bicycle and pedestrian improvements in town centers

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ABSTRACT

This study identifies relatively low-cost, easy-to-implement improvements to the pedestrian and bicycle environments in six small town centers in the Boston region: Duxbury (Hall's Corner), Essex, Holbrook, Lynnfield, Norfolk, and Southborough. The recommendations aim to improve pedestrian and bicyclist access and safety in these town centers by making connections to activity centers, including residential and commercial areas, schools, libraries, churches, and recreation areas, and by improving the quality of existing infrastructure. Also included is a set of general recommendations and a discussion of best practices in planning and designing improvements to the pedestrian and bicycle networks.

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introduction

A walkable and bikeable town center is an asset to a community, supporting economic vitality and improving safety. Better conditions for walking and bicycling improve the quality of life in cities and towns by encouraging exercise, reducing congestion, and improving air quality. Pleasant, safe, and convenient access for pedestrians and bicyclists within a town center can make those modes more attractive. These pedestrian and bicycle networks also provide alternatives to the automobile for trips within a community.

Traditional New England town centers were built in a pedestrian-oriented era, and therefore include many destinations within walking distance of each other, including municipal offices, fire and police stations, libraries, churches, and schools. Single-family homes are sometimes interspersed between the public buildings, but mainly lie in the immediate outskirts of the center. Multifamily housing for elderly and low-income populations is often located in town centers. These residents are less likely to own a car and therefore need to walk, bicycle, or use transit to get to the places they need to go. Town centers with this dense development pattern often have a comprehensive sidewalk network but have narrow roads constrained in width by existing development. This limits the ability to construct new sidewalks or stripe bicycle lanes in these areas.

Many communities in the Boston region do not have areas that resemble the traditional New England town centers: commercial development is dispersed in strip developments, and housing is spread out in low-density developments on the outskirts of town. It can be very difficult or unsafe to walk or bicycle in these automobile-oriented areas. Towns with a less dense development pattern often lack a comprehensive sidewalk network but often have wider roads to accommodate more automobile traffic.

This study includes recommendations for relatively low-cost, easy-to-implement improvements to the pedestrian and bicycle environments in six selected small town centers to improve pedestrian and bicycle access and safety within those centers. The recommendations are intended to improve the connectivity of these environments.

BACKGROUND

The Boston Region Metropolitan Planning Organization (MPO) is committed to improving the transportation network for pedestrians and bicyclists. The MPO's most recent policies support projects for improving the pedestrian and bicycle environments. These policies are under the categories of system preservation, modernization, and efficiency; mobility; environment; safety and security; and land use and economic development.

This study was created as a result of a recommendation in the MPO's 2004 report of the Congestion Management System (CMS), now known as the Mobility Management System (MMS). The MMS is an ongoing program whose purpose is to provide the MPO and other transportation planners with timely information about transportation system performance in the region and make recommendations in the areas where congestion and other mobility deficiencies are found. The MMS

documents how the region's transportation network accommodates bicycling and walking.

The Massachusetts Highway Department (MassHighway) released its Project Development and Design Guide (Guide) in 2006, providing designers and decision-makers with a framework for incorporating context-sensitive design and multimodal elements into transportation improvement projects. Transportation projects developed with the provisions outlined in the Guide are likely to significantly enhance the bicycle and pedestrian environments.

The concept of improving the bicycle and pedestrian environments in town centers is also supported by and consistent with regional, state, and federal bicycle transportation plans and policies, which include:

- Boston Region MPO Policies (adopted January 2006)
- *Massachusetts Pedestrian Transportation Plan* (1998)
- MetroFuture, the Metropolitan Area Planning Council's long-range land use plan for the Boston region
- MassHighway's Bicycle Route and Share the Road Signing Policy (Policy Directive P-98-003, August 25, 1998)
- The Executive Office of Transportation's *A Framework for Thinking – A Plan for Action*, the Statewide Transportation Plan
- *Massachusetts Bicycle Plan Update* (in development)
- *Regional Bicycle Plan* (prepared by the Metropolitan Area Planning Council for the Boston Region MPO, March 2007)

OBJECTIVES

In order to improve the pedestrian and bicycle environments in town centers, the MPO articulated three objectives for this study. The first objective was to identify small town centers to include in this study, with a focus on those communities that had not hosted a Walkable Community Workshop or had not fully examined pedestrian or bicycle issues. The second objective was to identify opportunities to improve pedestrian and bicycle access and safety within those town centers. The third objective was to recommend measures to take advantage of opportunities that could serve as a model for other communities in the region.

The tasks of this study were as follows:

1. Select six small town centers to include in the study.
2. Gather data related to bicycle and pedestrian accommodations in the selected town centers through field observations, community officials, and secondary sources.
3. Analyze the bicycle and pedestrian environments in the selected town centers and make recommendations to improve those environments.

SELECTION OF TOWN CENTERS

The criteria for site selection were organized into two tiers. The criteria for the first tier consisted of a town's geographic location within the region and its population and population density. Towns with a population of less than 20,000 were given preference. Towns that had hosted a Walkable Community Workshop were not considered for inclusion in this study.

The first-tier criteria produced a list of towns to be considered for the study. Thereafter, second-tier criteria were applied to help make the final selection of towns to be studied. In seeking to select a set of town centers with distinct characteristics, staff considered the following factors:

- The number of people and jobs within the town
- The availability of transit services
- The current status of pedestrian and bicycle characteristics of the town center and surrounding area

- Whether the local municipality or the MBTA may be planning transit-oriented development areas and/or mixed-use zoning overlay districts, or may be considering revitalization of the town center under a Downtown Streetscape Plan
- The location of services, such as town libraries, post offices, town halls, banks, and parks
- The availability of parking and vehicular access in the town center

The above criteria yielded six town centers as candidates for consideration for this study. Staff contacted municipal officials in the six towns to determine whether there was sufficient interest in participating in the study. Each of the towns expressed strong interest, and those town centers were approved by the MPO's Transportation Planning and Programming committee for inclusion in the study.

The selected town centers are: Duxbury (the Hall's Corner area), Essex, Holbrook, Lynnfield, Norfolk, and Southborough.

PEDESTRIAN AND BICYCLIST SAFETY

Pedestrians and bicyclists are very vulnerable when motor vehicle traffic is present. Between 1995 and 2001, pedestrians were involved in 1.79 percent of all traffic-related crashes, but made up 25.41 percent of all traffic-related fatalities, in the Boston Region MPO area. In the same period, bicyclists were involved in 0.82 percent of all traffic-related crashes, but made up 2.31 percent of all traffic-related fatalities.[1] Safety is a very important component of planning and designing improvements to the pedestrian and bicycle networks in the region.

SUMMARY

Improving the pedestrian and bicycle environments in town centers enhances a community's character, strengthens economic vitality, and improves safety. Safe bicycle and pedestrian networks serve as attractive alternatives to the automobile, further enhancing these benefits. Improving bicycling and walking in a town center can be a relatively low-cost way to revitalize activity in a community.

The six case studies presented in this report describe, for each town center, the particular issues that need to be addressed and the measures that are appropriate for addressing them. Before the individual cases are discussed, the study's general findings are summarized in the next chapter.

[1] Massachusetts Registry of Motor Vehicles crash data, 1995–2001

general findings and best practices

For each of the six town centers evaluated in this study, the subsequent chapters of this report describe the specific issues related to the pedestrian and bicycle environments to be addressed and include recommendations of specific measures for addressing them. This chapter summarizes some of the general pedestrian and bicycle issues encountered in the six town centers and the types of measures that can be implemented to address those issues. Estimated costs of these measures are also included in this chapter, as well as potential sources of funding to finance these measures.

MassHighway's *Project Development and Design Guide* (January 2006), which is referenced frequently in this chapter, provides a framework for incorporating context-sensitive design and multimodal elements into transportation improvement projects. Elements of the Guide can be applied to all transportation projects in Massachusetts.

PEDESTRIAN ENVIRONMENT

SIDEWALKS

An interconnected, comprehensive sidewalk network provides pedestrians with the mobility they need to access the activity centers in a community. Sidewalks should be constructed in all areas where pedestrian traffic exists or is desirable. Sidewalks should be located strategically to connect centers of activity, including residential and commercial areas, schools, libraries, churches, and recreation areas. A well-maintained, attractive sidewalk can induce more people to walk in a given area.

SURFACE TREATMENT

The sidewalks in the town centers included in this study are made of concrete, brick, or asphalt. These treatment materials are shown in Figure 1. Asphalt is considered by many to be a suburban or rural treatment, whereas brick and concrete are often considered urban treatments. Each of these treatments wears differently over time, and the installation costs vary considerably. Cost

and durability are often the main factors considered when deciding which treatment to employ.

SURFACE CONDITION

Sidewalks can become very uneven over time. Freezing and thawing of the soil can cause cracking and buckling of a sidewalk's surface. Some trees situated near sidewalks have roots that push upward on a sidewalk, causing large bumps and cracks to form, and general wear over time causes surface deterioration. All sidewalk surface materials require periodic maintenance, some more frequently than others. The condition of sidewalk surfaces in the town centers was evaluated using the five categories described in Figure 2. More detailed descriptions of sidewalk conditions in a given town are discussed in the chapter devoted to that town.

WIDTH

Sidewalks should be at least five feet wide to allow pedestrians to pass one another. It is considered acceptable for a sidewalk to be narrowed to three feet wide in order to bypass obstructions. Where there is no buffer between the sidewalk and the roadway, it is desirable for the sidewalk to be six feet wide in residential areas and eight feet wide in commercial areas. If the sidewalk is

Figure 1
SIDEWALK SURFACE TREATMENTS

Sidewalk with asphalt surface

Sidewalk with brick surface

Sidewalk with concrete surface

Wide sidewalk

Narrow sidewalk

adjacent to the wall of a building or a fence, the sidewalk should be wide enough to allow pedestrians to walk comfortably along the wall or fence.[1]

CURB CUT RAMPS

Curb cut ramps are constructed where sidewalks meet intersecting roadways or driveways to provide a smooth transition for pedestrians. Curb cut ramps, when constructed according to the Project Development and Design Guide, are accessible for those with limited mobility. However, pedestrians must go up and down two curb cut ramps at each intersecting roadway or driveway, and too many curb cut ramps can make a sidewalk difficult

[1] Massachusetts Highway Department, *Project Development and Design Guide*, January 2006, pp. 3–14 to 3–16.

Figure 2
SIDEWALK SURFACE CONDITION SCALE

Smooth surface

Some small bumps and/or cracks on the surface

Some medium-sized bumps and/or cracks on the surface

Significant bumps and/or cracks on the surface

Surface in serious disrepair

to traverse. Sidewalks with asphalt surfaces often slope down to the level of intersecting roadways and driveways to make a smooth connection. An alternative to constructing curb cut ramps is to increase the height of the intersecting roadway or driveway to the height of the sidewalk, allowing pedestrians to cross the roadway or driveway without having to go up and down two curb cut ramps.

Most of the sidewalks evaluated for this study have either curb cut ramps or sloping asphalt at intersecting roadways and driveways. Some sidewalks lack such accommodations, making the sidewalks difficult to traverse for persons with limited mobility.

Sidewalks without curbs or buffers invite motorists to park on them.

CURBS

Curbs along the roadway deter motorists from parking on the sidewalk or on a buffer between the roadway and the sidewalk. They also improve a pedestrian's perceived sense of safety, forming a physical barrier between traffic and pedestrians. Curbs are usually made of granite, concrete, or asphalt; each of these materials was used for curbing in the towns evaluated for this study.

Sidewalk with a buffer

BUFFERS

Buffers are sometimes installed between the sidewalk and the roadway to provide distance between vehicles and pedestrians. This distance increases a pedestrian's sense of safety on the sidewalk. Buffers often make a roadway more aesthetically pleasing when landscaped with grass, brick, or plants, including trees. There are buffers along some of the sidewalks in each of the towns evaluated in this study.

Sand and debris create an uneven sidewalk surface.

MAINTENANCE

Throughout the year, but primarily in the spring, sand and debris collect on sidewalks. Sidewalks should be cleared of debris at least seasonally to help maintain a safe surface for pedestrians. In the winter, sidewalks should be kept free of accumulated snow and ice. In most cases, it is the responsibility of the adjacent landowner to clear the sidewalks that front their property. Many of the sidewalks evaluated for this study had collected sand and debris, making the sidewalk surfaces uneven and sometimes hazardous for pedestrians.

Street furniture

STREET FURNITURE

Street furniture, such as benches and lighting, enhances the pedestrian experience by offering a place to rest or making the sidewalk more aesthetically pleasing. Street furniture should be located in places where it is most appropriate, and if it partially obstructs the sidewalk, it should not reduce the width of the sidewalk to less than three feet.[2]

CROSSWALKS

Crosswalks connect sidewalk segments across roadways and across some driveways. A well-designed crosswalk includes a highly visible treatment in the roadway (usually consisting of a painted pattern or inlaid brick), curb cut ramps on both sides, and signs that alert motorists to the crosswalk. Crosswalks should be installed at intersections and at other locations where it is safe and desirable for pedestrians to cross a roadway or a driveway. They should be strategically placed where pedestrians make connections to high-traffic destinations. Depending on the treatment employed, crosswalk surfaces require maintenance every few years to ensure high visibility.

Crosswalk with curb cut ramp

Crosswalk without curb cut ramp

TREATMENT

There are several crosswalk treatments that make crosswalks visible to pedestrians and motorists. MassHighway allows three crosswalk marking patterns: ladder-style (the agency's most-preferred option), parallel-bar-style, and "zebra"-style.[3] These markings are shown in Figure 3.

The majority of crosswalks in the town centers evaluated have a modified parallel-bar-style marking pattern. In

[2] Ibid., pp. 5–14 to 5–15.
[3] Ibid., p. 6-62.

Figure 3
CROSSWALK TREATMENTS

Ladder-style

Parallel-bar-style

Zebra-style

many cases, those crosswalks were accented by a solid paint color (yellow or green) or inlaid bricks between two parallel white lines.

CROSSWALK MARKINGS

The condition of the crosswalk markings in the town centers included in this study varies widely. Some crosswalks had recently been repainted and were highly visible, but others were very faded. Staff evaluated and ranked the condition of the crosswalks on a four-category scale, as described in Figure 4.

CURB CUT RAMPS

Curb cut ramps at the ends of crosswalks provide a smooth connection between the sidewalk and the crosswalk. The *Project Development and Design Guide* provides guidance regarding the slope, orientation, and other design elements of curb cut ramps at crosswalks.[4]

SIGNAGE

Signs are often installed near crosswalks to warn motorists of the presence of pedestrians. Several types of signs were observed in the town centers evaluated in this study: pedestrian-traffic, school, and state-law-

[4] Ibid., pp. 6-61 to 6–67.

Figure 4
CROSSWALK CONDITION SCALE

Highly visible

Sufficiently visible

Moderately faded

Very faded

yield-to-pedestrians (with or without an indication of a fine for not yielding). Yield-to-pedestrian signs on moveable posts are often placed in, or are adjacent to, the roadway, particularly at crosswalks near schools. These signs are shown in Figure 5.

Stop line

STOP LINES

Stop lines indicate where vehicles should stop at a stop sign or traffic signal. They are particularly helpful when placed before crosswalks to remind motorists to look for pedestrian traffic as well as vehicular traffic. The stop line should

Figure 5
SIGNS

Pedestrian-traffic sign

School sign

State-law-yield-to-pedestrians sign

Yield-to-pedestrians sign on a moveable post

be positioned at least four feet before the crosswalk.[5]

Pedestrian signal activation button

SIGNALIZED PEDESTRIAN CROSSWALKS

Signalized pedestrian crosswalks are typically located at signalized intersections, but are sometimes located where there is significant pedestrian traffic or where it may be unsafe to cross while automobile traffic is moving. They provide either an exclusive pedestrian phase, when only pedestrians are allowed to traverse the intersection, or a concurrent pedestrian phase, when pedestrians cross a crosswalk while motor vehicle traffic is moving in a parallel direction.

The pedestrian phase of a signalized crosswalk consists of a walk signal, which indicates when pedestrians may enter the crosswalk, and a flashing don't-walk signal, which indicates that pedestrians already in the crosswalk may continue to the other side of the roadway, but pedestrians not yet in the crosswalk should not begin to cross. The pedestrian phase should be long enough for a pedestrian walking at a speed of 3.5 feet per second to cross to the other side of the roadway.

Only two of the six towns evaluated for this study, Holbrook and Southborough, have signalized crosswalks. More information on those crosswalks can be found in the chapters for those towns.

BICYCLE ENVIRONMENT

ON-STREET BICYCLING

Roads in small towns can be ideal for bicycling: they have relatively low speeds and traffic volumes. While most lack bicycle lanes as exclusive accommodations for bicycles, roads in small towns can still be very safe to ride on. However, bicyclists and motorists must use caution, as conflicts can arise when sharing the road.

ROADWAY SURFACE

An uneven roadway surface can be a major deterrent to bicyclists. Large bumps and cracks can be uncomfortable and often dangerous for bicyclists. Bumps and cracks occur more often near the edge of a roadway, further detracting from bicyclist safety.

Smooth roadway surface

Uneven roadway surface

SHOULDERS

Paved shoulders provide space for bicycling outside of the travel lane. Shoulders that are at least four feet wide can fully accommodate bicyclists, but even narrower shoulders provide some space for bicyclists to partially avoid using the travel lane. Shoulders should be kept

[5] Ibid, p. 6-61.

free of debris (sand, gravel, and refuse) so as not to obstruct bicyclists. Drainage grates that are set back from the roadway so that bicyclists do not have to ride over

Wide shoulder

Narrow shoulder

Bicycle lane

them make for a smoother, safer bicycle ride.

BICYCLE LANES

Bicycle lanes are one-way facilities, usually delineated by striping, that usually accomodate bicycle traffic in the same direction as adjacent vehicle traffic. Bicycle lane markings increase a bicyclist's confidence that motorists will not stray into their path of travel. Likewise, passing motorists are less likely to swerve to the left out of their lane to avoid bicyclists on their right, as often occurs when bicyclists ride in the travel lane. Bicycle lanes should have a minimum width of 4 feet, but a width of 5 feet is preferred in most situations.[6] Many of the roadways in the town centers evaluated in this study are not wide enough to accommodate bicycle lanes.

On-street parking

ON-STREET PARKING

On-street parking can be very dangerous for bicyclists if motorists and bicyclists are not highly alert. Bicyclists should ride outside the reach of an opened car door to avoid a collision. Likewise, motorists wishing to exit their parked vehicle should look behind them for bicyclists before opening the door. Bicyclists should reduce their speed and ride to the left of parked cars in a straight, predictable line. Bicycle lanes and shoulder lines to the left of on-street parking guide bicyclists to a safe location on the roadway. They also remind motorists to be alert for passing bicyclists.

[6] Ibid., pp. 5-20 to 5–21.

Bicycle route sign

SIGNAGE

Bicycle-route and share-the-road signs serve two purposes: they imply a certain level of bicyclist comfort and safety, and they remind motorists to be on the alert for bicyclists along the roadway. None of the town centers evaluated in this study has bicycle-route or share-the-road signs. MassHighway sometimes installs these signs along state highways if several criteria are met. For more information, see MassHighway's Bicycle Route and Share the Road Signing Policy (Policy Directive P-98-003, August 25, 1998).

Children should be educated about bicycle safely.

EDUCATION

Bicycling can be a dangerous activity if bicyclists do not follow the rules of the road. Some common unsafe bicycling habits include riding against motor vehicle traffic in a roadway and riding without a helmet. Some bicyclists, including children, were observed disobeying traffic laws in the town centers evaluated for this study. It is especially important for children to be educated about how to ride safely on and off the roads. Also, parents should model safe bicycling behavior to their children. Educating children about safe bicycling is one component of the commonwealth's Safe Routes to School program, which is described later in this chapter.

BICYCLE PARKING

Bicyclists seek safe and convenient places to store their bicycles at a destination. Bicycle racks should be located at important activity centers, such as town halls, libraries, post offices, schools, commercial areas, recreational facilities, and transit stations. They should be located near the main entrance to these facilities, and should be highly visible. Where possible, bicycle racks should be positioned so that bicycles are protected from rain and harsh weather.

Municipalities in the Boston region are eligible to participate in the Regional Bike Rack Program (described later

in this chapter), which allows them to be reimbursed for bicycle racks purchased according to the program's guidelines.

Current bicycle parking guidelines[7] recommend that providers of bicycle parking select bicycle racks that:

- Support the bicycle frame in two locations, enabling the frame and one or both wheels to be secured
- Allow both front-in and back-in parking
- Are compatible with today's bicycle frames and locks

Common styles of bicycle parking racks are shown in Figure 6. Those that meet the above guidelines include: the inverted-U, "A" (an inverted-U with a horizontal bar), and post-and-loop (also known as bike hitch) racks, each of which supports two bicycles. Many manufacturers produce these or similar styles. These rack elements are often arranged in a row; the spacing between the rack elements should be a minimum of 30 inches (on centers), but preferably 36 to 42 inches.

POTENTIAL SOURCES OF FUNDING

The following programs are potential sources of state funding for the improvements to pedestrian and bicycle networks. In addition to these programs, municipalities can undertake pedestrian and bicycle improvements with their own municipal funds or resources.

CHAPTER 90

Some of the funds for transportation projects undertaken by municipalities is provided through the commonwealth's Chapter 90 program. These funds, which are distributed by MassHighway, may be used for many types of transportation projects, including roadway resurfacing, sidewalk construction, the installation of street lighting, and the construction and maintenance of bikeways. Municipalities pay for the projects they choose to undertake and are reimbursed through the program for eligible expenditures.

In state fiscal year 2006, MassHighway made $175 million in Chapter 90 funds available to municipalities for transportation projects. Funding is made available annually based on a municipality's population, employ-

[7] One reference is Bicycle Parking Guidelines (2002), adopted by the Association of Pedestrian and Bicycle Professionals. For more information, visit www.bicyclinginfo.org/bikepark.pdf.

Figure 6
COMMON BICYCLE RACKS

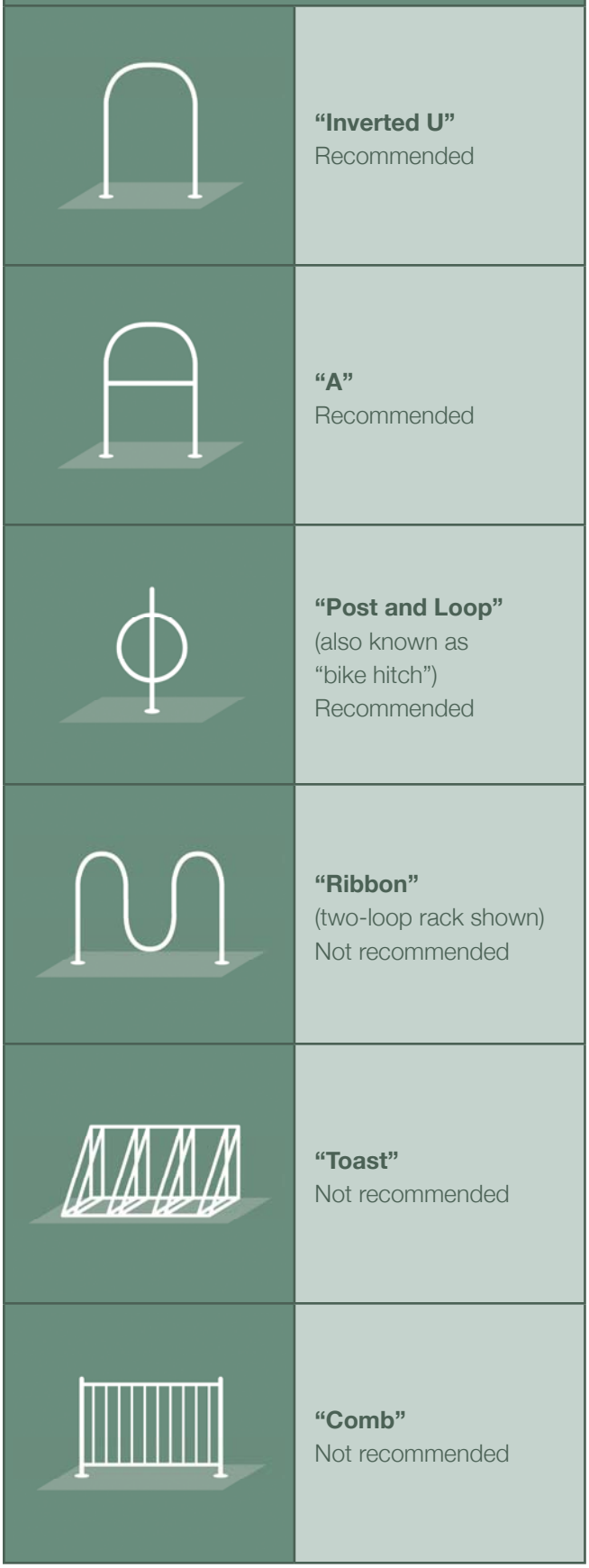


Figure 7
ESTIMATED COSTS OF PEDESTRIAN AND BICYCLE RECOMMENDATIONS

Improvement	Estimated Cost	Source
Install or resurface sidewalk	$110,000 per mile (asphalt)	EOT construction project estimator
	$350,000 per mile (concrete)	www.walkinginfo.org
Install curb along existing sidewalk	$40/linear foot (granite)	EOT construction project estimator
	$15/linear foot (concrete)	www.walkinginfo.org
Stripe crosswalk	$100 for thermoplastic parallel-bar-style marking	EOT construction project estimator
	$100 for paint marking	www.walkinginfo.org
	$300 for thermoplastic ladder-style marking	www.walkinginfo.org
Resurface roadway	$240,000 per mile (based on 24-foot-wide roadway)	EOT project cost estimator
Install sign	$185 for sign and post	EOT project cost estimator
Install bicycle rack	$60–$150 per "inverted-U" rack, $80–$100 per "post and loop" rack, $175–$250 per two–loop ribbon rack (costs do not include installation)	MAPC Regional Bike Parking Program contract price list
Install curb cut ramp	$800–$1,500 per curb cut ramp	www.walkinginfo.org
Stripe bicycle lane	$3,200 per mile	EOT project cost estimator
Stripe on-street parking	$200 for 10 spaces	EOT project cost estimator
Replace pedestrian signal	$15,000–$100,000	EOT project cost estimator

ment, and number of miles of local roadways. For more information on the Chapter 90 program, visit www.mass.gov/mhd.

REGIONAL BIKE PARKING PROGRAM

The Regional Bike Parking Program provides municipalities in the Boston region with the opportunity to purchase bicycle racks and be fully reimbursed for the purchase. The program is administered by MAPC and is funded by the Boston Region MPO, the Executive Office of Transportation, and the Federal Highway Administration. The program has three participating vendors that provide a variety of styles of bicycle racks and other related products.

To participate in the program, municipalities must pay up front for their purchases and are reimbursed for the purchase price if certain criteria are met. The costs of shipping and installation are the responsibility of the municipality and are not reimbursable. MAPC provides information on participating, and a location and installation guide on its Web site, www.mapc.org/transportation/bike_parking_program/intro.html.

TOD BOND PROGRAM

The Transportation-Oriented Development (TOD) Infrastructure and Housing Program (also known as the TOD Bond Program) was created to increase the supply of compact, mixed-use, walkable development close to transit stations. The program provides financial assistance for the construction of pedestrian improvements, bicycle facilities, housing projects, and parking facilities within 0.25 miles of a commuter rail station, subway station, bus station, bus rapid transit station, or ferry terminal. The program also funds the preliminary design

of pedestrian and bicycle facility projects near transit stations.

In state fiscal year 2006, $7 million was allocated to four projects. All public entities, including municipal governments, are eligible for the program. For more information on the TOD Bond Program, visit www.mass.gov/tod.

SAFE ROUTES TO SCHOOL PROGRAM

Massachusetts' Safe Routes to School program aims to improve walking and bicycling conditions for children traveling to school in the commonwealth. Elementary schools that are partnered with the program help implement education programs, activities to encourage bicycling and walking, traffic enforcement, and engineering solutions related to walking and bicycling to school.

Mass*RIDES* administers the Safe Routes to School program for the Executive Office of Transportation. The Safe Routes to School Manual has been sent to all elementary school principals in Massachusetts. The program is funded by the Federal Highway Administration, which has allocated $2.2 million to Massachusetts for its Safe Rates to School program in state fiscal year 2007.[8] For more information, or to download the manual, visit www.commute.com.

PUBLIC WORKS ECONOMIC DEVELOPMENT PROGRAM

The commonwealth's Public Works Economic Development (PWED) program assists municipalities in funding transportation infrastructure projects that stimulate economic development. The program supports transportation projects that are consistent with the commonwealth's Sustainable Development Principles and the Fix-It-First and Communities First initiatives. The PWED program is administered by the Executive Office of Transportation. For more information on the program, visit www.mass.gov/eot.

[8] Federal Highway Administration, Notice of Appointment of Fiscal Year 2007 Safe Routes to School Program Funds, October 3, 2006

duxbury

Duxbury is a residential community situated 33 miles south of Boston along the Atlantic Ocean. The town was incorporated in 1637 as a shipbuilding center. Duxbury's historic relationship to the sea is felt around Hall's Corner, where shops offer maritime memorabilia and a large nautical flagpole stands at the center of the Hall's Corner intersection.

Hall's Corner, located in the southeast area of Duxbury, is the main intersection in the largest commercial center in Duxbury. The Hall's Corner area includes the town's post office, many shops, a gas station, and restaurants, some of which are located at the main intersection. The areas just beyond the commercial center are largely residential. Duxborough Village, a senior housing development, is located within the study area, off of Chestnut Street. The town hall, the town manager's and selectmen's office, the fire department, the senior center, and two churches are located less than a mile away, along Tremont Street (Route 3A).

Duxbury is the largest and most populous town evaluated in this study. In 2000, there were 14,248 residents, a 2.5 percent increase from 1990.[1] The Metropolitan Area Planning Council (MAPC) projects that Duxbury is likely to grow to 16,798 by 2030, representing a 17.9 percent increase from 2000. Duxbury's employment, recorded at 2,347 jobs in 2000, is projected to increase by 19.1 percent by 2030.[2]

Duxbury is served by state routes 3, 3A, 14, 53, and 139, none of which is located within the study area. Route 3A runs north–south about 0.75 miles west of Hall's Corner. It is accessed from Hall's Corner by Chestnut and Depot streets. Route 3, a limited-access highway, is located further west of Hall's Corner.

The town's Ad Hoc Sidewalk Committee released a report in June 2001. It prioritizes roadways for the construction of new sidewalks and provides information about financing, construction standards, and safety. The report recommends that the Town budget $100,000 per year for sidewalk construction along priority roadways. Staff considered these priorities when making recommendations.

Sidewalk and storefront in Hall's Corner, Duxbury

Between 1995 and 2001, there were 20 reported crashes involving pedestrians in Duxbury, representing 1.02 percent of all crashes, and 9 reported crashes involving bicyclists, representing 0.46 percent of all crashes. None of these crashes resulted in fatalities. The pedestrian and bicyclist crash rates in Duxbury are lower than the region's average of 1.79 percent and 0.82 percent, respectively.[3]

STUDY AREA

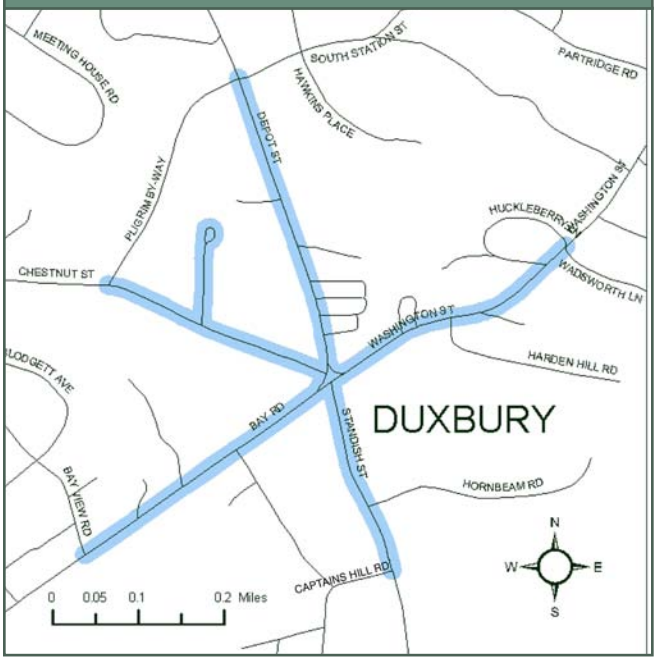
The study area for Duxbury (shown in Figure 8) includes:

- Chestnut Street from Hall's Corner to Pilgrim By-way
- Depot Street from Hall's Corner to South Station Street
- Washington Street from Hall's Corner to Huckleberry Lane

[1] U.S. census
[2] MAPC population and employment projections, January 2006
[3] Massachusetts Registry of Motor Vehicles crash data, 1995–2001

- Standish Street from Hall's Corner to Crescent Street
- Bay Road from Hall's Corner to Bayview Road
- The unnamed roadway leading to Duxborough Village

Figure 8
DUXBURY STUDY AREA



The limited sidewalk network does not include all connections that pedestrians want to make.

SIDEWALKS

Although some sidewalks in Hall's Corner are in good repair, others are uneven and narrow. There are several corridors without sidewalks or with gaps between sidewalk segments, which limits pedestrian mobility and safety. Chestnut and Washington streets have sidewalks on one side of the street for their entire length within the study area. Depot and Standish streets have sidewalks on one or both sides in areas with commercial activity near the Hall's Corner intersection, but they end shortly thereafter. The sidewalks in the Hall's Corner area have either asphalt or brick surfaces. Bay Road does not have a sidewalk on either side. See Figure 9 for a map of the pedestrian network.

CROSSWALKS

There are only two crosswalks at the Hall's Corner intersection: one across Washington Street and one across Bay Road. Some crosswalks in the study area are faded but are visible to motorists and pedestrians, and others have been recently repainted, making them highly visible. Some crosswalks lack curb cut ramps, which would connect the crosswalks to the sidewalks. The limited number of crosswalks in the Hall's Corner area severely restricts pedestrian mobility, as many connections cannot be made safely. See Figure 9 for a map of the pedestrian network.

This crosswalk is faded and does not have curb cuts.

SIGNALIZED PEDESTRIAN CROSSINGS

There are no signalized pedestrian crossings in the Hall's Corner area.

Cars parked along the street can be dangerous to bicyclists.

ON-STREET BICYCLING

The five roadways entering the Hall's Corner intersection are two-lane roads with relatively narrow widths. Washington Street and Bay Road are the only roads with marked shoulders, but the shoulders are not wide enough to fully accommodate bicyclists. The edges of the roadway do not have significant cracks or large debris, with a few exceptions and some of the drainage grates are set back from the roadway. The Hall's Corner intersection is surrounded by on-street parking spaces, which increases the risks to bicyclists, forcing them to use extreme caution when moving by parked cars. See Figure 9 for more information on the bicycle network.

BICYCLE PARKING

There is no bicycle parking in the Hall's Corner area.

TRANSIT

There is no transit service in the Hall's Corner area.

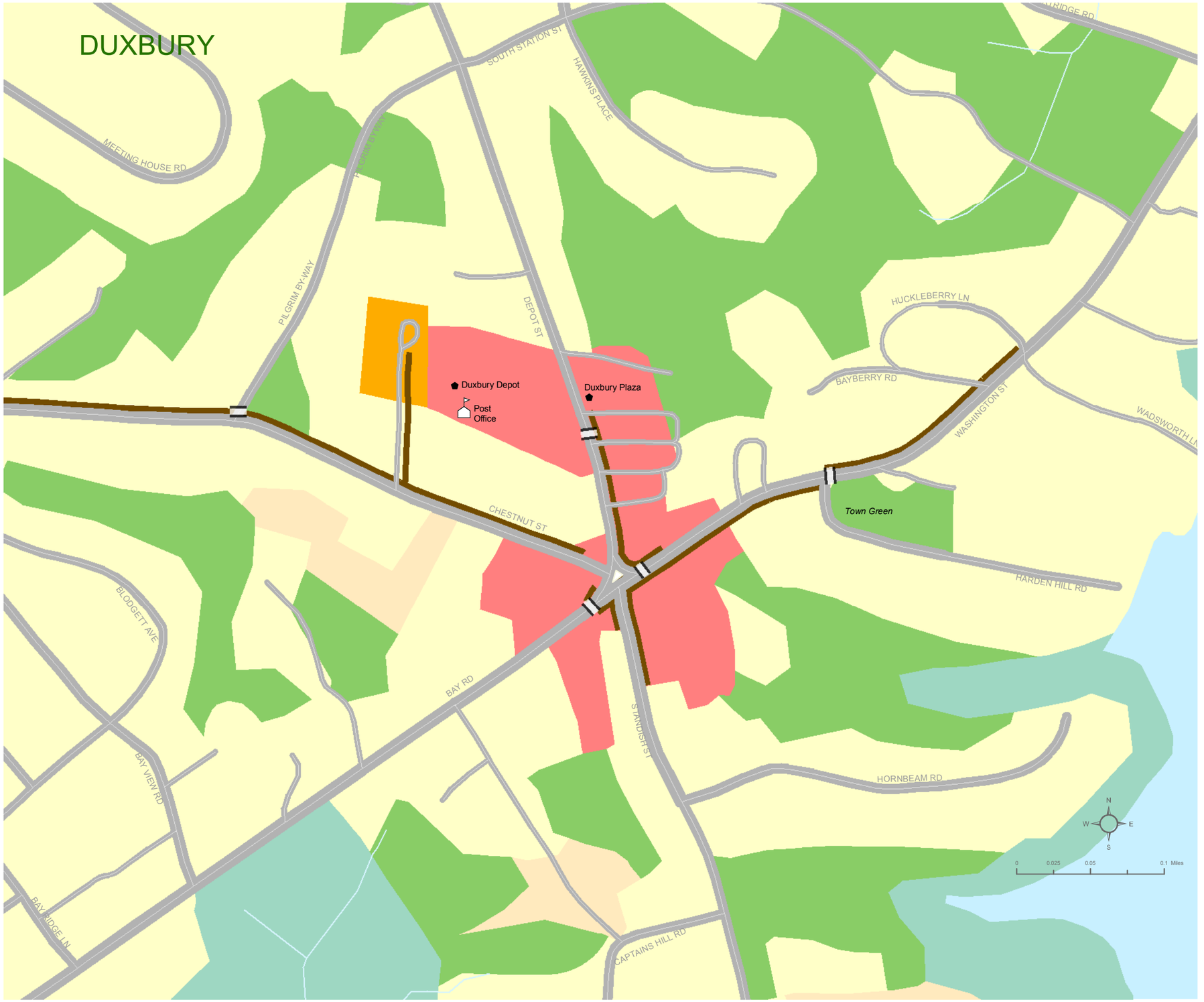


FIGURE 9

Pedestrian and Bicycle Network: Land Use and Activity Generators

Duxbury

Activity Center

- Post office
- Shopping area

Pedestrian Accommodations

- Crosswalk
- Sidewalk

Land Use

- Commercial
- Multifamily residential
- Single-family residential
- Agricultural
- Forest, open land
- Saltwater wetland
- Water

MAJOR INTERSECTION

HALL'S CORNER

Hall's Corner is a five-legged intersection where Depot Street, Washington Street, Standish Street, Bay Road, and Chestnut Street meet. The intersection functions as a traffic circle with an island in the middle. Four of the five roads have stop signs at the intersection; only Chestnut Street does not have a stop sign. The roadway width in the intersection varies from 43 feet to 76 feet, not including on-street parking areas. There are about 50 on-street parking spaces within 100 feet of the intersection. They are a mixture of parallel, angled, and head-in parking spaces. It is difficult to determine by observation whether the parking spaces are on public or private property, as there are no distinct boundaries between some of the parking spaces and the travel lanes.

With only two crosswalks, the sidewalks around the intersection are not well connected. The sidewalks have multiple surface treatments, contributing to the discontinuity:

- Between Chestnut Street and Depot Street: striped asphalt sidewalk along storefront, no curb
- Between Depot Street and Washington Street: brick sidewalk with granite curb
- Between Washington Street and Standish Street: brick sidewalk with granite curb
- Between Standish Street and Bay Road: brick sidewalk with granite curb
- Between Bay Road and Chestnut Street: concrete sidewalk under awning along store fronts, concrete curb

The intersection's unusual design may confuse pedestrians and bicyclists unfamiliar with the configuration. Furthermore, the gaps in the pedestrian network at this location also pose a safety threat.

Staff developed a hypothetical layout for the intersection based on the geometry of the intersection, shown in Figure 10. This layout is meant to show only one potential approach to improving the intersection. Traffic volumes and patterns were not taken into account, because such work goes beyond the scope of this study. In this layout, the intersection functions as a five-legged with a single travel lane. Brick would be installed around the existing island to decrease the width of the travel lane, while allowing large vehicles (fire trucks, for example) to make the turn. Brick islands would be installed at the corners to channelize the movement of vehicles and to provide refuge for pedestrians at some crosswalks, and crosswalks with curb cut ramps would be installed to provide pedestrian connections at all approaches to the intersection. Additional analysis, including the consideration of pedestrian and traffic counts and patterns, would be needed to determine a final set of recommendations to improve the intersection for pedestrians.

Figure 10
HYPOTHETICAL HALL'S CORNER
INTERSECTION LAYOUT

MAJOR CORRIDORS

CHESTNUT STREET: *HALL'S CORNER TO PILGRIM BY-WAY*

Corridor Length: 0.28 miles

ROADWAY

The two travel lanes on Chestnut Street are each 12 feet wide, and there are no marked shoulders or bicycle lanes. The posted speed limit is 30 mph in both directions. The travel lanes are divided by a single solid yellow line. The roadway surface is smooth, with no major impediments. The roadway edge is clear of obstructions that would inhibit the safety of bicyclists. (Figure 11 indicates that there are no rough roadway surfaces in the study area.)

SIDEWALKS

The June 2001 report of the Ad Hoc Sidewalk Committee identifies Chestnut Street as a priority corridor for pedestrians. Since then, a sidewalk has been constructed on the north side of the street from Hall's

Chestnut Street, looking west

Depot Street, looking north

Corner to Tremont Street (Route 3A). The sidewalk is 4.75 feet wide; it is made of asphalt with granite curbs. The surface is smooth and free of significant bumps or cracks (see Figure 11 for more details on sidewalk conditions). There is no buffer between the sidewalk and the roadway from Hall's Corner to Pilgrim By-way. There is a 2-foot-wide grass/dirt buffer extending from Pilgrim By-way to beyond the study area. The asphalt sidewalk slopes down to the level of intersecting roadways and driveways.

Duxborough Village, a senior housing development, is located off of Chestnut Street. There is an asphalt sidewalk leading to the development. There are some significant bumps and cracks in the sidewalk's surface in the portion of the sidewalk closest to Chestnut Street.

CROSSWALKS

There is one crosswalk along this corridor:

- Across Pilgrim By-way at Chestnut Street

This crosswalk has a highly visible pavement marking (see Figure 11 for more details on crosswalk condition).

BICYCLE PARKING

There is no bicycle parking along this corridor.

DEPOT STREET: *HALL'S CORNER TO PRIOR FARM ROAD*

Corridor Length: 0.37 miles

ROADWAY

Depot Street has two 10-foot-wide travel lanes. The posted speed limit is 30 mph heading north and is not posted in the southbound direction. The travel lanes are divided by a single solid yellow line. The roadway surface is mostly smooth, with a few sections of minor bumps and cracks. There are no marked bicycle lanes or shoulders. The roadway edge is relatively clear of obstructions that could inhibit bicyclist safety. (Figure 11 indicates that there are no rough roadway surfaces in the study area.)

SIDEWALKS

There is a sidewalk on the east side of the street from Hall's Corner to the Duxbury Marketplace shopping center. The sidewalk is five feet wide and has a brick surface with granite curbs. The sidewalk surface is fairly smooth, with some sections of minor unevenness that are not likely to decrease pedestrian safety (see Figure 11 for more details on sidewalk conditions). There is no buffer between the sidewalk and the roadway. At the driveway to the gas station in Hall's Corner, the brick surface crosses the driveway to meet the sidewalk on the other side.

The June 2001 report of the Ad Hoc Sidewalk Committee identifies Depot Street as a priority corridor for pedestrians. A sidewalk could be constructed along the east side of the street from the shopping center to South Station Street and beyond. This sidewalk would connect residents of Depot Street to the town offices to the north and the stores in the Hall's Corner area. If a sidewalk were to be constructed, a crosswalk across South Station Street would be necessary.

CROSSWALKS

There is one crosswalk along this corridor:

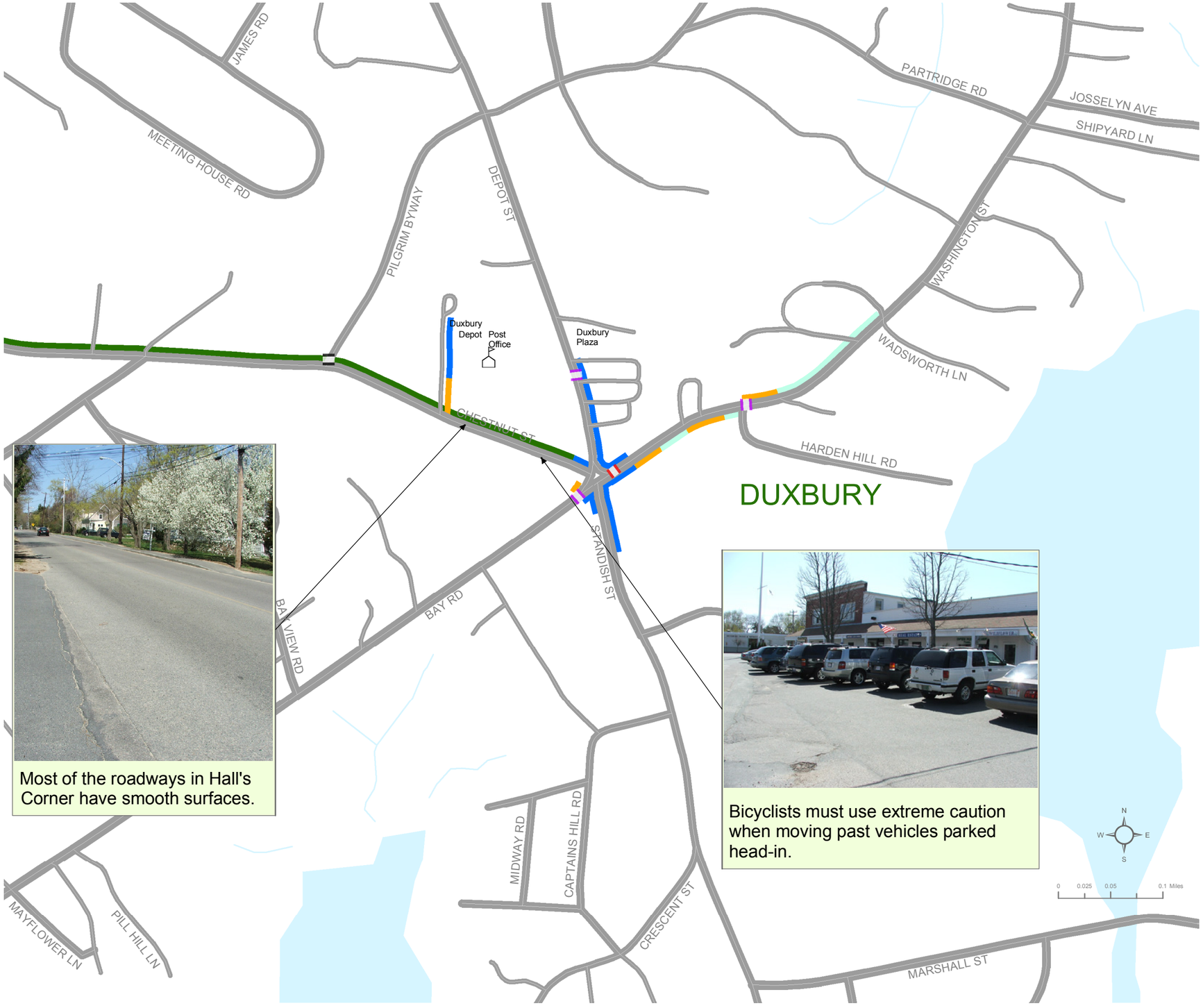
- Across Depot Street at the two shopping centers

This crosswalk has a moderately faded pavement marking (see Figure 11 for more details on crosswalk conditions). It should be relocated so that the crosswalk meets the sidewalk that leads to the shopping center on the west side of Depot Street.

FIGURE 11

Pedestrian and Bicycle Network: Conditions

Duxbury



Most of the roadways in Hall's Corner have smooth surfaces.

Bicyclists must use extreme caution when moving past vehicles parked head-in.

Crosswalk Markings

- Highly visible
- Sufficiently visible
- Moderately faded
- Very faded

Sidewalk Surface

- Smooth
- Some small bumps and/or cracks
- Some medium-sized bumps and/or cracks
- Significant bumps and/or cracks
- In serious disrepair

There are no crosswalks across South Station Street or the four driveways to the shopping center on the east side of Depot Street. Crosswalks at these locations could serve as a reminder for motorists to look for pedestrians and could guide pedestrians across the driveways.

BICYCLE PARKING

There is no bicycle parking along this corridor. A bicycle rack should be installed at each of the shopping centers on Depot Street.

WASHINGTON STREET: *HALL'S CORNER TO HUCKLEBERRY LANE*

Corridor Length: 0.33 miles

Washington Street, looking southwest

ROADWAY

Washington Street has two travel lanes that are 12 feet wide. The posted speed limit is 30 mph in both directions. The travel lanes are divided by a double solid yellow line. The roadway surface is mostly smooth, with a few sections of small bumps, cracks, and patches. There are no marked bicycle lanes or shoulders. Storm drain grates, sand, and gravel obstruct the roadway edge. (Figure 11 indicates that there are no rough roadway surfaces in the study area.)

SIDEWALKS

The June 2001 report of the Ad Hoc Duxbury Sidewalk Committee identifies Washington Street as a priority corridor for pedestrians. There are several sidewalk segments along Washington Street: on the north side of the street, in front of the gas station (a continuation of the Depot Street sidewalk); on the south side of the street from Hall's Corner to Harden Hill Road; and on the north side of the street from Harden Hill Road to Huckleberry Lane.

In front of the gas station, the sidewalk is 5 feet wide and has a brick surface with granite curbs. The sidewalk surface is smooth, with no major impediments affecting the safety of pedestrians (see Figure 11 for more details on sidewalk conditions). There is a narrow grass buffer between the sidewalk and the roadway. At the driveway to the gas station, the brick surface crosses the driveway to meet the sidewalk on the other side. The sidewalk ends, without any other connections, at the northern edge of the gas station property.

Along the east side of the street from Hall's Corner to Harden Hill Road, the sidewalk begins as a continuation of the Standish Street sidewalk, with a brick surface and granite curbs. In that section, it is about 5 feet wide. The brick surface crosses several driveways, meeting the sidewalk on the opposite side. At 21 Washington Street, the sidewalk surface becomes asphalt, with a concrete curb. In that section, the sidewalk is about 4 feet wide, with bumps, cracks, and patches that could make the sidewalk unsafe for some pedestrians. Several trees partially obstruct the right-of-way in some locations, and there is no buffer between the sidewalk and the roadway. The asphalt sidewalk slopes down to meet the level of intersecting driveways.

The sidewalk along the west side of the street begins at a crosswalk across Washington Street at Harden Hill Road, and continues north beyond the study area. The sidewalk begins with a width of 2.75 feet, but soon widens to 4.5 feet, and is made of asphalt, with a concrete curb. The surface has bumps, cracks, and patches that could make the sidewalk unsafe for some pedestrians. Utility poles and fire hydrants on the sidewalk partially obstruct passage in several locations. There is no buffer between the sidewalk and the roadway. The asphalt sidewalk slopes down to meet the level of intersecting driveways.

CROSSWALKS

There are two crosswalks along this corridor:

- Across Washington Street at Hall's Corner
- Across Washington Street at Harden Hill Road

These crosswalks have very faded and moderately faded pavement markings, respectively (see Figure 11 for more details on crosswalk conditions). The crosswalk at Harden Hill Road is striped at a sharp angle to the roadway. It should be restriped to be perpendicular to the roadway. Doing so shortens the length of the

crossing and positions pedestrians at a better angle to look both ways before crossing the roadway.

BICYCLE PARKING

There is no bicycle parking along this corridor. A bicycle rack should be installed at the Town Green along Washington Street.

STANDISH STREET: *HALL'S CORNER TO CAPTAINS HILL ROAD*

Corridor Length: 0.23 miles

Standish Street, looking south

ROADWAY

The travel lanes on Standish Street are each approximately 10 feet wide and have no marked shoulders or bicycle lanes. The posted speed limit is 30 mph in both directions. The two travel lanes are divided by a single solid yellow line. The roadway surface is mostly smooth, with a few cracks that are not safety concerns for bicyclists. The roadway edge is clear of obstructions that could pose a significant safety threat to bicyclists. (Figure 11 indicates that there are no rough roadway surfaces in the study area.)

There are 13 on-street parallel parking spaces on the east side of Standish Street near the Hall's Corner intersection, and 4 on-street, angle-in parking spaces on the east side of the street at the intersection. There are signs on the east side of the street south of the marked on-street parking spaces that indicate no parking between 8:00 AM and 5:00 PM Monday–Saturday. Cars are allowed to park at the edge of the roadway in this area at all other times. This narrows the width of the usable roadway usable for moving vehicles and bicyclists. Town officials should consider not allowing parking along the roadway at this location.

SIDEWALKS

The June 2001 report of the Ad Hoc Sidewalk Committee does not identify Standish Street as a priority corridor for pedestrians. There are two sidewalk segments along Standish Street.

Along the east side of Standish Street, the sidewalk is a continuation of the Washington Street sidewalk, ending before 27 Standish Street. It has a brick surface, and is separated from the roadway with a granite curb. The sidewalk surface is smooth, though it has some uneven sections that could decrease pedestrian safety (see Figure 11 for more details on sidewalk conditions). The sidewalk, which is 13 feet wide, has trees, benches, and utility poles that serve as buffers between the sidewalk and on-street parking along Standish Street. The brick surface crosses two driveways to meet the sidewalk on the other side. Where the sidewalk ends, a path continues in front of a few houses, showing potential demand for a sidewalk that would connect the residential areas of Standish Street to the shops at Hall's Corner.

Along the west side of Standish Street, the sidewalk has a brick surface and a granite curb. The sidewalk surface is smooth, with some uneven sections that may detract from pedestrian safety. The sidewalk is about 5.5 feet wide, widening as it approaches Hall's Corner. The sidewalk ends just after 8 Standish Street, but there is a worn path on the edges of lawns that continues past a few houses. This shows demand for a sidewalk that would connect the residential areas to Hall's Corner.

CROSSWALKS

There are no crosswalks along this corridor.

A crosswalk could be striped across Standish Street where the sidewalk on the west side of the street ends in order to provide a connection from that sidewalk to the shops on the other side of the street.

BICYCLE PARKING

There is no bicycle parking along this corridor. A bicycle rack should be installed in front of the shops on the east side of Standish Street.

BAY ROAD: *HALL'S CORNER TO BAYVIEW ROAD*

Corridor Length: 0.35 miles

ROADWAY

The roadway's two travel lanes are approximately 10 feet wide, for a combined width of 20 feet. The shoulder varies from 1 to 9 feet wide on the west side of the street and 3 to 7 feet wide on the east side. The posted speed limit is 30 mph heading west, but there is no

posted speed limit in the eastbound direction. The travel lanes are divided by a double solid yellow line, and solid white lines delineate the shoulders. The roadway surface is smooth, with a few cracks that do not pose a safety threat to bicyclists. However, the shoulders have a large amount of debris within 100 feet of Hall's Corner, making bicycling conditions very dangerous in that area. (Figure 11 indicates that there are no rough roadway surfaces in the study area.)

Bay Road, looking northeast

SIDEWALKS

The June 2001 report of the Ad Hoc Sidewalk Committee does not identify Bay Road as a priority corridor for pedestrians. There are no sidewalks along Bay Road. There is a short sidewalk connecting the west end of the crosswalk across Bay Road at the Hall's Corner intersection to the covered sidewalk in front of the shops at the intersection between Bay Road and Chestnut Street. This short segment is made of concrete and has significant cracks that make the surface very uneven.

CROSSWALKS

There is one crosswalk along this corridor:

- Across Bay Road at Hall's Corner

This crosswalk has moderately faded pavement markings (see Figure 11 for more details on crosswalk conditions).

RECOMMENDATIONS

Below is a set of recommendations for improvements to the pedestrian and bicycle environments in the Hall's Corner area. See Figure 12 for a map of these recommendations.

PEDESTRIAN ENVIRONMENT

CONSTRUCT SIDEWALKS

- Along the east side of Depot Street from the shopping center to South Station Street and beyond
- Along the east side of Standish Street from the end of the existing sidewalk to Hornbeam Road

RESURFACE SIDEWALKS

- Along the east side of the Duxborough Village driveway near Chestnut Street
- Along the east side of Washington Street in two short segments between Hall's Corner and Harden Hill Road
- Along the west side of Washington Street in a short segment between Harden Hill Road and Huckleberry Lane; widen to at least 4.5 feet
- Along the west side of Bay Road at the Hall's Corner intersection

INSTALL CROSSWALKS

- Across the four driveways to the shops on Depot Street
- Across South Station Street at Depot Street
- Across Standish Street at 8 Standish Street

RELOCATE CROSSWALK

- Across Depot Street at the shopping center; relocate the crosswalk so it meets the sidewalk that leads to the shopping center; and install curb cut ramps

IMPROVE CROSSWALK

- Across Washington Street at Harden Hill Road; make the crosswalk perpendicular to the road way, install curb cut ramps

BICYCLE ENVIRONMENT

ROADWAY RESURFACE

- Clear debris from the shoulders on Bay Road near the Hall's Corner intersection

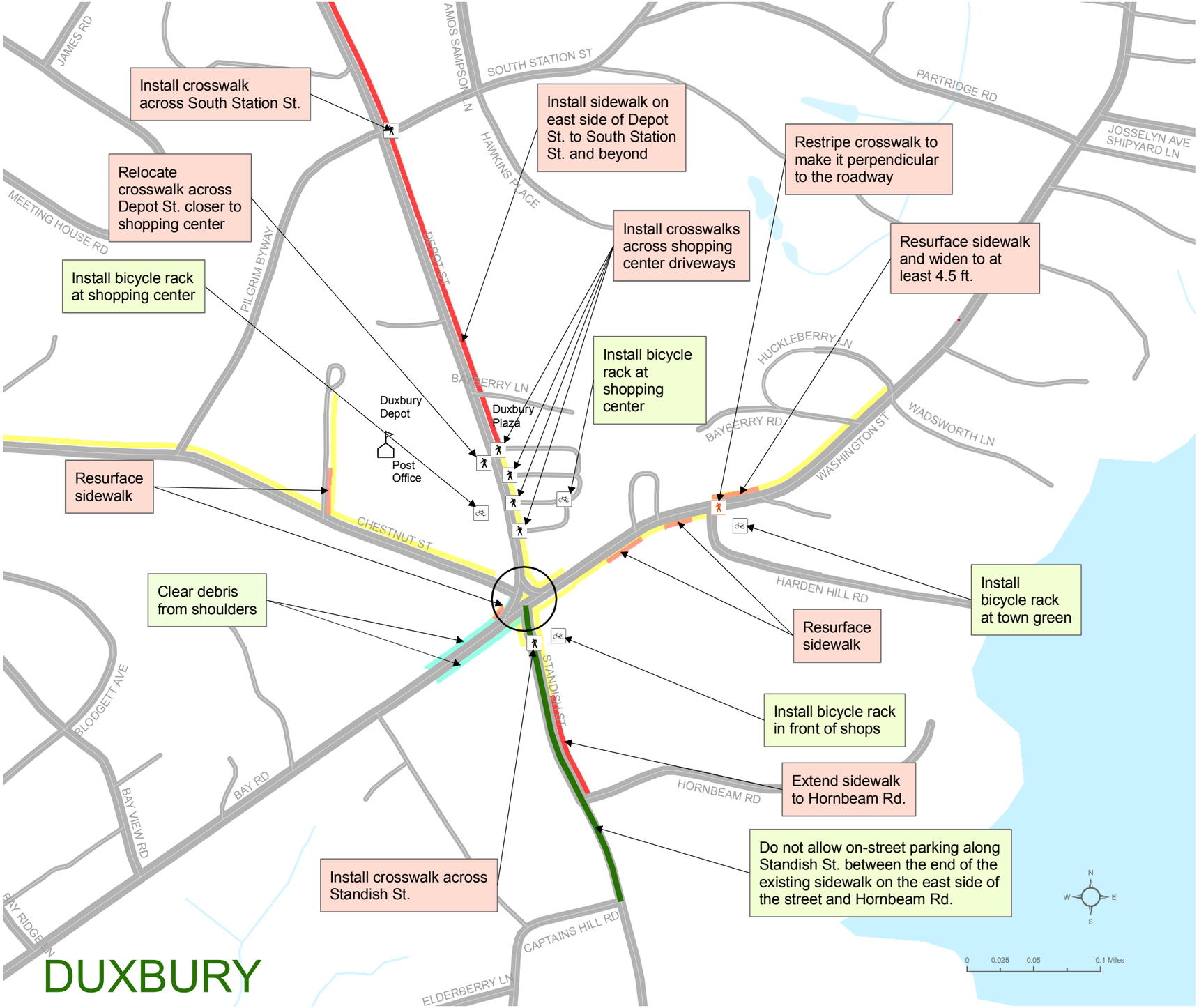
SIGNAGE

- Do not allow on-street parking along Standish Street between the end of the existing sidewalk on the east side of the street to Hornbeam Road; the roadway is not wide enough to safely accommodate on-street parking in this segment.

INSTALL BICYCLE RACKS

- At the two shopping centers on Depot Street
- At the town green at the corner of Washington Street and Harden Hill Road
- In front of the shops along Standish Street

FIGURE 12
Recommendations
Duxbury



Improvements detailed in Figure 10

Install crosswalk

Restripe crosswalk

Install bicycle rack

Install sidewalk

Resurface sidewalk

Install no-parking signs

Remove debris

Existing sidewalk

Pedestrian recommendation

Bicycle recommendation