



**pennsylvania**  
DEPARTMENT OF TRANSPORTATION  
LOCAL TECHNICAL ASSISTANCE PROGRAM

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# Pedestrians and Crosswalks



Roads Scholar II Course

*October 25, 2020*

## Pennsylvania Local Technical Assistance Program (LTAP)

Email: [ltap@pa.gov](mailto:ltap@pa.gov) Website: [gis.penndot.gov/ltap](http://gis.penndot.gov/ltap)

Phone: 1-800-FOR-LTAP or 717-787-5243 Fax: 717-783-9152

**LTAP shares transportation knowledge, improves road maintenance and safety skills, and puts research and new technology into practice at the local level through:**

**Training:** LTAP schedules classes throughout the state and they can be requested as a road show.

**Technical Assistance:** LTAP technical experts are available by phone, email, and in person to help municipalities troubleshoot specific issues on their roadways.

**Newsletter:** LTAP distributes a quarterly newsletter, *Moving Forward*, which features the latest news and new practices and technologies.

**Technical Information Sheets:** LTAP tech sheets provide useful, technical information on such topics as effective stop sign placement, how to use the MUTCD, paving roads, and other safety and maintenance issues related to local roads.

**Webinars:** LTAP provides webinars and has a catalog of on-demand webinars on the website.

**Drop-In Sessions:** LTAP provides informal, one-hour sessions on a specific topic. LTAP staff will initiate the session with a short discussion/presentation, and then open up the discussion to the attendees.

**Website:** LTAP's website is a valuable tool that provides up-to-date information on workshops, news items, LTAP Advisory Committee members, tech sheets, newsletters, and other resources.

**LTAP Professional Certification Program – Roads Scholar:** Participants must complete approved workshops within a three-year period and pass (70%) an in-class quiz taken at the end of each workshop which consists of 12 questions.

**You MUST include your name/contact information on the answer sheet for credit.**

- Roads Scholar 1 – 10 courses
- Roads Scholar II – 8 courses
- Roads Scholar Administration – 6 courses (must be an elected official or in a management role)
- Roads Scholar Police – 6 courses (must be a police officer)

Successful completion of certified CPR training also earns you one workshop credit.

For a list of approved courses, go to the LTAP website, Roads Scholar Program, View Roads Scholar Courses.

***All services are offered at No Cost to Municipalities***

# COURSE OBJECTIVES

The course objectives are:

- Examine the components of the pedestrian environment, including safety statistics, facilities, behavior, and characteristics.
- Review PennDOT and national regulations, guidelines, and research for implementation of pedestrian facilities including sidewalks and crosswalks.
- Apply proven safety countermeasures to improve walkability and pedestrian safety.

## PART 1: THE PEDESTRIAN ENVIRONMENT

### Sections

- Pedestrian Safety
- Pedestrian Laws
- Pedestrian Initiatives



## SECTION 1: THE PEDESTRIAN ENVIRONMENT - SAFETY

### National Highway Transportation Safety Administration (NHTSA) 2018 Safety Facts

There were 36,560 people killed in motor vehicle traffic crashes on U.S. roadways during 2018, a 2.4 percent decrease from 37,473 in 2017, which came after a 0.9 percent decrease from 2016 to 2017. Prior to 2016 there were two back-to-back yearly increases of 8.4 percent and 6.5 percent, respectively. Fatalities decreased from 2017 to 2018 in almost all segments of the population with the exception of fatalities in crashes involving large trucks and nonoccupant fatalities (pedestrians and pedalcyclists).

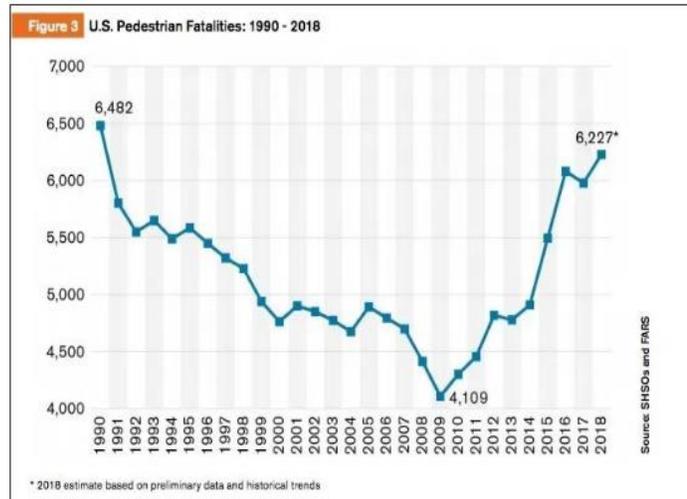
**36,560**  
fatalities in  
the USA

**6,283**  
pedestrian  
fatalities

## Inside Versus Outside the Vehicle

The proportion of people killed “inside the vehicle” (passenger car, light truck, large truck, bus, and other vehicle occupants) has declined from a high of 80 percent in 1996 to 66 percent in 2018, as seen in Figure 3.

Conversely, the proportion of people killed “outside the vehicle” (motorcyclists, pedestrians, pedalcyclists, and other nonoccupants) has increased from a low of 20 percent in 1996 to a high of 34 percent in 2018.



## Environmental Characteristics

### Where/when pedestrian fatalities occur

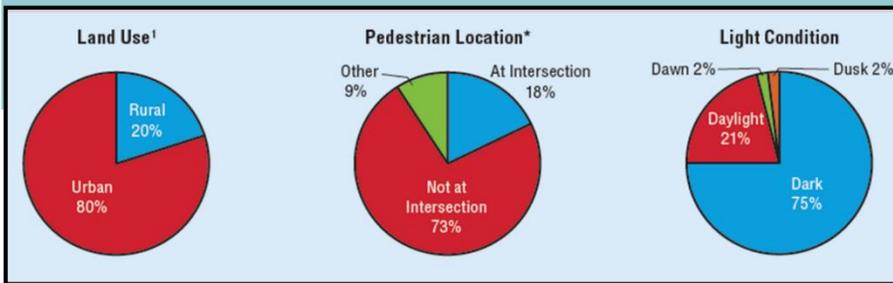


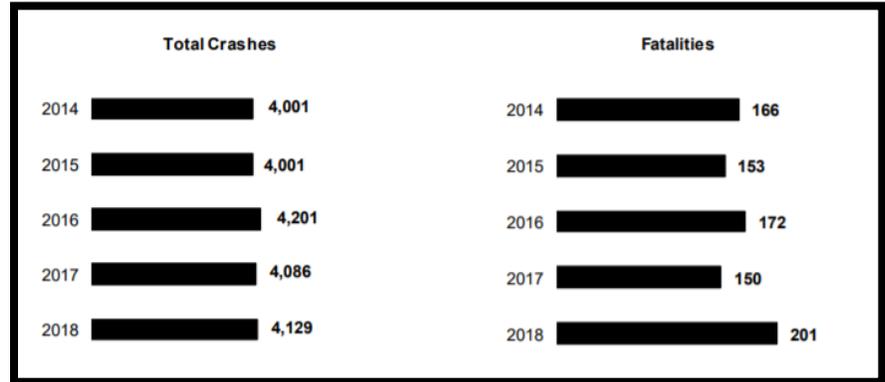
Figure 1 contains information on environmental characteristics (land use, pedestrian location, light condition, and time of day and season) describing where and when pedestrian fatalities occurred in 2017.

- More pedestrian fatalities occurred in urban areas (80%) than rural areas (20%).
- More pedestrian fatalities did not occur at intersections (73%) than those that occurred at intersections (18%); the remaining 9% occurred at other locations such as roadsides/shoulders, parking lanes/zones, bicycle lanes, sidewalks, medians/crossing islands, driveway accesses, shared-use paths/trails, non-traffic way areas, and other sites.
- More pedestrian fatalities occurred in the dark (75%) than in daylight (21%), dusk (2%), and dawn (2%).

Time of day is divided into eight 3-hour time intervals starting at midnight, and season is defined by months.

## Pennsylvania Pedestrian Statistics

- **Pedestrian**-related crashes represent 3.2% of the total reported traffic crashes; however, they account for 16.9% of all traffic crash fatalities.
- 74.7% of pedestrian fatalities at non-intersection locations like mid-block crossings, driveway crossings, etc.

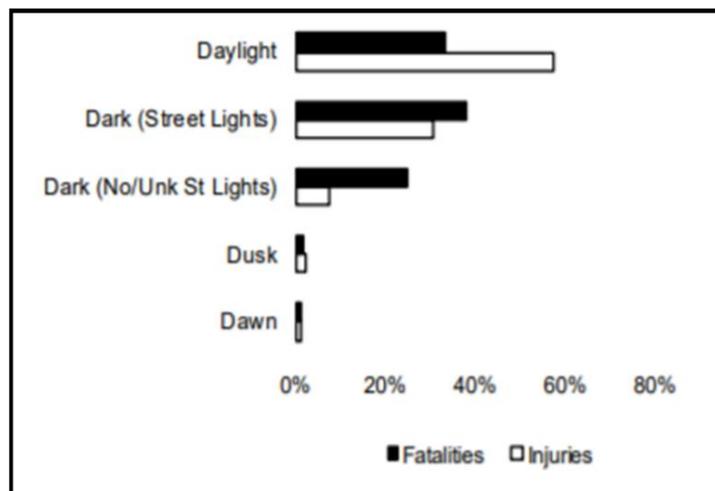


- 67% of pedestrian fatalities occurred at uncontrolled locations.
- Pedestrians ages 75 and over represent a sizable portion of pedestrian fatalities as displayed in the chart below. Overall, male pedestrian fatalities consisted of 67% of all pedestrian fatalities and were less than in 2017 (70%).

Pedestrian Action	Fatalities	Pedestrians Involved
Entering Crossing/Specified Location	98	1,875
Walking/Running/Jogging/Playing	45	1,275
Working	5	68
Pushing a Vehicle	0	3
Working on Vehicle	3	25
Standing	14	232
Approaching/Leaving a Vehicle	5	116
Other/Unknown	31	757
<b>Total</b>	<b>201</b>	<b>4,351</b>

Age Group	Female	Male	Total
0-4	0	2	2
5-9	0	2	2
10-14	0	2	2
15-19	1	3	4
20-24	6	4	10
25-29	4	7	11
30-34	2	11	13
35-39	3	7	10
40-44	2	7	9
45-49	4	9	13
50-54	3	12	15
55-59	9	11	20
60-64	8	13	21
65-69	3	7	10
70-74	1	15	16
75 and over	20	20	40
Unknown	0	3	3
<b>TOTAL</b>	<b>66</b>	<b>135</b>	<b>201</b>

- The majority of pedestrians were injured in daylight (57.8%), but more pedestrian fatalities occurred during non-daylight hours (66.7%). As shown in the bar chart, pedestrians were more likely to be fatally injured if struck in a non-daylight crash as compared to a day crash.



- 67.2% of pedestrian fatalities and 41.3% of pedestrian injuries occurred in areas other than intersections. “Non-intersections” as used below includes mid-block crossings, driveway crossings, etc.

Intersection	Fatalities	Injuries
Non-Intersection	135 (67.2%)	1,691 (41.3%)
4-Leg Intersection	37 (18.4%)	1,698 (41.5%)
T-Intersection	21 (10.5%)	546 (13.4%)
Other	8 (4.0%)	155 (3.8%)
<b>TOTAL</b>	<b>201 (100.0%)</b>	<b>4,090 (100.0%)</b>

- As the table shows, most pedestrian fatalities and injuries occurred in areas without traffic control devices (TCDs). These areas accounted for 151 pedestrian fatalities and 2,059 injuries.

Traffic Control Device	Fatalities	Injuries
Not Applicable	151 (75.1%)	2,059 (50.3%)
Traffic Signal	43 (21.4%)	1,443 (35.3%)
Stop Sign	3 (1.5%)	487 (11.9%)
Flashing Traffic Signal	2 (1.0%)	19 (0.5%)
Other/Unknown	2 (1.0%)	82 (2.0%)
<b>TOTAL</b>	<b>201 (100.0%)</b>	<b>4,090 (100.0%)</b>

## What are critical factors for Pedestrian safety?

Traffic speed affects pedestrian safety and the severity of injuries. Although this may seem obvious(!), the faster the traffic, the less time motorists have to react to a pedestrian, the longer the stopping distances, and the worse the impact is.

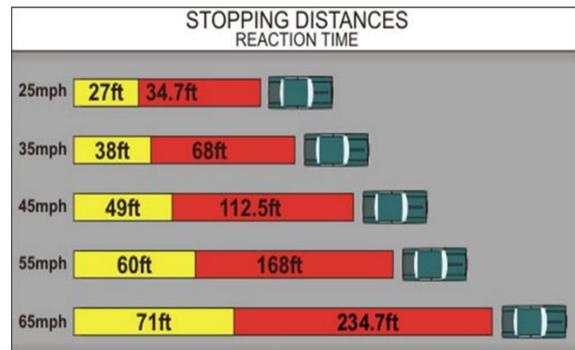


Traffic speed can be assessed in several ways. First, there is the posted speed limit. Second, there is the “operating speed,” which is the average speed that vehicles are traveling, which may be above the posted speed limit. Another speed factor is the 85th percentile speed, which can be collected and calculated. The 85th percentile speed can be used for stopping sight distance calculations.

Be extra careful on higher speed (> 40 MPH) and multi-lane roads (MUTCD Section 3B.18).

These results could be used to inform efforts to improve pedestrian safety, for example, by limiting traffic speeds to levels that are unlikely to result in severe injury or death in places where pedestrians and vehicles may encounter one another, creating physical separation of pedestrians and vehicles in places where higher traffic speeds are desired, and develop vehicle-based systems that detect pedestrians and warn the driver or brake automatically when a collision is imminent.

A driver’s ability to see the roadway ahead is critical for safety reasons. The available stopping sight distance is the distance necessary for a vehicle to stop before it reaches an object in its path. Think of the sight distance as the space between when a driver identifies and processes information, decides on a course of action, and acts. The action can be as simple as deciding to change lanes and turning on the turn signal, or more complex such as rounding a curve and seeing a cow standing in the roadway. If the action requires the vehicle to stop, the sight distance will also include the vehicle braking distance.



Variables are speed, grade, friction, and PIEV time.

PIEV is perception identification emotion and volition. Median value is 0.9 seconds for unexpected events, 2.7 seconds for individuals with slow reaction times, and 2.5 seconds for design.

Perception Reaction time is the distance your vehicle travels from the time you spot a problem to the time you decide to do something about it and move your foot from the accelerator to the brake pedal.

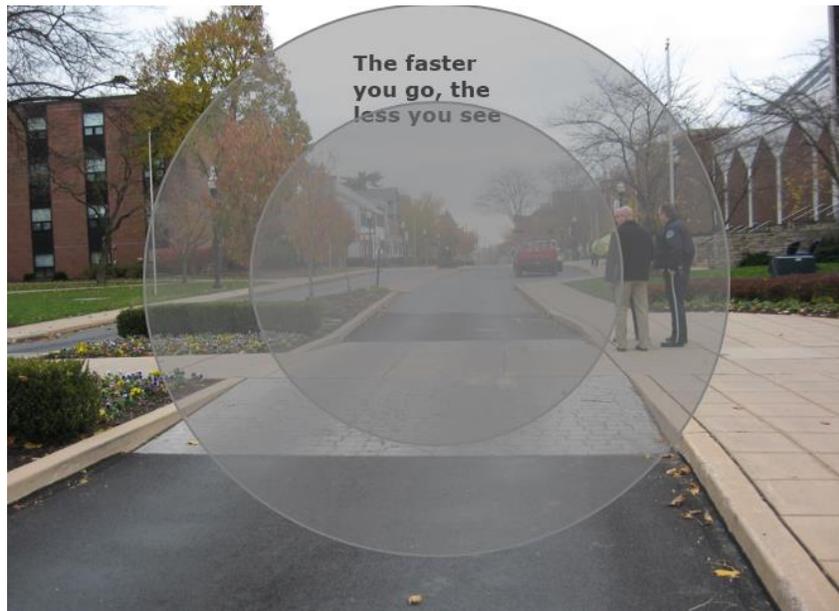
Braking distance is the distance your vehicle travels after the brakes have started to work, until your vehicle comes to a complete stop.

Sometimes pedestrians can be distracted or bold in crossing a road. Yellow flashing lights provide a warning to motorists but do not require a motorist to stop for a pedestrian on the sidewalk.



For trail crossings with cyclists and other users, the trail crossing should have a STOP sign for the trail traffic per the MUTCD Section 9B.03.

Also note that with the way we see, the faster we go the narrower our vision becomes (tunnel vision). We typically see 10 degrees horizontally, so at 20 MPH we may see a pedestrian on the side of the road, but at 40 MPH we do not see them.



## Crossing Distance

Crossing distance is an important safety factor. The longer the crossing distance, the more exposure to traffic for the pedestrian. Crossing distance should be measured from curb face to curb face.

Angled crossings can increase the distance.



## Walking Speed

“Normal” pedestrians walk at an average of 4 feet per second. This is equivalent to 5.9 miles per hour. For traffic signal timing calculations, a walking speed of 3.5 feet per second is used. This is equivalent to 5.1 miles per hour. The MUTCD also suggests slower walking speeds (such as 3 feet/second) can be used if there are pedestrians that walk slower (elderly, wheelchair users, etc.).



For this crosswalk of 110 feet, it would take 27.5 seconds to cross at 4 feet per second.

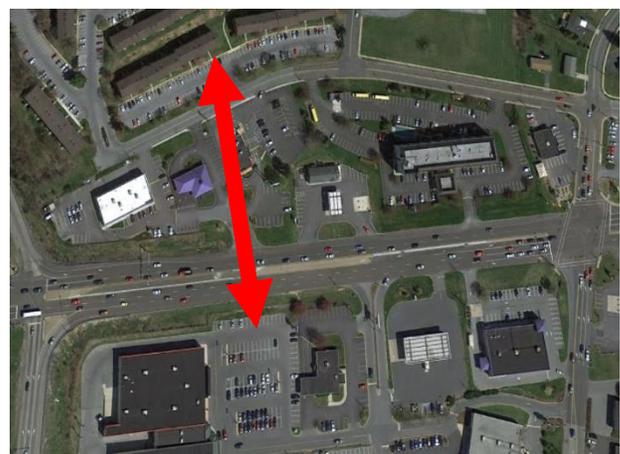
At 3.5 feet per second, it takes 31.4 seconds.

At 3 feet per second, it takes 36.7 seconds, almost 10 seconds longer.

## Shortest Path

Pedestrians will take the shortest path possible for their travel. In this example, there are apartments to the north (top of slide), and across a busy 5-lane road, there is a shopping plaza to the south. Pedestrians cross at a mid-block location, instead of traveling to the traffic signal and back.

The shortest pedestrian routes are often shown by worn paths.



## Number of Lanes

Multiple lanes create multiple threats for pedestrians. Further, even if one vehicle stops, it may block the visibility of the pedestrian for the motorist and the visibility of the motorist for the pedestrian.

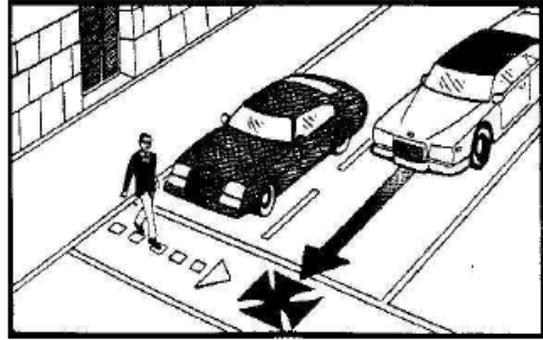


Figure 21. Illustration of multiple-threat pedestrian crash.

## Turning Vehicles

Turning vehicles at a crossing increase the number of conflicts points. Often, turning motorists are looking for conflicting vehicles and not for pedestrians.

## Nighttime Visibility

**Most fatal pedestrian crashes happen during darkness. Lighting is an essential component of crosswalk safety.**



An important purpose of lighting at pedestrian crosswalks is to provide illumination that increases the visibility of pedestrians who may be crossing the street, or about to cross the street. Crashes involving pedestrians on crosswalks are a common cause of road fatalities. Although there are many reasons for crashes involving pedestrians (speeding, alcohol, etc.), inadequate lighting at or adjacent to crosswalks might increase the risk to pedestrians crossing the road. The nighttime fatal vehicle/pedestrian crash rate in unlighted areas is around three times higher than the daytime rate.

## Pedestrian Type/Age

From the crash data, we know that young and old pedestrians are more at risk. The types of pedestrians that may use a crosswalk should be considered in the study.

## Sight Distance

The sight lines and sight distance are important for both pedestrians and motorists.

## Vulnerable road users

A group of road users can be defined as “vulnerable” in a number of ways, such as by the amount of protection in traffic (e.g. pedestrians and cyclists) or by the amount of task capability (e.g. the young and the elderly).

## Location

80% of pedestrian fatalities occurred in urban areas in 2017.

While only 20% of pedestrian fatalities occurred in rural areas in 2017, rural pedestrian crashes are nearly twice as likely to result in a fatality, and rural bicycle crashes are three times as likely to result in a fatality compared to urban crashes. (From UNC Highway Safety Research Center, 2006).

# PART 1: PEDESTRIAN ENVIRONMENT

## SECTION 2: PEDESTRIAN LAWS

### Title 75, Section 102: Definitions:

#### "Crosswalk"

(1) That part of a roadway at an intersection included within the connections of the lateral lines of the sidewalks on opposite sides of the highway, measured from the curbs or, in the absence of curbs, from the edges of the traversable roadway; and, in the absence of a sidewalk on one side of the roadway, that part of a roadway included within the extension of the lateral lines of the existing sidewalk.

(2) Any portion of a roadway at an intersection or elsewhere distinctly indicated for pedestrian crossing by lines or other markings on the surface.



## **Title 75**

### **3541. Obedience of pedestrians to traffic-control devices and regulations.**

(a) Traffic-control devices. – A pedestrian shall obey the instructions of a police officer or other appropriately attired person authorized to direct, control, or regulate traffic.

(b) Traffic and pedestrian-control signals. – Local authorities by ordinance may require pedestrians to obey traffic and pedestrian-control signals as provided in sections 3112 (relating to traffic-control signals) and 3113 (relating to pedestrian-control signals).

### **3542. Right-of-way of pedestrians in crosswalks.**

(a) General rule. – 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 any marked crosswalk or within any unmarked crosswalk at an intersection.

(b) Exercise of care by pedestrian. – No pedestrian shall suddenly leave a curb or other place of safety and walk or run into the path of a vehicle which is so close as to constitute a hazard.

(c) Limitation on vehicles passing. – Whenever any vehicle is stopped at any crosswalk at an intersection or at any marked crosswalk to permit a pedestrian to cross the roadway, the driver of any other vehicle approaching from the rear shall not overtake and pass the stopped vehicle.

(d) Application of section. – Subsection (a) does not apply under the conditions stated in section 3543(b) (relating to pedestrians crossing at locations other than crosswalks).

### **3544. Pedestrians walking along or on highways.**

(a) Mandatory use of available sidewalk. – Where a sidewalk is provided and its use is practicable, it is unlawful for any pedestrian to walk along and upon an adjacent roadway.

(b) Absence of sidewalk. – Where a sidewalk is not available, any pedestrian walking along and upon a highway shall walk only on a shoulder as far as practicable from the edge of the roadway.

(c) Absence of sidewalk and shoulder. – Where neither a sidewalk nor a shoulder is available, any pedestrian walking along and upon a highway shall walk as near as practicable to an outside edge of the roadway, and if on a two-way roadway, shall walk only on the left side of the roadway.

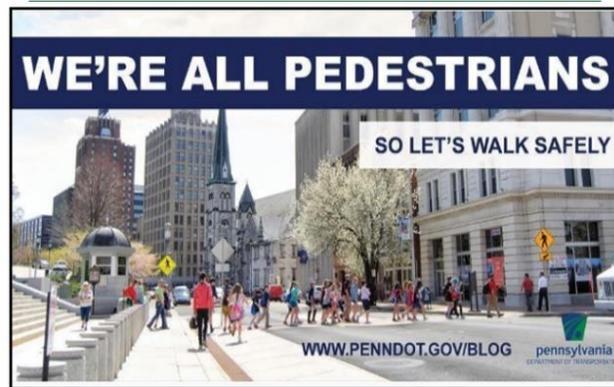


(d) Right-of-way to vehicles. – Except as otherwise provided in this subchapter, any pedestrian upon a roadway shall yield the right-of-way to all vehicles upon the roadway.

## Laws vs. Safety Tips

The rights and duties of pedestrians vary greatly depending on the situation. It's important to familiarize yourself with [Pennsylvania laws](#), as well as common-sense safety tips:

- LAW: Walk on sidewalks whenever they are available. If no sidewalk is available, you must walk on the left side of the road, facing traffic.
- TIP: Never assume a driver sees you. Make eye contact with drivers as they approach you to make sure you are seen.
- LAW: Motorists must yield to pedestrians crossing the street at marked and unmarked intersections, BUT the pedestrian must either be within the crosswalk or affirmatively indicate an intent to cross.
- TIP: Be visible at all times. Wear reflective materials, apply reflective tape, or use a flashlight at night.
- TIP: Cross streets at crosswalks or intersections whenever possible.
- LAW: Pedestrians shall not suddenly leave a curb or other place of safety and walk or run into the path of a vehicle which is so close as to constitute a hazard.
- TIP: Keep alert at all times. That means putting away your electronic devices so you can stay focused on the road.



## Tips for the Motorist

- The onus of safety doesn't rely solely on the pedestrian. As a motorist – especially in densely populated areas – it's important to always be aware of your surroundings.
- Use extra caution when driving in hard-to-see conditions, such as nighttime or in bad weather.
- It's illegal to pass vehicles stopped at a crosswalk. There may be people crossing that you can't see.
- Slow down and pay attention when approaching or turning at a crosswalk.
- If you are turning right at an intersection and the pedestrian has a lit WALK signal, the pedestrian has the right-of-way.
- Don't engage in distracted driving. Taking your eyes off the road, your hands off the wheel, or your mind off driving can have deadly consequences; a person engaged in distracted driving is up to four times more likely to be involved in a collision.

# PART 1: PEDESTRIAN ENVIRONMENT

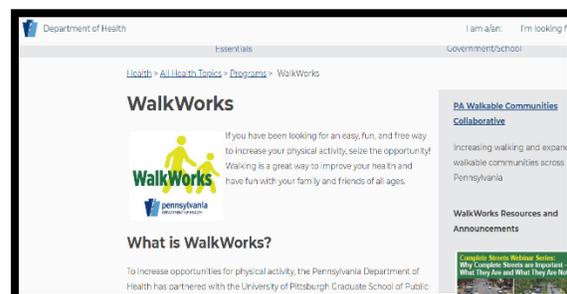
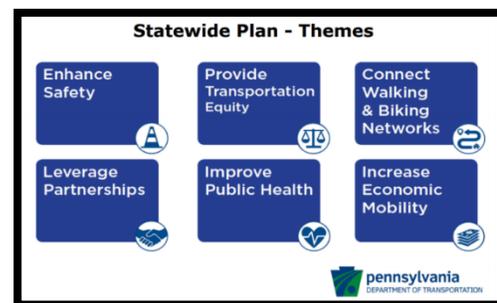
## SECTION 3: PEDESTRIAN INITIATIVES

The Pennsylvania Department of Transportation (PennDOT) is developing an **Active Transportation Plan for Pennsylvania** that will outline a vision and framework for improving conditions for walking and bicycling across Pennsylvania, most notably for those Pennsylvanians who walk and bicycle out of necessity rather than for leisure and recreation. The Active Transportation Plan will also identify and help prioritize strategies that increase the number of people walking and bicycling, while supporting safety and multimodal connectivity throughout the state.

## WalkWorks

- Identifies and promotes safe walking routes;
- Offers social support through guided, community-based walking groups;
- Helps schools develop walk-to-school programs; and Addresses local policies to increase safe walking routes.

References/Links: [Google WalkWorks](#)



## Safe Routes to School Programs

Safe Routes to School (SRTS) is an approach that promotes walking and bicycling to school through infrastructure improvements, enforcement, tools, safety education, and incentives to encourage walking and bicycling to school.

Nationally, 10%- 14% of car trips during morning rush hour are for school travel. SRTS initiatives improve safety and levels of physical activity for students. SRTS programs can be implemented by a department of transportation, metropolitan planning organization, local government, school district, or even a school. Extensive resources are available through a national center, including

an [SRTS Guide](#), [parent surveys](#) and [student tallies](#), and simple strategies, such as the [walking school bus](#), that schools can use to support bicycling and walking.



### References/Links:

<https://www.transportation.gov/mission/health/Safe-Routes-to-School-Programs>

<http://www.saferoutesinfo.org/>

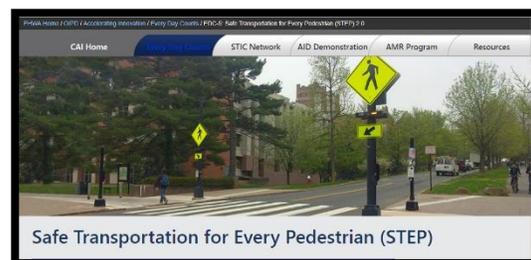
## FHWA Pedestrian Initiatives

Systemic application of cost-effective countermeasures with known safety benefits can help reduce pedestrian fatalities at both uncontrolled and signalized crossing locations.

Google: FHWA STEP

## PART 2: CROSSWALK BASICS

1. Crosswalk Responsibility
2. Crosswalk Considerations



## SECTION 1: CROSSWALK RESPONSIBILITY

The authority and responsibility for marking and maintaining crosswalks is defined in Title 75, Section 6122, and Title 67, Chapter 212, Official Traffic Control Devices, Section 212.5 Installation and Maintenance Responsibilities.

## Who is responsible for crosswalks?

- At intersections of local roads
- At intersections of local/state roads
- At traffic signals
- At mid-block locations

### **6122. Authority to erect traffic-control devices.**

**(a) General rule.**--The department on State-designated highways and local authorities on any highway within their boundaries may erect official traffic-control devices, which shall be installed and maintained in conformance with the manual and regulations published by the department upon all highways as required to carry out the provisions of this title or to regulate, restrict, direct, warn, prohibit, or guide traffic.

(1) Local authorities shall obtain approval of the department prior to erecting an official traffic-control device on a State-designated highway except where department regulations provide otherwise.

(2) Local authorities shall obtain approval of the department prior to erecting any traffic signal except in a municipality with a traffic engineer qualified in accordance with department regulations.

## Local Road Intersections – Municipality Responsible

The authority and responsibility for marking and maintaining crosswalks is defined in Title 67, Chapter 212, Official Traffic Control Devices, Section 212.5 Installation and Maintenance Responsibilities.

(c) Traffic-control devices on local highways.

As provided in 75 Pa.C.S. § 6122, local authorities are responsible for the installation, revision, maintenance, operation, and removal of any traffic-control device on highways under their jurisdictions, except local authorities shall obtain written Department approval for the following two items:

1) Installing, revising, or removing any school zone speed limit or traffic signal as indicated in 75 Pa.C.S. § 3365(b) (relating to special speed limitations) and § 6122(a)(2), respectively, except

Department approval is not required for cities of the first and second class, and other local authorities that have municipal traffic engineering certification in accordance with Chapter 205.

2) Revising or removing a traffic-control device installed in accordance with an agreement between the local authorities and the Department.

## State Road Intersections – Municipality Responsible

(b) Traffic-control devices on State-designated highways.

(iv) Local authorities may install, revise or remove the following devices, and Department approval is not required:

(A) Stopping, standing or parking signs (R7 and R8 Series).

(B) Street name signs (D3 Series).

**(C) Crosswalk markings at intersections.**

(D) Parking stall markings, except written Department approval is required prior to creating new angle parking.

## Mid-block Intersections – Municipality Responsible

(v) Local authorities, or other agencies as indicated, are responsible for installing, maintaining, and operating the following traffic-control devices, subject to Department approval prior to any change in the traffic restriction:

**(T) Pavement markings for mid-block crosswalks.**



# PART 2: CROSSWALK BASICS

## SECTION 2: CROSSWALK CONSIDERATIONS

### Why are crosswalks important?

#### The Walking Environment

Pedestrians are sensitive to out-of-the-way travel, and reasonable accommodation should be made to make crossings both convenient and at safe locations with adequate visibility.

### Considerations for marking crosswalks

- Crosswalk locations should be convenient for pedestrian access.
- Crosswalk markings alone are unlikely to significantly affect pedestrian safety.
- Crosswalks should only be marked as the result of a study.
- Pedestrian movements shall be accommodated (PennDOT Active Transportation Plan directive).

### Choosing to mark a crosswalk:

#### Section 3B.18 Crosswalk Markings

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.

### Choosing to Mark a Crosswalk:

#### Section 3B.18 Crosswalk Markings

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).

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 85<sup>th</sup> 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:

- 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
- 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.

### **Crosswalk Locations:**

- Uncontrolled approaches
- Controlled approaches
- Traffic signals
- Roundabouts
- Midblock locations

### **Controlled versus Uncontrolled Approaches**

- A controlled approach has a traffic control device that already controls the traffic flow, for example a STOP sign.
- An uncontrolled approach is where traffic normally does not have to stop, unless a pedestrian is in the crosswalk.
- Uncontrolled approaches are more of a safety concern.

## Traffic Signals

- Traffic signals are designed by engineers. As part of the study for the signal, the engineers will determine the appropriate level of pedestrian features, including signs, signals, and markings. PennDOT will approve and issue a permit for the traffic signal.
- Most of the time, municipalities are responsible for maintaining the traffic signals, including the pedestrian features. These features will be shown on the permit. It is important to ensure the traffic control devices in the field match the permit.
- If you want to change a pedestrian feature at a traffic signal, an engineer must update the permit. This includes changes to timing, markings, and signs.



## Crosswalks should not be marked indiscriminately

Pedestrians crossing a street is inherently dangerous. Any time pedestrians cross paths with vehicles, there is a chance of a crash.

## Study

A study should be performed to mark crosswalks.

## PART 3: CROSSWALK STUDY

1. Controlled Locations
2. Uncontrolled Locations

## PART 3: CROSSWALK STUDY SECTION 1: CONTROLLED CROSSWALK LOCATIONS

### Marked crosswalks on controlled approaches:

should be considered differently than uncontrolled approaches. On controlled approaches, there is signing already regulating traffic and the right-of-way.

Marked crosswalks should be installed if pedestrian facilities or pedestrian-oriented attractors/generators exist on both sides of the crossing and any of the following statements are true:

- The crossing is part of a walking route approximately ¼ mile or less between a residential development of moderate or heavy density and a school or recreational area
- The crossing is connected by pedestrian facilities to a rail transit stop or major bus transfer station within walking distance of approximately ¼ mile or less
- The crossing is part of a shared use path or trail
- The crossing is across a yield-controlled approach at an off-ramp junction or channelized right turn lane
- The crossing is within a downtown Central Business District area and/or is in an area of known pedestrian activity and pedestrian-oriented land-use

## **PART 3: CROSSWALK STUDY**

### **SECTION 2: UNCONTROLLED CROSSWALK LOCATIONS**

Marking crosswalks at uncontrolled approaches should be based on a study.

#### **What should a study consist of?**

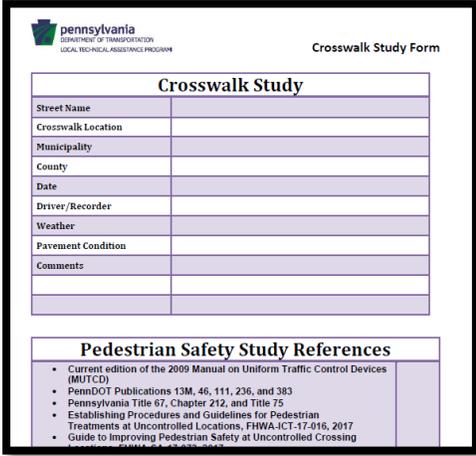
#### **Choosing to Mark a Crosswalk - Factors**

- Traffic speeds
- Crossing distance
- Number of lanes
- Visibility
- Turning conflicts
- Special needs of nearby vulnerable pedestrians
- Pedestrian facilities Traffic control devices
- Lighting
- Sight distance
- Traffic/ped volumes
- Crash experience
- Geometry
- Walkability/community connectivity

## Study Steps

1. Conduct field review
2. Collect data
3. Perform safety assessment
4. Assess walkability
5. Determine crosswalk markings
6. Consider signs and other features

LTAP has developed a form to guide the study process for a crosswalk. The form is part of the handouts.



The image shows a 'Crosswalk Study Form' from the Pennsylvania Department of Transportation (PennDOT) Local Technical Assistance Program. The form is titled 'Crosswalk Study' and contains several fields for data entry: Street Name, Crosswalk Location, Municipality, County, Date, Driver/Recorder, Weather, Pavement Condition, and Comments. Below the form is a section titled 'Pedestrian Safety Study References' which lists several key documents: the current edition of the 2009 Manual on Uniform Traffic Control Devices (MUTCD), PennDOT Publications 13M, 46, 111, 236, and 383, Pennsylvania Title 67, Chapter 212, and Title 75, and FHWA-ICT-17-016, 2017, 'Establishing Procedures and Guidelines for Pedestrian Treatments at Uncontrolled Locations'.

## Step 1: Field Review

- Existing traffic control devices
- Sight distance (pedestrians and approaching vehicles)
- Facilities (sidewalks, ramps, etc.)
- Roadway geometry (lanes, lane widths, parking, alignment, etc.)
- Crossing distance and number of lanes
- Speed limits and operating speeds
- Lighting

## Sight Distance

- Measure the sight distance for each crossing location.
- The sight distance is measured like intersection corner sight distance. Use the same stopping sight distance table from PennDOT Form M-950S or from PennDOT Pub. 212, Appendix Table B. Assuming a pedestrian height of 3.5 feet and an object (vehicle) height of 3.5 feet. Measure from the location a pedestrian would stand before crossing.
- Measure from both directions. How many measurements would you need at this intersection?
- Measure the sight distance for each crossing location.
- The sight distance is measured similar to that for intersection corner sight distance. Use the same stopping sight distance table
- Common obstructions include parked vehicles, vegetation, signs, etc.
- If there are no parked vehicles, and parking is permitted, park a vehicle in the closest legal spot to simulate the sight distance.

## FORMULA SIGHT DISTANCE TABLE

Speed (V) (Miles Per Hour)	Average Grade (G) (Percent)										
	Use plus grades when approaching vehicle is travelling upgrade.										
	0.0	+1.0	+2.0	+3.0	+4.0	+5.0	+6.0	+7.0	+8.0	+9.0	+10.0
25	147	145	144	143	142	140	139	138	137	136	135
30	196	194	191	189	187	185	183	182	180	178	177
35	249	245	242	239	236	233	231	228	226	224	221

### Step 2: Data Collection

- Crash data
- Traffic volumes
- Pedestrian volumes
- Pedestrian locations (desire lines)
- Pedestrian types
- Traffic speeds
- Priorities

#### Crash Data

Crash data can be reviewed on the PA Crash Information Tool (PCIT). The tool can show pedestrian specific crashes.

References/Links: <https://crashinfo.penndot.gov/PCIT/welcome.html>



## Traffic Data

Traffic data is on the PennDOT Traffic Information Repository (TIRe). You can access counts and other information for all state routes on this website.

References/Links: <https://gis.penndot.gov/TIRe>



## Pedestrian Data

Gather pedestrian data. How many pedestrians per hour? What type of pedestrians? When do pedestrians cross? Where do pedestrians cross (desire lines).

## Speed Data

Speed data includes the posted speed limit as well as information on the operating speed and 85<sup>th</sup> percentile speed.

**Operating speed** – the speeds at which vehicles are observed operating during free flow conditions. Free flow speeds are those observed from vehicles whose operations are unimpeded by traffic control devices (e.g., traffic signals) or by other vehicles in the traffic stream. The 85<sup>th</sup> percentile of the distribution of observed speeds is the most frequently used measure of the operating speed.

**Posted speed** – the maximum lawful vehicle speed for a particular location as displayed on a regulatory sign. Posted speeds are displayed on regulatory signs in speed values that are multiples of 5 MPH.

**85<sup>th</sup> percentile speed** – the speed at or below which 85 percent of vehicles travel.

References/Links: [https://safety.fhwa.dot.gov/speedmgt/ref\\_mats/fhwasa10001/](https://safety.fhwa.dot.gov/speedmgt/ref_mats/fhwasa10001/)

## 2.3 Prioritizing Concerns

Prioritizing non-motorized safety concerns will help a local agency in addressing its most pressing safety problems. In general, safety concerns associated with frequent crashes and higher crash severity levels are given greater priority. If reliable crash data are available, prioritization can be based on total crash frequency or crash rate (if non-motorized traffic volume data are available). Locations or crash types with the higher crash frequency or crash rate will have a higher priority.

When reliable crash data are not available, the likely frequency and severity of crashes associated with each safety concern can be qualitatively estimated and used to prioritize locations. Expected crash frequency can be qualitatively estimated on the basis of exposure (i.e., the number of non-motorized users that would likely be exposed to the identified safety issue) and probability (i.e., the likelihood that a crash would result from the identified safety issue). Expected crash severity can be qualitatively estimated on the basis of factors such as anticipated motor vehicle speeds.

These two risk elements (frequency and severity) are then correlated to obtain a qualitative risk assessment ranging from lowest to highest as shown in the table, which can assist in prioritization of non-motorized safety concerns. For example, potential crash severity can be related to potential crash frequency. A similar categorization can be considered for crash frequency correlated with non-motorized traffic volumes.

POTENTIAL CRASH FREQUENCY	POTENTIAL CRASH SEVERITY			
	Minor Injury	Moderate Injury	Serious Injury	Fatal
Frequent	High	High	Highest	Highest
Occasional	Moderate	Moderate	High	Highest
Infrequent	Low	Low	Moderately	High
Rare	Lowest	Low	Moderate	High

### Step 3: Perform Safety Assessment

There are several tools to assess the viability of marking the crosswalk from FHWA. There are analysis tables that consider the volumes and speed of traffic as well as the number of traffic lanes.

The PEDSAFE tool is another resource to generate ideas for crosswalk safety.

#### References/Links:

<http://www.pedbikesafe.org/pedsafe/>

Newer research from other states expand the FHWA table:

**IIM-TE-384 – Attachment A**  
**Unsignalized Marked Crosswalk Standards**

52 **Table 2. Recommendations for Considering Marked Crosswalks and Other Needed**  
53 **Pedestrian Improvements Across Uncontrolled Approaches**

Roadway Configuration	Roadway ADT and Speed Limit															
	1,500 to 9,000 VPD				9,000 to 12,000 VPD				12,000 to 15,000 VPD				More than 15,000 VPD			
	≤ 30 MPH	35 MPH	40 MPH	≥ 45 MPH	≤ 30 MPH	35 MPH	40 MPH	≥ 45 MPH	≤ 30 MPH	35 MPH	40 MPH	≥ 45 MPH	≤ 30 MPH	35 MPH	40 MPH	≥ 45 MPH
2 Lanes (undivided two-way street or two-lane one-way street)	A	A	B	B	A	A	B	B	A	A	B	B	B	B	B	C
3 Lanes with refuge island OR 2 Lanes with raised median*	A	A	B	B	A	B	B	B	A	A	B	B	B	B	B	C
3 Lanes (center turn lane)	A	A	B	B	A	B	B	B	A	B	B	C	B	C	C	C
4 Lanes (two-way street with no median)	A	B	C	C	B	B	C	C	B	C	C	D	C	C	C	D
5 Lanes with refuge island OR 4 lanes with raised median*	A	A	B	B	A	B	B	C	B	B	C	C	B	B	C	D
5 Lanes (center turn lane)	A	B	C	C	B	B	C	C	C	C	C	D	C	C	C	D
6 Lanes (two-way street with* or without median)	A	B	D	D	B	B	D	D	D	D	D	D	D	D	D	D

54 Source: Guidance for Installation of Pedestrian Crosswalks on Michigan State Trunkline Highways (Michigan Department of  
55 Transportation, 2014)  
56

**Condition A = Candidate site for marked crosswalk alone** (standard if speed limit is 30 MPH or less, high-visibility if speed limit is 35 MPH or greater.) Evaluate need for advance signing

**Condition B = Potential candidate site for marked crosswalk.** Location should be monitored & consideration given to providing a high-visibility crosswalk and/or warning signs

**Condition C = Marked crosswalks alone are insufficient.** The crosswalk shall use a high-visibility pattern and other improvements (warning signs and/or geometric/traffic calming improvements) will likely be necessary

**Condition D = Marked crosswalks shall not be installed**

**References/Links:**

[http://www.virginiadot.org/business/resources/IIM/TE-384\\_Ped\\_Xing\\_Accommodations\\_Unsignalized\\_Locs.pdf](http://www.virginiadot.org/business/resources/IIM/TE-384_Ped_Xing_Accommodations_Unsignalized_Locs.pdf)

**Assessment Example #1:**

Pine St (SR 413):

10,000 vehicles per day

Posted at 35 MPH

Two lanes with a painted median, uncontrolled approaches

Signal 400 feet to the north

Crosswalk used by school students, church, and residents to access library

Nine reportable crashes, none with pedestrians

**Assessment Example #2**

W. Penn Avenue (SR 422):

16,000 vehicles per day

Posted at 40 MPH

Four lanes + parking lanes, uncontrolled approaches

Crosswalk used occasionally by restaurant goers

No reportable pedestrian crashes

## Step 4: Assess Walkability

- Community connections
- Pedestrian travel desire lines and alternative crossing locations
- Types of pedestrians
- Facilities (sidewalks, paths, ramps, etc.)
- Relationship to other plans
- Transit stops/facilities

### Community connections

- Pedestrian generating/attracting land uses: schools, parks, recreational facilities, campuses, libraries, hospitals, restaurants, shopping areas, transit stops/centers, higher density residential areas, hotels, senior centers, etc.
- Connections to other paths, trails, and facilities

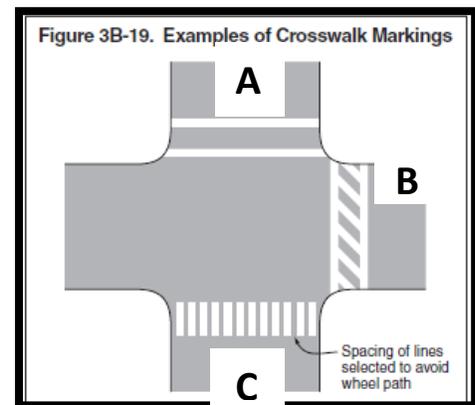
## Step 5: Determine Marking

### Standards for Marking a Crosswalk

- MUTCD Section 3B.18
- PennDOT Publication 111, TC-8600

### Three types of standard markings:

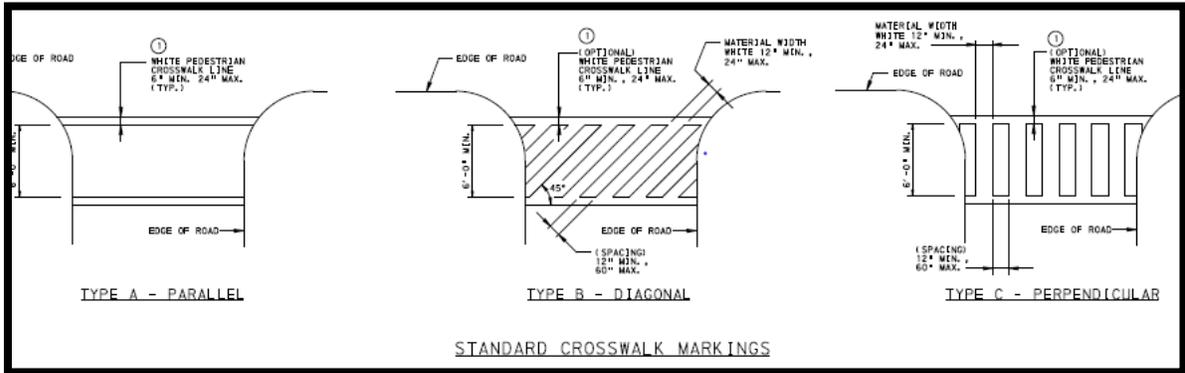
- Type A, parallel lines
- Type B, diagonal hatching
- Type C, perpendicular (blocks, piano keys, continental)



**References/Links:** PennDOT Publication 111 and MUTCD Section 3B.18

### Critical components:

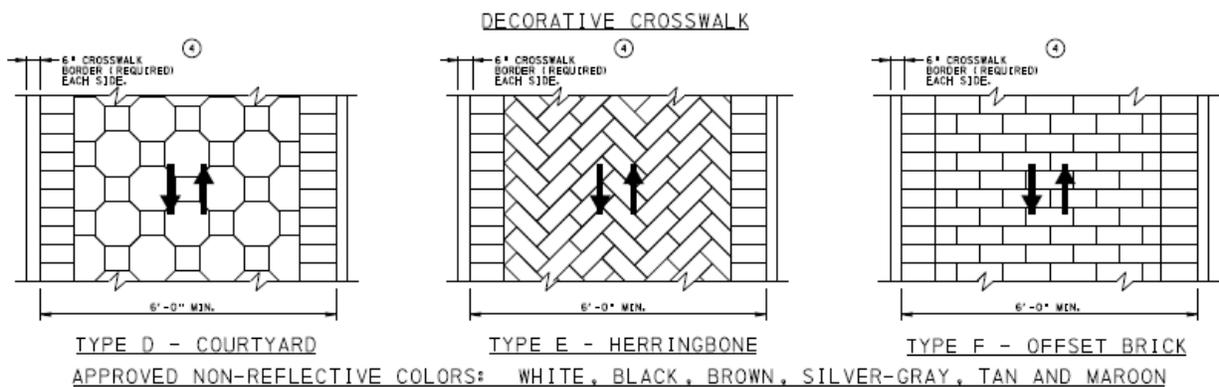
- Crosswalk minimum 6 feet wide
- Shall be white
- Curb ramps contained within crosswalk



**Decorative Crosswalks are permitted: PennDOT Pub 111** Decorative crosswalks are permitted, as long as PennDOT approved patterns are used. The decorative crosswalk must be bordered by retroreflective white lines, at least 6 inches wide. All the other details of crosswalks (location, width, etc.) apply.

Three patterns are permitted per PennDOT Pub 111: Courtyard(D), Herringbone (E), Offset Brick (F).

Approved colors are white, black, brown, silver-gray, tan, and maroon. These colors are intended to not conflict with traditional traffic control device colors.



## Visibility

The difference in visibility is determined by the amount of material on the roadway surface. The material must also be retroreflective.

**Q: Can I put any design or collection of art treatments in a crosswalk as long as the transverse white lines are present?**

**A:** No. The FHWA has consistently stated since 1984 through eight Official Interpretations that nothing except an aesthetic treatment is allowed between the white transverse lines of a crosswalk. If non-retroreflective colored pavement, including bricks and other types of patterned surfaces, is used as a purely aesthetic treatment and is not intended to communicate a regulatory, warning, or guidance message to road users, the colored pavement is not considered to be a traffic control device, even if it is located between the lines of a crosswalk. Additional guidance and a summary of past Official Interpretations on this topic is summarized in the first link.

**Q: I've heard about a crosswalk design that simulates 3-dimensional (3-D) objects in the roadway. Is such a concept compliant with the MUTCD?**

**A:** This concept does not comply with the MUTCD. As a result of demonstrated safety concerns, the FHWA is no longer considering field experimentation with "3-D" crosswalk designs. The FHWA had previously approved field experimentation with "3-D" markings until one such experiment showed unintended—and potentially dangerous—effects. A significant percentage of drivers swerved upon seeing the markings, perhaps perceiving them to be real raised objects on the roadway. While this type of driver reaction did decrease over time, the experiment showed that at least more than one in ten drivers might make an evasive or erratic maneuver upon experiencing this or similar installations for the first time. The results suggest that a "3-D" marking design can result in unsafe behavior by drivers. If the design is effective at portraying a 3-dimensional object and drivers believe there are real raised objects on the roadway, it is a reasonable expectation that drivers will take evasive action, such as braking abruptly, in fear of colliding with the perceived obstruction. This type of driver reaction is, in fact, what the experiment showed. The potential for a significant percentage of drivers to react unpredictably is too great a risk to allow further field experimentation.

## **Step 6: Determine Signs and Other Features**

This chart shows the different traffic control devices that can be used for pedestrian crossings, categorized from basic level to others.

FB = Flashing beacon

RRFB = Rectangular Rapid Flashing Beacon

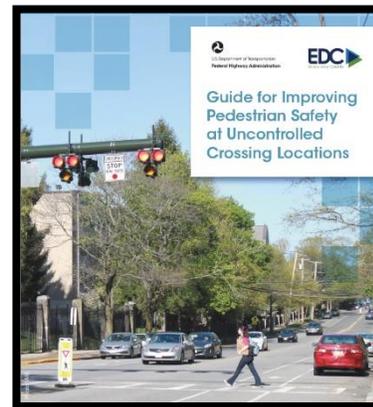
PHB = Pedestrian Hybrid Beacon. These are not permitted in PA per existing laws.



At-grade pedestrian-treatment categories	Example
Basic	Marked crosswalk with warning sign
Enhanced	Advanced stop line and sign
	In-street crossing sign
	Overhead crossing sign
Geometric	Curb extension
	Road diet
	Raised median
	Raised crosswalk
Warning beacon	FB
	RRFB
Control beacon	PHB

### Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations

This guide is a good reference to determine the types of treatments for specific crosswalks.



#### References/Links:

[https://www.fhwa.dot.gov/innovation/everydaycounts/edc\\_4/step.cfm](https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/step.cfm)

Table 1, Page 16 from the FHWA guide to improve uncontrolled crossings. The guide generates a list of potential countermeasures for you to consider.

Table 1. Application of pedestrian crash countermeasures by roadway feature.

Roadway Configuration	Posted Speed Limit and AADT								
	Vehicle AADT <9,000			Vehicle AADT 9,000–15,000			Vehicle AADT >15,000		
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph
<b>2 lanes</b> (1 lane in each direction)	① 2 4 5 6	① 7 9	① 5 6 ⑦ ⑨	① 4 5 6	① 7 9	① 5 6 ⑦ ⑨	① 4 5 6	① 7 9	① 5 6 ⑦ ⑨
<b>3 lanes with raised median</b> (1 lane in each direction)	① 2 3 4 5	① ③ 5 7 9	① ③ 5 ⑦ ⑨	① 3 4 5	① ③ 5 ⑦ ⑨	① ③ 5 ⑦ ⑨	① ③ 4 5	① ③ 5 ⑦ ⑨	① ③ 5 ⑦ ⑨
<b>3 lanes w/o raised median</b> (1 lane in each direction with a two-way left-turn lane)	① 2 3 4 5 6 7 9	① ③ 5 6 7 9	① ③ 5 6 ⑦ ⑨	① 3 4 5 6 7 9	① ③ 5 6 ⑦ ⑨	① ③ 5 6 ⑦ ⑨	① ③ 4 5 6 7 9	① ③ 5 6 ⑦ ⑨	① ③ 5 6 ⑦ ⑨
<b>4+ lanes with raised median</b> (2 or more lanes in each direction)	① ③ 5 7 8 9	① ③ 5 7 8 9	① ③ 5 ⑧ ⑨	① ③ 5 7 8 9	① ③ 5 ⑦ ⑧ ⑨	① ③ 5 ⑧ ⑨	① ③ 5 ⑦ ⑧ ⑨	① ③ 5 ⑧ ⑨	① ③ 5 ⑧ ⑨
<b>4+ lanes w/o raised median</b> (2 or more lanes in each direction)	① ③ 5 6 7 8 9	① ③ 5 ⑥ 7 8 9	① ③ 5 ⑥ ⑧ ⑨	① ③ 5 ⑥ 7 8 9	① ③ 5 ⑥ ⑦ ⑧ ⑨	① ③ 5 ⑥ ⑧ ⑨	① ③ 5 ⑥ ⑦ ⑧ ⑨	① ③ 5 ⑥ ⑧ ⑨	① ③ 5 ⑥ ⑧ ⑨
<p>Given the set of conditions in a cell,</p> <ul style="list-style-type: none"> <li># Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.</li> <li>● Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.</li> <li>○ Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*</li> </ul> <p>The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.</p>			<ul style="list-style-type: none"> <li>1 High-visibility crosswalk markings, parking restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning signs</li> <li>2 Raised crosswalk</li> <li>3 Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line</li> <li>4 In-Street Pedestrian Crossing sign</li> <li>5 Curb extension</li> <li>6 Pedestrian refuge island</li> <li>7 Rectangular Rapid-Flashing Beacon (RRFB)**</li> <li>8 Road Diet</li> <li>9 Pedestrian Hybrid Beacon (PHB)**</li> </ul>						

**PEDSAFE**

This is another resource to generate ideas for crosswalk safety.

References/Links: <http://www.pedbikesafe.org/pedsafe/>

**STEP**

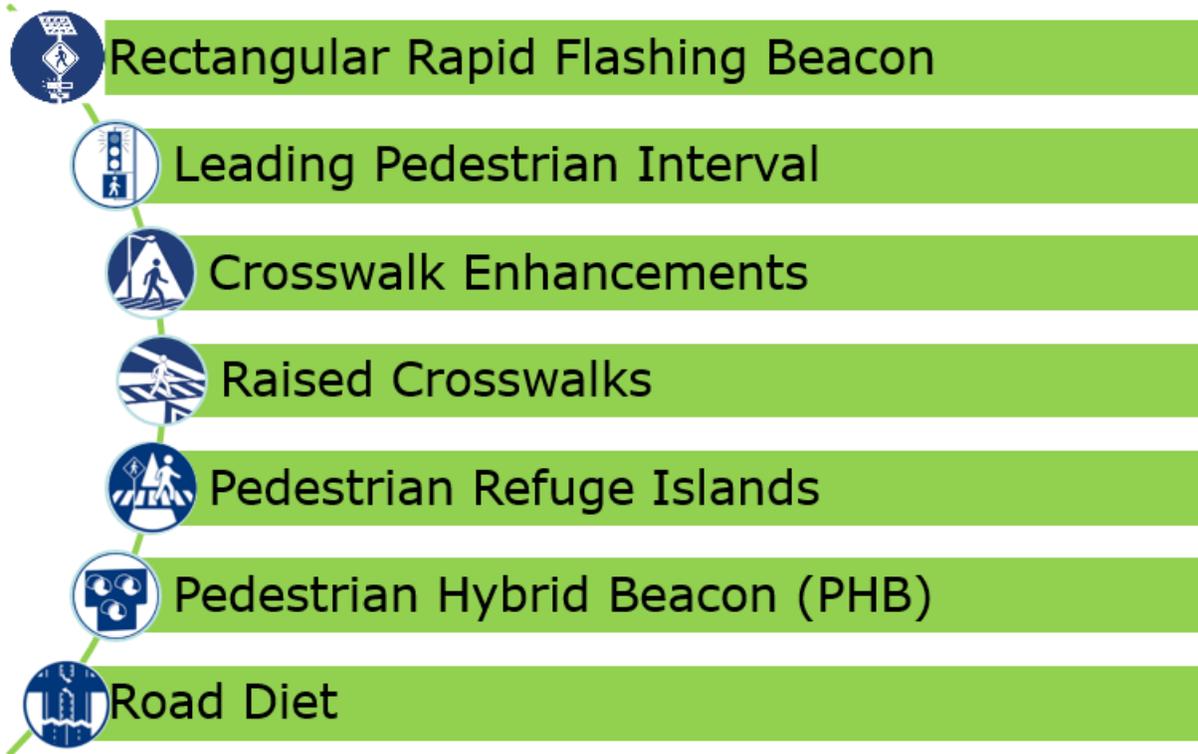
FHWA is promoting the following pedestrian safety countermeasures through the fourth round of Every Day Counts (EDC-4). EDC is a State-based model that identifies and rapidly deploys proven, yet underutilized innovations to shorten the project delivery process, enhance roadway safety, reduce traffic congestion, and integrate automation. Proven innovations promoted through EDC facilitate greater efficiency at the State and local levels, saving time, money, and resources that can be used to deliver more projects.

**References/Links:**

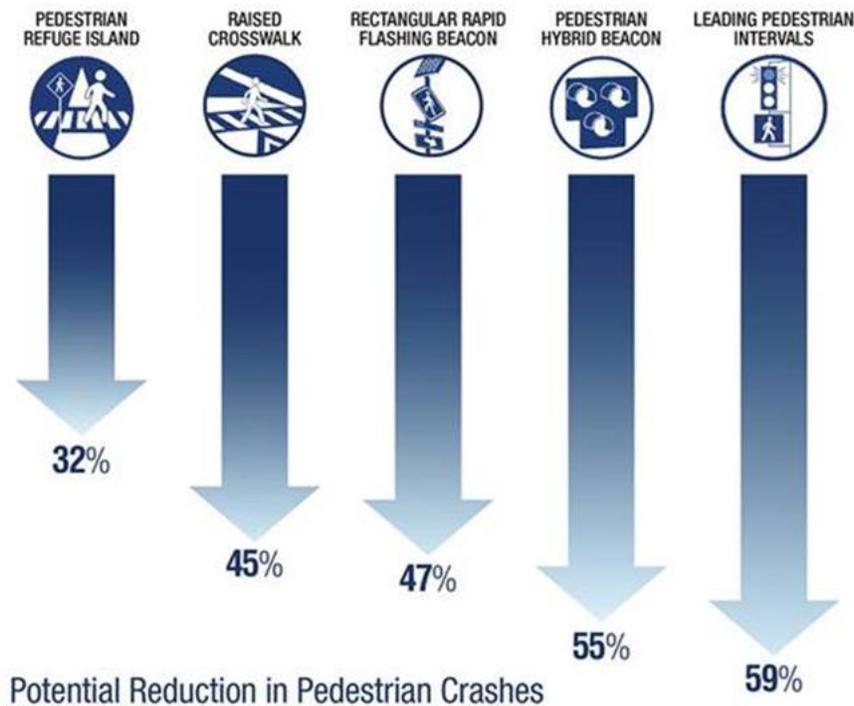
[https://www.fhwa.dot.gov/innovation/everydaycounts/edc\\_5/step2.cfm](https://www.fhwa.dot.gov/innovation/everydaycounts/edc_5/step2.cfm)

## FHWA Countermeasures

The “spectacular seven”. These are the countermeasures promoted by the FHWA as a part of the STEP program.



## STEP Countermeasures Improve Pedestrian Safety



### Implementation:

- Signs
- Lights
- Physical features

### Signs and sign placement for crosswalks

Which sign to use (ped vs hiker, vs bike/ped)?

Where to place the sign?

Which color to use (yellow vs fluorescent yellow green)?

Which plaques to add (ahead (W16-9p), distance (W16-103p), arrow (W16-7p)?

Installation details refer to Pub 111 and LTAP traffic signs basic course.

**References/Links:** MUTCD Section 2C and PennDOT Publication 111 for installation details.

At the crosswalk, the sign must have the downward diagonal arrow plaque (W16-7p).

The sign must be located as close to the crosswalk as possible.

The background color for the sign and plaque must match.

The signs on the right side can be supplemented with signs on the left side. The posts can be supplemented with reflective strips.

Signs in **advance of the crosswalk** can also be placed as an option. The sign must be on the right side but can be supplemented with a sign on the left. The sign must either have the ahead plaque (W16-9p) or distance plaque (W16-103p) beneath it.



The distance ahead of the crosswalk is determined by Table 2C-4 of the MUTCD. For a crosswalk, the warning to motorists is of a potential stop condition (see note 3).

At lower speeds (20-35 MPH), the sign placement is 100 feet minimum. As the speeds increase above 35 MPH, the distance increases. This assumes that the signs can be seen for 250 feet (see note 1), so make sure there are no obstructions limiting sight distance to the signs.

**References/Links:** MUTCD Section 2C.05, Placement of Advanced Warning Signs.

Posted or 85th-Percentile Speed	0 <sup>3</sup>
20 mph	100 ft <sup>6</sup>
25 mph	100 ft <sup>6</sup>
30 mph	100 ft <sup>6</sup>
35 mph	100 ft <sup>6</sup>
40 mph	125 ft
45 mph	175 ft
50 mph	250 ft
55 mph	325 ft

<https://mutcd.fhwa.dot.gov/htm/2009/part2/part2c.htm#table2C04>

PennDOT Publication 111 for installation details. PennDOT Pub. 236 for sign sheets

### The R1-6, In-street pedestrian sign

PennDOT study shows that the sign increases compliance with the law.

Place the sign as close to the crosswalk as practical. Beware of turning vehicles! The sign position should be adjusted if it is frequently hit.



## Lights

The signs can be supplemented with flashing devices. There are several options for flashing devices, including LEDs in the sign borders, Rectangular Rapid Flashing Beacons (RRFBs), and flashing beacons.

**References/Links:** MUTCD Section 2A.15:

<https://mutcd.fhwa.dot.gov/htm/2009/part2/part2a.htm#section2A15>

## RRFBs

### Purpose

Rectangular Rapid Flash Beacons (RRFB) can enhance safety by reducing crashes between vehicles and pedestrians at unsignalized intersections and midblock pedestrian crossings by increasing driver awareness of potential pedestrian conflicts.

## LEDs

Signs can be enhanced with LEDs. The LEDs can flash all the time or be push button activated.

### Purpose

Embedded Light Emitting Diodes (LED) in sign faces improve safety at intersections by enhancing driver awareness of traffic-control signs.

## Traditional flashers

These can also be used to supplement signs over the road or on the side of the road.

## In-street lights

These lights can also be used. However, the maintenance experience with these systems has been poor.



## Nighttime Light

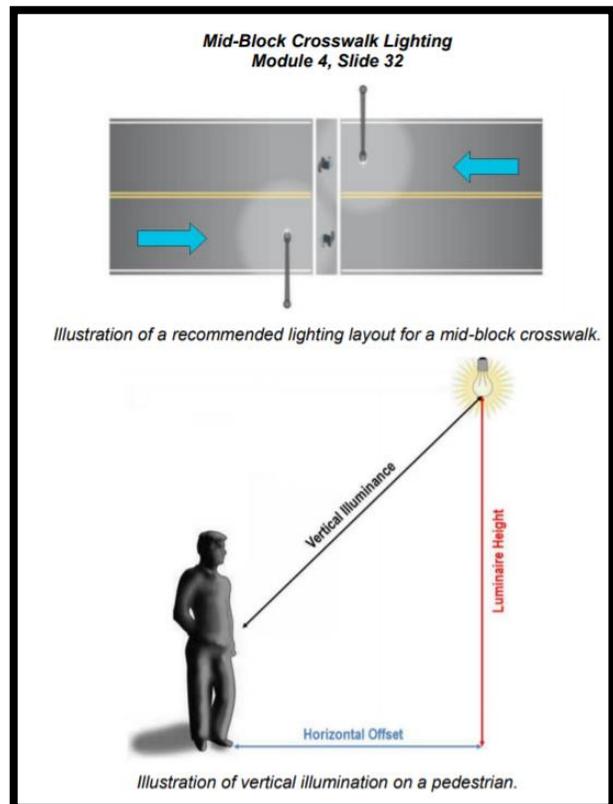
Proper nighttime lighting is critical for pedestrian safety. The traditional method of providing one streetlight for an intersection may not provide enough light levels for pedestrians, especially in the crosswalks away from the light.

Crosswalks are typically lighted by overhead light fixtures mounted on poles. For midblock crosswalks, it is recommended that lighting be placed on each side of the roadway approximately 15 feet in front of the crosswalk in each direction of vehicle travel. Placing the light fixtures in this manner provides higher vertical illuminance on pedestrians, making them more visible to drivers.

Lighting recommendations for crosswalks at intersections are similar to midblock crosswalks in that the lighting should be placed 15 feet before the crosswalk in each direction of vehicle travel. This layout is shown in the figure above.

Important considerations for crosswalk lighting include the vertical illumination levels on the pedestrians and the contrast between the pedestrians and the background. In areas where it is darker at night (less ambient lighting), such as a rural roadway, vertical illumination on the pedestrian can potentially be reduced, because there will be a good contrast between the pedestrian and the darker background against which they are viewed by drivers. However, on a city street, where nighttime ambient light levels are much higher, a higher level of vertical illuminance will be needed on pedestrians in crosswalks in order to provide equivalent visibility.

A study, “Informational Report on Lighting Design for Midblock Crosswalks”, performed by the Virginia Tech Transportation Institute found that a vertical illuminance of 20 lux (about 2 footcandles) in a crosswalk, measured at 5 feet above the road surface, allowed drivers to detect pedestrians at adequate stopping distances under rural conditions. Higher vertical light levels, perhaps as much as 40 lux, might be needed for urban crosswalks.



## Physical features

Physical features offer many benefits. They are more conspicuous to motorists, they can slow the speed of traffic, they can shorten crossing distances/exposure, improve sight lines, add opportunities for landscaping/water control, and other benefits. All physical features can also have side effects—they can affect response times for emergency vehicles, affect drainage, impact utilities, and others.

Refer to PennDOT Publication 383, Pennsylvania's Traffic Calming Handbook and the LTAP Traffic Calming class for more information.

Examples of physical features on the next few slides

## Proven Safety Countermeasures

- Median Refuge Area
- Raised crosswalk

## Yield Lines

These lines require a vehicle on multi-lane approaches to stop 20-50 feet before the crossing to reduce the chance of the double threat.

**Medians and Pedestrian Crossing Islands in Urban and Suburban Areas**

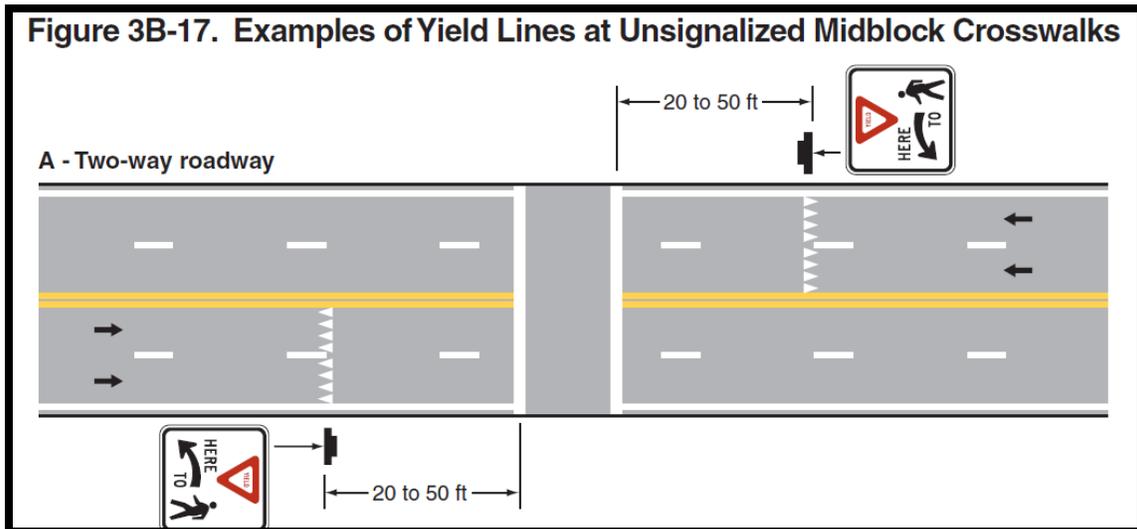


Median and pedestrian crossing islands near a roundabout.

Source: [www.pedbikeimages.org](http://www.pedbikeimages.org) / Dan Burden

**SAFETY BENEFITS:**

- Raised Median**  
**46%**  
Reduction in pedestrian crashes
- Pedestrian Crossing Island**  
**56%**  
Reduction in pedestrian crashes



## Unsignalized Midblock Crosswalks on State Routes

The study requirements are in PennDOT Publication 46, Chapter 11.9.

### Minimum Requirements for New Midblock Installations

1. **Speed Limit.** The posted speed limit is 35 MPH or less.
2. **Other Marked Crosswalks.** The nearest marked crosswalk on the same roadway is over 300 feet from the proposed crossing.
3. **Number of Pedestrian Crossings.** To qualify for midblock crosswalks, the minimum number of pedestrians crossing the street within 150 feet of the proposed crossing during an average day should be 80 or more during any 1 hour, or 40 or more during each of any 4 hours. However, if there is a high concentration of children, elderly or disabled pedestrians crossing the roadway in the vicinity of the proposed crossing, then these pedestrian volume warrants may be reduced 50%.
4. **Traffic Volume.** The maximum traffic volume on the roadway is 10,000 ADT, except on two-lane roadways the maximum traffic volume may be 15,000 ADT. If a raised median or pedestrian refuge island exists where pedestrians are protected from vehicular traffic, the maximum traffic volume applies to each segment of the pedestrian crossing, but no more than three travel lanes may be crossed without a raised median or pedestrian refuge island. In order to consider a refuge island, the minimum width of the refuge island is 4 feet from face-of-curb to face-of-curb, but the preferred minimum width is 6 feet. Islands should have a cut through ramp to accommodate wheelchair users.
5. **Parking Restrictions.** To improve visibility, parking is not permitted within 75 feet of the crosswalk, unless a 6- to 8-foot curb extension (sometimes referred to as bulb outs, bump outs, neck downs, sidewalk expansions, etc.) is in place to improve pedestrian visibility. If angle parking is present, any curb extension should place the curb at the inside edge of the parking lane. Curb extensions not only improve visibility between motorists and the pedestrians, but they also reduce the length of the crosswalk and the pedestrian exposure. However, curb extensions may impede drainage, street cleaning, and winter maintenance operations and create a formidable object.
6. **Sight Distance.** The available sight distance between an approaching driver and a person anywhere within the proposed crosswalk must satisfy the following minimum values, where both the eye and the object (i.e., the pedestrian) are assumed to be 3.5 feet above the roadway:

## Speed Limit (MPH)

Minimum Sight Distance for a Corresponding Grade (feet)

	-6%	level	+6%
25	215	200	184
30	271	250	229
35	333	305	278

TE-113 (7-09)			
<b>MID-BLOCK CROSSWALK ENGINEERING AND TRAFFIC STUDY</b>			
PLEASE TYPE OR PRINT ALL INFORMATION IN BLUE OR BLACK INK			
<b>A - LOCATION INFORMATION</b>			
COUNTY		MUNICIPALITY	
STREET NAME		TOWNSHIP ROAD #	
SR#		SEGMENT	
<b>B - REFERENCE INFORMATION</b>			
REFERENCE Chapter 212	SECTION(S) 212.5(b)(1)(v)(T)		
REFERENCE MUTCD	SECTION(S) 3B.17		
REFERENCE PUB 46	SECTION(S) Chapter 11.9		
REFERENCE Vehicle Code Title 75 P.a. C.S.	SECTION(S) § 3542		
REFERENCE TC-8600	SECTION(S) Sheet 4 of 8		

# PEDESTRIANS AND CROSSWALKS SUMMARY

Let's review some of the important issues we discussed today.

Is there a pedestrian safety problem?

What are some of the main safety issues/factors?

Who is responsible for choosing to mark and maintain crosswalks?

On State Routes? On local roads?

What should you do before marking a crosswalk?

What factors should you consider in a crosswalk study?

Is it important to follow standards?

What are the main pavement marking styles for crosswalks?

What signs can you use to make crosswalks more visible to motorists?

Can you supplement the signs with lights?

What other features can you implement with crosswalks?

Part 1: Pedestrian Environment

Section 1: Safety

Section 2: Pedestrian Laws

Section 3: Pedestrian Initiatives

Part 2: Crosswalks Basics

Section 1: Crosswalk Responsibility

Section 2: Crosswalk Considerations

Part 3: Crosswalks Studies

Section 1: Controlled Locations

Section 2: Uncontrolled Locations

## EVALUATIONS

In three months, you will receive an evaluation form via email for this course. Please click on the link in the email to complete the form. Your evaluation is combined with other class participants to support the value of the training.

## FOR MORE ASSISTANCE ...

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**pennsylvania**

DEPARTMENT OF TRANSPORTATION

LOCAL TECHNICAL ASSISTANCE PROGRAM

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