



Baystate Roads Program Local Technical Assistance Program (LTAP) **TECH**notes

CROSSWALKS #60

Pedestrian accommodation is a critical element of transportation safety

In 2011, pedestrian crashes accounted for 1.9% of all crashes and for over 12% of the fatal crashes in Massachusetts. This equated to 2,086 pedestrians involved in crashes.¹ Based upon these statistics, pedestrian accommodation should be a critical element of transportation safety, and, in fact, is required under Massachusetts General Law (M.G.L. Ch.89§11). One common practice for accommodating pedestrians is the use of crosswalks.

Roadways must accommodate a wide variety of pedestrians who behave differently and have a variety of physical, cognitive, and sensory abilities. From a crossing perspective, this is important as some pedestrians may require more time to cross a street and desire more predictable surfaces. Similarly, pedestrians who are visually impaired may require audible and tactile cues. Pedestrians using wheelchairs may cross the street more quickly, but are also more difficult to see from a vehicle.

1. UMass Safe Traffic Safety Research Program, "Massachusetts Traffic Safety Data Overview: Non-Motorist", April 2011, p.4.



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Designing a Crosswalk

Crosswalk markings provide guidance for pedestrians who are crossing roadways. Minimally, crosswalks must consist of two parallel lines that shall not be less than 6 inches or greater than 24 inches in width. The crosswalk should have a width of no less than six feet.

For added visibility, additional marking opportunities exist. For example, the preferred type of crosswalk marking in many municipalities is the ladder, or

"continental" pattern consisting of white longitudinal lines parallel to traffic flow; however, "zebra" (diagonal) striping may also be used. Longitudinal or diagonal lines should be 12 to 24 inches wide and separated by gaps of 12 to 60 inches. Crosswalk markings should avoid wheel paths if possible. In addition, the spacing should not exceed 2.5 times the width of the diagonal or longitudinal lines. See the *Manual on Uniform Traffic Control Devices (MUTCD Section 3B.18)* for more information.

Installing Crosswalks

Crosswalks are typically installed at intersections where pedestrian delineation proves beneficial. At non-intersection locations, crosswalks should only be added when there is both a significant pedestrian presence and after an engineering study deems it safe.



When to Install Crosswalks

Crosswalk markings provide guidance for pedestrians who are crossing roadways by defining and delineating paths on approaches to and within signalized intersections, and on approaches to other intersections where traffic stops.

In conjunction with signs and other measures, crosswalk markings help to alert road users of a designated pedestrian crossing point across roadways at locations that are not controlled by traffic control signals or STOP or YIELD signs. At non-intersection locations, crosswalk markings legally establish the crosswalk.

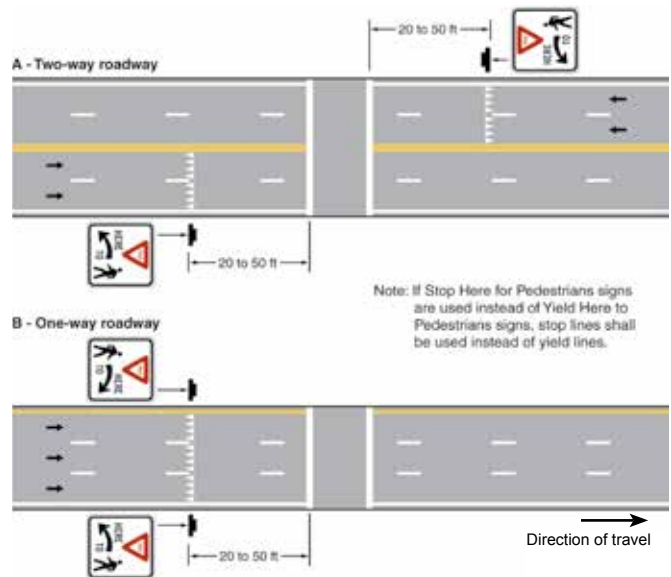
As per the MUTCD Section 3B.18, crosswalk lines should not be used indiscriminately. An engineering study should be performed before a marked crosswalk is installed at a location away from a traffic control signal or an approach controlled by a STOP or YIELD sign. The engineering study should consider the number of lanes, the presence of a median, the distance from adjacent signalized intersections, the pedestrian volumes and delays, the average daily traffic (ADT), the posted or statutory speed limit or 85th-percentile speed, the geometry of the location, the possible consolidation of multiple crossing points, the availability of street lighting, and other appropriate factors.

New marked crosswalks alone, without other measures designed to reduce traffic speeds, shorten crossing distances, enhance driver awareness of the crossing, and/or provide active warning of pedestrian presence, should not be installed across uncontrolled roadways where the speed limit exceeds 40 mph and either:

- A. The roadway has four or more lanes of travel without a raised median or pedestrian refuge island and an ADT of 12,000 vehicles per day or greater; or
- B. The roadway has four or more lanes of travel with a raised median or pedestrian refuge island and an ADT of 15,000 vehicles per day or greater.

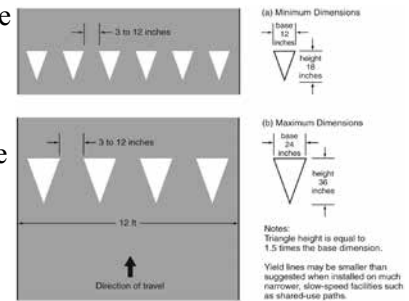
Because non-intersection pedestrian crossings are generally unexpected by the road user, warning signs should be installed for all marked crosswalks at non-intersection locations and adequate visibility should be provided by parking prohibitions that restrict parking within the 20 to 50 foot area between the yield line and the crosswalk.

See the *Manual on Uniform Traffic Control Devices (MUTCD, Section 2C.50 and 3B.17)*



Non-Intersection Crosswalks

At non-intersection locations, in addition to the crosswalk markings, yield lines may be used to indicate the point at which vehicles should yield to pedestrians. Yield lines consist of solid white isosceles triangles pointing toward approaching vehicles and extend across the approach lane. The individual triangles have a base 12 to 24 inches wide and a height of 1.5 times the base, and are spaced 3 to 12 inches apart. If used, yield lines should be placed next to a "Yield Here to Pedestrians" (R1-5) sign. See the *MUTCD Section 3B.16 and 3B.17* for additional details at these locations.



Crosswalks at Intersections

At locations controlled by traffic control signals or on approaches controlled by STOP or YIELD signs, crosswalk lines should be installed where engineering judgment indicates they are needed to direct pedestrians to the proper crossing path(s). Crosswalks should be marked so that:

- They help pedestrians find their way across a complex intersection;
- They show pedestrians a safe route across traffic;
- They minimize exposure to vehicles, bicycles, and traffic conflicts; and
- They position pedestrians where they can best be seen by oncoming traffic.
- Their curb ramps are within the extension of the crosswalk markings.



Crosswalk Enhancements On Local Roadways

Raised Crosswalks

These are marked crosswalks that are raised to act simultaneously as a speed hump. Approach markings signal drivers that the crosswalk is higher than the main roadway. Crosswalk markings or contrasting crosswalk materials show this element is also a crosswalk. As both a marked crosswalk and a traffic calming element, they provide a superior safety advantage to pedestrians. They are most appropriate on streets with only moderate traffic (<10,000 trips/day), such as a minor collector, or a residential street with a significant conflict between pedestrians and vehicles.

Roadway Lighting

Although street lighting provides a benefit at many locations, it is particularly beneficial at crosswalks where lighting increases the visibility of pedestrians and bicyclists to passing motorists.

Research described in a federal report (FHWA-HRT-08-053) is based on static and dynamic experiments of driver performance with regard to the detection of pedestrians in midblock crosswalks. Experimental condition variables included lamp type (high-pressure sodium and metal halide), vertical illuminance level, color of pedestrian clothing, position of pedestrians in the crosswalk and the presence of glare. Two additional lighting systems, a pro-beam luminaire and ground-installed LEDs, were also evaluated. Generally, research found that a vertical illuminance of 20 lx (lux, a measure of the intensity, as perceived by the human eye, of light that hits or passes through a surface) in the crosswalk, measured at a height of 1.5m (5 ft) from the road surface, provided adequate detection distance.

“High Intensity Activated Crosswalk” (HAWK) signal

The HAWK is a pedestrian activated beacon located on the roadside and on mast arms over major approaches to an intersection. The HAWK signal head consists of two red lenses over a single yellow lens (see center image above). It displays a red indication to drivers when activated, which creates a gap for pedestrians to use to cross a major roadway. The HAWK is not illuminated until it is activated by a pedestrian, triggering the warning flashing yellow lens on the major street. After a set amount of time, the indication changes to a solid yellow light to inform drivers to prepare to stop. The beacon then displays a dual solid red light to drivers on the major street and a walking person symbol to pedestrians. At the conclusion of the walk phase, the beacon displays an alternating flashing red light to drivers, and pedestrians are shown an upraised hand symbol with a countdown display informing them of the time left to cross.² 2. FHWA, *Pedestrian Forum, Fall 2010*, http://safety.fhwa.dot.gov/ped_bike/pedforum/2010/fall2010.cfm, p.2

Refuge Islands and/or Medians

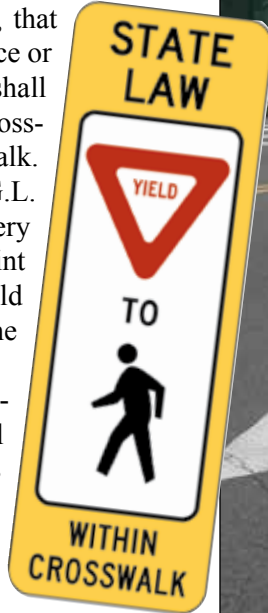
Many traffic engineers and citizens feel that pedestrian refuge islands found on multi-lane, high speed, high volume roadways provide higher levels of safety to pedestrians. A FHWA study found pedestrian refuge/median treatment to be a proven countermeasure. (see www.safety.fhwa.dot.gov/policy/memo071008/) This is because pedestrians are provided the option of crossing the roadway in two stages allowing the individual(s) to focus on one direction of traffic at a time. Splitter islands found at modern roundabouts serve the same purpose.

Pedestrian Laws and Regulations

Massachusetts General Law (M.G.L. Ch.89§11) requires, among other things, that when traffic control signals are not in place or not in operation, the driver of a vehicle shall yield the right-of-way to a pedestrian crossing the roadway within a marked crosswalk.

Regulations promulgated under M.G.L. Ch.90§18A, by MassDOT, require every pedestrian crossing a roadway at any point other than a marked crosswalk shall yield the right-of-way to all vehicles upon the roadways.

As per the *MUTCD Section 2B.12*, in-street pedestrian crossing signage shall not be used at signalized intersections and if it is placed in the roadway, the sign support shall comply with the breakaway requirements.



Resources

Main articles for *Tech Notes* are taken from the Massachusetts Department of Transportation's, *Massachusetts Safety Traffic Toolbox*.

The Manual on Uniform Traffic Control Devices (MUTCD)

Published by the FHWA, the *MUTCD* defines the standards used by transportation professionals nationwide to install and maintain traffic control devices on roads. <http://mutcd.fhwa.dot.gov/>

The Pedestrian and Bicycle Information Center (PBIC)

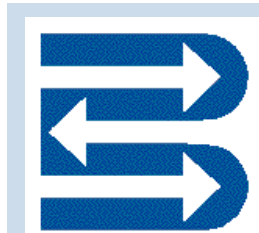
A national clearinghouse for information about health, safety, engineering, advocacy, education, enforcement, access, and mobility for pedestrians and bicyclists. <http://www.walkinginfo.org/index.cfm>

***Informational Report on Lighting Design for Midblock Crosswalks* FHWA-HRT-08-53**

Considerations for lighting parameters and design criteria when installing fixed roadway lighting for midblock crosswalks as well as those colocated with intersections.

LED Raised Pavement Markers FHWA-SA-09-007

Published by FHWA for Safe Roads for a Safer Future. Contact: ed.rice@dot.gov for more information



The Baystate Roads Program is a cooperative effort of the Federal Highway Administration, Massachusetts Department of Transportation (MassDOT), and the University of Massachusetts. Program Director, Dr. John Collura, and Program Manager, Christopher J. Ahmadjian, provide technology transfer assistance to all communities in the Commonwealth. Our purpose is to provide information and training on transportation and related topics, to answer the needs and problems of local agencies, to identify and transfer new technologies and innovations into a usable format, and to operate as a link between transportation research and practicing highway personnel.