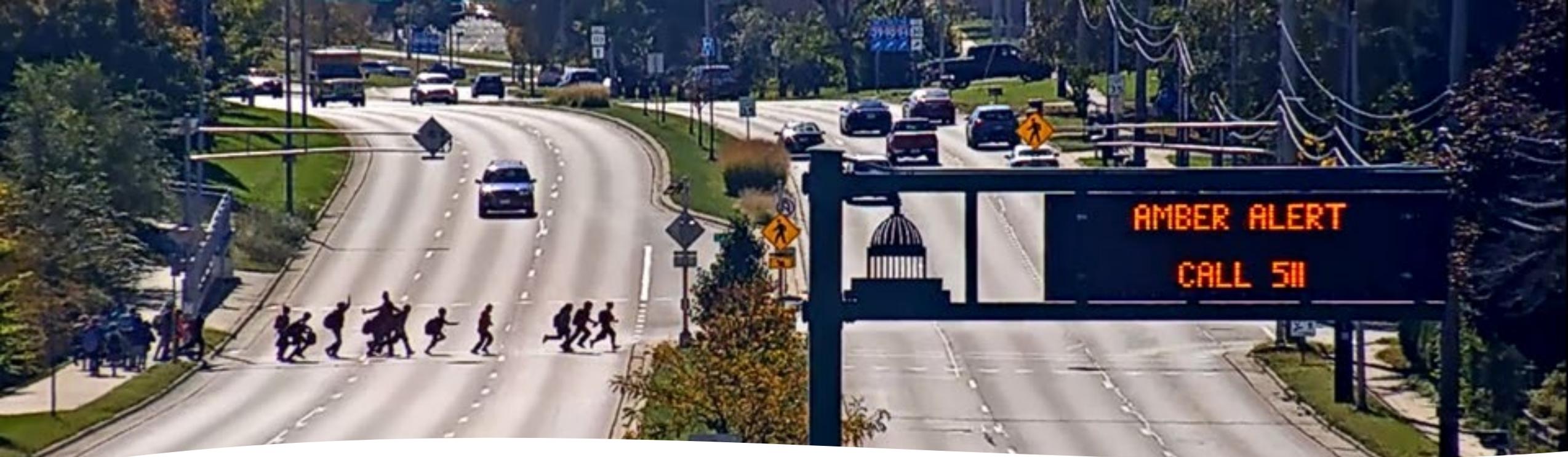


High Speed & High Volume Arterial Streets and the MUTCD Traffic Signal Warrants



Transportation Commission
City of Madison Traffic Engineering Division
[3/18/2026]





Why do we struggle at these intersections?

- High volume
- High speed
- Minor side street
- Demand for crossing

Signal Warrants

11th Edition MUTCD Traffic Signal Warrant Comparison on high volume arterials

| Warrant | | Reference | <35 mph | | 35-40 mph | | 40> mph | |
|---------|---------|-------------|----------|------|-----------|------|----------|------|
| | | | Vehicles | Peds | Vehicles | Peds | Vehicles | Peds |
| 1A | 8 HR | T: 4C-1 | 150 | - | 150 | - | 105 | - |
| 1B | 8 HR | | 75 | - | 75 | - | 53 | - |
| 2 | 4 HR | F: 4C-1 & 2 | 80 | 107 | 80 | 75 | 60 | 75 |
| 3 | Peak HR | F: 4C-3 | 100-150 | 133 | 100-150 | 93 | 75 | 93 |

Ped warrant volumes from Figures 4C-5 thru 4C-8

Applies to streets with over 1,000 vehicles per hour, over 40 mph (85th%), and 2+ mainline lanes per direction and 1 side street lane.

Signal Warrants

Table 4C-1. Warrant 1, Eight-Hour Vehicular Volume
Condition A—Minimum Vehicular Volume

| Number of lanes for moving traffic on each approach | | Vehicles per hour on major street (total of both approaches) | | | | Vehicles per hour on more critical minor-street approach (one direction only) | | | |
|---|--------------|--|------------------|------------------|------------------|---|------------------|------------------|------------------|
| Major Street | Minor Street | 100% ^a | 80% ^b | 70% ^c | 56% ^d | 100% ^a | 80% ^b | 70% ^c | 56% ^d |
| 1 | 1 | 500 | 400 | 350 | 280 | 150 | 120 | 105 | 84 |
| 2 or more | 1 | 600 | 480 | 420 | 336 | 150 | 120 | 105 | 84 |
| 2 or more | 2 or more | 600 | 480 | 420 | 336 | 200 | 160 | 140 | 112 |
| 1 | 2 or more | 500 | 400 | 350 | 280 | 200 | 160 | 140 | 112 |

| Number of lanes for moving traffic on each approach | | Vehicles per hour on major street (total of both approaches) | | | | Vehicles per hour on more critical minor-street approach (one direction only) | | | |
|---|--------------|--|------------------|------------------|------------------|---|------------------|------------------|------------------|
| Major Street | Minor Street | 100% ^a | 80% ^b | 70% ^c | 56% ^d | 100% ^a | 80% ^b | 70% ^c | 56% ^d |
| 1 | 1 | 750 | 600 | 525 | 420 | 75 | 60 | 53 | 42 |
| 2 or more | 1 | 900 | 720 | 630 | 504 | 75 | 60 | 53 | 42 |
| 2 or more | 2 or more | 900 | 720 | 630 | 504 | 100 | 80 | 70 | 56 |
| 1 | 2 or more | 750 | 600 | 525 | 420 | 100 | 80 | 70 | 56 |

^a Basic minimum hourly volume

^b Used for combination of Conditions A and B after adequate trial of other remedial measures

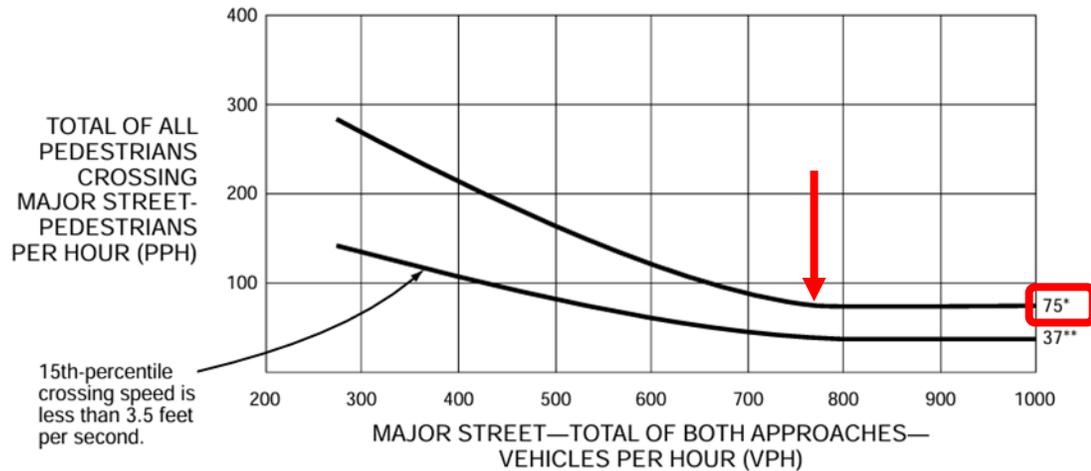
^c May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

^d May be used for combination of Conditions A and B after adequate trial of other remedial measures when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000



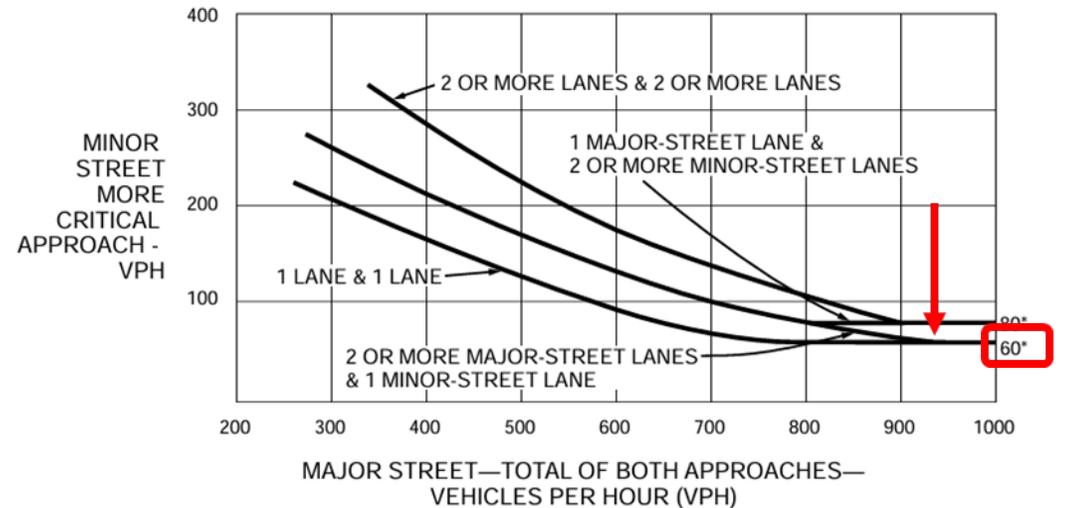
Signal Warrants

Figure 4C-7. Warrant 4, Pedestrian Four-Hour Volume (70% Factor)
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



* 75 pph applies as the lower threshold volume
 ** 37 pph applies as the lower threshold volume if the 15th-percentile crossing speed is less than 3.5 feet per second

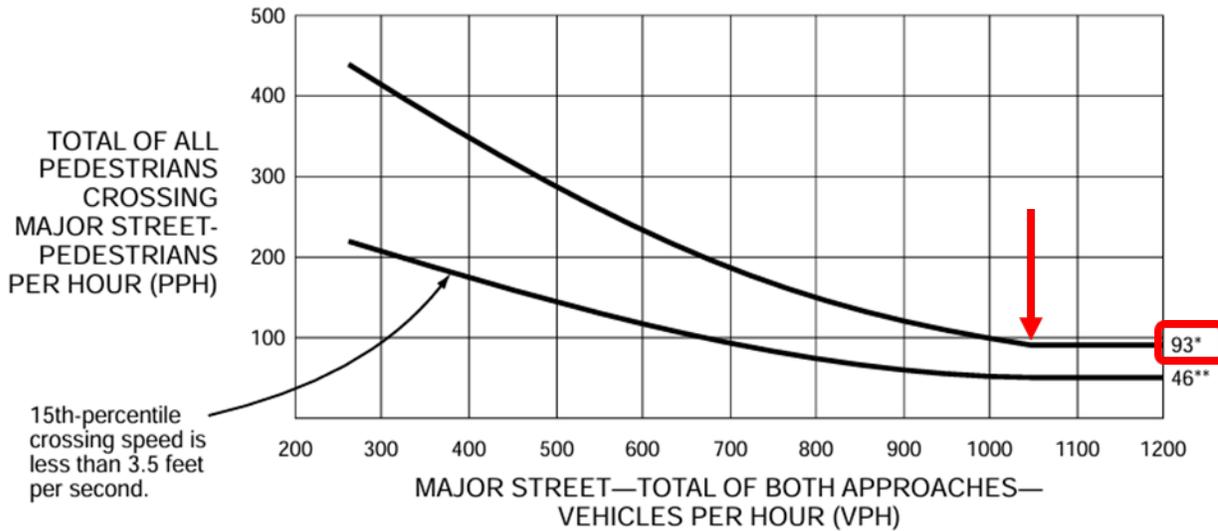
Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane

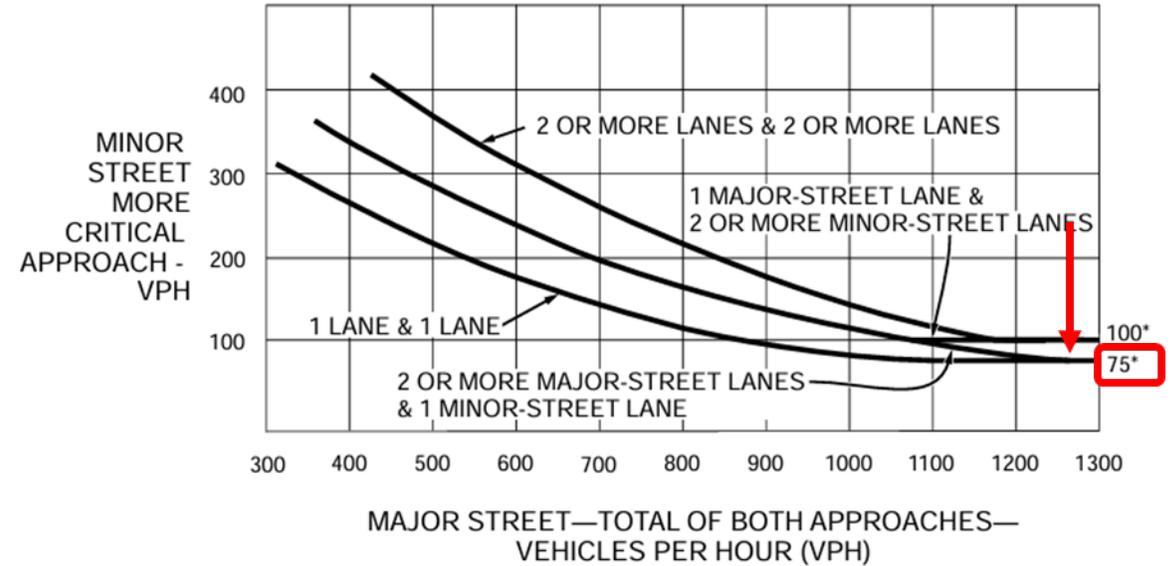
Signal Warrants

Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



* 93 pph applies as the lower threshold volume
 ** 46 pph applies as the lower threshold volume if the 15th-percentile crossing speed is less than 3.5 feet per second

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)

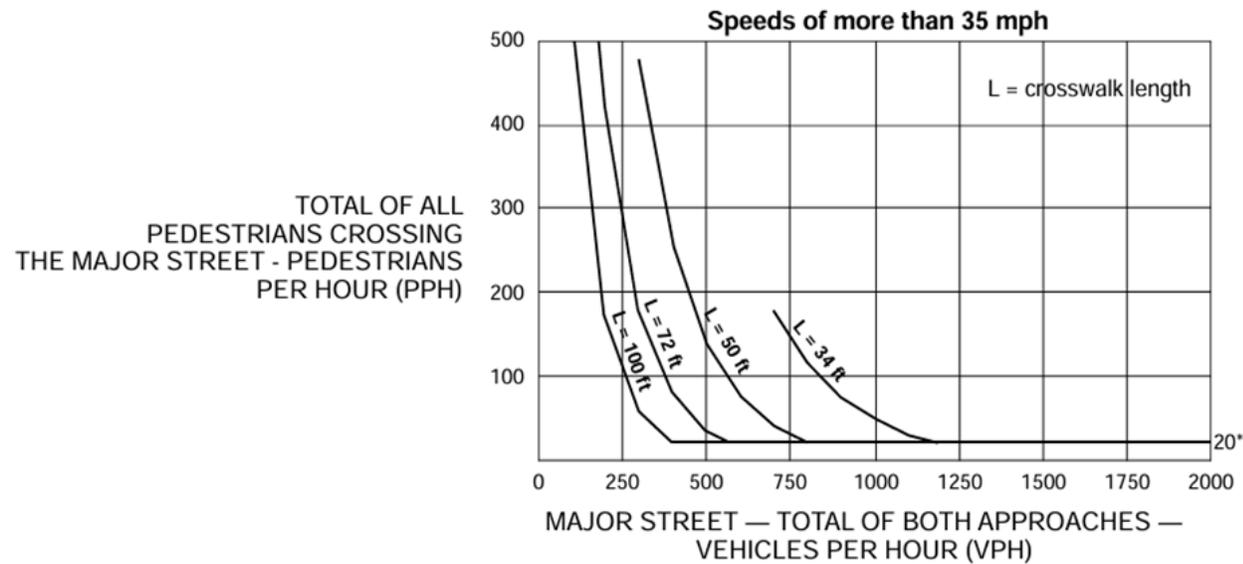


*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane





Figure 4J-2. Guidelines for the Installation of Pedestrian Hybrid Beacons on High-Speed Roadways



* Note: 20 pph applies as the lower threshold volume

Ped Hybrid Beacon (HAWK) Warrant

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

| Roadway Configuration | Posted Speed Limit and AADT | | | | | | | | |
|---|-----------------------------|--------|---------|---------------------------|--------|---------|----------------------|--------|---------|
| | Vehicle AADT <9,000 | | | Vehicle AADT 9,000–15,000 | | | Vehicle AADT >15,000 | | |
| | ≤30 mph | 35 mph | ≥40 mph | ≤30 mph | 35 mph | ≥40 mph | ≤30 mph | 35 mph | ≥40 mph |
| 2 lanes (1 lane in each direction) | 1 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 4 5 6 | 5 6 | 5 6 | 4 5 6 | 5 6 | 5 6 | 4 5 6 | 5 6 | 5 6 |
| | 7 9 | 7 9 | 7 9 | 7 9 | 7 9 | 7 9 | 7 9 | 7 9 | 9 |
| 3 lanes with raised median (1 lane in each direction) | 1 2 3 | 1 3 | 1 3 | 1 3 | 1 3 | 1 3 | 1 3 | 1 3 | 1 3 |
| | 4 5 | 5 | 5 | 4 5 | 5 | 5 | 4 5 | 5 | 5 |
| | 7 9 | 7 9 | 7 9 | 7 9 | 7 9 | 7 9 | 7 9 | 7 9 | 9 |
| 3 lanes w/o raised median (1 lane in each direction with a two-way left-turn lane) | 1 2 3 | 1 3 | 1 3 | 1 3 | 1 3 | 1 3 | 1 3 | 1 3 | 1 3 |
| | 4 5 6 | 5 6 | 5 6 | 4 5 6 | 5 6 | 5 6 | 4 5 6 | 5 6 | 5 6 |
| | 7 9 | 7 9 | 7 9 | 7 9 | 7 9 | 7 9 | 7 9 | 7 9 | 9 |
| 4+ lanes with raised median (2 or more lanes in each direction) | 1 3 | 1 3 | 1 3 | 1 3 | 1 3 | 1 3 | 1 3 | 1 3 | 1 3 |
| | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | 7 8 9 | 7 8 9 | 8 9 | 7 8 9 | 7 8 9 | 8 9 | 7 8 9 | 8 9 | 8 9 |
| 4+ lanes w/o raised median (2 or more lanes in each direction) | 1 3 | 1 3 | 1 3 | 1 3 | 1 3 | 1 3 | 1 3 | 1 3 | 1 3 |
| | 5 6 | 5 6 | 5 6 | 5 6 | 5 6 | 5 6 | 5 6 | 5 6 | 5 6 |
| | 7 8 9 | 7 8 9 | 8 9 | 7 8 9 | 7 8 9 | 8 9 | 7 8 9 | 8 9 | 8 9 |

Given the set of conditions in a cell,

- # Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.
- 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 crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*

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 restrictions on crosswalk approach, adequate nighttime lighting levels, and crossing warning signs
- 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 Rectangular Rapid-Flashing Beacon (RRFB)**
- 8 Road Diet
- 9 Pedestrian Hybrid Beacon (PHB)**

*Refer to Chapter 4, 'Using Table 1 and Table 2 to Select Countermeasures,' for more information about using multiple countermeasures.
 **It should be noted that the PHB and RRFB are not both installed at the same crossing location.
 This table was developed using information from: Zegeer, C.V., J.R. Stewart, H.H. Huang, P.A. Lagerwey, J. Feaganes, and B.J. Campbell. (2005). Safety effects of marked versus unmarked crosswalks of uncontrolled locations: Final report and recommended guidelines. FHWA, No. FHWA-HRT-04-100. Washington, D.C.; FHWA. Manual on Uniform Traffic Control Devices, 2009 Edition. (revised 2012). Chapter 4F, Pedestrian Hybrid Beacons. FHWA, Washington, D.C.; FHWA. Crash Modification Factors (CMF) Clearinghouse. <http://www.cmfclearinghouse.org/>; FHWA. Pedestrian Safety Guide and Countermeasure Selection System (PESSSAFE). <http://www.pedbikesafe.org/PESSSAFE/>; Zegeer, C., R. Srinivasan, B. Lam, D. Carter, S. Smith, C. Sundstrom, N.J. Thirk, J. Zegeer, C. Lynn, E. Ferguson, and R. Van Houten. (2017). NCHRP Report 841: Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments. Transportation Research Board, Washington, D.C.; Thomas, Thirk, and Zegeer. (2016). NCHRP Synthesis 498: Application of Pedestrian Crossing Treatments for Streets and Highways. Transportation Research Board, Washington, D.C.; and personal interviews with selected pedestrian safety practitioners.



FHWA STEP Guidelines



FDOT Experimental Midblock Ped Crossing

https://www.youtube.com/watch?v=Ob_ctkym-s-o

Thank you



Jerry Schippa, P.E. (He/Him)

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