

PROCEDURE



SIGNS



SIGNALS



MARKINGS



SPECIAL
OPERATIONAL
TOPICS



Section 5.1

GOLF CART CROSSING AND OPERATION ON THE STATE HIGHWAY SYSTEM

5.1.1 PURPOSE

The purpose of this section is to establish criteria and guidelines for safe operation of golf carts on authorized portions of the State Highway System.

5.1.2 GENERAL

- (1) The Department has developed this section in response to a growing public interest in using golf carts. Golf carts are increasingly used to make short trips for shopping, social and recreational purposes from nearby residential neighborhoods such as planned unit communities with golf courses. These passenger-carrying vehicles, although low-speed, offer a variety of advantages, including comparatively low-cost and energy-efficient mobility.
- (2) Golf cart use and operation on public roads is authorized only under certain circumstances as provided in [Section 316.212, F.S.](#) The intent of this section is to provide criteria and guidelines for authorizing golf cart crossings at designated locations along State Highway System and promote uniformity within the State. This section also provides safety recommendations to counties and municipalities wishing to enact ordinances authorizing the use of golf carts on sidewalks adjacent to or on the State Highway System within their corresponding jurisdictions.

5.1.3 DEFINITIONS

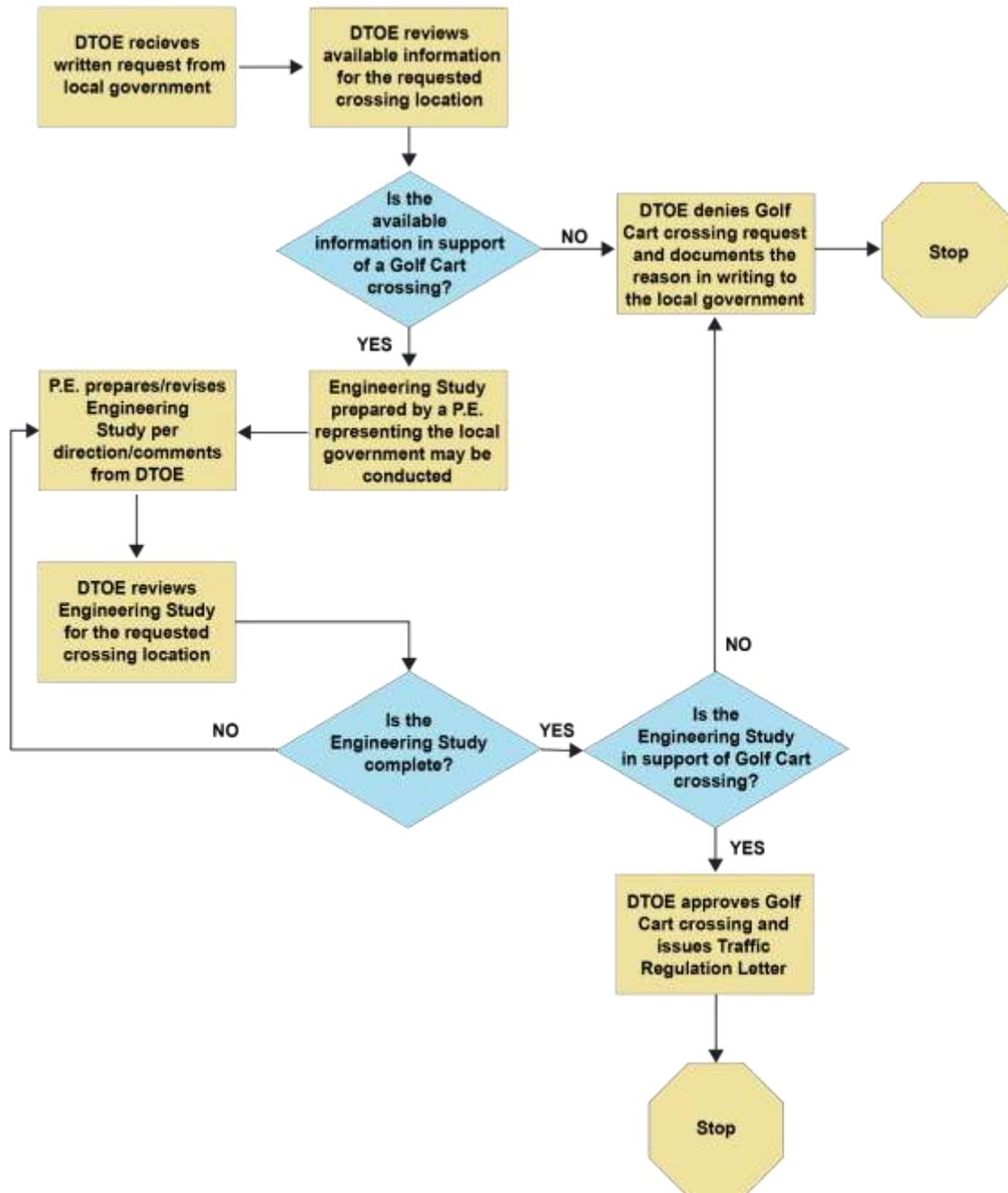
- (1) **Golf Cart.** A motor vehicle designed and manufactured for operation on a golf course for sporting or recreational purposes and that attain speeds of less than 20 miles per hour.
- (2) **Grade Separated Crossing.** A tunnel or overpass designed and constructed for the purpose of crossing a street or highway.
- (3) **Local Government.** A City or County as defined in [Section 11.45 \(e\), F.S.](#)
- (4) **State Roadway.** Any roadway of the State Highway System under jurisdiction of the State except limited access facilities.

5.1.4 PROCEDURE

- (1) Any golf cart crossing proposed for a location on the State Highway System shall be reviewed and approved by the appropriate [District Traffic Operations Engineer \(DTOE\)](#) prior to installation. The Department's preferred design for golf cart

- crossing of any state road shall be via grade separated facility.
- (2) A request from a local government shall be submitted to the appropriate [DTOE](#). Non-governmental entities wishing to obtain authorization for a golf cart crossings shall do so through the local government with jurisdictional authority.
 - (3) If the [DTOE's](#) review of available information supports the installation of a golf cart crossing based upon the criteria outlined in **TEM 5.1.5**, then a full engineering study prepared by a professional engineer licensed in the State of Florida representing the requester may be conducted.
 - (4) The criteria referenced in **TEM 5.1.5**, as documented in an engineering study, shall be met as a condition for approval of a golf cart crossing. The engineering study shall also contain the following information:
 - (a) Document the need for a golf cart crossing based on conditions set forth in [Section 316.212, F.S.](#), and verify the following:
 - The intersecting county or municipal road has been designated for use by golf carts.
 - A golf course or single mobile home park is constructed on either sides of a state road.
 - (b) Document all safety considerations with respect to intersecting sight distances, proximity to intersection and driveway conflict areas, number and configuration of approach lanes to signalized intersections and roadway speed and volume thresholds as described in **TEM 5.1.5** that can be satisfied at the proposed location.
 - (c) Document the proposed golf cart crossing and/or roadway segment location (Roadway ID and Mile Post) and corresponding signing, marking, and signal treatments (if applicable). A schematic layout should be provided over aerial photography or survey to show locations of signs, markings, and other treatments in proximity to existing traffic control devices.
 - (d) Document all crash history within the vicinity of the proposed golf cart crossing based upon a minimum three years of data.
 - (5) If the evaluation results in a decision not to authorize the installation of a golf cart crossing, the [DTOE](#) shall document the reasons and advise the local government of the findings. Meeting the minimum criteria outlined in this section does not guarantee approval of a request for a golf cart crossing.
 - (6) Prior to the approval of a golf cart crossing, coordination is necessary between the appropriate [District Traffic Operations Office](#), District Maintenance Office and local governments to determine any permitting requirements or responsibilities for maintenance.

Figure 5.1-1. Procedure Flowchart

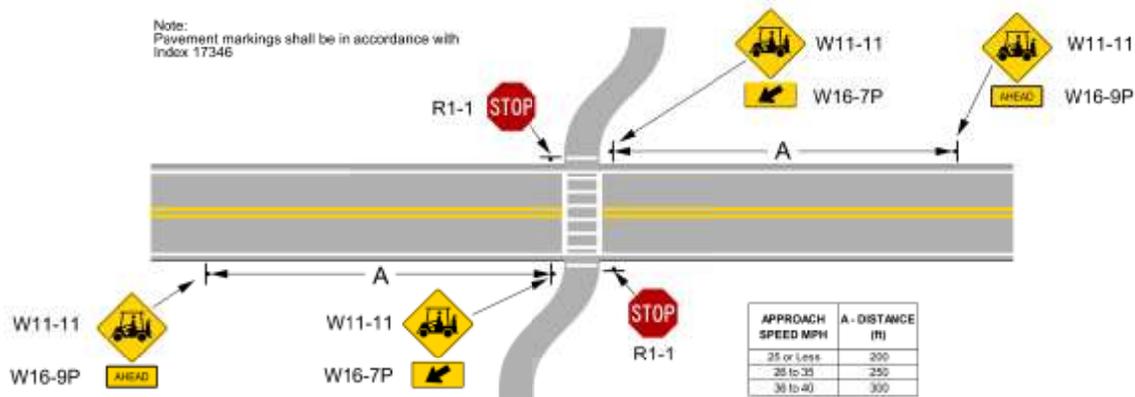


5.1.5 CRITERIA FOR APPROVAL OF CROSSING

- (1) **Mid-Block Crossing:** To be considered for a golf cart crossing at a mid-block location along any state road where a golf course or a single mobile home park is constructed or located on both sides of the roadway, the proposed location and roadway characteristics shall meet the following criteria:

- (a) Maximum vehicular volume of 15,000 Average Daily Traffic (ADT) or less along the roadway segment.
- (b) Maximum Posted Speed Limit of 40 miles per hour or less.
- (c) Maximum number of lanes is three (3) with or without bike lanes.
- (d) Maximum allowable median width is 15 feet or less.
- (e) Minimum distance to the nearest driveway, access point or pedestrian crosswalk is 350 feet in each direction.
- (f) Crossing along roadway tangents only with the nearest point of curvature at least 350 feet in each direction.
- (g) A clear and unobstructed view of the roadside on the approach to the crossing.
- (h) Signing and pavement markings are installed as shown in **Figure 5.1-2**.
- (i) Golf carts are the only vehicle permitted to use the designated crossing or to traverse State right-of-way. Other vehicles such as Low Speed Vehicles are strictly prohibited. See [320.01\(42\) F.S.](#)

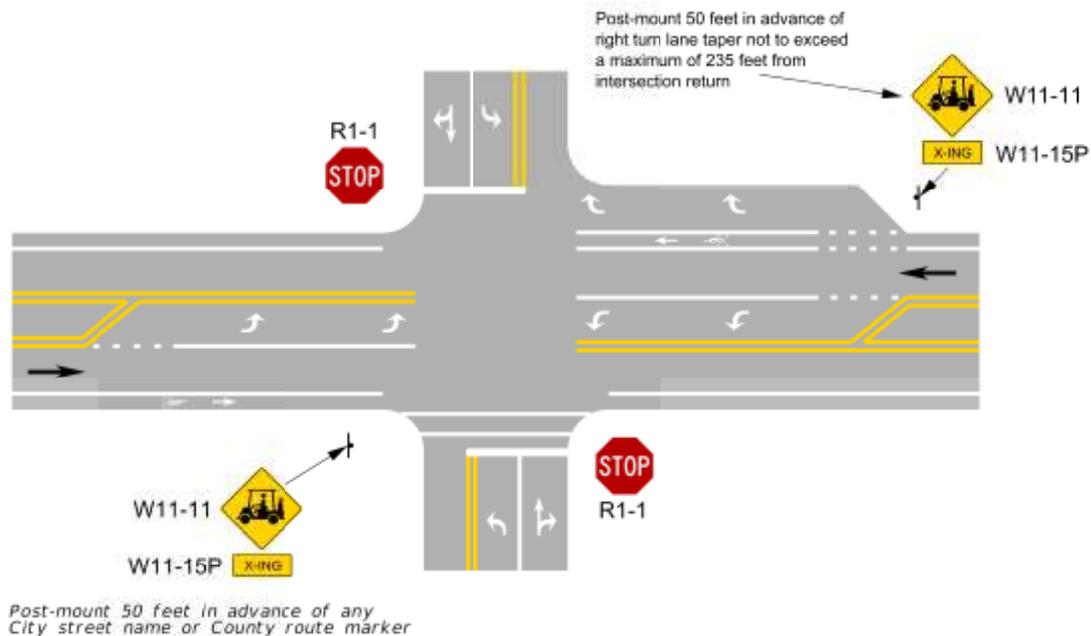
Figure 5.1-2. Mid-Block Crossing



- (2) **Side Street Stop Controlled Intersections:** To be considered for a golf cart crossing at a roadway intersection with side street stop control, the location along any state road shall meet the following criteria:
 - (a) Side street maximum vehicular volume 1,200 ADT and AM/PM Peak Hour not to exceed 110 vehicles per hour single direction.
 - (b) Main street posted speed limit or 85th percentile intersection approach speed is 35 miles per hour or less.
 - (c) Maximum crossing distance for undivided roadways shall be equal to three

- (3) lanes or less not including any right turn lanes, bike lanes and crosswalks. For divided roadways of four (4) lanes or less, a minimum of twenty-two (22) feet median width is required (**Figure 5.1-4**).
- (d) Side street approaches should have an exclusive left turn lane and a shared through-right turn lane. Other lane approach configurations will be considered on case-by-case basis.
 - (e) Side street intersection alignment shall be a 90 degrees (not more than 105 degrees) angle to the mainline tangent. Skewed or offset intersections are not recommended for golf cart crossings.
 - (f) Approach stop signs and pavement markings shall be in accordance with [MUTCD](#) and [Standard Plans, Index 711-001](#).
 - (g) Golf Cart signs (W11-11) should be placed on the mainline approach as shown in **Figure 5.1-3** and **Figure 5.1-4**.

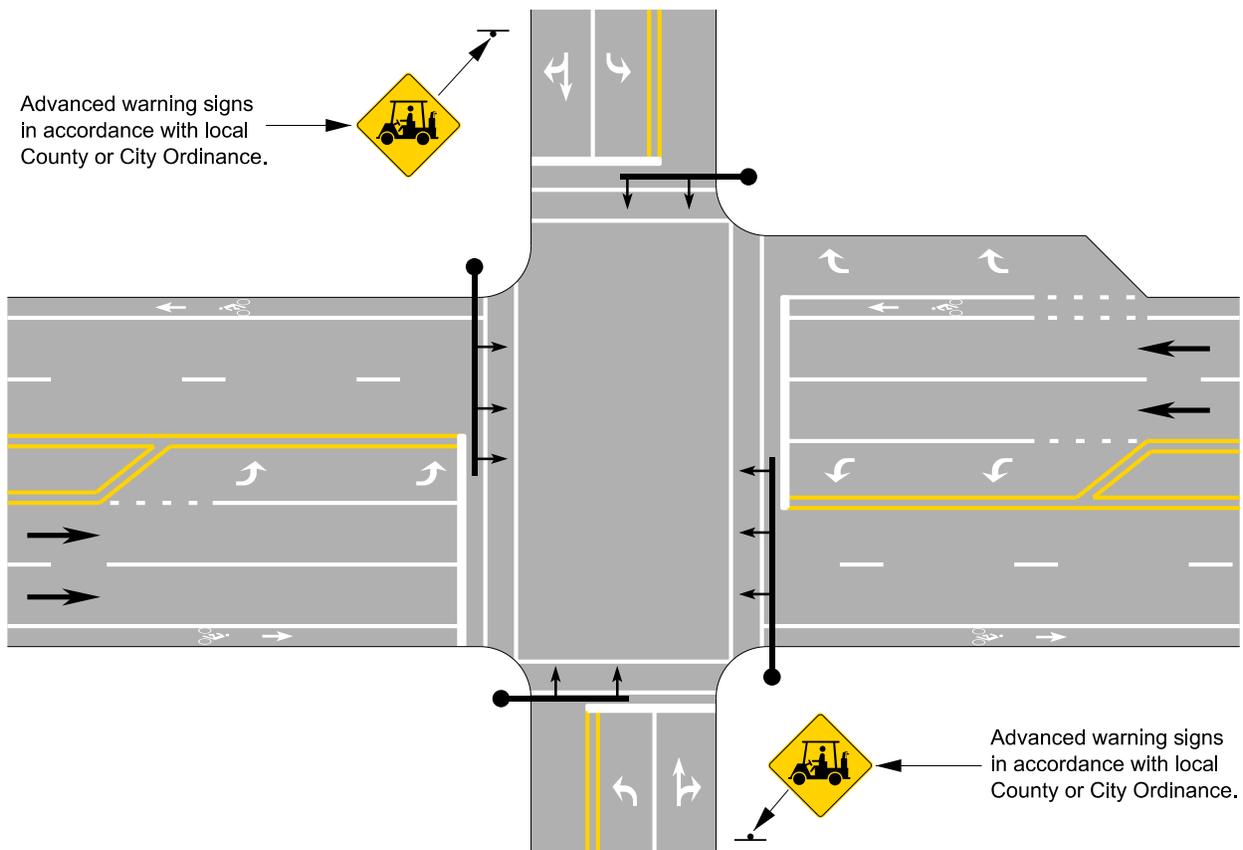
Figure 5.1-3. Stop-Controlled Crossing



purpose of crossing the mainline state road.

- (g) Golf cart crossings are not permitted at “T” intersections.
- (h) For existing signalized “T” intersections, a proposed forth leg approach and receiving lane for the exclusive use of golf cart crossing shall not be permitted.
- (i) Approach traffic control signs and pavement markings shall be in accordance to [MUTCD](#) and [Standard Plans, Index 711-001](#).
- (j) Golf Cart signs (W11-11) should be placed on the side street approach as shown in **Figure 5.1-5**.

Figure 5.1-5. Traffic Signal Controlled Crossing

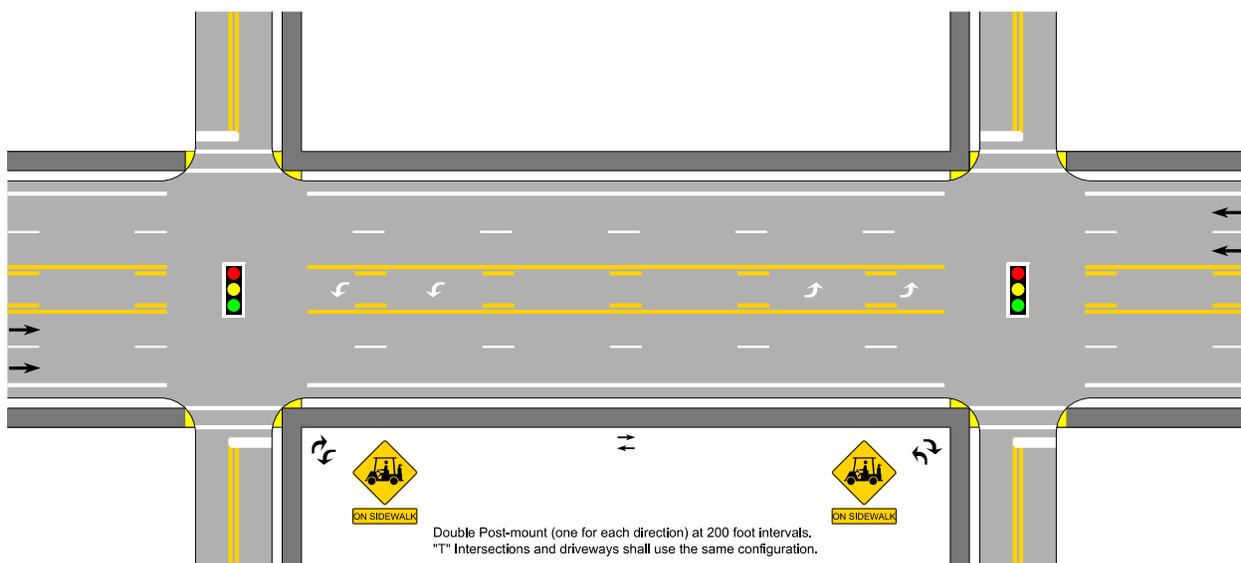


5.1.6 OPERATION OF GOLF CARTS ON SIDEWALKS

- (1) Under [Title 23 of United States Code, Section 217](#), existing and proposed non-motorized trails and pedestrian walkways using Federal transportation funds do not permit motorized use, including golf cars or golf carts. However, the legislation authorizes exceptions and the Federal Highway Administration (FHWA) has developed framework for an exception process.

- (2) **Safety and Operational Recommendations:** The following recommendations for the operation of golf carts on pedestrian sidewalks adjacent to a state road should be considered when authorizing such use by local government ordinance:
- (a) Access to State maintained sidewalks should be from county or city-maintained sidewalks adjacent to side streets intersecting with a state road. In-street golf cart operation onto State operated sidewalks via ADA curb ramps is not permitted.
 - (b) Crossing a state road from county or city-maintained streets or sidewalks to access State operated adjacent sidewalks is not recommended. If a local government submits a request for a golf cart crossing and seeks consultation for golf cart operation on a State operated sidewalk at the same location, the golf cart crossing will not be allowed.
 - (c) A minimum un-obstructed sidewalk width of 8 feet is required and separated from back of curb or edge of shoulder by at least 5 feet is recommended.
 - (d) A minimum width of 4 foot grassed or stabilized, relatively flat area should be provided beyond the outside edge of sidewalks for recovery or stalled golf carts. Sidewalks with existing adjacent drainage features or fencing should not be considered.
 - (e) Golf cart operation on State operated sidewalks should terminate at a connecting county or city-maintained sidewalk.
 - (f) State approved, Golf Cart On Sidewalk signs should be installed along State operated sidewalks as shown in **Figure 5.1-6**.

Figure 5.1-6. Golf Cart Operation on Sidewalks



Section 5.2

TREATMENTS FOR PEDESTRIAN CROSSWALKS AT MIDBLOCK AND UNSIGNALIZED INTERSECTIONS

5.2.1 PURPOSE

This section establishes criteria and guidelines for the consistent installation and operation of pedestrian treatments at midblock and unsignalized intersections on the State Highway System. These treatments include marked pedestrian crosswalks, signs, traffic control devices, and other measures. Information on pedestrian crosswalks at roundabouts can be found in [FDOT Design Manual \(FDM\) 213](#).

5.2.2 GENERAL

- (1) A crosswalk facilitates pedestrian access and concentrates pedestrian crossing activity to a safe and predictable location. The intention of pedestrian treatments at midblock and unsignalized intersections is to improve pedestrian connectivity and reduce instances of pedestrians crossing at unpredictable locations. This can be achieved by reducing confusion and removing measurable risks to pedestrians and other road users.
- (2) Pedestrian crosswalks applied at midblock and unsignalized intersections may be a suitable treatment where documented pedestrian demand exists. For these locations, the distance to the nearest controlled intersection crossing would result in significant out-of-direction travel for pedestrians, increasing the risk for unexpected crossings and crashes.
- (3) Adding supplemental signage can improve safety and compliance in locations where a marked pedestrian crosswalk has been installed, including locations with or without traffic control devices. Other crosswalk design treatments, including refuge islands, curb extensions, lighting, and raised crosswalks, could also be considered to support pedestrian visibility and safety. **Figure 5.2-13** illustrates the combined use of many of these treatments.
- (4) Marked crosswalks and pedestrian treatments that are well located and thoughtfully designed can serve as a mechanism for improving pedestrian connections, community walkability, and pedestrian safety. However, they are not suitable for all locations. Suitability can be determined by careful evaluation regarding expected levels of pedestrian crossing demand, safety characteristics of the crossing location, and design considerations for the crossing control type.

5.2.3 DEFINITIONS

Alternative Pedestrian Crossing Location. Any controlled location with a STOP sign, traffic signal, or a grade-separated pedestrian bridge or tunnel that accommodates pedestrian movement across the subject roadway.

Average Day. A day representing traffic volumes normally and repeatedly found at a specific location. Weekdays having volumes influenced by employment or weekend days having volumes influenced by entertainment or recreation represent two types of an Average Day.

Context Classification. Description of the land use and transportation context where a roadway is found. Roadways are designed to match the characteristics and demands defined by the appropriate Context Classification. See [FDM 200](#) for additional information.

Controlled Approach. All lanes of traffic moving toward an intersection or a midblock location from one direction (including any adjacent parking lane) that are controlled by a sign, signal, marking, or other devices.

In-Roadway Lights. Special types of highway traffic control devices installed in the roadway surface to warn road users that they are approaching a condition on or adjacent to the roadway that might not be readily apparent and might require the road users to slow down and/or come to a stop.

Marked Crosswalk. Any portion of a roadway segment, including an intersection or midblock distinctly indicated as a pedestrian crossing by pavement marking lines on the surface which might be supplemented by contrasting pavement structure, style, or color. Marked crosswalks serve to provide guidance, define and delineate crossing paths, define intersections, and designate a stopping location when motorists are required to stop in the absence of a stop line.

Midblock Crossing. Any location where a marked crosswalk (signalized or unsignalized) is proposed or already exists between intersections.

Midblock Pedestrian Signal (MPS). An MPS is a hybrid between a Midblock Traffic Control Signal and a Pedestrian Hybrid Beacon and it is currently an **MUTCD Request to Experiment (RTE)**. It is a highway traffic signal in which traffic is alternately directed to stop, then a flashing RED indication during the pedestrian clearing interval is activated to assist pedestrians crossing a street or highway at a marked crosswalk.

Midblock Traffic Control Signal. Any highway traffic signal by which traffic is alternately directed to stop and permitted to proceed at a midblock crosswalk.

Passive Pedestrian Detection. Automated pedestrian detection systems that can detect the presence and direction of pedestrians and activate the traffic control device without any required action by the pedestrian.

Pedestrian Attractor. A residential, commercial, office, recreational, or other land use that is expected to be an end destination for pedestrian trips.

Pedestrian Generator. A residential, commercial, office, transit, recreational or other land use that serves as the starting point for a pedestrian trip.

Pedestrian Hybrid Beacon (PHB). A special type of hybrid beacon used to warn and control traffic at an unsignalized location to assist pedestrians in crossing a street or highway at a marked crosswalk. It is also known as high-intensity activated crosswalk (HAWK).

Rectangular Rapid Flashing Beacon (RRFB). A traffic control device consisting of two rapidly and alternately flashing rectangular yellow indications having LED array-based pulsing light sources that function as a warning beacon.

Shared Use Path. A multi-user path outside the traveled way and physically separated from motorized vehicular traffic by an open space or barrier and either within the highway right-of-way or within an independent alignment. Shared use paths are used by pedestrians (including skaters, users of manual and motorized wheelchairs, and joggers), bicyclists and other authorized motorized and non-motorized users.

Two-Stage Pedestrian Crossing. A marked crosswalk controlled by RRFB, PHB or midblock traffic signal that is designed to allow pedestrians to cross each half of the roadway independently, using a median refuge island for pedestrians to wait before completing the crossing. A two-stage pedestrian crossing may have a lesser impact on vehicle delay (compared to a single crossing) since the signal serves each direction independently while the median serves as a refuge area for pedestrians to wait prior to completing their crossing.

Uncontrolled Approach. All lanes of traffic moving toward an unsignalized intersection or a midblock location from one direction (including any adjacent parking lane) that are not controlled by any sign, signal, marking, or other control devices.

Unsignalized intersection. Any at-grade junction of two or more public roads at which a highway traffic signal does not control the right-of-way for motorists, bicyclists, and pedestrians.

Unmarked Crosswalk. The legal crossing area at an intersection connecting opposite sides of the roadway that does not have painted lines, words, or images.

5.2.4 PROCEDURE

The procedures below are applicable for all crosswalks at midblock and unsignalized intersections.

- (1) The appropriate [District Traffic Operations Office](#) handles all submitted requests for evaluation of marked crosswalks or other treatments at a midblock or unsignalized intersection (including driveways).

- (2) Special emphasis crosswalk markings and advance warning signs shall be installed for all midblock. This will also apply to all uncontrolled approaches with crosswalks.
- (3) Additional treatments, such as pavement markings, signs, signals or other countermeasures, may be installed when meeting the criteria listed in **TEM 5.2.5**.
- (4) A study or warrant analysis shall be required for the use of midblock traffic control signals or PHBs for existing marked crosswalks at midblock or unsignalized intersections. Refer to **TEM 5.2.5** for more detailed guidance.
- (5) For new marked crosswalks, an engineering study is required in accordance with **TEM 5.2.6**. The engineering study shall include the pedestrian-vehicle crash history. All proposed crosswalk treatments shall meet the criteria listed in **TEM 5.2.5**.
- (6) For new marked crosswalks, the following minimum safety considerations should be evaluated:
 - (a) Adequate stopping sight distance at marked crosswalks
 - (b) Presence of crosswalk illumination
 - (c) For a roadway with five (5) or more lanes, a refuge island or raised median to facilitate a two-stage crossing
 - (d) Appropriate bus stop location to minimize conflicts with transit vehiclesFor further safety improvements, see **TEM 5.2.7**.
- (7) Prior to the approval of a new marked crosswalk, or treatments to an existing marked crosswalk, the [District Traffic Operations Office](#) should coordinate with the local maintaining agency to determine the eligibility of adding the newly installed treatments to the maintenance and compensation agreement.
- (8) Any marked crosswalk or other treatment proposed for a midblock or unsignalized intersection on the State Highway System shall be reviewed and approved by the [DTOE](#) prior to installation.

5.2.5 SELECTION CRITERIA

5.2.5.1 Criteria for Marked Crosswalk

Placement of marked crosswalks at midblock and uncontrolled approaches should be based upon a strategic plan and requires an engineering study to validate the need. Marked crosswalks should not be used indiscriminately at midblock and unsignalized intersections. An engineering study (see **TEM 5.2.6**) shall include, but not be limited to, pedestrian-vehicle crash history, proximity to significant generators and attractors,

minimum levels of pedestrian demand, and minimum location characteristics. Listed below are the criteria for placement of marked crosswalks:

- (1) Proximity to significant generators and attractors
 - (a) Any midblock or unsignalized intersection under consideration for a marked crosswalk should have either of the following characteristics:
 - A well-defined spatial pattern of pedestrian generators, attractors, and flow (across a roadway) between them; or
 - A well-defined pattern of existing pedestrian crossings.
 - (b) Identification of pedestrian generators and attractors shall be documented in an engineering study to illustrate potential pedestrian routes in relation to any proposed marked crosswalk locations, as described in **TEM 5.2.6**.
- (2) Recommended Levels of Pedestrian Demand
 - (a) Pedestrian volume data for an average day shall be collected with the methods described in **TEM 5.2.6**.
 - (b) The following threshold should be considered for a new marked crosswalk:
 - 20 or more pedestrians during a single hour (any four consecutive 15-minute periods) of an average day.
 - (c) Pedestrian volume demand data is not needed for the following conditions:
 - Pedestrian crosswalks within a school zone
 - Pedestrian crosswalks under the following Context Classifications:
 - C2T Rural Town Context Classification zone
 - C3C Suburban Commercial Context Classification zone
 - C4 Urban General Context Classification zone
 - C5 Urban Center Context Classification zone
 - C6 Urban Core Context Classification zone
 - (d) Crosswalks threshold at midblock or unsignalized intersection connecting a **SHARED USE PATH**
 - To promote the use of shared use paths and reduce the occurrence of multiple roadway crossings, crossing locations connecting to a

shared use path may use a 50 percent reduction to the recommended pedestrian threshold in **TEM 5.2.5.1-(2)b**.

- Check with local strategic plan when determining the location for installing these types of marked crosswalks.

(e) Nature-based trail crossings

- See **TEM 2.33** for additional information on nature-based trail crossings.
- Before a new nature-based trail crossing is approved, the **DTOE** should evaluate whether it's appropriate to install the trail crossing on the State Highway System (SHS).

(3) Minimum Location Characteristics

(a) A minimum vehicular volume of 2,000 Average Daily Traffic (ADT) along the roadway segment.

(b) Minimum distance to nearest alternative intersection or crossing location

- The minimum distance to nearest alternative intersection or crossing location is 300 feet per the **FDM 222**.
- A proposed crossing location that falls between 100 and 300 feet from an alternative existing crossing may be considered if it is more practical for pedestrian use; this justification must be documented in the engineering study.

(c) Adjacent signalized intersection

- The proposed location must be outside the influence area of adjacent signalized intersections, including the limits of the auxiliary turn lanes.

An interactive tool that helps designers select the applicable treatment options can be found in the following link: [Treatment Options Selection Matrix Tool](#)

5.2.5.2 Criteria for Beacons and Signals

(1) Yellow Flashing Beacon

Use Yellow Flashing Beacons to enhance conspicuity for standard signs in accordance with [Section 2A.15 of the MUTCD](#).

(2) Rectangular Rapid Flashing Beacon (RRFB)

Limit the use to the roadways with the following conditions:

- Posted speed limit of 35 mph or less
- A marked special emphasis crosswalk
- Four (4) or fewer through lanes (both directions) irrespective of median presence, or five (5) lanes with a median refuge island (Note: For locations with five (5) lanes with a Two-Way Left Turn Lane, a refuge island or raised median need to be installed for RRFB application).

For locations that do not meet the criteria above, a variation must be submitted to the [State Traffic Engineering and Operations Office](#) for review and approval. The variation shall include the following:

- AADT
- Sight distance
- Speed data
- Supplemental information including location description and observations
- Crash data

(3) Pedestrian Hybrid Beacon (PHB)

Install PHBs at a minimum distance of 100 feet from side streets or driveways controlled by stop or yield signs when installing a PHB. Do NOT install PHBs at an intersection or a driveway.

For locations less than 100 feet from the side streets or driveways controlled by a stop sign, the engineer of record shall address additional treatments to reduce conflict risk between pedestrians and vehicles. These additional treatments may include blank-out signs, static signs, in- roadway lights, **R1-6a sign**, **R10-6 (STOP HERE ON RED) sign**, or other treatments to inform drivers of the PHB.

Consider the following conditions for the installation of a PHB:

- Where a midblock traffic control signal is not justified under [Chapter 4C of the MUTCD](#) signal warrants and when gaps in traffic are not adequate to permit pedestrians to cross.
- Where the speed of vehicles approaching the location on the major street is too high to permit pedestrians to cross.
- Where pedestrian delay is excessive.

See [Chapter 4F of the MUTCD](#) for PHB volume guidance. This guidance is summarized in [Figure 5.2-1](#) and [Figure 5.2-2](#).

In an urban corridor under context classification C4, C5, and C6 with a site location that warrants a PHB in accordance to the above criteria, the PHB may be substituted with a midblock traffic control signal using [Warrant 8 of the MUTCD, Roadway Network](#).

Follow [Section 4F.02 of the MUTCD](#) for a sequence for a PHB and adjust according to this manual. The guidance is shown in [Figure 4F-3](#).

- Keep the signal dark outside of the activation window.
- Follow [TEM 3.6.2.1](#) for the duration of the flashing yellow.
- The steady yellow change interval is determined using engineering practices with a minimum duration of 3 seconds and a maximum duration of 6 seconds (see [Section 4D.26 of the MUTCD](#)). The longer intervals are reserved for use on approaches with higher speeds or multiple travel lanes.
- Make the duration of steady red equal to the pedestrian walk interval. The guidance is shown in [Section 4F.03 of the MUTCD](#).
- Make the duration of the alternating flashing red equal to the pedestrian clearance interval. The guidance is shown in [Section 4F.03 of the MUTCD](#).

(4) Midblock Traffic Control Signal

Traffic control signals at midblock crosswalks should meet a minimum distance of 300 feet from side streets or driveways controlled by a stop or yield sign.

For midblock crosswalks that are greater than 300 feet from the nearest signalized intersection, its distance to adjacent signals and availability of adequate gaps for pedestrian crossing shall also be considered to determine whether the signal is needed for safe pedestrian crossing.

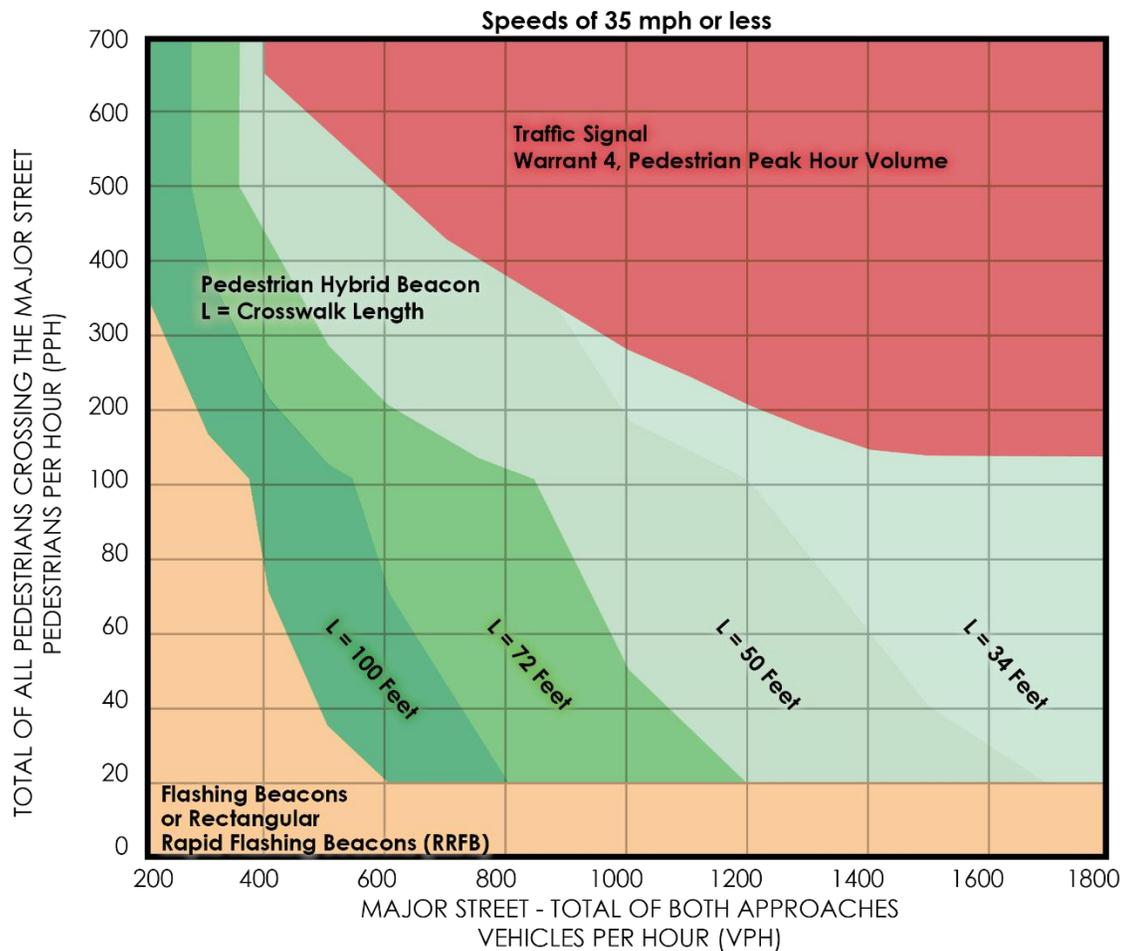
Traffic Control Signals at midblock crosswalks shall meet [Warrant 4 of the MUTCD, Pedestrian Volume](#). [Figure 5.2-1](#) and [Figure 5.2-2](#) summarize this warrant. The minimum pedestrian volume threshold under Warrant 4 may be reduced for the following conditions:

- When the 15th percentile crossing speed is less than 3.5 feet per second, the pedestrian volume that crosses the major street can be reduced as much as 50 percent.
- When the 85th percentile speed on the major street exceeds 35 mph or when the area of the midblock crossing is within the built-up area of an isolated community having a population of less than 10,000, the pedestrian volume that crosses the major street can be reduced by 30 percent.

Combining both pedestrian volume reductions of 30 and 50 percent is allowed when it meets the criteria listed above.

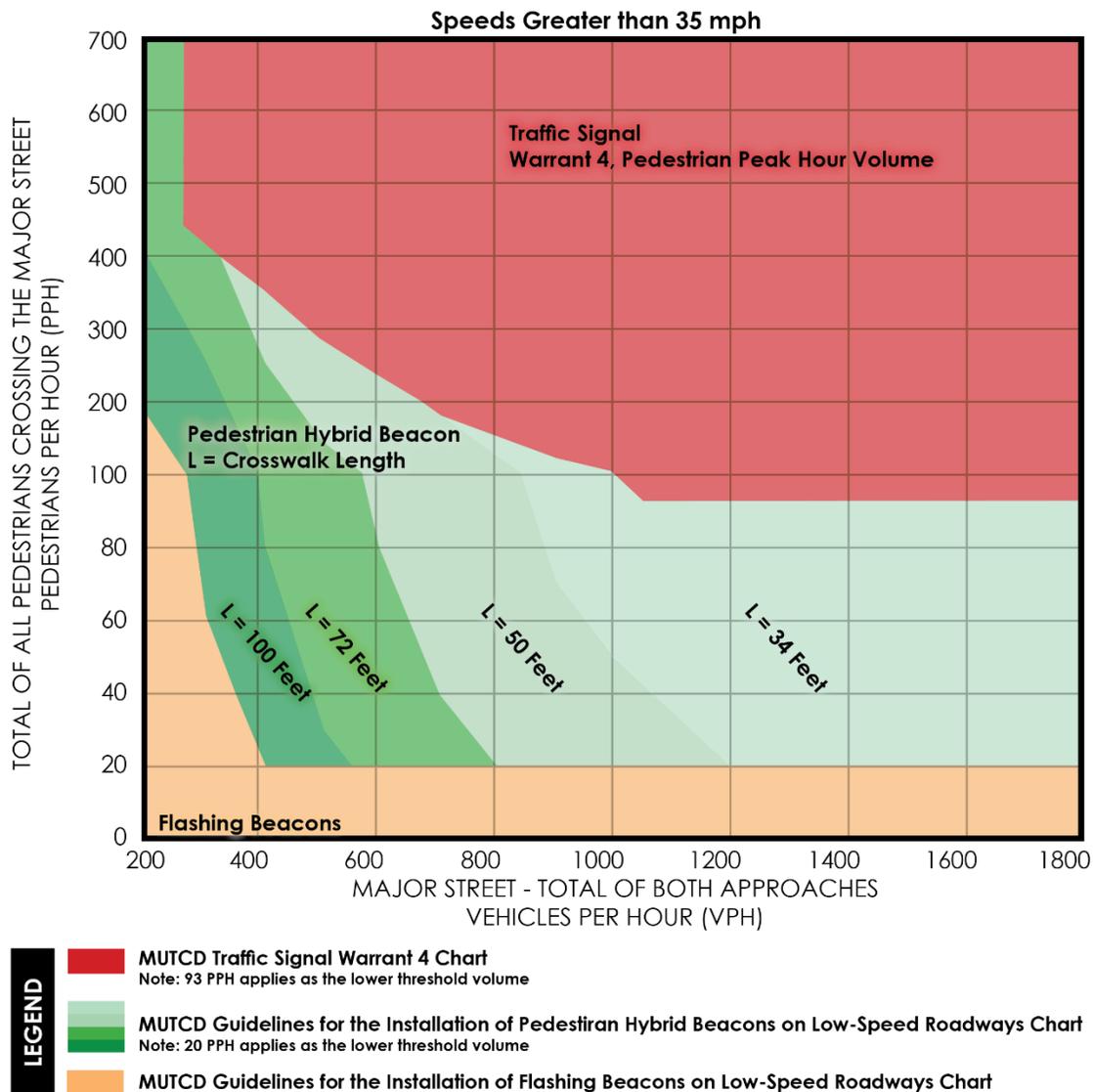
Information on requirements for traffic control signal at intersections can be found in **TEM 3.3**.

Figure 5.2-1. Guidelines for the Installation of Pedestrian Treatments on Low-Speed Roadways



- LEGEND**
- MUTCD Traffic Signal Warrant 4 Chart
 Note: 133 PPH applies as the lower threshold volume
 - MUTCD Guidelines for the Installation of Pedestrian Hybrid Beacons on Low-Speed Roadways Chart
 Note: 20 PPH applies as the lower threshold volume
 - MUTCD Guidelines for the Installation of Flashing Beacons or Rectangular Rapid Flashing Beacons on Low-Speed Roadways Chart

Figure 5.2-2. Guidelines for the Installation of Pedestrian Treatments on High-Speed Roadways



An interactive tool that helps designers select the applicable treatment options can be found in the following link: [Treatment Options Selection Matrix Tool](#)

5.2.6 ENGINEERING STUDY

- (1) An engineering study shall be conducted before the installation of a marked pedestrian crosswalk and/or treatments at a midblock crosswalk location or unsignalized intersection. Criteria for selecting the specific treatment(s) shall include, but not be limited to, pedestrian and vehicular volumes, roadway characteristics, and other environmental factors as documented in the study.

- (2) The engineering study should include the following information:
- (a) Field data to demonstrate the need for a marked crosswalk based upon minimum pedestrian volumes (except as described in **TEM 5.2.5.1** and availability of any alternative crossing locations that satisfy the criteria described in **TEM 5.2.5**).
 - Data collection should be based upon pedestrian volumes observed crossing the roadway outside a crosswalk at or in the vicinity of the proposed location or at an adjacent (nearby) intersection. If applicable, a cyclist can be counted as a pedestrian.
 - The [Department's Manual on Uniform Traffic Studies \(MUTS\)](#) provides additional information on obtaining pedestrian group size and vehicle gap size field data for use in making assessments of opportunities for safe crossings at midblock and unsignalized intersections.
 - (b) Field data to estimate individual pedestrian walking speeds, pedestrian speed cumulative curve, and the 15th percentile pedestrian crossing speed. The [Chapter 9 of the Department's Manual on Uniform Traffic Studies \(MUTS\)](#) provides additional information on the procedure and method for calculating the parameters of pedestrian walking speed.
 - (c) Potential links between pedestrian generators and attractors. Generators and attractors should be identified over an aerial photograph to illustrate potential pedestrian routes in relation to any proposed marked crosswalk location. This information is required for establishing the proposed crossing location or to confirm existing pedestrian crossing patterns.
 - (d) All safety considerations as described in **TEM 5.2.4** with respect to stopping sight distances, illumination levels, and proximity to intersection conflict areas.
 - (e) Proposed crossing location and corresponding signing, marking, and signal treatments as follows:
 - A schematic layout should be provided over aerial photography or survey to show locations of signs, markings, and other treatments in proximity to existing traffic control devices.
 - Treatments are dependent upon the site context, vehicle operating speeds, roadway cross-section, pedestrian volumes, and other variables. Treatments may include consideration of traffic signals or other warning devices to enhance driver yielding behavior. Other treatments such as median refuge areas, curb extensions, raised crosswalks, and supplemental signing and markings may also be applicable at some locations to support reduced crossing distance

and enhanced pedestrian visibility. See **TEM 5.2.7** for discussion of treatment options and guidance on treatment selection.

- (f) Latest three years of pedestrian-vehicle crash history within the vicinity of the proposed crosswalk. Document the number and nature of pedestrian-vehicle conflicts based on field observations.
 - (g) Transit route data and the location of transit stops within the vicinity of the proposed crosswalk.
- (3) Alternative analysis can be conducted at adjacent intersection and midblock locations through the procedure described in the [Department's Manual on Intersection Control Evaluation](#). Intersection and midblock crosswalk's needs might be identified and resolved by considering alternative control strategies that meet the project's purpose and need. The [Department's Manual on Intersection Control Evaluation](#) provides guidelines on these alternative designs.

5.2.7 TREATMENT OPTIONS

5.2.7.1 Pavement Markings

Marked Pedestrian Crosswalk

Special Emphasis Crosswalk. Marked crosswalks at unsignalized intersections (uncontrolled approach) and midblock crossings require a special emphasis crosswalk. Follow the procedures identified in **TEM 5.2.4** prior to installation.

Standard Crosswalk. At an unsignalized intersection-controlled approach, the crosswalk marking must comply with [FDM 230](#) design criteria. An engineering study is not required for the installation of standard crosswalks.

PEDESTRIAN CROSSING WARNING Sign (*W11-2*) Pavement Markings

The **W11-2** pavement markings may be used to supplement existing signage at marked pedestrian crossings when high vehicular volumes and speeds are documented in an engineering study. Receive [DTOE](#) approval of **W11-2** pavement markings the prior to installation. The use of **W11-2** pavement markings as a safety countermeasure is recommended and should be installed if any of the following conditions apply:

- Multi-lane roadway (45 mph or greater)
- Rural two-lane roadway (50 mph or greater)
- Crosswalks have restricted sight distance due to obstructions such as trees or parked vehicles
- There is a documented history of non-compliant driver yielding to pedestrian behavior

When installing at midblock or unsignalized intersections, apply the **W11-2** pavement markings as follows (see **Figure 5.2-3** and **Figure 5.2-4** for additional information):

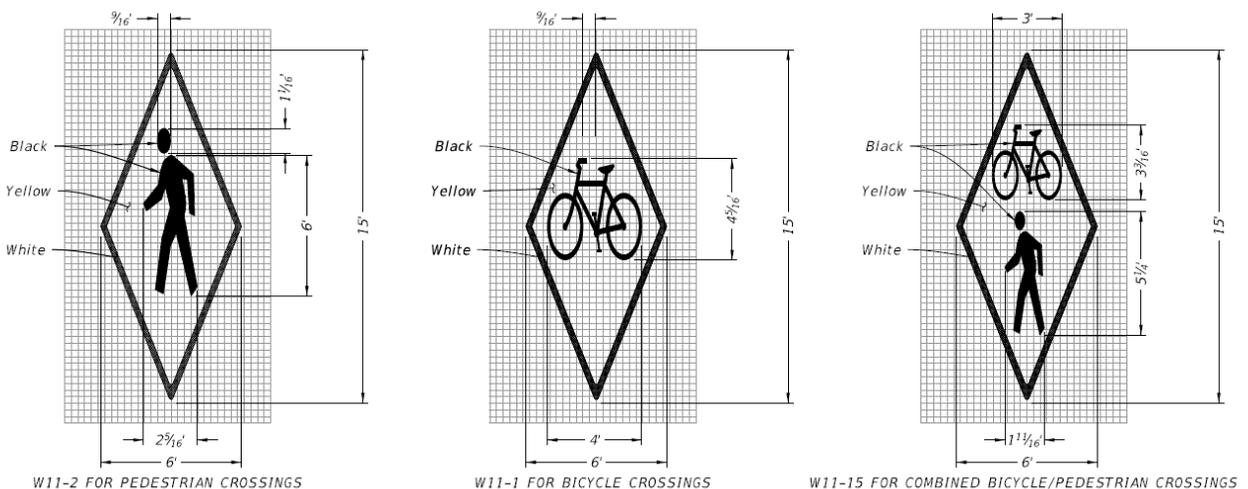
- Centered in the travel lane(s) on the approach to the crosswalk and in alignment with adjacent lanes when used on multi-lane approaches
- The **W11-2** pavement marking shall not be intermixed with other pavement markings

Coordinate the **W11-2** pavement markings installation with the District Maintenance Office.

Figure 5.2-3. PEDESTRIAN CROSSING WARNING Sign (W11-2) Pavement Marking



Figure 5.2-4. PEDESTRIAN and BICYCLE CROSSING WARNING Signs Pavement Marking Details



Pavement Word Markings

See **TEM 4.2** for information on the use of Pavement Word Markings.

5.2.7.2 Signs

General

The signs covered in this subsection may be installed at midblock crosswalks and unsignalized intersections to improve non-compliant driver yielding and stopping behavior to pedestrians. See [FDM 230](#) for sign placement details.

To enhance sign conspicuity, highlighted signs and flashing beacons may be installed in accordance with [Section 2A.15 of the MUTCD](#).

STOP HERE FOR PEDESTRIANS Sign (**R1-5b** and **R1-5c**)

For additional emphasis, a stop line may be installed with the STOP HERE FOR PEDESTRIANS (**R1-5b** and **R1-5c**) sign in accordance with [Section 2B.11 of the MUTCD](#). If used, place the stop lines 40 feet in advance of the marked crosswalk.

When the STOP HERE FOR PEDESTRIANS sign is installed, parking is prohibited in the area between the stop line and the marked crosswalk. Use a solid lane line between the stop line and crosswalk.

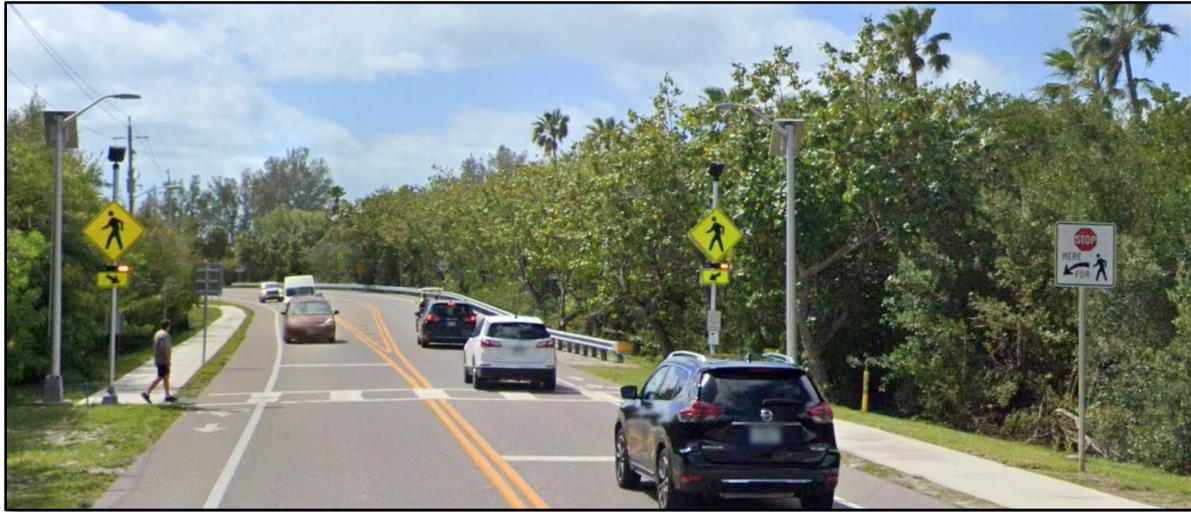
Use the **R1-5b** and **R1-5c** signs with the advanced warning **W11-2** and **W16-7P** signs.

Do NOT use the **R1-5b** and **R1-5c** signs in combination with the traffic signal or PHB.

The **R1-5b** and **R1-5c** sign may be used at locations where there is non-compliant stopping for pedestrians at an existing mid-block crosswalk, as follows:

- One sign in each direction
- Within 100 feet in advance of the crosswalk
- Does not interfere with required signs

**Figure 5.2-5. Pedestrian Crossing Signs
(R1-5b and W11-2 with an RRFB)**



TURNING VEHICLES STOP FOR PEDESTRIANS sign (R10-15a)

See **TEM 2.44** for guidance on the use of the TURNING VEHICLES STOP FOR PEDESTRIANS sign (**R10-15a**) at locations other than midblock crosswalks.

PEDESTRIAN CROSSING Signs

Use a PEDESTRIAN CROSSING (**W11-2**) warning sign with supplemental AHEAD plaque (**W16-9P**) in combination with the **R1-5b** or **R1-5c** sign.

A school sign (**S1-1**) with supplemental diagonal downward pointing arrow (**W16-7P**) may be used to advise road users that they are approaching a crosswalk in close proximity to a school.

The combined bicycle/pedestrian sign (**W11-15**) may be used where both bicyclists and pedestrians might be crossing the roadway. A TRAIL X-ING (**W11-15P**) supplemental plaque may be mounted below the **W11-15** sign.

In-Street Sign (R1-6a)

In-street signs (**R1-6a**) are useful on low-speed roadways to remind road users of laws regarding right-of-way at a midblock or unsignalized pedestrian crosswalk. Implement in-street signs (**R1-6a**) in roadways with four (4) or fewer through lanes (both directions) and with a posted speed limit of 35 mph or less.

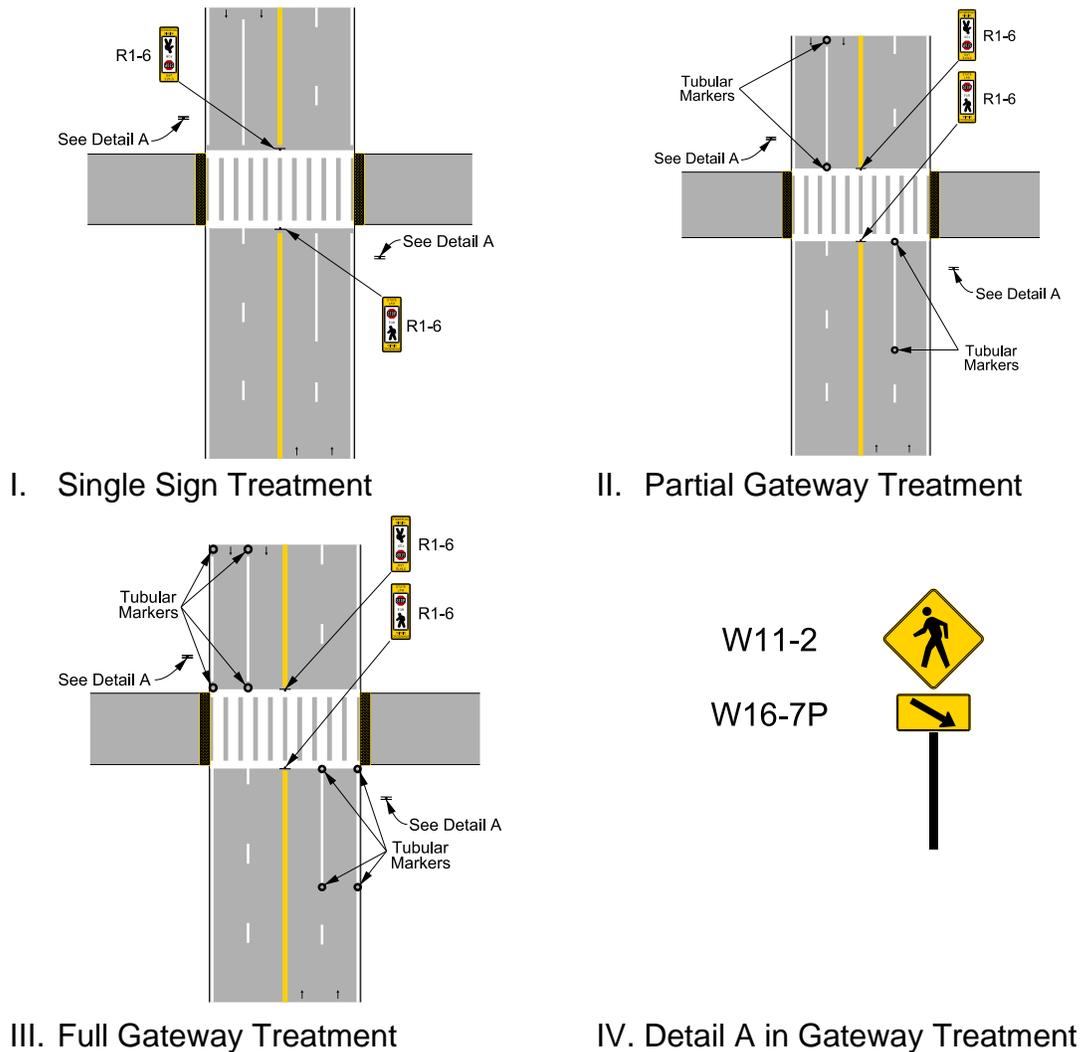
Coordinate with the District Maintenance Office prior to [DTOE](#) approval for the use of the in-street sign (**R1-6a**).

If used, place the in-street signs (**R1-6a**) at one of the following locations:

- In the roadway at the marked crosswalk location on the center line,

The use of supplemental tubular marker for gateway treatment is compliant with the [MUTCD](#). See FHWA Official Ruling [3\(09\)-61 \(I\) – Channelizing Devices at Mid-Block Pedestrian Crossings in Conjunction with In-Street Pedestrian Crossing \(R1-6 Series\) Signs](#) issued on August 3, 2020, with guidance and illustrations.

Figure 5.2-7. Gateway Treatment with R1-6a and Tubular Marker



Portable Changeable Message Sign (PCMS)

To inform the traveling public of a new traffic control pattern, a PCMS is required for all new RRFB, PHB, flashing yellow beacon, and midblock traffic control signals in accordance with the following criteria.

- Display the following safety message the PCMS:
 - NEW SIGNAL XX/XX
 - PREPARE TO STOP

- Coordinate with district to notify local law enforcement and local agency two weeks before the new traffic control device is installed.
- Install the PCMS two weeks prior and remain in place for a minimum of one week after the installation of traffic control devices mentioned above.

An interactive tool that helps designers select the applicable treatment options can be found in the following link: [Treatment Options Selection Matrix Tool](#)

5.2.7.3 Beacons (Signal Warrant Analysis Not Required)

General

For locations not warranted for traffic control signals or PHBs, alternative pedestrian-actuated warning devices presented in this section may be considered to provide additional emphasis on the marked crosswalk and of the presence of pedestrians. For guidance on supplemental warning device options that are exempt from warrants, see **TEM 5.2.4** for details.

Additional treatments not included in this section may also be appropriate depending upon the individual site characteristics. Engineering judgment should guide decisions about which additional treatment options to include, if any.

Rectangular Rapid Flashing Beacons (RRFB)

The FHWA issued [Interim Approval 21, Rectangular Rapid Flashing Beacons at Crosswalks \(IA-21\)](#) on March 20, 2018, which specifies the intended use and design requirements for RRFB devices.

FDOT has received FHWA approval to install RRFBs on the State Highway System. Local agencies must receive FHWA approval prior to installing RRFBs on their local roads.

The rectangular beacons are provided in pairs below the PEDESTRIAN CROSSING warning sign (**W11-2**) (and above the diagonal downward arrow (**W16-7P**) plaque for post-mounted RRFB) and operate in a flash pattern upon activation by the pedestrian. For school zone or trail crossings, school sign (**S1-1**) or combined bicycle/pedestrian sign (**W11-15**) may be placed alternatively above the rectangular beacons instead of the pedestrian crossing sign (**W11-2**). Detailed conditions of use, including sign/beacon assembly, dimensions, placement, and flashing rates are provided in [Interim Approval \(IA-21\)](#). Refer to the following FDOT policy for more guidance on RRFB implementation:

- [Standard Plans, Index 654-001](#)
- [FDM 327](#)
- [Standard Specifications, Section 700](#)

[Standard Specifications, Section 654](#) requires that RRFBs to include an instruction sign with the following 3-line legend PUSH BUTTON FOR WARNING LIGHTS / WAIT FOR TRAFFIC TO STOP / CROSS WITH CAUTION (**FTP-68C-21**) sign mounted adjacent to or integral with the pedestrian push button device.

As of January 1, 2021, include, on all RRFB installations, an audible warning message that states “WAIT FOR TRAFFIC TO STOP THEN CROSS WITH CAUTION” when activated. An example of the RRFB treatment is shown in **Figure 5.2-8**.

Figure 5.2-8. Rectangular Rapid Flashing Beacons



Flashing Yellow Beacons

For locations where traffic signals are not warranted, additional emphasis on the crossing location can be provided when using flashing yellow beacons to supplement the appropriately marked crossing warning or regulatory signs. These devices are still allowable in the [MUTCD](#), although newer devices such as RRFBs have increased in popularity. See [Chapter 4L of the MUTCD](#) for a complete list of requirements.

See [Standard Plans, Index 700-120](#) for design and installation details.

Configuration of beacons is either overhead or side-mounted; however, the preferred configuration is a side post-mounting to avoid drivers confusing the beacons for a flashing traffic signal.

- When post-mounted, the recommendation is to have a configuration of two vertically aligned beacons. Operate these beacons in an alternating flash pattern.
- When overhead mounted, flashing yellow beacons should feature an internally illuminated Overhead Pedestrian Crossing sign (**R1-9a**) in conjunction with the beacons, which is continuously lit at night.

In-Roadway Lights

[Chapter 4N of the MUTCD](#) provides detailed guidance on the installation of in-roadway lights. Coordinate with the District Maintenance Office prior to seeking [DTOE](#) approval on the use of the in-roadway lights.

In-roadway lights are installed in the roadway surface to warn road users that they are approaching a condition on or adjacent to the roadway that might not be readily apparent and might require the road users to slow down or come to a stop. This includes marked midblock crosswalks and marked crosswalks on uncontrolled approaches.

In-roadway lights may be installed at certain marked crosswalks, based on an engineering study or engineering judgment, to provide additional warning to road users. Operate in-roadway lights in a flashing pattern.

The installation of in-roadway lights in conjunction with overhead or LED roadside highlighted signs or flashing yellow beacons is allowed as long as the flashing rates are identical and flash in unison. Exercising engineering judgment is of great importance.

In locations where overhead lighting has been omitted by the engineer of record, consider in-roadway lights. Use following criteria for in-roadway lights:

- Install only at marked crosswalks with applicable warning signs;
- Install along both sides of the crosswalk and span its entire length; and
- Do NOT use at crosswalks controlled by YIELD signs, STOP signs, or traffic control signals.

If pedestrian push button actuates the in-roadway lights, mount a PUSH BUTTON TO TURN ON WARNING LIGHTS (with push-button symbol) (**R10-25** or **FTP-68C-21**) sign adjacent to or integral with each pedestrian push button.

5.2.7.4 Beacons and Signals (Warrant Analysis Required)

Pedestrian Hybrid Beacon (PHB)

A possible alternative to the traffic signal is a PHB. Use PHBs in conjunction with signs and pavement markings to warn and control traffic at locations where pedestrians enter or cross a street or highway. See **Figure 5.2-9** for an example of the PHB treatment.

Only install PHBs at midblock crosswalks. See [Chapter 4F of the MUTCD](#) for guidance and criteria on PHB installations.

For six-lane roadways or crossing distances exceeding 80 feet, consider a two-stage pedestrian crossing with a median refuge island where a warranted PHB will control the proposed marked crossing.

Include the CROSSWALK, STOP ON RED, PROCEED ON FLASHING RED WHEN CLEAR (**R10-23a**) sign in PHB treatments. The **R10-23a** replaces the existing **MUTCD R10-23** sign per the [FHWA Interpretation Letter 4\(09\)-61\(I\)](#).

Figure 5.2-9. Pedestrian Hybrid Beacons



Midblock Traffic Control Signal

Where pedestrian volumes meet the [Signal Warrant 4 of the MUTCD](#), a midblock traffic control signal may be installed to serve this demand in accordance with [Section 4C.05 of the MUTCD](#). Ensure that the new pedestrian signal is compatible with the signal system along the arterial corridor.

Where signalized control is selected for the pedestrian crossing, additional coordination is recommended with the District Access Management Review Committee and the [DTOE](#).

For six-lane divided roadways or crossing distances exceeding 80 feet, also consider a two-stage pedestrian crossing with a median refuge island where a warranted traffic control signal will control the proposed marked midblock crossing.

At locations where pedestrian compliance is of concern, feedback devices may be installed with the traffic control signal button to provide pedestrians with confirmation of the call.

For locations where signal warrants are met, consideration may be given to providing a pedestrian bridge or tunnel to address safety and compliance issues that cannot be addressed by a traffic signal.

In some cases, a traffic control signal may not be needed at the study midblock location if adjacent coordinated traffic control signals consistently provide gaps of adequate length for pedestrians to cross the roadway.

See the [Department's Manual on Uniform Traffic Studies \(MUTS\)](#) for guidance on conducting Pedestrian Group Size and Vehicle Gap Size studies.

See [TEM 3.7](#) for information on the use of accessible pedestrian signals.

See [Standard Plans, Index 653-001](#) for details on installing midblock traffic control signals. An example of the midblock traffic control signal treatment is shown in [Figure 5.2-10](#).

Figure 5.2-10. Midblock Traffic Control Signal



5.2.7.5 Other Treatments

Consider incorporating pedestrian refuge islands, raised median, curb extensions, raised crosswalks (See [Figure 5.2-11](#)) or the following treatments to improve visibility, support pedestrian travel, and increase awareness for pedestrians at crossings. For other **speed reduction treatments** see [FDM 202](#).

See [FDM 222](#) for design criteria of pedestrian treatments.

Figure 5.2-11. Raised Pedestrian Crosswalk



Crosswalk Illumination

There are locations such as environmental-sensitive areas or crosswalks serving facilities that are open only during daylight hours, where lighting may be omitted. [D_{TOE}'s](#) approval is required for this omission. Consider in-roadway lighting at locations that omit illuminating the crosswalk.

Provide crosswalk illumination in accordance with [FDM 222 and 231](#).

Passive Pedestrian Detection

In addition to traditional active pedestrian detection (push button), passive pedestrian detection may be used to supplement and improve pedestrian detection for signals, RRFBs, PHBs, and warning beacons.

Consider passive pedestrian detection in locations with documented observations of low usage of the active pedestrian detection (push button). This could be acquired by field review, demographics, or per request. Children/teenagers, school zone, aging roadway users, and other demographics should be considered when implementing passive pedestrian detection.

When passive pedestrian detection is installed, adequate passing space around the waiting detection area on the sidewalk should be present. Provide overhead lighting to

increase pedestrian visibility and detector accuracy. Adjust detection zones after installation to cover the exact specified pedestrian waiting area.

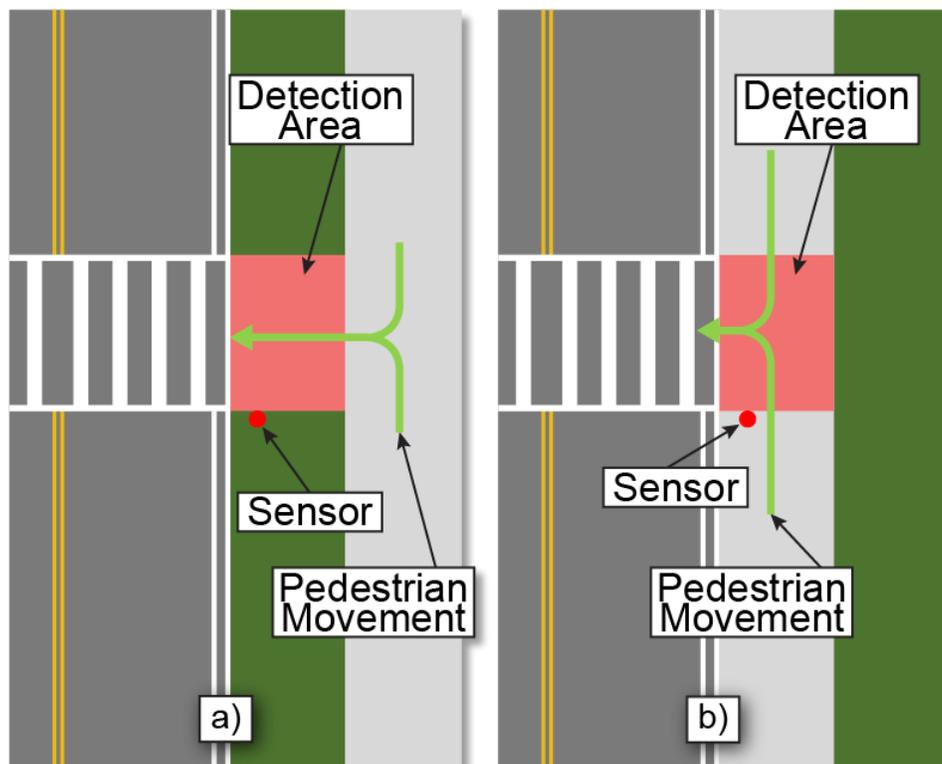
When using passive pedestrian detection, ensure adequate installation height, detection distance, and position and angle of the detector to recognize pedestrian features and detect the presence of pedestrians. If there are no existing poles or infrastructure at the implementation site, consider a supplemental pole or an extended arm from an existing pole.

When deploying a passive pedestrian detection system, two options will be encountered for the sidewalk locations as illustrated in **Figure 5.2-12**.

For the option in **Figure 5.2-12 a)**, a grassy shoulder/buffer is constructed between the sidewalk and the road. The area leading towards the crosswalk can be used as the detection zone for the system, providing a well-established and clear area for detection. This option is preferable for deploying passive pedestrian detection.

For the option in **Figure 5.2-12 b)**, a sidewalk is constructed next to a curb without any buffer between them, which is common in urban environments with limited right-of-way. The area that can be used for detection is smaller, and a pedestrian walking on the sidewalk turning into the crosswalk may not be detected in some cases. There may also be false detections with this design. The pedestrian “WALK” signal can be activated by pedestrians walking along the sidewalk but not turning to the crosswalk. Consider this limitation when implementing passive pedestrian detection.

Figure 5.2-12. Sidewalk Location Options for Passive Pedestrian Detection



For a shared-use path that crosses a state roadway, passive bicyclist detection may be added in addition to an active bicyclist detection (push button) to improve driver yielding behavior and cyclist safety. Consider the following guidance when installing passive bicyclist detection at midblock or unsignalized intersections:

- At unsignalized intersections and midblock that require bicyclists detection, consider passive bicyclist detection.
- Place the passive bicyclist detection devices in the expected path of the bicyclists.
- Locate bicycle detection devices in the most conspicuous location and supplemented by appropriate signing and pavement markings to inform bicyclists of where to wait.
- Install advanced bicycle detection on the approach to the intersection to extend the phase or to prompt the phase and allow for continuous bicycle through movements.
- Consider the amount of metal in typical bicycles in design of loop detectors. Certain loop configurations are better at detecting bicyclists than others. Adjust settings for loop detectors to detect bicycles properly.

Transverse Rumble Strips

Transverse rumble strips in advance of rural stop-controlled intersections have shown to improve driver awareness and overall safety performance. Therefore, this type of rumble strips may be used in advance of midblock and unsignalized intersections where driver yielding behavior has not been successful with other advance warning treatments identified in this section. Install transverse rumble strips in accordance with [Standard Plans, Index 546-001](#), [Standard Specifications, Section 546](#), and [FDM 210](#). Consider the following factors when installing transverse rumble strips near midblock or unsignalized intersections:

- Evaluate the noise impact of installing transverse rumble strips near residential areas before installation.
- Coordinate with the District Maintenance Office prior to [DTOE](#) approval for the use of the transverse rumble strips.
- There are two basic layouts for transverse rumble strips, extending across the entire traffic lane or placement only in the wheel tracks. The wheel track layout is preferred because it allows drivers that do not need any additional warning to avoid the rumbles without driving into the opposing lane.
- Use the transverse rumble strips in combination with Pedestrian Crossing ([W11-2](#)) signs.

An interactive tool that helps designers select the applicable treatment options can be found in the following link: [Treatment Options Selection Matrix Tool](#)

5.2.8 TREATMENT OPTIONS SELECTION MATRIX

Select pedestrian treatments at midblock crosswalks and unsignalized intersections based on pedestrian volume, roadway context classification, number of lanes, posted speed limit, and other related factors as identified in **TEM 5.2.4**, **TEM 5.2.5**, and **TEM 5.2.7**. As a reference **Figure 5.2-13** has been designed to aid in the treatment option selections process. This matrix highlights the procedures, selection criteria and treatment requirements identified in **TEM 5.2**.

An interactive tool that helps designers select the applicable treatment options can be found in the following link: [Treatment Options Selection Matrix Tool](#)

Figure 5.2-13. Midblock Crosswalk and Unsignalized Intersection Selection Guidance Matrix

TEM 5.2 Midblock Crosswalks and Unsignalized Intersection Selection Guidance Matrix			Midblock and Unsignalized Intersections						Midblock		TEM SECTION			
			Pavement Marking			Beacons			Beacons and Signals					
			Special Emphasis Crosswalk			Standard Crosswalk			RRFB			Flashing Beacon	PHB	Traffic Signal
			20 PPH for 1 Hr or SHARE USE PATH 50% PPH reduction or school zones			Stop controlled sidestreets and driveways			2-4 lanes	3-5 lanes With TWTL		2-4 lanes	Florida warrants must be met	
			or C2T, C3C, C4, C5, and C6 ≤35 mph	40-45 mph	>45 mph									
Pavement Markings	Special emphasis crosswalk	Midblock	M	M	M	N	M	M	M	M	M			
		Intersection	M	M	M	N	M	M	M	N	N			
	Standard crosswalk		N	N	N	M	N	N	N	N	N			
	Other pavement markings		O	O	O	O	O	O	O	O	O			
Signs	R1-5b/R1-5c	Enhance option: highlighted or beacon	O	O	O	O	M	M	O	N	N			
			M	M	M	M	M	M	M	M	M			
	W11-2/W16-9P		O	O	O	O	M	M	O	O	O			
	W16-7P/FTP-68C-21		O	O	O	O	O	M	M	O	O			
	R1-9a		O	O	O	O	O	M	M	O	O			
	R10-23a		N/A	N/A	N/A	N/A	N/A	N/A	N/A	M	N/A			
Beacons	Audible message		N/A	N/A	N/A	N/A	M	M	N	N	N			
	In-roadway warning light		N/A	N/A	N/A	N/A	O	O	O	O	N			
Other Treatments	Two-stage pedestrian crossing	Pedestrian refuge islands	O	O	R	O	R	M	O	R	R			
		Raised median	O	O	R	O	O	R	O	R	R			
	Passive pedestrian and bike detection	SHARED USE PATH	N/A	N/A	N/A	N/A	R	R	R	R	R			
		All others locations	N/A	N/A	N/A	N/A	O	O	O	O	O			
	Curb extensions		O	O	R	O	O	O	O	O	O			
	Transverse rumble strips		O	O	O	O	O	O	O	O	O			
	Raised crosswalks		O ⁽²⁾	N	N	N	N	N	N	N	N			
	Speed reduction treatments		O	O	R	O	O	O	O	O	O			
Overhead lighting		M	M	M	O	M	M	M	M	M				
TEM SECTION			5.2.5.1			5.2.5.2								

Legend

- M Mandatory if applied
- R Recommended Option
- O Available Option
- N Not to be Applied
- N/A Not Available Option⁽¹⁾

Note
 (1) Identifies where the treatment cannot be applied because the infrastructure is not there. Ex: Audible Message on a Marked Crosswalk
 (2) Not to be applied at 35 mph

Section 5.3

TREATMENTS FOR PEDESTRIANS AND BICYCLISTS ON MOVABLE BRIDGES

5.3.1 PURPOSE

The intent of this section is to establish criteria and guidelines for the consistent installation and operation of pedestrian treatments on movable bridges. These treatments include swing-style pedestrian gate, signs, and advanced detection systems such as LiDAR and Thermal Imaging cameras. See [Structures Design Guidelines \(SDG\) 8.1.9](#) for more design information.

5.3.2 GENERAL

Pedestrian and bicyclist safety can significantly improve by thoughtfully placed signs and swing-style pedestrian gate on movable bridges. Advanced Detection Systems help the bridge tenders detect pedestrians or bicyclists and prevent the bridge from opening when there are any pedestrians or bicyclists in the vulnerable zones of the movable span.

5.3.3 DEFINITIONS

Advanced Detection System. A passive detection systems that can identify, target, track, and alert if static or dynamic human characteristics are spatially referenced in a predetermined geographical space during all weather conditions.

Bascule Bridge. A movable bridge (also referred to as a drawbridge or a lifting bridge) with a counterweight that continuously balances a span, or leaf, throughout its upward swing to provide clearance for maritime traffic. It may be single- or double-leafed.

Bridge Tender. Operator of the movable bridge according to the regulations of the United States Coast Guard (Chapter 33 of the Code of Federal Regulations Section 117.1101, which is included in Volume I: Appendix G) and with the State of Florida Statutes.

Lift Bridge. A vertical-lift bridge or just lift bridge is a type of movable bridge in which a span rises vertically while remaining parallel with the deck.

Movable Bridge. A bridge that moves to accommodate the passage of maritime vessels. There are several types of movable bridges mentioned in this section.

Swing Bridge. A swing bridge (or swing span bridge) is a movable bridge that has, as its primary structural support, a vertical locating pin and support ring which is usually at or near its center of gravity about which the swing span (turning span) can then pivot horizontally.

Swing-Style Pedestrian Gate. A gate that opens and closes automatically with the assistance of electronic, hydraulic, or mechanical means. Swing-style pedestrian gates open on their vertical axes so that they swing towards or away from pedestrians.

Vulnerable Zones. Areas of high risk for pedestrians, bicycles, and vehicles that may cause harm during bridge openings.

5.3.4 TREATMENT OPTIONS

Swing-Style Pedestrian Gate: Install swing-style pedestrian gate on movable bridges in accordance with [SDG 8.1.9](#).

Signage: Install a **NO PEDESTRIANS OR BICYCLES BEYOND GATE** sign on movable bridge swing-style pedestrian gate as shown in *TEM 2.6.6*.

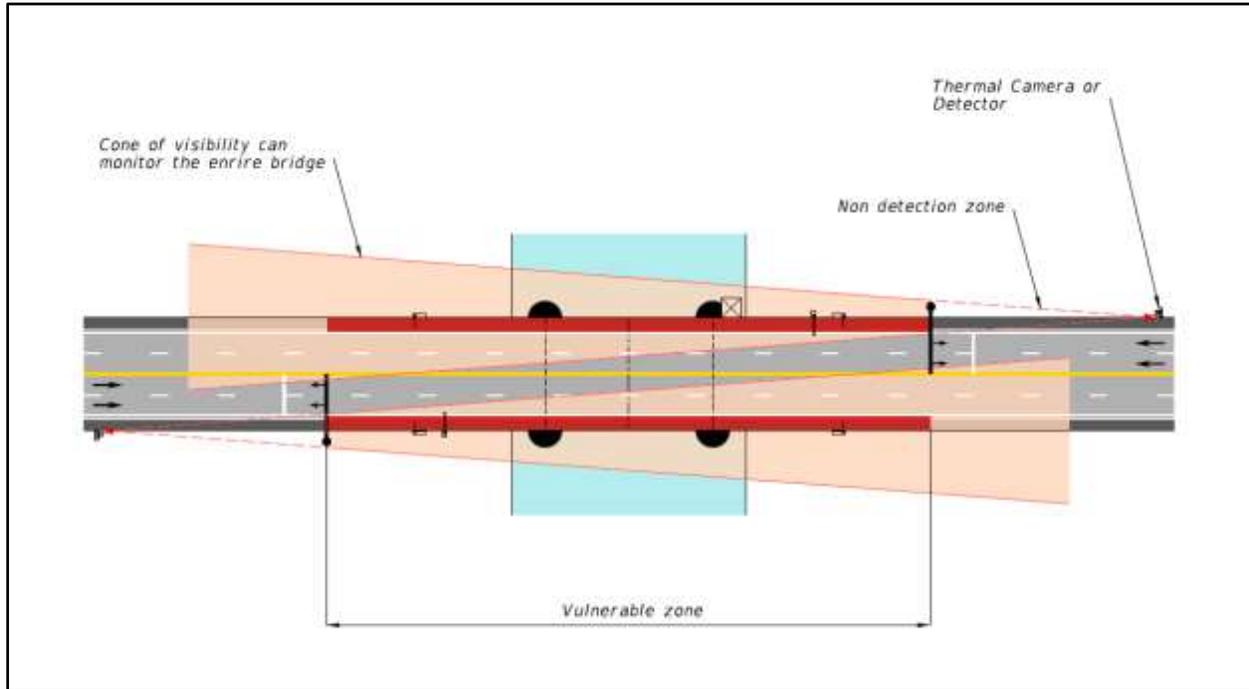
Advanced Detection Systems: These passive thermal or laser-based systems identify, target, track, and alert the bridge tender station if any pedestrians or bicyclists are detected in vulnerable zones of the movable bridge.

- The thermal camera system is an advanced detection system that uses infrared radiation to detect and locate heat signature objects.
- LiDAR camera system is an advanced detection system that uses **Light Detection and Ranging** technology. Pulsed laser beams are emitted in a predetermined geographic space that measures the time taken for each pulse of laser light to be reflected back from the environment and objects of interest creating a 3D image of the target. Typically, these lasers can be visible light, infrared or ultraviolet lasers.

Bridge tender house receives the sensor data from the advanced detection system into a computer, with an uninterruptible power supply, that displays the feed through a monitor. These systems, including all integrated components, are currently on the [Department's Approved Products List \(APL\)](#). Systems may include but are not limited to:

- Thermal camera, or LiDAR camera
- Controller or server cabinet
- Communication system (wired or wireless or cellular service)
- Network switch
- Conduit and pull box
- Power supply (hook up to existing power or solar power systems)
- Wire, cable, and related fittings

Figure 5.3-1. Typical Detection Zones



The advanced detection system technology selection is at the discretion of the [D_{TOE}](#). [S_{TOE}](#) approval is required to select technology not covered in this section.