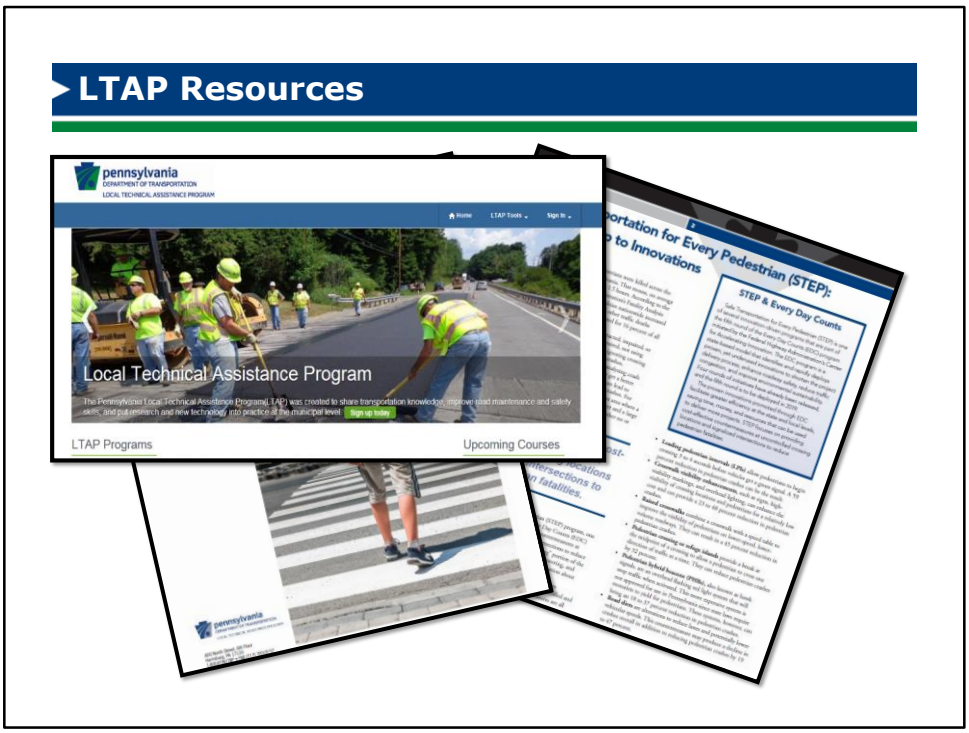
LTAP Pedestrian and Crosswalks Webinar
Version 1.1
August 19, 2019

The webinar presenter is Patrick Wright, LTAP Traffic Engineer. Pat has 34 years of experience and has worked with LTAP since 2005.

The photo is Pat playing ultimate frisbee at the 2019 USA National Championships in Denver, Colorado. Pat's team, the Relics, won the gold medal for the second time.



LTAP has a website filled with resources on the local, state, and federal level.

You can register for classes—including the new pedestrians and crosswalks class--and request a tech assist on the website.

LTAP publishes a quarterly newsletter and techs sheets.

These can be found on the LTAP Website.

Agenda

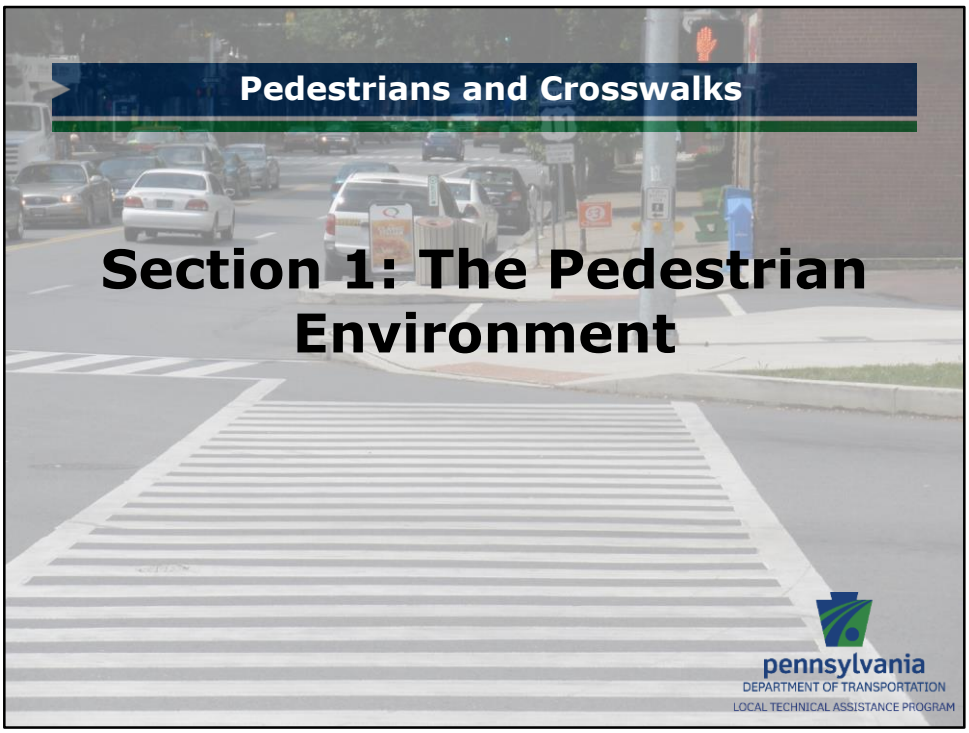
1. The Pedestrian Environment
2. Pedestrian Facilities
3. Pedestrian Safety Features

Course Notes:

The webinar 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.

References/Links:



Course Notes:
Section break slide

References/Links:

Part 1: The Pedestrian Environment

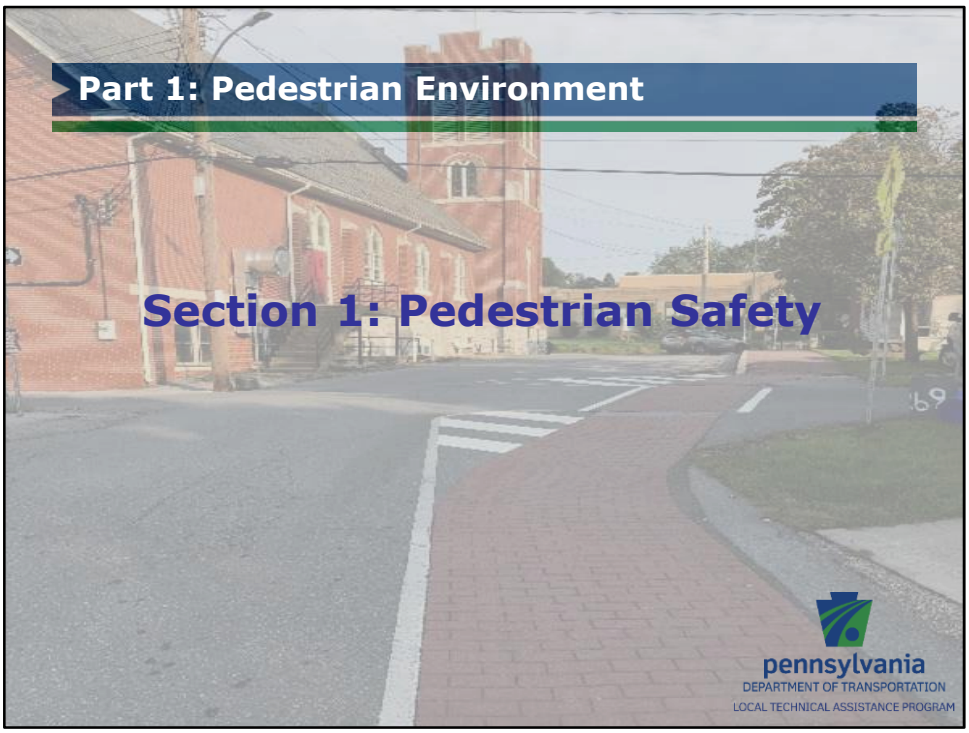
1. **Pedestrian Safety**
2. **Pedestrian Laws**
3. **Pedestrian Initiatives**

Course Notes:

Section 1 will discuss:

1. Pedestrian Safety
2. Pedestrian Laws
3. Pedestrian Initiatives

References/Links:



Course Notes:
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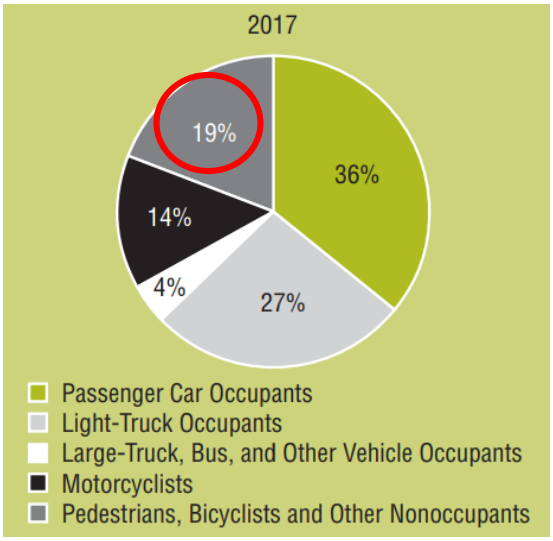
References/Links:

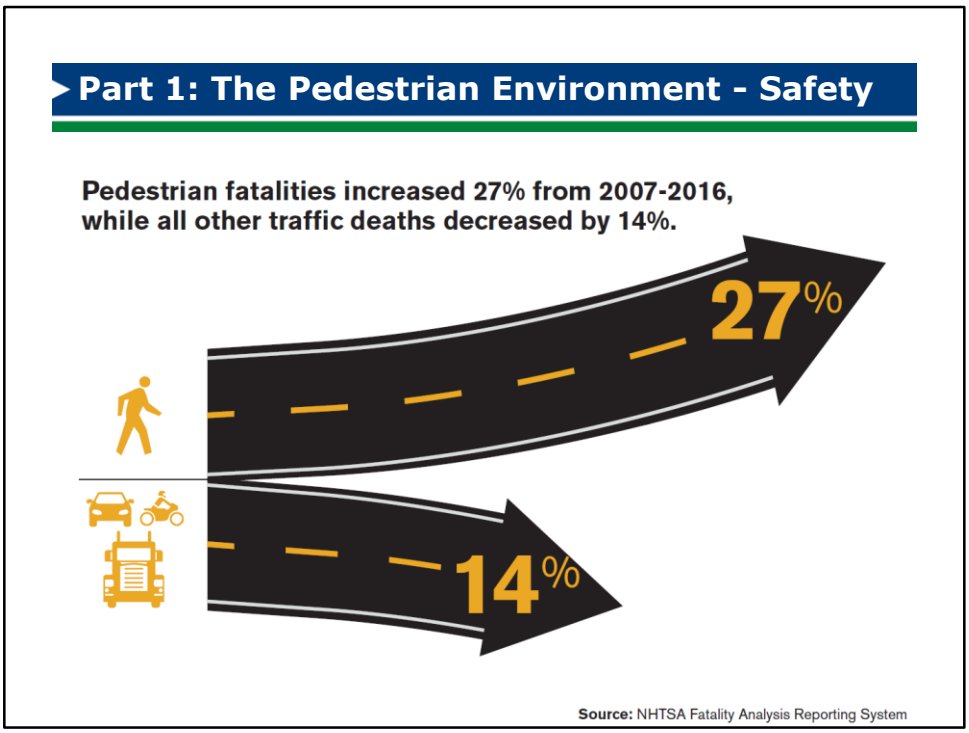
Part 1: The Pedestrian Environment - Safety



Course Notes:
National Highway Transportation Safety Administration (NHTSA) 2017 Pedestrian Safety Facts indicate the size of the pedestrian and bicyclist safety problem in the United States:
5,977 pedestrians were killed in traffic crashes.
783 bicyclists were killed in traffic crashes.
An additional 228 of other nonoccupants were killed in traffic crashes.

- 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%).

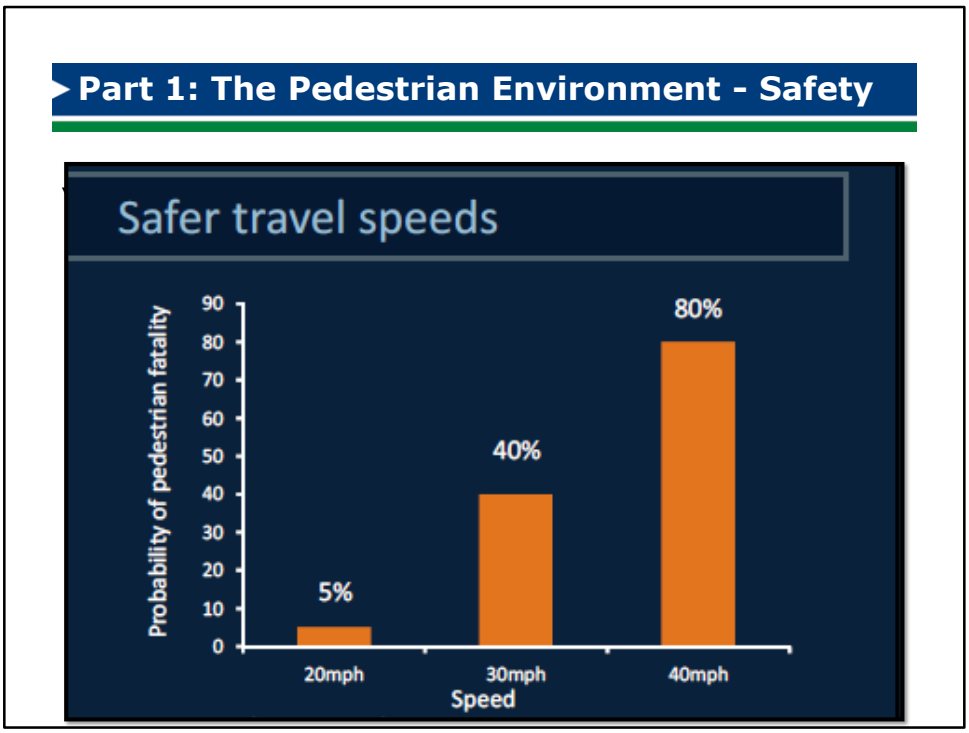
References/Links:
- https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812603



Course Notes:

References/Links:

- https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812681



Course Notes:

Vulnerable road users. Summary. 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).

References/Links:

- Source: AAA Foundation for Traffic Safety

Part 1: The Pedestrian Environment - Safety

Pennsylvania Statistics:

CRASH SEVERITY LEVEL BY YEAR

	2013 CRASHES	2014 CRASHES	2015 CRASHES	2016 CRASHES	2017 CRASHES
FATAL INJURY	149	161	151	174	148
SUSPECTED SERIOUS INJURY	321	267	331	414	444
SUSPECTED MINOR INJURY	840	826	780	1046	1022
POSSIBLE INJURY	1756	1579	1496	1194	1175
UNKNOWN SEVERITY	1310	1167	1254	1378	1301
UNKNOWN IF INJURED	1	5	1	3	0
PROPERTY DMG ONLY	5	6	3	3	5
TOTAL	4382	4011	4016	4212	4095

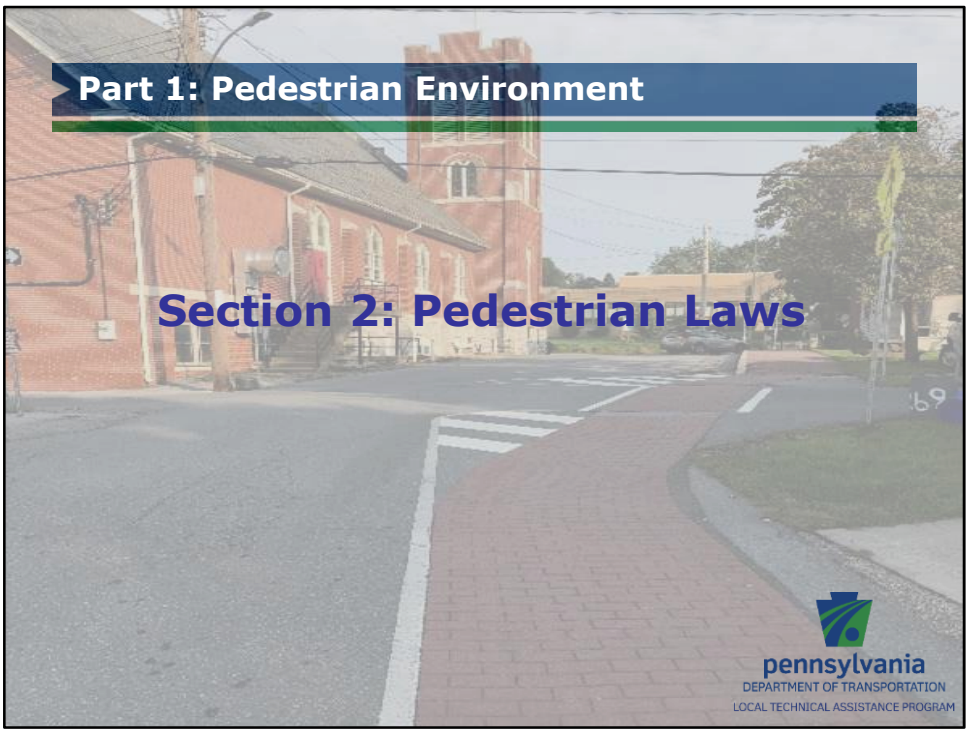
Course Notes:
Pedestrian Safety in Pennsylvania

✓13.2% of all traffic crash fatalities are pedestrians.

✓74.7% of pedestrian fatalities at non-intersection locations like mid-block crossings, driveway crossings etc.

✓67% of pedestrian fatalities occurred at uncontrolled locations.

References/Links:
- 2017 Pennsylvania Crash Facts and Statistics



Course Notes:
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References/Links:

Part 1: Pedestrian Laws

What is a crosswalk?

What are the duties of a pedestrian?

What are the duties of vehicles?

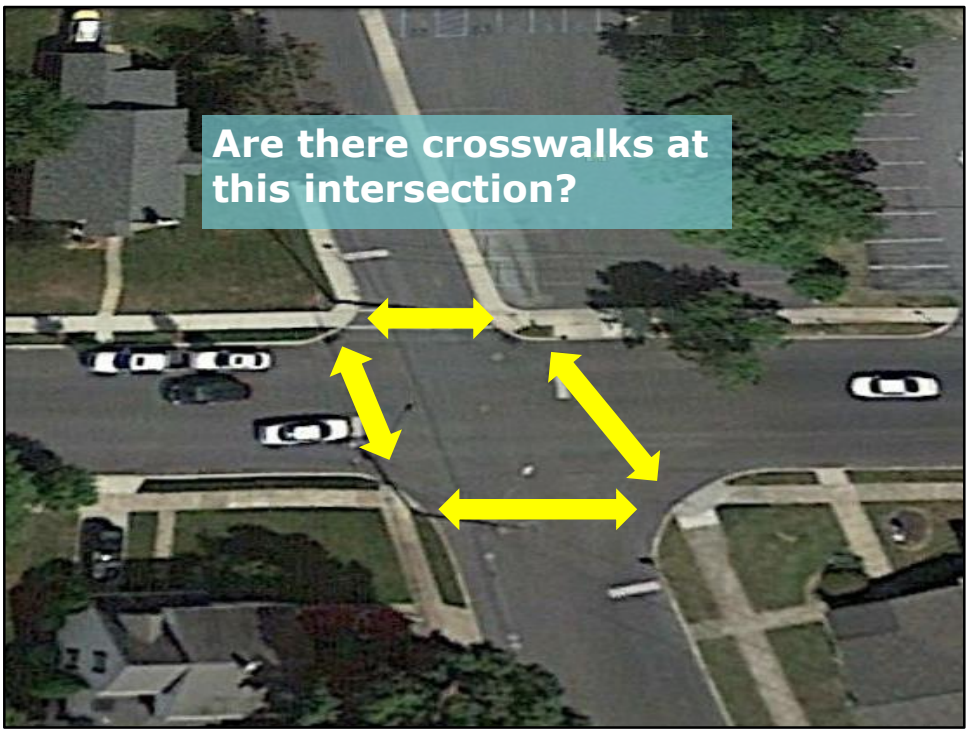
Course Notes:

References/Links:

Course Notes:
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.

References/Links:
- https://www.legis.state.pa.us/cfdocs/legis/LI/consCheck.cfm?txtType=HTM&ttl=75&div=0&chpt=1&sctn=2&subsctn=0



Course Notes:
By the extension of the sidewalks at this intersection, there are four crosswalks—whether they are marked or not.

References/Links:
- https://www.legis.state.pa.us/cfdocs/legis/LI/consCheck.cfm?txtType=HTM&ttl=75&div=0&chpt=1&sctn=2&subsctn=0

Course Notes:
Title 75, Section 102: Definitions:

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(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.

References/Links:
- https://www.legis.state.pa.us/cfdocs/legis/LI/consCheck.cfm?txtType=HTM&ttl=75&div=0&chpt=1&sctn=2&subsctn=0

Course Notes:
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).

References/Links:
- https://www.legis.state.pa.us/WU01/LI/LI/CT/HTM/75/00.035..HTM

Course Notes:
Title 75

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).

References/Links:
- https://www.legis.state.pa.us/WU01/LI/LI/CT/HTM/75/00.035..HTM

Course Notes:
Title 75

3543. Pedestrians crossing at other than crosswalks.
(a) General rule.--Every pedestrian crossing a roadway at any point other than within a crosswalk at an intersection or any marked crosswalk shall yield the right-of-way to all vehicles upon the roadway.
(b) At pedestrian tunnel or overhead crossing.--Any pedestrian crossing a roadway at a point where a pedestrian tunnel or overhead pedestrian crossing has been provided shall yield the right-of-way to all vehicles upon the roadway.
(c) Between controlled intersections in urban district.--Between adjacent intersections in urban districts at which traffic-control signals are in operation, pedestrians shall not cross at any place except in a marked crosswalk.
(d) Crossing intersection diagonally.--No pedestrian shall cross a roadway intersection diagonally unless authorized by official traffic-control devices or at the direction of a police officer or other appropriately attired person authorized to direct, control, or regulate traffic. When authorized to cross diagonally, pedestrians shall cross only in accordance with the signal pertaining to the crossing movements.

References/Links:
- https://www.legis.state.pa.us/WU01/LI/LI/CT/HTM/75/00.035..HTM

Course Notes:
Title 75

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.

References/Links:
- https://www.legis.state.pa.us/WU01/LI/LI/CT/HTM/75/00.035..HTM

Part 1: Pedestrian Laws

Course Notes:
Title 75

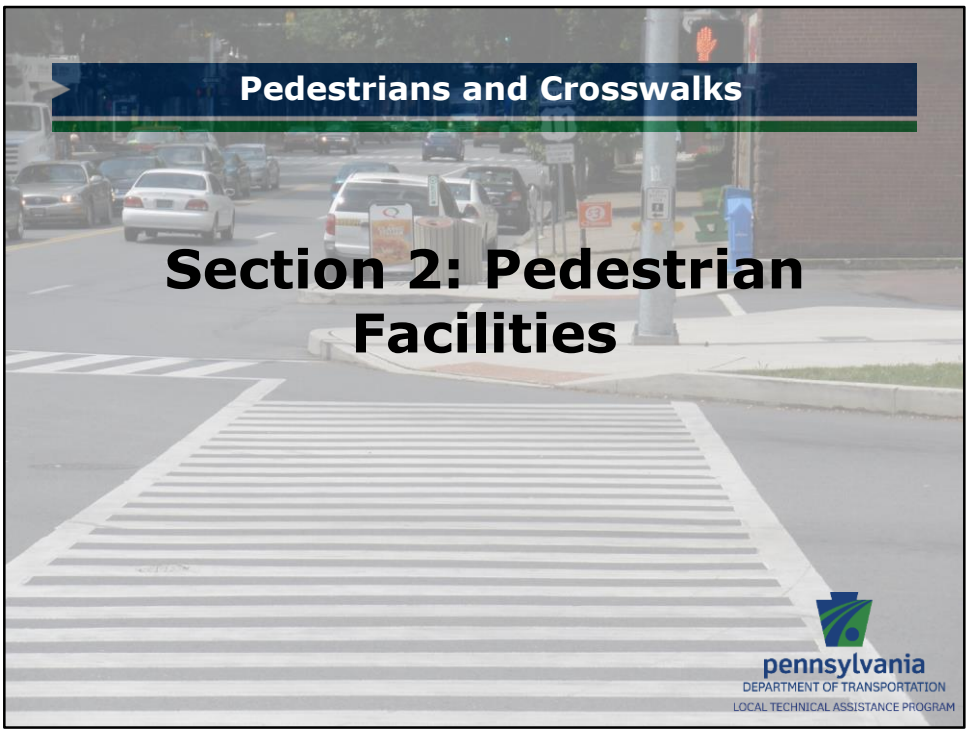
Laws vs. Safety Tips
The rights and duties of pedestrians vary greatly depending on the situation. It's important to familiarize yourself with Pennsylvania laws, as well as common-sense safety tips:
LAW: Walk on sidewalks whenever they are available. If no sidewalk is available, you must walk on the 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 condition, 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.

References/Links:

- https://www.penndot.gov/PennDOTWay/Pages/Article.aspx?post=54



Course Notes:
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References/Links:

Part 2: Crosswalks

Who is responsible for crosswalks?

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

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

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.

References/Links:
- https://www.legis.state.pa.us/cfdocs/legis/LI/consCheck.cfm?txtType=HTM&ttl=75&div=0&chpt=61&sctn=22&subsctn=0
- https://www.pacode.com/secure/data/067/chapter212/067_0212.pdf

Course Notes:
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.

References/Links:
- https://www.pacode.com/secure/data/067/chapter212/067_0212.pdf

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

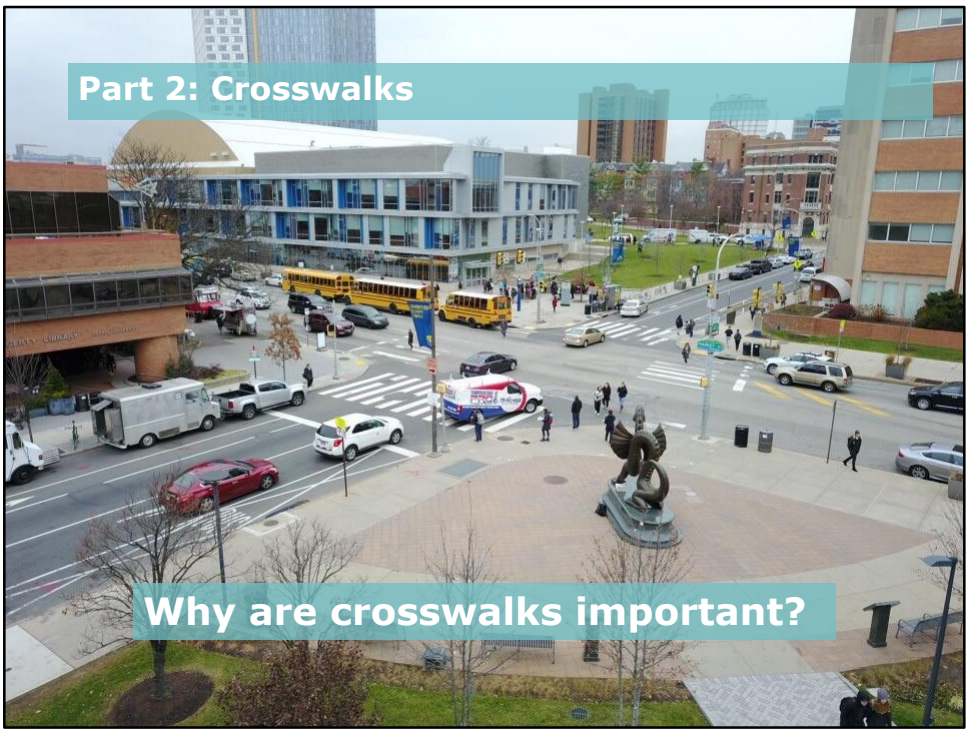
(b) Traffic-control devices on State-designated highways.
(iv) Local authorities may install, revise or remove the following devices, and Department approval is not required:
(A) Stopping, standing or parking signs (R7 and R8 Series).
(B) Street name signs (D3 Series).
(C) Crosswalk markings at intersections.
(D) Parking stall markings, except written Department approval is required prior to creating new angle parking.

References/Links:
- https://www.pacode.com/secure/data/067/chapter212/067_0212.pdf

Course Notes:
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.

(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.

References/Links:
- https://www.pacode.com/secure/data/067/chapter212/067_0212.pdf



Course Notes:
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

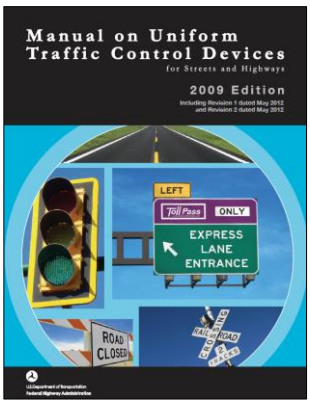
The Walking Environment
4. Marked Crosswalks and Enhancements
Marked crosswalks indicate locations for pedestrians to cross and signify to motorists to yield to them. Crosswalks are often installed at signalized intersections and other selected locations. Various crosswalk marking patterns are given in the MUTCD. Marked crosswalks are desirable at high pedestrian volume locations to guide pedestrians along a preferred walking path. They can be raised or installed in conjunction with other enhancements that physically reinforce crosswalks and reduce vehicle speeds. It is also useful to supplement crosswalk markings with warning signs. In some locations, signs can get "lost" in visual clutter so care must be taken in placement. The most effective approach combines engineering treatments with enforcement and education.
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.

References/Links:
- https://safety.fhwa.dot.gov/saferjourney1/library/countermeasures/04.htm

Part 2: Crosswalks

Choosing to mark a crosswalk:

- Crosswalks should not be marked indiscriminately
- A study should be performed before a crosswalk is marked on an uncontrolled approach



Course Notes:

Section 3B.18 Crosswalk Markings

Support:

01 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.

02 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.

03 At non-intersection locations, crosswalk markings legally establish the crosswalk.

References/Links:

- https://mutcd.fhwa.dot.gov/htm/2009r1r2/part3/part3b.htm

Part 2: Crosswalks

Choosing to mark a crosswalk:

- At uncontrolled intersections, crosswalk markings are discretionary
- For traffic signals, crosswalks must conform to the signal permit drawing
- At controlled intersections, crosswalks can be marked to guide pedestrians

Course Notes:

Section 3B.18 Crosswalk Markings

07 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).

08 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-%ile speed, the geometry of the location, the possible consolidation of multiple crossing points, the availability of street lighting, and other appropriate factors.

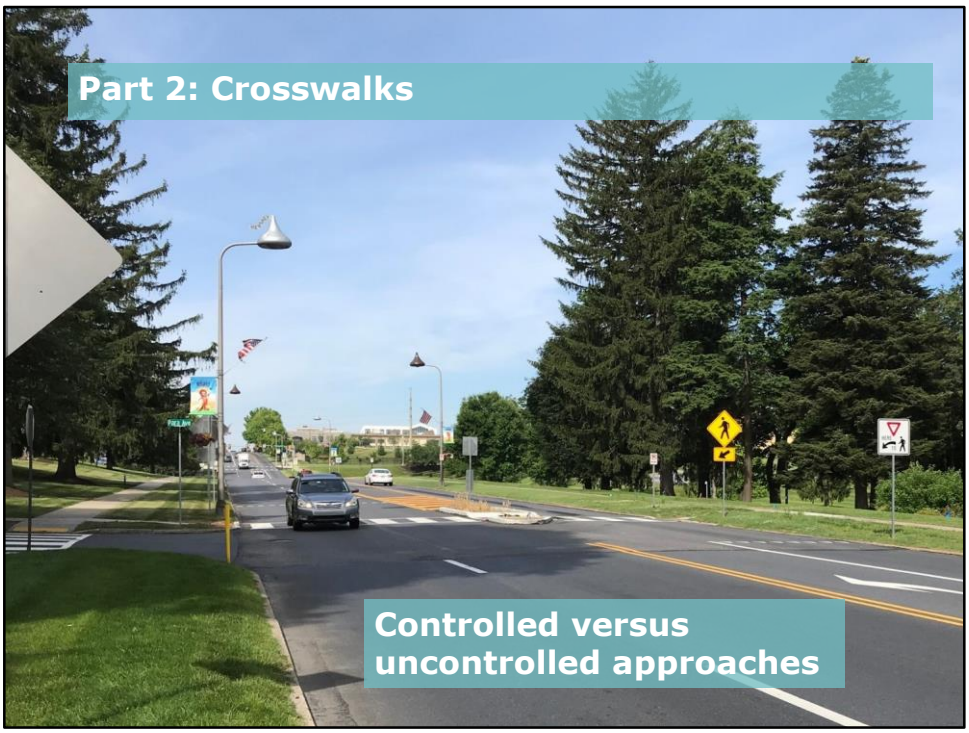
09 New marked crosswalks alone, without other measures designed to reduce traffic speeds, shorten crossing distances, enhance driver awareness of the crossing, and/or provide active warning of pedestrian presence, should not be installed across uncontrolled roadways where the speed limit exceeds 40 mph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

References/Links:

- https://mutcd.fhwa.dot.gov/htm/2009r1r2/part3/part3b.htm



Course Notes:
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.

References/Links:

Part 2: Crosswalks

Traffic signals

Course Notes:
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.

References/Links:

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

References/Links:
- https://mutcd.fhwa.dot.gov/htm/2009r1r2/part3/part3b.htm

Part 2: Crosswalks

What should a study consist of?

Course Notes:

References/Links:

Part 2: Crosswalks

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

Course Notes:

References/Links:

Part 2: Crosswalks – Study Steps

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

Course Notes:

References/Links:

Part 2: Crosswalks – Study Step 3

Table 1. Recommendations for Installing Marked Crosswalks at Uncontrolled Locations

Roadway Type (# of Travel Lanes and Median Type)	ADT ≤ 9,000			ADT 9,000 - 12,000			ADT 12,000 - 15,000			ADT > 15,000		
	Speed Limit**											
	≤30 mph	35 mph	40 mph	≤30 mph	35 mph	40 mph	≤30 mph	35 mph	40 mph	≤30 mph	35 mph	40 mph
2 Lanes	C	C	P	C	C	P	C	C	N	C	P	N
3 Lanes	C	C	P	C	P	P	P	P	N	P	N	N
Multi-Lane (4 or More Lanes) With Raised Median +	C	C	P	C	P	N	P	P	N	N	N	N
Multi-Lane (4 or More Lanes) Without Raised Median	C	P	N	P	P	N	N	N	N	N	N	N

C = Candidate sites for marked crosswalks
P = Possible increase in pedestrian crash risk
N = Marked crosswalks alone are insufficient

Course Notes:

Table 1 Notes:

* These guidelines include intersection and midblock locations with no traffic signals or STOP signs on the approach to the crossing. They do not apply to school crossings. A two-way
center turn lane is not considered a median. Crosswalks should not be installed at locations that could present an increased safety risk to pedestrians, such as where there is
poor sight distance, complex or confusing designs, a substantial volume of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone will not make crossings safer, nor will they necessarily result in more vehicles stopping for pedestrians. Whether or not marked crosswalks are installed, it is important to consider other pedestrian facility enhancements (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic-calming measures, curb extensions), as needed, to improve the safety of the crossing. These are general recommendations; good engineering judgment should be used in individual cases for deciding where to install crosswalks.

** Where the speed limit exceeds 40 mi/h, marked crosswalks alone should not be used at unsignalized locations.

*** The raised median or crossing island must be at least 4 ft wide and 6 ft long to serve adequately as a refuge area for pedestrians, in accordance with MUTCD
and American Association of State Highway and Transportation Officials (AASHTO) guidelines.

C = Candidate sites for marked crosswalks. Marked crosswalks must be installed carefully

and selectively. Before installing new marked crosswalks, an engineering study is needed to determine whether the location is suitable for a marked crosswalk. For an engineering study, a site review may be sufficient at some locations while a more in depth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, and other factors may be needed at other sites. It is recommended that a minimum utilization of 20 pedestrian crossings per peak hour (or 15 or more elderly and/or child pedestrians) be confirmed at a location before placing a high priority on the installation of a marked crosswalk alone.

P = Possible increase in pedestrian crash risk may occur if crosswalks are added without other pedestrian facility enhancements. These locations should be closely monitored and enhanced with other pedestrian crossing improvements, if necessary, before adding a marked crosswalk.

N = Marked crosswalks alone are insufficient since pedestrian crash risk may be increased by providing marked crosswalks alone. Consider using other treatments, such as traffic-calming treatments, traffic signals with pedestrian signals where warranted, or other substantial crossing improvement to improve crossing safety for pedestrians.

References/Links:

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

Table 2. Recommendations for Considering Marked Crosswalks and Other Needed 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

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

Course Notes:
Newer research from other states expand the FHWA table:

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

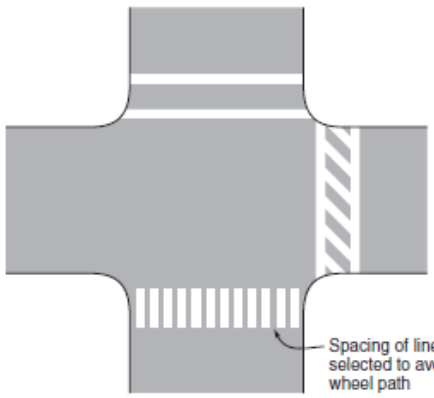
Course Notes:
Pine St (SR 413):
10,000 vehicles per day
Posted at 35 mph
Two lanes with a painted median, uncontrolled approaches
Signal 400 feet to the north
Crosswalk used by school students, church, and residents to access library
Nine reportable crashes, none with pedestrians

References/Links:

Part 2: Crosswalks – Study Step 5

Step 5: Determine Marking

Figure 3B-19. Examples of Crosswalk Markings



Course Notes:

Standards for Marking a Crosswalk

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

Three types of standard markings:

1. Type A, parallel lines
2. Type B, diagonal hatching
3. Type C, perpendicular (blocks, piano keys, continental)

Crosswalks **shall** be white.

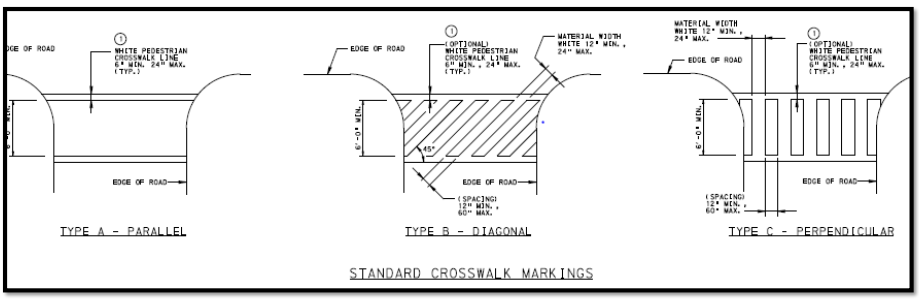
References/Links:

- PennDOT Publication 111
- MUTCD Section 3B.18

Part 2: Crosswalks – Study Step 5

Critical components:

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



Course Notes:

Critical components:

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

References/Links:

- PennDOT Publication 111
- MUTCD Section 3B.18

Course Notes:

References/Links:
- PennDOT Publication 111
- MUTCD 3B.18

Course Notes:

References/Links:
- PennDOT Publication 111
- MUTCD 3B.18

Course Notes:

References/Links:

- PennDOT Publication 111

Course Notes:
A good system is to use Type A markings at controlled crossings. Then use the Type C crossings at uncontrolled crossings and crossings with special users (schools, parks, campuses, etc.).

Also note the location of the uncontrolled crossing—is that the best choice for pedestrians? Why or why not?

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

Course Notes:

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.

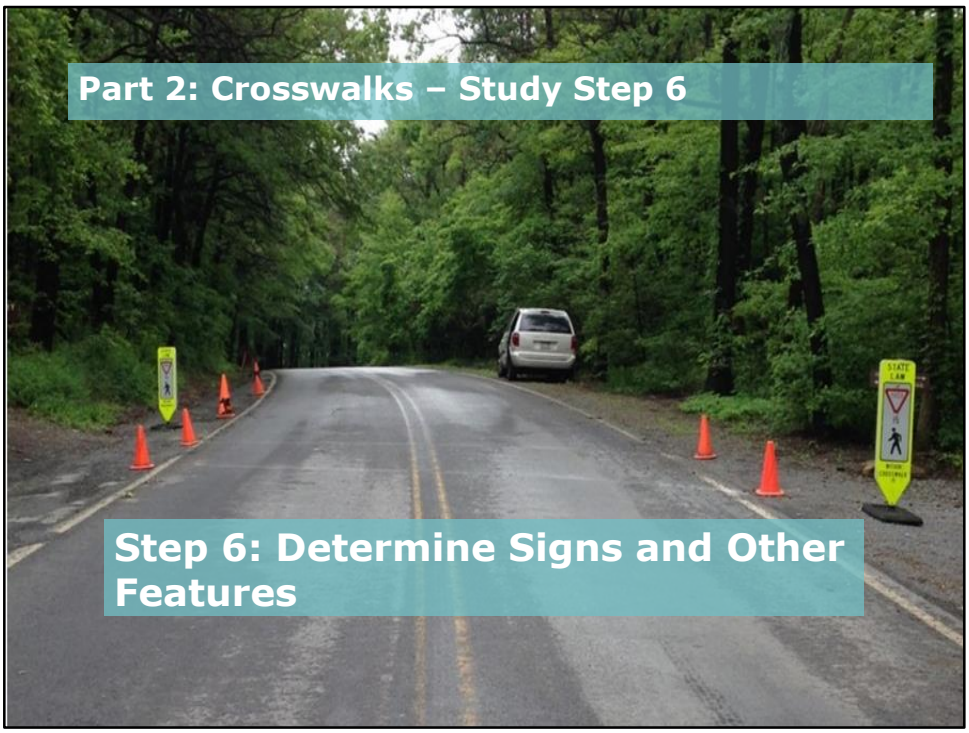
Q: I've heard about a crosswalk design that simulates 3-dimensional (3-D) objects in the roadway. Is such a concept compliant with the MUTCD?

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.

References/Links:

- https://mutcd.fhwa.dot.gov/resources/interpretations/3_09_24.htm
- https://mutcd.fhwa.dot.gov/knowledge/faqs/faq_part3.htm#cwq2
- MUTCD Section 3B.18



Course Notes:

References/Links:

Part 2: Crosswalks – Study Step 6

Types of Treatments

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

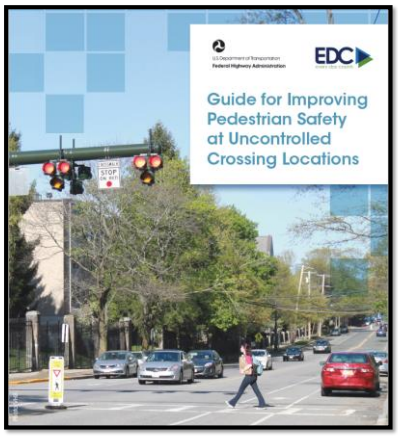
Course Notes:
This chart shows the different traffic control devices that can be used for pedestrian crossings.

FB = Flashing beacon
RRFB = Rectangular Rapid Flashing Beacon
PHB = Pedestrian Hybrid Beacon. These are not permitted in PA per existing laws.

References/Links:

Part 2: Crosswalks – Study Step 6

Step 6: Determine Signs and Other Features



Course Notes:
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/guide_to_improve_uncontrolled_crossings.pdf

Roadway Configuration	Speed Limit								
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph
	Vehicle AADT <9,000			Vehicle AADT 9,000–15,000			Vehicle AADT >15,000		
2 lanes*	❶ 2 3 4 5 6	❶ ❸ 5 6 7	❶ ❸ 5 6 ❼	❶ 3 4 5 6	❶ ❸ 5 6 7	❶ ❸ 5 6 ❼	❶ 3 4 5 6 7	❶ ❸ 5 6 7	❶ ❸ 5 6 ❼
3 lanes with raised median*	❶ 2 3 4 5	❶ ❸ 5 7	❶ ❸ 5 ❼	❶ 3 4 5 7	❶ ❸ 5 ❼	❶ ❸ 5 ❼	❶ ❸ 4 5 7	❶ ❸ 5 ❼	❶ ❸ 5 ❼
3 lanes w/o raised median†	❶ 2 3 4 5 6 7	❶ ❸ 5 6 7	❶ ❸ 5 6 ❼	❶ 3 4 5 6 7	❶ ❸ 5 6 ❼	❶ ❸ 5 6 ❼	❶ ❸ 4 5 6 7	❶ ❸ 5 6 ❼	❶ ❸ 5 6 ❼
4+ lanes with raised median‡	❶ ❸ 5	❶ ❸ 5 7	❶ ❸ 5 ❼	❶ ❸ 5 7	❶ ❸ 5 ❼	❶ ❸ 5 ❼	❶ ❸ 5 ❼	❶ ❸ 5 ❼	❶ ❸ 5 ❼
4+ lanes w/o raised median‡	❶ ❸ 5 6 7 8	❶ ❸ 5 ❻ 7 8	❶ ❸ 5 ❻ ❼ 8	❶ ❸ 5 ❻ 7 8	❶ ❸ 5 ❻ ❼ 8	❶ ❸ 5 ❻ ❼ 8	❶ ❸ 5 ❻ ❼ 8	❶ ❸ 5 ❻ ❼ 8	❶ ❸ 5 ❻ ❼ 8

*One lane in each direction †One lane in each direction with two-way left-turn lane ‡Two or more lanes in each direction

Given the set of conditions in a cell,

❶ Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.

\# Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.

The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.

1 High-visibility crosswalk markings, parking restriction on crosswalk approach, adequate nighttime lighting levels
2 Raised crosswalk
3 Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line
4 In-Street Pedestrian Crossing sign
5 Curb extension
6 Pedestrian refuge island
7 Pedestrian Hybrid Beacon
8 Road Diet

This table was developed using information from: Zegeer, C. V., Stewart, J. R., Huang, H. H., Lagerwey, P. A., Feaganes, J., & Campbell, B. J. (2005). Safety effects of marked versus unmarked crosswalks at uncontrolled locations: Final report and recommended guidelines (No. FHWA-HRT-04-100); Manual on Uniform Traffic Control Devices, 2009 Edition, Chapter 4F. Pedestrian Hybrid Beacons; the Crash Modification Factors (CMF) Clearinghouse website (http://www.cmfclearinghouse.org/); and the Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE) website (http://www.pedbikesafe.org/PEDSAFE/).

Course Notes:

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

References/Links:

- https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/guide_to_improve_uncontrolled_crossings.pdf

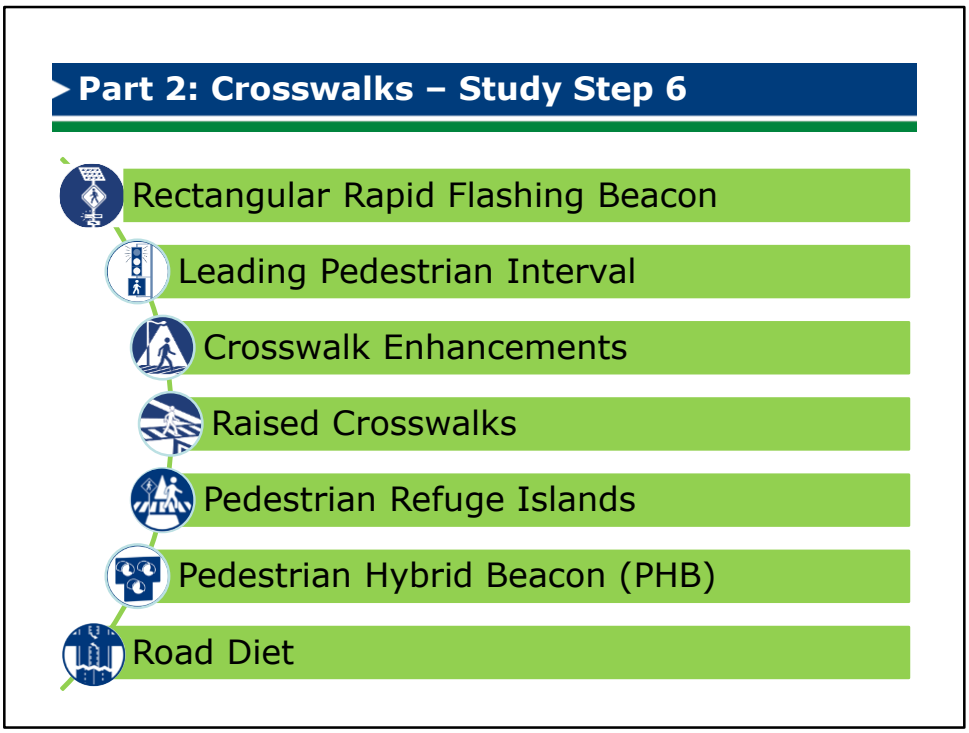
Part 2: Crosswalks – Study Step 6

STEP

Safe Transportation for Every Pedestrian

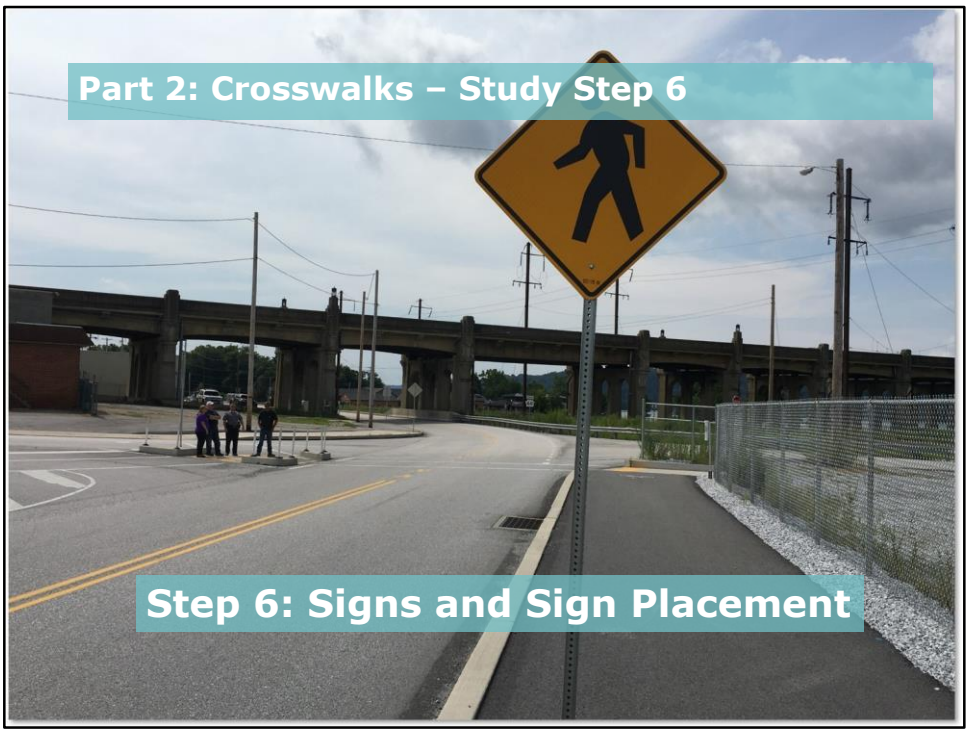
Course Notes:
FHWA is promoting the following pedestrian safety countermeasures through the fourth round of Everyday Counts (EDC-4). EDC is a State-based model that identifies and rapidly deploys proven, yet underutilized innovations to shorten the project delivery process, enhance roadway safety, reduce 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



Course Notes:
The "spectacular seven." These are the countermeasures promoted by FHWA as a part of the STEP program.

References/Links:
- https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/step.cfm



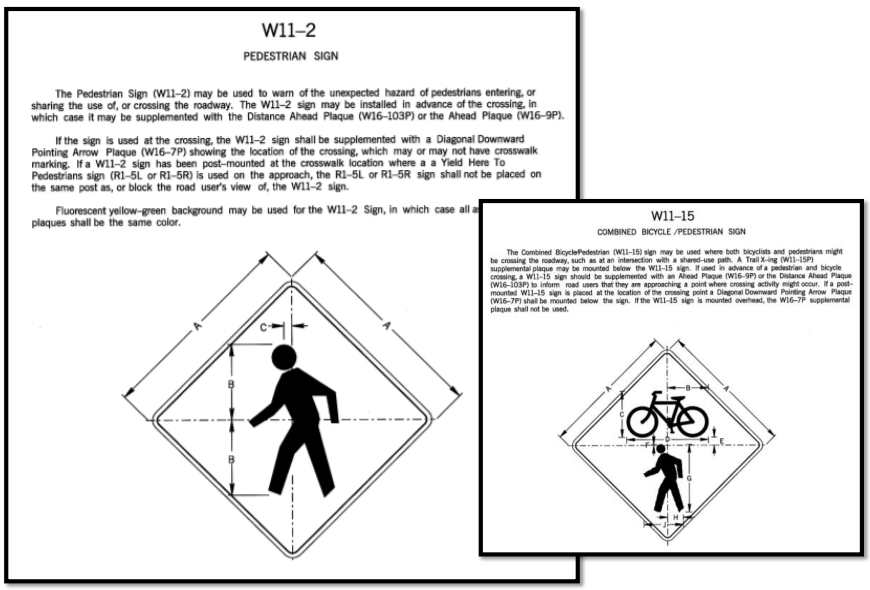
Course Notes:
Signs and sign placement for crosswalks.

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
- PennDOT Publication 111 for installation details.

Part 2: Crosswalks – Study Step 6



W11–2

PEDESTRIAN SIGN

The Pedestrian Sign (W11–2) may be used to warn of the unexpected hazard of pedestrians entering, or sharing the use of, or crossing the roadway. The W11–2 sign may be installed in advance of the crossing, in which case it may be supplemented with the Distance Ahead Plaque (W16–103P) or the Ahead Plaque (W16–9P).

If the sign is used at the crossing, the W11–2 sign shall be supplemented with a Diagonal Downward Pointing Arrow Plaque (W16–7P) showing the location of the crossing, which may or may not have crosswalk marking. If a W11–2 sign has been post–mounted at the crosswalk location where a a Yield Here To Pedestrians sign (R1–5L or R1–5R) is used on the approach, the R1–5L or R1–5R sign shall not be placed on the same post as, or block the road user's view of, the W11–2 sign.

Fluorescent yellow–green background may be used for the W11–2 Sign, in which case all a plaques shall be the same color.

W11–15

COMBINED BICYCLE /PEDESTRIAN SIGN

The Combined BicyclePedestrian (W11–15) sign may be used where both bicyclists and pedestrians might be crossing the roadway, such as at an intersection with a shared–use path. A Trail X–ing (W11–15P) supplemental plaque may be mounted below the W11–15 sign. If used in advance of a pedestrian and bicycle crossing, a W11–15 sign should be supplemented with an Ahead Plaque (W16–9P) or the Distance Ahead Plaque (W16–103P) to inform road users that they are approaching a point where crossing activity might occur. If a post–mounted W11–15 sign is placed at the location of the crossing point a Diagonal Downward Pointing Arrow Plaque (W16–7P) shall be mounted below the sign. If the W11–15 sign is mounted overhead, the W16–7P supplemental plaque shall not be used.

Course Notes:

MUTCD

Section 2C.50 Non-Vehicular Warning Signs (W11-2, W11-3, W11-4, W11-6, W11-7, W11-9, and W11-16 through W11-22)

Option:

01 Non-Vehicular Warning (W11-2, W11-3, W11-4, W11-6, W11-7, W11-9, and W11-16 through W11-22) signs (see Figure 2C-11) **may** be used to alert road users in advance of locations where unexpected entries into the roadway might occur or where shared use of the roadway by pedestrians, animals, or equestrians might occur.

Guidance:

03 If used in advance of a pedestrian, snowmobile, or equestrian crossing, the W11-2, W11-6, W11-7, and W11-9 signs should be supplemented with plaques (see Section 2C.55) with the legend AHEAD or XX FEET to inform road users that they are approaching a point where crossing activity might occur.

Standard:

04 **If a post-mounted W11-2, W11-6, W11-7, or W11-9 sign is placed at the location of the crossing point where pedestrians, snowmobilers, or equestrians might be crossing the roadway, a diagonal downward pointing arrow (W16-7P) plaque (see Figure 2C-12) shall be mounted below the sign. If the W11-2, W11-6, W11-7, or W11-9 sign is mounted overhead, the W16-7P plaque shall not be used.**

Option:

05 A Pedestrian Crossing (W11-2) sign may be placed overhead or may be post-mounted with a diagonal downward pointing arrow (W16-7P) plaque at the crosswalk location where Yield Here To (Stop Here For) Pedestrians signs (see Section 2B.11) have been installed in advance of the crosswalk.

Standard:
06 **If a W11-2 sign has been post-mounted at the crosswalk location where a Yield Here To (Stop Here For) Pedestrians sign is used on the approach, the Yield Here To (Stop Here For) Pedestrians sign shall not be placed on the same post as or block the road user's view of the W11-2 sign.**

Option:
07 An advance Pedestrian Crossing (W11-2) sign with an AHEAD or a distance supplemental plaque may be used in conjunction with a Yield Here To (Stop Here For) Pedestrians sign on the approach to the same crosswalk.
08 The crossing location identified by a W11-2, W11-6, W11-7, or W11-9 sign may be defined with crosswalk markings (see Section 3B.18).
09 The W11-2 and W11-9 signs and their related supplemental plaques may have a fluorescent yellow-green background with a black legend and border.

Guidance:
10 When a fluorescent yellow-green background is used, a systematic approach featuring one background color within a zone or area should be used. The mixing of standard yellow and fluorescent yellow-green backgrounds within a selected site area should be avoided.

Option:
11 A Warning Beacon (see Section 4L.03) may be used with any Non-Vehicular Warning sign to indicate specific periods when the condition or activity is present or is likely to be present, or to provide enhanced sign conspicuity.
12 A supplemental WHEN FLASHING (W16-13P) plaque (see Figure 2C-12) may be used with any Non-Vehicular Warning sign that is supplemented with a Warning Beacon to indicate specific periods when the condition or activity is present or is likely to be present.

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

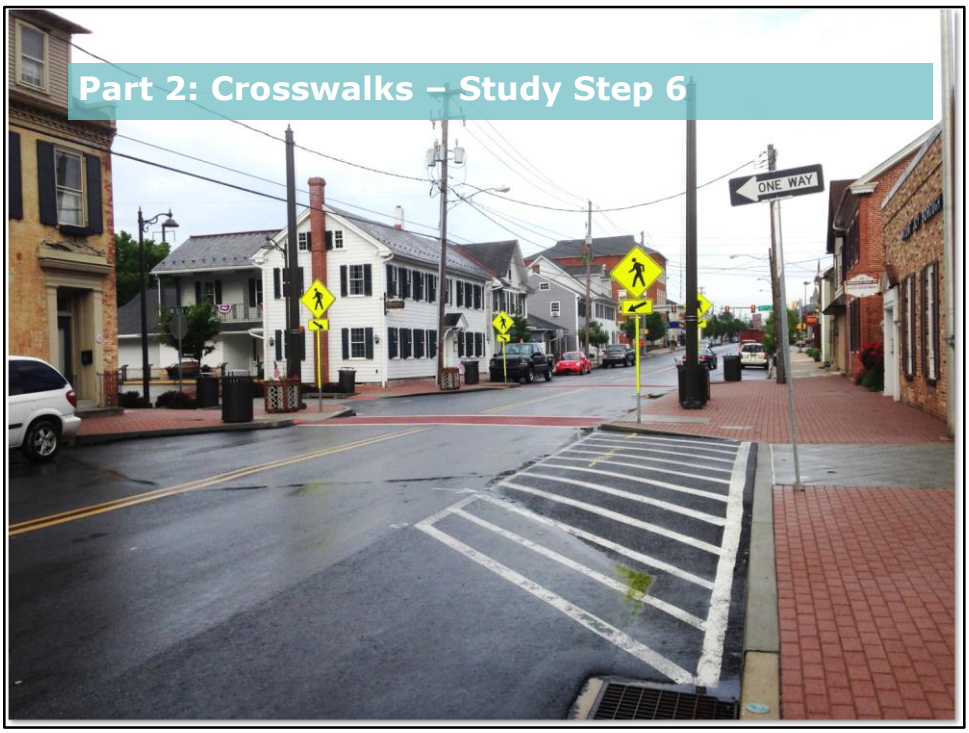
References/Links:
- MUTCD Section 2C.50, Non-Vehicular Warning Signs. https://mutcd.fhwa.dot.gov/htm/2009/part2/part2c.htm#section2C50
- PennDOT Publication 111 for installation details.
- PennDOT Pub 236 for sign sheets

Course Notes:
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.

References/Links:
- MUTCD Section 2C.50, Non-Vehicular Warning Signs. https://mutcd.fhwa.dot.gov/htm/2009/part2/part2c.htm#section2C50
- PennDOT Publication 111 for installation details.
- PennDOT Pub 236 for sign sheets



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

References/Links:
- MUTCD Section 2C.50, Non-Vehicular Warning Signs. https://mutcd.fhwa.dot.gov/htm/2009/part2/part2c.htm#section2C50
- PennDOT Publication 111 for installation details.
- PennDOT Pub 236 for sign sheets

Part 2: Crosswalks – Study Step 6

Course Notes:
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.

References/Links:
- MUTCD Section 2C.05, Placement of Advanced Warning Signs. https://mutcd.fhwa.dot.gov/htm/2009/part2/part2c.htm#table2C04
- PennDOT Publication 111 for installation details.
- PennDOT Pub 236 for sign sheets

Part 2: Crosswalks – Study Step 6

Table 2C-4. Guidelines for Advance Placement of Warning Signs

Posted or 85th-Percentile Speed	Advance Placement Distance[1]								
	Condition A: Speed reduction and lane changing in heavy traffic[2]	Condition B: Deceleration to the listed advisory speed (mph) for the condition							
		0[3]	10[4]	20[4]	30[4]	40[4]	50[4]	60[4]	70[4]
20 mph	225 ft	100 ft[6]	N/A[5]	—	—	—	—	—	—
25 mph	325 ft	100 ft[6]	N/A[5]	N/A[5]	—	—	—	—	—
30 mph	460 ft	100 ft[6]	N/A[5]	N/A[5]	—	—	—	—	—
35 mph	565 ft	100 ft[6]	N/A[5]	N/A[5]	N/A[5]	—	—	—	—
40 mph	670 ft	125 ft	100 ft[6]	100 ft[6]	N/A[5]	—	—	—	—
45 mph	775 ft	175 ft	125 ft	100 ft[6]	100 ft[6]	N/A[5]	—	—	—
50 mph	885 ft	250 ft	200 ft	175 ft	125 ft	100 ft[6]	—	—	—
55 mph	990 ft	325 ft	275 ft	225 ft	200 ft	125 ft	N/A[5]	—	—
60 mph	1,100 ft	400 ft	350 ft	325 ft	275 ft	200 ft	100 ft[6]	—	—
65 mph	1,200 ft	475 ft	450 ft	400 ft	350 ft	275 ft	200 ft	100 ft[6]	—
70 mph	1,250 ft	550 ft	525 ft	500 ft	450 ft	375 ft	275 ft	150 ft	—
75 mph	1,350 ft	650 ft	625 ft	600 ft	550 ft	475 ft	375 ft	250 ft	100 ft[6]

Course Notes:
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 increases 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.

Table 2C-4 notes:
1 The distances are adjusted for a sign legibility distance of 180 feet for Condition A. The distances for Condition B have been adjusted for a sign legibility distance of 250 feet, which is appropriate for an alignment warning symbol sign. For Conditions A and B, warning signs with less than 6-inch legend or more than four words, a minimum of 100 feet should be added to the advance placement distance to provide adequate legibility of the warning sign.

2 Typical conditions are locations where the road user must use extra time to adjust speed and change lanes in heavy traffic because of a complex
driving situation. Typical signs are Merge and Right Lane Ends. The distances are determined by providing the driver a PRT of 14.0 to 14.5 seconds
for vehicle maneuvers (2005 AASHTO Policy, Exhibit 3-3, Decision Sight Distance, Avoidance Maneuver E) minus the legibility distance of 180 feet for the appropriate sign.

3 Typical condition is the warning of a potential stop situation. Typical signs are Stop Ahead, Yield Ahead, Signal Ahead, and Intersection Warning signs. The distances are based on the 2005 AASHTO Policy, Exhibit 3-1, Stopping Sight Distance, providing a PRT of 2.5 seconds, a deceleration rate of 11.2 feet/second^2, minus the sign legibility distance of 180 feet.

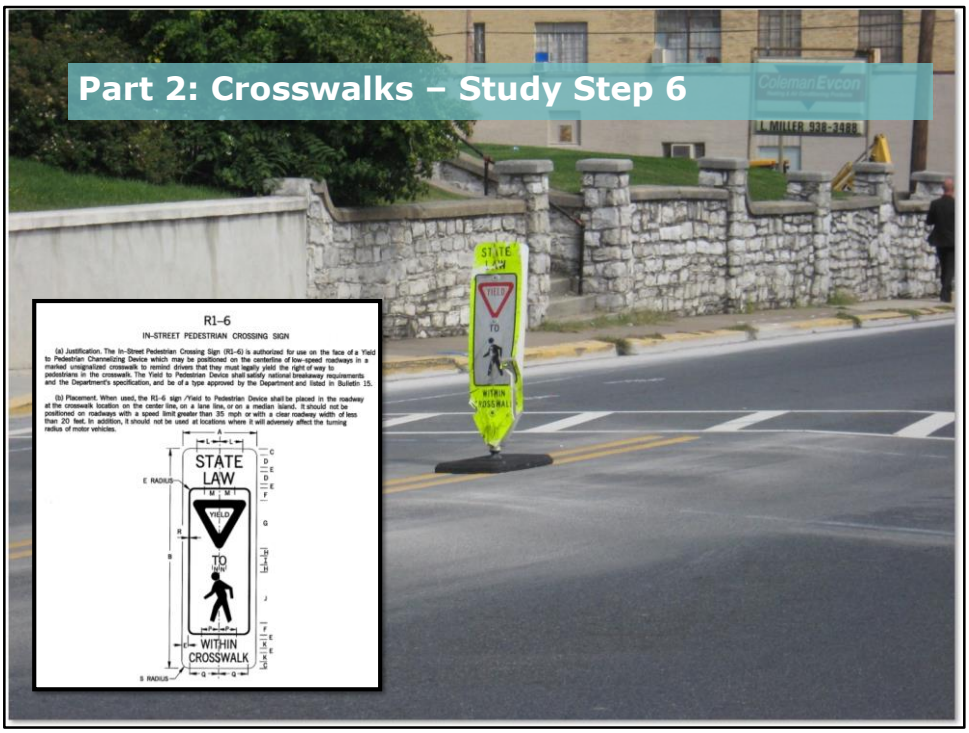
4 Typical conditions are locations where the road user must decrease speed to maneuver through the warned condition. Typical signs are Turn, Curve, Reverse Turn, or Reverse Curve. The distance is determined by providing a 2.5 second PRT, a vehicle deceleration rate of 10 feet/second^2, minus the sign legibility distance of 250 feet.

5 No suggested distances are provided for these speeds, as the placement location is dependent on-site conditions and other signing. An alignment warning sign may be placed anywhere from the point of curvature up to 100 feet in advance of the curve. However, the alignment warning sign should be installed in advance of the curve and at least 100 feet from any other signs.

6 The minimum advance placement distance is listed as 100 feet to provide adequate spacing between signs.

References/Links:

- MUTCD Section 2C.05, Placement of Advanced Warning Signs. https://mutcd.fhwa.dot.gov/htm/2009/part2/part2c.htm#table2C04
- PennDOT Publication 111 for installation details.
- PennDOT Pub 236 for sign sheets



Course Notes:
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.

References/Links:
- PennDOT Pub 707: http://www.dot.state.pa.us/public/PubsForms/Publications/PUB%20707.pdf
- MUTCD Section 2C.50, Non-Vehicular Warning Signs. https://mutcd.fhwa.dot.gov/htm/2009/part2/part2c.htm#section2C50
- PennDOT Publication 111 for installation details.
- PennDOT Pub 236 for sign sheets

Course Notes:
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 (RRFB's), and flashing beacons.

References/Links:
- MUTCD Section 2A.15: https://mutcd.fhwa.dot.gov/htm/2009/part2/part2a.htm#section2A15

Part 2: Crosswalks – Study Step 6

Course Notes:
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.

Alternative Names:
Solar-powered LED road signs, flashing LED-enhanced solar-powered traffic signs, LED-enhanced signs.
This summary is one in a series describing Innovative Intersection Safety Treatments. The summaries identify new technologies and techniques to improve intersection safety developed since NCHRP Report 500 Volumes 5 and 12 were published in 2003 and 2004, respectively. These treatments show promise for improving safety, but comprehensive effectiveness evaluations are not yet available.

Operation
LEDs can be embedded in standard highway warning and regulatory signs to outline either the sign itself or the words and symbols on the sign. The LEDs may be set to flash or operate in steady mode. LEDs may be illuminated 24 hours a day or be activated by vehicles or pedestrians. Due to the low power requirements of LEDs, signs with embedded LEDs can typically be powered using stand-alone solar panel units.
This treatment is applicable for regulatory and warning signs at unsignalized intersections

with the intended purpose of improving the visual conspicuity of the signs. Typical locations where LED-embedded signs can be implemented include:
Locations with sight visibility limitations (horizontal curves, dusk/dawn glare, etc.);
Locations with documented problems of drivers failing to recognize an intersection; and
At STOP signs – this treatment may help to increase the rate of vehicles stopping and to avoid drivers failing to detect the STOP sign.

Potential Benefits
In general, embedded LED units are used to:
Improve driver compliance with regulatory signs through improved conspicuity; and
Enhance visibility and recognition of regulatory and warning signs to drivers, especially under low-light or low-visibility conditions.

Agency Experience
A study on safety effects of LEDs embedded in STOP signs, conducted by the Texas Transportation Institute in 2004 found:
A 28.9% reduction in the number of vehicles not fully stopping; and
A 52.9% reduction in the number of vehicles moving through the intersection without significantly slowing.
Gates, T.J., Carlson, P.J., and Hawkins, H.G., Jr., "Field Evaluations of Warning and Regulatory Signs with Enhanced Conspicuity Properties."

A similar study, conducted by the Virginia Transportation Research Council in 2007, found:
A statistically significant decrease in vehicle approach speeds ranging from 1.9 to 3.4 MPH with an average of 2.7 MPH (a 7% decrease) indicated that LED STOP signs positively affected driver behavior.
Speed decreases tended to be greater during the night than during the day.
E. D. Arnold, Jr., and K. E. Lantz, Jr., "Evaluation of Best Practices in Traffic Operations and Safety: Phase 1: Flashing LED Stop Signs and Optical Speed Bars."

LED lights have been used in signs in Florida and Wisconsin and have been evaluated in STOP signs in Virginia and Texas. Naval Station Mayport in Florida installed a pedestrian walk sign with embedded LEDs.

Implementation Considerations
Due to low power usage, solar applications make the use of this treatment flexible enough for nearly any location.
LEDs may be set to flash 24 hours a day or be vehicle or pedestrian activated.

Manual on Uniform Traffic Control Devices (MUTCD) Specifications:
If used, the LEDs shall be the same color as the sign legend, border, or background. If flashed, all LED units on an installation shall flash simultaneously at a rate of more than 50 and less than 60 times per minute. The uniformity of the sign shall be maintained without any decrease in visibility, legibility, or driver comprehension during either daytime or nighttime conditions. *MUTCD, Section 2A.08*.

MUTCD, Section 2A.08 contains further information that should be consulted when installing a sign with embedded LEDs.
Lighting elements for illuminated signs (e.g. LED-embedded signs) should be replaced on a regular maintenance schedule. *MUTCD, Section 2A.22*.

Costs
During the course of the 2007 Virginia Transportation Research Council study, the costs for 48-inch, 36-inch, and 30-inch signs embedded with LEDs were estimated at $1,860, $1,640, and $1,600, respectively. This included the cost of the solar power supply but did not include an additional $175 for post and anchor or the cost of installation.

References/Links:
- https://safety.fhwa.dot.gov/intersection/conventional/unsignalized/tech_sum/fhwasa09006/

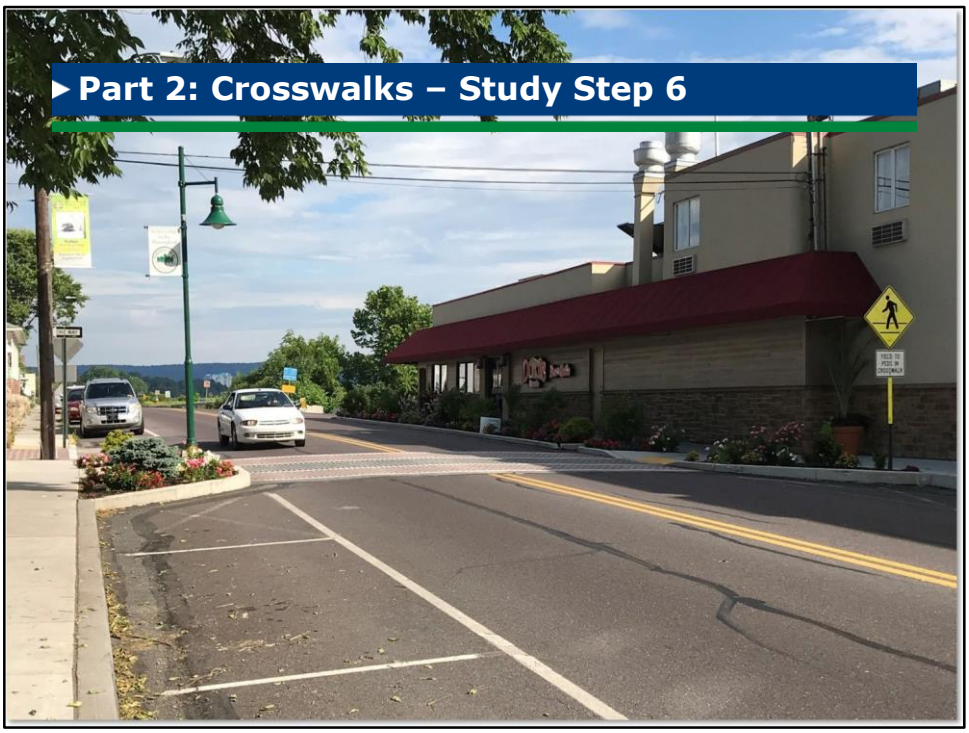
Course Notes:
Physical features offer many benefits. They are more conspicuous to motorists, they can slow the speed of traffic, they can shorten crossing distances/exposure, improve sight lines, add opportunities for landscaping/water control, and other benefits. All physical features can also have 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.

References/Links:
- https://www.dot.state.pa.us/public/PubsForms/Publications/PUB%20383.pdf

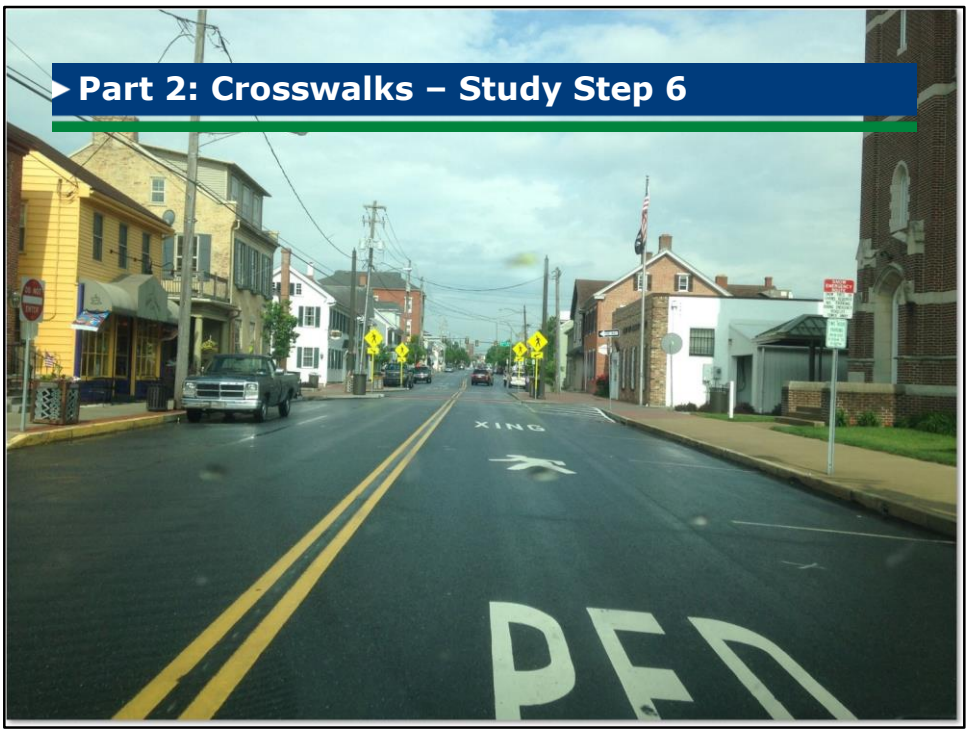
Course Notes:
Decorative bump out.

References/Links:



Course Notes:
Physical bump out.

References/Links:



Course Notes:
Example of supplemental pavement markings.

References/Links:

Part 2: Crosswalks – Study Step 6

Medians and Pedestrian Crossing Islands in Urban and Suburban Areas

Median and pedestrian crossing islands near a roundabout.

Source: www.pedbikeimages.org / Dan Burden

SAFETY BENEFITS:

Raised Median
46%
Reduction in pedestrian crashes

Pedestrian Crossing Island
56%
Reduction in pedestrian crashes

Course Notes:
Median Refuge area. They are a proven safety countermeasure.

References/Links:
- https://safety.fhwa.dot.gov/provencountermeasures/ped_medians/

Part 2: Importance of Crosswalks

The best defense is to have safe roads without crashes.

Lawsuit over 'dangerous' crosswalk begins

The pedestrian crosswalk between the Chester County Justice center, at right, and its multi-level parking garage is the subject of a lawsuit that began in Common Pleas Court Monday. A former county court tipstaff was seriously injured when she was using the crosswalk several years ago. Her attorneys contend the crosswalk should not have been designed the way it was. MICHAEL P. RELLAHAN – DIGITAL FIRST MEDIA

Course Notes:

References/Links:

Attend the new LTAP class for more details and information.