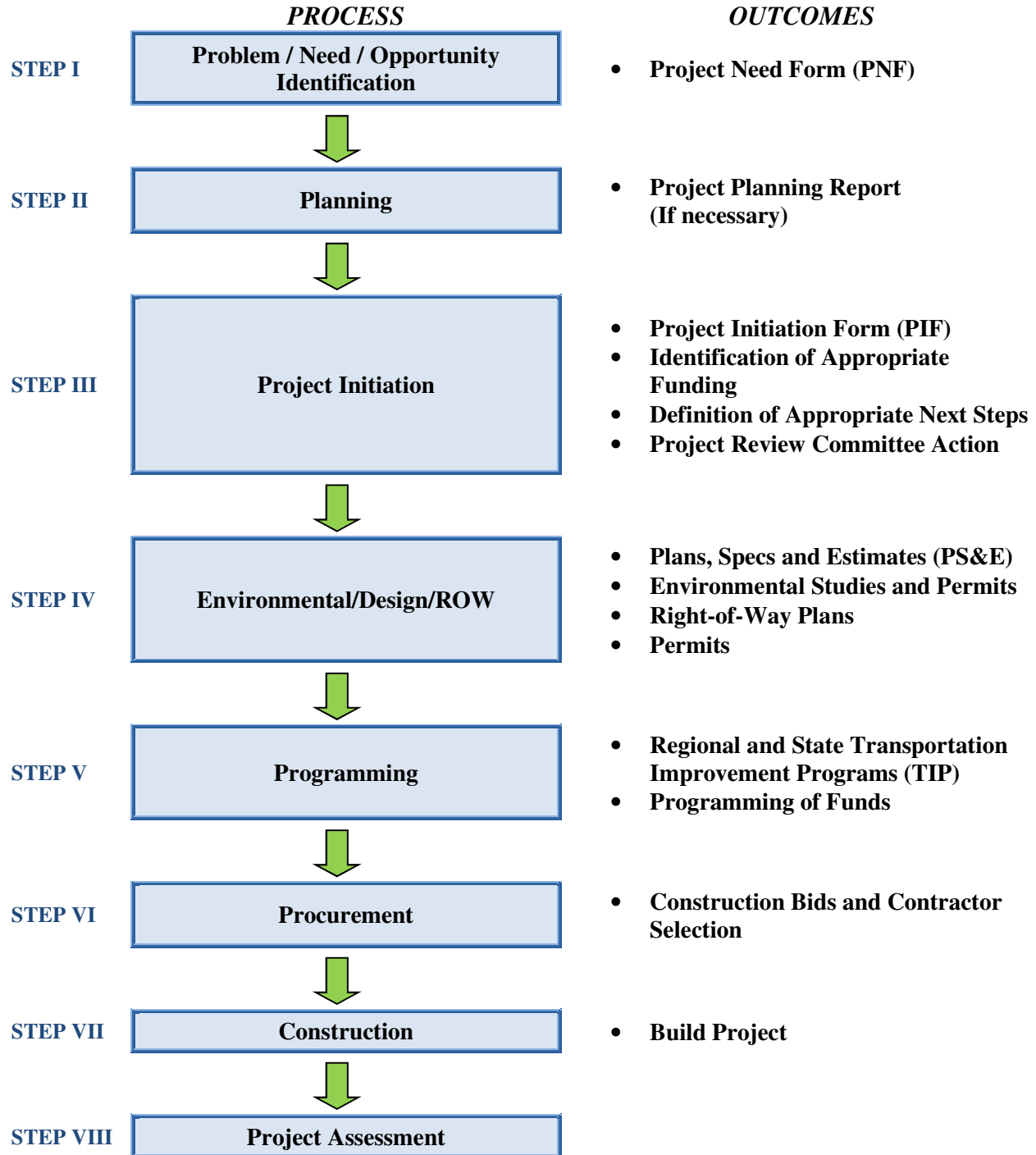
- When MassDOT is the proponent; or
- When MassDOT is responsible for project funding (state or federal-aid projects); or
- When MassDOT controls the infrastructure (projects on state highways)

Projects with local jurisdiction and local funding sources are not required to go through this review process unless the project is located on the National Highway or Federal-Aid Systems.

The ***MassDOT Project Development Process*** is designed to progressively narrow the projects focus in order to develop a project that addresses identified needs at that location. There should be opportunities for public participation throughout. The eight steps in the flow chart below are described in detail in Chapter 2, Project Development Guide of the MassDOT Highway Division Design Guidebook:

<http://www.mhd.state.ma.us/default.asp?pgid=content/designGuide&sid=about>

MassDOT Project Development Process Steps & Outcomes Flow Chart



Source: MassDOT Highway Division

Further Comments on the MassDOT Project Development Process:

- Before submitting a Project Need Form (PNF), a community should request a meeting with the District Office of the MassDOT Highway Division to review and discuss the potential project. The District office can provide the community with information and feedback about the possible project's scope, cost, issues, etc.
- Submit a PNF, along with any support materials, on the potential project to the District office.
- After review and feedback from MassDOT Highway Division on the PNF, a Project Initiation Form (PIF), again with any supporting materials, is prepared and submitted to the District office.
- MassDOT and the Project Review Committee (PRC) act upon the PIF. If the project is approved by the PRC, the community is notified and, if applicable, initiates the design process for the project.
 - The municipality hires a design consultant and also begins work on the right of way plans as well as any permits, local approvals, etc.
 - During this phase the project is incorporated into the Montachusett TIP. Placement and prioritization of the project is based upon available funds, evaluation criteria scoring, design status and public support and comments.
- Design public hearing is held at the 25% design phase.
- Design progresses to 100% and all plans, specifications and estimates (PS&E) are completed. Project is then ready for advertisement by MassDOT.

The MMPO and Project Development

Decisions related to project development, prioritization, funding and scheduling are made through the metropolitan planning process of the MMPO and the MRPC serves as staff to the MMPO. Through continued and active involvement in the planning process via the MRPC, the Montachusett Joint Transportation Committee (MJTC) and the MMPO, issues and projects important to the community can be discussed, heard and acted upon with their input and knowledge. MRPC staff can work with the community in creating and implementing a smart growth multimodal transportation system and provide technical assistance.

Transportation Role of the Regional Planning Agency

Note: This section includes key information about MassDOT Policies and Documents.

The MRPC acts as staff to the MMPO that has the responsibility of prioritizing transportation projects within the Montachusett Region. This presents municipalities with greater chances for input in setting local priorities. This shift in priority setting is intended to give municipalities a stronger role in planning transportation improvements that directly affect them. It is important to note that transportation projects and plans must be included in a regional transportation plan in order to receive federal funding for implementation. Key transportation documents include:

MRPC: Regional Transportation Plan

The Regional Transportation Plan (RTP) outlines the transportation priority needs and policies for the region. Before projects receive federal funding, they must be identified and incorporated into the policy goals and visions of the RTP. The RTP is developed through studies, discussions with local officials, boards and commissions and public comment. Each MPO in the Commonwealth of Massachusetts develops a RTP to provide guidance to local and state officials in deciding how to spend federal and state transportation funds. The RTP for the Montachusett Region identifies both short and long range projects for local roads, highways, bridges, rail, transit, bike and pedestrian trails, freight and airports as well as priorities, goals, visions and strategies.

The existing RTP prepared by the MRPC was endorsed on August 24, 2011. It should be noted that after the plan is completed and endorsed, the MMPO can still incorporate any changes through an amendment to the RTP. Information on the development of the RTP can be found on the MRPC website at www.mrpc.org.

MRPC: Transportation Improvement Program

For the Montachusett TIP see the **Funding** section below.

MRPC: Unified Planning Work Program (UPWP)

The Unified Planning Work Program (UPWP) for the MMPO is a financial programming tool developed annually as part of the federally certified transportation planning process. This document contains task descriptions of the transportation planning program of the MMPO, with

associated budget information and funding sources for the current program year. The purpose of the UPWP is to ensure a comprehensive, cooperative, and continuing (3C) transportation planning process in the Leominster-Fitchburg Urbanized Area and the Montachusett Region. In addition, this document provides for the coordination of planning efforts between communities in the Montachusett Region.

MRPC: Public Participation Procedures

Public participation continues to be a vital element of the transportation planning process. Community representatives of the Montachusett Joint Transportation Committee (MJTC) meet every month on the third Wednesday to discuss transportation projects and issues of regional importance. In order to guide the MMPO in this outreach effort, a Public Participation Program (PPP) was developed to solicit input to the various tasks undertaken. The PPP will continue to be reviewed and refined as necessary to insure compliance with federal regulations and improve the public input process.

MRPC: Title VI

The issue of Environmental Justice and how it relates to the MRPC will continue to be reviewed. As part of this effort, the regulations and requirements of Title VI of the Civil Rights Act of 1964 will continuously be examined. Prior efforts have led to the development and adoption of a Limited English Proficiency (LEP) Access Plan for the MMPO as well as submittal of annual reports indicating the work done to meet state and federal regulations.

MassDOT: Complete Streets

MRPC considers the Complete Streets as an important part of our planning process. The concept of Complete Streets is that all users of the road should be accommodated. Automobiles, bicyclists, public transportation vehicles and riders, and pedestrians of all ages and abilities should have equal access to roadway use. Instituting a Complete Streets policy ensures that transportation planners and engineers consistently design and operate the entire roadway with all users in mind.

MassDOT: GreenDOT

GreenDOT is the Massachusetts Department of Transportation sustainability initiative. It is designed to support the implementation of the following state laws.

- Climate Protection and Green Economy Act (Mass. Gen. L. c. 21N)
- Green Communities Act (Chapter 169 of the Acts of 2008)
- Healthy Transportation Compact (section 33 of Chapter 25 of the Acts of 2009)
- Leading by Example (Executive Order of Governor Patrick, no. 488)
- MassDOT's weMove Massachusetts planning initiative
- The "Complete Streets" design standards of the 2006 MassDOT Highway Division Project Development and Design Guide, as amended

The GreenDOT initiative incorporates three main goals:

1. Reduce greenhouse gas (GHG) emissions
2. Promote the healthy transportation modes of walking, bicycling, and public transit
3. Support smart growth development

Through the GreenDOT policy, MassDOT will promote sustainable economic development, protect the natural environment, and enhance the quality of life for all the Commonwealth's residents and visitors through the full range of our activities, from strategic planning to construction and system operations.

GreenDOT was designed in response to several existing state laws, Executive Orders, and MassDOT policies. These include the 2009 Transportation Reform Law that created MassDOT and established the Healthy Transportation Compact that promotes improved public health through active transportation; the Global Warming Solutions Act, which calls for measurable and enforceable economy-wide greenhouse gas reductions; and MassDOT's Complete Streets design approach that calls for appropriate accommodation of all transportation system users. MassDOT GreenDOT can be found at: <https://www.massdot.state.ma.us/GreenDOT.aspx>.

As part of the implementation plan for GreenDOT:

- "Secretary and CEO Richard Davey in October 2012 announced MassDOT's mode shift goal to triple the distance traveled by our customers through bicycling, transit and walking. That

goal now joins other goals incorporated into MassDOT's GreenDOT Implementation Plan with tasks and indicators.

- MassDOT established the goal to build a more efficient transportation system where fewer of our customers depend on driving alone to get where they are going. We want to reduce greenhouse gas emissions from the transportation system and support better public health outcomes by working to give our customers more healthy travel options.
- MassDOT will measure our progress on this ambitious mode shift goal using Personal Miles Traveled (PMT) - distances traveled by all our customers for bicycling, driving, transit and walking in a one year period. It also measures all the trips taken by our customers, not just work trips which are often the focus in transportation planning. Measuring the distance traveled by each mode allows MassDOT to see strategic opportunities to improve the travel options for our customers, strengthen the relationship between land use and transportation planning, and draw a link to greenhouse gas emissions.
- Goal numbers are listed in the table below.”

Year	Bicycling PMT	Transit PMT	Walking PMT	Total
2010 (baseline)	150.4m	1.83b	101.1m	2.08b
2020 (benchmark)	330.0m	3.99b	223.9m	4.55b
2030 (goal year)	516.m	5.93b	333.6m	6.78b

For more on the goals:

<https://blog.mass.gov/transportation/greendot/massdot-goal-triple-travel-by-bicycle-transit-walking/>

The policies and goals of the Commonwealth, such as GreenDOT and Mode Shift, will be reviewed, considered and incorporated in all relevant MRPC planning studies.

Recommendations derived from these studies will be consistent with state policies.

Funding

Montachusett Transportation Improvement Program

The Montachusett TIP is a list of highway and transit projects and their funding sources which will be discussed below. The TIP is a federally required, annually updated, prioritized listing of short-range highway construction and transit projects proposed for implementation during a five federal fiscal year cycle. It is a means of allocating scarce federal and state monetary resources across the state to projects that each region deems to be its highest priorities. The TIP must be financially constrained to projections of available federal aid. The Massachusetts Department of Transportation (MassDOT) Highway Division, moreover, is committed to funding those projects that will be ready for advertisement in the current Federal Fiscal Year (FFY) and beyond. To this end the Montachusett TIP contains a financial plan showing the revenue source or sources, current or proposed, for each project, for each anticipated FFY of advertisement.

To receive Federal or State funding, a transportation project must be included in the TIP. Projects listed in the TIP must also conform to the State Implementation Plan (SIP) for Air Quality Conformity in accordance with the Clean Air Act Amendments (CAAA), giving special consideration to "regionally significant" projects. Transportation projects funded with Federal funds from other Federal agencies, or with local or private resources, should be identified in the document to reflect the integrated and intermodal nature of the metropolitan transportation planning process.

The TIP must also be consistent with the current RTP for the Montachusett Region. In addition the TIP estimates future funding sources for operating and maintaining the current transportation network as well as the costs of capital improvements. The agency responsible for implementing highway projects in the TIP, unless otherwise noted, is the MassDOT Highway Division and, for transit projects, the Franklin County or Montachusett Regional Transit Authorities.

The Montachusett TIP is the product of the 3C Process (3C = a Comprehensive, Continuing and Cooperative effort) to improve the regional transportation system by local officials, the Montachusett Joint Transportation Committee (MJTC), the Montachusett Regional Transit Authority (MART), the MRPC and the MassDOT. Together these organizations along with local officials comprise the signatories representing the MMPO.

MassDOT Complete Street Program Description

The Massachusetts Department of Transportation (MassDOT) has announced the availability of funds through the Complete Streets Funding Program for communities in the Commonwealth. The program offers incentives to adopt policies and practices that provide safe and accessible options for all travel modes (walking, biking, transit and vehicles) for people of all ages and abilities.

To be eligible for up to \$50,000 in technical assistance and \$400,000 in construction funding, a municipality must meet three primary requirements:

- Attendance of a municipal employee at one of two different Complete Streets training workshops (see below for more)
- Passage of a municipal Complete Streets Policy
- Development of a Complete Streets Prioritization Plan

Reimbursement for technical assistance and project funding will be managed by the appropriate Highway District Local Aid Office, i.e. for our region, District 2 in Northampton and District 3 in Worcester. Available funding for FY 2016 and 2017 total \$12.5 million and must be spent by June 30, 2017.

For a community to begin to be eligible for these funds and to completely understand the program, attendance at the Complete Street workshops hosted by the Baystate Roads program out of UMass/Amherst is required. To register for free and to see a schedule of upcoming dates and locations for a workshop, visit their website at: <http://baystateroads.eot.state.ma.us/>.

Additional information on the program, including a downloadable copy of the “Complete Streets Funding Program Guidance”, can be found at:

<http://www.massdot.state.ma.us/highway/DoingBusinessWithUs/LocalAidPrograms/CompleteStreets.aspx>

The MRPC encourages Town of Harvard to review this program in order to become eligible to access valuable additional funds to address problem areas within your community. MRPC staff is available to answer questions and provide support and guidance to help our members in any way possible. Feel free to contact Brad Harris at (978) 345-7376 ext. 311.

Description of Federal Aid Highway Programs*

On December 4, 2015, President Obama signed into law the new Federal Surface Transportation Authorization known as *Fixing America's Surface Transportation Act* (FAST Act). Federal Aid is received by the State as reimbursement, and the State is required to contribute a matching share to most projects receiving Federal funds.

The FAST Act has generally maintained the program structure of MAP-21 that had combined several activities previously carried out under existing formula programs into a new core formula program structure. The FAST Act includes the following:

- National Highway Performance Program (NHPP)
- Surface Transportation Block Grant Program (STBGP)
- Highway Safety Improvement Program (HSIP)
- Railway-Highway Grade Crossings Program^
- Congestion Mitigation and Air Quality Improvement Program (CMAQ)
- National Highway Freight Program (NHFP)^
- STBGP Set-Aside (formerly the Transportation Alternatives Program (TAP))

This TIP includes projects funded under these programs as well as potentially carried over programs from prior federal authorizations such as High Priority Program (HPP) funds.

All of the programs listed are administered by the MassDOT. A project may be initiated by MassDOT or the local community. If approved, the project is submitted to Federal Highway Administration for funding. A description of each of these programs follows:

- National Highway Performance Program (NHPP): The enhanced National Highway Performance Program (NHPP) is composed of rural and urban roads serving major population centers, international border crossings, intermodal transportation facilities, and major travel destinations. It includes the Interstate System, all principal arterials (including some not previously designated as part of the NHS) and border crossings on those routes, highways that provide motor vehicle access between the NHS and major intermodal transportation facilities, and the network of highways important to U.S. strategic defense (STRAHNET) and its connectors to major military installations. The funding split for this program is generally 80% federal 20% state.

- Surface Transportation Block Grant Program (STBGP): The FAST Act converts the long-standing Surface Transportation Program into the Surface Transportation *Block Grant* Program acknowledging that this program has the most flexible eligibilities among all Federal-aid highway programs and aligning the program's name with how FHWA has historically administered it. The STBG promotes flexibility in State and local transportation decisions and provides flexible funding to best address State and local transportation needs. As under MAP-21, the FAST Act directs FHWA to apportion funding as a lump sum for each State then divide that total among apportioned programs. Each State's STBG apportionment is calculated based on a percentage specified in law. (See "Apportionment" fact sheet for a description of this calculation). The funding split for this program is generally 80% federal 20% state.
- Congestion Mitigation and Air Quality (CMAQ): The CMAQ program is continued in the FAST Act to provide a flexible funding source to State and local governments for transportation projects and programs to help meet the requirements of the Clean Air Act. Funding is available to reduce congestion and improve air quality for areas that do not meet the National Ambient Air Quality Standards for ozone, carbon monoxide, or particulate matter (nonattainment areas) and for former nonattainment areas that are now in compliance (maintenance areas). The funding split for this program is generally 80% federal 20% state.
- Highway Safety Improvement Program (HSIP): The FAST Act continues the Highway Safety Improvement Program (HSIP) to achieve a significant reduction in traffic fatalities and serious injuries on all public roads, including non-State-owned public roads and roads on tribal lands. The HSIP requires a data-driven, strategic approach to improving highway safety on all public roads that focuses on performance. The funding split is 90% federal and 10% state.
- STBGP Set-Aside: The FAST Act eliminates the MAP-21 Transportation Alternatives Program (TAP) and replaces it with a set-aside of Surface Transportation Block Grant (STBG) program funding for transportation alternatives (TA). These set-aside funds include all projects and activities that were previously eligible under TAP, encompassing a variety of smaller-scale transportation projects such as pedestrian and bicycle facilities, recreational trails, safe routes to school projects, community improvements such as

historic preservation and vegetation management, and environmental mitigation related to stormwater and habitat connectivity. The funding split for this program is generally 80% federal 20% state.

- **High Priority Projects:** This program provides designated funding for specific projects identified in SAFETEA-LU. Projects are identified with a specified amount of funding over the 5 years of SAFETEA-LU. The funds designated for a project are available only for that project until expended. HPP projects are fully funded and are included on the TIP when they are expected to be “ready to go.” The funding split is 80% federal and 20% state.

FAST Act funding information from FHWA Fact Sheets can be found at the FAST Act website: <http://www.fhwa.dot.gov/fastact/factsheets/index.cfm>

^descriptions for these programs are under development at this time.

Description of Transit Funding Programs**

The new Federal Surface Transportation Authorization known as Moving Ahead for Progress in the 21st Century (MAP-21) significantly changed the categories of transit funding available to grantees from what was under the prior authorization known as the Safe Accountable Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). However carryover funds from SAFETEA-LU are still available as carryover funds for some projects programmed under previous TIP's.

The biggest change between MAP-21 and SAFETEA-LU is the reduction of discretionary funding. Most of the discretionary categories such as “State of Good Repair” and “Bus and Bus Facilities” which were formerly 5309 funds are now formula funds and have their own new 53 subsection categories (5337 and 5339 conversely). Other discretionary funding categories have been repealed under MAP-21 such as the “Clean Fuels” (5308) program. Formula grant programs are funded to States based on formulas of population. Each grant program is referred to by name and most also by a number that correlates to the section number of Chapter 53 of Title 49 of the United States Code, as Amended by MAP-21. Specific allocation of funding amounts into each category is laid out in Section 5338.

Formula Grants:

- **Urbanized Area Formula Program (5307) Funds:** This formula program makes funds available on the basis of a statutory formula to all urbanized areas in the country. Eligible activities are capital projects, planning and job access/reverse commute projects (JARC - formerly 5316 funds). Operating assistance is continued as an eligible expense under Section 5307. Operating assistance caps are now in place for urbanized areas over 200,000 but operating fewer than 100 buses (no rail), not just those under 200,000 (as determined by the U.S. Census Bureau), as is the case in previous law.
- **Transportation for Elderly Persons and Persons with Disabilities (5310) Funds:** This program provides capital funding for transportation services for elderly and disabled persons.
 - Authorization under MAP-21 has moved the formula allocation from a single statewide allocation to an Urbanized Area allocation. The funds may go to private, non-profit organizations or to public bodies which coordinate service. Also funds available to our area are in a single allocation with two other “Small Urban” areas, therefore MassDOT has made all the apportioned funds a competitive application. No less than 55% of these funds must be used for capital projects. Up to 45% may be used for operating assistance projects that would formerly been eligible under New Freedom funds. No more than 10% may be used be a recipient for Administrative Expenses associated with a project. The Rail and Transit Division of the Massachusetts Department of Transportation through the State Transportation Bond authorization program, makes capital grants available through its Mobility Assistance Program to public agencies to purchase vehicles and related equipment for transporting elderly and disabled persons.
- **Formula Grants for Other than Urbanized Areas (5311) Funds:** This program provides funds on the basis of a statutory formula for rural areas using the latest available U.S. decennial census data. Its share is established at 7.07 percent of the total overall MAP-21 funding and 12% of Sections 5307 and 5311 fund combined, which is an increase over previous law. Eligible activities now included projects previously classified under JARC for rural areas.

- **Job Access and Reverse Commute Program (5316) Funds:** Repealed – integrated into 5307 and 5311 funds.
- **New Freedom Program (5317) Funds:** Repealed – integrated into 5310 funds.
- **Bus and Bus Facilities (5339) Funds:** This program provides capital assistance for new and replacement buses, related equipment, and facilities. It was formerly a discretionary program but is now formula based by urbanized area. As with the 5310 formula, 5339 is apportioned to our region via the state thru an allocation for “Small Urban,” with a statewide allocation as well. Therefore a competitive process thru MassDOT has been established for the 3 small urban and 3 rural RTA’s to obtain these funds. The Federal share of eligible capital costs is no more than 80 percent of the net capital project cost.
- **State of Good Repair Formula Grants (5337):** Eligible recipients are state and local government authorities in urbanized areas with fixed guideway public transportation facilities operating for at least 7 years. Although the Fitchburg-Leominster urbanized area does receive a formula allocation for these funds under MAP-21, the Montachusett Regional Transit Authority is not an eligible recipient since there is not currently any fixed guideway or high-speed motorbus operated under the authority. These funds can be transferred to the MBTA for use in rehabilitation projects related to the commuter rail which runs in our area.

Discretionary Grants:

The Federal Transit Administration and the U.S. Department of Transportation still have a few discretionary grant programs that MART is eligible to apply under. A Notice of Funding Availability (NOFA) is published in the Federal Register each year stating program amounts and instructions for applying for these Competitive grants.

- **Fixed Guideway Capital Investment Grants (“New Starts”) (5309):** The Bus and Bus Related Equipment and Facilities program (Bus program) provides capital assistance for new and replacement buses, related equipment, and facilities. It is a discretionary program to supplement formula funding in both urbanized and rural areas. The Federal share of eligible capital costs is 80 percent of the net capital project cost, unless the grant recipient requests a lower percentage. The Federal share may exceed 80 percent for

certain projects related to the ADA, the Clean Air Act (CAA), and certain bicycle projects.

- **TIGER (USDOT):** The Transportation Investment Generating Economic Recovery, or TIGER Discretionary Grant program, provides a unique opportunity for the U.S. Department of Transportation to invest in road, rail, transit and port projects that promise to achieve critical national objectives. The TIGER program enables DOT to use a rigorous process to select projects with exceptional benefits, explore ways to deliver projects faster and save on construction costs, and make investments in our Nation's infrastructure that make communities more livable and sustainable.

*Source of *Federal Aid Highway Programs* info: Montachusett Metropolitan Planning Organization Transportation Improvement Program FFY2017 – 2021.

**The *Transit Funding Programs* info is being updated for FFY2017 – 2021 Transit TIP. Contact MART for the latest *Transit Funding Programs* info.