CITY OF MANITOWOC
PEDESTRIAN CROSSING TREATMENT INSTALLATION GUIDELINES

June 2017

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Introduction

The City of Manitowoc receives numerous requests to install Pedestrian Crossing Treatments every year. In order to clarify City Policy and provide a procedure for the request of these treatments, the City has created the following guidelines.

In an effort to treat all requests uniformly, and to be mindful of the use of government facilities and resources, the City will commit staff time to review requests for Pedestrian Crossing Treatments to ensure that their installation would have a positive effect upon the safety of our community.

In order to submit a request for the installation of pedestrian crossing treatments, the following steps must be completed:

- Read the City of Manitowoc Pedestrian Crossing Treatment Guidelines
- Retain a consultant, or ensure that a qualified professional fills out the Crossing Location Evaluation Worksheet
- Submit the completed worksheet, a map of the area in question, and a letter explaining the background of the request to the City Engineering Department, located at City Hall, 900 Quay Street, Manitowoc WI.
- Promptly comply with any requests for additional information from City Staff.
- Requests will be reviewed and considered by the City's Capital Allocation Working Group (CAWG), which is composed of a diverse group of department heads and managers, representing all facets of the City of Manitowoc, and are responsible for monitoring and / or allocating disbursement of capital expenditures.
- If the CAWG group agrees with the request, recommendations are then forwarded on to the Common Council for final approval.

Goals & Objectives

Providing safe and efficient pedestrian facilities is a goal of the City of Manitowoc, and the decision to travel as a pedestrian is partially subject to their perceived ability to safely and efficiently cross streets along their travel route. With this mind, the City of Manitowoc has established this document to provide criteria, procedures, and policies to guide the installation of crossing treatments. Specifically, this document summarizes:

1. Proposed pedestrian criteria and procedures for evaluating the need for crossing treatments.
2. Specific pedestrian crossing treatments that may be applicable for a particular set of pedestrian volumes, pedestrian types, vehicular volumes, vehicular speeds, and roadway geometry.

National standards provide little guidance for the installation of marked crosswalks and treatments, particularly at mid-block locations. Crosswalks and other crossing treatments are typically installed based on engineering judgement. Key issues, such as the circumstances in which a crosswalk should be installed, how much safety benefit crosswalks provide, and the application of various crossing enhancements are still commonly debated topics.

A Federal Highway Administration (FHWA) study has shown that marked crosswalks alone at uncontrolled intersections on two lane roadways have no effect on pedestrian accident rates (Zegeer et al). However, and somewhat counterintuitively, the study suggests that on higher volume, multi – lane roadways, marked crosswalks alone (i.e. without any other treatments) are actually associated with ***higher*** vehicle – pedestrian accident rates as compared to unmarked locations. In addition, evaluations have shown that while enhanced crosswalks often result in significant increases in driver compliance, such as yielding to crossing pedestrians, some of these devices may lead to higher vehicle – vehicle and vehicle – pedestrian accidents at multi – lane, high pedestrian / vehicle volume locations.

These Pedestrian Crossing Treatment Guidelines are intended to provide consistent procedures for considering the installation of crossing treatments where requested on a case by case basis within the City of Manitowoc. Implementation of crossing treatments will require funds that could potentially have been spent on other improvements, and therefore, must be considered carefully in the funding allocation process. In addition, there are instances where the installation of treatments may actually have detrimental effects on pedestrian safety.

1.0 Definitions

This section includes the definitions of some of the common technical terms used in this document.

Average Daily Traffic (ADT)
The amount of vehicular traffic that crosses an imaginary line across a roadway in a 24 hour period. ADT information typically includes both directions of vehicle travel (if on a two way street).

Controlled Pedestrian Crossing
A pedestrian crossing where motorists are required to stop by either a stop sign or traffic signal.

Crosswalk Lighting
Street lighting applied at a pedestrian crossing to help approaching motorists see a crossing pedestrian. Crosswalk lighting is at a "vehicular scale" like normal street lighting rather than at a "pedestrian scale" that is sometimes used along a sidewalk or path.

Curb Extensions (Bump Outs)
A roadway edge treatment where a curb line is extended out toward the roadway in order to reduce the width of the street. Curb extensions are sometimes used at the location of a crosswalk as a means of minimizing the distance and time that a crossing pedestrian must be in the roadway.

Differential Vehicle Queuing
See also *Vehicle Queue*. A condition on a roadway with two or more travel lanes in a single direction where the line of stopped traffic in one travel lane is significantly longer than the line of stopped traffic in the adjacent travel lane. Differential vehicle queuing across a pedestrian crosswalk can cause a significant safety concern as it increases the potential for "multiple threat" pedestrian accidents.

Gap in Traffic
A gap in traffic is the space between vehicles approaching the pedestrian crossing. Gaps are typically measured in seconds, not distance, as it is the length of the gap in time that a pedestrian must be able to cross in. A directional gap is the gap between vehicles approaching in a single direction. A directional gap can be measured between vehicles in a single lane, or between vehicles approaching in the same direction but in different lanes on a multi-line approach. If there is no median refuge at the crossing, a pedestrian will need to find an acceptable gap in traffic approaching from two directions at once.

Marked Crosswalk
A pedestrian crosswalk that is delineated by crosswalk pavement markings. Marked crosswalks typically also are delineated by a variety of traffic signs, as well as curb ramps.

Median Refuge (Island)
An area in the middle of a roadway where a crossing pedestrian can take shelter from approaching traffic in either direction. In the context of these guidelines, the median refuge must include a raised median of some width that allows a pedestrian to cross each direction of approaching traffic in a separate step. By using the refuge, the pedestrian must only find an acceptable gap in traffic for one approach direction at a time.

Minimum Pedestrian Volume Threshold
The minimum amount of pedestrian crossing traffic (typically in a one hour period) that must be present to warrant the installation of a pedestrian crossing treatment.

Motorist Compliance Data
Observations made and recorded at a pedestrian crossing where it is determine if the approaching motorist complied with their legal requirement to yield to a crossing pedestrian who is in or about to enter the crosswalk.

Multiple Threat Accidents
A type of pedestrian accident that occurs on a roadway with two or more lanes in the same direction. A motorist that stops for a crossing pedestrian can obscure the view of the pedestrian from another motorist approaching in the adjacent travel lane. If the second motorist does not slow down it creates the potential for a crossing pedestrian to step out in front of a high speed approach vehicle with potentially dire consequences.

Multi-Use Path Crossing
A location where a sidewalk designated as a multi-use path intersects a roadway at grade, and the path extends on both sides of the roadway.

Pedestrian Traffic Signal
A conventional traffic signal with circular red, yellow, and green displays for motorists and Walk / Don't Walk signals for pedestrians that are applied at a pedestrian crossing. Typically, a pedestrian signal would be applied in a mid – block location since it would be considered a normal intersection related traffic signal if it were to be applied at an intersection.

Raised Median
An area in the middle of a roadway, commonly separating vehicles traveling in opposite directions, that is surrounded by curb and gutter and is physically raised above the surrounding pavement where vehicles travel.

Rectangular Rapid Flash Beacons (RRFB)
RRFBs are small rectangular yellow flashing lights that are deployed with pedestrian crossing warning signs. They are typically actuated by a pedestrian push button and flash for a predetermined amount of time, to allow a pedestrian to cross the roadway before going dark. RRFBs are warning devices and do not themselves create a legal requirement for a vehicle to stop when they are flashing.

School Crossing
A School Crossings is defined as a crossing location where ten or more student pedestrians per hour are crossing.

Uncontrolled Pedestrian Crossing
An established pedestrian crossing that does not include a traffic signal, beacon, or stop sign that requires motor vehicles to stop before entering the crosswalk.

Vehicle Queue
A line of stopped vehicles in a single travel lane, commonly caused by traffic control at an intersection.

2.0 Crossing Location Evaluation Procedures & Considerations

2.1 Evaluation Steps

Evaluation of an individual crossing location for consideration of potential crossing treatments within the City of Manitowoc should include the four basic steps:

1. Identification & Description of Crossing Location
2. Physical Data Collection
3. Traffic Data Collection & Operational Observations
4. Application of Data to Determine Appropriate Treatments

Step 1: Identification & Description of Crossing Location

a. Identify the pedestrian crossing location including the major street and specific location of the crossing (i.e. cross street, street address, intersection, path, or trail, etc.)
b. Determine if the crossing location connects both ends of a multi - use path. If it does, the minimum pedestrian volume requirements are waived.
c. Note the posted speed along the major street at the crossing location.
d. Identify the existing traffic control (if any) and any existing crossing treatments (signs, markings, or physical treatments), street lighting, and curb ramps.

Step 2: Physical Data Collection

a. Determine the existing roadway configuration including the number of lanes and the presence of painted or raised medians at the crossing location.
b. Identify the nearest marked or protected crossing and measure the distance to this crossing.
c. Measure the stopping sight distance (SSD) on all vehicular approaches to the crossing.

Step 3: Traffic Data Collection & Operational Observations

a. Gather or collect pedestrian crossing volumes during the peak hours of use, differentiating between pedestrians and bicyclists, as well as separately noting the number of young, elderly, and / or disabled pedestrians. For locations involving school crossing traffic, the volume of student pedestrians should also be separately noted. Whenever possible, volumes should be collected during warm weather and fair weather conditions to represent peak activity.
b. The requesting party should retain a consultant to gather or collect hourly and average daily traffic (ADT) volumes for automobile traffic along the major roadway at the

crossing location. A one day sample should be adequate, with hourly volumes collected during the same hour as the pedestrian crossing volumes.

c. Due to the potential for vehicular traffic queues to impact safety at the crossings, the presence of queues extending from downstream signals or intersections back into the crossing location should be observed as well as any "differential" queuing that may occur on a lane to lane basis. While collecting automobile traffic data, the formation of vehicle queues from adjacent intersections should be noted. If one or both directional queues reach back to the crossing location, the number of times per hour that it reaches the crossing location should be noted and the maximum queue length should also be recorded. If there is more than one through lane in each direction, it should be noted if the queues reaching back to the crossing are approximately the same length in each lane, or there are significant differences in the length of queues in each lane. If the queues are routinely of different length as they extend beyond the crossing location, notes should be made as to the potential cause of the differential queuing.

Step 4: Application of Data to Determine Appropriate Treatments

Using the available data, utilize this document to determine which, if any, treatment(s) for crossings may be appropriate.

2.2 Additional Evaluation Considerations

The following information should be considered by the user of these guidelines when determining the appropriate pedestrian crossing treatment(s):

2.2.1 Types of Crossing Treatments at Uncontrolled Locations

Table 1 identifies six primary types of uncontrolled crossing treatments for consideration depending upon the physical roadway conditions, vehicle volume, and pedestrian volume at the proposed crossing location. The crossing types are as follows:

Crossing Type A:

- Marked Crosswalk
- Yield to Pedestrian Signs Placed
- Advanced pedestrian warning signs mounted in advance of the crossing

- School Crossing signs installed

Crossing Type B:

- All of Type A, plus
- Yield to Pedestrians – Placed within Crosswalk

Crossing Type C:

- All of Type B, plus
- The addition of curb extensions (neck downs) and median refuge islands in order to shorten the crossing distance and increase the visibility of pedestrians to approaching motorists.

Crossing Type D:

- Marked Crosswalk
- Median Refuge Island (Note: If a median refuge cannot be constructed on a 2 way street, then go to *Crossing Type F*).
- "State Law – Yield to Pedestrians" signs mounted on the side of the roadway and in the median at the crossing
- Pedestrian actuated Rectangular Rapid Flash Beacons (RRFBs) mounted with the "State Law…" Signs
- Standard advance pedestrian warning signs mounted in advance of the crossing
- If there are 2 approach lanes in a single direction, install advance yield signs and Yield to Pedestrian signs
- Use School Zone Signs, as appropriate
- Consider adding curb extensions if on – street parking exists, and storm drainage can be accommodated

Crossing Type E:

- Where speed limit is initially greater than or equal to 45 miles per hour
- Determine if the speed limit can be effectively reduced to 40 miles per hour AND a raised median refuge island can be installed
    - If yes, go to *Crossing Type D*
    - If no, go to *Crossing Type F*

Crossing Type F:

- Crossing has 3 or more through lanes in a given direction, or is otherwise not suitable for an uncontrolled crosswalk

- Consider beacons, pedestrian traffic signals, or grade separated pedestrian crossings
- Must also consider corridor signal progression, grades, physical constraints, and other engineering factors

2.2.2 Minimum Vehicle Volume for Treatments

Recognizing the limited availability of resources to implement crossing treatments within the City, crossing treatments should generally not be installed at locations where the ADT is lower than 2,500 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 per hour.

2.2.3 Minimum Pedestrian Volume for Treatments at Uncontrolled Crossing Locations

The City of Manitowoc has evaluated crosswalk enhancements at uncontrolled crossing locations and has determined that there is a clear relationship between driver compliance, in the form of yielding, and the pedestrian and / or bicycle crossing volume. Data collected at crosswalks where RRFB or State Law yield signs were installed shows that driver compliance typically increases with higher crossing volumes. The theory is that the primary reason for this relationship is that drivers tend to ignore enhanced crossing treatments over time at locations where they infrequently see pedestrians crossing.

Studies have shown that below roughly 20 pedestrians per hour, driver compliance decreases significantly. Thus, the base threshold for the consideration of an enhanced crossing treatment at an uncontrolled location is 20 pedestrians per hour. This threshold is consistent with recent national guidance and policies adopted by other states and cities, as determined through literature research.

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 aged pedestrians traveling to / from school in any one hour**

* Young, elderly, and disabled pedestrians count 2X

** School crossing defined as a crossing location where 10 or more student pedestrians per hour are crossing

2.2.4 Definition of a Pedestrian Median Refuge & Median Refuge Width

A pedestrian refuge median is a means of increasing the safety and efficiency of a pedestrian crossing, and the presence (or not) of a median refuge will influence the type of pedestrian crossing treatment that can be considered (Table 1). The pedestrian median is thus defined as a location in the crossing where a pedestrian can take refuge, by separating the crossing into distinct segments, thereby increasing the number of acceptable gaps for pedestrians to safely cross a roadway.

A pedestrian refuge must include some type of raised median as described below:

- A painted center median or a painted turn lane *cannot* be considered a pedestrian refuge
- A raised median nose can only be considered a pedestrian refuge for the adjacent crosswalk if the median is at least 4 feet wide and the left turn volume is less than 20 vehicles per hour.
- A raised median at a mid-block pedestrian crossing can only be considered a refuge if it is at least 6 feet wide and includes curb ramps or an at grade walkway through the median. This minimum width allows for splash protection, pedestrian storage, and will accommodate a bicycle. For multi – use path crossing location, a 10 foot width is ideal to better accommodate bicycles with child trailers, recumbent bicycles, and tandem bicycles.

2.2.5 Distance to Nearest Marked or Protected Crossing

The Pedestrian Crossing Treatment Flowchart shown in Figure 1 describes spacing criteria for an uncontrolled crossing to the nearest marked or projected crossing. The flowchart requires the proposed uncontrolled mid – block crossing be at least 300 feet from the nearest crossing. The flowchart allows for this criteria to be waived if the proposed crossing is a multi – use path, or the pedestrian crossing volume exceeds double the minimum threshold.

This criteria is subject to engineering judgement. In conditions where the block lengths vary, the engineer may consider allowing a smaller minimum spacing, provided the resulting crossing:

- Does not cross any auxiliary lanes (left or right turn lanes, or their transitions) where it is anticipated that vehicles will be changing lanes and may be distracted from observing pedestrians in the crosswalk.
- Is not in an intersection influence area where it will create undue restriction to vehicular traffic operations.

2.2.6 Conditions That May Limit the use of Rectangular Rapid Flash Beacons at Pedestrian Crossings

The use of rectangular rapid flash beacons (RRFBs) at pedestrian crossings can greatly increase motorist yielding to pedestrians at unsignalized crosswalks. However, the use of these RRFBs may not be appropriate in locations where there is a combination of both high traffic volumes and high pedestrian volumes. In these conditions, there may be an increase in traffic accidents and / or traffic delay that make the use of these devices ineffective. In these cases, the use of conventional traffic signals may be more appropriate.

2.2.7 Selecting between a Pedestrian Traffic Signal or RRFB

Pedestrian traffic signals may be considered for application at high volume pedestrian crossings based on engineering judgement. The MUTCD has warrants for conventional pedestrian traffic signals based on traffic volumes. These signals are typically considered when there are over 130 pedestrians per hour crossing a roadway.

The City of Manitowoc has used RRFBs to increase motorist yielding to pedestrians at unsignalized crossings, typically where there are two travel lanes in each direction. A minimum crossing volume of 20 pedestrians per hour is typically required, however, there may be cases where the combination of high pedestrian and traffic volumes may make the application of RRFBs appropriate.

The final decision should be based on engineering judgement. Factors to be considered include: automobile, bicycle, and pedestrian volumes, vehicular speeds, crossing distances, the presence or absence of a median, potential impact to corridor signal progression, proximity to signalized intersection, and vehicle queue formation.

2.2.8 Signal Progression and Traffic Operational Considerations

The installation of RRFBs or pedestrian traffic signals can have significant impacts on traffic in a corridor. The automobile and pedestrian crossing volumes, the spacing to the adjacent signalized intersections, the type of pedestrian population (students, elderly, a mix) should all be considered when selecting the crossing treatment type and how it will be operated. Where practical, pedestrian traffic signals should be coordinated with the signal progression in the corridor to minimize the impact of the new signal on the corridor traffic flow. However, coordinated signals may be less responsive to pedestrian actuation, and the delay in pedestrian service may result in some pedestrians crossing against the signal rather than waiting. Not coordinating the pedestrian crossing signals may result in unacceptable increases in automobile congestion and delay.

RRFBs used at high volume pedestrian crossings in congested roadway corridors can also have a significant impact on automobile congestion and compromise effective signal progression.

2.2.9 Differential Vehicle Queue Lengths and Pedestrian Safety

A pedestrian crossing of a roadway with two or more lanes in a single direction has the potential for multiple threat accidents, which are defined as when one lane of traffic stops for a pedestrian and obscures the view of the crossing pedestrian to a motorist in the adjacent travel lane. The result is that a pedestrian can step in front of a vehicle that is approaching too fast to stop. This condition is magnified when there are vehicle queues that extend back from the pedestrian crossing. If the queue in one lane backs into the crossing and is much longer than the queue in the adjacent lane, a motorist would likely assume that the stopped traffic is the result of queueing (which may actually be the case). However, if a vehicle in one lane stops for a pedestrian instead of the queue, the chance for a multiple threat accident increases.

It is therefore important for the engineer to be aware of the potential for queues that may conflict with pedestrian crossings, especially those that may occur routinely that are longer in one lane than the other. The engineer should also determine whether or not this situation can be mitigated.

2.2.10 Unmarked Pedestrian Crossing Facilitation

In locations where pedestrians regularly cross arterial roadways, but the crossing does not serve a multi – use path or school, and the pedestrian volume is below the

minimum thresholds in Figure 1 for installing the types of marked and signed treatments detailed in Table 1, it may be appropriate to install treatments that facilitate pedestrian or bicycle crossings, but stop short of the signed and marked treatment defined in Table 1. These treatments may include curb ramps and / or a raised median refuge, but without efforts made to attract pedestrians to the crossing, as a simple acknowledgment of the low volume crossings at the location. These treatments would then not be an endorsement of the crossing, yet make it safer for those that are using it. These treatments should only be considered if the location is more than 300 feet from the nearest signed and marked pedestrian crossing, whether it is controlled or uncontrolled, and it is believed that there is little potential to redirect pedestrians to a more defined crossing location.

City of Manitowoc Pedestrian Crossing Treatment Installation Guidelines

Crossing Location Evaluation Worksheet

LOCATION DESCRIPTION

Major Street: _____ Crossing Location: _____

Is this a multi – Use Path Crossing? Yes _____ No _____ Posted Speed Limit _____

Existing Traffic Control: Stop Sign _____ Traffic Signal _____ Uncontrolled _____

Existing Crossing Treatments (if any): _____

_____

Nearby Pedestrian Generators (School, transit Stop, Commercial, etc.): _____

_____

PHYSICAL DATA

Roadway Configuration: 2 Lane _____ 4 Lane _____ Raised Median _____

Crossing Distance/Direction: ___ ft. total _____ ft. to median 1 _____ ft. to median 2

(For uncontrolled locations only) Stopping Sight Distance (SSD) = _____ ft.

Is the SSD greater than, or equal to, 8X the speed limit? Yes _____ No _____
If no, are SSD improvements feasible? Yes _____ No _____

TRAFFIC DATA

Pedestrian Crossing Volumes / Bicycle Crossing Volumes

	AM	**Mid – Day**	**PM**	**Other**
Time:	To	To	To	To
Date / Day of Week:	/	/	/	/
Major Street Vehicular Volume (**Hourly**)				
Number of Transit Boardings (if applicable)				
Number of Young Pedestrians / Bicyclists	/	/	/	/
Number of Elderly Pedestrians				
Number of Disabled Pedestrians				
Number of Non – Y/E/D Pedestrians / Bicyclists	/	/	/	/
Total Pedestrians – Actual (Include all Bicyclists				
Total Pedestrians (Adjusted for 2X Y/E/D)				
Major Street Vehicular Volume (**Daily**): ADT = _____veh/day				

OPERATIONAL OBSERVATIONS

Nearest Intersection (Direction 1): Cross Street Name: _____

Located _____ ft. to the _____ (direction) of the crossing location

Signalized? Yes _____ No _____ Distance from Crossing _____ ft.

	AM	Mid - Day	PM	Other
How many times/hr. did the downstream vehicle queue back up into the pedestrian crossing?				
If multiple lanes per direction, are queue lengths approximately equal?	Y N	Y N	Y N	Y N
If NO, which lane is longer and by how many feet?				

Nearest Intersection (Direction 2): Cross Street Name: _____

Located _____ ft. to the _____ (direction) of the crossing location

Signalized? Yes _____ No _____ Distance from Crossing _____ ft.

	AM	Mid - Day	PM	Other
How many times/hr. did the downstream vehicle queue back up into the pedestrian crossing?				
If multiple lanes per direction, are queue lengths approximately equal?	Y N	Y N	Y N	Y N
If NO, which lane is longer and by how many feet?				

Apply Data to Figure 1 and Table 1:

Recommended Treatment(s): _____

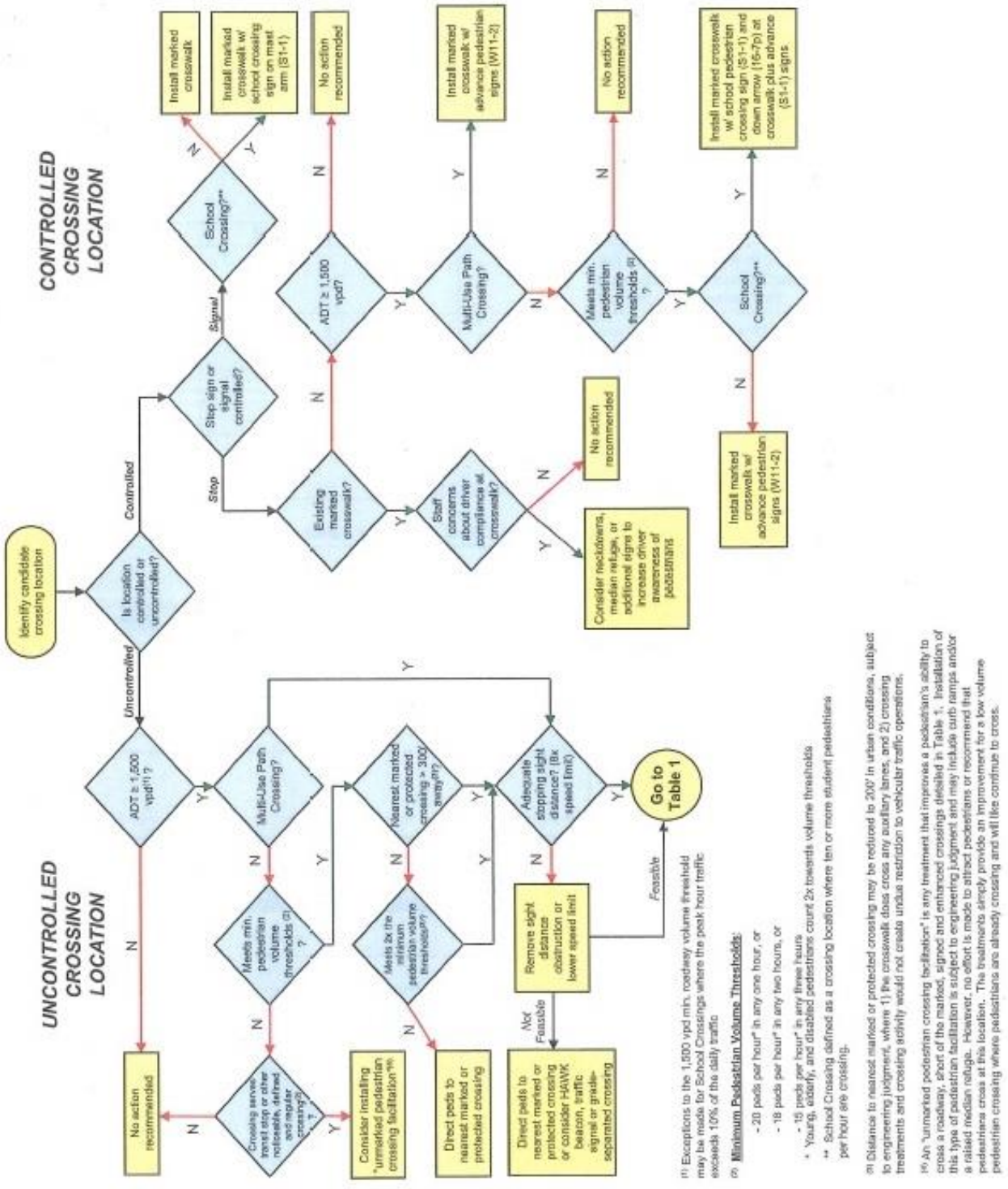
_____

_____

_____

Figure 1

Pedestrian Crossing Treatment Flowchart



(1) Exceptions to the 1,500 vpd min. roadway volume threshold may be made for School Crossings where the peak hour traffic exceeds 10% of the daily traffic

(2) Minimum Pedestrian Volume Thresholds:
- 20 peds per hour* in any one hour, or
- 18 peds per hour* in any two hours, or
- 15 peds per hour* in any three hours

* Young, elderly, and disabled pedestrians count 2x towards volume thresholds

** School Crossing defined as a crossing location where ten or more student pedestrians per hour are crossing.

(3) Distance to nearest marked or protected crossing may be reduced to 200' in urban conditions, subject to engineering judgment, where 1) the crosswalk does cross any auxiliary lanes, and 2) crossing treatments and crossing activity would not create undue restriction to vehicular traffic operations.

(5) An "unmarked pedestrian crossing facilitation" is any treatment that improves a pedestrian's ability to cross a roadway, short of the marked, signed and enhanced crossings detailed in Table 1. Installation of this type of pedestrian facilitation is subject to engineering judgment and may include curb ramps and/or a raised median refuge. However, no effort is made to attract pedestrians or recommend that pedestrians cross at this location. The treatments simply provide an improvement for a low volume pedestrian crossing where pedestrians are already crossing and will like continue to cross.

Table 1

Uncontrolled Locations Crossing Treatment Criteria

Roadway Configuration	# of lanes crossed to reach a refuge[1]	# of multiple threat lanes[2] per crossing	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	B	C	E	A	B	C	E	B	B	C	E	B	C	C	E
2 Lanes (two way street with no median)	2	0	A	B	C	E	A	B	C	E	B	B	C	E	B	C	C	E
3 Lanes w/Raised Median	1 or 2	0 or 1	A	B	D	E	A	C	D	E	B	D	D	E	C	D	D	E
3 Lanes w/Striped Median	3	0 or 1	C	C	D	E	C	C	D	E	C	C	D	E	C	D	D	E
4 Lanes (two way street with no median)	4	2	A	D	D	E	B	D	D	E	B	D	D	E	D	D	D	E
5 Lanes w/Raised Median	2 or 3	2	A	B	D	E	B	C	D	E	B	C	D	E	C	C	D	E
5 Lanes w/Striped Median	5	2	D	D	D	E	D	D	D	E	D	D	D	E	D	D	D	E
6 Lanes (two way street with or without median)	3 to 6	4	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F

Notes:

1. Painted medians can never be considered a refuge for a crossing pedestrian. Similarly, a 4 foot wide raised median next to a left turn lane can only be considered a refuge for pedestrians if the left turning volume is less than 20 vehicles per hour (meaning that in most cases the left turn lane is not occupied while the pedestrian is crossing).
2. A multiple threat lane is defined as a through lane where it is possible for a pedestrian to step out from in front of a stopped vehicle in the adjacent travel lane (either through or turn lane).

Treatment Descriptions:

A ***Install marked crosswalk with enhanced road-side signs***

Specific Guidance: Install marked crosswalk with "State Law - Yield to Pedestrian" signs mounted on the side of the roadway with standard (W11-2) advance pedestrian warning signs; use S1-1 signs for School Crossing locations.

B ***Install marked crosswalk with enhanced road-side and in-roadway (bollard mounted) signs***

Specific Guidance: Install marked crosswalk with "State Law - Yield to Pedestrian" signs mounted on the side of the roadway and on in-roadway bollards; use standard (W11-2) advance pedestrian warning signs; use S1-1 signs for School Crossing locations.

C ***Install marked crosswalk with enhanced signs and geometric improvements to increase pedestrian visibility and reduce exposure***

Specific Guidance: For 2 or 3-lane roadways, install marked crosswalk with "State Law - Yield to Pedestrian" signs mounted on the side of the roadway and on in-roadway bollards or median mounted signs; use standard (W11-2) advance pedestrian warning signs; use S1-1 signs for School Crossing locations. Add neckdowns or median refuge islands to shorten the pedestrian crossing distance and increase pedestrian visibility to motorists.

D ***Install marked crosswalk with enhanced signs, pedestrian activated RRFBs, and geometric improvements to increase pedestrian visibility and reduce exposure***

Specific Guidance: Install raised median refuge island (unless it is a one-way street or one already exists) to shorten the pedestrian crossing distance and increase pedestrian visibility to motorists. [If a median refuge can not be constructed on a two-way street, Go To Scenario F]. Install marked crosswalk with "State Law - Yield to Pedestrian" signs WITH pedestrian activated RRFBs mounted on the side of the roadway and on median mounted signs; use standard (W11-2) advance pedestrian warning signs; use S1-1 signs for School Crossing locations. Consider adding neckdowns at the crossing if on-street parking exists on the roadway and storm drain considerations will allow. [Note: If pedestrian volume falls above the RRFB limit line on Figure 2, consider Hawk beacon, pedestrian traffic signal, or grade-seperated crossing.]

E ***Do not install marked crosswalk at uncontrolled crossing. Determine if the speed limit can be effectively reduced to 40 mph AND a raised refuge median can be installed. If so, utilize Scenario D criteria above. If this is not possible, or if pedestrian volume falls above the RRFB limit line on Figure 2, consider HAWK beacon, pedestrian traffic signal, or grade-separated crossing.***

Specific Guidance: Consider HAWK beacon, pedestrian traffic signal or grade-separated crossing; application of these treatments will consider corridor signal progression, existing grades, phyiscal contraints, and other engineering factors

F ***Do not install marked crosswalk at uncontrolled crossing with 3 or more THROUGH lanes per direction or where the speed limit is ≥ 45 mph and/or there is not a median refuge on a 5-lane crossing. Consider HAWK beacon, pedestrian traffic signal, or grade-separated crossing.***

Specific Guidance: Consider HAWK beacon, pedestrian traffic signal or grade-separated crossing; application of these treatments will consider corridor signal progression, existing grades, phyiscal contraints, and other engineering factors

3.0 Supplemental Policies

3.1 Crosswalk Lighting

FHWA recommendations include adequate lighting be provided at marked crosswalks to enhance the safety of pedestrians crossing at night.

3.2 Avoiding Overuse of Crossing Treatments

FHWA recommendations also warn against the overuse of crosswalk treatments in order to maximize their effectiveness. Crosswalks and sign treatments (such as the "State Law – Yield to Pedestrians" and RRFBs) should be used discriminately within the City of Manitowoc so that the effectiveness of these treatments is not diminished by overuse. While these treatments may be effective at select locations, overuse may decrease their value as drivers become desensitized to them. Minimum pedestrian and vehicular volume criteria have been established by this document with this in mind.

3.3 Accessible Crosswalks

It is the goal of the City of Manitowoc that the installation of all crosswalks will be in compliance with the Americans with Disabilities Act (ADA) in order to maximize mobility for all users. When crosswalks are installed in curbed roadways, curb ramps shall include a detectable warning surface.

3.4 Raised Crossings at Right – Turn Bypass Islands

Raised pedestrian crossings at right – turn bypass islands improve visibility for pedestrians, enhance accessibility, and help mitigate the speed of right turning vehicle traffic. City staff will review all new or proposed right turn bypass movements in order to determine if a raised crossing should be installed.

3.5 Removal of Treatments

Conditions that contribute to the need for a crosswalk or crossing treatment may change over time, and an existing crosswalk or treatment may no longer be needed. When a

roadway is to be reconstructed or resurfaced, a review of any unprotected crosswalks should be performed to determine their use and need. If the use of a crosswalk is less than half of that which would be required for it to be warranted based on the criteria established in these guidelines for a new installation, the crosswalk should not be replaced, and any other treatments removed. In such cases, residents and property owners within 1000' of the crosswalk in question will be notified. In addition, notices will be visibly posted for 30 days prior to inform the public of the intent to remove them. City contact information will be provided, and should concerns arise from the public as a result, staff may begin a more substantial public process with concerned parties.

References

Zeeger, C.V, Stewart, R.J, Huang H.H, and Lagerway, P.A. *Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations: Executive Summary and Recommended Guidelines*, FHWA RD – 01 – 075. Federal Highway Administration, Washington D.C., February 2002.