JOPLIN HIGH SCHOOL CROSSWALK

TECHNICAL MEMORANDUM

PREPARED FOR

Dakota Rusk
City of Joplin
1301 W 2nd Street,
Joplin, MO 64801



July 11, 2022

PREPARED BY:

CJW

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Joplin High School Crosswalk Technical Memorandum

To: City of Joplin
From: CJW Transportation Consultants, LLC.
Date: July 11, 2022
Re: Crosswalk Analysis – 20th Street at Missouri Avenue / Sunny Jim Park

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The City of Joplin requested an analysis regarding the installation of a crosswalk on 20th Street connecting the Joplin High School to Sunny Jim Park. A review of the Federal Highway Administration's (FHWA) Field Guide for Selecting Countermeasures at Uncontrolled Pedestrian Intersections revealed that four options should be considered given the roadway configuration, existing traffic volumes, and speed on 20th Street. Those options are provided below increasing levels of safety, starting with the lowest impact of striping the crosswalk to the highest impact of adding a High-Intensity Advanced Crosswalk (HAWK) Signal at the intersection.

Study Area

Table 1 shows the primary characteristics of the key roadway corridor including roadway classification, speed limit, average annual daily traffic (AADT), number of lanes, lane widths, and the existence of pedestrian or bicycle facilities.

Table 1: Study Corridor Characteristics

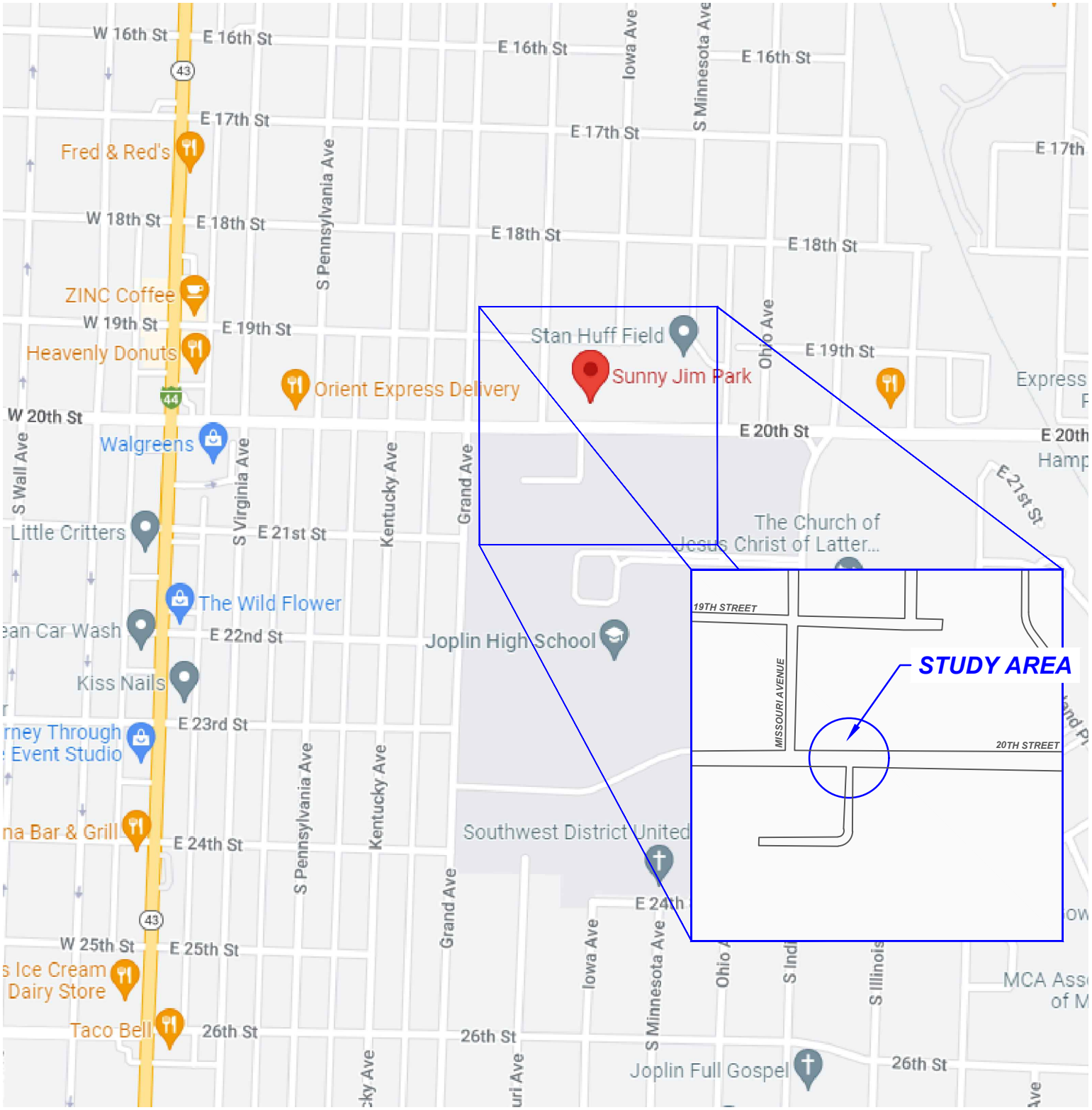
Name	Classification[1]	Speed Limit (MPH)	Average Annual Daily Traffic (AADT)[2]	Lanes	Lane Widths (ft)	Ped/Bicycle Facilities
20th Street	Minor Arterial	35	14,083	5 Lane with TWLTL	11	Sidewalks (Both Sides)

[1] Roadway Classification determined based on information provided by the MoDOT Functional Classification Map for Joplin, MO.
[2] Average Daily Traffic volumes were obtained using Traffic Volume Maps provided by the Missouri Department of Transportation (MoDOT).

Exhibit 1 shows a map of the study area below.

20TH STREET CROSSWALK
JOPLIN, MISSOURI

EXHIBIT 1
STUDY AREA



NORTH

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Existing Pedestrian Counts

Table 2 below shows the average daily pedestrian counts observed over a 7 day period with the AM average representing pedestrians who interacted with the intersections between 7:30-8:30 am and the PM average representing pedestrians who interacted with the intersections between 3:40-4:00 pm. The AM and PM times represent just before and after school starts and ends respectively. Due to the proximity of Missouri Avenue & Sunny Jim Park Alley to each other, they were counted as one intersection. The table also shows how many students who interacted with Missouri Avenue & Sunny Jim Park Alley got into vehicles waiting in the parking lot. This indicates that individuals picking students up from school chose to park here and have the students come over to them instead of waiting in a designated pick-up line for the students. The counts were provided by Jim Hounschell, the Director of Safety and Security for Joplin Schools.

Table 2: Average Existing Pedestrian Counts

	Missouri / Sunny Jim Park & 20th	Pedestrians Who Entered Waiting Cars at Sunny Jim Park	Ohio & 20th	Indiana & 20th
Average AM:	18	N/A	4	1
Average PM:	51	9	N/A	N/A

It is important to note that the intersections of Ohio Avenue & 20th Street and Indiana Avenue & 20th Street were not observed in the PM as the large majority of students crossed at Missouri Avenue / Sunny Jim Park Alley & 20th Street. Additionally, pedestrians who exited a vehicle and then crossed 20th Street from Sunny Jim Park Alley were not counted separately in the AM peak.

Crosswalk Safety Analysis

The City of Joplin has requested third party guidance regarding pedestrian travel across 20th Street near Missouri Avenue & Sunny Jim Park, as it experiences high traffic volumes during the times students are either entering or exiting school grounds. A variety of safety options were reviewed to help determine what would be the best solution for a mid-block crosswalk while providing better safety for pedestrians than what currently exists. When looking at what safety options are appropriate, the engineer reviewed the *Field Guide for Selecting Countermeasures at Uncontrolled Pedestrian Crossing Locations*. Table 1 within the field guide provides a variety of suggestions based on the roadway configuration, the speed limit of the roadway, the vehicle ADT, and is shown in **Appendix I**. As can be seen in **Table 1** of this memo, 20th Street has an Average Annual Daily Traffic Volume of 14,083 vehicles. It also has a speed limit of 35 mph and is a five-lane roadway. According to Table 1 in the *Field Guide*, the appropriate measures to review as viable are as follows: High-visibility Crosswalk Markings, Crosswalk Visibility Enhancement (Signs), Pedestrian Refuge Island, and a Pedestrian Hybrid Beacon. Additionally, sidewalk geometrics were evaluated to better address the movement of pedestrians through the intersection.

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Existing Pedestrian Facilities

In the existing condition, 20th Street at Missouri Avenue / Sunny Jim Park across from the Joplin High School has no existing crosswalk for pedestrians to utilize. The section of the roadway contains overhead lighting approximately 70 feet from the proposed crosswalk location. There are sidewalks along both the north and south side of 20th Street which ensures connectivity to any potential crosswalk.

Baseline Option: High-Visibility Crosswalk Marking

At a minimum, 20th Street at Missouri Avenue / Sunny Jim Park should have crossing stripes painted on the pavement. Given that 20th Street is a major street, zebra stripes should be painted within the crossing stripes to allow for more visibility. By adding High-Visibility crosswalk markings along with the existing overhead lighting, pedestrians would have a select location along 20th Street to cross and gain access to the Joplin High School. The designated crosswalk would increase visibility and allow drivers to prepare to yield for pedestrians.

Additional Option: Crosswalk Visibility Enhancement

When a striped crosswalk is introduced to the roadway, it becomes imperative that drivers see signing that informs them of the crosswalk before they reach it. Adding advanced signing would ensure that drivers are more attentive and should reduce the likelihood of a crash involving a pedestrian. According to the MUTCD, it is recommended that advanced warning "School Area" signing should be placed at the beginning and end of the school zone. The placement of the signs would give enough advanced warning to allow vehicles to look for pedestrians and reduce speed or stop should pedestrians be in the crosswalk. Additionally, a school crossing sign with a down arrow should be placed at the crosswalk to inform vehicles they have reached the area previously warned about. Finally, a yield bar should be installed 20 to 50 feet ahead of the crosswalk to direct drivers where they should yield to pedestrians. A figure displaying the proposed signing and yield bar is shown below in **Exhibit 2.**

20TH STREET CROSSWALK
JOPLIN, MISSOURI

EXHIBIT 2
PROPOSED SIGNING



NORTH

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Additional Option: Pedestrian Refuge Island

For the site of interest on 20th Street near Missouri Avenue / Sunny Jim Park, a Pedestrian Refuge Island is highly recommended. An island allows a pedestrian to cross one direction of traffic at a time when a roadway has four or more lanes without a raised median. The island would improve traffic visibility for pedestrians and provide a barrier between pedestrians and automobiles. Pedestrians have the option of taking their time and crossing the rest of the crosswalk when it is safe.

Additional Option: Rectangular Rapid-Flashing Beacon (RRFB)

When looking at a Pedestrian Hybrid Beacon, there are several different options that provide a varying level of expense and involvement. The first and least involved would be a rectangular rapid flashing beacon (RRFB). A RRFB consists of a beacon with a pedestrian crossing sign on it. When a pedestrian comes to the intersection, they press a button which activates the flashing beacon and warns vehicles that a pedestrian may be in the crosswalk. This would help to maximize the visibility of the intersection and would only flash when an individual who intends to cross, presses the button. Should the City of Joplin decide to move forward with a RRFB, an educational component should go along with its installation to help better inform the drivers of what they are looking at when they see the beacon flash. This will further ensure that pedestrians remain safe as they try to cross the roadway. The only issue with this option is that the flashing beacon does not guarantee that traffic will stop. So if the roadway doesn't have a lot of gaps in traffic, pedestrians will continue to struggle to find those gaps.

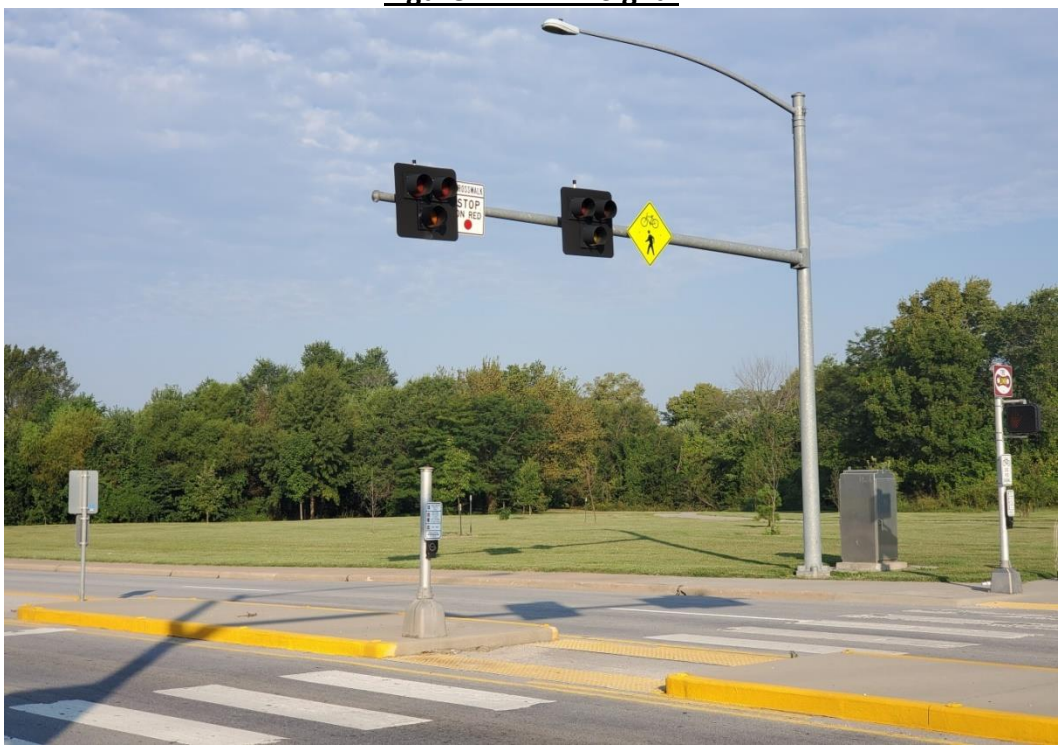
Additional Option: High Intensity Activated Crosswalk Signal (HAWK)

The most intensive option would be the installation of a pedestrian signal. A photo of an existing midblock pedestrian HAWK Signal in Springfield, MO is shown below in **Figure 1.**

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Figure 1: HAWK Signal

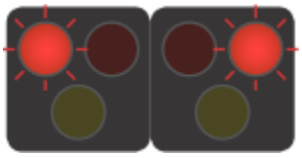


A HAWK or **H**igh-Intensity **A**ctivated Cross**W**al**K** signal is a federally approved signal that provides a safe and effective crossing for pedestrians. It is usually employed in areas that require pedestrians to cross busy roadways. Upon activation, a HAWK signal will go through a six-step process shown below in **Figure 2.**

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Figure 2: HAWK Signal Process

1.		Signal Off	Cars Proceed with Caution through Crossing, Pedestrian Presses Pushbutton
2.		Flashing Yellow	Cars Start to Slow Down
3.		Solid Yellow	Cars Prepare to Stop
4.		Solid Red	Cars Stop, Pedestrians Start Crossing
5.		Flashing Red	Cars Stop, then Proceed with Caution if Clear, Pedestrians Finish Crossing
6.		Signal Off	Cars Proceed With Caution if Clear

A HAWK Signal is very effective at allowing pedestrians to safely cross a busy street at a crosswalk. It is only in operation when it is activated by a pedestrian pressing the crosswalk button, which maximizes the flow of traffic on the roadway while also ensuring the safety of pedestrians when they decide to cross. Like the RRFB, any installation should be accompanied by an educational component to help drivers make informed decisions when they encounter a HAWK signal. The HAWK Signal requires that oncoming traffic come to a stop and forces gaps for pedestrians to safely cross.

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Recommendations

Following the review above, the City of Joplin has a variety of options available to them to improve visibility of the crosswalk, reduce speed, and ensure a safe pedestrian crossing over 20th Street at Missouri Avenue / Sunny Jim Park. It is the recommendation of the engineer that the City introduce high-visibility pavement markings for the crosswalk with zebra striping at 20th Street and Joplin High School. Advanced warning "School Zone" signs and "School" pavement marking should be introduced at the beginning and end of the school zone. Given the overall width of the roadway, a Pedestrian Refuge Island would help pedestrians cross sections of directional traffic as safe gaps between vehicles appear. Finally, it should be up to the City of Joplin to determine which beacon option they would like to consider. Both the Rectangular Rapid Flashing Beacon and the HAWK Signal produce high visibility for pedestrians. However, while the HAWK signal has higher costs associated with it, it is the most effective at creating gaps for pedestrians to safely cross the street. **Table 3** below shows the effectiveness of each option combination.

Table 3: Countermeasure Effectiveness

Countermeasure	Motorist Compliance
High-Visibility Crosswalk Marking[1]	
Crosswalk Marking	25%
"School Zone" Marking	30%
Crosswalk Visibility Enhancement[1]	
Advance Warning "School Zone" signs	35%
Yield Bar	35%
Pedestrian Refuge Island[1]	45%
Rectangular Rapid-Flashing Beacon (RRFB)[2]	81%
HAWK Signal[2]	96%

[1] Percentages determined based on information derived from the *CMF Clearinghouse.*
[2] Percentages determined based on information provided by *Evaluation of Pedestrian Hybrid Beacons and Rapid Flashing Beacons.*

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We trust this traffic memorandum satisfactorily answers questions concerning the traffic impact of the proposed development on the roadway network. If you need additional information, please contact me.

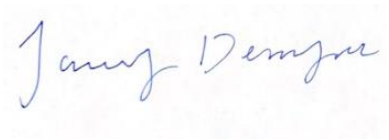
Sincerely,



Dane Seiler, P.E., PTOE
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APPENDIX I – EXISTING PEDESTRIAN TRAFFIC

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Existing Pedestrian Counts:

Date	Missouri & East Alley	Ohio	Indiana	Those counted in Column B who got into waiting cars.
9-9-21 A.M	13	2	3	
9-9-21 P.M.	43			8
9-10-21 A.M.	16	5	0	
9-10-21 P.M.	55			10
9-13-21 A.M.	17	8	1	
9-13-21 P.M.	54			7
9-14-21 A.M.	20	7	2	
9-14-21 P.M.	45			7
9-15-21 A.M.	19	3	2	
9-15-21 P.M.	47			11
9-16-21 A.M.	20	3	0	
9-16-21 P.M.	38			4
9-17-21 A.M.	19	3	0	
9-17-21 P.M.	78			15
Average A.M.	18	4	1	
Average P.M.	51			9

Counted by: Jim Hounschell, Director of Safety and Security for Joplin Schools

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9-9-21 P.M.	43			8
9-10-21 A.M.	16	5	0	
9-10-21 P.M.	55			10
9-13-21 A.M.	17	8	1	
9-13-21 P.M.	54			7
9-14-21 A.M.	20	7	2	
9-14-21 P.M.	45			7
9-15-21 A.M.	19	3	2	
9-15-21 P.M.	47			11
9-16-21 A.M.	20	3	0	
9-16-21 P.M.	38			4
9-17-21 A.M.	19	3	0	
9-17-21 P.M.	78			15
Average A.M.	18	4	1	
Average P.M.	51			9

Counted by: Jim Hounschell, Director of Safety and Security for Joplin Schools

Table 1: Application of Pedestrian Crash Countermeasures by Roadway Feature

Table 1 identifies suggested countermeasures for uncontrolled crossing locations according to roadway and traffic features. Review the corresponding worksheets for countermeasures considered for the site. The worksheets describe additional design and installation considerations for the countermeasures.

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/).