Guidance for Installation of Pedestrian Crosswalks on Michigan State Trunkline Highways

MDOT
Michigan Department of Transportation

TZD Toward Zero Deaths™
National Strategy on Highway Safety

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Background

The Michigan Department of Transportation's (MDOT) overall mission includes the provision of safe and efficient transportation facilities for all road users.

> MDOT Mission – Providing the highest quality transportation services for economic benefit and improved quality of Life.

Figure 1 - MDOT Strategic Area of Focus

Determining when and where to provide appropriate pedestrian treatments such as marked crosswalks and pedestrian signing on state trunkline is often complicated. According to guidance developed by the FHWA, pedestrian crossings at both midblock and intersection locations "should provide safe and comfortable locations to cross the street"[1]. However, the *Michigan Manual on Uniform Traffic Control Devices (*MMUTCD) states that "crosswalk lines should not be used indiscriminately" and further that an engineering study should be conducted prior installing a crosswalk at an uncontrolled approach. In situations where a signalized or stop-controlled crossing is not warranted but potential crossing demand may exist, enhanced crossing treatments or actuated crossings should be considered[2]. An important concept specific to pedestrian crossing design is that pedestrians will often cross where necessary to conveniently access their destination, particularly in cases where the spacing of crossings is high or the desire line is directly across the street[3]. The decision to install marked crosswalks, including enhanced crossing treatments (such as additional signing, pedestrian hybrid beacons or rectangular-rapid flashing beacons), represents a complex decision-making process which should incorporate a broad range of engineering factors. Elements that can affect decisions on whether to install crossing treatments and what type include:

- Posted speed limit
- Volumes of vehicular and pedestrian/bicycle traffic
- Number of travel lanes and geometry of the roadway at the crossing location (including medians, refuge islands, etc.)
- Pedestrian characteristics (proportion of crosswalk used by elderly, children or those with disabilities)
- Type of roadway
- Setting (urban, suburban or rural)
- Community needs – Non-Motorized Plans
- Area land use – trip generators, schools, community centers, senior centers, etc.
- Available right of way

[1] Achieving Multimodal Networks: Applying Design Flexibility and Reducing Conflicts – FHWA (2016)
[2] Urban Street Design Guide – NACTO (2018)
[3] Designing Walkable Urban Thoroughfares: A Context Sensitive Approach – ITE (2010)

- Type of connecting pathways
- Transit use
- Connectivity

All of the elements listed above can influence the decision to install a crosswalk at a given location and if additional treatments should be considered for the crosswalk. Crosswalks should be applied uniformly to locations where crossing demand is high, a safe crossing can be achieved, and driver expectations can be met. Not providing a uniform approach to pedestrian crossing treatments on state trunkline can create confusion for both motorists and pedestrians, potentially increasing risk to pedestrians. The context sensitive solutions (CSS) process can be used to help achieve proper crosswalk decisions. CSS emphasizes that transportation facilities should fit their physical settings within communities to maintain safety and mobility for all users of the transportation network.

> "With a thorough understanding of the CSS (context sensitive solutions) principles and design process, the practitioner planning or designing a thoroughfare seeks to integrate community objectives, accommodate all users and make decisions based on an understanding of the trade-offs that frequently accompany multiple or conflicting needs." *ITE Designing Walkable Urban Thoroughfares: A Context Sensitive Approach*

The objective of this guidance document is to establish a step-by-step procedure to identify the appropriate location for a crosswalk and selection of appropriate crossing treatments on state trunkline. This guidance is expected to provide crosswalk treatment recommendations that meet both motorist and pedestrian expectations by providing consistency on state trunkline routes. Recent pedestrian research studies, existing crosswalk guidelines used by other governmental agencies, manuals on traffic control devices, and state statute were reviewed in order to establish this document.

As the crosswalk treatment is evaluated and selected using the process discussed in this guidance document, each local MDOT office and local agency must be aware of local regulations and ordinances. Michigan currently does not have a state law that requires motorists to yield (or stop) to pedestrians in an unsignalized crosswalk. Each local municipality must either adopt the Uniform Traffic Code or write their own ordinance language that clearly identifies the right-of-way and expected actions for both driver and pedestrian. An example of such language from the Michigan Uniform Traffic Code is provided as follows:

> "R 28.1702 Rule 702. Pedestrians; right-of-way in crosswalk; violation as civil infraction. (1) When traffic-control signals are not in place or are not in operation, the driver of a vehicle shall yield the right-of-way, slowing down or stopping if need be to so yield, to a pedestrian crossing the roadway within a crosswalk when the pedestrian is on the half of the roadway on which the

vehicle is traveling or when the pedestrian is approaching so closely from the opposite half of the roadway as to be in danger, but a pedestrian shall not suddenly leave a curb or other place of safety and walk or run into a path of a vehicle that is so close that it is impossible for the driver to yield. (2) A person who violates this rule is responsible for a civil infraction." *MI Uniform Traffic Code (can be adopted by a local unit of government)*

Crosswalk Evaluation Procedures

The evaluation of a proposed crosswalk location for potential crossing treatments on state trunkline routes should include the following four basic steps:

1) Identification and Description of the Crossing Location
2) Roadway Data Collection
3) Traffic Volume/Crash Data Collection and Operational Observations
4) Application of Data to Determine Appropriate Treatments

Step 1: Identification and Description of the Proposed Crossing Location (or evaluation of an existing crosswalk)

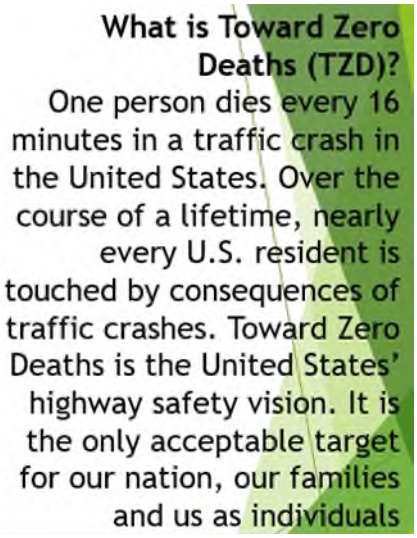
a) Identify the major street and the specific location of the crossing
b) Review the local Non-Motorized plan for alignment with community needs and obtain feedback from the community
c) Determine if another project is planned for the future that might coordinate with any crossing treatments (if found appropriate)
d) Determine if the crossing location connects both ends of a proposed or existing sidewalk or shared-use path or other pedestrian generating features
e) Note the posted speed limit along the major street at the crossing location.
f) Identify the existing traffic control, if any, and any existing crossing treatments (signs, markings or physical treatments), street lighting and curb ramps.
g) Consider conducting a Road Safety Audit for the corridor or location being considered for a crossing if there are safety concerns.

Step 2: Roadway Data Collection

a) Determine the existing roadway configuration including the number of lanes, existence of on-street parking and the presence of raised medians or refuge islands (including width) at the crossing location.

b) Note any marked or signed restrictions.
c) Identify the nearest marked or protected crossing and measure the distance to this proposed crossing.
    - Note type of traffic control at adjacent crossings (i.e. signal, stop sign or yield sign)
    - Identify any vehicle queue lengths at intersections
d) Measure the distance to the nearest transit stop (if any)
e) Measure the stopping sight distance (SSD) on all vehicular approaches to the proposed crossing. Review the MDOT Road Design Manual and Sight Distance Guidelines[4] and if SSD is insufficient, determine if improvements (such as removal of obstructions) are feasible means to mitigate the inadequate SSD. Consider geometric roadway changes or other installations such as traffic calming treatments that would encourage lower driving speeds.

Step 3: Traffic/Crash Data Collection and Operational Observations



a) Collect pedestrian crossing volumes during the peak hours of use. This will typically involve collection of data during the AM, midday, and PM peaks hours. Locations near schools may only require two hours of data collection, corresponding to school opening and closing times. Pedestrian volumes should include and differentiate between pedestrians and bicyclists, the number of young, elderly and/or pedestrians with disabilities. For locations where school crossing traffic is anticipated, the volume of student pedestrians (school age pedestrians on their way to/from school) should also be noted separately.
    - Whenever possible, pedestrian and bicycle volumes should be collected during warm weather months and during fair weather conditions to represent peak crossing activity.
    - Be aware of when school is in session (including typical break periods such as winter break, spring break, summer, etc.)
    - Consider gathering data before, during and after special events or near venues that generate large pedestrian volumes.
    - Consider other factors when collecting that may vary throughout the day such as transit usage/volumes, shift changes, school hours, etc.
b) Collect hourly and average daily traffic (ADT) volumes for vehicle traffic along the roadway at the crossing location, including truck volumes and turning movements simultaneously with pedestrian data.
c) Collect gap data for pedestrian crossings. This involves measuring the time between successive vehicles entering the crossing area and noting whether 1.) a pedestrian

[4] Sight Distance Guidelines

was waiting to cross and 2.) whether the pedestrian accepted or rejected the gap. Refer to MDOT's Electronic Traffic Control Device Guidelines for additional information on collecting gap data.[5]

d) Review the last five years of crash data and determine if there are patterns related to pedestrian crossing activity. If the location is determined to have a specific safety issue with pedestrian access and mobility, consider alternative methods of collecting pedestrian volumes as justification for installing traffic control devices (particularly electronic devices). Safety and moving Toward Zero Deaths (TZD) is a top priority on MDOT facilities.
    - Surrogate measures of pedestrian volumes to meet the minimum threshold volumes are discussed in the Surrogate Measures section of this document.

Step 4: Application of Data to Determine Appropriate Treatments

a) Using the available data (or from the Surrogate Measures section), utilize
    - Figure 6 – Pedestrian Crossing Treatment Flowchart at Controlled Crossings,
    - Figure 7 – Pedestrian Crossing Treatment Flowchart at Uncontrolled Crossings and
    - Table 1 - Criteria for Crossing Treatments at Uncontrolled Locations (if applicable) to determine appropriate treatment(s) for signalized, stop-controlled or uncontrolled locations.

Consider and incorporate the following additional evaluation considerations as appropriate in Figure 8a and 8b – Installation of Pedestrian Hybrid Beacon, Pedestrian Signals or Rectangular Rapid Flashing Beacon Signs. If an electronic device is being considered, submit Form 1597 to MDOT Signal Operations to request a study for any electronic pedestrian device.

Types of Crossing Treatments at Uncontrolled Locations

Four primary types of uncontrolled crossing treatments are discussed below. These treatments consider the physical roadway conditions, vehicle volumes and pedestrian volume at the potential crossing location. Table 1 also shows this information. All crossing types shall include ADA compliant sidewalk ramps and shall be MMUTCD (Michigan Manual on Uniform Traffic Control Devices) compliant. An uncontrolled location includes mid-block and unsignalized intersections where mainline of the state trunkline does not stop. This section may not capture all best practices and other applicable treatment alternatives that become available. Also, for more information on different treatments refer to MDOT's Best Design Practices for Walking and Bicycling in Michigan.[6]

[5] Electronic Traffic Control Device Guidelines
[6] MDOT's Best Design Practices for Walking and Bicycling in Michigan

Crossing Type A:

- Marked special emphasis crosswalk (See MDOT PAVE 945 series)
- Standard pedestrian warning signs (W11-2) (See MDOT Traffic Sign Design, Placement and Application Guide). Evaluate need for advanced signing.
- Gateway Treatment – R1-6 In-Street signs (see MDOT's User Guide for R1-6 Gateway Treatment for Pedestrian Crossings[7]). See Sidebar.
- If the location is a designated school crossing, then standard school crossing signs (S1-1) should be used

Crossing Type B:

- Marked special emphasis crosswalk (See MDOT PAVE 945 series)
- Standard pedestrian warning signs (MDOT Traffic Sign Design, Placement and Application Guide). Evaluate need for advanced warning signs/electronic additions (flashers).
- Geometric improvements (such as bulb outs or median refuge islands) or consider pedestrian activated Rectangular Rapid Flashing Beacons (RRFB) if criteria are met in Figure 8a or 8b. Please see page 19 for more discussion on RRFBs and submit form 1597 to MDOT Signal Operations to request a study for any electronic pedestrian device or contact MDOT Safety Programs to evaluate need based on safety considerations (and using surrogate volume measures)
- Consider use of in-street yield to pedestrian crossing sign (R1-6) in low speed urban

[7] MDOT User Guide for R1-6 Gateway Treatment for Pedestrian Crossings

setting if the local unit of government has adopted the Michigan Uniform Traffic Code for Cities Townships and Villages. Gateway Treatment – R1-6 In-Street signs (see MDOT's User Guide for R1-6 Gateway Treatment for Pedestrian Crossings[7])

- Additional pavement markings may be required such as double yellow centerline or cross hatching in advance of a median refuge island per the MDOT Pavement Marking standards
- If the location is a designated school crossing, then standard school crossing signs (S1-1) should be used
- Consider curb extensions if on-street parking is present and storm drainage can be accommodated
- If pedestrian volume falls above the RRFB limit line on Figure 8a or 8b, go to Crossing Type D

Crossing Type C:

- Where the posted speed limit is greater than or equal to 45 mph, determine if traffic calming measures can be installed to effectively reduce the operating speed such that the posted speed limit could be changed to 40 mph and if a raised median can be installed.
- If so, go to Crossing Type B
- If not, go to Crossing Type D

Crossing Type D:

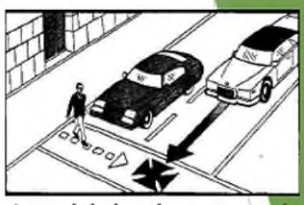
- Crossing has 3 or more through lanes in a given direction and the posted speed limit is greater than 40 mph or is otherwise not suitable for an uncontrolled marked crosswalk
- Consider the Pedestrian Hybrid Beacon (PHB) (see Figure 2), pedestrian traffic signal or grade separated pedestrian crossing. Please see page 21 for more discussion on

PHBs and submit form 1597 to MDOT Signal Operations to request a feasibility study for any electronic pedestrian device or contact MDOT Safety Programs to evaluate need based on safety considerations (and using surrogate volume measures)

- Must consider corridor signal progression, grades, physical constraints and other engineering factors

Figure 2 PHB on Gratiot (M-3) near Quinn Rd/Finley St, Clinton

Table 1 lists the number of lanes crossed to reach refuge and the number of multiple threat lanes per crossing (see definition in sidebar[8]). This information does not directly play into the use of Table 1 but does provide important context to help distinguish the crossing types and support the difference in recommended crossing treatments.



A multiple-threat crash involves a driver stopping in one lane of a multilane road to permit pedestrians to cross, and an oncoming vehicle (in the same direction) strikes the pedestrian who is crossing in front of the stopped vehicle. This crash type involves both the pedestrian and driver failing to see each other in time to avoid the collision.

Once the crossing type has been identified and specifically when an electronic device is deemed appropriate, local MDOT Traffic and Safety staff should work with the community (neighborhood associations, local outreach groups, city/county officials, etc.) in order to educate the potential users of the crossing and devices. Educating pedestrians on the proper way to activate devices and what and when to expect responses is an essential component in the effectiveness of any device or treatment. Additionally, local enforcement should be encouraged to monitor and support the treatment.

[8] Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations – FHWA 2005

When considering a crossing specifically for schools (for example through Safe Routes to School funding, https://saferoutesmichigan.org/) treatments should account for the users. School age children typically are not able to judge vehicular speed or distance adequately and may not be able to determine a sufficient gap in traffic to safely cross. Use of crossing guards before and after school (and other times where high-volume student crossings occur) to assist in making these crossing choices is highly recommended. Additionally, working with school officials to educate and enforce appropriate crossing behaviors is recommended.

Minimum Vehicle Volume for Treatments

Crossing treatments should generally not be installed at locations where the ADT is lower than 1,500 vehicles per day. Exceptions may be made at school crossing locations where the peak hour vehicle traffic exceeds 10% of the ADT. School crossings are defined as locations where 10 or more student pedestrians are crossing in any given hour and the crossing is a designated school walking route. Treatments for roadways with greater than 1,500 vehicles per day should be installed based on the criteria in Figure 6, Table 1 and the information in Figure 8 (a or b depending on speed limit).

Minimum Pedestrian Volume for Treatment at Uncontrolled Crossing Locations

The base threshold for consideration of an enhanced crossing treatment at an uncontrolled location is 20 pedestrians per hour. This threshold is consistent with national guidance and policies adopted by other states and cities.

The Minimum Pedestrian Volume Thresholds are as follows:

- 20 pedestrians per hour* in any one hour, or
- 18 pedestrians per hour* in any two hours, or
- 15 pedestrians per hour* in any three hours, or
- 10 school age (grades K-12) pedestrians traveling to or from school in any one hour and the crossing is a designated school walking route

*Young, elderly, and pedestrians with disabilities count two times towards volume thresholds

Surrogate Pedestrian Volume Count Data Methodology when Safety Related Concerns Exist at Crossing Location.

When safety concerns at a crossing location are identified as a main justification for the pedestrian crossing but physical pedestrian count data is not available or representative, surrogate measures can be used to meet the defined thresholds defined in the previous section of this document. The volume thresholds for electronic devices still need to be met and quantified

because they:

- Define a need – without volumes present or defined using other methodologies, there may be other opportunities to use the available resources for safety at an alternative location.
- Reasonably justify allocated resources.

Surrogate measures can include the following:

- Transit ridership count data – review transit stop counts and determine if based on these crossings can reasonably be assumed (see Figure 3).
- Corridor volumes – it is reasonable to assume that installing a device would help channelize pedestrian use within a corridor.
- Expected trips (trip generation) from and to generators. This may be calculated with a Traffic Impact Study for new developments.
- Area population – neighborhood population, usage characteristics, anticipated utilization.
- School location – student population distribution (see Figure 4).
- MDOT Pedestrian/Bicycle Risk Model
- Review a similar location type with similar characteristics that there are pedestrian volumes for. These could be utilized as surrogate volumes if shown to be representative of the study location.
- Trail usage volumes.
- Parking availability/utilization. A parking study may need to be conducted for this justification.
- Non-Motorized counts from MDOT's Traffic Data Management System (TDMS)

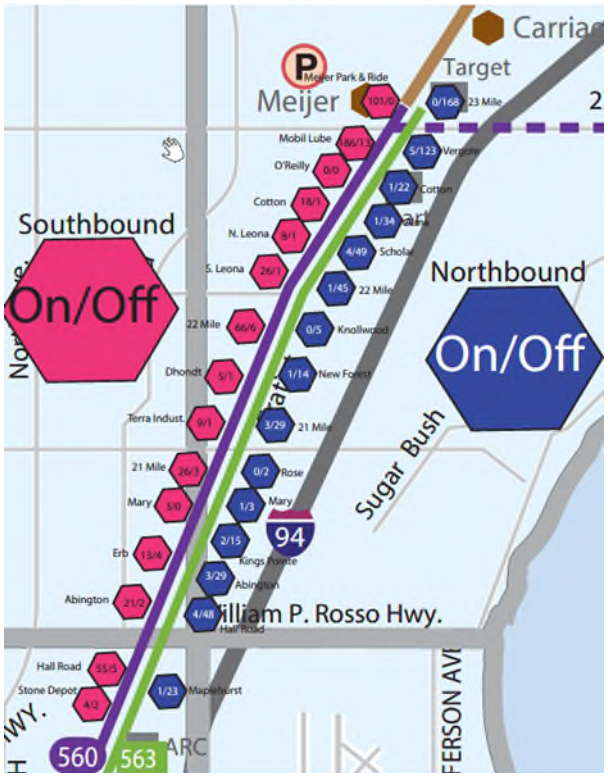


Figure 3

- Other methods of volume determination – discuss with Safety Programs

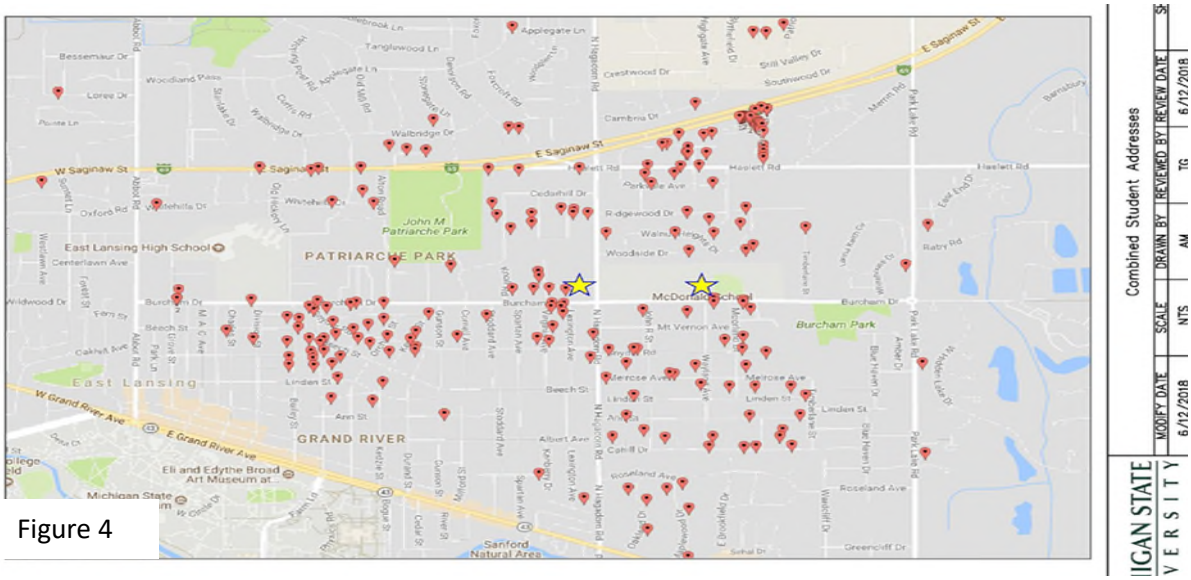


Figure 4

Surrogate Measures Methodology:

Once a safety need is identified and either physical pedestrian volumes are collected or surrogate volume measures are used, the volume data should be summarized with a discussion on the methodology of collection and validity of the data. The local Traffic and Safety engineer for that region or local office will approve the volumes and appropriateness of the treatment for the location to be submitted to Safety Programs for final review including the MDOT Signals staff in the process.

Definition of a Pedestrian Median Refuge and Minimum Median Refuge Width

A pedestrian median refuge island is defined as a location in the middle of a pedestrian crossing where a pedestrian can take refuge, separating the crossing into two stages, across each direction of approaching traffic. A painted center median or a painted turn lane does not constitute a pedestrian refuge. A pedestrian refuge must include some type of raised median as described below:

Figure 5

- A raised median nose at an intersection (next to a left turn bay for example) can only be considered a pedestrian refuge for the adjacent crosswalk if the median is at least four feet wide and the left turn volume is less than 20 vehicles per hour. This low left

turn volume means that during most pedestrian crossings there will not be a vehicle in the left turn lane as they cross the street.

- A raised median at a mid-block pedestrian crossing must be at least six feet wide (preferably 8 feet wide) and includes curb ramps or a walkway at grade through the median. For shared-use path crossing locations, a 10 foot median refuge width is desirable to accommodate bicycles with child trailers, recumbent bicycles and tandem bicycles. See Figure 5.

Distance to Nearest Marked or Protected Crossing

The Pedestrian Crossing Flowchart in Figure 6 includes consideration of spacing criteria for an uncontrolled crossing to the nearest marked or signalized crossing. The flowchart requires that a new uncontrolled mid-block crossing be at least 300 feet from the nearest crossing. However, this spacing criterion can be waived if the proposed crossing serves a shared-use path or the pedestrian crossing volume exceeds twice the minimum threshold. This criterion is subject to engineering judgment. In urban conditions, where a typical block length is 400 feet, the local MDOT agency may want to consider allowing a minimum of 200 feet, provided that the pedestrian crossing:

- Does not cross any left or right turn lanes or their transitions, where it is anticipated that vehicles will be changing lanes
- Is not near an intersection area where it will create undue restriction to vehicular traffic operations.

Pedestrian Crossing Treatments at Higher Speed Roadways with Rural Character

There may be conditions that necessitate the installation of pedestrian crossings where speeds are higher and special consideration is warranted. Engineering judgment should be applied and consideration given to providing an uncontrolled crosswalk. Engineering judgment should also be used in rural scenarios at shared use path crossings. Pedestrian warning signs/advanced pavement markings may be adequate in some situations.

Monitor Outcomes

Locations where pedestrian crossing treatments are constructed should be monitored after installation for:

- Effectiveness – collect crash and count data to demonstrate benefits and use
- Review pedestrian and vehicle interactions to help determine best practices for future installations at locations with similar roadway characteristics
- Review traffic operations (queues, congestion, etc.) and enforcement activities around treatment
- Review durability and life cycle maintenance needs for devices installed

Additional Considerations

During the process of crossing treatment selection, it is important to involve stakeholders that will be involved in the long term with costs and upkeep of the markings, signs, devices, etc.

- Consider parking restrictions as appropriate based on treatment selection
- Consider/coordinate with maintenance practices for treatments such as median/refuge islands, etc.
- Local participation in sidewalks, lighting, etc.
- Consider excessive signs/markings during crossing location review in order to allow emphasis treatments to stand out to drivers
- Consider a Road Safety Audit

Figure 6
Pedestrian Crossing Treatment Flow Chart for Controlled Crossing

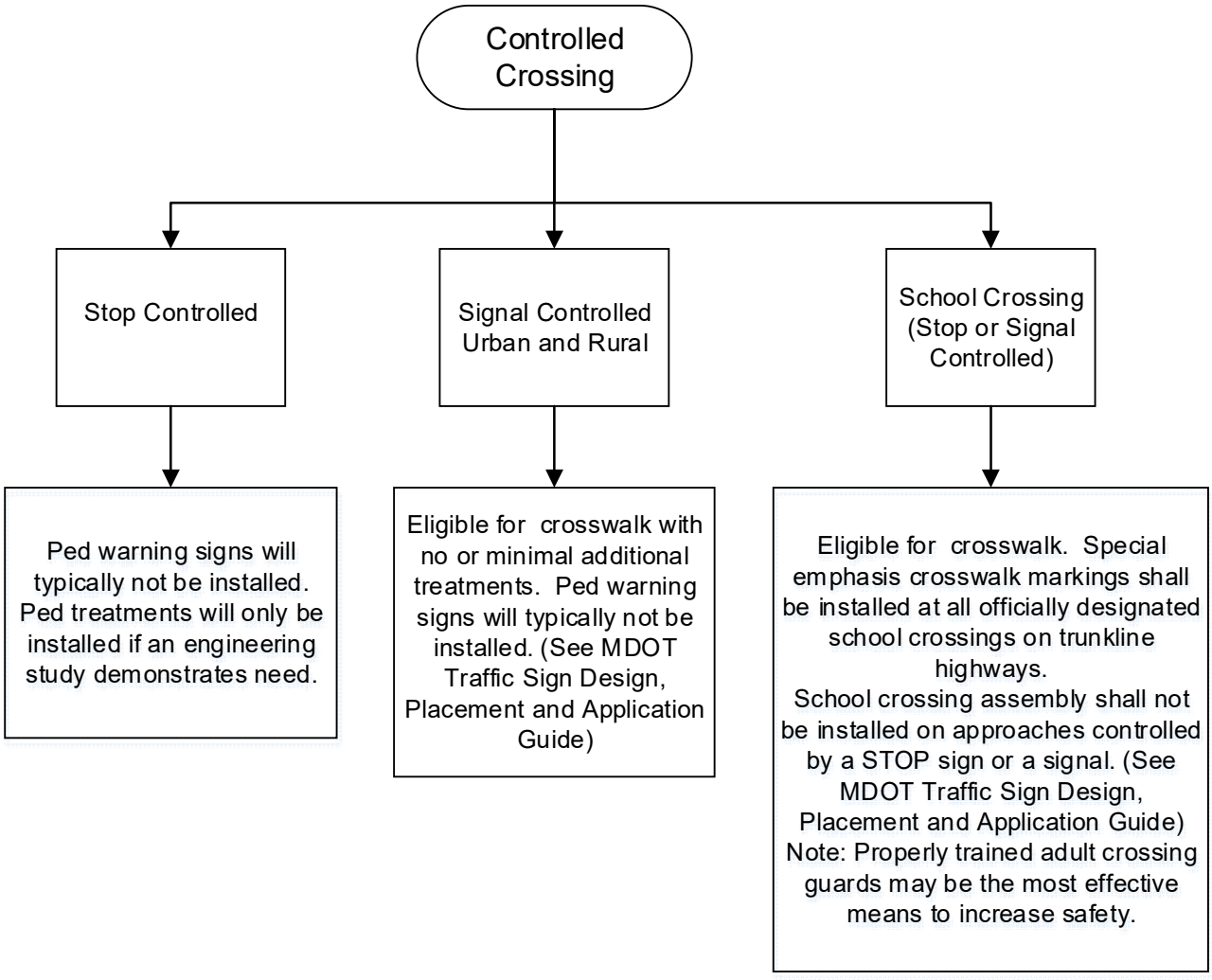
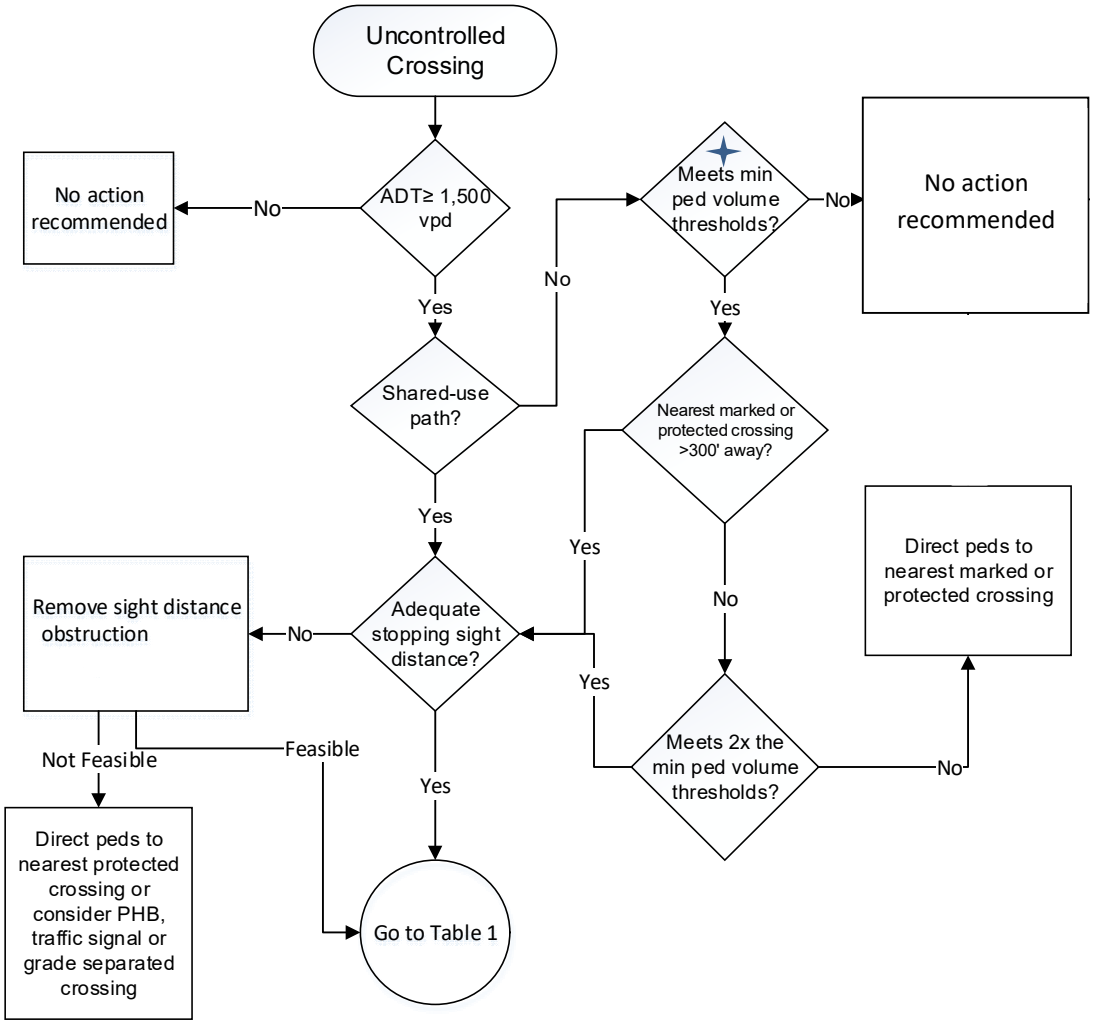


Figure 7
Pedestrian Crossing Treatment Flow Chart for Uncontrolled Crossing



- 20 pedestrians per hour* in any one hour, or
- 18 pedestrians per hour* in any two hours, or
- 15 pedestrians per hour* in any three hours, or
- 10 school age (grades K-12) pedestrians traveling to or from school in any one hour and the crossing is a designated school walking route

*Young, elderly, and pedestrians with disabilities count two times towards volume thresholds

(Using location counts or surrogate measures as applicable)

Table 1

Criteria for Crossing Treatments at Uncontrolled Locations

Roadway configuration	# of lanes crossed to reach a refuge	# of multiple threat lanes*	Roadway ADT and Posted Speed															
			1,500 - 9,000 vpd				9,000 - 12,000 vpd				12,000 - 15,000 vpd				>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 (one way street)	2	1	A	A	A	B	A	A	B	B	A	A	B	B	A	A	B	B
2 Lanes (two way street with no median)	2	0	A	A	A	B	A	A	B	B	A	A	B	B	A	A	B	B
3 Lanes w/refuge island or 2 Lanes w/raised median	1	0	A	A	A	B	A	A	B	B	A	A	B	B	A	B	B	B
3 Lanes (center turn lane)	3	1	A	A	B	B	A	B	B	B	A	B	B	B	A	B	B	B
4 Lanes (two way street with no median)	4	2	A	B	B	C	A	B	C	C	A	B	C	C	B	B	C	C
5 Lanes w/ refuge island or 4 lanes w/raised median	2	2	A	A	B	B	A	B	B	C	A	B	C	C	B	B	C	C
5 Lanes (center turn lane)	5	2	A	B	C	C	B	B	C	C	C	C	C	D	C	C	C	C
6 lanes (two way street with or without median)	3 to 6	4	A	B	D	D	B	B	D	D	D	D	D	D	D	D	D	D

* A multiple threat lane is defined as a through lane where it is possible for a pedestrian to step out in front of a moving vehicle in the adjacent travel lane (Either through or turn)

Using Table 1, determine the treatment type recommended for the features of the roadway being considered for a pedestrian crossing location. Use the discussion and suggested installations for each crossing type.

Review any current best practices or alternatives that may be available for the location type determined by Table 1. Discuss these applications with Safety Programs.

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Figure 8a
Installation of Pedestrian Hybrid Beacon (PHB) or Rectangular Rapid Flashing Beacon (RRFB) Signs on Low Speed Roadways (≤ 35 mph)

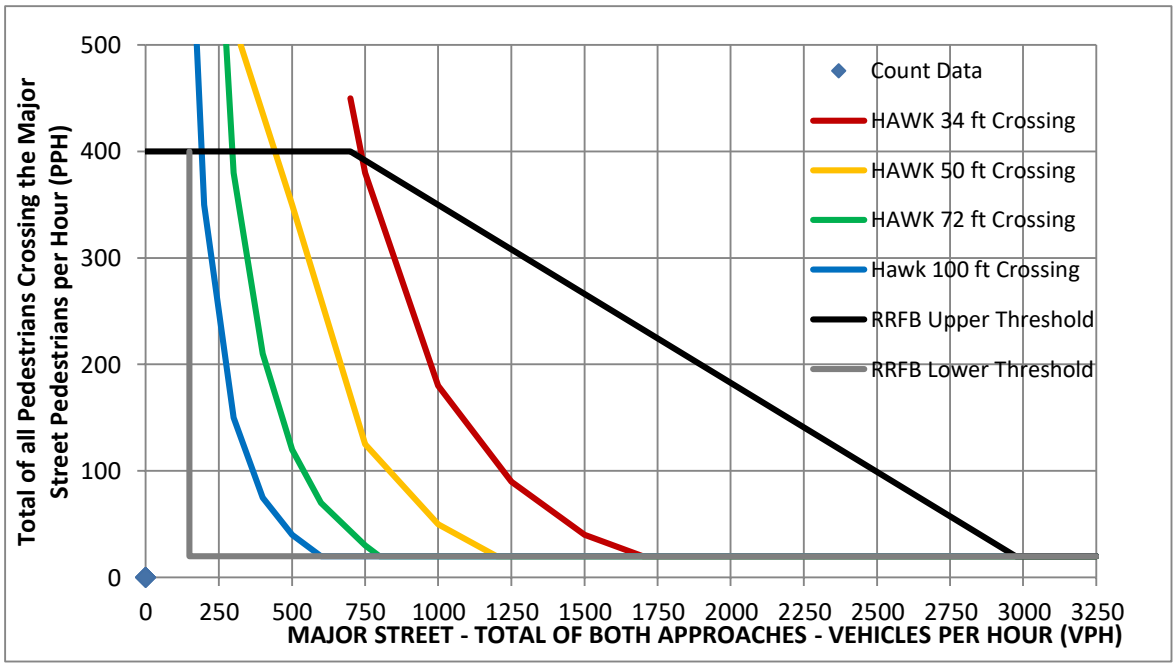
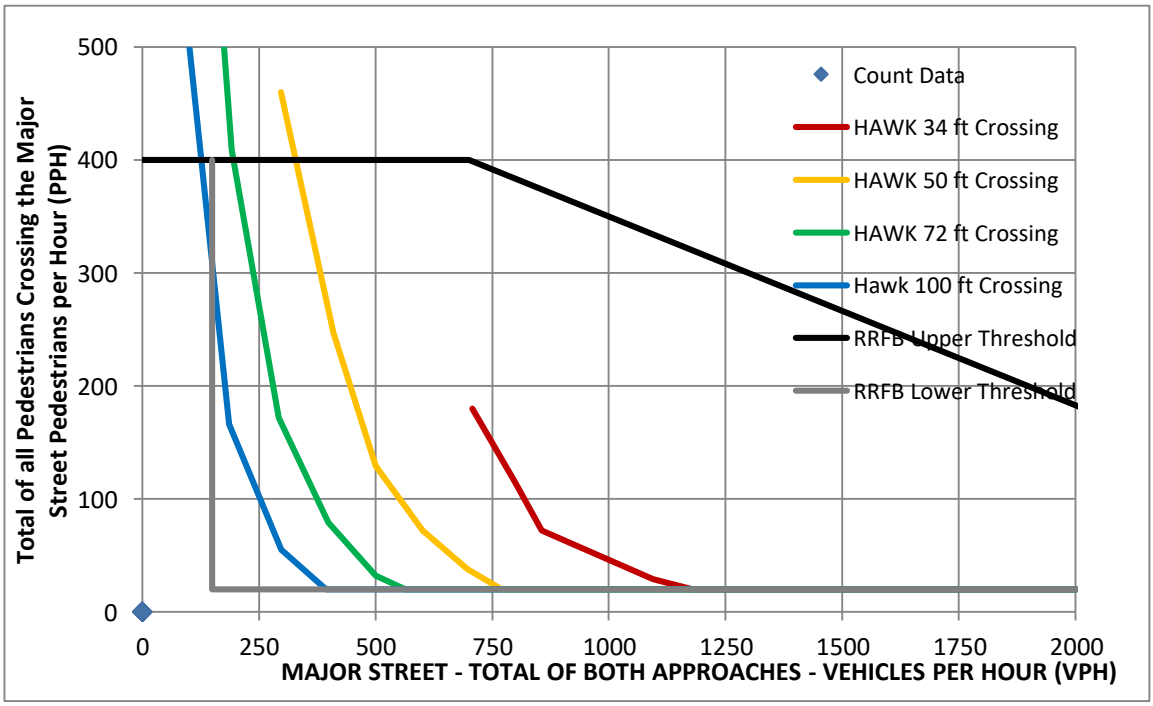


Figure 8b
Installation of Pedestrian Hybrid Beacon (PHB) or Rectangular Rapid Flashing Beacons (RRFB) Signs on High Speed Roadways (≥ 35



*See MMUTCD for pedestrian signal warrant graphs. Submit form 1597 to MDOT Signal Operations to request a feasibility study for any electronic pedestrian device.

Rectangular Rapid Flashing Beacons (RRFB)

Rectangular rapid flashing beacons (RRFB) used in conjunction with pedestrian crossing or school crossing signs can alert drivers that a pedestrian may be entering the crosswalk. The RRFB is intended to provide emphasis to the crossing signs where drivers may not be expecting pedestrians, or where special emphasis is required. The RRFB is a pedestrian actuated device which is an essential aspect of its effectiveness.

The decision to use an RRFB must be based on engineering analysis of the site conditions (see Section 'Types of Crossing Treatments at Uncontrolled Locations').

Figure 9: Example of RRFB with W11-2 sign and W16-7p plaque at unsignalized crosswalk.
[Photo courtesy of City of St. Petersburg, Florida]

Application

An RRFB shall only be installed to function as a Warning Beacon (per Section 4 of the Michigan Manual on Uniform Traffic Control Devices (MMUTCD)).

An RRFB shall only be used to supplement a W11-2 (Pedestrian) or S1-1 (School) crossing warning sign with a diagonal downward arrow (W16-7p) plaque, located at or immediately adjacent to a marked crosswalk.

The RRFB is to be used at mid-block pedestrian crossings or pedestrian crossings at intersection approaches that are not controlled by another traffic control device (e.g. YIELD signs, STOP signs, Pedestrian Hybrid Beacon or traffic control signals). The RRFB may be applicable to a crosswalk across the approach to and/or egress from a roundabout, if it is a new crossing.

Design

For design details please see MDOT's online ***RECTANGULAR RAPID FLASHING BEACON*** special detail.

The outside edges of the RRFB indications, including any housings, shall not project beyond the outside edges of the W11-2 or S1-1 sign.

As a specific exception to MMUTCD guidance, the RRFB shall be located between the bottom of the crossing warning sign and the top of the supplemental downward diagonal arrow plaque, rather than 12 inches above or below the sign assembly.

For any approach on which RRFBs are used, two W11-2 or S1-1 crossing warning signs (each

with RRFB and W16-7p plaque) shall be installed at the crosswalk, one on the right-hand side of the roadway and one on the left-hand side of the roadway. On a divided highway, the left-hand side assembly should be installed on the median, if practical, rather than on the far left side of the highway.

An RRFB shall not be installed independent of the crossing signs for the approach the RRFB faces. The RRFB shall be installed on the same support as the associated W11-2 (Pedestrian) or S1-1 (School) crossing warning sign and plaque.

Operation

The RRFB shall be normally dark, shall initiate operation only upon pedestrian actuation, and shall cease operation at a predetermined time after the pedestrian actuation or, with passive detection, after the pedestrian clears the crosswalk.

All RRFBs associated with a given crosswalk shall, when activated, simultaneously commence operation of their alternating rapid flashing indications and shall cease operation simultaneously.

If pedestrian pushbuttons (rather than passive detection) are used to actuate the RRFBs, a pedestrian instruction sign with the legend PUSH BUTTON TO TURN ON WARNING LIGHTS should be mounted adjacent to or integral with each pedestrian pushbutton.

The duration of a predetermined period of operation of the RRFBs following each actuation should be based on the MMUTCD procedures for timing of pedestrian clearance times for pedestrian signals.

When activated, the two yellow indications in each RRFB shall flash in a rapidly alternating "wig-wag" flashing sequence (left light on, then right light on).

As a specific exception to MMUTCD requirements for the flash rate of beacons, RRFBs shall use a much faster flash rate. Each of the two yellow indications of an RRFB shall have 70 to 80 periods of flashing per minute and shall have alternating but approximately equal periods of rapid pulsing light emissions and dark operation. During each of its 70 to 80 flashing periods per minute, one of the yellow indications shall emit two rapid pulses of light and the other yellow indication shall emit three rapid pulses of light.

The flash rate of each individual yellow indication, as applied over the full on-off sequence of a flashing period of the indication, shall not be between 5 and 30 flashes per second, to avoid frequencies that might cause seizures.

The light intensity of the yellow indications shall meet the minimum specifications of Society of Automotive Engineers (SAE) standard J595 (Directional Flashing Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles) dated January 2005.

Pedestrian Hybrid Beacon (PHB)

A Pedestrian Hybrid Beacon (PHB), often referred to as a HAWK signal, is intended as an alternative when the warrants for a full pedestrian traffic signal are not met but additional traffic control beyond signing and pavement markings are desirable.

The PHB signal provides a protected walk movement but during the Flashing Don't Walk, the vehicle traffic is shown a flashing red to minimize delay.

When a requested, a screening is completed similar to requests for traffic signals. If deemed appropriate, a full study is conducted. An important distinction is these are minimum thresholds not "warrants".

PHBs should only be considered if the crosswalk is at least 100 feet away from an intersecting street or driveway.

Traffic Control Device Guidance

Crosswalk Pavement Marking Guidance

Crosswalk markings at an intersection shall be two 6 inch transverse markings as specified in the Pavement Marking Standard for Intersection, Stop Bar and Crosswalk Markings.

Crosswalk markings for established school crossings and mid-block locations shall be Special Emphasis 12" longitudinal markings as specified in the Pavement Marking Standard for Intersection, Stop Bar and Crosswalk Markings.

Pavement marking materials shall be placed as specified in the Pavement Marking Materials Usage Guidelines.

Crosswalk Signing Guidance

Guidance for signing can be found in the MDOT Traffic Sign Design, Placement and Application Guidelines.

Traffic Signal Guidance

Guidance for the installation of traffic signals can be found in the MDOT document Electronic Traffic Control Device Guidelines.

References

1) Michigan Manual on Uniform Traffic Control Devices, 2011.
2) Designing Walkable Urban Thoroughfares: A Context Sensitive Approach, ITE 2010
3) Safety Effects of Marked vs Unmarked Crosswalks at Uncontrolled Locations: Final Report and Recommended Guidelines, Zeeger, C.V. and others, U.S. Department of Transportation, Federal Highway Administration, September 2005.
4) City of Boulder Pedestrian Crossing Treatment Installation Guide, November 2001.
5) Improving Pedestrian Safety at Unsignalized Crossings, Kay Fitzpatrick and others, Transit Cooperative Research Program Report 112 and National Cooperative Highway Research Program Report 562, 2006.
6) The Effects of Advance Stop Lines and Sign Prompts on Pedestrian Safety in a Crosswalk on a Multilane Highway, Van Houten, R., Journal of Appiled Behavior Analysis, Number 3, pages 245-251, Fall 1988.
7) Pedestrian Facilities Users Guide – Providing Safety and Mobility, Zegeer, C.V. and others, Federal Highway Administration publication number FHWA-RD-01-102, March 2002.
8) Safety Analysis of Marked Versus Unmarked Crosswalks in 30 Cities, Zeeger, C.V. and others, ITE Journal, January 2004.
9) Toward Zero Deaths https://www.towardzerodeaths.org/
10) Federal Highway Administration – Road Safety Audit https://safety.fhwa.dot.gov/rsa/
11) Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations, USDOT, FHWA EDC, July 2018