MAPC 50 YEARS
METROPOLITAN AREA PLANNING COUNCIL
SMART GROWTH AND REGIONAL COLLABORATION

Town of Reading
Bicycle Network and Pedestrian Priority Plan

July 2014

Acknowledgments

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Cover photo: Bicycles parked at the Reading commuter rail station

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Executive Summary

The Metropolitan Area Planning Council (MAPC), a regional planning agency serving the 101 cities and towns of Metro Boston, collaborated with the Town of Reading to complete a bicycle network and pedestrian prioritization plan. MAPC conducted fieldwork, analysis, and extensive local outreach in order to create a short-term and low cost plan aimed to improve bicycle and pedestrian accommodations within the Town and also connecting to adjacent communities. This study is meant to prioritize safety, health, and the environment – and complements recent bicycle and pedestrian improvements within the Town, including the new bicycle lane on Haverhill Street and the many streetscape improvements in Downtown Reading.

Study area observations were completed during the Fall of 2013, and focused primarily on major roadways within the Town, as well as some local and residential roads identified by the Town and local residents. MAPC focused on improving bicycle and pedestrian access to schools, trails, retail and employment centers, transit, and parks.

MAPC's study revealed:

- There is significant opportunity to install bicycle lanes within the Town without making any changes to roadway curb locations, travel lanes, and/or parking. When roadways are repaved as part of normal roadway maintenance, new lane striping can allow for bicycle accommodations. This study identifies 8.4 miles of roadway for short-term bicycle lane installation.
- A number of opportunities exist for "shared lanes" and/or signage on roadways that are currently not wide enough to accommodate bicycle lanes.
- There are numerous opportunities throughout the Town to focus on improving the safety and comfort of pedestrians, especially around schools and accessing the commuter rail station. Potential improvements include new crosswalks, curb ramps, curb extensions, and other potential improvements.
- A number of locations were identified for sidewalk installation. Sidewalk priority areas were identified on Grove Street, Hopkins Street, and Salem Street.

In this report, MAPC has outlined several recommendations that can improve bicycle and pedestrian access in the Town of Reading in the short-term, and has also identified several longer-term goals. MAPC encourages the Town to prioritize these improvements, and allocate funding for implementation, as well as local education about bicycle lanes, sharing the road, and pedestrian safety. These improvements will help the residents, employees and patrons who frequent this area.

Introduction

The Metropolitan Area Planning Council (MAPC) is assisting the Town of Reading in advancing pedestrian and bicycle plans, focusing on short-term and low-cost solutions. The Town has already taken several proactive steps to prioritize bicycle and pedestrian access, including approximately 2 miles of new bicycle lanes on Haverhill Street, reconstructing the Downtown to make it a more pedestrian-friendly environment, and advancing a Complete Streets policy. This Bicycle Network and Pedestrian Priority Plan will supplement these efforts and help create connectivity for non-vehicular travel throughout the Town. The primary goals of this effort are to 1) develop a bicycle and pedestrian network plan consisting of town-wide 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 pedestrian facilities and bicycle accommodations during upcoming roadway repaving efforts.

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

This report is organized into two sections. First, it provides an overview of pedestrian facilities followed by a detailed discussion of pedestrian recommendations at high priority sites. Second, it provides an overview of bicycle facilities followed by a detailed discussion of the bicycle recommendations.

These recommendations create a network of bicycle and pedestrian facilities based upon existing roadway configurations with no changes to curb location, existing on-street parking requirements, 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 crosswalk or 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 the Town to examine whether rights of way are wide enough to incorporate bicycle and/or pedestrian facilities when completely redesigning and reconstructing roads and encourage the Town to examine whether there are opportunities to reduce the number of travel lanes or remove on-street parking in order to provide bicycle facilities.

An example of a roadway reallocation is shown in **Figure 1** and **Figure 2**. The first diagram depicts the existing conditions of West Street in Reading. The second diagram depicts MAPC's proposed reallocation of the roadway space. Without any changes in the curb-to-curb width, this segment is able to accommodate bicycle lanes in each direction by slightly narrowing the vehicular travel lanes. The travel lanes, which are proposed as 10.5' and 11.0' are well within the guidance provided by the MassDOT Project Development and Design Guide. According to this guidance, travel lanes on non-local roads should be between 10' and 12'.

[1] Major roads were identified by examining the MassDOT functional roadway classification for the Town of Reading (See Appendix C). In general, local roads were excluded from the analysis unless the Town identified them as an important connection.

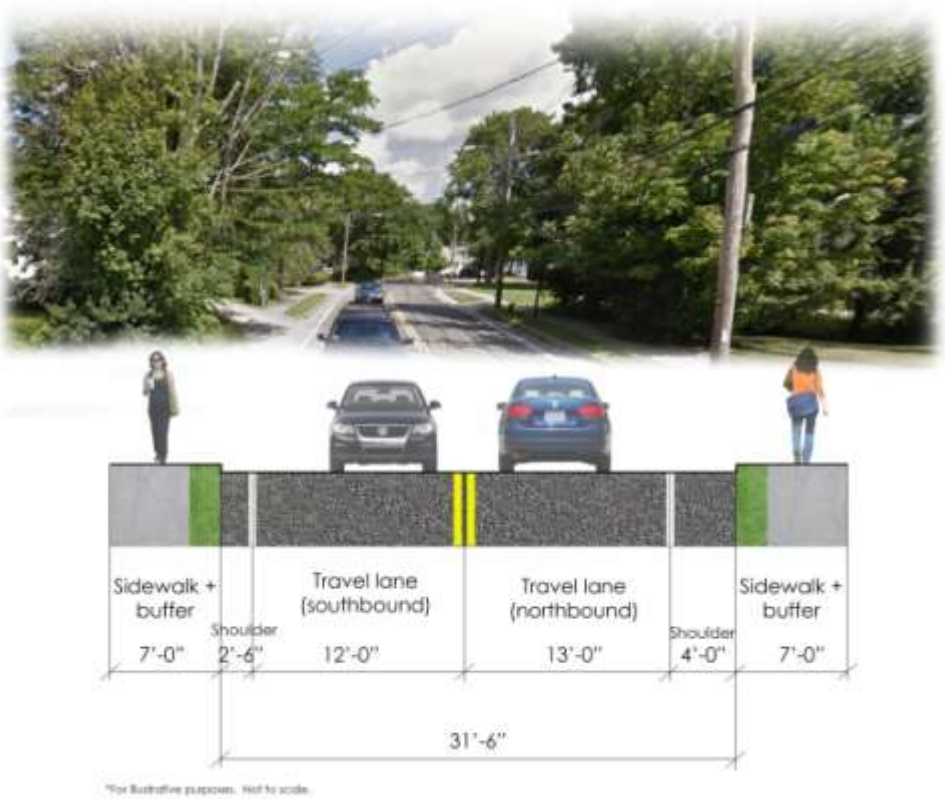


Figure 1: Example of existing conditions - West Street (between Oak St. and Woburn City line)

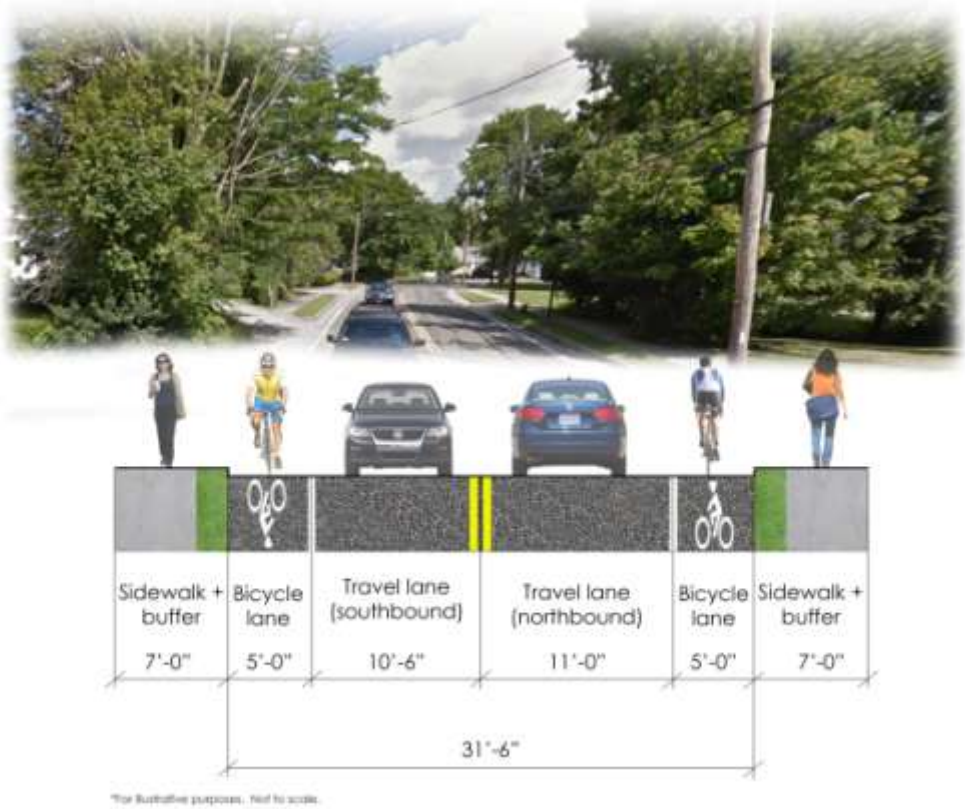


Figure 2: Example of proposed conditions - West Street (between Oak St. and Woburn City line)

MAPC considered the following for potential bicycle accommodations: exclusive bicycle lanes, cycle tracks or buffered bicycle lanes, shared lane markings, and shared use paths. As compared with bicycle lanes and shared lane markings, cycle tracks and buffered bicycle lanes require greater roadway width to accommodate these facilities. Although MAPC considered opportunities to include these facilities, under existing roadway widths there were no opportunities within the Town. The Town may wish to consider incorporating these facilities in the future for any roadway reconstruction projects.

Pedestrian recommendations focus on local priority areas and include crossing improvements, sidewalk improvements, and new sidewalk locations. At the conclusion of the planning effort, it will be the responsibility of the Town 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.

Note on Recommendations

MAPC developed the following recommendations for pedestrian and bicycle accommodations based on current best practices and local conditions.[2] MAPC has met with staff members from the Town of Reading to discuss and finalize the recommendations. The Town should implement these recommendations based on local priorities, funding and public support. In addition, proper education for all users of the roadway should be prioritized along with any changes in infrastructure.

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 Reading and compared with regional and state 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.

Table 1: Travel to Work Mode Share

Municipality	*Population*	*Employees*	*Walk (%)*	*Bicycle (%)*	*Drive (%)*	*Transit (%)*	*Other (%)*
Reading	24,747	12,654	1.6	0.4	86.5	6.8	4.3
MAPC	3,066,394	1,820,350	6.6	1.1	66.7	16.7	8.8
Massachusetts	6,587,536	3,304,919	4.8	0.7	75.6	9.4	9.5

Source: 2010 American Community Survey, 2010 Census.
Percentages may not equal 100% due to rounding.

The Reading commuter rail station is the most highly utilized on the Haverhill line, with approximately 927 daily weekday boardings[3]. Although the Reading commuter rail station is very popular, given the current mode shares for Reading residents there is still room for significant increases in non-auto mode shares including transit, walking, and biking. As shown in **Table 1**, the percentage of commuters traveling by private vehicles in Reading is significantly higher than the MAPC region and state average with approximately 87% of all residents driving to work. In addition, the bicycle and walking mode share for the Town is lower than the averages for both the MAPC region and the Commonwealth. Because residents have access to a commuter rail stop, bus line, as well as many neighborhood walking routes, there is potentially a significant opportunity to increase the

[2] Note that MAPC did not undertake detailed intersection design as a part of this plan; rather, 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 evaluated by the municipalities to ensure that the roadway is able to incorporate the recommendations.
[3] MBTA *Ridership and Service Statistics*. Thirteenth Edition 2010.

percentages of these non-vehicular modes of travel. Prioritizing and funding the installation of additional bicycle and pedestrian facilities may increase the non-vehicular mode share, improve air quality in the town and increase physical activity of residents.

Complete Streets Policy

Complete streets refer to roadways that are safe, comfortable, and accessible for all users – including pedestrians, bicyclists, motorists, and bus riders – of the roadway of all ages and abilities. In conjunction with this bicycle and pedestrian plan project, the Town of Reading has decided to pursue adoption of a complete streets policy through its Board of Selectmen. The policy is not a design prescription for required facilities on specific roadways; rather, it directs the Town to consider and look for opportunities to incorporate the needs of all users during both routine maintenance and roadway reconstruction projects. This bicycle and pedestrian plan report is intended to provide specific recommendations to assist with planning and implementation of the complete streets policy. Working with Reading's Parking-Traffic-Transportation Task Force, MAPC has drafted a complete streets policy tailored to meet the Town's goals, such as improving the health of its residents through increased physical activity. MAPC presented the draft policy to the Community Planning and Development Commission on January 27, 2013. The Commission unanimously voted to support adoption of the policy by the Board of Selectmen. A vote by the Board of Selectmen is tentatively scheduled to take place in June 2014.

Town of Reading Bicycle-Pedestrian Accomplishments

This bicycle network and pedestrian priority plan is the latest among a number of initiatives the Town has engaged in to promote alternative forms of transportation and improve the health and safety of the community. These multiple initiatives and programs work together and the Town has recently seen record numbers of both bicycling and walking throughout the community.

Related projects and initiatives include:

- **Healthy Communities initiative** – this program aims to encourage walking and includes a public education component of the benefits of everyday physical activity
- **Main St. Improvement Project** – From 2008-2009, the Town's downtown was reconstructed with wide sidewalks, brick pavings, pedestrian-scaled street lighting, updated crossing signals, new crosswalks, and curb extensions
- **Parking, Transportation, Traffic, Task Force –** This group, comprised of Planning, Department of Public Works, Town Engineering, Police Safety Officers, and Town Administrator meets monthly to discuss pedestrian and bicycle planning efforts, new opportunities, and issues
- **Update of zoning by-law –** the Town is in the process of updating its zoning by-laws. The updated by-laws will reflect current zoning best practices for creating a sustainable community with a high quality of life.
- **South Main Street Design Best Practices –** The Community Planning and Development Commission has developed a set of Design Best Practices as a way to communicate to property owners and developers the community's preferences related to development attributes in this corridor, which aim to improve the quality of site design and improve the pedestrian environment.
- **Main St. Road Diet –** the Town worked with the Boston Metropolitan Area Planning Organization to study the feasibility of reducing the number of travel lanes on a segment of Main Street from four to three, thus allowing for space for bicycle lanes.
- **Main St. Corridor Study** – the Town collaborated with MAPC, Wakefield, and Melrose to develop a transportation plan that focuses on achieving sustainable development and land use objectives.

- **North Suburban Planning Council Priority Mapping Project** – The NSPC Priority Mapping Project was a 1.5 year-long effort to identify and map local and regional priorities for development, preservation, and infrastructure investments within the subregion. Reading was one of eight municipalities that participated in this project.
- **Sidewalk along Vine Street** – The Town constructed a sidewalk from Mineral Street to High Street. This is a street heavily used by commuters and the sidewalk has increased the safety of both commuters and school children.
- **Haverhill St. bike lane** – the Town's first bicycle lane was constructed, comprising approximately two miles of roadway.
- **Complete streets policy** – the Town is working with MAPC to develop a framework complete streets policy to consider and look for opportunities to incorporate the needs of all users during both routine maintenance and roadway reconstruction projects.

Pedestrian Recommendations

Working with Town staff, MAPC identified several high priority areas for pedestrian improvements. The high priority areas include schools, the commuter rail station, and dense retail districts. These recommendations include crosswalk striping, curb extension locations, sidewalk improvements, and new sidewalks.

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 may help reduce the number of vehicular trips in Reading.

Town of Reading Neighborhood Walking Routes

Walkable Reading and the Town have completed a "neighborhood walks" map that contains several loops throughout the Town, which provide routes to various points of interest, including off-road trails, parks, conservation areas, sports fields, and playgrounds. See **Figure 3** for a map of these routes. Although it has not yet been formalized, the Town may consider prioritization of sidewalk projects based upon these key routes. In addition, during the development of the Priority Mapping Project the Board of Selectmen discussed the importance of creating a neighborhood link to Lake Q. This would enhance pedestrian and bicycle access to this regional destination. The Town is examining whether easements could provide a link to this popular area.

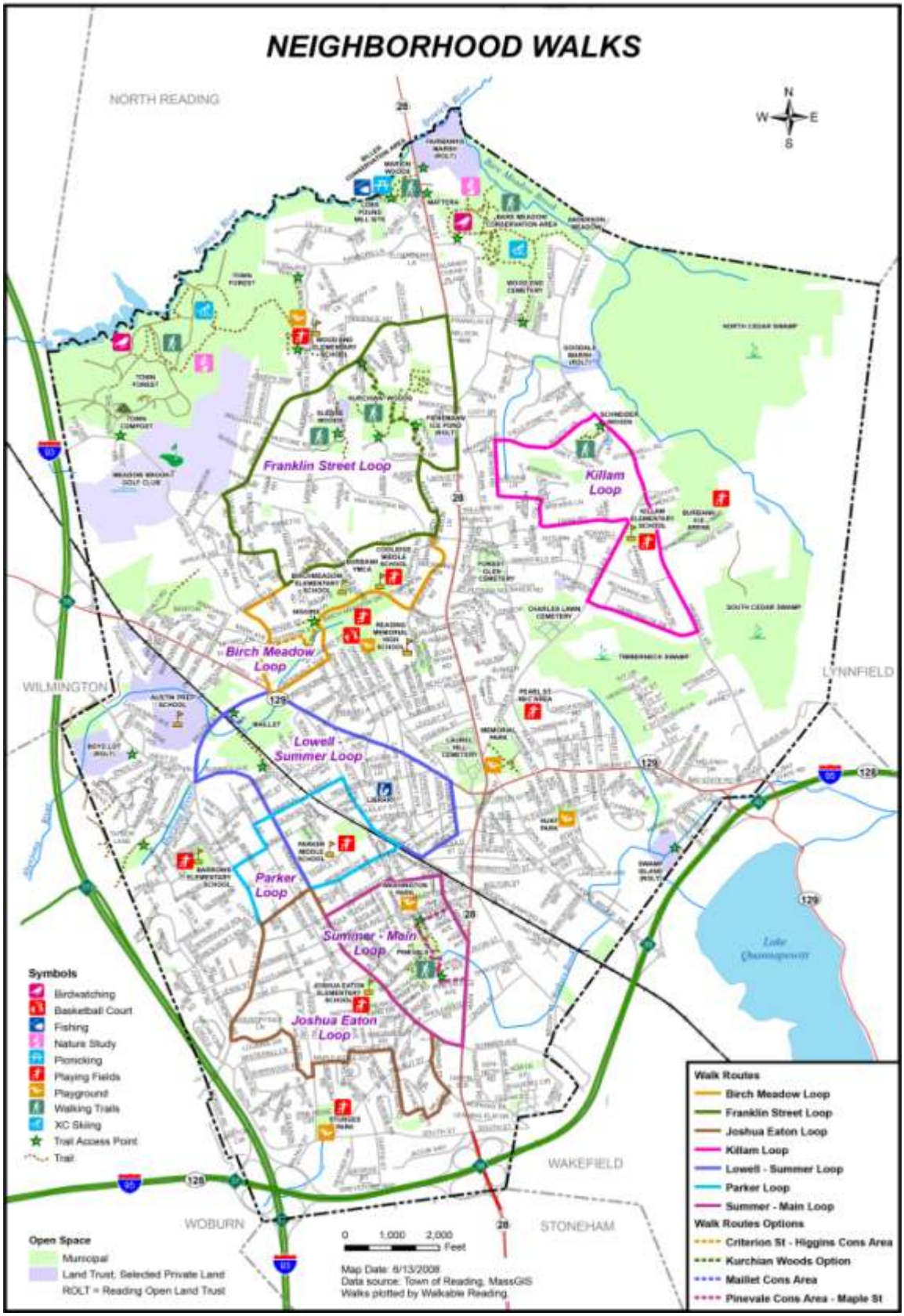


Figure 3: Town of Reading Neighborhood Walking Routes Map

Overview of Pedestrian Facilities

A number of resources are available that provide detailed information on pedestrian facilities, including *The Boston Region's Pedestrian Transportation Plan*.[4] The following are brief descriptions of the facilities considered for Reading's high priority locations. See **Appendix A** for a list of additional resources for pedestrian and bicycle facility guidelines.

Sidewalks

Sidewalk availability and accessibility is an important part of transportation infrastructure in every city and town. Increased levels of activity (including walking and cycling) 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. Generally, 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.

Crosswalks

Crosswalks greatly contribute towards pedestrian safety. Crosswalks should be provided at intersections or mid-block locations where pedestrians cross the roadway, should be placed at regular intervals and at convenient locations, and be visible to both the motorist and the pedestrian. ADA-compliant wheelchair ramps should be provided at all crosswalks.

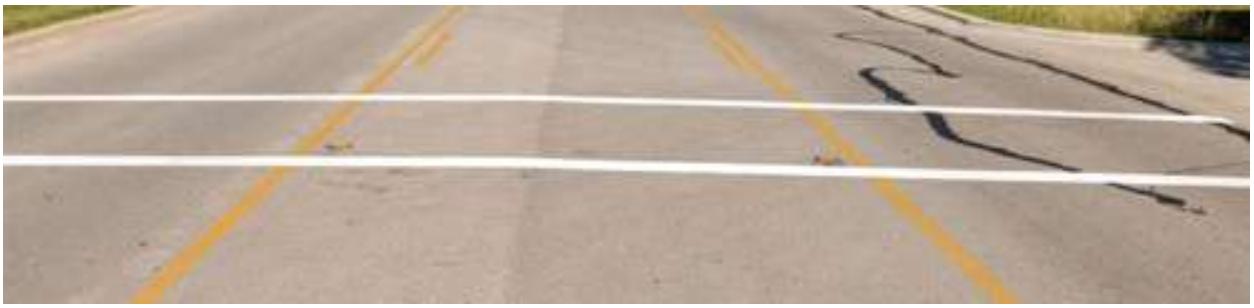
MAPC recommends utilizing the continental or ladder style crosswalks as opposed to the transverse marking style (also known as the "standard" style), because they are more visible to motorists. Crosswalks should ideally consist of non-skid, thermoplastic, retro-reflective material. Although this material is initially more costly than paint, it is longer lasting and requires less maintenance; therefore, it is more cost effective in the longer run.

As with sidewalks, crosswalks should be a smooth surface and accessible for wheelchairs and walkers of all ages and abilities. Brick crosswalks, therefore, should generally be avoided. The Town may wish, however, to utilize enhanced crosswalk designs that do not impede users' ability to cross. These designs include different colored pavements and/or bands of decorative paving (e.g., bricks) or decorative stamps along the outside edges of the crosswalk (i.e., not within the pedestrian path of travel).

[4] Adopted and released by MAPC in June, 2010. www.mapc.org/resources/ped-plan

Ladder crosswalk

Continental sidewalk (High Street, Reading)



Transverse (Standard) crosswalk

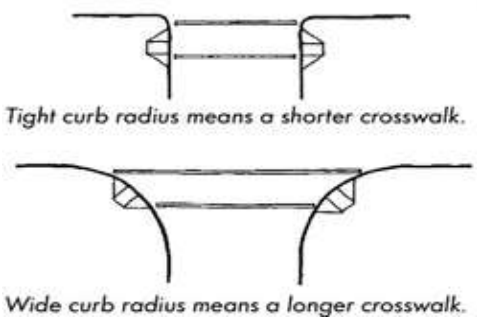
Additional Pedestrian Facilities Considered

ADA compliance – Americans with Disabilities Act Standards for Accessible Design applies to all projects involving new or altered pedestrian facilities. While these improvements for people with disabilities are mandated, street designs that accommodate people with disabilities, e.g., tactile curb ramps, create a better walking environment for all pedestrians.

Advanced yield lines – These markings encourage drivers to stop further back from crosswalks and, therefore, improve their visibility of pedestrians in the roadway.

Curb extensions – Extending the sidewalk at crossings decreases the crossing distance for pedestrians and increases their visibility. Emergency access is often improved because intersections are kept clear of parked cars. Curb extensions should only be utilized where on-street parking is present (i.e., they should not be used to reduce a travel lane or a bicycle lane to an unsafe width).

Crossing (refuge) islands –Raised islands within the roadway have many benefits, such as allowing pedestrians to cross fewer lanes of traffic at a time, providing a refuge so that slower pedestrians can wait for a break in the traffic stream, allowing pedestrians to focus on traffic from only one direction at a time, and reducing the total distance over which pedestrians are exposed to potential conflicts with motor vehicles.



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 because it allows for more sidewalk space, 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.

In-street Stop for Pedestrian Signs – These signs are placed in the center of the roadway at crosswalk locations to increase the visibility of pedestrians and remind motorists to yield to them.

Lighting - According to the Federal Highway Administration, effective street lighting can decrease pedestrian crashes by approximately 50 percent. Street lighting, necessary for all modes of transportation, provides visibility and safety during non-daylight hours. The height of street lights and spacing between street lights needs to both clearly illuminate pedestrians and the roadway.

Pedestrian Signals - Signal indications inform pedestrians when it is safe to cross the roadway. The timing of walk indications are determined by the crosswalk length and should be timed to allow for pedestrians to safely cross roadways. Traffic signal timings should be updated with the 2009 Manual on Uniform Traffic Control Devices (MUTCD) walking rate of 3.5 feet per second. Pedestrian countdown timers, indicating the amount of time remaining for pedestrian crossings, should be installed where appropriate.

Raised Crosswalk – A raised crosswalk provides pedestrians with an elevated roadway crossing, making the pedestrian more visible than in a standard crosswalk. The raised crosswalk also works as a traffic calming device, as the elevation change requires the driver to drive more slowly.

Town of Reading High Priority Area Pedestrian Recommendations

The following provide observations and recommendations for Reading's high priority areas.

Commuter Rail Station

The commuter rail station is centrally located in the Town's 40R Smart Growth District and within easy walking distance of Reading's downtown and numerous residential neighborhoods. The area is a hub of activity, including high numbers of walkers, bikers, and bus and commuter rail riders. In general, sidewalks are present and well-maintained throughout the vicinity. The following photos and associated text highlight specific issues noted.

At several intersections there were no crosswalks, including:

- Washington St and High St (pictured)
- Vine and High Street, including to Commuter Rail Station
- Minot St and Washington Street
- Green Street and High Street
- Lincoln Street and Woburn Street

In some instances (e.g., Washington and High Street) the crossing distance is very wide, which can both encourage high speeds, as well as require pedestrians to walk in the roadway for longer than necessary.

Crosswalk style was inconsistent and often utilized the less visible standard crosswalk style. MAPC recommends striping continental or ladder style crosswalks.

Location: High Street

Crossing distances between Reading's Downtown and the commuter rail station are very long and may pose a safety issue for pedestrians. Reading may wish to consider crossing islands or narrowing the roadway lane widths to improve pedestrian safety.

Location: High Street

One ramp to the station platform along High Street is not aligned to a crosswalk, and thus pedestrians must jaywalk or walk along the roadway to reach a crosswalk.

Location: High Street

The bus stop on Lincoln Street lacks amenities, such as a shelter to protect from inclement weather and wind. The Town should work with the MBTA on ways to incorporate this important amenity. For example, the Town could examine whether the row of parking in the lot adjacent to the sidewalk could be shifted slightly in order to widen the sidewalk and, hence, create space for a shelter. Alternatively, one or two on-street parking spaces on Lincoln Street adjacent to the bus stop could be removed in order to construct a curb extension. The shelter could be located within this space.

Location: Lincoln Street

At the intersection of High Street and Woburn Street, the crosswalks did not connect to ramps. MAPC recommends installing ADA accessible curb ramps at all crosswalks.

Location: High Street

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 may help reduce the number of vehicular trips in Reading. 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. In general, these roadway improvements result in a higher compliance rate (i.e., lower speeds), increased pedestrian safety, and have a longer lifespan than paint or signage improvements.

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 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. Reading is a Safe Routes to School partner district so therefore has access to these resources. If the Town is interested in better understanding how students and families travel to school it should consider conducting the survey. For information on beginning this process or for additional information, please visit http://masaferoutessurvey.org.

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.

Arthur B Lord Drive / Birch Meadow Drive Area

Along Arthur B Lord Drive and Birch Meadow Drive there are a number of pedestrian destinations, including an elementary school, middle school, high school, YMCA, and sports fields. Because of this concentration of students, this area is especially important to ensure safe and adequate facilities for pedestrians and bicyclists. Many of the crosswalks in this area were faded and in poor condition, and should be repainted to ensure pedestrian visibility.

The presence of an in-street "yield to pedestrian" sign assists with alerting motorists to pedestrians. However, the a-typical crosswalk treatment may confuse drivers. For consistency and to avoid confusion, MAPC recommends striping a continental or ladder style crosswalk when the existing crosswalk needs to be replaced.

Location: Birch Meadow Drive

Continental or ladder style crosswalks are more highly visible than the transverse style (shown to the left), and are recommended especially near schools and popular pedestrian destinations.

In addition, the Town should examine whether curb radii can be reduced at the intersection of Arthur B Lord Drive and Birch Meadow Drive and at the entrance to the high school. Reducing curb radii can slow turning vehicles and thus improve pedestrian safety.

Location: Birch Meadow Drive

Parts of the northbound side of Arthur B Lord Drive lack a sidewalk. If the necessary right-of-way exists, MAPC recommends installing a sidewalk to ensure a continuous route for pedestrians.

Location: Arthur B Lord Drive

Joshua Eaton School

The Joshua Eaton School is an elementary school located at 365 Summer Avenue. The area has sidewalks in varying conditions, as well as crosswalks at all intersections. The following are several opportunities for improvements.

The crosswalks along Summer Avenue and Oak Street are in the standard transverse style. In some cases they can be difficult for motorists to see, which can pose a safety threat for pedestrians. In this area, MAPC recommends striping continental or ladder style crosswalks.

Location: Summer Avenue

The accompanying photo is another example of a transverse style crosswalk that may be difficult for vehicles to see. Continental or ladder style crosswalks are strongly recommended.

Location: Oak Street

Parts of the sidewalk along Oak Street are in poor condition with cracked and uneven surfaces. MAPC recommends installing concrete sidewalks, which are a more durable material than asphalt.

Location: Oak Street

A. M. Barrows School

A. M. Barrows School is an elementary school located at 16 Edgemont Avenue, off of West Street. There are several opportunities, near term and longer term to improve the safety of pedestrians in this area, listed below.

Crosswalks are present in the area, but are in the transverse style. Continental or ladder style crosswalks can be more visible to motorists, which can improve pedestrian safety.

Location: Edgemont Avenue

The crosswalk in front of the entrance to the school is full of parked cars, resulting in poor sight lines for motorists trying to observe pedestrians crossing the road. The location of the crosswalk and the black car in the accompanying photo could be switched so that the crosswalk is not between two parked vehicles (behind the black car is a driveway). Alternatively, a curb extension would dramatically increase visibility and reduce the crossing distance of pedestrians.

Location: Edgemont Avenue

A curb cut with ADA compliant ramps should be present at all crosswalks.

Location: Edgemont Avenue

Due to parked cars it can be difficult to see pedestrians crossing Edgemont Avenue at West Street. Continental or ladder style crosswalks and curb extensions can improve visibility and reduce crossing distances.

Location: Edgemont Avenue

Other Schools

In addition to the locations above, MAPC observed the conditions at the other schools located in the Town. In these cases there were fewer opportunities for improvement. A summary of observations and recommendations is **Table 2** below.

Table 2: Pedestrian Recommendations, Additional Schools

Location	Positive elements	Recommendations for improvement
Austin Preparatory School 101 Willow Street	• Secluded campus setting	• Stripe crosswalk at Willow Street entrance • Consider whether entrance requires two lanes in each direction • Consider reducing curb radii to slow turning vehicles
Killam School 333 Charles Street	• Flashing sign	• Consider curb extensions along Charles Street
Walter Parker Middle School 45 Temple Street	• Located off quiet, low-speed street	• Sidewalk buffer is in poor condition and at a steep grade • Restripe crosswalks along Summer Ave in continental or ladder style
Wood End Elementary School 85 Sunset Rock Lane	• Located off quiet, low-speed street	• Restripe crosswalks at Franklin Street in continental or ladder style

Walkers Brook Drive

Walkers Brook Drive is a busy commercial district with "big box" chain retailers, grocery stores, and offices. The area is primarily auto-centric with multiple vehicular lanes in each direction; however, there is also a highly utilized bus stop for the Route 137 which travels from Reading to Malden. In addition, the route provides direct access to Lake Quinnapowitt in Wakefield. Both pedestrians and bicyclists travel along this roadway to the Lake. Improving this corridor to limit the width of crossings through a lane diet and lowering vehicular speeds would add to the comfort of non-auto users.

The intersection design at New Crossing Road is an issue for local residents and pedestrians. The intersection currently lacks a crosswalk on the western leg of the intersection and thus requires pedestrians traveling from the grocery store and nearby residential neighborhood to cross three legs of the intersection in order to access the sidewalk located on New Crossing Road. MAPC recommends either striping a fourth crosswalk on the western leg of the intersection across Walkers Brook Drive, or installing a sidewalk on the eastern side of New Crossing Road, in order to improve access for local pedestrians crossing this roadway.

Bus stop (Walkers Brook Drive)

The bus stop on Walkers Brook Drive at New Crossing Road currently lacks amenities that could improve the comfort for bus riders. The Town, however, is in the process of purchasing a shelter and finalizing an easement agreement with abutting land owners to place this amenity. The new shelter is scheduled to be installed in 2014 and will greatly improve the comfort of riders waiting for the bus at this popular stop.

Reading Downtown District

MAPC examined Main Street in the downtown retail district. This area has been recently reconstructed and contains wide, buffered sidewalks, highly visible crosswalks, audible crossing signals, and a well-designed streetscape. Because the crosswalks are constructed of brick, which can become uneven over time, MAPC recommends monitoring the condition of these crosswalks to ensure that they remain in good condition.

Off-Road Trails

Rail Line Right of Way

MAPC examined whether there was sufficient right-of-way along the existing commuter rail line to allow for a multi-use path. The commuter rail extends throughout the Town and south into Wakefield near Lake Quannapowitt. After a site visit and speaking with MBTA staff, MAPC determined that a rail trail is not feasible due to limited right of way and planned expanded use of the existing railway lines. MAPC recommends two alternatives for access the Lake:

- Traveling from Ash Street, a quiet road in Reading to Parker Road in Wakefield, continuing along Elm Street to Winn Street, which provides access to the Lake.
- Traveling along Walkers Brook Drive to Northern Avenue in Wakefield. Walkers Brook Drive would benefit from improvements to the pedestrian experience including improved sidewalk, landscaping, crossings, and reduced vehicular speeds on the roadway.

Potential Ash Street to Walkers Brook Trail

A sewer easement from a residential area on Ash Street could potentially provide an off-road trail connection to Walkers Brook Drive. MAPC examined this area to analyze the feasibility of this project. The trail would require an at-grade crossing of the existing commuter rail line, something that in practice is extremely difficult and expensive to implement. While this could be implemented in the long term, MAPC recommends that the Town focus its priorities in other areas that can be more easily implemented.

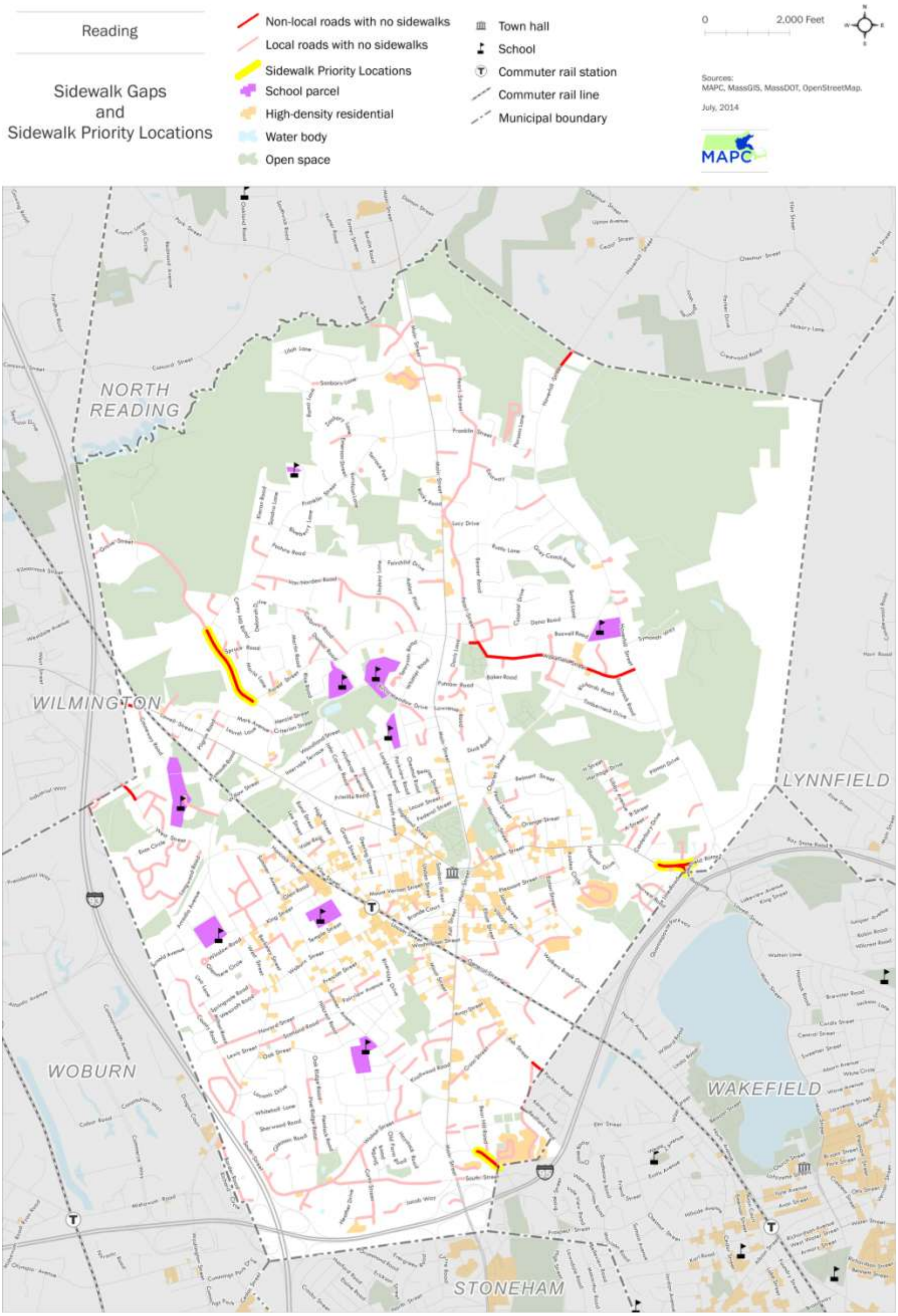
Sidewalk Gaps

MAPC reviewed all of the sidewalk gaps for both local and -non-local roads in Reading. **Figure 4** illustrates the areas 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 3** provides a list of the top priority recommendations (in alphabetical order) for pedestrian facilities in Reading, based on key connections (these locations are also highlighted on the 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 3: Reading Pedestrian Infrastructure Priority Locations

Street	*Limits*	*Comments*
Grove Street	Franklin Street to Strout Avenue	Provides connection to Town Forest and trails
Hopkins Street	Main Street to Wakefield Town line	Provides connection to Wakefield
Salem Street	Torre Street to Reading-Wakefield Rotary	Important connection to Wakefield near Lake Quinnapowitt and other sites including a senior housing complex and fitness center

Figure 4: Reading Sidewalk Gaps (Local and Non-local Roads) and Sidewalk Priority Locations



Bicycle Recommendations

The Town of Reading has been proactive in providing bicycle lanes on Haverhill Street, and has requested assistance in identifying additional opportunities for bicycle facilities to create a Town-wide network of bicycle facilities. MAPC examined the entire street network of non-local roads for the Town of Reading, 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 striping the recommended bicycle lanes or shared lanes when repaving roadways identified in the network plan. Restriping 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 proposes bicycle facilities on roads not owned by the municipalities, but rather the State (i.e., MassDOT) 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.

In addition, MAPC has examined previous bicycle planning efforts conducted for the Town. This includes:

1. Community Transportation Technical Assistance Program: Main Street (Route 28) from South Street to Washington Street, Reading memorandum[5]
   This study, conducted by the Boston Metropolitan Planning Organization, studied the feasibility of reducing the existing configuration of two travel lanes in each direction to one lane in each direction plus a center turning lane along Main Street from South Street to Washington Street. This reconfiguration, known as a "road diet", would provide space for bicycle lanes in each direction. The study divided the study area into three sections and recommended the road diet from Hopkins Street to the railroad tracks near Ash Street. MAPC has incorporated these recommendations as part of its bicycle network plan for the Town.

2. Main Street Corridor Study: Prepared for the Towns of Reading, Wakefield, and the City of Melrose[6]
   MAPC collaborated with Reading, Wakefield and Melrose to develop a coherent, forward-looking transportation plan. The Main Street Corridor Study looks at ways to improve upon the existing transportation network by reducing automobile traffic while promoting commuter rail, walking, bicycling and bus transportation. This study addresses a full range of transit options and focuses on achieving sustainable development and land use objectives.

3. North Suburban Regional Bicycle Transportation Plan – Reading section[7]
   This study, conducted by Weston & Sampson, examined the creation of a multi-municipality on-road bicycle network that included the Town of Reading. The study identified 5 potential routes through the Town. MAPC has incorporated these routes as part of its bicycle network plan for the Town; however, MAPC relies on the most up-to-date guidance for widths of travel and bicycle lanes, which may differ from the recommendations in the Weston & Sampson report.

[5] Boston Region Metropolitan Planning Organization. December 19, 2013.
[6] Metropolitan Area Planning Council. January, 2012.
[7] Weston and Sampson. 2005.

Overview of Bicycle Facilities

The on-road bicycle accommodations that were considered in this network plan include bicycle lanes, shared lane markings, and shared paths. 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. In addition, ensuring that bicycle lanes are free from debris such as sand and trash is important to allow cyclists to safely use the bicycle facilities.

In general, MAPC based its recommendations upon the design guidelines specified in the AASHTO Guide for Planning, Design, and Operation of Bicycle Facilities[8]. Following the established guidance MAPC recommends on-street parking lanes of 7-8' and travel lanes of 10-12'. Eleven feet is often ideal. Travel lanes greater than 12' may encourage vehicles to speed, whereas 10' is adequate on many roads but may be less than optimal for bus routes and roadways with heavy or wide vehicles.

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.[9]

[8] See Chapter 4: Design of On-Road Facilities: http://www.railstotrails.org/resources/documents/ourWork/trailBuilding/DraftBikeGuideFeb2010.pdf

[9] 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/

Cycle Track - A cycle track, illustrated in **Figure 5**, 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.

Figure 5: Cycle track (Source: NACTO)

Buffered Bicycle Lane - Buffered bicycle lanes, illustrated in **Figure 6**, 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 there is generally no physical separation between vehicles and cyclists.

Figure 6: Buffered bicycle lanes (Source: NACTO)

Bicycle Lane - A bicycle lane, illustrated in **Figure 7**, 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 7: Bicycle lanes (Source: NACTO)

Shared Lane - Shared lane markings (SLMs), or "sharrows," illustrated in **Figure 8**, 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 and mark the recommended position within the roadway for bicyclists. Sharrows should be marked as frequently as 100' apart and not greater than 250' apart, as well as immediately after intersections.

Figure 8: 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.

Examples of bicycle signage

Town of Reading Bicycle Facilities Recommendations

There are a number of streets in Reading identified on the Reading Bicycle Network Map (**Figure 9**) and Reading Bicycle Recommendations Table (**Table 4**) with potential for bicycle facilities in the short term. The bicycle network creates connections to schools, the commuter rail station, downtown, residential areas, and to the adjacent communities. Providing safe and comfortable bicycle facilities to these important connections can improve the health of the Town's residents, and reduce reliance on automobiles for shorter trips, which in turn can reduce congestion in the Town.

The table provides details on the recommendations for proposed striping. There is often flexibility in the recommendations regarding the allocation of roadway space while still following the guidance from MassDOT. For non-local roads, MassDOT recommends travel lane widths between 10-12 feet. For local roads, MassDOT recommends travel lane widths of 9-11 feet. For example, a 30' foot road with no on-street parking could be configured with:

- Two 5' bicycle lanes and two 10' travel lanes;
- Two 4.5' bicycle lanes and two 10.5' travel lanes; or,
- Two 4' bicycle lanes and two 11' travel lanes

Working within the established guidance presented in this document, the Town has the ability to make adjustments to the recommendations where appropriate to meet Town approval.

The Network Plan proposes approximately 8.4 miles of new bicycles lanes throughout the Town of Reading. Many miles of shared lanes (sharrows) are also proposed on roadways that cannot accommodate bicycle lanes within their current geometric configuration. These recommendations are based upon existing roadway configurations and widths with the exception of a segment of Main Street, which was previously identified for a "road diet" in order to accommodate bicycle lanes. In a recent analysis, the Boston Region Metropolitan Planning Organization recommends changing the roadway configuration from two travel lanes in each direction to one lane in each direction plus a center turning lane between Hopkins Street and the railroad crossing near Ash Street.

In addition to the segment of Main Street discussed above, MAPC recommends the Town analyze two additional roadway segments for suitability of a road diet:

1. Main Street from Salem Street to North Reading Town line

   Main Street north of the downtown has two travel lanes in each direction and lacks adequate width to stripe bicycle lanes. This segment of Main Street is a busy roadway with vehicles often traveling at high speeds. In its current configuration, MAPC recommends routing bicycle traffic along Charles Street to Pearl Street, which runs approximately parallel to Main Street. The segment of Main Street from Salem Street to Charles Street is a gap in this connection and in the short term could be partially addressed through shared lane markings. The Town has begun considering whether Main Street from Salem Street to the North Reading Town line would be appropriate for a road diet. Specifically, it has had preliminary conversations with MassDOT to examine the potential for converting the four travel lanes to two travel lanes plus wide bicycle lanes. MassDOT will perform additional analysis during a roadway construction project in summer 2014 to determine whether a lane diet is appropriate.

2. Walkers Brook Drive from John Street to Wakefield Town line

   Walkers Brook Drive is a high-speed roadway with two to three travel lanes in each direction and direct access to I-95. It also provides an important connection to the popular Lake Quannapowitt, located directly south of Reading/Wakefield town line. The existing space allows for four foot bicycle lanes, which meets the minimum standards set forth by MassDOT. In order to provide additional safety and comfort for bicyclists MAPC recommends the Town analyze whether a road diet is appropriate or whether there is adequate right-of-way to create a multiuse side-path adjacent to the roadway for both pedestrians and cyclists.

The Reading Bicycle Network Plan also identifies several locations as "conflict points." These points are potentially dangerous intersections for cyclists and/or pedestrians to navigate. These areas may require design changes, traffic calming treatments, or signals to improve safety.

The conflict points MAPC identified are located at the following intersections:

- Main Street at Pearl Street. As illustrated on the Reading Bicycle Network Plan, Pearl Street is proposed as a bicycle route heading north through the Town as an alternative to Main Street. The intersection where Pearl Street crosses Main Street has poor sight lines and lacks crosswalks. These attributes, along with the high speeds of vehicles driving along Main Street, as well as the four travel lanes, can create a potentially dangerous situation.
- Main Street at Franklin Street. As with the intersection described above, the intersection of Main Street and Franklin Street provides a potentially dangerous crossing. The Town of Reading is currently working with MassDOT on both near term and longer term improvements. The near-term improvements for summer/fall 2014 will include:
    - ADA compliant sidewalk improvements
    - Left turn lanes on Main Street, so that queued opposing left turn vehicles do not obscure oncoming through traffic
    - Protected-only left turn phasing on Main Street and provide far-side post-mounted signals on Main Street northbound and southbound to improve signal visibility
    - Extending the length of exclusive left-turn phase on Main Street southbound to allow more vehicles to turn left without conflict
    - Evaluating signal timing on all approaches and adjusting the timing to improve intersection efficiency, if possible
    - Installing new pavement markings and traffic signage to support the creation of the dedicated left-turn lane on Main Street

  In addition to the improvements listed above, MassDOT plans to undertake a resurfacing project that may include a lane diet and allow for bicycle facilities.
- Main at Ash Street. This area contains several aspects that create a potentially dangerous situation for bicyclists. Main Street crosses the commuter rail tracks and then intersects Ash Street at a non-right angle. The roadway configuration at this intersection results in an extremely long crossing at Ash Street and the wide turning radii allow cars to turn onto Main Street at high speeds. In addition, auto-oriented businesses, such as a McDonald's drive-through area and a gas station result in many turning vehicles.
- Entrances to rotary at Haverhill Street and Salem Streets. Rotaries designed for high speed vehicles, such as the one Reading shares with Wakefield, pose a challenge for bicyclists and pedestrians. Over the long term this rotary should be reconstructed in a way that safely accommodates all users. In the shorter term, the Town should explore ways to increase the safety and comfort, such as widening the sidewalk to accommodate both bicyclists and pedestrians, striping highly visible crosswalks, and installing signs altering motorists to cyclists and pedestrians.

A section of Lincoln Street (between Washington Street and Prescott Street) contains pull-in angled parking. This roadway segment contains adequate width for bicycle lanes; however, pull-in angled parking located to the right of a bicycle lane is dangerous for cyclists as visibility is severely limited while backing out of the space. An alternative configuration reverses the angle of the parking, requiring drivers to back-in rather than pull-in. The rear of the vehicle is adjacent to the sidewalk rather than the vehicle lane. Since back-in angled parking

Example of reverse Angled Parking
Location: Akron, Ohio
Source: Downtown Akron Partnership

increases driver visibility, there are fewer conflicts with pedestrians and bicyclists. This parking configuration also allows for safer loading and unloading of passengers and goods. This parking alternative would retain the existing number of parking spaces and increase bicyclist safety. In addition, a segment of High Street (between Washington Street and Woburn Street) contains head-on parking. Requiring vehicles to back in to these spaces would increase bicyclist safety and would not require any changes to the roadway configuration.

There are a number of roadways that were considered for bicycle facilities but either lacked sufficient curb-to-curb space, did not support an important connection, or an alternative connection exists. Of note, based upon feedback at a community meeting, MAPC examined Middlesex Avenue which provides a connection to the Town Library. Because of limited right-of-way, however, the roadway does not currently have sufficient space for the inclusion of bicycle lanes; in addition, because the roadway is unstriped, it would not be appropriate to stripe shared lane markings at this time. If, in the future, the Town decides to repave and stripe the road, shared lane markings should be considered. See **Appendix C** for a list of all the street segments and their associated widths analyzed by MAPC.

MAPC also discussed potential off-road trails with the Town. There are currently a number of trails throughout the Town, most of which are located in the Town Forest and Bare Meadow. There is a proposal from the Northern Area Greenway Task Force to connect these two large areas of open space into a connected trail known as the Ipswich River Greenway, identified on Bicycle Network Plan as a Regional Greenway.[10] The Town should also explore whether a trail through the wetlands on the east side of the Town parallel to Haverhill Street is feasible. Finally, a trail through conservation land at the end of Vine Street to Willow Street (parallel to the tracks) would create an alternative route for commuters to avoid heavily trafficked routes.

[10] See http://readingma.virtualtownhall.net/Pages/ReadingMA_Conservation/IRG for additional information.

Figure 9: Reading Bicycle Network Plan

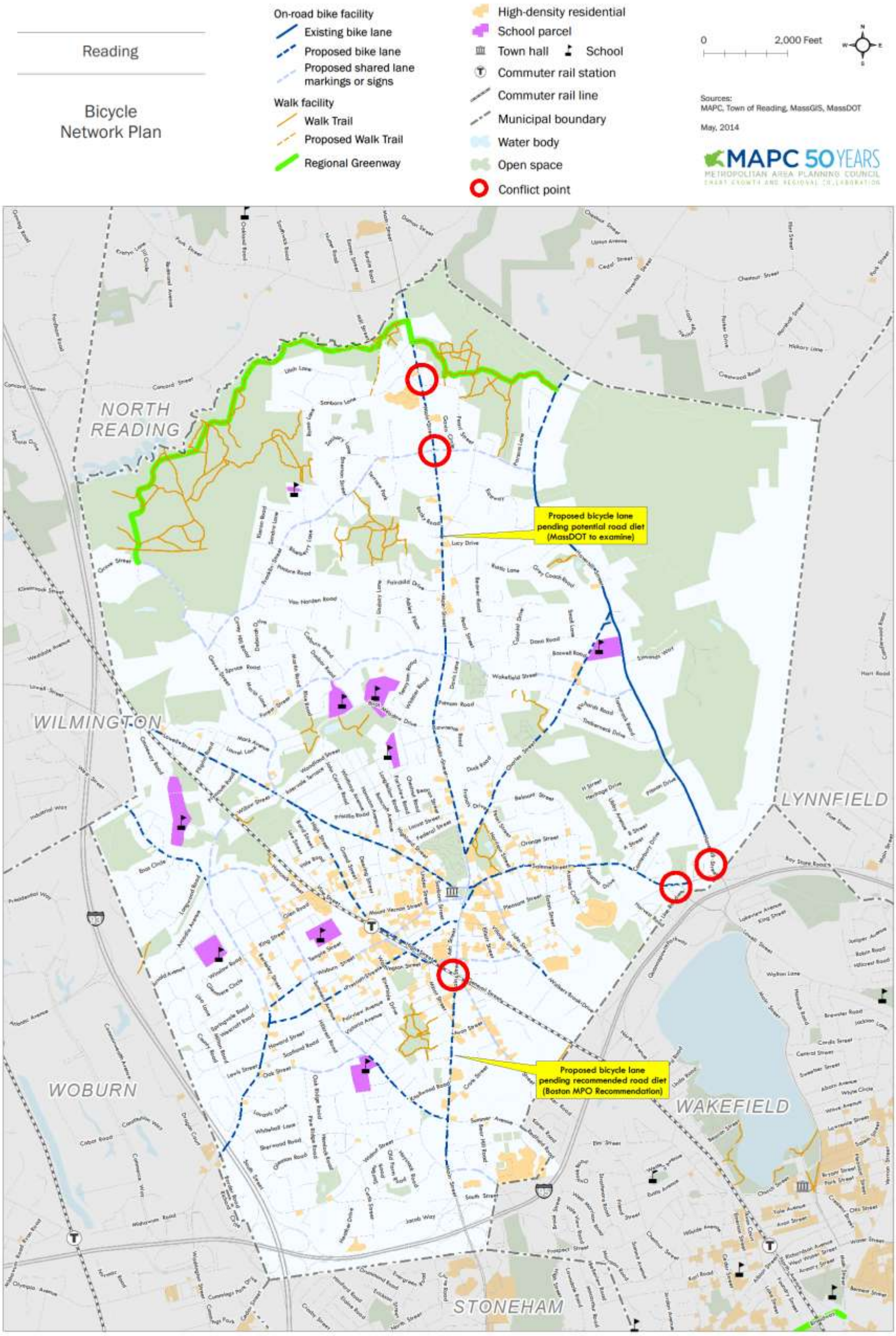


Table 4: Reading Bicycle Recommendations

Street Name	From	To	Road classification	Roadway							Existing Conditions*									Recommendation	Recommendation - Details									
				Travel Direction			Parking				Curb-to-Curb	Bike Lane	Shoulder	Parking	Travel Lanes		Parking	Shoulder	Bike Lane		Parking	Buffer or Shoulder	Bike Lane	Buffer	Travel Lane (s)	Travel Lane (s)	Buffer	Bike Lane	Buffer or Shoulder	Parking
				Two-Way	One-Way	Multiple lanes?	None	Both	One Side	Painted?	Width	WB/SB (width)	WB/SB (Width)	WB/SB (Width)	WB/SB (Width)	EB/NB (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
Ash Street	Town line (Wakefield)	Main Street	Urban Collector	X			X				24.5				12.5	12				Shared lanes					12.25	12.25				
Charles Street	Haverhill Street	Wakefield Street	Urban Collector	X			X				30		2		13	12		3		Bicycle lanes			4.5		10.5	10.5		4.5		
Charles Street	Wakefield Street	Main Street	Urban Collector	X			X				28		1.5		12.5	12		2		Bicycle lanes			4		10	10		4		
Forest Street	Grove Street	Main Street	Urban Collector	X			X				23				11	12				Shared lanes					11.5	11.5				
Franklin Street	Grove Street	Fox Run Lane	Urban Minor Arterial	X			X				24				12	12				Shared lanes					12	12				
Franklin Street	Fox Run Lane	Main Street	Urban Minor Arterial	X			X				25.5				12	13.5				Shared lanes					12.75	12.75				
Franklin Street	Main Street	Haverhill Street	Urban Minor Arterial	X			X				24				12.5	11.5				Shared lanes					12	12				
Grove Street	Lowell Street	Forest Street	Urban Minor Arterial	X			X				24				11	12		1		Shared lanes					12	12				
Grove Street	Forest Street	Franklin Street	Urban Minor Arterial	x			X				25		1		11.5	11.5		1		Shared lanes					12.5	12.5				
Grove Street	Franklin Street	Strout Avenue	Local Road	X			X				20				10	10				Shared lanes					10	10				
Harnden St	Salem Street	Union Street	Urban Minor Arterial	X			X				31				16	15				Bicycle lanes			5		10.5	10.5		5		
Harnden St	Union Street	Main Street	Urban Minor Arterial		NB			X		Yes	31			8		15	8			Bicycle lanes	7				11			5		8
Haven Street	Main Street	Linden Street	Local Road		WB			X		Yes	34			8	18		8			Bicycle lanes	8		5.5		12.5					8
Haven Street	Linden Street	High Street	Local Road		WB			X		Yes	32.5			8	16.5		8			Bicycle lanes	8		5		11.5					8
Haverhill Street	Town line (North Reading)	Franklin Street	Urban Minor Arterial	X			X				29.5		2.5		12.5	12.5		2		Bicycle lanes			4.25		10.5	10.5		4.25		
Haverhill Street	Franklin Street	Charles Street	Urban Minor Arterial	X							35	5.5			12	12.5			5	Bicycle lanes			5.5		12	12.5		5		
Haverhill Street	Charles Street	Reading-Wakefield Rotary	Urban Minor Arterial	X			X				35	6			12.5	11.5			5	Bicycle lanes			5.5		12	12		5.5		
High Street	Washington Street	Woburn Street	Urban Collector	X		Incl. head-on parking		X		Yes	56			8	12.5	17.5	18			Bicycle lanes; Require back-in parking only to improve motorists' visibility of cyclists	7		5		10.5	10.5		5		18
High Street	Woburn Street	Lowell Street	Urban Collector	X			X				30				15	15				Bicycle lanes			4.5		10.5	10.5		4.5		
Hopkins Street	Main Street	Town line (Wakefield)	Local Road	X			X				24									Shared lanes					12	12				
John Street	Washington Street	Salem Street	Urban Minor Arterial	X			X				23.5				12	11.5				Shared lanes					11.75	11.75				
Lincoln Street	Washington Street	Prescott Street	Local	X		Incl. angle parking			X	Yes	52			15	20	17				Bicycle lanes; Reconfigure angle parking to be back-in parking	15		6		13	12		6		
Lincoln Street	Prescott St	Woburn Street	Local	X					X	Yes	33			8	12	13				Shared lanes					12.5	12.5				8
Lowell Street	Town line (Wilmington)	High Street	Urban Principal Arterial	X			X				30		4		11	12		3		Bicycle lanes			4		11	11		4		
Lowell Street	High Street	Main Street	Urban Principal Arterial	X			X				32.5		2		12.5	14.5		3.5		Bicycle lanes			5		11	11.5		5		
Main Street	Hopkins Street	Cross Street	Urban Principal Arterial	X		2 each direction	X				43		1.5		9.5, 11.5	9.5, 9.5		1.5		Bicycle lane, pending implementation of CTPS-recommended "road diet"			5		11.5, 11	11.5		5		
Main Street	Cross Street	Washington Street	Urban Principal Arterial	X		2 each direction	X				43		1.5		10, 10	10, 10		1.5		Bicycle lane, pending implementation of CTPS-recommended "road diet"			5		11, 11	11		5		
Main Street	Washington Street	Haven Street	Urban Principal Arterial	X		1 SB, 2 NB	X				35		1		11	11, 11		1		Shared lanes					11	11, 13				
Main Street	Haven Street	Pleasant Street	Urban Principal Arterial	X		2 each direction		X		Yes	58			7	11, 11	11, 11	7			Shared lanes	7				12, 10	10, 12				7
Main Street	Pleasant Street	Salem Street	Urban Principal Arterial	X		2 each direction	X				46		1		11, 11	11, 11		1		Shared lanes					12, 11	11, 12				
Main Street	Salem Street	Charles Street	Urban Principal Arterial	X		2 each direction	X				48.5		0.5		10.5, 13	11.5, 12.5		0.5		Shared lanes					11,13	11,13				
Main Street	Charles Street	Forest Street	Urban Principal Arterial	X		2 each direction	X				46		2		13, 10.5	10.5, 9.5		0.5		Buffered bicycle lanes, pending implementation of potential "road diet"			5	3	11, 11	11	3	5		
Main Street	Forest Street	Franklin Street	Urban Principal Arterial	X		2 each direction	X				46		2		13, 10.5	10.5, 9.5		0.5		Buffered bicycle lanes, pending implementation of potential "road diet"			5	3	11, 11	11	3	5		
Main Street	Franklin Street	Town line (North Reading)	Urban Principal Arterial	X		2 each direction	X				43.5		2		10, 10	10, 9.5		1.5		Bicycle lanes, pending implementation of potential "road diet"			5		11, 11	11.5		5		
Oak Street	West Street	Summer Ave	Local	X			X				25.5									Shared lanes					12.75	12.75				
Prescott Street	West Street	Summer Ave	Local Road	X			X				30				15	15				Bicycle lanes			4.5		10.5	10.5		4.5		
Prescott Street	Summer Ave	Vine Street	Local Road	X			X				34				17	17				Bicyle lanes			5.5		11.5	11.5		5.5		
Salem Street	Wakefield-Reading Rotary	Main Street	Urban Principal Arterial	X			X				30		2.5		12	12		3.5		Bicycle lanes			4.5		10.5	10.5		4.5		
Salem Street	Main Street	Lowell Street	Urban Principal Arterial	X		1 EB turning lane			X	Yes	41			8	12	10, 10		1		Shared lanes	8				11	11, 13				
Summer Ave	Willow Street	Woburn Street	Local	X			X				27		1.5		10.5	10.5		1.5		Shared lanes					13.5	13.5				
Summer Ave	Woburn Street	Oak Street	Urban Collector	X			X				28		1		13	13		1		Bicycle lanes			4		10	10		4		
Summer Ave	Oak Street	Woburn Street	Urban Collector	X			X				27		1		12	13		1		Shared lanes					13.5	13.5				
Wakefield Street	Pearl Street	Charles Street	Urban Collector	X			X				22									Shared lanes					11	11				
Wakefield Street	Charles Street	Haverhill Street	Urban Collector	X			X				20									Shared lanes					10	10				
Walkers Brook Drive	Washington Street	Town line (Wakefield)	Urban Minor Arterial	X		2 each direction	X				52		3		12, 11.5	11.5, 11		3		Bicycle lanes			4.5		10.5, 11	10.5, 11		4.5		
Washington Street	Walkers Brook Drive	Main Street	Urban Collector	X			X				24				12	12				Shared lanes					12	12				
West Street	Town line (Woburn)	Oak Street	Urban Minor Arterial	X			X				31.5		2.5		12	13		4		Bicycle lanes			5		10.5	11		5		
West Street	Oak Street	Woburn Street	Urban Minor Arterial	X			X				30		2		12	14.5		1.5		Bicycle lanes			4.5		10.5	10.5		4.5		
West Street	Woburn Street	Willow Street	Urban Minor Arterial	X			X				26.5		2		11.5	11.5		1.5		Shared lanes					13	13.5				
West Street	Willow Street	Town line (Wilmington)	Urban Minor Arterial	X			X				30		3		12	12		3		Bicycle lanes			4.5		10.5	10.5		4.5		
Willow Street	West Street	Lowell Street	Urban Minor Arterial	X			X				25.5		0.5		13	11		1		Shared lanes					12.5	13				
Woburn Street	West Street	Summer Ave	Urban Minor Arterial	X			X				33		1		15	16		1		Bicycle lanes			5		11.5	11.5			5	
Woburn Street	Summer Ave	High Street	Urban Minor Arterial	X					X	No	32		1		12	18		1		Shared lanes					12.5	12.5				7
Woburn Street	High Street	Main Street	Urban Minor Arterial	X					X	No	32		0.5		11.5	12	8			Shared lanes					12	12				8

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

Next Steps

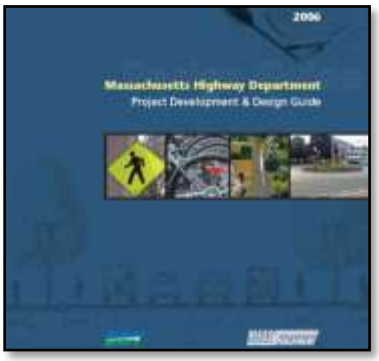
This report provides a number of opportunities for constructing bicycle and pedestrian facilities. Implementation of the plan requires a multi-prong approach. Below is a summary of next steps to further the Town of Reading's efforts to increase walking and bicycling and to improve the quality of life and health of the community. Action steps include:

- **Incorporate bicycle facilities as a matter of routine** – most bicycle facilities, such as bicycle lanes and shared lane markings are relatively low cost solutions. Incorporating these facilities when a road is repaved/restriped will lead to incremental change in a cost-effective manner.
- **Prioritize sidewalk investments proactively –** the Town should review its approach to prioritizing sidewalk construction and repairs. One consideration for prioritizing sidewalk construction and improvements could be the Neighborhood Walks Map.
- **Seek out additional funding sources** – Reading typically allocates approximately $50,000 per year to sidewalk improvements. The Town should proactively seek out additional funding sources and grants. An example of potential funding is the pending Complete Streets Certification program. This program will allocate $10,000,000 per year for five years to be distributed among certified communities to plan and implement complete streets.
- **Adopt a complete streets policy** – The Town is in the process of adopting a complete streets policy, which aims to make incorporate pedestrian and bicycle facilities and amenities a part of both routine projects, as well as larger ones.
- **Work with adjacent communities** – As Reading prioritizes and begins to install pedestrian and bicycle facilities, Planning, DPW, and Engineering should communicate with their counterparts in the adjacent communities of Lynnfield, North Reading, Stoneham, Wakefield, Wilmington, and Woburn, to ensure continuous facilities beyond municipal borders, especially when there are important destinations for Reading residents, including access to Lake Quinnapowitt.
- **Work with community partners –** the Town may wish to engage relevant community partners involved in increasing physical activity to explore ways to improve the pedestrian and bicycle experience. For example, the Town of Lexington worked with a local bicycle shop to increase the number and quality of bicycle parking near its shop.
- **Continue to promote walking and bicycling** – in addition to providing new and improved pedestrian/bicycle infrastructure and amenities, the Town can advertise its walking routes and trails through the Town's website and through other media.

Appendix A – Pedestrian and Bicycle Facility Design Guidelines and References

MassDOT's Development and Design Guidebook[11]

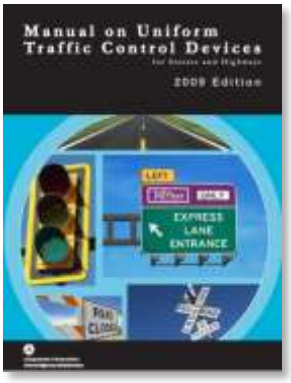
The primary resource that should be adhered to is the MassDOT Project Development and Design Guidebook.



Multimodal accommodation that encourages and supports safe travel for pedestrians, bicyclists and other modes of travel is a key feature of the MassDOT Guidebook. The MassDOT Guidebook directs the designer to begin at the edge with the pedestrian and work their way in, 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.

NACTO's *Urban Street Design Guide*

The NACTO Urban Street Design Guide shows how streets of every size can be reimagined and reoriented to prioritize safe driving and transit, biking, walking, and public activity. Unlike older, more conservative engineering manuals, this design guide emphasizes the core principle that urban streets are public places and have a larger role to play in communities than solely being conduits for traffic. In April 2014 MassDOT officially endorsed the Urban Street Design Guide.



Manual on Uniform Traffic Control Devices (MUTCD)[12]

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. States must adopt the 2009 National MUTCD as their legal State standard for traffic control devices within two years.

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.

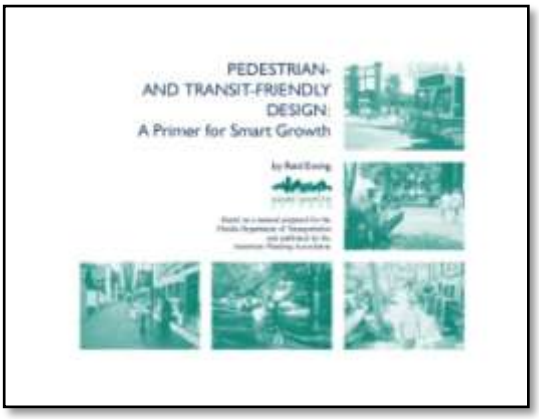
[11] www.massdot.state.ma.us/highway/DoingBusinessWithUs/ManualsPublicationsForms/ProjectDevelopmentDesignGuide.aspx
[12] http://mutcd.fhwa.dot.gov/pdfs/2009r1r2/pdf_index.htm

Creating Design Standards for 40R Districts[13]

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.

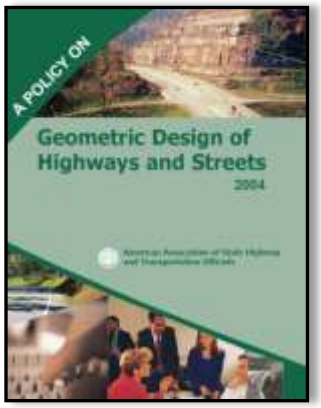
It provides practical information and references for crafting workable standards that will apply to the land uses and development within Smart Growth Zoning Districts. Accommodations for pedestrians such as walkway and sidewalk width, provision of benches, lighting fixtures and other street furniture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

Pedestrian and Transit-Friendly Design: A Primer for Smart Growth[14]



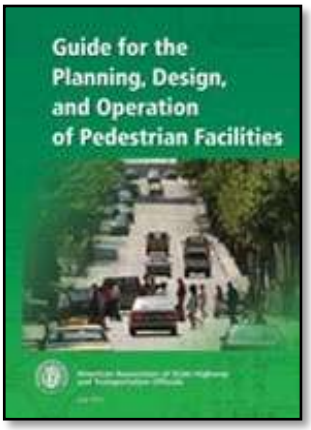
Published by the Smart Growth Network, this guide is based on a manual prepared for the Florida Department of Transportation. The publication is a general guide to and discussion of design concepts that support pedestrian activity and transit use.

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

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.

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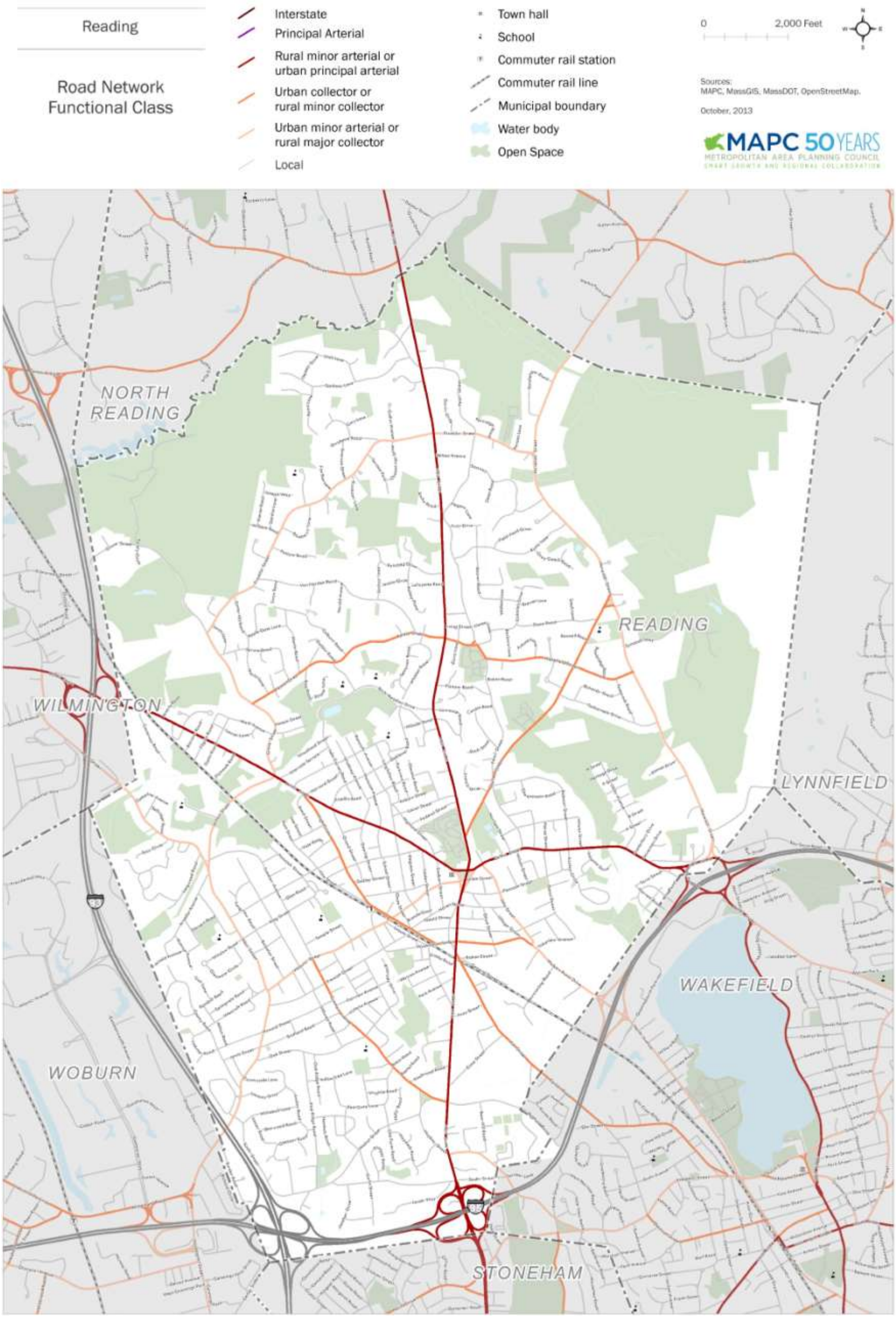
[13] http://www.growsmartri.org/training/Creating%20Design%20Standards%20for%20Transit-Oriented%20Districts.pdf

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

Appendix B – MassDOT Road Network Functional Classifications



Appendix C – List of All Street Segments Analyzed

Street Name	From	To	Road classification	Roadway							Existing Conditions*										Recommendation	Recommendation - Details									
				Travel Direction			Parking				Curb-to-Curb	Bike Lane	Shoulder	Parking	Travel Lanes		Parking	Shoulder	Bike Lane			Parking	Buffer or Shoulder	Bike Lane	Buffer	Travel Lane (s)	Travel Lane (s)	Buffer	Bike Lane	Buffer or Shoulder	Parking
				Two-Way	One-Way	Multiple lanes?	None	Both	One Side	Painted?	Width	WB/SB (width)	WB/SB (Width)	WB/SB (Width)	WB/SB (Width)	EB/NB (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
Ash Street	Town line (Wakefield)	Main Street	Urban Collector	X			X				24.5				12.5	12					Shared lanes					12.25	12.25				
Charles Street	Haverhill Street	Wakefield Street	Urban Collector	X			X				30		2		13	12		3			Bicycle lanes			4.5		10.5	10.5		4.5		
Charles Street	Wakefield Street	Main Street	Urban Collector	X			X				28		1.5		12.5	12		2			Bicycle lanes			4		10	10		4		
Forest Street	Grove Street	Main Street	Urban Collector	X			X				23				11	12					Shared lanes					11.5	11.5				
Franklin Street	Grove Street	Fox Run Lane	Urban Minor Arterial	X			X				24				12	12					Shared lanes					12	12				
Franklin Street	Fox Run Lane	Main Street	Urban Minor Arterial	X			X				25.5				12	13.5					Shared lanes					12.75	12.75				
Franklin Street	Main Street	Haverhill Street	Urban Minor Arterial	X			X				24				12.5	11.5					Shared lanes					12	12				
Grove Street	Lowell Street	Forest Street	Urban Minor Arterial	X			X				24				11	12		1			Shared lanes					12	12				
Grove Street	Forest Street	Franklin Street	Urban Minor Arterial	x			X				25		1		11.5	11.5		1			Shared lanes					12.5	12.5				
Grove Street	Franklin Street	Strout Avenue	Local Road	X			X				20				10	10					Shared lanes					10	10				
Harnden St	Salem Street	Union Street	Urban Minor Arterial	X			X				31				16	15					Bicycle lanes			5		10.5	10.5		5		
Harnden St	Union Street	Main Street	Urban Minor Arterial		NB			X		Yes	31			8		15	8				Bicycle lanes	7				11			5		8
Haven Street	Main Street	John Street	Local Road		EB			X		Yes	26.5			7		12	7.5				Leave as is					Leave as is					
Haven Street	Main Street	Linden Street	Local Road		WB			X		Yes	34			8	18		8				Bicycle lanes	8		5.5		12.5					8
Haven Street	Linden Street	High Street	Local Road		WB			X		Yes	32.5			8	16.5		8				Bicycle lanes	8		5		11.5					8
Haverhill Street	Town line (North Reading)	Franklin Street	Urban Minor Arterial	X			X				29.5		2.5		12.5	12.5		2			Bicycle lanes			4.25		10.5	10.5		4.25		
Haverhill Street	Franklin Street	Charles Street	Urban Minor Arterial	X							35	5.5			12	12.5				5	Bicycle lanes			5.5		12	12.5		5		
Haverhill Street	Charles Street	Reading-Wakefield Rotary	Urban Minor Arterial	X			X				35	6			12.5	11.5				5	Bicycle lanes			5.5		12	12		5.5		
High Street	Washington Street	Woburn Street	Urban Collector	X		Incl. head-on parking		X		Yes	56			8	12.5	17.5	18				Bicycle lanes; Require back-in parking only to improve motorists' visibility of cyclists	7		5		10.5	10.5		5		18
High Street	Woburn Street	Lowell Street	Urban Collector	X			X				30				15	15					Bicycle lanes			4.5		10.5	10.5		4.5		
Hopkins Street	Main Street	Town line (Wakefield)	Local Road	X			X				24										Shared lanes					12	12				
John Street	Washington Street	Salem Street	Urban Minor Arterial	X			X				23.5				12	11.5					Shared lanes					11.75	11.75				
Lincoln Street	Washington Street	Prescott Street	Local	X		Incl. angle parking			X	Yes	52			15	20	17					Bicycle lanes; Reconfigure angle parking to be back-in parking	15		6		13	12		6		
Lincoln Street	Prescott St	Woburn Street	Local	X					X	Yes	33			8	12	13					Shared lanes					12.5	12.5				8
Lowell Street	Town line (Wilmington)	High Street	Urban Principal Arterial	X			X				30		4		11	12		3			Bicycle lanes			4		11	11		4		
Lowell Street	High Street	Main Street	Urban Principal Arterial	X			X				32.5		2		12.5	14.5		3.5			Bicycle lanes			5		11	11.5		5		
Main Street	I-95 Interchange	Hopkins Street	Urban Principal Arterial	X		2 each direction	X				44		1.5		9.5, 11.5	9.5, 9.5		1.5			Leave as is					Leave as is					
Main Street	Hopkins Street	Cross Street	Urban Principal Arterial	X		2 each direction	X				43		1.5		9.5, 11.5	9.5, 9.5		1.5			Bicycle lane, pending implementation of CTPS-recommended "road diet"			5		11.5, 11	11.5		5		
Main Street	Cross Street	Washington Street	Urban Principal Arterial	X		2 each direction	X				43		1.5		10, 10	10, 10		1.5			Bicycle lane, pending implementation of CTPS-recommended "road diet"			5		11, 11	11		5		
Main Street	Washington Street	Haven Street	Urban Principal Arterial	X		1 SB, 2 NB	X				35		1		11	11, 11		1			Shared lanes					11	11, 13				
Main Street	Haven Street	Pleasant Street	Urban Principal Arterial	X		2 each direction		X		Yes	58			7	11, 11	11, 11	7				Shared lanes	7				12, 10	10, 12				7
Main Street	Pleasant Street	Salem Street	Urban Principal Arterial	X		2 each direction	X				46		1		11, 11	11, 11		1			Shared lanes					12, 11	11, 12				
Main Street	Salem Street	Charles Street	Urban Principal Arterial	X		2 each direction	X				48.5		0.5		10.5, 13	11.5, 12.5		0.5			Shared lanes					11, 13	11, 13				
Main Street	Charles Street	Forest Street	Urban Principal Arterial	X		2 each direction	X				46		2		11, 10.5	10.5, 9.5		0.5			Buffered bicycle lanes, pending implementation of potential "road diet"			5	3	11, 11	11	3	5		
Main Street	Forest Street	Franklin Street	Urban Principal Arterial	X		2 each direction	X				46		2		11, 10.5	10.5, 9.5		0.5			Buffered bicycle lanes, pending implementation of potential "road diet"			5	3	11, 11	11	3	5		
Main Street	Franklin Street	Town line (North Reading)	Urban Principal Arterial	X		2 each direction	X				43.5		2		10, 10	10, 9.5		1.5			Bicycle lanes, pending implementation of potential "road diet"			5		11, 11	11.5		5		
Oak Street	West Street	Summer Ave	Local	X			X				25.5										Shared lanes					12.75	12.75				
Pleasant Street	Main Street	John Street	Local Road	X					EB	No	31				15.5	8.5	7				Leave as is					Leave as is					
Prescott Street	West Street	Summer Ave	Local Road	X			X				30				15	15					Bicycle lanes			4.5		10.5	10.5		4.5		
Prescott Street	Summer Ave	Lincoln Street	Local Road	X			X				34				17	17					Bicycle lanes			5.5		11.5	11.5		5.5		
Salem Street	Wakefield-Reading Rotary	Main Street	Urban Principal Arterial	X			X				30		2.5		12	12		3.5			Bicycle lanes			4.5		10.5	10.5		4.5		
Salem Street	Main Street	Lowell Street	Urban Principal Arterial	X		1 EB turning lane			X	Yes	41			8	12	10, 10		1			Shared lanes	8				11	11, 13				
South Street	West Street	Walnut Street	Local	X			X				21										Leave as is					Leave as is					
Summer Ave	Willow Street	Woburn Street	Local	X			X				27		1.5		10.5	10.5		1.5			Shared lanes					13.5	13.5				
Summer Ave	Woburn Street	Oak Street	Urban Collector	X			X				28		1		13	13		1			Bicycle lanes			4		10	10		4		
Summer Ave	Oak Street	Woburn Street	Urban Collector	X			X				27		1		12	13		1			Shared lanes					13.5	13.5				
Summer Ave	Woburn Street	West Street	Local	X			X				26.5		2		11.5	11.5		1.5			Leave as is					Leave as is					
Union Street	John Street	Main Street	Local Road	X			X				27.5				14.5	13					Leave as is					Leave as is					
Wakefield Street	Pearl Street	Charles Street	Urban Collector	X			X				22										Shared lanes					11	11				
Wakefield Street	Charles Street	Haverhill Street	Urban Collector	X			X				20										Shared lanes					10	10				
Walkers Brook Drive	Washington Street	Town line (Wakefield)	Urban Minor Arterial	X		2 each direction	X				52		3		12, 11.5	11.5, 11		3			Bicycle lanes			4.5		10.5, 11	10.5, 11		4.5		
Walnut Street	Hokins Street	South Street	Local	X			X				22.5										Leave as is					Leave as is					
Washington Street	Walkers Brook Drive	Main Street	Urban Collector	X			X				24				12	12					Shared lanes					12	12				
West Street	Town line (Woburn)	Oak Street	Urban Minor Arterial	X			X				31.5		2.5		12	13		4			Bicycle lanes			5		10.5	11		5		
West Street	Oak Street	Woburn Street	Urban Minor Arterial	X			X				30		2		12	14.5		1.5			Bicycle lanes			4.5		10.5	10.5		4.5		
West Street	Woburn Street	Willow Street	Urban Minor Arterial	X			X				26.5		2		11.5	11.5		1.5			Shared lanes					13	13.5				
West Street	Willow Street	Town line (Wilmington)	Urban Minor Arterial	X			X				30		3		12	12		3			Bicycle lanes			4.5		10.5	10.5		4.5		
Willow Street	West Street	Lowell Street	Urban Minor Arterial	X			X				25.5		0.5		13	11		1			Shared lanes					12.5	13				
Woburn Street	West Street	Summer Ave	Urban Minor Arterial	X			X				33		1		15	16		1			Bicycle lanes			5		11.5	11.5			5	
Woburn Street	Summer Ave	High Street	Urban Minor Arterial	X					X	No	32		1		12	18		1			Shared lanes					12.5	12.5				7
Woburn Street	High Street	Main Street	Urban Minor Arterial	X					X	No	32		0.5		11.5	12	8				Shared lanes					12	12				8

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