

# APPENDIX B:

DESIGN FEATURES, STANDARDS, AND BEST PRACTICES

# DESIGN FEATURES AND STANDARDS

In order to realize the creation of a functional, safe and user friendly pedestrian network, design improvements and a consistency of purpose and philosophy should exist at the state, regional and local levels. Increased emphasis on healthy transportation modes has created greater demands on our transportation systems. Any viable pedestrian planning activity or improvement must reflect a familiarity with the following terms, definitions and concepts:

## WALKING ENVIRONMENT

### SIDEWALKS, CROSSWALKS AND CURB RAMPS

Crosswalks, sidewalks, and curb ramps are important tools for pedestrian accessibility and safety and should always be found together.

#### Sidewalks

The definition of a sidewalk is “a paved path for pedestrians at the side of the road.” While this definition is technically accurate, it does not capture the full essence of the entity. A sidewalk’s main purpose is to provide safe travel for a pedestrian but it also can be a social space or an attraction for business, for example a sidewalk with enough room to accommodate seating for a streetside café as shown in Figure 1. When designing or improving a sidewalk it is important to not only take into account the safety of pedestrians, the nature of the roadway/area and potential for economic development should also be considered.



Figure 1: Example of a sidewalk with a social aspect

Typical dimensions for sidewalks as recommended by most guidelines consist of a minimum sidewalk width of 5 feet with a 6-inch curb, preferred total curb and sidewalk width of 6 feet. Sidewalks can be incorporated on one or both sides of the roadway based on the presence of pedestrian generators and space constraints. All sidewalks should be in compliance with ADA standards including a minimum passing width of ???. Care should also be taken to place street furniture such as utility poles and boxes, signage, trash receptacles, bike racks, benches, etc. out of the travel path. Sidewalks should always incorporate crosswalks and curb ramps to allow for safe crossing and accessibility.

#### Crosswalks

Crosswalks are defined as specially paved or marked paths for pedestrians crossing a street and typically fall into two categories – intersection crosswalks and mid-block crosswalks. Intersection crosswalks are generally considered safer than mid-block crossings as the stop control of the intersection usually provides some form of protection for the crossing pedestrian and pedestrians crossing at intersections are also more expected than mid-block crosswalks. While intersection crossings are typically preferred, there are some situations where a mid-block crossing is necessary, for example places where there is a long distance between intersections and/or there are a high volume of pedestrians crossing. Features such as curb extensions (bump-outs), median refuge islands, in-street signage, rectangular rapid flashing beacons, HAWK systems and others as discussed in the traffic calming section can increase the safety of mid-block crossings.

There are several different patterns associated with crosswalk pavement markings, the most common being the “standard” format consisting of two white lines outlining the crosswalk. Other types solid, continental, dashed, zebra and ladder as shown in Figure 18. Studies have shown that the continental and ladder crosswalks are the most visible to motorists and when blank space between lines is aligned with the wheel path are also the longest lasting type of marking.

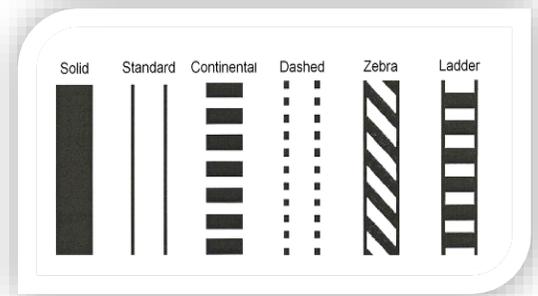


Figure 2: Types of Crosswalk Pavement Markings

### Curb Ramps

Curb ramps and curb ramps are solid ramps providing transition between the sidewalk and street level and can either face the direction of travel through the crosswalk or be placed at an apex angle to provide access to two perpendicular crosswalks. Curb ramps that face the direction of travel or directly lead into a crosswalk are preferred over apex ramps by low vision and blind users as they provide guidance on the location of the crosswalk as well as the appropriate direction of travel. A typical curb ramp is shown in Figure 19. Curb ramps should always meet Americans with Disability Act (ADA) design guidance and should have a tactile warning panel. Tactile (or detectable) warning panels, as shown in Figure 20, are rectangular panels with raised bumps that alert pedestrians with low vision or blindness to the presence and direction of a roadway crossing. The panels should be a contrasting color to the sidewalk to allow for greater visibility and should always face the direction of travel.

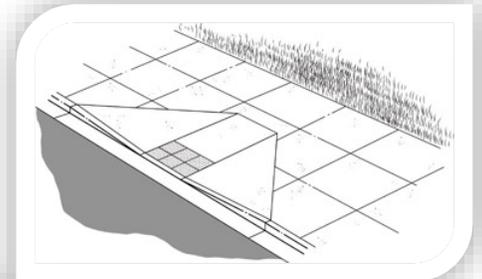


Figure 4: Typical Curb Ramp



Figure 3: Tactile (detectable) Warning Panel

## AMERICANS WITH DISABILITIES ACT (ADA) STANDARDS

The Americans with Disabilities Act (**ADA**) became law in 1990 and is a civil rights law that prohibits discrimination against individuals with disabilities in all areas of public life, including jobs, schools, transportation, and all public and private places that are open to the general public.

The Department of Justice’s revised regulations for [Titles II](#) and [III](#) of the Americans with Disabilities Act of 1990 (ADA) were published in the Federal Register on September 15, 2010. These regulations adopted revised, enforceable accessibility standards called the **2010 ADA Standards for Accessible Design**, "2010 Standards." On March 15, 2012, compliance with the 2010 Standards was required for new construction and alterations under [Titles II](#) and [III](#). March 15, 2012, is also the compliance date for using the 2010 Standards for program accessibility and barrier removal. (Source: 2010 ADA Standards for Accessible Design, Department of Justice, September 15, 2010)

## TRAFFIC CALMING

Traffic calming refers to roadway treatments that slow, or “calm,” traffic. The measures described in this section have been proven to increase the safety of pedestrians by slowing traffic and other features.

### Curb Extensions

Curb extensions, also called bump-outs or bulb-outs, are a physical extension of the sidewalk into the roadway to narrow the roadway and provide additional pedestrian space at key locations. Curb extensions enhance pedestrian safety by increasing pedestrian visibility, shortening crossing distances, slowing turning vehicles by tightening the turn radius, and visually narrowing the roadway. They can be used at intersections or mid-block crossings and can often be used as an opportunity to create public spaces, improve the visual appeal of an area or provide a waiting area for transit.

Generally, the further the bulb-out extends into the roadway and the tighter the turn radius created by the bulb-out the greater the benefits, but should be balanced against roadway characteristics and the needs of large vehicles to navigate turns. Some other considerations include expense of additional materials/design, loss of parking and ease of snow removal.

### Median Refuge Islands

Median refuge islands, sometimes referred to as pedestrian safety areas, are a raised or marked area between two opposing directions of travel that allow pedestrians to cross one direction of traffic at a time. This significantly reduces the complexity of the crossing. Providing raised medians or pedestrian refuge areas at pedestrian crossings at marked crosswalks has demonstrated a 46 percent reduction in pedestrian crashes. At unmarked crosswalk locations, pedestrian crashes have been reduced by 39 percent.<sup>3</sup> Installing raised pedestrian refuge islands on the approaches to unsignalized intersections has had the most impact reducing pedestrian crashes.



Figure 5: Example of a Median Refuge Island

### Signage

Signage can be a low cost measure to improve pedestrian safety. High visibility crosswalk signs or crosswalk signage placed in the street make the crosswalk more apparent to drivers. (Need to expand)

Various signs may be placed at marked crosswalks, indicating that motorists must yield for pedestrians crossing within them. In-roadway and overhead signs increase the visibility of crosswalks, compared with signs posted on the sides of roadways. For wide crossings, which expose pedestrians to vehicular traffic for a longer period of time, measures in addition to signs may be needed



Figure 6: In Road Pedestrian Signage

### Rectangular Rapid Flashing Beacons (RFFB)

Rectangular Rapid Flashing Beacons (RFFB) generally consist of a pedestrian warning sign, diagonal downward arrow plaque, and user-activated light-emitting diodes (LEDs) using an irregular flash pattern as shown in Figure B-. See Chapter 4F and Section 4L.03 of the MUTCD, as well as FHWA’s RFFB Informational Sheet. RFFBs are not yet incorporated into the MUTCD, but MassDOT and local agencies have interim approval from FHWA to use them (see Figure 7).

**Flashing Beacons** Three primary types of flashing beacons may be used to warn motorists of pedestrian crossings: Figure 7. Example of a hybrid beacon (top) and an RFFB (bottom) Case Study: Brookline For decades, people walking along the Emerald Necklace park

system in Brookline struggled to cross Route 9, a busy six-lane roadway. Rather than walk 650 feet out of the way in either direction to access designated crosswalks, most people would choose the most direct route across Route 9, utilizing a narrow median as a refuge. Initiated in 2011, the planning process involved coordination between multiple jurisdictions including the Town of Brookline, City of Boston, MassDOT, MBTA and the Department of Conservation and Recreation. The project was advised by the Emerald Necklace Bicycle and Pedestrian Crossings Committee. Completed in 2016, the project added a 12-foot-wide shared use crossing, traffic signals, Accessible Pedestrian Signal (APS) buttons, a widened median, new connecting shared use paths, and modifications to Route 9 and intersecting streets designed to calm traffic and improve safety for all users. For more information, visit the Town of Brookline’s project website. New crossing of Route 9 in Brookline. Credit: Jenna Fisher, Wicked Local Pedestrian Transportation Plan | Municipal Resource Guide 18 » Pedestrian hybrid beacons (PHB) - pedestrian-activated warning device located on the roadside or on mast arms over mid-block pedestrian crossings. The beacon head consists of two red lenses above a single yellow lens (see Figure 7). » Warning beacons - consists of one or more signal sections of a standard traffic signal face with a flashing circular yellow signal indication in each signal section. Warning beacons may only be used to supplement an appropriate warning or regulatory sign or marker.

### High Intensity Activated Crosswalk (HAWK) Systems

Figure 7: Example of Rectangular Rapid Flashing Beacons

Figure 8: Example of a HAWK System

Figure 9: How a HAWK Signal Operates

## SIGNALIZED INTERSECTION MEASURES

### Pedestrian Leading Interval, Pedestrian Countdown Signals, etc. exclusive vs concurrent



Signals should include pedestrian indicators with countdown timers and pedestrian phases timed at a minimum of 3.5 feet per second, the average walking speed of a typical adult. Approaches may include automatic methods for detecting pedestrians, programming signals so that walk cycles automatically appear, and concurrent phasing featuring leading pedestrian intervals as described below. (APS) are required at all signalized whether or not the walk phase is

Accessible pedestrian signals crossings regardless of

automatic. For more information, see: » Accessible Pedestrian Signals on page 34 » Pages 37 – 40 of FHWA’s Achieving Multimodal Networks Leading Pedestrian Intervals Used as a strategy to reduce conflicts with turning vehicles, communities can give pedestrians a head start at signals, often referred to as a Leading Pedestrian Interval (LPI). The walk phase begins three to seven seconds before parallel traffic is given the green light, allowing pedestrians to enter the crosswalk before motorists begin to move (see Figure 8). This makes people walking more visible to motorists, and allows them to finish crossing and get back onto the sidewalk sooner. For more information, see Leading Pedestrian Interval in the USDG

## DESIGN GUIDANCE/GUIDELINES

The following guidelines and reference manuals are recommended for pedestrian infrastructure design:

- Manual on Uniform Traffic Control Devices
- Massachusetts Highway Design Guide
- National Association of City Transportation Officials (NACTO) Urban Street Design Guide, 2013.
- American Association of State and Highway Transportation Officials (AASHTO) Guide for the Planning, Design and Operation of Pedestrian Facilities, July 2004.
- MassDOT Municipal Resource Guide for Walkability, 2017

