



Consortium for Sustainable Communities

Assabet River Rail Trail Communities Bicycle and Pedestrian Network Plan

Hudson | Marlborough | Maynard | Stow

February 2014



Acknowledgments

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Cover photo: Newly installed bicycle facilities on Manning Road in Hudson, MA, installed as a part of this bicycle network planning process.

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Introduction

MAPC is assisting several groups of communities in advancing pedestrian and bicycle plans, focusing on short-term and low-cost solutions. The primary goals of this effort are to 1) develop a bicycle and pedestrian network plan consisting of region-wide on- and off-road connections; and, 2) begin to institutionalize the implementation of pedestrian and bicycle accommodation at the local level in all projects. The recommendations in this report are not intended to supplant or contradict any existing plans in the communities (open space plans, master plans, etc.). Rather, this document can be used in conjunction with these other initiatives, as well as in coordination with private development efforts, and assist in prioritization and identifying opportunities for new bicycle accommodation during upcoming roadway repaving efforts. This study is part of a larger regional bicycle and pedestrian effort comprising 13 total communities in the MAPC region. This report covers four municipalities located west of Boston – Hudson, Marlborough, Maynard, and Stow – that contain the Assabet River Rail Trail (ARRT). The ARRT (described in more detail on page 6) is a multiuse recreation rail trail that runs between Marlborough and Acton. These communities also contain other proposed regional off-road trails, including the Boroughs Trail in Marlborough, and the Mass Central Rail Trail in Stow and Hudson.

As part of this planning effort, existing conditions and potential opportunities have been identified for all major roads within each of the four municipalities. This planning effort identifies a network of on- and off-road connections and routes for each of the regional clusters, including proposed bicycle and pedestrian accommodations, and the proposed cross-sections (i.e., allocation of the curb-to-curb space).¹

This report is organized into two sections. First, it provides an introduction on bicycle and pedestrian recommendations applicable to all of the municipalities. Second, it provides detailed discussion and recommendations for each municipality. Although the detailed recommendations are presented separately for each community, MAPC encourages all of the communities to work together on the implementation of the plan, especially in areas near community borders.

These recommendations create a cluster-wide network of bicycle and pedestrian facilities based upon existing roadway configurations with no changes to curb location, existing on-street parking requirements², or the existing number of vehicular travel lanes. Recommendations are based on highlighting existing, low-cost opportunities for improvements, generally through roadway restriping for bicycle facilities and sidewalk improvements or construction of pedestrian facilities. Therefore, the proposed changes are appropriate for near-term (ranging from immediate to 2-3 year) implementation.

Beyond the scope of this study, we urge communities to examine whether rights of way are wide enough to incorporate bicycle and/or pedestrian facilities when completely redesigning and reconstructing roads.

An example of a roadway reallocation is shown in Figure 1. In the first image, Manning Street in Hudson has no bicycle facilities. As a result of MAPC's analysis of roadway conditions, MAPC recommended that bicycle lanes be installed on the existing roadway, especially desirable because of the roadway's location adjacent to a school and high density housing. When the roadway was

¹ Major roads were identified by examining the MassDOT functional classification for all roads in the four communities (See Appendix E). In general, local roads were excluded from the analysis unless the community identified them as an important connection.

² In Maynard, after discussions with the Town Administrator, DPW, and Planning departments, MAPC has recommended removing one side of underutilized on-street parking on Sudbury Street in order to allow bicycle lanes on this important connection.

recently repaved, Hudson staff worked with MAPC to incorporate these recommended bicycle facilities.



Figure 1: Example of Conditions before/after bicycle facilities on Manning Street in Hudson (between Cox St. and Town line)

Within this report, proposed bicycle accommodations include: buffered bicycle lanes, bicycle lanes, shared lane markings, centerline removal, and shared use paths. Cycle tracks are noted where possible, but are considered a longer term goal due to cost. Therefore, this plan identifies potential cycle tracks as buffered bicycle lanes (i.e., bicycle lanes with a painted hatched buffer adjacent to the vehicular travel lanes), a lower cost alternative to cycle tracks. Pedestrian recommendations include new sidewalk locations and crossing improvements. At the conclusion of the planning effort, it will be the responsibility of the individual municipalities to implement the recommendations. MAPC recommends implementing these bicycle and pedestrian recommendations as roadways are

repaved and/or reconstructed over the next few construction seasons to minimize costs and to ensure optimal roadway surface conditions for cycling.

MAPC encourages the municipalities to implement the recommendations in this report. In addition, MAPC recommends communities to explore various funding opportunities (e.g., grant opportunities), implement “complete streets” design concepts³, and improve upon existing methods of prioritizing reconstruction of local and nonlocal roads. MAPC also recommends that communities work towards passing an official complete streets policy (resolution, bylaw/ordinance, etc.). Adopting a complete streets policy ensures that the needs of all roadway users (including bicycles and pedestrians) are routinely considered in road design, construction, and repaving.

Commute Data

The 2010 American Community Survey compiles statistics over a 5 year period about the modes people use to travel to work. The results are summarized for the four communities and compared with regional data in Table 1 below. Note that the ACS survey is given to less than 15% of all households over a five year period; therefore, margins of error may be significant. This data does not include recreational or utility trips (e.g., errands) that are taken by foot or bicycle in these communities.

Table 1: Selected Travel to Work Data

<i>Municipality</i>	<i>Population</i>	<i>Employees</i>	<i>Walk (%)</i>	<i>Bicycle (%)</i>	<i>Drive (%)</i>	<i>Transit (%)</i>	<i>Other (%)</i>
<i>Hudson</i>	14,907	7,873	3.2	0.0	92.3	0.5	0.1
<i>Marlborough</i>	38,499	26,038	2.8	0.0	91.5	1.7	0.8
<i>Maynard</i>	10,106	3,376	3.3	0.4	89.9	1.0	1.4
<i>Stow</i>	6,590	2,551	0.1	0.0	89.3	1.6	1.6
<i>MAPC</i>	3,066,394	1,820,350	6.6	1.1	66.7	16.7	8.8
<i>Massachusetts</i>	6,587,536	3,304,919	4.8	0.7	75.6	9.4	9.5

Source: 2010 American Community Survey, 2010 Census

As shown in Table 1, the percentage of commuters traveling by private vehicles in these four communities is higher than the MAPC and state averages with approximately 90% of all residents driving to work. In addition, the bicycle and walking mode share for all of the ARRT communities are lower than the averages for both the MAPC region and the Commonwealth. Parts of the Assabet River Rail Trail communities have greater than average population density compared to the MAPC region (in particular, Maynard, Marlborough, and the eastern portion of Hudson), indicating an opportunity to increase the percentage of non-motorized (bicycle and pedestrian) commutes.

Assabet River Rail Trail

The Assabet River Rail Trail is a multi-use path in Marlborough, Hudson, Stow, Maynard, and Acton, parts of which are constructed, and parts of which are proposed. A portion of the right-of-way parallels the Assabet River. At the north end it terminates at the South Action commuter rail station, and the south end terminates in Marlborough. The trail is being built along the abandoned rail bed of the former Marlborough Branch railroad, which was active between 1853 and 1980.

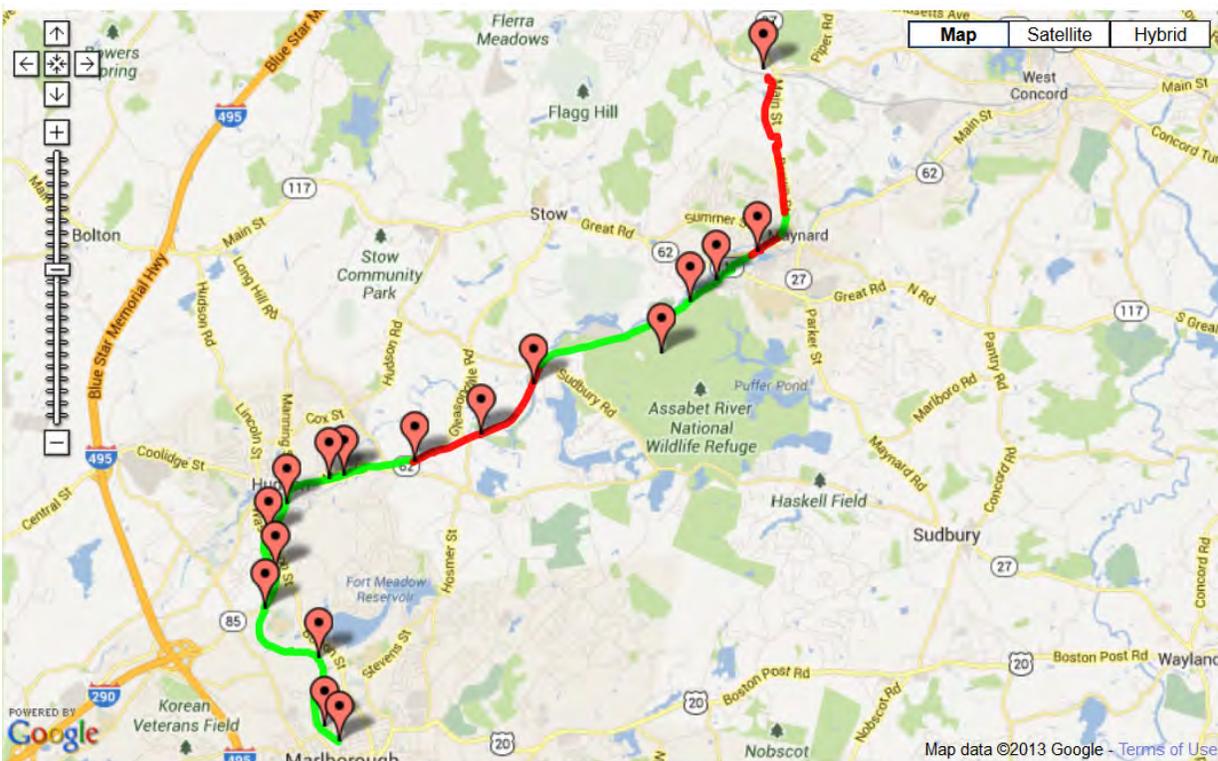
Currently, sections of the Trail are in various stages of completion (from south to north):

- Marlborough: the Trail is completed (3.1 miles)

³ Complete Streets refer to roadways that are safe, accessible, and comfortable for users of all ages and of all abilities. Refer to www.smartgrowthamerica.org/complete-streets for additional info.

- **Hudson:** the Trail is completed from the Marlborough line to Wilkins Street (1.5 miles). From Wilkins Street to the Stow Town line the Trail is not passable due to existing rights-of-way issues.
- **Stow:** From the Hudson Town line to the Honey Pot Hill Orchards property the Trail is not passable due to existing rights-of-way issues through private property and missing bridges over the Assabet River. From Track Road to the Maynard Town line, the Trail is passable to walkers and off-road bicycles but is not paved (0.5 miles)
- **Maynard:** From the Stow line to Maple Street Commuter Rail Station parking lot, the trail is passable in parts for walkers and off-road bicycles. In several sections, access may be difficult due to poor conditions (2.9 miles)

Figure 2 provides a map of the completed and proposed sections of the Assabet River Rail Trail⁴.



The completed 6 miles of the trail in Marlborough and Hudson are in green. The section in red is the proposed trail in Stow, Maynard and Acton. The two green sections in Maynard and one in Stow are walkable, but not paved yet.

Figure 2: Assabet River Rail Trail

Throughout the communities covered in this report, there are numerous instances where the Assabet River Rail Trail crosses vehicular roads. The municipalities should prioritize safety-related accommodations at these crossings. For example, Figure 3 shows an intersection with the Assabet River Rail Trail and Ash Street in Marlborough. There are several enhancements that could better alert motorists to potential cyclists and pedestrians crossing the street, including:

- High visibility ladder or continental design crosswalks in place of the traditional parallel line crosswalk (See Figure 4)
- Shark teeth yield markings (See Figure 5)
- Flashing beacons or high-visibility signage to alert motorists to the trail crossing
- Colored pavement within the crosswalks

⁴ Assabet River Rail Trail. http://www.arrtinc.org/google3_map5.asp



Figure 3: Example of an Assabet River Rail Trail street crossing (Ash Street, Marlborough)



Figure 4: Ladder Style Crosswalk

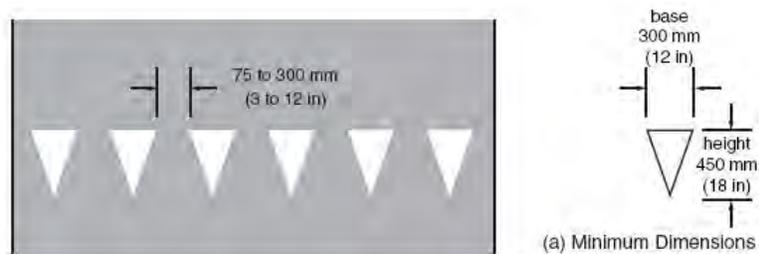


Figure 5: Shark Teeth Yield Lines

Bicycle Recommendations

MAPC examined the entire street network of non-local roads for the four communities, collecting street width and existing condition data, and identifying opportunities and constraints for providing bicycle accommodation in those areas. The focus of this effort has been to identify – based on the existing street widths, curb locations, and parking locations the opportunity to provide bicycle facilities on these roads in the next roadway repaving cycle. The recommendations detail the proposed roadway layout, including bicycle lane, parking, and travel lane widths. For roadways owned by the municipality MAPC recommends providing bicycle lanes or shared lanes when repaving

roadways identified in the network plan. Restriping immediately after repaving is a cost-saving measure and provides a better surface for cycling, although communities are encouraged to install bicycle facilities at any time. In some cases MAPC proposed bicycle facilities on roads not owned by the municipalities, but rather the State (i.e., MassDOT or DCR) or private ownership. In these cases the process for implementation on these roads will differ from municipality-owned roads, and MAPC encourages active engagement with the appropriate state offices to implement the recommendations.

Table 2 provides a summary of the number of proposed miles of new bicycle lanes per community. The table illustrates that there is varying opportunity for bicycle accommodations, due to a variety of reasons, including narrow curb-to-curb road widths and the miles of non-local roads in a municipality.

Table 2: Proposed bicycle lane miles per municipality

<i>Municipality</i>	<i>Proposed bike lanes (approx. miles)</i>
<i>Hudson</i>	11.7
<i>Marlborough</i>	15.0
<i>Maynard</i>	2.5
<i>Stow</i>	3.5
<i>TOTAL</i>	32.7

The on-road bicycle accommodations that were considered in this network plan include buffered bicycle lanes, bicycle lanes, shared lane markings, centerline removal, and shared use paths. In addition, as noted earlier, recommended buffered bicycle lanes may, alternatively, be constructed at a higher cost as cycle tracks (described below). Because of limited pavement width, some roads may not provide adequate room for bicycle lanes facilities. In these cases MAPC may recommend widening the shoulders and narrowing the travel lanes as much as is practical in order to increase the comfort and safety of both cyclists and motorists, as noted in the detailed recommendations tables.

Complementing bicycle facilities should be campaigns (e.g., driver education, mailings, signage) to educate both motorists and cyclists on the meaning of the new pavement markings and the laws governing how these modes of transport interact with each other.

On one-way roads with parking on one side of the street, bicycle lanes and parking lanes may be placed on opposite sides of the roadway to reduce potential “dooring” conflicts (i.e., when a car door is opened into a bicycle lane and hits a cyclist).

In general, MAPC based its recommendations upon the design guidelines specified in the [AASHTO Guide for the Planning, Design, and Operation of Bicycle Facilities](#)⁵. The following are brief descriptions of different types of bicycle facilities. The list is ordered by desirability, with facilities providing the highest separation between vehicles and bicycles listed first. Please see **Appendix A – Pedestrian and Bicycle Facility Design Guidelines and References** for resources containing complete descriptions, photos, and design guidance for these bicycles facilities:⁶

- Parking lanes: 7-8’ wide.

⁵ See Chapter 4: Design of On-Road Facilities:

<http://www.railstotrails.org/resources/documents/ourWork/trailBuilding/DraftBikeGuideFeb2010.pdf>

⁶ The illustrations below depicting the various bicycle facilities are from the [NACTO Urban Bikeway Design Guide](#), accessible online at <http://nacto.org/cities-for-cycling/design-guide/>

- Travel lanes: 10-12' wide. Eleven feet is often ideal. Greater than 12' may encourage vehicles to increase their speed, whereas 10' is adequate on many roads but may be less than optimal for bus routes and roadways with high volumes of heavy or wide vehicles.
- Bicycle lanes: 5' wide. A five foot bicycle lanes generally provides enough comfort for a bicyclist to ride side-by-side with a vehicle. Four foot bicycle lanes may be installed where bicycle lanes are desired but additional space is not available. Six foot bicycle lanes are also feasible when the roadway is wide enough, and a 1 foot buffer may be considered to create a 5 foot bicycle lane. Bicycle lanes wider than six feet should be installed with a buffer, and may not be ideal as they are often mistaken for and utilized as a vehicular parking lane.

The following are brief descriptions of the various bicycle facilities considered in this report.

Cycle Track - A cycle track, illustrated in Figure 6, is an exclusive bicycle facility that combines the user experience of a separated path with the on-street infrastructure of a conventional bicycle lane. A cycle track is physically separated from motor vehicle traffic and is distinct from the sidewalk. A cycle track may be placed at the street level, sidewalk level, or in between. There are several potential opportunities to include cycle tracks in discreet road segments. Classified in this report as buffered bicycle lanes (described below), these segments are listed in the Bicycle Recommendations for several of the municipalities. Because of the greater capital investment of cycle tracks, this report assumes municipalities may prefer less expensive options, such as buffered bicycle lanes, but encourages municipalities to consider providing cycle tracks and physically separated bicycle facilities where feasible.



Figure 6: Cycle track (Source: NACTO)

Buffered Bicycle Lane - Buffered bicycle lanes, illustrated in Figure 7, are conventional bicycle lanes paired with a designated buffer space separating the bicycle lane from the adjacent motor vehicle travel lane and/or parking lane. Pavement markings usually provide this buffer, and lack any sort of physical separation.



Figure 7: Buffered bicycle lanes (Source: NACTO)

Bicycle Lane - A bicycle lane, illustrated in Figure 8, is defined as a portion of the roadway that has been designated by striping, signage, and pavement markings for the preferential or exclusive use of bicyclists.



Figure 8: Bicycle lanes (Source: NACTO)

Shared Lane - Shared lane markings (SLMs), or “sharrows,” illustrated in Figure 9, are road markings that indicate a shared lane environment for bicycles and automobiles. Among other benefits, shared lane markings reinforce the legitimacy of bicycle traffic on the street. Sharrows should be marked as 100’ apart and not greater than 250’ apart, as well as immediately after intersections.

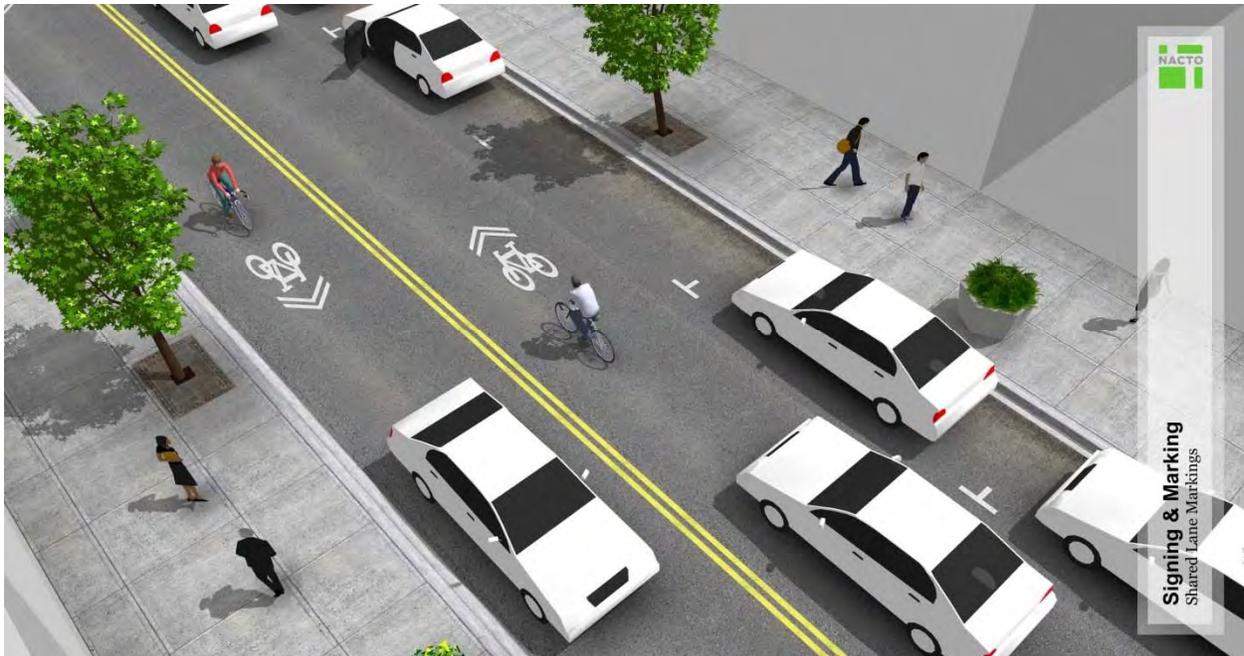


Figure 9: Shared lane markings (Source: NACTO)

Signage – Signs can complement the pavement markings, further alerting motorists to the presence of bicyclists and encouraging all users to share the road. On quiet residential streets with good connections and low traffic volumes or low speeds, signs can be used as a means of connecting the bicycle network through these areas without the need to install pavement markings. Signs can also be used for wayfinding purposes to direct cyclists to off-road paths and various points of interest.



Figure 10: Examples of bicycle signage

Alternative Strategies for Bicycle Facilities

The following strategies, centerline removal and advisory lanes, are recommended as potential bicycle facilities in several cases. Although they may be considered in the same roadway context, the network maps label these roadway segments as centerline removal, as opposed to advisory lanes, because the latter is not currently a common bicycle facility in the United States. Communities wishing to consider an advisory lane on certain roadways are advised to contact MAPC for further discussion and assistance.

Centerline removal⁷ – In some cases, removing the roadway centerline striping can "soften" the appearance of a roadway, altering motorist perception, and create a more residential and local visual character for the roadway (see Figure 11). With the elimination of centerline delineation, motorists tend to drive closer to the center of the roadway, creating roadside area for pedestrians and cyclists. In general, centerlines should only be considered in roadways with minimal horizontal and vertical curves, as sight lines are important when attempting to provide space in the roadway for bicycles and pedestrians. Centerlines should not be removed on high volume roadways.

By removing centerlines where appropriate, several neighborhood benefits may be achieved:

- Eliminates roadway visual identification as a bypass routes
- Creates the appearance of a minor residential roadway
- Allows motorists to drive towards the center of the roadway
- Typically reduces motorist speeds by eliminating clearly defined travel lanes, creating a shared roadway

Centerlines will remain where necessary to guide motorists around horizontal or vertical curves. While this traffic calming measure may lose its effectiveness to everyday users over time, its impact should be effective on occasional users.



Figure 11: Example of a road with no centerline or other striping

Advisory lane – Advisory lanes consist of one motor vehicle traffic lane in the middle of the street and two bicycle (or shared use with pedestrian) lanes, one on each side of street (see Figure 12 and Figure 13 for an example). The traffic lane and bicycle lanes are separated with white dashed lines, which indicate that both bicycles and vehicles can intercross each other under certain circumstances. Motor vehicles must yield to pedestrians or cyclists in the advisory lanes (as they must do without special lane markings).

Advisory lanes have not yet been employed in Massachusetts, but have recently been implemented in Minnesota, are being considered in Oregon, and have been used in several European countries for over 15 years.

⁷ Text for this section is from www.acgov.org/pwa/programs/traffic/measures.htm#1A



Figure 12: Advisory lane (Minnesota)

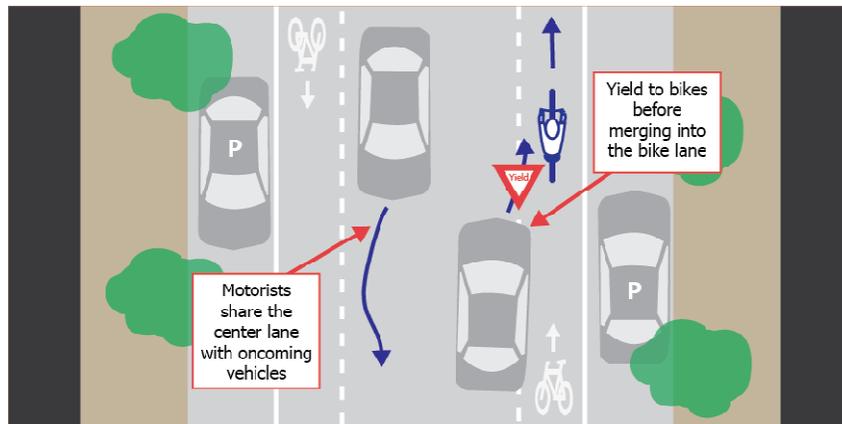


Figure 13: Vehicular movement in an advisory lane

Pedestrian Recommendations

Sidewalk availability and accessibility is an important part of transportation infrastructure in every city and town. Along with bicycling, increased rates of walking in a community can improve health, provide an increase in economic development, and reduce vehicle use, air pollution, and the cost for maintaining local roadways.

The current regional policy guidelines (*The Boston Region's Pedestrian Transportation Plan*) call for the provision of sidewalks or other pedestrian accommodation on both sides of all roadways. The sidewalks should provide pedestrians with multiple options to access their destination, and to minimize the need for pedestrians to cross roadways to access a sidewalk. Although limited rights of way may limit the possible width of sidewalks, The Americans with Disabilities Act mandates a minimum width of three feet of unobstructed sidewalk passageway. A sidewalk width of five feet allows two adults to walk comfortably side-by-side. A grass buffer of one or more feet, often with planted trees, can separate the pedestrian space from the vehicular travel lanes, adding to the comfort of pedestrians.

As noted in the table below, a significant number of roads in the four communities lack sidewalks on at least one side of the road. In some cases the lack of sidewalks may be due to limited right-of-way.

Table 3: Sidewalk Coverage by Municipality (2007)

Municipality	% of Roads with Sidewalks*	
	Main Roads	Local Roads
Hudson	48%	39%
Marlborough	51%	41%
Maynard	29%	66%
Stow	15%	16%

Source: MassGIS, 2007

*On at least one side of the road

In order to prioritize pedestrian infrastructure and improvements, MAPC reviewed the sidewalk locations on non-local roads during on-site visits as well as sidewalk location details from MassGIS. MAPC recommends that communities provide pedestrian facilities on at least one side of every main road, as well as well-stripped ladder-crossing style crosswalks across roadways at intersections and other locations that have high pedestrian volumes.

A number of resources are available that provide detailed information on pedestrian facilities, including *The Boston Region's Pedestrian Transportation Plan*.⁸ See **Appendix A** for a list of these additional resources. See **Appendix B** for brief descriptions of sidewalk design considerations.

Schools

Areas around schools, in particular, should focus on providing pedestrian amenities in order to increase the safety of students, parents, and teachers. Providing a safe pedestrian environment for students to access school is essential and should be a priority for all communities. Improvements could include enhanced striping and pedestrian crossing signals. Traffic calming measures, such as speed tables, curb extensions, flashing beacons, rumble strips, and narrower travel lanes should also be considered.

Hundreds of schools across Massachusetts have adopted programs to encourage students and their parents to choose walking, biking and other non-auto modes for commutes to and from school. The effectiveness of such programs largely depends on the number of students who are living within walking distance from school, but are currently being driven.

The Massachusetts Safe Routes to School (SRTS) program partners with schools throughout the Commonwealth to help plan and implement programs that increase student walking and biking activities. The program's goals are to reduce traffic congestion and air pollution near schools while increasing the health, safety, and physical activity of students.

Evaluating trends in how students and families choose to travel to school is a key component to building a successful Safe Routes to School program. Safe Routes to School staff will assist partner schools with the administration of a 3-minute online survey. Hudson, Marlborough, and Maynard are all Safe Routes to School partner districts. The survey, however, is open to all communities, including non-partner districts such as Stow, that are interested in better understanding how students and families travel to school. For municipalities interested in conducting the survey or for additional information, please visit <http://masaferoutessurvey.org>. Typically, the survey is initiated by a Mass-in-Motion coordinator, if available; however, any member of Town staff is able to initiate

⁸ The Boston Region's Pedestrian Transportation Plan. MAPC. 2010. www.mapc.org/resources/ped-plan

the survey. Interested participants should coordinate with MassRides, the agency that coordinates the state's Safe Routes to School program (www.commute.com/schools/about).

Informational and marketing materials are available for schools to make parents aware of the online survey tool and provide them with a link to the survey. Paper versions of the survey are also available and Safe Routes to School program staff can assist with the survey collection process. Both the online and paper versions are available in multiple languages. School administrators can have direct access to survey results and reports through an administrative login on the website and program staff can also assist with report generation and the presentation of results. School and district level reports include a summary of the results accompanied by maps, tables, and charts. The reports are available to school and community officials. With this survey information, communities can target their sidewalk and bicycle investments near schools that have the most potential for change.

Note on Recommendations

MAPC developed the following recommendations for pedestrian and bicycle accommodations based on current best practices and local conditions.⁹ MAPC has met with each community to discuss and finalize the recommendations; however, implementation of the plan, although strongly recommended, is not required. What is implemented is up to each town based on local priorities, funding and public support. As previously mentioned, proper education for all users of the roadway should be prioritized along with any changes in infrastructure. Ultimately, communities should focus on improving the safety of all users of the roadway.

Figure 14 provides a map detailing the Assabet River Rail Trail Communities Bicycle Network within Hudson, Maynard, Marlborough and Stow. The proposed network among the four communities of on-road bicycle lanes is approximately 33 miles. The following sections provide a detailed description of local recommendations for each community and a map detailing those recommendations. A detail of each community's network plan is included in their relevant sections.

⁹ Note that MAPC did not undertake detailed intersection design as a part of this plan; rather, as a part of a regional bicycle network plan, these recommendations are based upon on-site mid-block measurements and observations, and may require additional design at intersections and other conflict areas. Because roadway widths can be inconsistent, prior to installing bicycle facilities, road segments should be reviewed by the municipalities to ensure that the roadway is able to incorporate the recommendations.

Hudson, Marlborough,
Maynard, & Stow

Bicycle Facilities

	Proposed	Existing
Shared-use paths		
Improved path	--- (dashed green)	— (solid green)
Unimproved path	--- (dashed brown)	— (solid brown)
Bicycle facilities (on-road)		
Bike lane	--- (dashed blue)	— (solid blue)
Shared lane	--- (dashed grey)	— (solid grey)
One bike lane & one shared lane	--- (dashed red)	— (solid red)
Center line removal	--- (dashed cyan)	— (solid cyan)
Widened shoulders	--- (dashed purple)	— (solid purple)

- Train station
- Town/city hall
- Commuter Rail
- Municipal Boundary
- Water Bodies
- School & Hospital Parcels
- Open Space
- High-Density Residential



Source: MAPC, Town of Hudson, City of Marlborough, Town of Maynard, Town of Stow, MassGIS, MassDOT, OpenStreetMap.

November, 2013

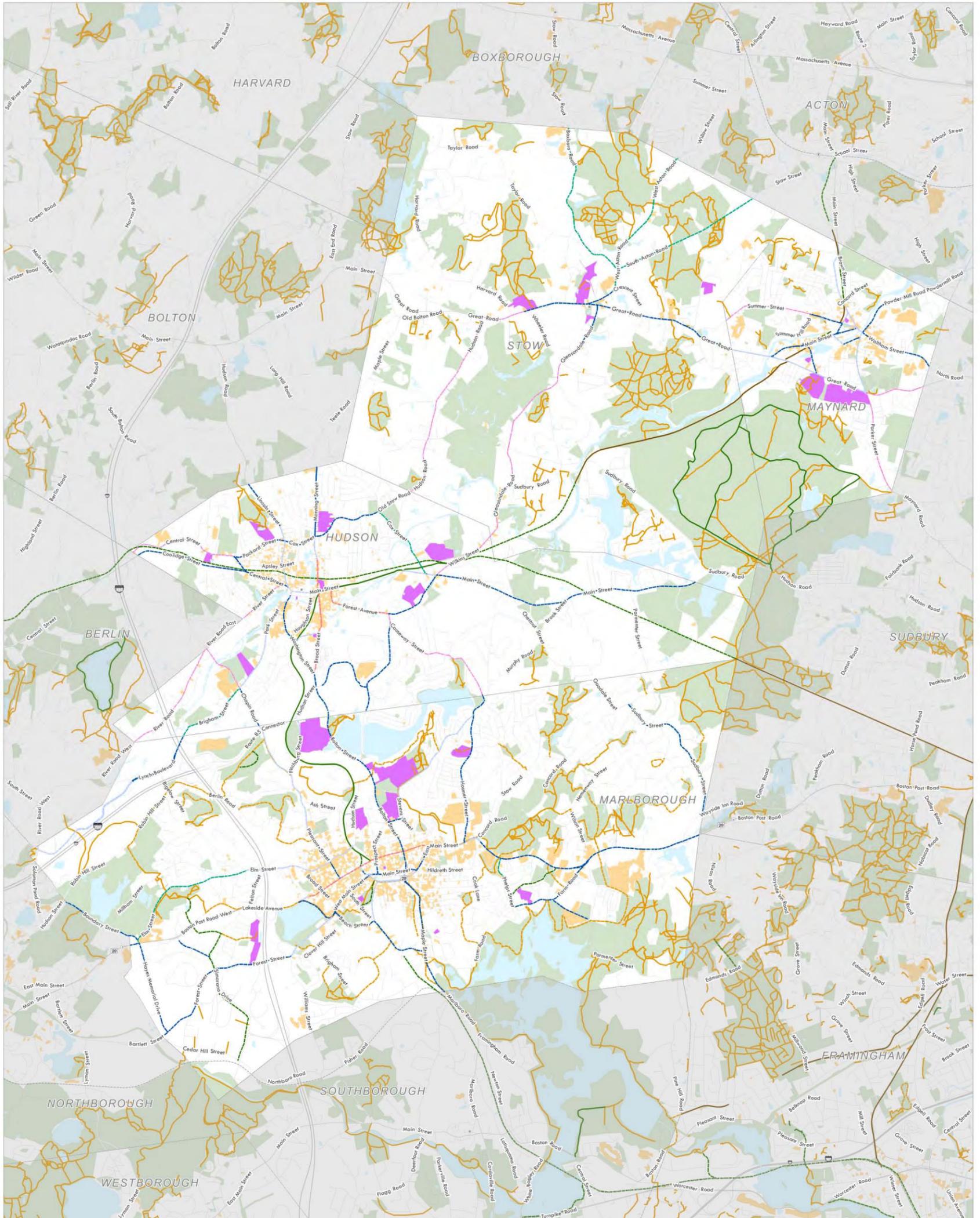


Figure 14: Assabet River Rail Trail Bicycle Network Plan

Hudson

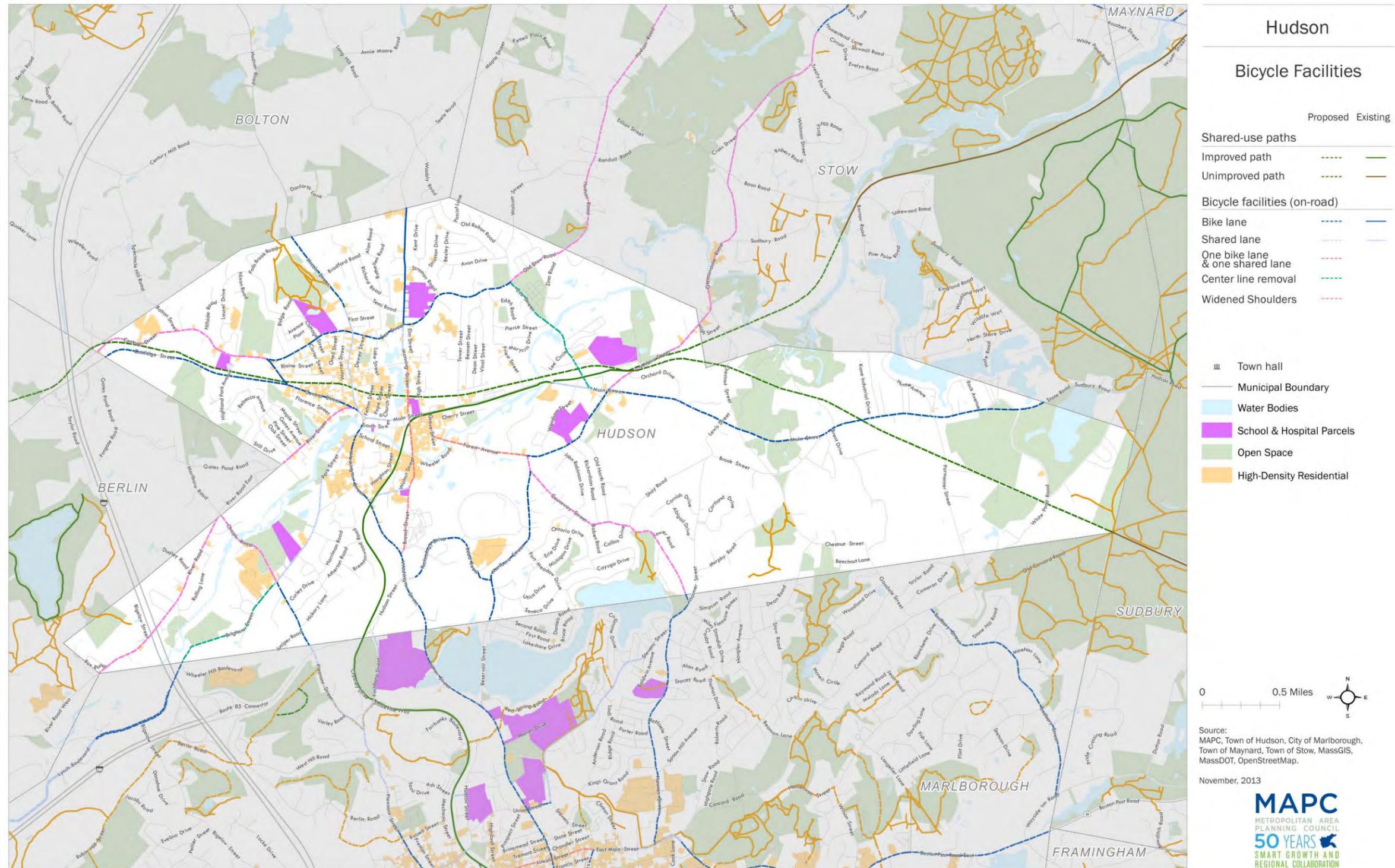


Figure 15: Hudson Bicycle Network Plan

The Town of Hudson is located approximately 20 miles west of Boston. The Town borders Marlborough to the south, Sudbury to the east, and Stow to the north, all of which are included in this regional bicycle and pedestrian analysis. It also borders Berlin to the west and Bolton to the northwest. As of the 2010 Census, Hudson's population was approximately 15,000 residents, with approximately 8,000 jobs located within the Town. The Assabet River Rail Trail (ARRT) is substantially complete in Hudson, with the exception of the section from Wilkins Street to the Stow line due to a private property right of way issue. There are a number of opportunities throughout Hudson to connect to the Assabet River Rail Trail, schools, high density residential areas (e.g., senior housing authority properties, multifamily units, and 40(b) developments), and the main retail corridors. Currently, there are gaps in the bicycle and pedestrian network to all of these key locations. In addition, the Town of Hudson is a participant in Metrowest Moves (along with Framingham and Marlborough), an initiative to facilitate opportunities for people to engage in active, smoke-free living, as well as healthy eating. Increasing bicycle and pedestrian infrastructure is a means to achieve greater active living as a part of the everyday lives of the town's residents and commuters. More information on this program is available at www.metrowestmoves.org.

In addition to the recommendations provided in the following sections, MAPC reviewed the 2008-2010 data involving crashes between vehicles and pedestrians or bicyclists. The Town may wish to consider this supplementary information when prioritizing investments in bicycle and pedestrian facilities in order to improve safety. Please see **Appendix C** for the locations and other details of these crashes.

Projects (Current and Future)

The following list of projects is based upon discussions with the Town and is not part of this report's recommendations. It is intended to highlight important projects and is not intended to be an exhaustive list of all planning and construction projects. Hudson should consider this report's recommendations within the context of these other projects.

- Route 85 reconstruction – Route 85 is undergoing a major upgrade, which includes sidewalks on both sides, 3' bicycle shoulder accommodations, ADA compliant ramps, crosswalks, and pedestrian-activated signals at all signalized intersections. The ARRT crosses Route 85 at approximately the mid-point of this project and the pedestrian-activated signals are included at this key intersection, as well.
- Master plan – Hudson has engaged VHB for the development of a town-wide master plan.
- Downtown retail area – Hudson is seeking funds to study and recommend detailed transportation plans in this area, especially the rotary at Main Street and Washington Street.

Bicycle Recommendations

There are a number of streets in Hudson identified on the Hudson Bicycle Network Map (Figure 15) and Hudson Bicycle Recommendations Table (Table 4) with potential for bicycle facilities in the short term. As a result of working with MAPC on this project, Manning Street (Cox Street to Town line) has had bicycle lanes installed. Packard Street (Central Street to Cox Street) has also had bicycle lanes installed during its recent restriping.

The table provides details on the recommendations for proposed striping. The recommendations call for the installation of approximately 11.7 miles of bicycle lanes in Hudson. Note that the majority of the bicycle recommendations are on Town-owned land. In some cases roads may be owned by various state organizations (e.g., MassDOT) or privately owned. In these cases municipalities should work with the respective owner(s) to incorporate the recommended bicycle facilities. Among the recommendations in Hudson, MassDOT owns Washington Street from Technology Drive to Brigham Street. **Appendix E** contains a list of all the street segments analyzed.

Pedestrian Recommendations

MAPC reviewed all of the sidewalk conditions and gaps on the non-local roads in Hudson. Figure 16 illustrates the non-local roads that lack pedestrian facilities, highlighting priority locations. MAPC recommends providing pedestrian facilities (sidewalks, shared use paths, etc.) on at least one side of all roadways. In addition, Table 5 provides a list of the top priority recommendations (in alphabetical order) for pedestrian facilities in Hudson, based on key connections and Town input (these locations are highlighted on the following map). While the Town should direct its priorities to fixing these gaps, it should not preclude construction of sidewalks or other pedestrian facilities in other areas. Note that these recommendations reflect priorities based on gaps and network continuity, and do not reflect the cost of construction, right of way, or ownership issues.

Table 5: Hudson Pedestrian Infrastructure Priority Locations

<i>Street</i>	<i>Limits</i>	<i>Key Connections</i>
Brigham Street	Berlin Town line to Chapin Road	High density residential areas and school
Cox Street	Manning Street to Main Street	Schools
Forest Avenue	Grove Street to Main Street	Schools and high density residential
Central Street	Bolton Town line to Laurel Street	High Density residential area and school
Technology Drive and Reed Road	Hudson Street to Marlboro Street	High density residential area

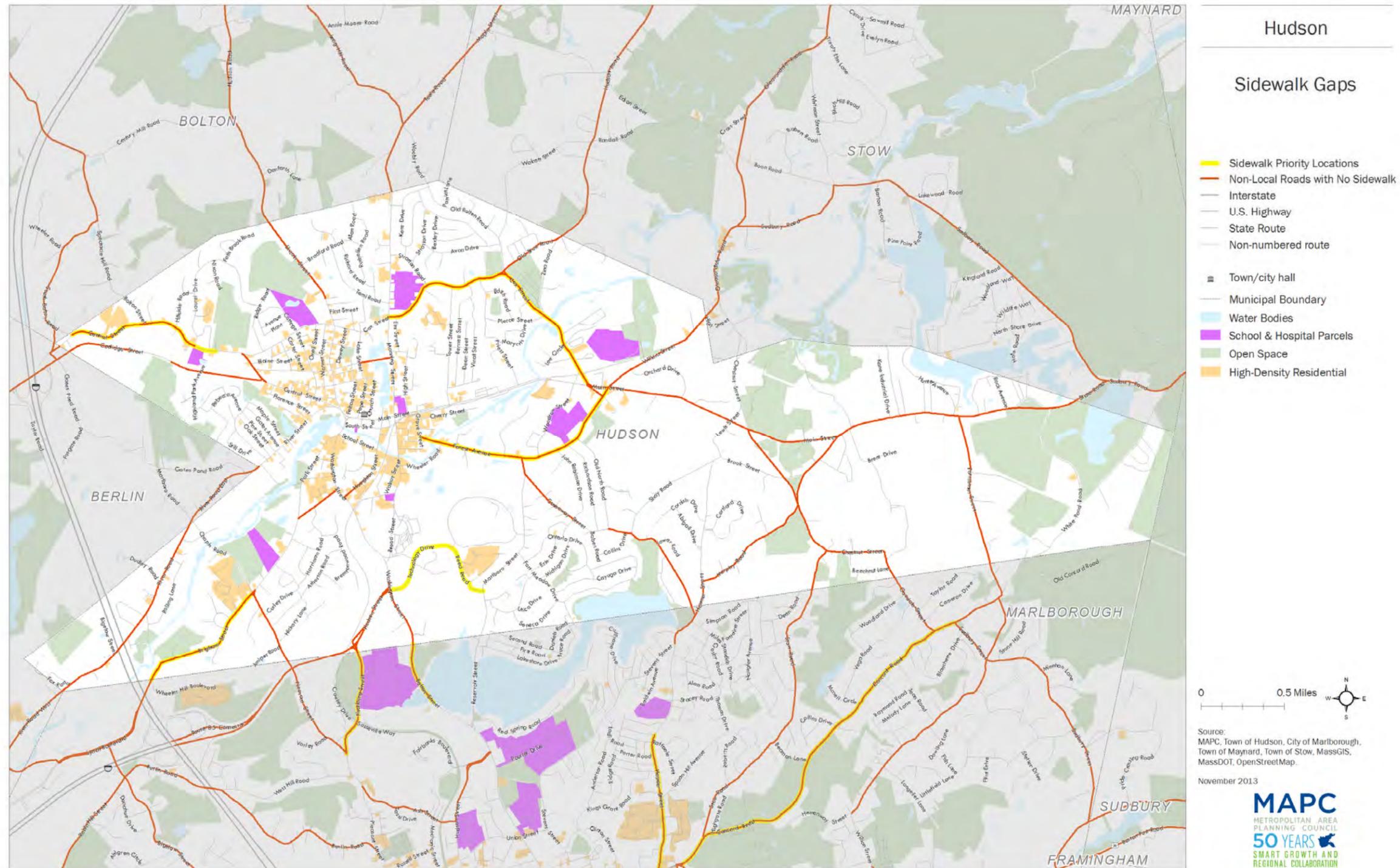


Figure 16: Hudson Sidewalk Gaps (Non-local Roads) and Sidewalk Priority Locations¹⁰

¹⁰ Road segments that have yellow highlight only indicate local roads that lack sidewalks but are designated by the Town as priority locations for sidewalk construction.

Marlborough

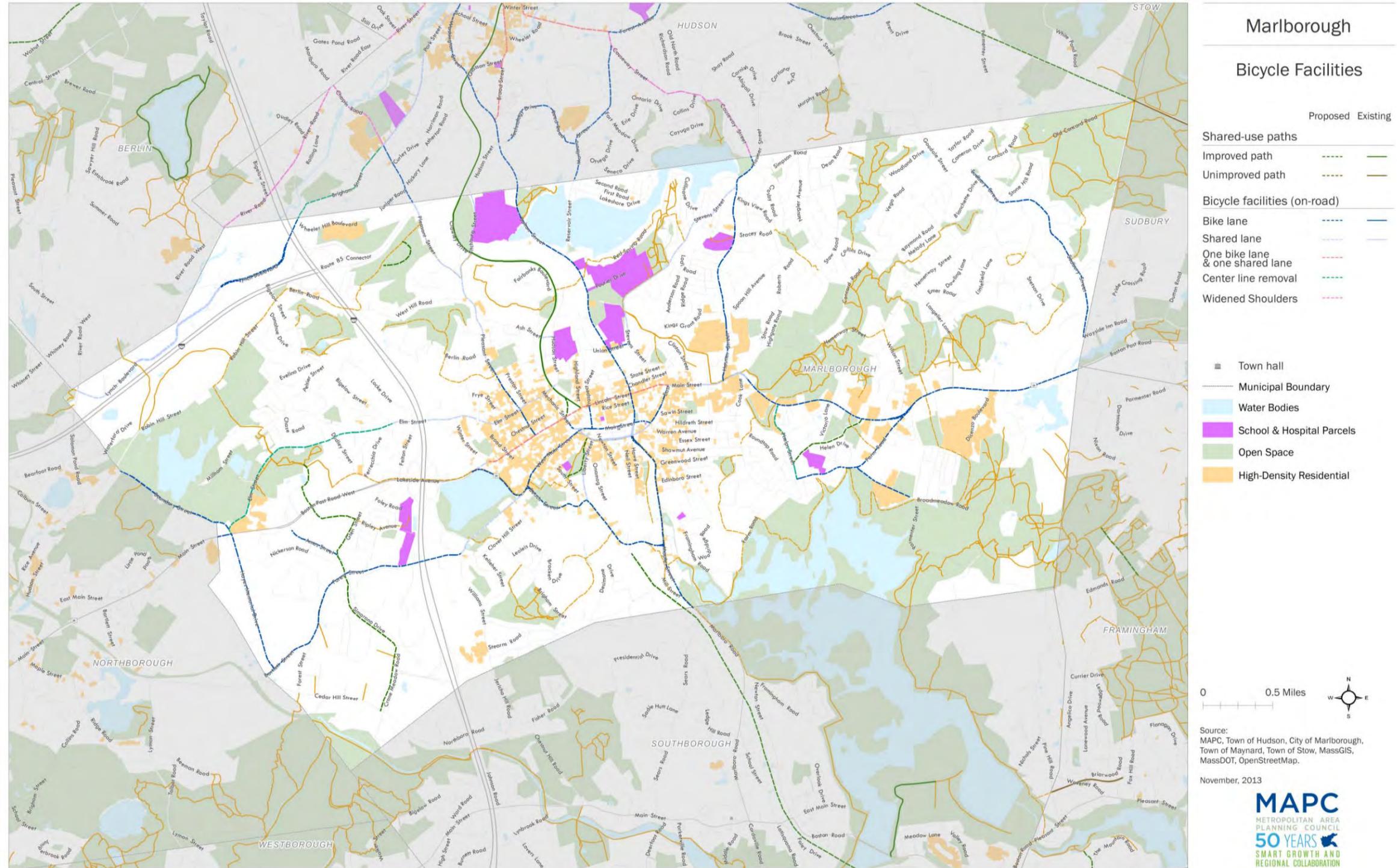


Figure 17: Marlborough Bicycle Network Plan

The City of Marlborough is located approximately 20 miles west of Boston. The City borders Hudson to the north, which is included in this regional bicycle and pedestrian analysis. It also borders Framingham and Sudbury to the east, Southborough to the south, Northborough to the west, and Berlin to the northwest. As of the 2010 Census, Marlborough's population was approximately 38,500 residents, with approximately 26,000 jobs located within the City. The Assabet River Rail Trail (ARRT) is completed in Marlborough.

Priorities for Marlborough include connections to the Assabet River Rail Trail, schools, and retail areas. Currently, there are gaps in the bicycle and pedestrian network to all of these key locations. In addition, the City of Marlborough is a participant in Metrowest Moves (along with Framingham and Hudson), an initiative to facilitate opportunities for people to engage in active living, as well as healthy eating. Increasing bicycle and pedestrian infrastructure is a means to achieve greater active living as a part of the everyday lives of the town's residents and commuters. More information on this program is available at www.metrowestmoves.org.

In addition to the recommendations provided in the following sections, MAPC reviewed the 2008-2010 data involving crashes between vehicles and pedestrians or bicyclists. The Town may wish to consider this supplementary information when prioritizing investments in bicycle and pedestrian facilities in order to improve safety. Please see **Appendix C** for the locations and other details of these crashes.

Bicycle Recommendations

There are a number of streets in Marlborough identified on the Marlborough Bicycle Network Map (Figure 17) and Marlborough Bicycle Recommendations Table (Table 6) with potential for bicycle facilities in the short term. The table provides details on the recommendations for proposed striping. The recommendations call for the installation of approximately 15 miles of bicycle lanes in Marlborough. This represents the largest amount of potential bicycle lanes among the four communities and, thus, the greatest opportunity. **Appendix E** contains a list of all the street segments analyzed.

Note that the majority of the bicycle recommendations are on city-owned roadways. In some cases roads may be owned by various state organizations (e.g., MassDOT, DCR) or privately owned. In these cases municipalities should work with the respective owner(s) to incorporate the recommended bicycle facilities. In Marlborough, among the recommendations MassDOT owns Route 20 from Stevens Street to Sudbury line and from the Northborough line to Hayes Memorial Drive. In addition, MassDOT recently performed a road safety audit at the intersection of Maple Street (Route 85) and Walker Street, and a redesign of the intersection is being drafted. Both MAPC and the RSA report recommend that bicycle facilities be included in the intersection redesign.

MAPC and the City also recommend constructing an off-road paved path from Glen Street to Route 20, which is through privately-owned land. The City should work with developers to construct this proposed path.

Marlborough should prioritize installation of bicycle facilities based upon the key priority connections listed above, as well as the City's repaving schedule. The City should also use its best judgment on where to concentrate its resources. For example, Boston Post Road East (Route 20) is identified on the Marlborough Bicycle Plan (Figure 17) as a location for bicycle lanes or shared lane markings, because its current curb-to-curb width allows for it and because this road provides one of the only viable east-west routes out of the city. However, as a multi-lane, high traffic road with safety considerations under the current roadway configuration, the City may choose to prioritize investment in bicycle infrastructure in other areas of the city in the shorter term. Along Boston Post Road East

the segment from Hosmer Street to Concord Road is a particular challenge with the existing roadway configuration encouraging high automobile speeds. MAPC recommends that the City study this area further for how to best accommodate bicycle usage in a safe manner.

The City has a number of intersections along the Assabet River Rail Trail where sight distance and safety is an issue. This report's Introduction contains general guidance on increasing safety for cyclists and pedestrians at these crossings, to which the City should refer. In addition, the crossing at Fitchburg Street at Crowley Drive, as shown in Figure 18, is particularly challenging because of the wide crossing distance, large turning radii, and high vehicular speeds. In addition to enhancements listed in the Introduction section, the City should consider some or all of the following intersection improvements: decreasing the crossing distance by reducing pavement in the northwest corner; tightening the curb radii, especially onto Crowley Drive, in order to decrease the speed of turning vehicles; and, reducing the northbound travel lane width to calm traffic speeds and reduce crossing distances. Figure 19 provides an illustration of these potential improvements. Through the permitting process with Boston Scientific, plans are proposed which address several of these recommendations, most significantly eliminating the extra pavement located on the northwest corner of the intersection. In addition, the plan proposes solar-powered flashing warning beacons to alert motorists to cyclists and pedestrians.



Figure 18: Existing Conditions Assabet River Rail Trail Crossing at Fitchburg Street

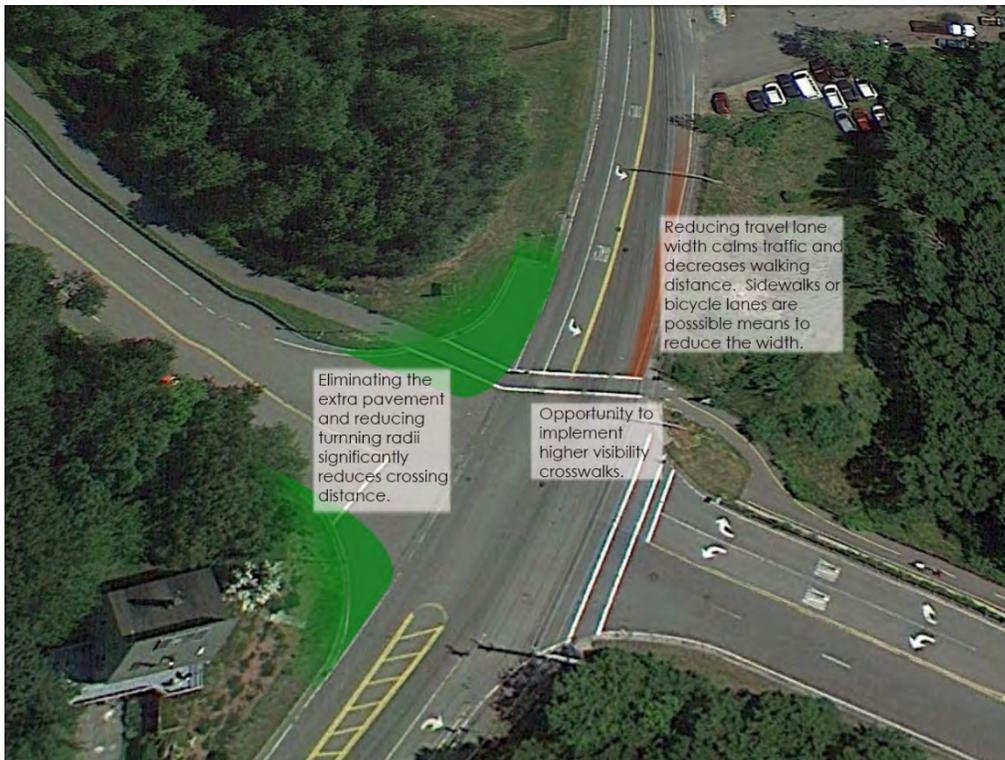


Figure 19: Potential improvements to ARRT Crossing at Fitchburg Street

Table 6: Marlborough Bicycle Recommendations

Street Name	From	To	Roadway						Existing Conditions*						Recommendation	Recommendation - Details													
			Sidewalks			Travel Direction			Parking			Curb-to-Curb	Shoulder	Parking		Travel Lanes		Parking	Shoulder	Parking	Buffer or Shoulder	Bicycle Lane	Buffer	Travel Lane (s)	Travel Lane (s)	Buffer	Bicycle Lane	Buffer or Shoulder	Parking
			Number	Two-Way	One-Way	None	Both	One Side	Width	WB/SB (Width)	WB/SB (Width)	WB/SB (Width)	EB/NB (Width)	EB/NB (Width)		EB/NB (Width)	WB/SB	WB/SB	WB/SB	WB/SB	WB/SB	WB/SB	WB/SB	EB/NB	EB/NB	EB/NB	EB/NB	EB/NB	EB/NB
Stevens Street	Hosmer Street	Union Street	1	X		X			25			12.5	12.5			One bicycle lane, one shared lane			5		10	10							
Stevens Street	Union Street	Boston Post Road East	1	X		X			25			12.5	12.5			One bicycle lane, one shared lane			5		10	10							
Union Street	Stevens Street	Bolton Street	1	X		X			34			17	17			Bicycle lanes			5		12	12			5				
West Main Street	Williams Street	Broad Street	2	X		X			34	7.5		12	12		2.5	Bicycle lanes			5		12	12			5				
West Main Street	Broad Street	Pleasant Street	2	X		X			36	6		13	12		5	Bicycle lanes			5.5		12.5	12.5			5.5				
West Main Street	Pleasant Street	Granger Boulevard	2	X		X			36	6		13	12		5	Bicycle lanes			5.5		12.5	12.5			5.5				
Williams Street	Lakeside Avenue	Forest Street	0	X		X			28	2		12	12		2	One bicycle lane, one shared lane					11.5	11.5			5				
Wilson Street	Boston Post Road East	Hemenway Street	1	X		X			34	1		16	16		1	Bicycle lanes			5		12	12			5				

Notes:
 --Red text in the travel lanes indicates shared lane markings.
 --*A breakdown of Existing Conditions striping within the curb-to-curb space is provided when possible. If blank, this indicates that either the roadway does not have existing striping.

Potential Cycle Tracks

As discussed in the Bicycle Recommendations section of the Introduction, a cycle track is an exclusive bicycle facility that is physically separated from moving vehicles. By being physically separated from traffic, cyclists often feel safer than they do with traditional bicycle lanes. Cycle tracks, however, require greater investment than standard on-road bicycle lane striping. Due to the cost, this study labels potential cycle tracks as buffered bicycle lanes. The City should consider the importance of the connection when considering whether to construct a cycle track. Based upon existing right-of-way width, the following road segments could incorporate a cycle track rather than a buffered bicycle lane:

- Bolton Street (Main Street to Lincoln Street)
- Boston Post Road East (Phelps Street to Wilson Street)
- Farm Road (Broadmeadow Road to Boston Post Road East)
- Hayes Memorial Drive (Bartlett Street to Boston Post Road West)
- Hosmer Street (Boston Post Road East to Hudson line)
- Maple Street (Edinboro Street to South Street; Brigham Street to Southborough line)
- Pleasant Street (Lincoln Street to Elm Street)
- South Street (Maple Street to Liberty Street)

Pedestrian Recommendations

MAPC reviewed all of the sidewalk conditions and gaps on the non-local roads in Marlborough. Figure 20 illustrates the non-local roads that lack pedestrian facilities. MAPC recommends providing pedestrian facilities (sidewalks, shared use paths, etc.) on at least one side of all roadways. In addition, Table 7 provides a list of the top priority (in alphabetical order) recommendations for pedestrian facilities in Marlborough, based on key connections and Town input (these locations are highlighted on the following map). While the Town should consider these priorities when constructing new sidewalks, it should not preclude the construction of sidewalks or other pedestrian facilities in other areas. Note that these recommendations reflect priorities based on gaps, and network continuity, and do not reflect the cost of construction, right of way, or ownership issues.

Table 7: Marlborough Pedestrian Infrastructure Priority Locations

<i>Street</i>	<i>Limits</i>	<i>Key Connections</i>
Ames Street	Route 20 to Forest Street	Important feeder road with connections to Route 20 and Simmarano Drive
Bolton Street	Hudson Town line to Blaiswood Avenue	Assabet Valley Regional Technical High School
Boundary Street	Route 20 to Northborough Town line	City-owned reservoir reservation land
Broadmeadow Road	Farm Road to Parmenter Street	High density residential areas
Concord Road	Mosher Lane to Main Street	Key corridor with residential and open space, approved for sidewalks from Ghiloni Park to Sudbury Street
Fitchburg Street	Hudson Town line to Pleasant Street	Assabet Valley Regional Technical High School
Hosmer Street	Blossom Lane to East Main Street	Connection between school and high density residential areas
South Street	Liberty Street to Maple Street	High density residential areas

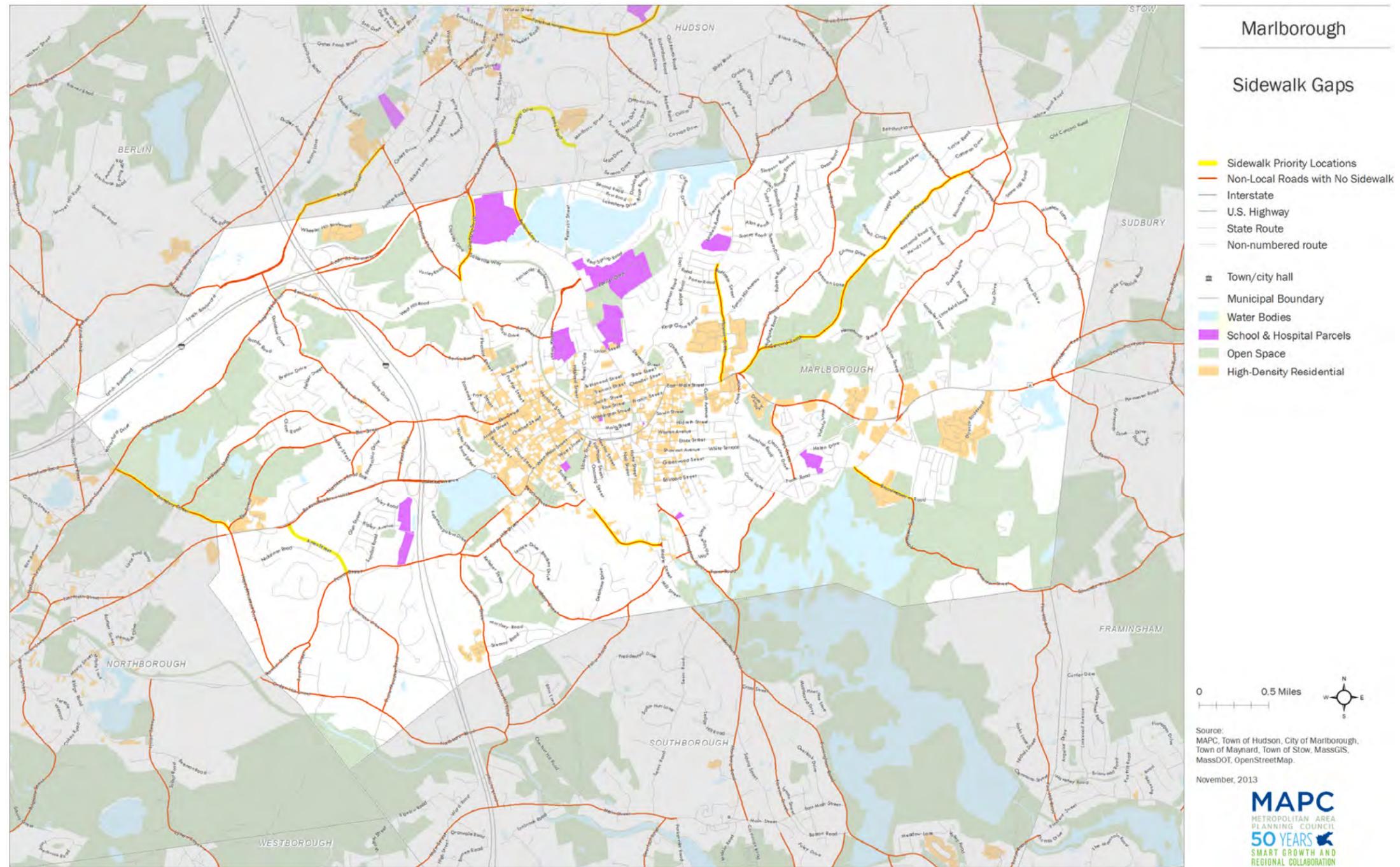


Figure 20: Marlborough Sidewalk Gaps (Non-local Roads)¹¹

¹¹ Road segments that have yellow highlight only indicate local roads that lack sidewalks but are designated by the City as priority locations for sidewalk construction.

Maynard

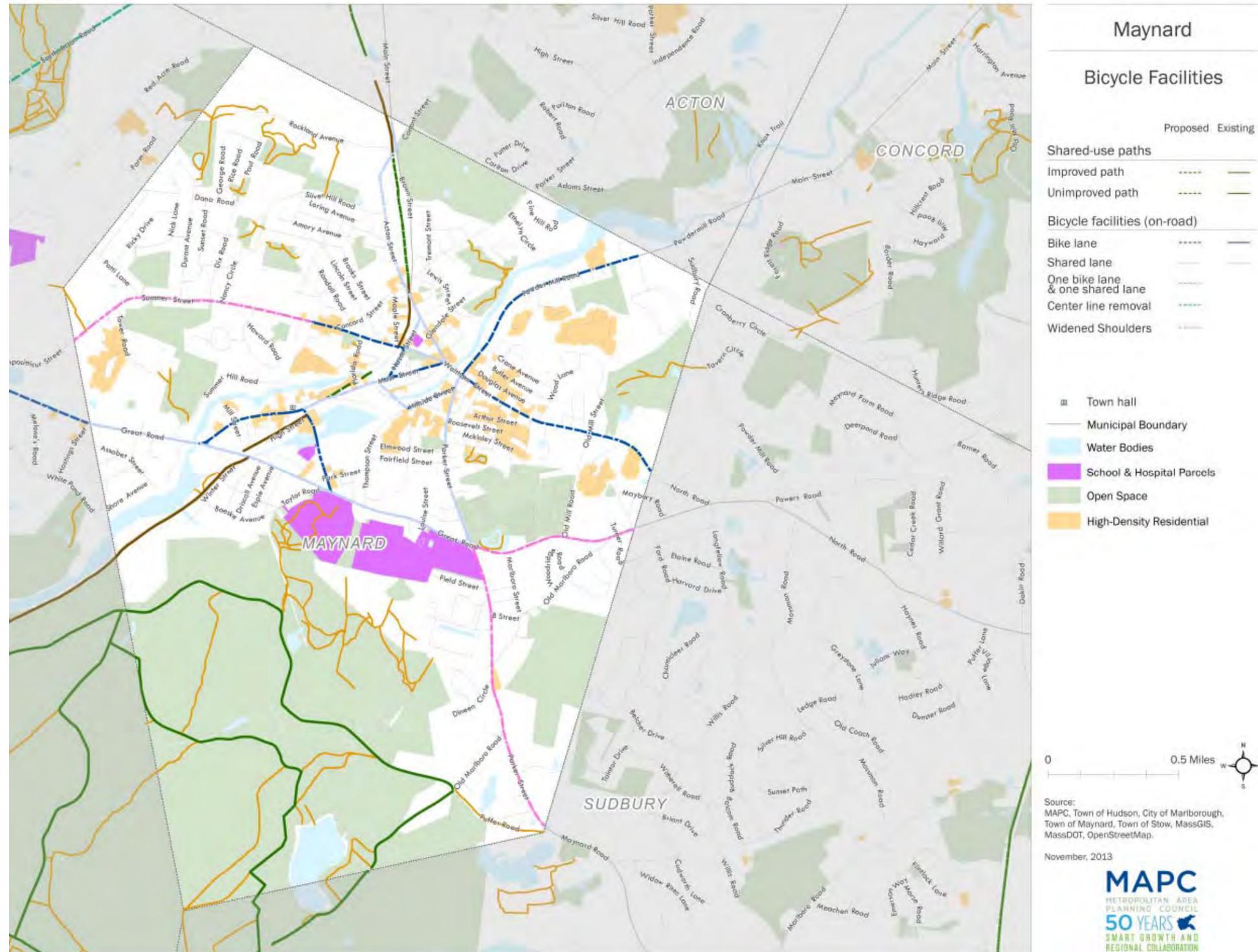


Figure 21: Maynard Bicycle Network Plan

The Town of Maynard is located approximately 20 miles west of Boston. The Town borders Stow to the west and Sudbury on its south and east edges. It also borders Acton to the north. As of the 2010 Census, Maynard's resident population was over 10,000, with approximately 3,000 jobs located within the Town. Priorities for Maynard include connections to the Assabet River Rail Trail, schools, retail clusters, and dense residential areas. Currently, there are gaps in the bicycle and pedestrian network to all of these key locations. In addition, the ARRT is partially completed in Maynard with most sections currently passable for pedestrians and off-road bicycles.

In addition to the recommendations provided in the following sections, MAPC reviewed the 2008-2010 data involving crashes between vehicles and pedestrians or bicyclists. The Town may wish to consider this supplementary information when prioritizing investments bicycle and pedestrian facilities in order to improve safety. Please see **Appendix C** for the locations and other details of these crashes.

Projects (Current and Future)

The following list of projects is based upon discussions with the Town and is not part of this report's recommendations. It is intended to highlight important projects and is not intended to be an exhaustive list of all planning and construction projects. Maynard should consider this report's recommendations within the context of these other projects.

- Parker Street – plans are under review for development along a portion of Parker Street. Currently, there is not adequate pavements space to allow for bicycle lanes (MAPC's recommendation is to widen the shoulders as much as possible). However, potential road reconstruction could allow for higher quality bicycle and pedestrian facilities (e.g., bicycle lanes and sidewalks) than what is proposed in this report based on existing conditions.
- Clock Tower Place – this office park near the downtown retail district is being considered for a conversion to approximately 600 residential units.
- Powder Mill Road – a potential 40(b) development is being considered near the Acton line
- Acton Street – as part of a feasibility study, the Town is considering changing the road configuration of part of Acton Street from a two-way to one-way road.

Bicycle Recommendations

There are a number of streets in Maynard identified on the Maynard Bicycle Network Map (Figure 21) and Maynard Bicycle Recommendations Table (Table 8) with potential for bicycle facilities in the short term. The table provides details on the recommendations for proposed striping. The recommendations call for the installation of approximately 2.5 miles of bicycle lanes in Maynard. **Appendix E** contains a list of all the street segments analyzed.

Maynard should prioritize installation of bicycle facilities based upon the key connections listed above, as well as the Town's repaving schedule. MAPC in general has based its recommendations upon existing curb-to-curb widths and existing parking conditions; however, based on discussions with the Town Administrator, Planning Director, and DPW Director, **MAPC recommends removing one side of parking on Sudbury Street**. This street provides an important connection from the central retail district to the Town's public schools. The curb-to-curb width and existing parking configuration allowing parking on both sides of the road do not allow for bicycle lanes. Multiple site visits and discussions with Town officials confirmed that parking demand is very low on this street (see Figure 22). Removing one side of parking would allow for the installation of bicycle lanes on both sides of the roadway, while adequately accommodating motorists' parking needs on this street.



Figure 22: MAPC recommends removing one side of parking on Sudbury Street

Potential Cycle Tracks

As discussed in the Bicycle Recommendations section of the Introduction, a cycle track is an exclusive bicycle facility that is physically separated from moving vehicles. By being physically separated from traffic cyclists often feel safer than they do with traditional bicycle lanes. Cycle tracks do, however, require greater investment than standard bicycle lane striping. Due to the cost, study labels potential cycle tracks as buffered bicycle lanes. The Town should consider the importance of the connection when considering whether to construct a cycle track. Based upon existing right-of-way width, Main Street (between Waltham Street and Walnut Street) could incorporate a cycle track rather than a buffered bicycle lane.

Pedestrian Recommendations

Maynard has been proactively investing in pedestrian infrastructure over the past two years by dedicating funds for new sidewalk construction and sidewalk improvements (\$500,000 in 2013). MAPC reviewed all of the sidewalk locations and gaps on the non-local roads in Maynard, based on key connections and Town input. Figure 23 illustrates the non-local roads that lack pedestrian facilities. MAPC recommends providing pedestrian facilities (sidewalks, shared use paths, etc.) on at least one side of all roadways. In addition, Table 9 provides a list of the top priority recommendations (in alphabetical order) for pedestrian facilities in Maynard (these locations are highlighted on the following map). While the Town should consider these priorities when constructing new sidewalks, it should not preclude the construction of sidewalks or other pedestrian facilities in other areas. Note that these recommendations reflect priorities based on gaps, and network continuity, and do not reflect the cost of construction, right of way, or ownership issues.

Table 9: Maynard Pedestrian Infrastructure Priority Locations

<i>Street</i>	<i>Limits</i>	<i>Key Connections</i>
Great Road	Main Street to Winter Street	Completes continuous pedestrian-way along Great Road
Parker Street	Sudbury Town line to Great Road	Future development sites and schools
Summer Street	Stow Town line to Howard Road	Connects high density residential to Town center
Waltham Street	Sudbury Town line to Wood Lane	High density residential

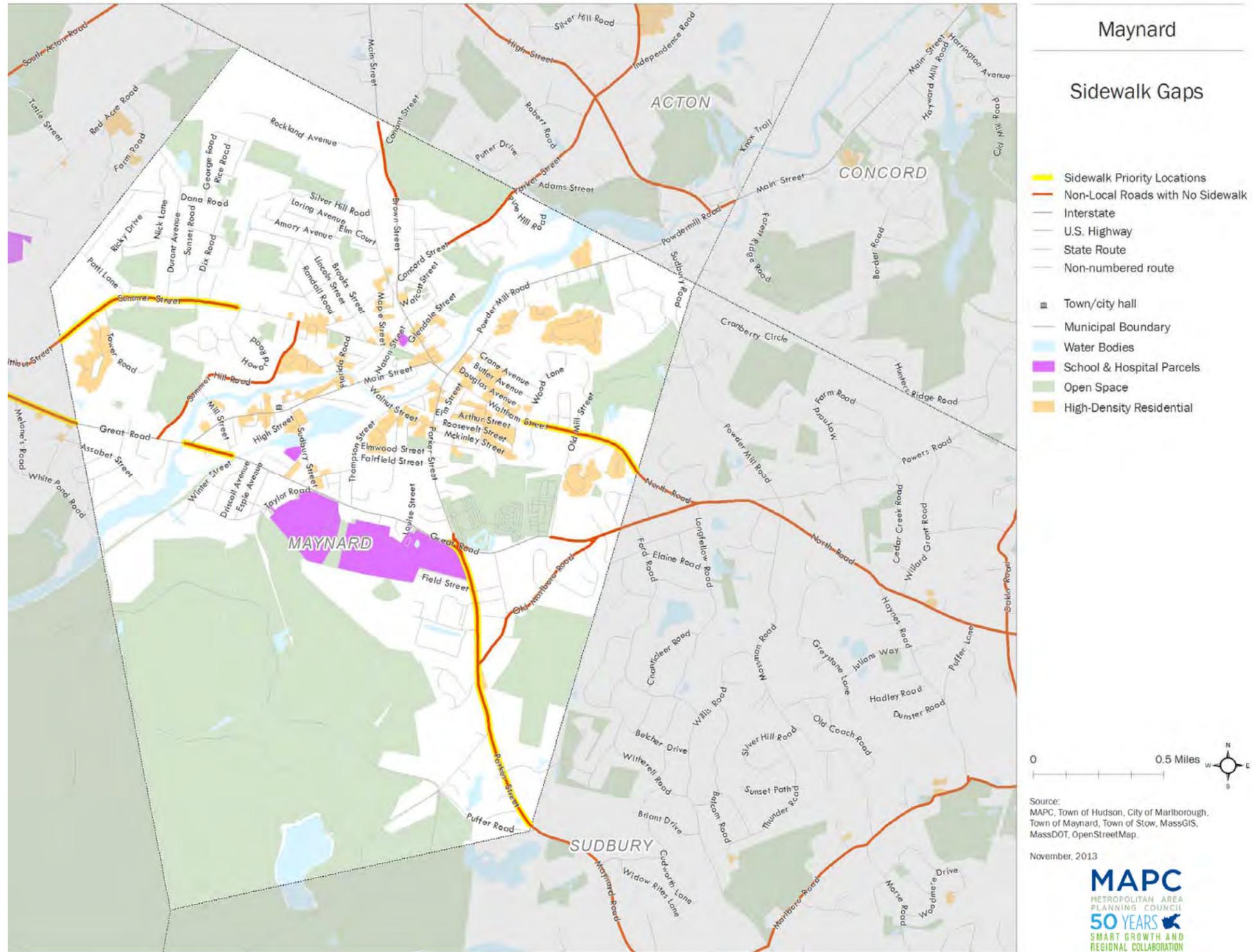


Figure 23: Maynard Sidewalk Gaps (Non-local Roads)

Stow

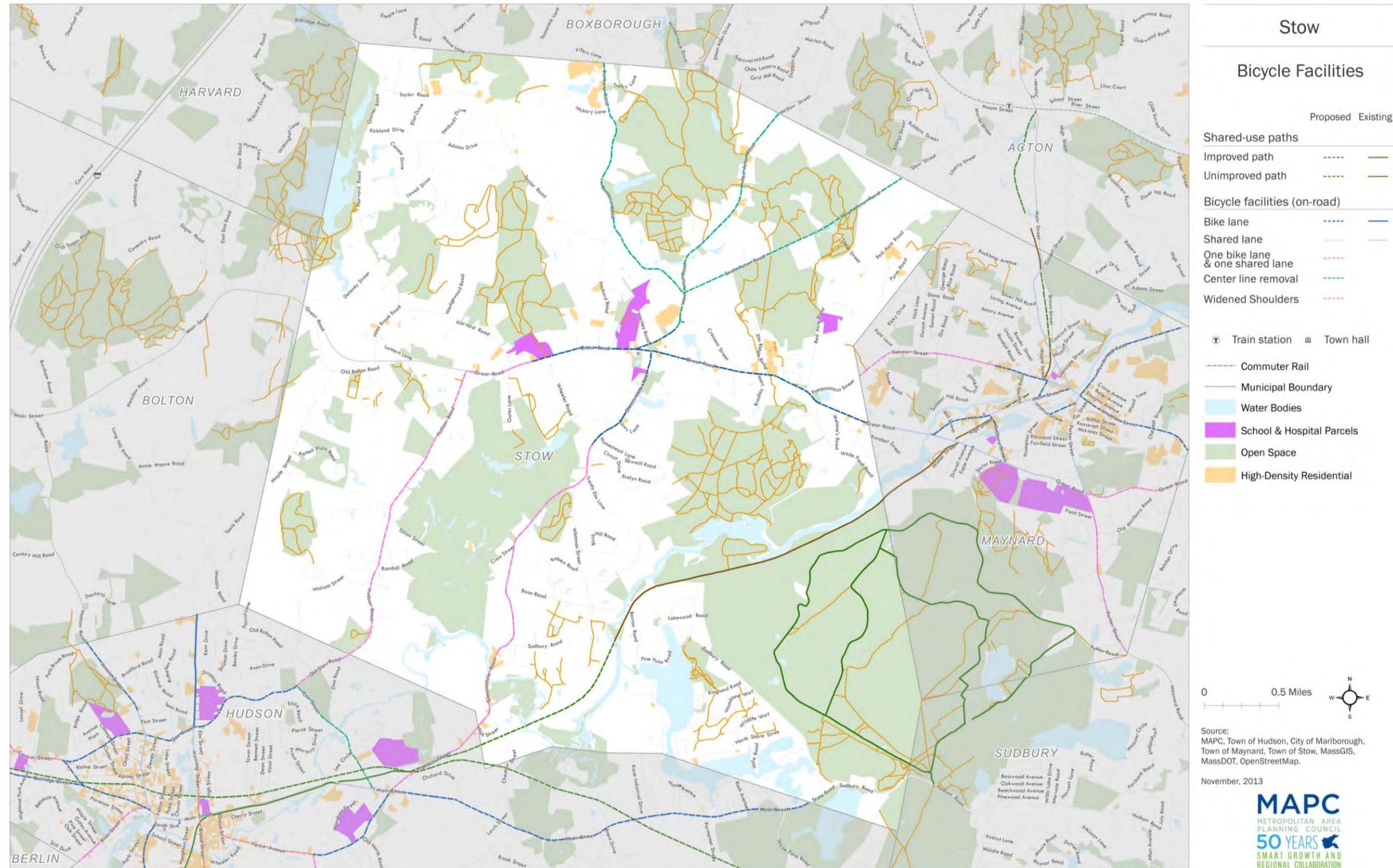


Figure 24: Stow Bicycle Network Plan

The Town of Stow is located approximately 20 miles west of Boston. The Town borders Maynard to the east and Hudson to the south, both of which are included in this regional bicycle and pedestrian analysis. It also borders Sudbury to the east, Acton and Boxborough to the north, and Harvard and Bolton to the west. As of the 2010 Census, Stow's population was approximately 6,500 residents, with approximately 2,500 jobs located within the Town. There are a number of opportunities throughout Stow to connect to the Town's dense residential areas, affordable housing developments, Stow Community Park, Town Center, Lower Village, and schools. Dense residential developments include:

- The Villages at Stow (off Great Road)
- Pilot Grove I (off Warren Road) and Pilot Grove II (currently under construction off Warren Road)
- Arbor Glen Active Adult Neighborhood (off Arbor Glen Drive)
- Meeting House and Faxon Farm Independent Senior Living Residence (off Meeting House Lane)
- Plantation Apartments (on Johnston Way)

In addition to the recommendations provided in the following sections, MAPC reviewed the 2008-2010 data involving crashes between vehicles and pedestrians or bicyclists. The Town may wish to consider this supplementary information when prioritizing investments in bicycle and pedestrian facilities in order to improve safety. Please see **Appendix C** for the locations and other details of these crashes.

Projects (Current and Future)

The following list of projects is based upon discussions with the Town and is not part of this report's recommendations. It is intended to highlight important projects and is not intended to be an exhaustive list of all planning and construction projects. Stow should consider this report's recommendations within the context of these other projects.

- Route 117, Great Road Traffic Circulation and Pedestrian Safety Improvements – Town Meeting approved funding for final design and construction plans in October 2013.
- Rt. 62 Gleasondale Road, Gleasondale Village Revitalization Planning Project – Potential traffic calming and pedestrian safety upgrades to coincide with revitalization of mill village.
- Pilot Grove II – 30 Units of apartments off Warren Road, currently under construction
- Hemenway Farm Planned Conservation Development – 26 single family homes off proposed Hemenway Farm Lane, currently in permitting process

Gaps and Barriers

In the Town of Stow there is an existing gap in the proposed route of the Assabet River Rail Trail (ARRT) in the section owned by Honey Pot Hill Orchards. The Honey Pot Hill Orchard is a 200-acre family-owned farm with a long history in the Town, which currently has concerns about the rail trail passing through its property. Stow should continue working with Honey Pot Hill Orchard and other stakeholders to determine if a mutually agreeable arrangement can be reached to provide access through the property. In the event an agreement is not possible, Stow should determine an alternate route (e.g., an on-road route) to connect the ARRT.

Bicycle Recommendations

There are a number of streets in Stow identified on the Stow Bicycle Network Map (Figure 24) and Stow Bicycle Recommendations Table (Table 10) with potential for bicycle facilities in the short term. The table provides details on the recommendations for proposed striping. The recommendations call for the installation of approximately 3.5 miles of bicycle lanes in Stow. **Appendix E** contains a list of all the street segments analyzed.

Stow should prioritize installation of bicycle facilities based upon the key connections listed above, as well as the Town's repaving schedule. In particular, South Acton Road has been identified, along with West Acton Road and Boxboro Road, as suitable roadways for a centerline removal or advisory lane configuration (see Introduction for further details). Because of its direct connection to nearby public transit in Acton, as well as its relatively wide layout and straight road configuration, MAPC recommends prioritizing South Acton Road for this type of bicycle/pedestrian accommodation. If after considering these alternative treatments for the roadways, the Town decides these are not desirable, then MAPC recommends widening the shoulders to the extent possible to provide a safer and more comfortable experience for cyclists and pedestrians.

Table 10: Stow Bicycle Recommendations

Street Name	From	To	Roadway						Existing Conditions						Recommendation	Recommendation - Details														
			Sidewalks			Travel Direction			Parking			Curb-to-Curb	Shoulder	Parking		Travel Lanes			Parking	Shoulder	Parking	Buffer or Shoulder	Bicycle Lane	Buffer	Travel Lane (s)	Travel Lane (s)	Buffer	Bicycle Lane	Buffer or Shoulder	Parking
			Number	Two-Way	One-Way	None	Both	One Side	Width	WB/SB (Width)	WB/SB (Width)	WB/SB (Width)	EB/NB (Width)	EB/NB (Width)		EB/NB (Width)	WB/SB	WB/SB	WB/SB	WB/SB	WB/SB	EB/NB	EB/NB	EB/NB	EB/NB	EB/NB	EB/NB	EB/NB	EB/NB	
Crescent Street	Library Hill Road	West Acton Road	1	X		X			28.5	2		13.5	12		1	Bicycle lanes			4.25		10	10			4.25					
Gleasondale Road	Hudson line	Sudbury Road	0	X		X			26	1.5		11.5	11.5		1.5	Widen Shoulders		2.5			10.5	10.5				2.5				
Gleasondale Road	Sudbury Road	Wheeler Road	0	X		X			24			12	12			Add signage														
Gleasondale Road	Wheeler Road	Great Road	0	X		X			30	1		14	14		1	Bicycle lanes			4		11	11			4					
Great Road	Maynard line	Pompositticut Street	0	X		X			30	3		12	12		3	Bicycle lanes			4		11	11			4					
Great Road	Pompositticut Street	Crescent Street	1	X		X			29	2.5		12	12		2.5	Bicycle lanes			4		10.5	10.5			4					
Great Road	Crescent Street	Gleasondale Road	1	X		X			28	2		13	12		1	Bicycle lanes			4		10	10			4					
Great Road	Gleasondale Road	Wheeler Road	2	X		X			33.5	1		12	13.5		2	Bicycle lanes			5		11.75	11.75			5					
Hudson Road	Hudson line	Great Road	1	X		X			26	1.5		11.5	11.5		1.5	Widen Shoulders		2.5			10.5	10.5			2.5					
South Acton Road	Boxboro Road	Acton line	0	X		X			26	2		11	11		2	Center line removal														
West Acton Road	Boxboro Road	Acton line	0	X		X			27			14	13			Center line removal														

Notes:
 --Red text in the travel lanes indicates shared lane markings.

Pedestrian Recommendations

MAPC reviewed all of the sidewalk conditions and gaps on the non-local roads in Stow. Figure 25 illustrates the non-local roads that lack pedestrian facilities. MAPC recommends providing pedestrian facilities (sidewalks, shared use paths, etc.) on at least one side of all roadways. In addition, Table 11 provides a list of the top priority recommendations (in alphabetical order) for pedestrian facilities in Stow, based on key connections and Town input (these locations are highlighted on the following map). While the Town should consider these priorities when constructing sidewalks, it should not preclude the construction of sidewalks or other pedestrian facilities in other areas. Note that these recommendations reflect priorities based on gaps, and network continuity, and do not reflect the cost of construction, right of way, or ownership issues.

Table 11: Stow Pedestrian Infrastructure Priority Locations

<i>Street</i>	<i>Limits</i>	<i>Key Connections</i>
Crescent Street	West Acton Road to Library Hill Road	Connects high density residential (Warren Road) to Town Center
Great Road	Old Bolton Road to Maynard Town line	Schools and high density residential areas, including Meeting House and Faxon Farm Independent Senior Living Residence and Plantation Apartments to Town Center and Lower Village
Hudson Road	Great Road to Arbor Glen Drive	Arbor Glen Active Adult Neighborhood to Lower Village
Old Bolton Road	Maple Street to Great Road	Stow Community Park
West Acton Road	South Acton Road to Crescent Street	High density residential

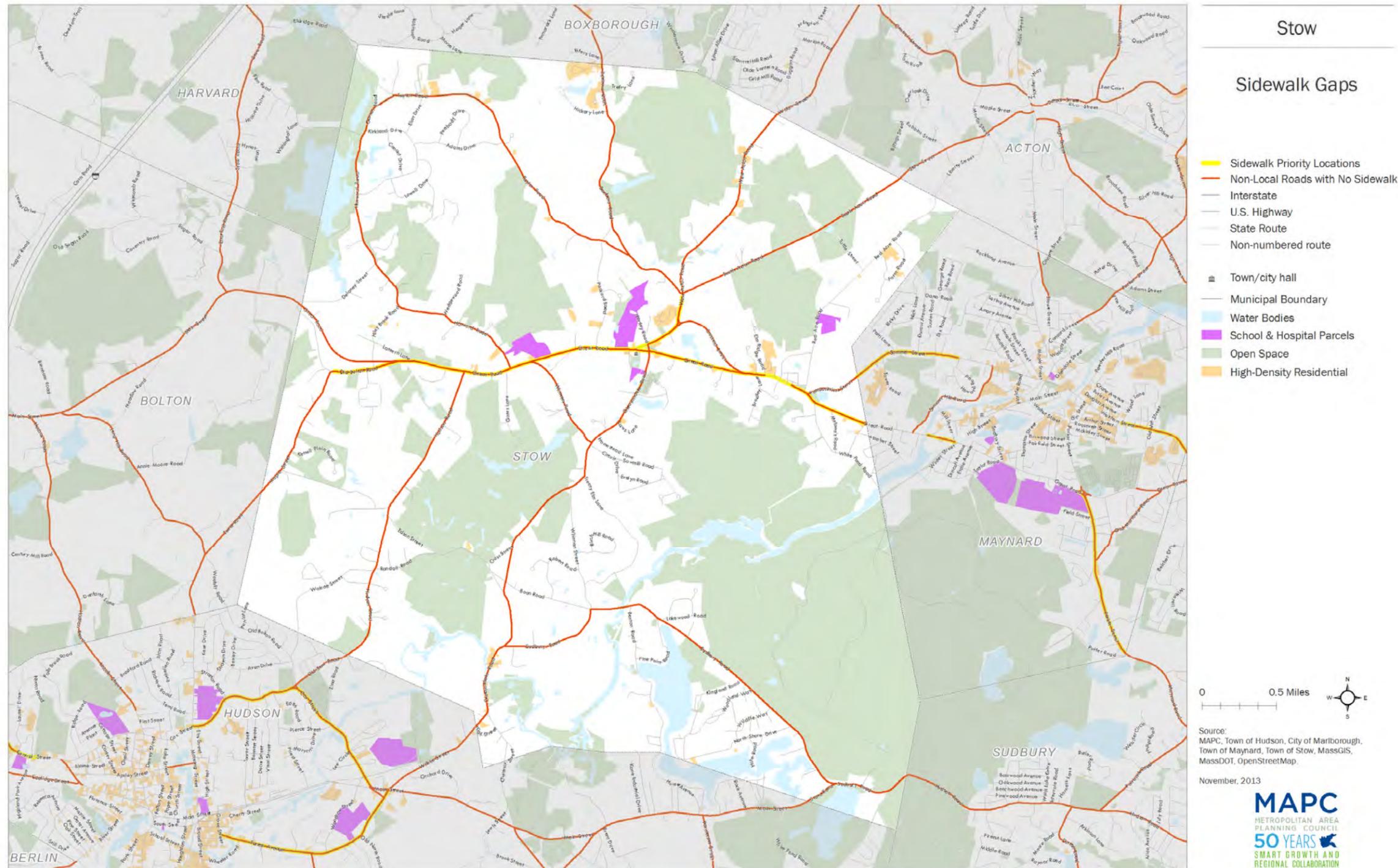


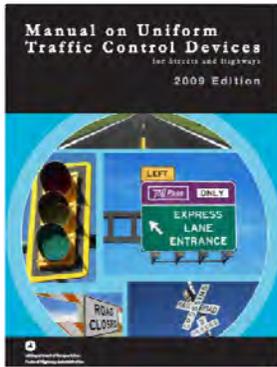
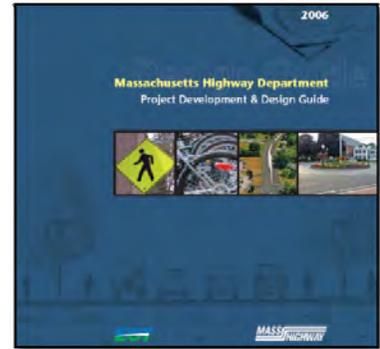
Figure 25: Stow Sidewalk Gaps (Non-local Roads)

Appendix A – Pedestrian and Bicycle Facility Design Guidelines and References

MassDOT's Project Development and Design Guide¹²

The primary resource that should be adhered to is the MassDOT Project Development and Design Guidebook.

This guide emphasizes multimodal accommodation that encourages and supports safe travel for pedestrians, bicyclists and other modes of travel. The MassDOT Guide directs the designer to ensure that the needs of non-motorized users remain integral to project planning and design. This approach facilitates the use of context-sensitive design, environmental protection and the careful consideration of the safety and accessibility needs of pedestrians, bicyclists and non-motorized facility users.



Manual on Uniform Traffic Control Devices (MUTCD)¹³

The Manual on Uniform Traffic Control Devices, or MUTCD, defines the standards used by road managers nationwide to install and maintain traffic control devices on all public streets, highways, bikeways, and private roads open to public traffic.

The MUTCD gives guidelines regarding the location and frequency of crosswalk installation, how long a pedestrian should wait at an intersection before crossing, how much time a pedestrian has to cross a street as well as the design and placement of signals and striping.

Creating Design Standards for 40R Districts¹⁴

Prepared jointly by the Massachusetts Department of Housing and Community Development and the Cecil Group in 2008, this Guidebook serves as a resource for communities and citizens in Massachusetts working to establish special design standards in conjunction with Smart Growth Zoning Districts enabled by M.G.L. Chapter 40R.

It provides practical information and references for crafting workable standards that will apply to the land uses and development within Smart Growth Zoning Districts. Accommodations for pedestrians such as walkway and sidewalk width, provision of benches, lighting fixtures and other street furniture elements are addressed in this Guidebook.



¹² www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/ProjectDevelopmentDesignGuide.aspx

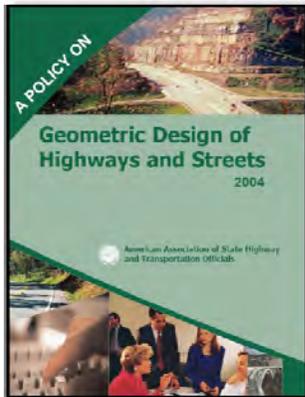
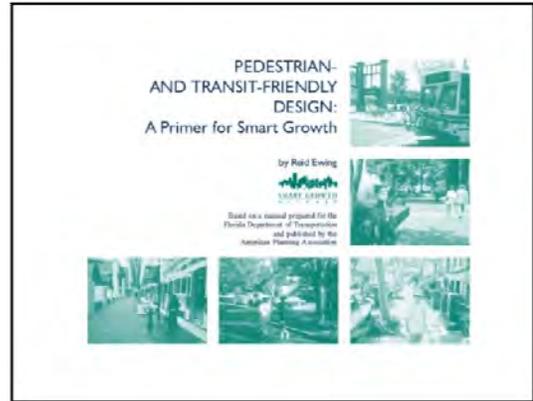
¹³ http://mutcd.fhwa.dot.gov/pdfs/2009r1r2/pdf_index.htm

¹⁴ <http://www.growsmartri.org/training/Creating%20Design%20Standards%20for%20Transit-Oriented%20Districts.pdf>

Pedestrian and Transit-Friendly Design: A Primer for Smart Growth¹⁵

Published by the Smart Growth Network, this guide is based on a manual prepared for the Florida Department of Transportation. The publication is a general guide of design concepts that support pedestrian activity and transit use.

The concepts are not presented in the format of design standards but they do provide some of the underlying rationale and strategies around which a community might develop measurable standards. The guide's various elements are broken into three categories: "Essential Features", "Highly Desirable Features", and "Nice Additional Features."

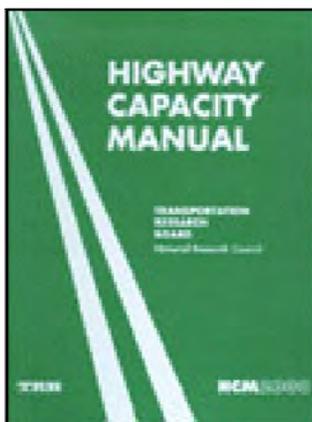
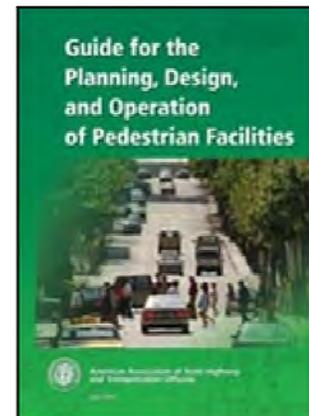


AASHTO's A Policy on Geometric Design of Highways and Streets

Frequently referred to as the 'Green Book', this policy manual contains information about the latest design practices in universal use as the standard for highway geometric design. The intent of the 'Green Book' is to provide guidance to the designer by referencing a recommended range of values for critical dimensions. The pedestrian and pedestrian facilities are referenced throughout the 'Green Book.'

AASHTO's Guide for the Planning, Design and Operation of Pedestrian Facilities (2012)

The purpose of this guide is to provide guidance on the planning, design, and operation of pedestrian facilities along streets and highways. Specifically, the guide focuses on identifying effective measures for accommodating pedestrians on public rights-of-way. The AASHTO Guide is widely used in the planning and engineering industry.



Highway Capacity Manual (HCM) (2000)

A publication of the Transportation Research Board (TRB), The Highway Capacity Manual (HCM) contains concepts, guidelines, and computational procedures for computing the capacity and quality of service of various highway facilities, including freeways, highways, arterial roads, roundabouts, signalized and unsignalized intersections, rural highways, and the effects of mass transit, pedestrians, and bicycles on the performance of these systems.

¹⁵ http://www.epa.gov/smartgrowth/pdf/ptfd_primer.pdf#search=Primer%20on%20Street%20Design%20Guidelines

Appendix B – Description of Sidewalk Design Considerations

Accessibility - Pedestrian facility design must comply with accessibility standards in the Rehabilitation Act of 1973 (Section 504) and the Americans with Disabilities Act (ADA) of 1990. ADA Standards for Accessible Design applies to all projects involving new or altered pedestrian facilities, not just projects funded by state or federal sources.

Sidewalks - Sidewalks are critical components for an effective pedestrian network. Sidewalks, provided on both sides of a street, are generally the preferred pedestrian facility and provide for a safe walking area outside the motor vehicle traffic travel-way. The preferred and most common sidewalk surface is concrete as it requires the least amount of maintenance and has a long life span. Other materials such as asphalt, brick, crushed granite/stone, or bricks and pavers may be used as long as ADA requirements are met. A minimum sidewalk width of 5 feet is encouraged to allow for two adult pedestrians to comfortably walk side-by-side. The Americans with Disabilities Act (ADA) mandates a minimum width of 3 feet of unobstructed sidewalk passageway. Reasonable flexibility exists to allow communities to adjust some dimensions to meet community goals.

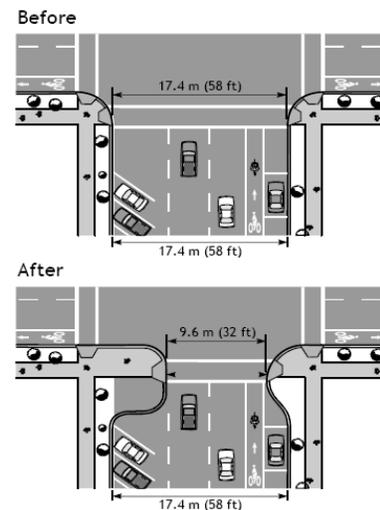
Lighting - Pedestrians often assume that motorists can see them at night. Without appropriate lighting motorists may not be able to see pedestrians crossing roads in time to stop. Well-designed and well-placed street lighting improves pedestrian visibility and safety.

Crosswalks - Marked crosswalks are used to help designate areas where motorists yield to pedestrians and direct pedestrians to preferred crossing points. Marked crosswalks contribute towards pedestrian safety. Ideally, marked crosswalks should be used in conjunction with other measures, such as curb extensions, advance warning signage for motorists, traffic signals and traffic calming treatments, to improve pedestrian crossing safety.

Curb extensions - These extend the sidewalk into the street, reducing the time and distance it takes a pedestrian to cross. Curb extensions can also prevent drivers from parking in crosswalks and blocking curb ramps.



Figure 26: Examples of curb extensions



Curb radii - Curb radii is the measurement of the sharpness of a corner at an intersection. Generally, a smaller or tighter curb radius is better for pedestrians. Compared to a large curb radius, a smaller curb radius allows for more pedestrian area at the corner, flexibility in the placement of curb ramps, shorter street crossings, requires vehicles to slow as they turn the corner, and improves sight distance between pedestrians and drivers.

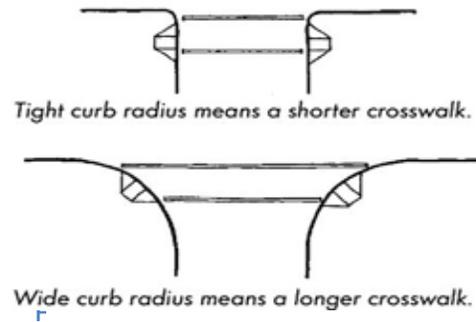


Figure 27: Curb radius illustration

Curb ramp - Curb ramps are used wherever there is a difference in level along a path a pedestrian is traversing. They should be designed to provide an accessible route so pedestrians may safely transition from a roadway to a curbed sidewalk and vice versa.

Intersection signals - In an effort to create safe and walkable communities, different actions can be taken to help make traffic signals work well for pedestrians. Signal timing is an important component to how an intersection operates for pedestrians. Traffic signals create gaps in the traffic flow and allow pedestrians to safely cross a street. Each municipality should perform a complete inventory of its signals and ensure that the equipment is updated and properly maintained. Signals need to be designed and timed to be pedestrian friendly and allow for adequate crossing time.

Appendix C – 2008-2010 Vehicle Crash Data with Pedestrians or Bicycles

This appendix provides information on crashes between vehicles and pedestrians or cyclists for each of the four communities. The maps provide locations by type, and the tables at the end of this section provide additional details, including date, road conditions, weather at time of crash, etc.

Hudson

Figure 28 below illustrates crashes between vehicles and pedestrians or cyclists. From 2008-2010 there were 11 crashes, one of which resulted in a non-fatal injury (Broad Street and Wheeler Road), and one of which resulted in a fatal injury (Cox Street and Lake Street). MAPC reviewed these crash areas and recommends shared lane markings on Broad Street and bicycle lanes on Cox Street.

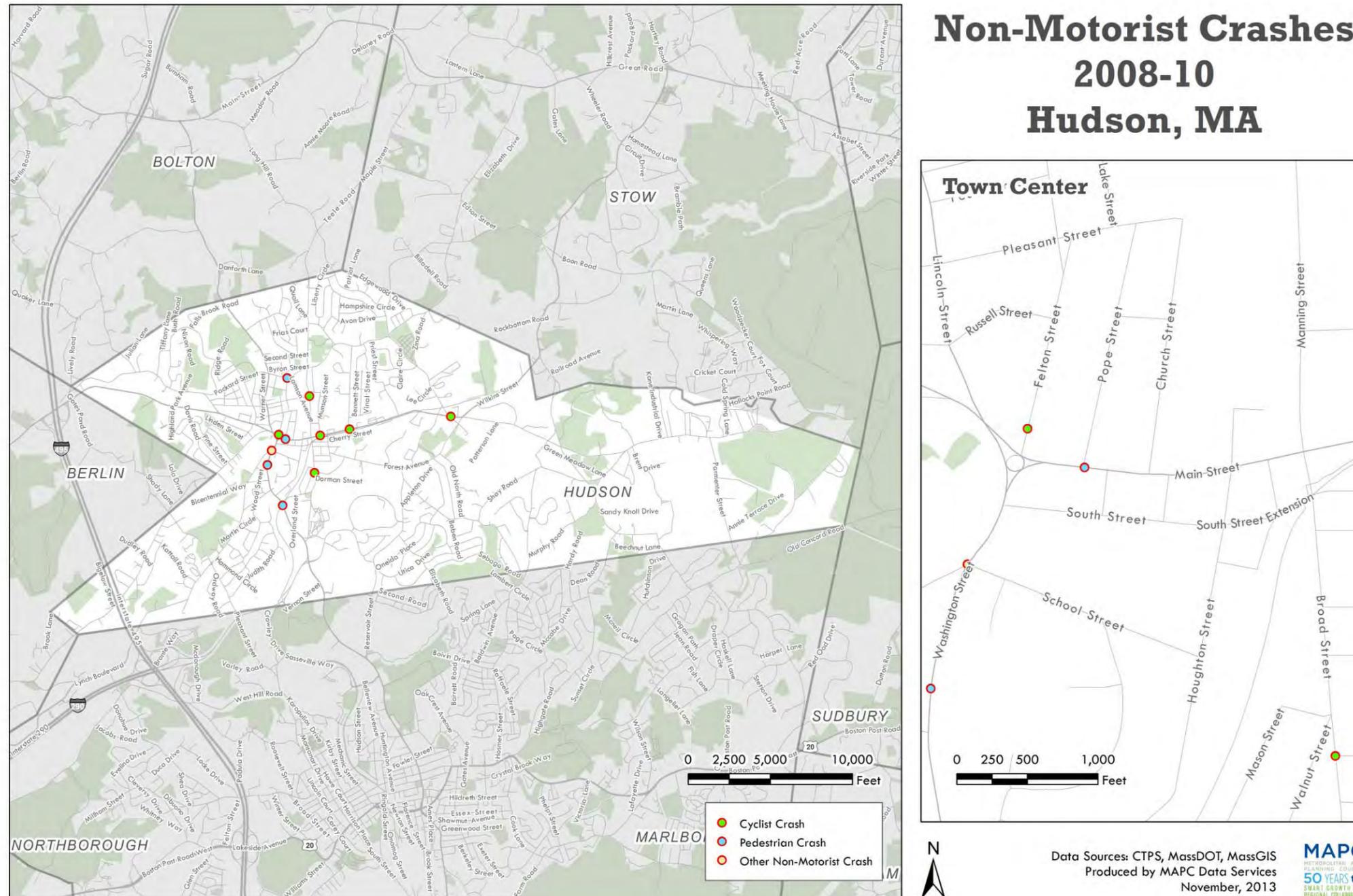
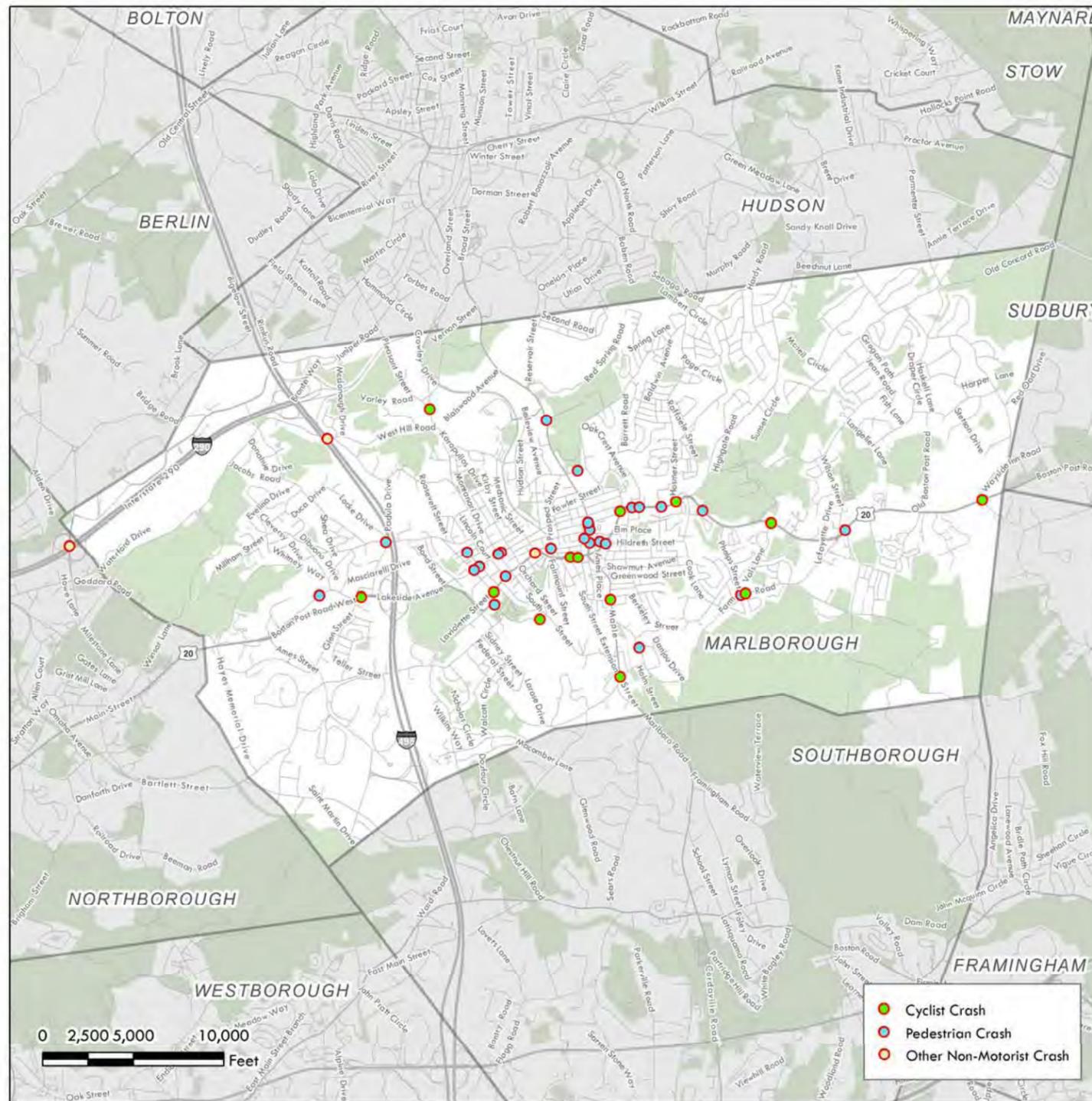


Figure 28: Hudson Bicycle and Pedestrian Crashes (2008-10)

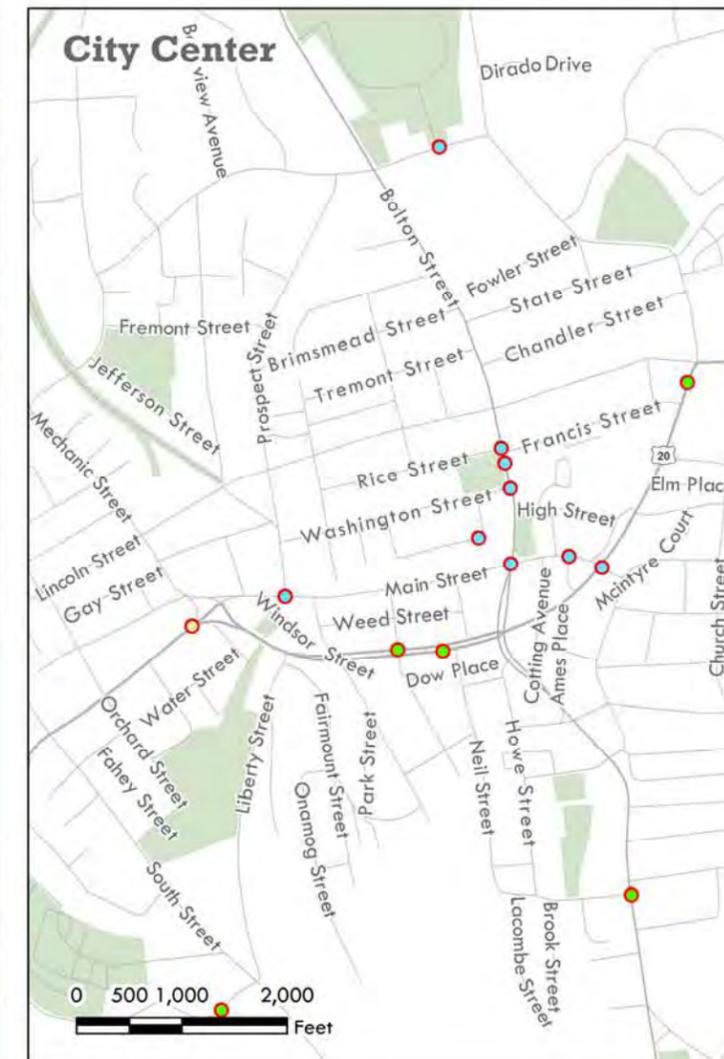
HUDSON												
Type	Crash_Date	Crash_Time	Crash_Sev	Collision	Veh_Action	Veh_Trav	Most_Harm	Veh_Config	Road_Cc	Light	Weather	Intersect
Cyclist Crash	14-Jun-2008	9:59 AM	Property damage only (none injured)	Single vehicle crash	V1: Leaving traffic lane	V1:Westbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Clear	456 MAIN STREET / Rte 62
Pedestrian Crash	22-Jul-2008	3:00 PM	Property damage only (none injured)	Angle	V1: Slowing or stopped in traffic	V1:Southbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Daylight	Cloudy	WASHINGTON STREET / GIASSON STREET
Pedestrian Crash	13-Aug-2008	9:06 AM	Fatal injury	Head-on	V1: Travelling straight ahead	V1:Eastbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Daylight	Clear	26 COX STREET / LAKE STREET
Pedestrian Crash	30-Aug-2008	6:35 PM	Property damage only (none injured)	Angle	V1: Backing	V1:Northbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Daylight	Clear	68 WASHINGTON STREET Rte 85 N
Cyclist Crash	17-May-2009	10:21 AM	Property damage only (none injured)	Head-on	V1: Turning right	V1:Southbound	V1: Collision with cyclist	V1: Light truck(van, mini-van, panel, pickup, sport utility)	Wet	Daylight	Cloudy	MAIN STREET / TOWER STREET / VILA DO PORTO BOULEVARD
Cyclist Crash	08-Jun-2009	11:17 AM	Non-fatal injury	Single vehicle crash	V1: Turning right	V1:Northbound	V1: Collision with cyclist	V1: Light truck(van, mini-van, panel, pickup, sport utility)	Dry	Daylight	Cloudy/Cloudy	BROAD STREET / WHEELER ROAD
Cyclist Crash	14-Jun-2009	11:59 AM	Property damage only (none injured)	Single vehicle crash	V1: Travelling straight ahead	V1:Northbound	V1: Collision with cyclist	V1: Passenger car	Wet	Daylight	Cloudy/Rain	6 FELTON STREET
Cyclist Crash	24-Jun-2009	9:38 AM	Property damage only (none injured)	Angle	V1: Travelling straight ahead	V1:Westbound	V1: Collision with cyclist	V1: Passenger car	Wet	Daylight	Rain/Cloudy	246 MAIN STREET / HIGH STREET
Pedestrian Crash	12-Mar-2010	4:16 PM	Property damage only (none injured)	Single vehicle crash	V1: Backing	V1:Eastbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Daylight	Clear	10 feet E from Intersection 50 MAIN STREET / POPE STREET
Other Non-motorist Crash	20-May-2010	7:22 AM	Property damage only (none injured)	Rear-end	V1: Travelling straight ahead / V2:Travelling straight ahead	V1:Southbound / V2:Not reported	V1: Collision with motor vehicle in traffic / V2: Not reported	V1: Passenger car / V2:Light truck(van, mini-van, panel, pickup, sport utility)	Dry	Daylight	Clear	WASHINGTON STREET / PARK STREET
Cyclist Crash	26-May-2010	7:44 AM	Property damage only (none injured)	Single vehicle crash	V1: Slowing or stopped in traffic	V1:Eastbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Clear	MANNING STREET / APSLEY STREET

Marlborough

Figure 29 below illustrates crashes between vehicles and pedestrians or cyclists. From 2008-2010 there were 44 crashes, 32 of which resulted in non-fatal injuries, and one of which resulted in a fatal injury (Main Street and Prospect Street). The fatal injury was an automobile-pedestrian collision in the early morning, despite sidewalks on both streets. The non-fatal injuries were split between automobile collisions with cyclists and pedestrians.



Non-Motorist Crashes 2008-10 Marlborough, MA



Data Sources: CTPS, MassDOT, MassGIS
Produced by MAPC Data Services
November, 2013



Figure 29: Marlborough Bicycle and Pedestrian Crashes (2008-2010)

MARLBOROUGH												
Type	Crash_Date	Crash_Time	Crash_Sev	Collision	Veh_Action	Veh_Trav	Most_Harm	Veh_Config	Road_Cond	Light	Weather	Intersect
Pedestrian Crash	06-Feb-2008	2:53 PM	Non-fatal injury	Angle	V1: Turning left / V2:Slowing or stopped in traffic	V1:Eastbound / V2:Southbound	V1: Collision with pedestrian / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Passenger car	Wet	Daylight	Cloudy	LINCOLN STREET / CROSS STREET
Pedestrian Crash	17-Feb-2008	7:18 AM	Non-fatal injury	Sideswipe, same direction	V1: Travelling straight ahead	V1:Westbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Daylight	Clear/Unknown	100 NORTHBORO ROAD
Pedestrian Crash	14-Apr-2008	6:57 AM	Property damage only (none injured)	Single vehicle crash	V1: Turning left	V1:Eastbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Daylight	Clear/Other	LINCOLN STREET / PLEASANT STREET
Cyclist Crash	17-May-2008	6:47 PM	Non-fatal injury	Single vehicle crash	V1: Travelling straight ahead	V1:Southbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Clear	200 BEACH STREET
Pedestrian Crash	26-Jun-2008	8:17 AM	Property damage only (none injured)	Rear-end	V1: Turning right	V1:Northbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Daylight	Clear	PETERS AVENUE / BOSTON POST ROAD EAST
Pedestrian Crash	19-Jul-2008	10:30 PM	Non-fatal injury	Single vehicle crash	V1: Backing	V1:Westbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Dark - lighted roadway	Cloudy	AMES PLACE / MAIN STREET
Cyclist Crash	29-Jul-2008	9:47 AM	Non-fatal injury	Angle	V1: Turning left	V1:Southbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Clear	HAGER STREET / BOSTON POST ROAD EAST
Cyclist Crash	10-Aug-2008	1:19 PM	Non-fatal injury	Rear-end	V1: Turning right	V1:Northbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Cloudy/Clear	HOSMER STREET / EAST MAIN STREET
Cyclist Crash	18-Aug-2008	5:23 PM	Property damage only (none injured)	Sideswipe, same direction	V1: Turning right	V1:Eastbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Clear	214 WEST MAIN STREET Rte 20
Cyclist Crash	01-Sep-2008	12:55 PM	Non-fatal injury	Sideswipe, opposite direction	V1: Travelling straight ahead	V1:Northbound	V1: Collision with cyclist	V1: Light truck(van, mini-van, panel, pickup, sport utility)	Dry	Daylight	Clear	418 MAPLE STREET Rte 85
Cyclist Crash	17-Sep-2008	8:28 AM	Non-fatal injury	Angle	V1: Turning left	V1:Westbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Clear	BOSTON POST ROAD EAST Rte 20 / VICTORIA LANE
Pedestrian Crash	19-Sep-2008	7:01 AM	Fatal injury	Single vehicle crash	V1: Travelling straight ahead	V1:Eastbound	V1: Collision with pedestrian	V1: Light truck(van, mini-van, panel, pickup, sport utility)	Dry	Dawn	Clear	MAIN STREET / PROSPECT STREET
Cyclist Crash	20-Sep-2008	4:30 PM	Non-fatal injury	Single vehicle crash	V1: Turning right	V1:Westbound	V1: Collision with cyclist	V1: Not reported	Dry	Daylight	Clear	LINCOLN STREET / PLEASANT STREET
Cyclist Crash	30-Sep-2008	1:14 PM	Non-fatal injury	Angle	V1: Turning left	V1:Eastbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Cloudy	GRANGER BOULEVARD Rte 20 E / FLORENCE STREET
Cyclist Crash	16-Oct-2008	8:38 AM	Non-fatal injury	Angle	V1: Turning right	V1:Eastbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Clear	MAPLE STREET Rte 85 N / VALLEY STREET
Pedestrian Crash	07-Nov-2008	2:14 PM	Non-fatal injury	Single vehicle crash	V1: Slowing or stopped in traffic	V1:Southbound	V1: Collision with pedestrian	V1: Passenger car	Wet	Daylight	Rain/Cloudy	12 DAVIS STREET / EAST MAIN STREET
Pedestrian Crash	18-Nov-2008	3:15 PM	Non-fatal injury	Single vehicle crash	V1: Slowing or stopped in traffic	V1:Westbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Daylight	Clear	54 BOLTON STREET / GRANGER BOULEVARD
Cyclist Crash	01-Apr-2009	8:31 PM	Non-fatal injury	Rear-end	V1: Travelling straight ahead	V1:Eastbound	V1: Collision with cyclist	V1: Passenger car	Wet	Dark - lighted roadway	Rain/Unknown	400 LAKESIDE AVENUE Rte 20 E
Pedestrian Crash	17-May-2009	9:03 PM	Property damage only (none injured)	Single vehicle crash	V1: Travelling straight ahead	V1:Westbound	V1: Collision with pedestrian	V1: Passenger car	Wet	Daylight	Rain/Cloudy	FARM ROAD / PHELPS STREET
Pedestrian Crash	11-Jul-2009	5:14 PM	Non-fatal injury	Angle	V1: Entering traffic lane	V1:Southbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Daylight	Clear	WEST MAIN STREET / GIBBON STREET
Cyclist Crash	25-Jul-2009	5:05 PM	Non-fatal injury	Unknown	V1: Travelling straight ahead	V1:Northbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Clear	FITCHBURG STREET / PLEASANT STREET
Pedestrian Crash	05-Sep-2009	9:43 AM	Non-fatal injury	Sideswipe, opposite direction	V1: Turning right	V1:Westbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Daylight	Clear	431 LINCOLN STREET
Pedestrian Crash	12-Sep-2009	3:50 PM	Non-fatal injury	Single vehicle crash	V1: Turning left	V1:Northbound	V1: Collision with pedestrian	V1: Not reported	Wet	Dark - roadway not lighted	Cloudy/Rain	CLINTON STREET / EAST MAIN STREET
Pedestrian Crash	17-Sep-2009	7:42 PM	Non-fatal injury	Single vehicle crash	V1: Travelling straight ahead	V1:Westbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Dark - lighted roadway	Clear	25 UNION STREET
Pedestrian Crash	06-Oct-2009	10:29 AM	Non-fatal injury	Single vehicle crash	V1: Turning left	V1:Eastbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Daylight	Clear	BEVERLY DRIVE / FRAMINGHAM ROAD
Pedestrian Crash	09-Oct-2009	3:14 PM	Non-fatal injury	Single vehicle crash	V1: Turning left	V1:Northbound	V1: Collision with pedestrian	V1: Light truck(van, mini-van, panel, pickup, sport utility)	Wet	Daylight	Rain/Cloudy	FELTON STREET / ELM STREET
Pedestrian Crash	22-Oct-2009	4:47 PM	Non-fatal injury	Single vehicle crash	V1: Travelling straight ahead	V1:Southbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Daylight	Clear	531 LINCOLN STREET
Cyclist Crash	25-Oct-2009	3:08 PM	Non-fatal injury	Sideswipe, same direction	V1: Turning right	V1:Eastbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Clear	FARM ROAD / FARMINGTON CIRCLE
Pedestrian Crash	01-Dec-2009	6:06 PM	Non-fatal injury	Single vehicle crash	V1: Travelling straight ahead	V1:Northbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Dark - lighted roadway	Clear	LINCOLN STREET / PLEASANT STREET
Pedestrian Crash	06-Jan-2010	3:32 PM	Non-fatal injury	Single vehicle crash	V1: Travelling straight ahead	V1:Westbound	V1: Collision with motor vehicle in traffic	V1: Passenger car	Dry	Daylight	Clear	53 BELMONT STREET
Pedestrian Crash	11-Jan-2010	7:05 AM	Property damage only (none injured)	Single vehicle crash	V1: Turning left	V1:Eastbound	V1: Collision with pedestrian	V1: Not reported	Dry	Daylight	Clear/Other	LINCOLN STREET / PLEASANT STREET
Pedestrian Crash	10-Mar-2010	6:04 PM	Non-fatal injury	Unknown	V1: Turning left	V1:Northbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Dusk	Clear	MAIN STREET / BOLTON STREET
Pedestrian Crash	21-May-2010	10:56 PM	Property damage only (none injured)	Sideswipe, same direction	V1: Parked / V2:Travelling straight ahead	V1:Eastbound / V2:Not reported	V1: Collision with motor vehicle in traffic / V2: Collision with pedestrian	V1: Not reported / V2:Not reported	Dry	Dark - lighted roadway	Clear	34 DEVENS STREET
Cyclist Crash	08-Jun-2010	12:24 PM	Non-fatal injury	Sideswipe, same direction	V1: Overtaking/passing / V2:Travelling straight ahead	V1:Southbound / V2:Southbound	V1: Collision with cyclist / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Not reported	Dry	Daylight	Clear	BOSTON POST ROAD EAST / WAYSIDE INN RD / HAGER ST
Pedestrian Crash	20-Jul-2010	5:53 PM	Non-fatal injury	Angle	V1: Turning left	V1:Westbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Daylight	Clear	BOLTON STREET / WASHINGTON STREET
Pedestrian Crash	29-Jul-2010	4:11 PM	Non-fatal injury	Single vehicle crash	V1: Backing	V1:Southbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Daylight	Clear	EAST MAIN STREET
Cyclist Crash	26-Aug-2010	8:00 AM	Property damage only (none injured)	Sideswipe, same direction	V1: Turning right	V1:Southbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Clear	GRANGER BLVD
Pedestrian Crash	01-Sep-2010	11:03 AM	Property damage only (none injured)	Single vehicle crash	V1: Turning right	V1:Southbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Daylight	Clear	MAIN STREET / PROSPECT STREET
Pedestrian Crash	28-Sep-2010	5:39 PM	Property damage only (none injured)	Single vehicle crash	V1: Travelling straight ahead	V1:Westbound	V1: Collision with pedestrian	V1: Passenger car	Wet	Daylight	Rain	EAST MAIN ST
Pedestrian Crash	13-Oct-2010	4:10 PM	Non-fatal injury	Single vehicle crash	V1: Backing	V1:Northbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Daylight	Clear	BOLTON ST
Cyclist Crash	17-Oct-2010	4:22 PM	Property damage only (none injured)	Single vehicle crash	V1: Travelling straight ahead	V1:Eastbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Clear	EAST MAIN ST
Pedestrian Crash	08-Nov-2010	3:32 PM	Non-fatal injury	Single vehicle crash	V1: Travelling straight ahead	V1:Southbound	V1: Collision with pedestrian	V1: Passenger car	Wet	Daylight	Cloudy/Rain	BOLTON ST
Pedestrian Crash	01-Dec-2010	3:50 PM	Property damage only (none injured)	Single vehicle crash	V1: Travelling straight ahead / V2:Not reported	V1:Southbound / V2:Southbound	V1: Collision with motor vehicle in traffic / V2: Not reported	V1: Passenger car / V2:Not reported	Wet	Daylight	Rain/Cloudy	BEACH STREET
Pedestrian Crash	31-Dec-2010	5:59 PM	Non-fatal injury	Single vehicle crash	V1: Travelling straight ahead	V1:Westbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Dark - lighted roadway	Clear	BOSTON POST ROAD EAST

Maynard

Figure 30 below illustrates crashes between vehicles and pedestrians or cyclists. From 2008-2010 there were 7 crashes, one of which resulted in a non-fatal pedestrian injury (at 100 Parker Street). This segment of Parker Street contains existing pedestrian facilities. In addition, MAPC recommends shared lane markings in this segment of Parker Street to raise the visibility and comfort for cyclists on the road.

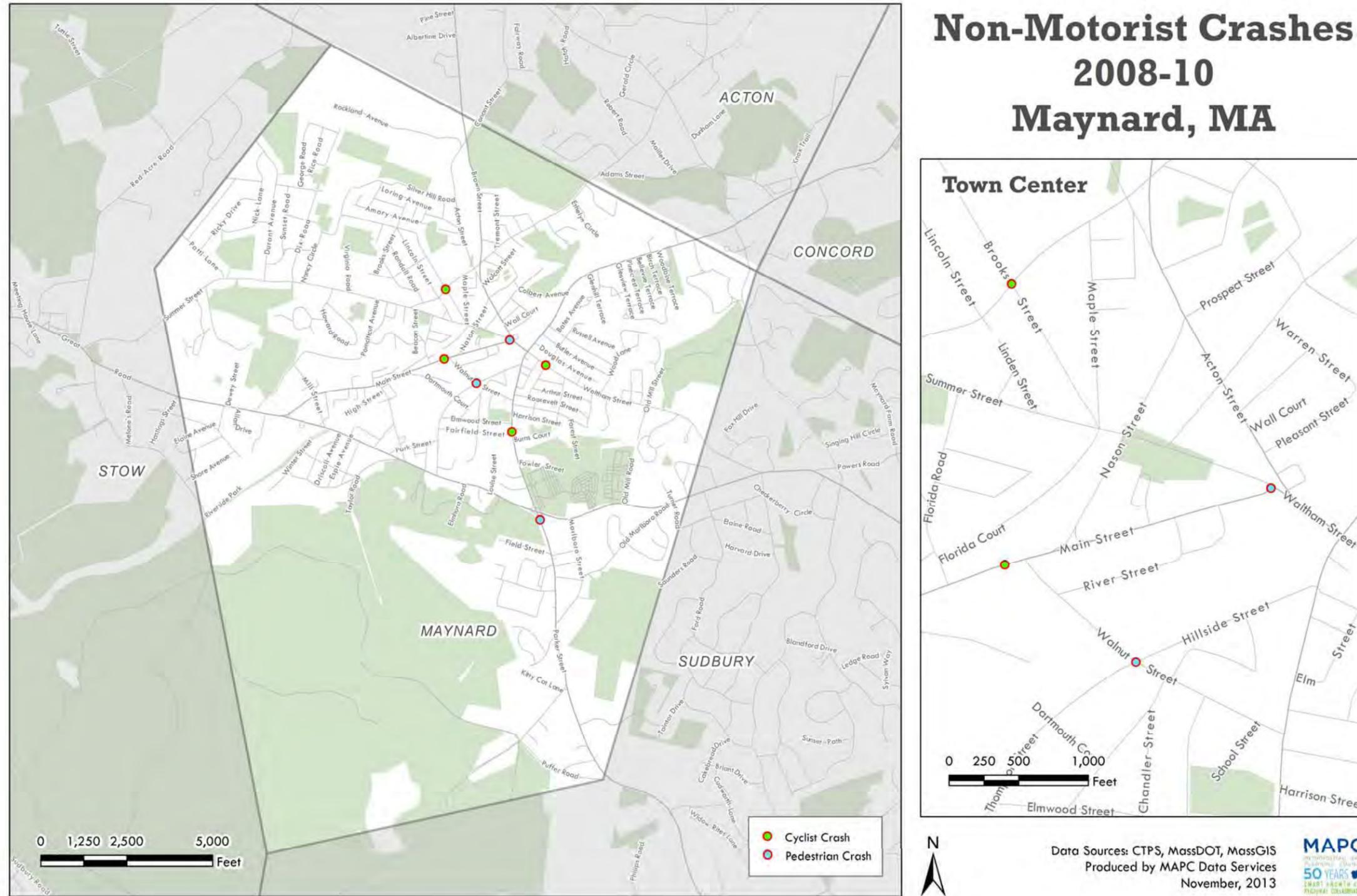


Figure 30: Maynard Bicycle and Pedestrian Crashes (2008-2010)

MAYNARD

Type	Crash_Date	Crash_Time	Crash_Sev	Collision	Veh_Action	Veh_Trav	Most_Harm	Veh_Config	Road_Cond	Light	Weather	Intersect
Cyclist Crash	02-Jun-2008	5:31 PM	Property damage only (none injured)	Head-on	V1: Travelling straight ahead	V1:Southbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Clear	117 MAIN STREET / Rte 62
Pedestrian Crash	08-Aug-2008	5:22 PM	Property damage only (none injured)	Single vehicle crash	V1: Entering traffic lane	V1:Westbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Dusk	Cloudy/Cloudy	2 MAIN STREET
Cyclist Crash	08-Jan-2009	1:28 PM	Property damage only (none injured)	Angle	V1: Travelling straight ahead	V1:Eastbound	V1: Collision with cyclist	V1: Passenger car	Wet	Daylight	Cloudy	CONCORD STREET / BROOKS STREET
Cyclist Crash	28-Nov-2009	8:45 PM	Not Reported	Single vehicle crash	V1: Entering traffic lane	V1:Not reported	V1: Collision with cyclist	V1: Not reported	Dry	Dark - lighted roadway	Clear/Unknown	51 PARKER STREET
Cyclist Crash	09-Aug-2010	6:49 PM	Property damage only (none injured)	Angle	V1: Slowing or stopped in traffic	V1:Northbound	V1: Collision with cyclist	V1: Light truck(van, mini-van, panel, pickup, sport utility)	Dry	Daylight	Cloudy	GARFIELD STREET / WALTHAM STREET
Pedestrian Crash	14-Sep-2010	4:55 PM	Non-fatal injury	Single vehicle crash	V1: Slowing or stopped in traffic	V1:Northbound	V1: Collision with pedestrian	V1: Light truck(van, mini-van, panel, pickup, sport utility)	Dry	Daylight	Clear	100 PARKER STREET
Pedestrian Crash	29-Oct-2010	4:06 PM	Property damage only (none injured)	Single vehicle crash	V1: Travelling straight ahead	V1:Westbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Daylight	Cloudy	WALNUT STREET / THOMPSON STREET

Stow

Figure 31 below illustrates crashes between vehicles and pedestrians or cyclists. From 2008-2010 there were 6 crashes, all of which resulted in non-fatal injuries to the cyclist. MAPC recommends bicycle facilities on the associated roadways for five of the six crashes, including bicycle lanes (Great Road), center line removal (West Acton Road, South Acton Road), and widened shoulders (Hudson Street). The sixth crash occurred on Cross Street, a local road.

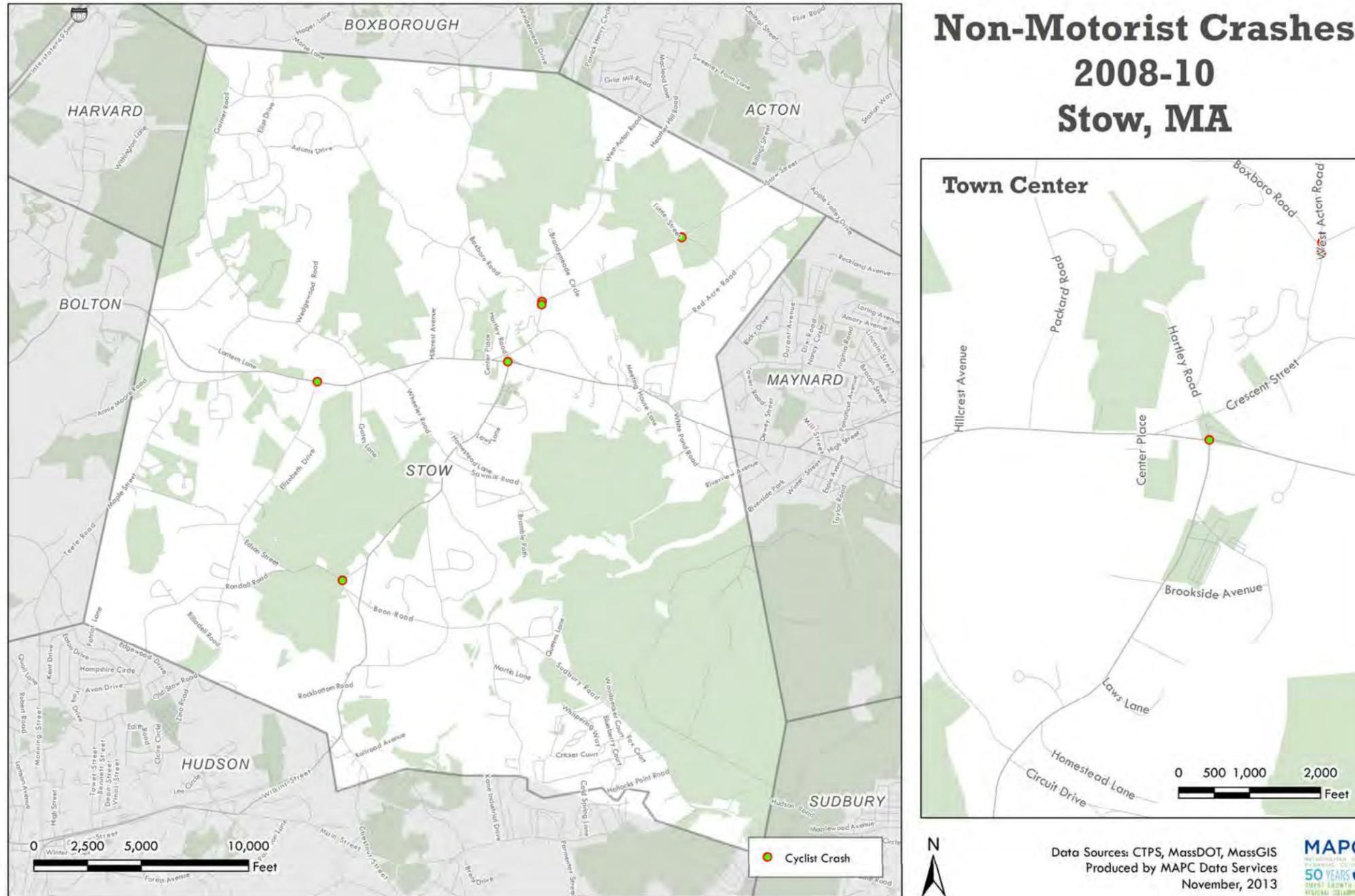


Figure 31: Stow Bicycle and Pedestrian Crashes (2008-2010)

STOW

Type	Crash_Date	Crash_Time	Crash_Sev	Collision	Veh_Action	Veh_Trav	Most_Harm	Veh_Config	Road_Cond	Light	Weather	Intersect
Cyclist Crash	01-Jun-2008	8:15 AM	Non-fatal injury	Angle	V1: Turning left	V1:Northbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Clear	WEST ACTON ROAD / SOUTH ACTON ROAD
Cyclist Crash	19-Aug-2008	7:00 PM	Non-fatal injury	Angle	V1: Turning left	V1:Westbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Clear/Cloudy	HUDSON ROAD / GREAT ROAD
Cyclist Crash	11-Oct-2008	3:16 PM	Non-fatal injury	Single vehicle crash	V1: Turning left	V1:Eastbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Clear	CROSS STREET / RANDALL ROAD
Cyclist Crash	06-Sep-2009	5:34 PM	Non-fatal injury	Head-on	V1: Travelling straight ahead	V1:Westbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Clear	GREAT ROAD / GLEASONDALE ROAD
Cyclist Crash	10-Oct-2009	2:40 PM	Non-fatal injury	Sideswipe, opposite direction	V1: Travelling straight ahead	V1:Southbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Clear	WEST ACTON ROAD / BOXBORO ROAD
Cyclist Crash	14-Aug-2010	10:50 AM	Non-fatal injury	Angle	V1: Turning left	V1:Westbound	V1: Collision with cyclist	V1: Passenger car	Dry	Daylight	Clear	SOUTH ACTON RD / TUTTLE LN

Appendix D – MassDOT Road Network Functional Classifications

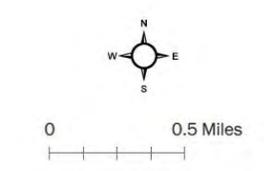


Hudson

Road Network Functional Class

- Interstate
- Principal Arterial
- Rural minor arterial or urban principal arterial
- Urban collector or rural minor collector
- Urban minor arterial or rural major collector
- Local

- Train station
- Commuter Rail / Subway
- Town hall
- Municipal boundary
- Water bodies
- Open Space



Source:
 MAPC, Town of Hudson, City of Marlborough,
 Town of Maynard, Town of Stow, MassGIS,
 MassDOT, OpenStreetMap.
 May, 2013



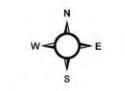


Marlborough

Road Network Functional Class

- Interstate
- Principal Arterial
- Rural minor arterial or urban principal arterial
- Urban collector or rural minor collector
- Urban minor arterial or rural major collector
- Local

- Train station
- Commuter Rail / Subway
- Town hall
- Municipal boundary
- Water bodies
- Open Space



Source:
 MAPC, Town of Hudson, City of Marlborough,
 Town of Maynard, Town of Stow, MassGIS,
 MassDOT, OpenStreetMap.

May, 2013



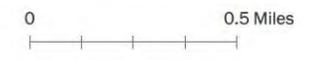


Maynard

Road Network Functional Class

-  Interstate
-  Principal Arterial
-  Rural minor arterial or urban principal arterial
-  Urban collector or rural minor collector
-  Urban minor arterial or rural major collector
-  Local

-  Train station
-  Commuter Rail / Subway
-  Town hall
-  Municipal boundary
-  Water bodies
-  Open Space



Source:
 MAPC, Town of Hudson, City of Marlborough,
 Town of Maynard, Town of Stow, MassGIS,
 MassDOT, OpenStreetMap.

May, 2013



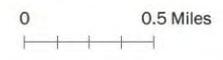


Stow

Road Network
Functional Class

- Interstate
- Principal Arterial
- Rural minor arterial or urban principal arterial
- Urban collector or rural minor collector
- Urban minor arterial or rural major collector
- Local

- Train station
- Commuter Rail / Subway
- Town hall
- Municipal boundary
- Water bodies
- Open Space



Source:
MAPC, Town of Hudson, City of Marlborough,
Town of Maynard, Town of Stow, MassGIS,
MassDOT, OpenStreetMap.

May, 2013



Appendix E – List of All Street Segments Analyzed

Table 4: Hudson Bicycle Recommendations

Street Name	From	To	Roadway						Existing Conditions*						Recommendation	Recommendation - Details																							
			Sidewalks		Travel Direction		Parking		Curb-to-Curb	Shoulder	Parking	Travel Lanes		Parking		Shoulder	Parking	Buffer or Shoulder	Bicycle Lane	Buffer	Travel Lane (s)	Travel Lane (s)	Buffer	Bicycle Lane	Buffer or Shoulder	Parking													
			Number	Two-Way	One-Way	None	Both	One Side	Width	WB/SB (Width)	WB/SB (Width)	WB/SB (Width)	EB/NB (Width)	EB/NB (Width)		EB/NB (Width)	WB/SB	WB/SB	WB/SB	WB/SB	WB/SB	EB/NB	EB/NB	EB/NB	EB/NB	EB/NB													
Apsley Street	Central Street	Lincoln Street	1	X			X				32														Leave as-is	Alternate connections - leave as is													
Apsley Street	Lincoln Street	Manning Street	1	X		X					30														Leave as-is	Alternate connections - leave as is													
Brigham Street	Berlin line	Chapin Road	1	X		X					25			12	13										One bicycle lane, one shared lane				10.5	10.5			4						
Brigham Street	Chapin Road	Park Street	1	X		X					27			14	13										One bicycle lane, one shared lane				11	11			5						
Brigham Street	Park Street	Washington Street	1	X		X					22.5			11.5	11										Leave as-is	Leave as-is.													
Broad Street	Washington Street	Water Street	2	X		X					28			14	14										One bicycle lane, one shared lane				5				11.5	11.5					
Broad Street	Water Street	Main Street	2	X		X					28			14	14										One bicycle lane, one shared lane				5				11.5	11.5					
Brook Street	Main Street	Chestnut Street	0	X		X					21														Leave as-is	Leave as-is.													
Causeway Street	Marlborough line	Marlboro Street	1	X		X					25			13	12										Widen shoulders				2.5				10	10			2.5		
Central Street	Berlin line	Packard Street	1	X		X					24			12	12										Center line removal	Center line removal													
Central Street	Packard Street	Coolidge Street	1	X		X					32			16	16										Bicycle lanes								11	11			5		
Central Street	Coolidge Street	Lincoln Street	2	X		X					32	2		14	14										Bicycle lanes								11	11			5		
Chapin Road	Berlin line	Brigham Street	2	X		X					28	2		12	12										Widen shoulders				3.5				10.5	10.5				3.5	
Chapin Road	Brigham Street	Marlborough line	0	X		X					31	1.5		13.5	14										Bicycle lanes								10.5	10.5			5		
Chestnut Street	Brook street	Stony Brook Road	0	X		X					19														Leave as-is	Leave as-is.													
Chestnut Street	Stony Brook Road	Marlborough line	0	X		X					19														Leave as-is	Leave as-is.													
Chestnut Street	Main Street	Murphy Road	0	X		X					22														Leave as-is	Leave as-is.													
Coolidge Street	Berlin Street	Highland Park Avenue	0	X		X							4												Bicycle lanes	Formalize painted shoulders to bicycle lanes													
Coolidge Street	Highland Park Avenue	Central Street	0	X		X							10												Bicycle lanes	Formalize painted shoulders to bicycle lanes													
Cox Street	Main Street	Old Stow Road	1	X		X					26			13	13										Center line removal	Center line removal													
Cox Street	Old Stow Road	Manning Street	1	X		X					35			19	16										Bicycle lanes								12.5	12.5			5		
Cox Street	Manning Street	Lincoln Street	1	X		X					34			17	17											Bicycle lanes								12	12			5	
Forest Avenue	Main Street	Marlboro Street	1	X		X					33	4		14	11											Bicycle lanes								11.5	11.5			5	
Forest Avenue	Marlboro Street	Grove Street	1	X		X					26			13	13											One bicycle lane, one shared lane								11	10			5	
Giasson Street	Broad Street	Washington Street	1	X		X					24			12	12											Shared lanes								12	12				
Grove Street	Vila do Porto Blvd	Water Street	Varies	X		X					25.5			12.75	12.75											One bicycle lane, one shared lane								11	10.5			4	
Houghton Street	Washington Street	Main Street	1	X		X					22.5														Leave as-is	Leave as-is.													
Hudson Street	Washington Street	Marlborough line	0	X																					Leave as-is	Leave as-is.													
Lincoln Street	Bolton line	Third Street	2	X		X					30	3		12	12										Bicycle lanes								11	11			4		
Lincoln Street	Third Street	Cox Street	2	X		X					28	1		12	12											Shared lanes								14	14				
Lincoln Street	Cox Street	Apsley Street	2	X		X					26.5	1		12	11											Shared lanes								13.25	13.25				
Lincoln Street	Apsley Street	Central Street	2	X		X					26	1		12	12											Shared lanes								13	13				
Main Street	Stow line	Parmenter Street	0	X		X					33	4.5		12.5	12.5											Bicycle lanes								11.5	11.5			5	
Main Street	Parmenter Street	Brook Street	0	X		X					32.5	5		12	12											Bicycle lanes								11.25	11.25			5	
Main Street	Brook street	Chestnut Street	0	X		X					30.5	Varies		12	12											Bicycle lanes								10.75	10.75			4.5	
Main Street	Chestnut Street	Forest Ave	0	X		X					30.5	2		12	12											Bicycle lanes								10.75	10.75			4.5	
Main Street	Forest Avenue	Grove Street	2	X																						Has adjacent off-road bicycle facilities	Leave as-is.												
Main Street	Grove Street	Manning Street	2	X			X				36		8	10	10		8									Shared lanes								11	11				7
Main Street	Manning Street	Washington Street	2	X			X				36		8	10	10		8									Shared lanes								11	11				7
Manning Street	Bolton line	Cox Street	2	X		X					29			14.5	14.5											One bicycle lane, one shared lane								12	12			5	
Manning Street	Cox Street	Apsley Street	1	X		X					23			12	11											Shared lanes								11.5	11.5				
Manning Street	Apsley Street	Main Street	2	X		X					27			12	15											One bicycle lane, one shared lane								11	11			5	
Marlboro Street	Marlborough line	Causeway Street	1	X		X					32			18	14											Bicycle lanes								11	11			5	
Marlboro Street	Causeway Street	Forest Ave	1	X		X					28	2		12	12											One bicycle lane, one shared lane								12	11			5	
Murphy Road	Chestnut Street	Marlborough line	0	X		X					21															Leave as-is	Leave as-is.												
Old Stow Road	Stow line	Cox Street	0	X		X					26			13	13											Widen shoulders								10.5	10.5			2.5	
Packard Street	Lincoln Street	Central Street	2	X		X					35			17	18											Bicycle lanes								12.5	12.5			5	
Park Street	Brigham Street	Washington Street	2	X		X					27	1		12	12											Shared lanes								13.5	13.5				
Parmenter Street	Marlborough line	Main Street	0	X		X					16.5															Leave as-is	Leave as-is.												
Reed Road	Technology Drive	Marlboro Street	1	X		X					31	4.5		11	11											Formalize shoulders into bicycle lanes								11	11			4.5	
River Road	Berlin line	Berlin line	0	X		X					28	1		13	13											Widen shoulders								11	11			3	
River Street	Central Street	Berlin line	2	X		X					26			13	13											Leave as-is								10.5	10.5			2.5	
Stony Brook Road	Chestnut Street	Marlborough line	0	X		X					16															Leave as-is	Leave as-is.												
Technology Drive	Washington Street																																						

Table 6: Marlborough Bicycle Recommendations

Street Name	From	To	Roadway						Existing Conditions*						Recommendation	Recommendation - Details																								
			Sidewalks		Travel Direction		Parking		Curb-to-Curb	Shoulder	Parking	Travel Lanes		Parking		Shoulder	Parking	Buffer or Shoulder	Bicycle Lane	Buffer	Travel Lane (s)	Travel Lane (s)	Buffer	Bicycle Lane	Buffer or Shoulder	Parking														
			Number	Two-Way	One-Way	None	Both	One Side	Width	WB/SB (Width)	WB/SB (Width)	WB/SB (Width)	EB/NB (Width)	EB/NB (Width)		EB/NB (Width)	WB/SB	WB/SB	WB/SB	WB/SB	WB/SB	EB/NB	EB/NB	EB/NB	EB/NB	EB/NB														
Ames Street	Route 20	Forest Street	0	X		X			28			14	14												As part of a private development proposal, City wishes to widen roadway to include sidewalks and bicycle lanes			5			12	12			5					
Ash Street	Hudson Street	Pleasant Street	1	X		X			22																Leave as-is															
Bartlett Street	Northborough line	Forest Street	1	X		X			36	3.5		14.5	14.5			3.5									Bicycle lanes			5.5			12.5	12.5			5.5					
Beach Street	West Main Street	Clover Hill Street	0			SB			22			9	13												Bicycle lane						10									
Beach Street	Clover Hill Street	South Street	0			SB			22			9	13												Bicycle lane	7		5			10									
Berlin Road	Pleasant Street	Robin Hill Street	0	X		X			22			11	11												Leave as-is															
Bigelow Street	Donald Lynch Boulevard	Shea Drive	0	X		X			26			13	13												Leave as-is															
Bigelow Street	Shea Drive	Elm Street	0	X		X			24			12	12												Leave as-is															
Bolton Street	Granger Boulevard	Main Street	2	X		X			52			26	26												Shared lanes						26	26								
Bolton Street	Main Street	Lincoln Street	2	X		X			39	1		19	18			1									Buffered bicycle lanes			5		2.5	12	12		2.5		5				
Bolton Street	Lincoln Street	Union Street	2	X		X			38	2.5		17.5	15.5			2.5									Bicycle lanes			6			13	13				6				
Bolton Street	Union Street	Hudson Street	1	X		X			38			19	19												Bicycle lanes			6			13	13				6				
Bolton Street	Hudson Street	Hudson line	2	X		X			35			20	15												Bicycle lanes			5			12.5	12.5				5				
Boston Post Road East	Sudbury line	Hager Street	0	X		X			36	6		12	12			6									Formalize shoulders to bicycle lanes			6			12	12				6				
Boston Post Road East	Hager Street	Farm Road	2	X		X			60			Varies	Varies												Bicycle lanes			4			21	31				4				
Boston Post Road East	Farm Road	Phelps Street	1	X		X			40	8		12	12			8									Buffered bicycle lanes			5		3	12	12		3		5				
Boston Post Road East	Phelps Street	Cook Lane	1	X		X			32	3		13	13			3									Bicycle lanes			5			11	11				5				
Boston Post Road East	Cook Lane	Stevens Street	2	X		X			52			26	26												Bicycle lanes			5			21	21				5				
Boston Post Road West	Northboro Road Central	Felton Street	1	X		X																			Leave as-is															
Boston Post Road West	Northborough line	Northborough Road Central	1	X		X			62	7		24	24			7									Formalize shoulders to bicycle lanes		2	5			24	24			5	2				
Boundary Street	Elm Street	Robin Hill Street	0	X		X			22			11	11												City-owned land; City wishes to widen roadway to add bicycle lanes and sidewalks			5			11	11			5					
Brigham Street	Clover Hill Street	Fisher Road	0	X		X			22																Leave as-is															
Brigham Street	Fisher Road	Maple Street	0	X		X			21																Leave as-is															
Broad Street	Elm Street	Lincoln Street	2	X		X			26			13	13												Leave as-is															
Broad Street	Lincoln Street	West Main Street	2	X			X		35			17.5	17.5												Leave as-is															
Broadmeadow Road	Farm Road	Parmenter Street	1	X		X			30	1		14	14			1									Bicycle lanes			4.5			10.5	10.5			4.5					
Cedar Hill Street	Simarano Drive	Northborough line	0	X		X			29			15	14												Leave as-is															
Church Street	Hildreth Street	Boston Post Road East	2	X		X			26			12	14												Leave as-is															
Church Street	Hildreth Street	Edinboro Street	2	X					26																Leave as-is															
Clover Hill Street	Williams Street	Brigham Street	1	X		X			24			12	12												Leave as-is															
Clover Hill Street	Beach Street	Brigham Street	0	X		X			24.5			13	11.5												Leave as-is															
Concord Road	Goodale Street	Stow Road	0	X		X			25	2		12	11			2									Leave as-is															
Concord Road	Stow Road	Boston Post Road East	0	X		X			25			12.5	12.5												Leave as-is															
Concord Road	Sudbury Street	Goodale Street	0	X		X			24	1		11	11			1									Leave as-is															
Concord Road / Hemenway	Sudbury Street	Hudson line	0	X		X			24	1		11	11			1									Leave as-is															
Cook Lane	Farm Road	Hildreth Street	1	X		X			27			14	13												Leave as-is															
Cook Lane	Hildreth Street	Boston Post Road East	1	X		X			26			13	13												Leave as-is															
Curtis Avenue	Boston Post Road East	Hildreth Street	2	X		X			26	1		12	12			1									Leave as-is															
Donald Lynch Boulevard	North Bigelow Street	Hudson line	0	X		X			48			24	24												Bicycle lanes			4			20	20			4					
East Dudley Street	Elm Street	Northboro Road East	1	X		X			23																Leave as-is															
East Main Street	Main Street	Concord Road	2	X		X			28	1		12	12			1									Shared lanes						14	14								
Edinboro Street	Church Street	Maple Street	1	X			X		24																Leave as-is															
Elm Street	Boundary Street	Millham Street	0	X		X			24			10	14												Center line removal															
Elm Street	Millham Street	Bigelow Street	1	X		X			24			12	12												Center line removal															
Elm Street	Bigelow Street	Felton Street	1	X		X			26			13	13												Shared lanes						13	13								
Elm Street	Felton Street	Broad Street	1	X		X			24			11	13												Shared lanes						12	12								
Elm Street	Broad Street	Pleasant Street	2	X		X			31			15	16												Shared lanes						15.5	15.5								
Elm Street	Pleasant Street	Mechanic Street	2	X		X			29			14	15												Shared lanes						14.5	14.5								
Farm Road	Framingham Road	Cook Lane	1	X		X			28	3		11	11			3								Leave as-is																
Farm Road	Cook Lane	Phelps Street	1	X		X			30	3	</																													

