







FDOT

TEM

Traffic Engineering Manual

JANUARY
2027

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CHAPTER

1

Procedure

SECTION 1.1

ADOPTION PROCEDURE

1.1.1 PURPOSE

The ***Traffic Engineering Manual (TEM)*** provides traffic engineering standards and guidelines to be used on the State Highway System (SHS) by the FDOT ***District Traffic Operations Offices***.

1.1.2 AUTHORITY

The ***TEM*** was adopted by the authority conferred in ***Sections 20.23(4)(a)*** and ***334.048(3)***, Florida Statutes (F.S.).

1.1.3 SCOPE

The ***TEM*** is intended for use by FDOT engineers, consultants, and contractors to develop projects that meet Florida policies and standards.

1.1.4 REFERENCES

Chapter 316, F.S. State Uniform Traffic Control

Rule 14-15.010, F.A.C. Manual on Uniform Traffic Control Devices (MUTCD)

1.1.5 DISTRIBUTION

The official recipients of the ***TEM*** are the ***District Traffic Operations Engineers (DTOEs)*** and their staff, and the ***State Traffic Engineering and Operations Office*** managers and staff.

1.1.6 AVAILABILITY

The ***TEM*** is available under ***Traffic Studies*** within the ***Traffic Services Section*** of the ***State Traffic Engineering and Operations Office website***.

1.1.6.1 Registration

TEM users interested in receiving automatic notifications of revisions can subscribe through ***Contact Mailer***. We will survey our registration list by March 1 each odd-numbered year and purge any outdated registrations, as required by ***Section 283.55, F.S.***

1.1.7 REVISIONS

The ***State Traffic Operations Engineer (STOE)*** and the ***DTOEs*** make up the ***Manual Review Committee***.

Statewide ***DTOE*** meetings are held quarterly, and any necessary or recommended additions or changes to the ***TEM*** are discussed there. Items that warrant immediate change are updated with the approval of the ***STOE*** after passing a majority vote of the ***Manual Review Committee*** and consulting with affected parties.

Substantive revisions or policy-related issues, as determined by the ***Manual Review Committee***, are reviewed for approval by the ***Chief Engineer of Operations***.

The approved revisions are announced through a bulletin and posted on the ***State Traffic Engineering and Operations Office*** website. The ***TEM*** is published annually and posted during the regular publishing cycle by the first week of November. Substantive or policy-related revisions as approved by the STOE and Chief Engineer of Operations may be announced outside of the regular publishing cycle.

A notification is sent to all registered ***TEM*** subscribers covering revisions posted to the website.

1.1.8 TRAFFIC ENGINEERING VARIATIONS

FDOT's traffic engineering criteria and standards, as described in this manual, are based on guidelines from the ***Manual on Uniform Traffic Control Devices (MUTCD)*** and the ***American Association of State Highway and Transportation Officials (AASHTO)*** and specific research.

There may be site-specific conditions or certain circumstances that warrant a variation from ***TEM*** criteria or standards. A variation is a one-time event, granted on a case-by-case basis. The variation process is described in ***TEM Section 1.1.9***. In addition, follow ***MUTCD*** guidance if ***MUTCD Standards*** are not met.

1.1.9 VARIATION PROCESS

A local government agency, engineering consultant, or other authorized party may submit a formal written request to the appropriate ***DTOE*** to approve a variation from the ***TEM*** criteria or standards. Include all of the following that apply.

- Proposed location (state road name, roadway ID, and milepoint)
- Applicable standard or criterion (chapter and section number)
- Justification of why the required criteria or standards do not apply to site-specific conditions
- Proposed variation

- Evaluation of how the proposed variation is at least as safe as the ***TEM*** criterion or standard
- Describe impacts of the variation on operations, environmental, or community needs
- Provide examples, including before and after data for a comparable site, if available

District Traffic Operations Office staff will review and evaluate the proposed variation based on the following considerations.

- The proposed variation is necessary to complete the project.
- The applicant has considered other alternatives meeting ***TEM*** criteria or standards.
- The proposed variation has been used elsewhere, locally, in Florida, or nationally.
- The proposed variation may require Federal Highway Administration (FHWA) approval or coordination.

If a variation is not warranted, the ***DTOE*** will document the reasons and advise the requester of the findings.

If a variation is warranted, the ***DTOE*** will forward the proposed variation to the ***State Traffic Engineering and Operations Office*** for review and approval.

Upon review and recommendations from ***State Traffic Engineering and Operations Office*** staff, the ***STOE*** responds to the appropriate ***DTOE*** with a memorandum addressing the request. The memorandum may include special conditions or requirements. The ***STOE*** may solicit feedback from the ***DTOEs*** to achieve statewide consensus before approving and authorizing the requested variation.

The memorandum signed by the ***STOE*** serves as the formal document authorizing or denying the requested variation from the applicable ***TEM*** criterion or standard. These memoranda are filed on the ***State Traffic Engineering and Operations Office*** ***SharePoint*** site and are geolocated for easy access under the ***TEM Variation Locations*** layer on ***Internal eTraffic***.

1.1.10 FORMS

See the ***Procedural Document Library*** for forms referenced in this manual.



CHAPTER

2

Signs

SECTION 2.1

SLIPPERY WHEN WET SIGNS

2.1.1 PURPOSE

This section provides guidance on when, where, and how to place *SLIPPERY WHEN WET* signs (W8-5).

2.1.2 CONDITIONS FOR USE

At locations where pavement is slippery, the ***District Traffic Operations Engineer (DTOE)*** requests that the District Maintenance Engineer install *SLIPPERY WHEN WET* signs (***W8-5***). Pavement is considered slippery when a standard friction test at 40 mph results in skid numbers less than 25.

DTOE also requests that the District Maintenance Engineer install *SLIPPERY WHEN WET* signs (***W8-5***) when the posted highway speed is above 45 mph, skid numbers are less than 30, and one of the following conditions is met:

(1) The actual crash rate divided by critical crash rate is greater than or equal to 1.

(2) There is a downgrade greater than 3 percent.

(3) The location includes intersections with traffic signals.

2.1.3 LOCATION AND PLACEMENT

Additional *SLIPPERY WHEN WET* signs (***W8-5***) may be needed at locations with the following conditions:

Horizontal Curves: Place *SLIPPERY WHEN WET* signs (***W8-5***) prior to a *CURVE WARNING* sign (***W1-1 through W1-15***) with an advisory speed plaque. The Ball-Bank Indicator Method allows for a reasonable speed through the curve, but consider setting a lower advisory speed if there are known extraordinary hazards, such as hydroplaning.

Hydroplaning: Generally, hydroplaning only occurs at speeds above 47 mph, but it can happen at lower speeds due to excessive stormwater runoff across travel lanes. Hydroplaning is a risk on roadways with multiple lanes, rutted lanes, built-up shoulders, or downgrades. If excessive water buildup cannot be corrected at these locations, *SLIPPERY WHEN WET* signs (***W8-5***) may be needed, regardless of the skid numbers.

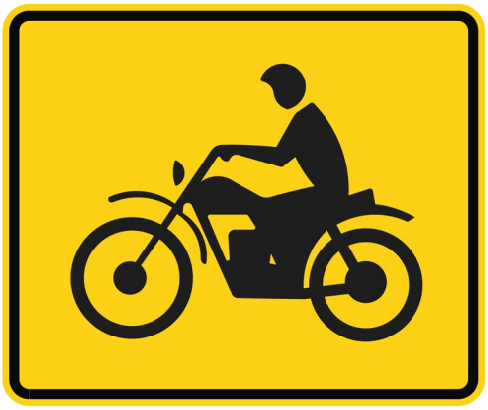
Ramp and Bridge Decks: Interchange exit or entrance ramps on sharp curves and downgrades can be dangerous if the pavement is slippery. Give special attention to ramps with compound curves. FDOT maintains a pavement friction inventory for interchange ramps, but engineers can request special tests at speeds less than 40 mph. *SLIPPERY WHEN WET* signs (***W8-5***) should be used with the following advisory exit or ramp speed signs: *EXIT RAMP XX MPH (**W13-2**)* or *RAMP XX MPH* (***W13-3***).

Place *SLIPPERY* WHEN *WET* signs (***W8-5***) in advance of all movable and non-movable steel deck bridges as directed in the ***Manual on Uniform Traffic Control Devices (MUTCD) Table 2C-3***.

2.1.4 ENHANCEMENT

Where wet roadway surface conditions might adversely affect motorcyclists' ability to control their vehicles, mount a *MOTORCYCLE* plaque (***W8-15aP***), shown in ***Figure 2.1-1***, below the warning sign. Place additional warning signs at appropriate intervals where this condition exists.

Figure 2.1-1. Motorcycle Plaque



2.1.5 NOTIFICATION

The District Maintenance Engineer will promptly notify the ***DTOE*** in writing when *SLIPPERY WHEN WET* signs (***W8-5***) have been installed.

The ***DTOE*** will direct the District Maintenance Engineer to remove *SLIPPERY WHEN WET* signs (***W8-5***) that are no longer warranted.

SECTION 2.2

OVERHEAD STREET NAME SIGNS

2.2.1 PURPOSE

This section defines guidelines for installing overhead street name signs at signalized intersections. Street name guide signs for most streets intersecting a road on the State Highway System are usually furnished, installed, and maintained by the appropriate local government. FDOT may, however, furnish and install larger overhead street name signs at signalized intersections.

2.2.2 STANDARDS

Use street name signs only to identify cross streets. They are not intended to identify destinations such as cities or facilities.

Abbreviate or delete the words "street," “boulevard,” “avenue,” etc., as needed to conserve sign panel length unless doing so would cause confusion. For example, if two streets in an area have similar names, like Seminole Street and Seminole Avenue, do not abbreviate the roadway name.

When a cross street is known by its route number and local name, use the local name on overhead street name signs. Route markers (***FTP-212-25***) identify the route number along the route.

When a cross street has more than one local street name designation—for example, NW 31 Avenue and Martin Luther King, Jr. Boulevard—engineers may place both names on overhead street name signs. FDOT is responsible for the primary designation (i.e., the name shown on the ***Florida Official Transportation Map***). If a secondary designation is approved by local resolution, the local government is responsible for installing signs with the secondary designation.

When a cross street has a different name on each side of an intersection, include both names on the overhead street name sign. Use two signs: one on the left and one on the right side of the intersection. Some signal span designs necessitate a single sign with both names. In those cases, separate the names and add directional arrows, with the left name above the right.

There is no need to display block numbers when two street names with arrows are provided on a single panel.

2.2.3 INSTALLATION

The location of the overhead street name sign on a signal strain pole or mast arm may vary. However, it must not interfere in any way with the motorist's view of the signal heads.

(a) For static signs, the preferred installation is shown in the ***Standard Plans, Index 659-010***.

(b) For internally-illuminated signs, the preferred installation is shown in the ***Standard Plans, Index 700-050***.

When separate street names are on each side of the intersection, place one sign to the right of the centerline and signal heads and the other to the left.

2.2.4 SIGN DESIGN

Design overhead street name signs according to ***MUTCD Section 2D.45***.

The sign panel for overhead street name signs is 24 inches high. The legend determines the width. An example of this design is shown in ***Figure 2.2-1***.

Block or house numbers may be used as a supplemental legend on a overhead street name sign to help emergency responders and motorists locate addresses, per ***MUTCD***. There is no need to display block numbers when two street names with arrows appear on a single panel.

Use at least 8-inch uppercase and 6-inch lowercase lettering for the street name, and 6-inch all-uppercase lettering for the block numbering text on the second line. Use Series E Modified font. Series E font may also be used to accommodate the legend if needed. An example of this design is shown in ***Figure 2.2-2***.

When structurally possible, design overhead street name signs in accordance with at least 12-inch uppercase and 9-inch lowercase lettering to comply with Federal Highway Administration (FHWA) recommendations for older motorists (***MUTCD Table 2D.6***) and Recommendation I-J-2 of the ***FHWA Design Handbook for Older Drivers and Pedestrians***.

Where sign panel dimensions, structural constraints, or the display of multiple street names limit these letter heights, use the largest practical lettering and font that can be accommodated while maintaining sign legibility and conforming to standard sign panel dimensions.

Use internally-illuminated signs whenever possible to improve nighttime visibility and benefit older motorists. Use devices from ***FDOT's Approved Products List (APL)*** and design them with white lettering and a white border (if used) on a green background.

Design overhead street name signs using standard panels with a white message and border on a green background. If not using internally-illuminated overhead street name signs, use high-intensity sheeting for added visibility at night.

If sign panels are visible from opposite approaches, make them double-sided so they are visible from both sides of each intersection approach.

Figure 2.2-1. Overhead Street Name Sign



Figure 2.2-2. Overhead Street Name Sign with Block Numbers



SECTION 2.3
SIGNS AND MARKINGS AT UNSIGNALIZED INTERSECTIONS ON DIVIDED HIGHWAYS

2.3.1 PURPOSE

This section offers guidance on the placement of *MOVEMENT LANE CONTROL* signs (***FTP-034-25*** and ***FTP-034A-25***) and *MANDATORY MOVEMENT LANE CONTROL* signs (***R3-7***) at unsignalized intersections.

FDOT's standards for signs and markings at unsignalized intersections on divided highways are shown in the ***FDOT Design Manual (FDM) 230*** and the ***Standard Plans, Index 711-001***.

2.3.2 MINOR STREET SINGLE LANE APPROACH

Install a post-mounted *INTERSECTION LANE CONTROL* sign (***FTP-034-25***) below the stop sign at driveways and side street connections where a turning movement is mandatory. Install the *INTERSECTION LANE CONTROL* sign (***FTP-034-25***) at intersections where increased emphasis, improved recognition, or increased legibility is needed, as determined by engineering judgment or study (speed, volume, crash frequency, or other factors).

2.3.3 MINOR STREET MULTILANE APPROACH

Install a post-mounted *MANDATORY MOVEMENT LANE CONTROL* sign (***R3-7***) at driveways and side streets that have multilane approaches with a dedicated turn lane. Mount the sign below the stop sign or in advance of the intersection. See ***MUTCD Section 2B.28*** for additional information.

SECTION 2.4

SYMBOL SIGNS ON THE STATE HIGHWAY SYSTEM

2.4.1 PURPOSE

This section provides guidance on the use of symbol signs on the State Highway System. Symbol signs are easier for the public to recognize and understand. Use them instead of word message signs whenever possible. The ***MUTCD*** encourages their use as the primary advisory or warning sign. With Florida's large tourist population, the broader use of symbol signs is a desirable and important step toward greater traffic safety and smoother operations.

2.4.2 DEFINITIONS

Educational Plaque: A word message sign used with a new symbol sign to familiarize motorists with the symbol's meaning.

Symbol Sign: A sign used to regulate, warn, advise, or inform of an impending situation. A pictorial or graphical representation of the approaching situation or applicable information.

Word Message Sign: A sign used as an alternative to a symbol sign that describes an approaching situation or applicable information in words.

2.4.3 CONDITIONS FOR USE

Use a symbol sign, if available, where a regulatory, warning, or advisory sign is warranted to depict an approaching situation. A word message sign is generally less effective but, in some circumstances, is more appropriate. The ***DTOE*** maintains documentation of these exceptions in district files.

FDOT and FHWA must approve any proposed new symbol, as noted in ***MUTCD Section 1B.05***. Send all requests for a new symbol to the ***State Traffic Operations Engineer (STOE)*** for review and processing with FHWA.

When a sign with a new symbol is installed, consider including an educational plaque that explains the new symbol in words, as advised by ***MUTCD Section 2A.09***.

SECTION 2.5
DESTINATION-DISTANCE SIGNS AT RURAL INTERSTATE AND FREEWAY EXIT RAMP TERMINALS

2.5.1 PURPOSE

This section sets standards for consistent design and placement of *DESTINATION* (***D1*** series) and *DISTANCE* (***D2*** series) signs.

2.5.2 BACKGROUND

DESTINATION signs (***D1*** series) display a destination name and direction. *DISTANCE* signs (***D2*** series) indicate the distance to the destination shown on the sign. *DESTINATION* and *DISTANCE* signs are especially valuable to motorists unfamiliar with a particular area.

2.5.3 CONDITIONS FOR USE

Use combined *DESTINATION-DISTANCE* signs (***D1-1a***, ***D1-2a***, and ***D1-3a***) at exit ramp terminals on rural interstates and freeways in lieu of *DESTINATION* signs (***D1-1***).

Install the combined *DESTINATION-DISTANCE* sign (***D1-1a***, ***D1-2a***, and ***D1-3a***) facing only exiting traffic from rural interstate and freeway ramps.

Replace existing *DESTINATION* signs (***D1-1***) at exit ramp terminals with the combination *DESTINATION-DISTANCE* signs (***D1-1a***, ***D1-2a***, and ***D1-3a***) during routine sign replacement activities.

Determine the distance using the best information available. Measure it from the ramp terminal to a control point at the named destination. The Transportation Data and Analytics Office maintains control points for all Florida cities. These are listed on the official ***Florida Official Intercity Highway Mileage*** web page.

For destinations not on the Florida Official Intercity Highway Mileage web page, the district may define a control point, usually at the junction of two main routes in the urban area.

Show distance figures just after the destination name. When a sign must accommodate destinations in different directions, divide the destinations with a line, as shown in ***MUTCD Figure 2D-9***.

DESTINATION-DISTANCE signs (***D1-1a***, ***D1-2a***, and ***D1-3a***) display a white legend on a green background. Detail the signs individually in plans and specify numerals and uppercase letters at least 8 inches high and lowercase letters at least 6 inches high.

SECTION 2.6
BRIDGE SIGNS AND MARKINGS

2.6.1 PURPOSE

This section offers guidance on the placement of bridge signs and markings.

2.6.2 BRIDGE AND SIGN STRUCTURE LOW CLEARANCE SIGNS

Place a *LOW CLEARANCE* advance warning sign (***W12-2***) at the stopping sight distance of every bridge or structure with a minimum vertical clearance of 14 feet 6 inches or lower. In urban areas, where advance signs could be blocked by traffic or rendered ineffective by competing advertising signs, place the *LOW CLEARANCE* advance warning sign (***W12-2***) on the bridge beam or equivalent structure.

Place *LOW CLEARANCE* overhead warning signs (***W12-2a or W12-2b***) on the bridge beam or equivalent of every bridge or structure with a minimum vertical clearance of 13 feet 6 inches or less.

Consider using additional *LOW CLEARANCE* advance warning signs (***W12-2***) at upstream decision points.

Follow the criteria for *LOW CLEARANCE* advance warning signing in ***MUTCD Section 2C.25***.

2.6.3 BRIDGE PIER MARKING

Mark bridge piers only when they are not protected by a guardrail or barrier and are less than 30 feet from the near pavement edge.

Use a Type 3 object marker 12 x 36-inch panel with alternating black and yellow stripes sloping downward at a 45-degree angle toward the side of the pier traffic will be passing.

For additional emphasis, treat a large surface bridge pier with sheeting that has diagonal stripes at least 12 inches wide and is similar in design and application to the Type 3 object marker.

2.6.4 CROSSROAD NAME SIGNS ON OVERPASSES

Do not install crossroad name signs on overpass signs, except as requested by law enforcement agencies or emergency rescue organizations. This guidance includes

signs mounted on the bridge beam or on a post. When installed, crossroad name signs must display 10.67-inch Series E Modified lettering.

2.6.5 NARROW BRIDGE TREATMENT

Design signs and markings on narrow bridge approaches per the current edition of the ***Standard Plans, Index 700-106***.

2.6.6 GUIDE SIGNS ON OVERPASSES

See the ***Structures Manual, Volume 3, Section 2.6*** for limitations using bridge-mounted signs.

2.6.7 SWING-STYLE PEDESTRIAN GATE SIGNS ON MOVABLE BRIDGES

Mount a *NO PEDESTRIANS OR BICYCLES BEYOND GATE* sign (***FTP-036-25***) as shown in ***Figure 2.6-1*** to the front of each swing-style pedestrian gate on movable bridges. This is illustrated in the ***Structures Manual, Volume 1, Section 8.1.9***. Sign details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library***.

Figure 2.6-1. Swing-Style Pedestrian Gate Sign on Movable Bridges



SECTION 2.7

PLACE NAME SIGNS ON THE STATE HIGHWAY SYSTEM

This section has been rescinded since it is now included in the ***Florida Administrative Code, Rule Chapter 14-51, Part IV***.

SECTION 2.8

MOVE VEHICLES FROM TRAVEL LANES SIGN

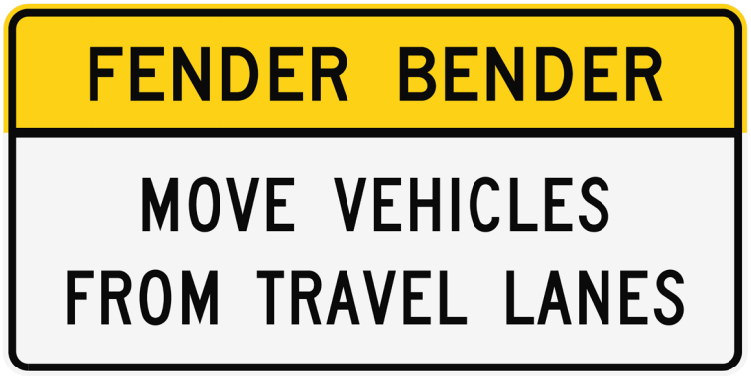
2.8.1 PURPOSE

This section guides the placement and design of the *MOVE VEHICLES FROM TRAVEL LANES* sign (***FTP-008-25***).

2.8.2 SIGN DESIGN

Use of the *MOVE VEHICLES FROM TRAVEL LANES* sign (***FTP-008-25***), shown in ***Figure 2.8-1***, is intended to encourage compliance with ***Section 316.061(2), F.S.***, which requires motorists involved in certain crashes to move vehicles from travel lanes when the vehicles can be safely driven or moved. Additional guidance on this sign type is provided in ***MUTCD Section 2B.70*** and Florida-specific sign details are available in ***FDOT's Sign Library***.

Figure 2.8-1. Move Vehicles from Travel Lane Sign



2.8.3 LOCATION AND PLACEMENT

Install a *MOVE VEHICLES FROM TRAVEL LANES* sign (***FTP-108-25***) on non-limited-access highways in urban areas when its use is expected to reduce queue lengths and delays, eliminate interference with traffic signal vehicle detectors, or enhance intersection capacity.

Place a *MOVE VEHICLES FROM TRAVEL LANES* sign (***FTP-108-25***) on the right side of limited-access highways, such as urban freeways, downstream from an entrance ramp when its use will improve motorist behavior related to unnecessary and unlawful constriction of freeway travel lanes due to traffic crashes.

MOVE VEHICLES FROM TRAVEL *LANES* sign details are available in ***FDOT's Sign Library***.

For permanent installations, specify a yellow retroreflective background for the *FENDER BENDER* enhancement.

Mounting heights and lateral clearances are specified in the ***Standard Plans, Index 700-101***. Use support systems that meet or exceed FDOT's frangibility standards. Meet or exceed the standards shown in ***Standard Specifications, Section 700*** for support systems.

SECTION 2.9
NO PASSING ZONE SIGNS

2.9.1 PURPOSE

This section guides placement and design for the use of *NO PASSING ZONE* pennant-shaped isosceles triangle signs (***W14-3***).

2.9.2 BACKGROUND

Use of the *NO PASSING ZONE* sign (***W14-3***) supports ***Section 316.0875, F.S.***

MUTCD Section 2C.53 establishes standards for installing *NO PASSING ZONE* signs (***W14-3***) on public roadways.

2.9.3 CONDITIONS FOR USE

Do not routinely install the *NO PASSING ZONE* sign (***W14-3***), shown in ***Figure 2.9-1***, at the beginning of all no passing zones.

Engineers may install the *NO PASSING ZONE* sign (***W14-3***) as a supplement to pavement markings that establish a no passing zone under the following circumstances:

(a) At locations, such as vertical or horizontal curves, where pavement markings indicating no passing zones are not visible far enough in advance to give motorists adequate warning.

(b) In other locations where an engineering study has determined such signs may enhance safety.

DTOEs must review and approve proposed uses of *NO PASSING ZONE* signs (***W14-3***) at locations meeting the above criteria prior to installation.

Figure 2.9-1. *NO PASSING ZONE* Pennant-Shaped Sign



SECTION 2.10
REST AREA PLAQUES

2.10.1 PURPOSE

This section guides the design and placement of supplemental rest area plaques.

2.10.2 PHYSICAL CHARACTERISTICS

The *VENDING MACHINES* plaque (***FTP-408-25***) and *VENDING FREE COFFEE* plaque (***FTP-410-25***) are 78 x 36 inches with two lines of legend in 8-inch Series D lettering. The legend and border are white on a blue background.

The SAFETY BREAK plaque (***FTP-411-25***) and *MACHINES* plaque (***FTP-412-25***) are 78 x 15 inches with one line of legend in 8-inch Series D lettering. The legend and border are white on a blue background.

Sign details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library***.

2.10.3 PLACEMENT

Append these plaques at the bottom and between the supports of *REST AREA* advance signs (***D5-1 series***). Do not impair the sign's breakaway characteristics with its placement.

At some rest areas, these plaques are designed into a sign with a flip panel that reveals the message when a safety break is in effect.

SECTION 2.11
BICYCLE SIGNS

2.11.1 PURPOSE

This section provides guidance on using bicycle signs when a documented need exists. The objective of using bicycle signs is to improve motorist awareness of people biking on state roadways.

2.11.2 GENERAL

MUTCD Chapters 9B, 9C, and 9D and ***Section 2C.54*** establish the standards for bicycle signs installed on public roadways. Review and consider the ***MUTCD*** when evaluating bicycle sign requests.

The use of bicycle signs as a warning is shown in ***MUTCD Section 9C.04*** and ***Section 2C.54***. The use of bicycle signs for regulatory purposes is shown in ***MUTCD Chapter 9B***.

The District Bicycle/Pedestrian Coordinator and District Bicycle/Pedestrian Safety Specialist provide recommendations for all bicycle sign requests and consider the following conditions in their review:

(a) Context classification

(b) Land use

(c) Volumes

(d) Crash data

(e) Geometric criteria

Mounting heights and lateral clearances are specified in the ***Standard Plans, Index 700-101***. Use support systems that meet or exceed FDOT's frangibility standards. Meet or exceed the standards shown in ***Standard Specifications, Section 700*** for support systems.

2.11.3 *BICYCLES ALLOWED USE OF FULL LANE* SIGN

Use the *BICYCLES ALLOWED USE OF FULL LANE* sign (***R9-20***) where it is important to inform motorists that bicyclists might occupy the full travel lane—for example, where commuter bicyclists are common motorists. The *BICYCLES ALLOWED USE OF FULL LANE* sign (***R9-20***) may be installed on roadways when a shared-lane marking (***Standard Plans, Index 711-002***) is present or when all of the following conditions exist:

(a) Travel lanes are less than 14 feet wide.

(b) A bicycle lane is not present.

(c) A rideable paved shoulder may be present but is narrower than 4 feet.

A shared-lane marking is not required for the use of the *BICYCLES ALLOWED USE OF FULL LANE* sign (***R9-20***).

Submit requests to install *BICYCLES ALLOWED USE OF FULL LANE* signs (***R9-20***) on multilane roadways to the ***DTOE***.

2.11.4 *BICYCLE PASSING CLEARANCE* SIGN

Florida Statute 316.083 requires motor vehicles to pass bicycles at a safe distance of not less than 3 feet. The *BICYCLE PASSING CLEARANCE* sign (***R4-19***) with a *FLORIDA LAW* plaque (***FTP-037-25***) reminds motorists of the law (***Figure 2.11-1***).

Install the *BICYCLE PASSING CLEARANCE* sign (***R4-19***) with a *FLORIDA LAW* plaque (***FTP-037-25***) on roadways with the following characteristics:

(a) There is a designated bicycle route.

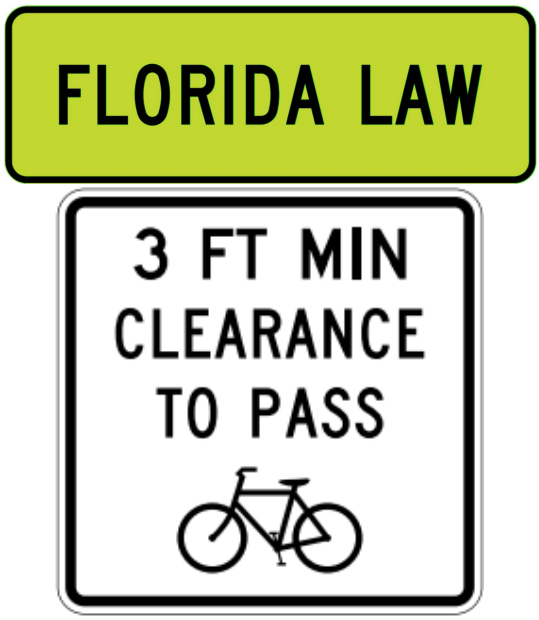
(b) *BICYCLES ALLOWED USE OF FULL LANE* (***R9-20***) signs are installed.

Install the *BICYCLE PASSING CLEARANCE* sign (***R4-19***) where there is a documented history of crashes or near misses. Documented history can include citizen complaints, field observations, or crash records.

Place the *BICYCLE PASSING CLEARANCE* sign (***R4-19***) where it does not interfere with the visibility of other regulatory or warning signs.

Plaque details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library***.

Figure 2.11-1. BICYCLE PASSING CLEARANCE Sign



SECTION 2.12
RECYCLING COLLECTION CENTER SIGNS

2.12.1 PURPOSE

This section guides the design, location, and placement of *RECYCLING CENTER* signs (***FTP-607-25*** and ***FTP-608-25***).

2.12.2 DEFINITION

Recycling Collection Center: A facility open full-time to the general public that collects items for recycling, e.g., oil, aluminum, batteries, etc. The facility may operate as part of a recycling plant or as a collection center for distributing these items to a recycling center elsewhere.

2.12.3 SIGN DESIGN

The *RECYCLING COLLECTION CENTER* sign (***FTP-607-25****)* is 42 x 60 inches with white text and border on a green background. The lettering is 4 inches high, in Series C font.

The *RECYCLING COLLECTION CENTER (WITH MUNICIPALITY NAME)* sign *(**FTP-608-25**)* is 42 x 66 inches with white text and border on a green background. Lettering is 4 inches high, Series C font.

Sign details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library***. Attach a directional arrow (***M6 Series***) below the sign panel if desired.

2.12.4 SIGN INSTALLATION

Local governments must submit sign requests to the appropriate District Traffic Operations Office for review and approval.

Mounting heights and lateral clearances are specified in the ***Standard Plans, Index 700-101***. Use support systems that meet or exceed FDOT’s frangibility standards. Meet or exceed the standards shown in ***Standard Specifications, Section 700*** for support systems.

Do not place a *RECYCLING COLLECTION* sign (***FTP-607-25***) or a *RECYCLING COLLECTION CENTER* sign (***FTP-608-25***) where it might obscure traffic control devices or otherwise compete for the motorist's attention—for example, next to a *STOP* sign.

SECTION 2.13
SAFETY BELT USE AND CHILD RESTRAINT LAW SIGNS

2.13.1 PURPOSE

This section establishes uniform criteria for installing safety belt use and child restraint law signs.

2.13.2 BACKGROUND

The Florida Safety Belt Law (***Section 316.614, F.S.***) requires state agencies to conduct a continuing safety and public awareness campaign and adopt programs that encourage motorist compliance with the safety belt law. This procedure establishes guidance for implementing signing that supports the statute's purpose.

2.13.3 OUT-OF-STATE ENTRY POINTS TO THE STATE HIGHWAY SYSTEM

Install and maintain signing at all State Highway System entry points to the State of Florida to inform motorists of the statutory requirement for safety belt use.

On limited-access highways, install a *FLORIDA SAFETY BELT AND CHILD RESTRAINT LAW* sign (***FTP-004A-25***) downstream of existing *WELCOME TO FLORIDA* signs (***FTP-404-25***) and speed limit signs.

On non-limited-access highways, install a *FLORIDA SAFETY BELT AND CHILD RESTRAINT LAW* sign (***FTP-004-25****)* downstream of existing *WELCOME TO FLORIDA* signs (***FTP-404-25***) and speed limit signs.

2.13.4 REST AREAS AND INTERSTATE WELCOME CENTERS

When an existing *BUCKLE UP* sign at a rest area or Welcome Center exit needs to be replaced, replace it with the *FLORIDA SAFETY BELT AND CHILD RESTRAINT LAW* sign (***FTP-004A-06***).

Install and maintain a *REST AREA SAFETY BELT LAW* sign (***FTP-006-25***), shown in ***Figure 2.13-1***, in all rest areas and Interstate Welcome Centers, informing motorists of the specific requirements of Florida's safety belt and child restraint laws. Place the sign in a prominent location where pedestrians can easily see it.

Figure 2.13-1. Florida Rest Area Safety Belt Law



2.13.5 OTHER LOCATIONS

The ***DTOE*** may grant permission for the *FLORIDA SAFETY BELT AND CHILD RESTRAINT LAW* sign (***FTP-004-25*** and ***FTP-004A-25***) to be posted at other locations on the State Highway System at locations where:

(a) There is documented evidence of a high crash count; or

(b) A high percentage of traffic is tourists or visitors; and

(c) The sign will not interfere with or detract from regulatory, guide, or warning signs, or other traffic control devices.

2.13.6 *BUCKLE UP IT'S THE LAW* SIGN

Use the *BUCKLE UP IT'S THE LAW* sign (***FTP-005-25*** and ***FTP-005A-25***) for general educational purposes.

On limited-access facilities at county lines, install the 36 x 48-inch *BUCKLE UP IT'S THE LAW* sign (***FTP-005A-25***). ***DTOEs*** may also install this sign where a documented need exists.

On non-limited-access highways and in urban areas, install the 24 x 30-inch *BUCKLE UP IT'S THE LAW* sign (***FTP-005-25***) where there is a documented need.

2.13.7 SIGN DESIGN

Sign details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library***.

Mounting heights and lateral clearances are specified in the ***Standard Plans, Index 700-101***. Use support systems that meet or exceed FDOT's frangibility standards. Meet or exceed the standards shown in ***Standard Specifications, Section 700*** for support systems.

2.13.8 SIGN AVAILABILITY

Maintenance may obtain new or replacement signs by requisition from the Lake City Sign Shop. Coordinate with the Sign Fabrication Shop Supervisor. For current contact information, visit ***fdot.gov/maintenance/staffdirectory.shtm***.

SECTION 2.14
EMERGENCY MANAGEMENT SIGNS

2.14.1 PURPOSE

This section establishes a uniform basis for installing and maintaining emergency management signs on the State Highway System.

2.14.2 BACKGROUND

The Florida Division of Emergency Management (FDEM) plans for natural and man-made disasters. It also prepares and implements a statewide Comprehensive Emergency Management Plan (CEMP). FDEM serves as the State's liaison with federal and local agencies for emergencies of all kinds. It offers local governments technical assistance as they prepare emergency plans and procedures.

The FDEM requested that FDOT install and maintain signs along official evacuation routes on the State Highway System to educate motorists about available routes. FDOT is responsible for sign placement to guide motorists away from high-risk areas. Evacuation Route and Zone Maps are available on the ***FDEM website***.

2.14.3 PROCEDURE

At the County Emergency Management Director's request, the ***DTOE*** initiates the district-level actions needed to implement these guidelines and sign evacuation routes properly and promptly. The district maintenance office will install and maintain the signs in the field.

The ***DTOE*** is responsible for informing the FDEM of subsequent signing changes or additions upon a local agency's request through FDOT's Emergency Coordination Officer.

2.14.4 EVACUATION ROUTE SIGN

Use the 36 x 36-inch *EVACUATION ROUTE* sign (***FTP-415A-25***) on limited-access facilities and the 24 x 24-inch *EVACUATION ROUTE* sign (***FTP-415-25***) on non-limited-access facilities.

Use a vertical arrow pointing upward, a horizontal arrow pointing left or right, or a bent arrow pointing left or right to provide advance warning of a turn. Sign details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library***.

2.14.4.1 Sign Use

Use the *EVACUATION ROUTE* sign (***FTP-415A-25***) exclusively along regional evacuation routes designated on the approved statewide regional evacuation route plans recorded by the FDEM.

Use *EVACUATION ROUTE* signs (***FTP-415-25***) to guide motorists along regional evacuation routes and away from potential high-risk areas. Comply with the applicable provisions in ***MUTCD Section 2N.03***.

2.14.4.2 Evacuation Route Sign Placement

Place an *EVACUATION ROUTE* sign (***FTP-415A-25***) 150 to 300 feet before and at any turn on an approved evacuation route. Place additional *EVACUATION ROUTE* signs (***FTP-415-25***) along the route as needed.

2.14.5 SIGN INSTALLATION

FDOT furnishes, installs, and maintains signs along official evacuation routes on the State Highway System.

Install signs only at locations reviewed and approved by the ***DTOE*** so they do not interfere with existing traffic control devices.

Place signs according to existing FDOT standards and consistent with ***MUTCD Section 2N.03***. Mounting heights and lateral clearances are specified in the ***Standard Plans, Index 700-101***. Use support systems that meet or exceed FDOT's frangibility standards. Meet or exceed the standards shown in ***Standard Specifications, Section 700*** for support systems.

2.14.6 *SHELTER AND TRAVELER INFORMATION* SIGN

The ***STOE*** addresses operational concerns about evacuation route signing and related operational needs within FDOT and with the FDEM.

The ***DTOE*** coordinates districtwide evacuation shelter signing efforts. If shelters or evacuation traveler information require signing, include sign use in the CEMP area's regional evacuation plan.

Develop evacuation plans with *SHELTER* signs ***(see Section 2.14.7)*** posted along highways at locations determined by a joint effort between the ***DTOE*** and local agencies.

Install signs under the following conditions:

- The shelter location is part of the regional plan.
- The local agency purchases the signs.
- The local agency takes responsibility for flipping signs to the appropriate position.

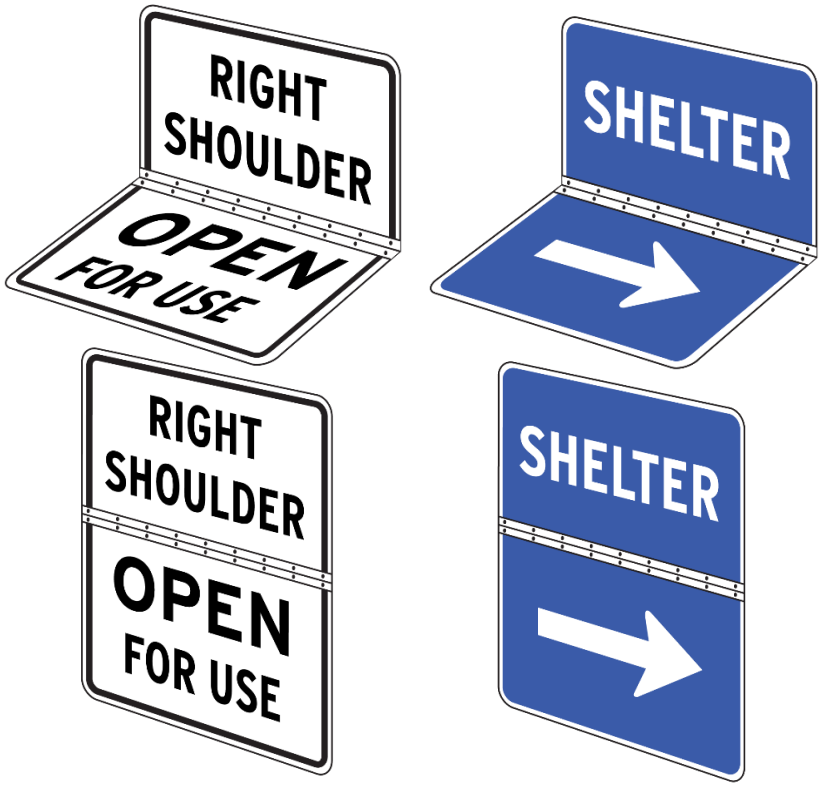
2.14.7 *SHELTER* SIGN DESIGN AND USE

Design *SHELTER* signs with a white background in accordance with ***MUTCD Section 2N.09***.

The ***DTOE*** determines the type of shelter signing support used on the State Highway System: portable (temporary) or permanent.

Shelter signs may be permanent or temporary. The permanent design uses a “flip-down” design, as shown in ***Figure 2.14-1***. This means the bottom panel flips down to reveal the shelter message or “Right Shoulder Open For Use” during Emergency Shoulder Use (ESU) operations. The sign is not a dual-purpose message sign, so maintain the undeployed sign face blank. The CEMP assigns responsibility for turning the flip-down signs during emergency conditions and back up when conditions return to normal.

Figure 2.14-1. Flip-Down Sign



2.14.8 *TRAVELER INFORMATION* SIGN DESIGN AND USE

Design the *TRAVELER INFORMATION* sign ***(D12 series)*** with a blue background and a white legend, as shown in ***Figure 2.14-2***, in accordance with ***MUTCD Standard Signs D12 series*** and ***MUTCD Section 2I.09***.

Figure 2.14-2. Traveler Information Sign



The CEMP may require evacuation information, local shelter information, and official traveler information stations. Local agencies may coordinate with FDOT through a written agreement to include the frequency for local radio stations that are official traveler information stations. This can be done with changeable message signs or by installing the *TRAVELER INFORMATION* sign ***(D-12 series)*** above the flip-down signs.

2.14.9 CONTINUOUS HINGE REQUIREMENTS

See ***Standard Plans, Index 700-010*** for continuous hinge requirements.

2.14.10 *RADIO FREQUENCY INFORMATION* SIGN

FDOT approved the addition of *RADIO FREQUENCY INFORMATION* (***FTP-422-25,*** ***FTP-422A-25,*** and ***FTP-422B-25***) signs along evacuation routes on the State Highway System as an important communication link for public safety during evacuation. These signs were added when Florida Public Radio Stations volunteered to partner with other State and local agencies in the State's evacuation efforts.

2.14.10.1 Sign Design

Design the *RADIO FREQUENCY INFORMATION* sign (***FTP-422-25***, ***FTP-422A-25,*** and ***FTP-422B-25***) with a blue background and a white legend in accordance with the ***MUTCD Standard Signs D12 series*** and ***MUTCD Section 2I.09***.

2.14.10.2 Sign Placement

Place the *RADIO FREQUENCY INFORMATION* sign (***FTP-422-25***, ***FTP-422A-25,*** and ***FTP-422B-25***), shown in ***Figure 2.14-3***, along the following qualifying links:

- All limited-access facilities designated as evacuation routes.
- Principal non-limited-access facilities where limited-access facilities are not the main evacuation routes.
- Principal non-limited-access facilities that are critical links leading to limited-access facilities.

On limited-access facilities, use an *EVACUATION ROUTE* sign (***FTP-415A-25***) and a 42 x 30-inch *RADIO FREQUENCY INFORMATION* sign (***FTP-422B-25***). Use the 36 x 24-inch *RADIO FREQUENCY INFORMATION* sign (***FTP-422A-25***) at locations with sign placement limitations.

On State Highway System non-limited-access facilities, use an *EVACUATION ROUTE* sign (***FTP-415-25***). Attach a 24 x 18-inch *RADIO FREQUENCY INFORMATION* sign (***FTP-422-25***) to the existing sign assembly.

Sign details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library***.

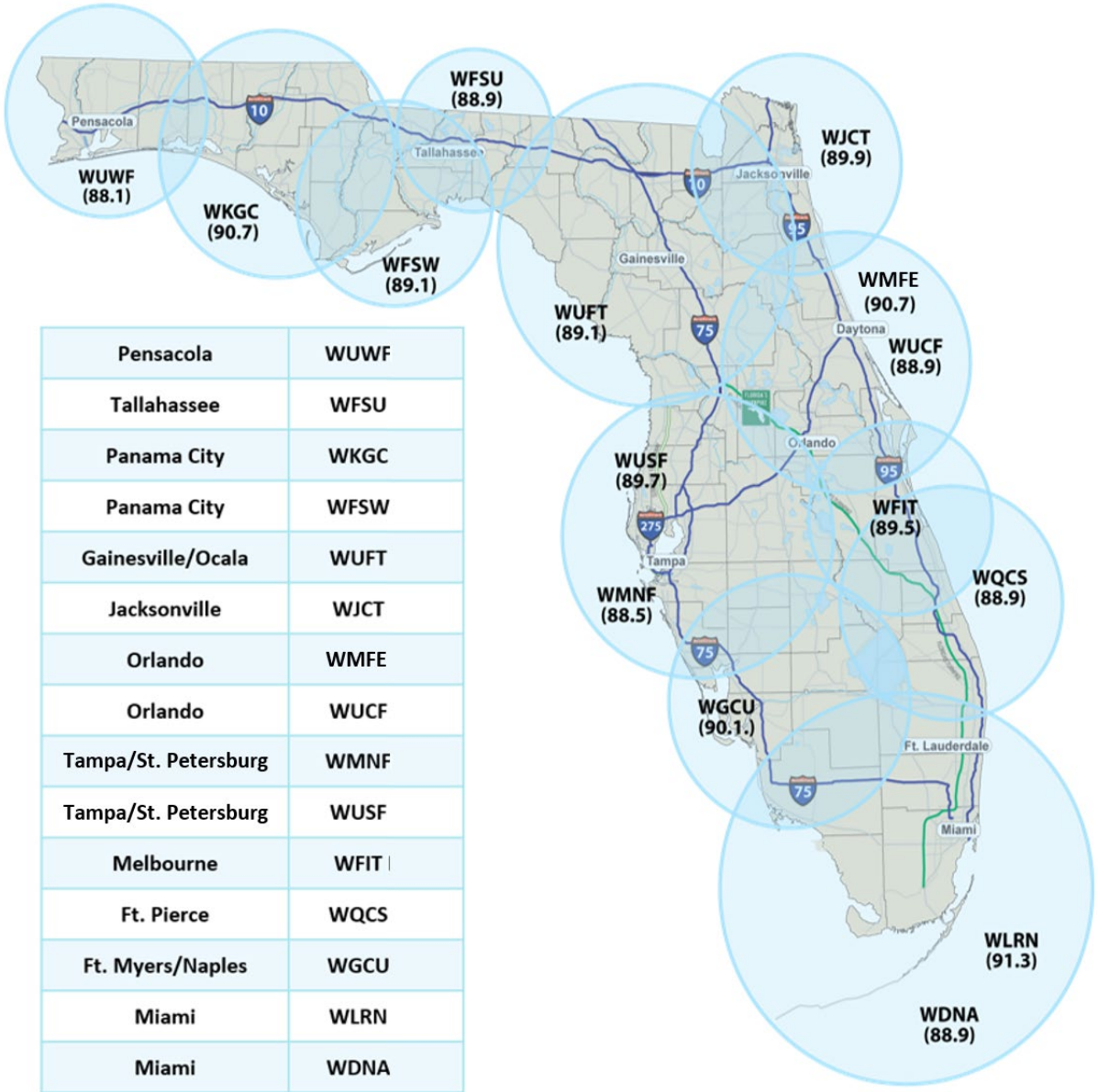
Position these sign assemblies near county lines where radio coverage is present and where radio frequency coverage changes. In areas of overlap, modify the *RADIO FREQUENCY INFORMATION* sign (***FTP-422-25***, ***FTP-422A-25***, and ***FTP-422B-25***) as appropriate to reflect the frequency motorists are driving into. The beginning and termination points of qualifying links are additional locations to consider for sign placement.

When long segments occur, on both limited-access and non-limited-access facilities, install confirmation *RADIO FREQUENCY INFORMATION* signs (***FTP-422-25***, ***FTP-422A-25***, and ***FTP-422B-25***) at 10-mile intervals. ***Figure 2.14-4*** represents the general statewide radio coverage area for this program.

Figure 2.14-3. Radio Frequency Information Sign



Figure 2.14-4. FM Radio Coverage Area



Pensacola	WUWF
Tallahassee	WFSU
Panama City	WKGC
Panama City	WFSW
Gainesville/Ocala	WUFT
Jacksonville	WJCT
Orlando	WMFE
Orlando	WUCF
Tampa/St. Petersburg	WMNF
Tampa/St. Petersburg	WUSF
Melbourne	WFIT
Ft. Pierce	WQCS
Ft. Myers/Naples	WGCU
Miami	WLRN
Miami	WDNA

Note: WXEL-FM call letters have changed to WPBI-FM
WFIT-FM has been added to the Florida Public Broadcasting network.

2.14.10.3 Sign Installation

DTOEs determine the locations for *RADIO FREQUENCY INFORMATION* signs (***FTP-422-25***, ***FTP-422A-25***, and ***FTP-422B-25***). Prepare work orders for installation using the district maintenance office's usual procedures. See ***Standard Plans, Index 700-101*** for mounting heights and lateral clearances.

In some cases, attaching an additional panel to an existing sign may result in a mounting height less than the standard 7 feet. On rural arterials and collectors, mount the secondary sign at least 5 feet above the traveled way. In urban areas with pedestrians, modify the support to maintain the required height.

SECTION 2.15
SMOKE ON HIGHWAY SIGNS

2.15.1 PURPOSE

This section provides guidance for the use of smoke- and fire-related warning signs on the State Highway System. Select a sign based on the condition being communicated to motorists.

The *REDUCE SPEED SMOKE AHEAD* (***TTC-019-25*** and ***TTC-019A-25***) signs are temporary traffic control devices used when smoke is affecting or is expected to affect roadway visibility and create a traffic hazard.

The *PRESCRIBED BURN AHEAD* (***FTP-207-25*** and ***FTP-207A-25***) signs provide advance notice of a planned prescribed burn operation that may produce smoke near the roadway.

The FIRE SMOKE AREA (***FTP-208-25*** and ***FTP-208A-25***) signs warn motorists that they are entering an area where smoke from wildfires may be encountered.

The Florida Department of Agriculture and Consumer Services (FDACS) Florida Forest Service (FFS) and Florida Highway Patrol (FHP) developed a cooperative agreement for response to and management of smoke intrusion on Florida highways, detailing a cooperative policy and process to warn and advise travelers about roadway visibility conditions resulting from wildfires and prescribed burns.

In the case of wildfires or controlled burns under prescribed conditions, the FDACS FFS is most knowledgeable about smoke conditions.

The use of temporary traffic control devices for incident management is addressed in ***MUTCD Chapter 6O***.

2.15.2 TEMPORARY *REDUCE SPEED SMOKE AHEAD* SIGN

Use the *REDUCE SPEED SMOKE AHEAD* (***TTC-019-25*** and ***TTC-019A-25***) signs, shown in ***Figure 2.15-1*** for incident management when smoke is affecting, or is expected to affect roadway visibility to the extent that temporary traffic control measures are warranted. The sign is not intended to provide advance notice of a prescribed burn or to identify areas where smoke may be encountered.

FDOT supplies temporary incident management signs for use during fire and smoke emergencies as needed.

FDOT has the authority to place the signs. FFS is authorized but has no duty to place the signs to warn motorists of an existing smoke hazard.

FFS will notify FHP whenever FFS has knowledge that smoke may impact traffic on the State Highway System. FDOT and FFS will assist when requested by FHP.

FFS will coordinate the removal of these signs with FHP or FDOT.

The signs and support hardware must comply with FDOT standards. Sign details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library***.

Figure 2.15-1. *REDUCE SPEED SMOKE AHEAD* Signs



2.15.3 *PRESCRIBED BURN AHEAD* SIGN

Consider using the PRESCRIBED BURN AHEAD (***FTP-207-25*** and ***FTP-207A-25***) signs, shown in ***Figure 2.15-2***, to provide advance notice of a scheduled prescribed burn operation near a roadway. These signs may be used regardless of whether smoke affects roadway visibility.

Prescribed burns are pre-planned and approved through the FFS authorization process.

These signs are optional and must be removed when prescribed burn activities are completed. The prescribed fire practitioner planning and executing the burn may supply, install, and remove precautionary warning signs on non-limited-access roadways. Prescribed fire practitioners require written approval from FDOT to place these signs on limited-access public roadways.

The signs and support hardware must comply with FDOT standards. Sign details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library***.

Choose sign materials that comply with the current edition of the ***Standard Specifications, Section 994***.

Mount signs in accordance with the current edition of the ***Standard Plans, Index 102-600***.

Adhere to mounting heights and lateral clearances specified in the current edition of the ***Standard Plans, Index 700-101***:

- Case II (rural locations): Sign edge 12-foot minimum from driving lane edge
- Case V (urban locations): Sign edge 2-foot minimum from curb face

Figure 2.15-2. *PRESCRIBED BURN AHEAD* Signs



2.15.4 *FIRE SMOKE AREA* SIGN

Consider using the *FIRE SMOKE AREA* (***FTP-208-25*** and ***FTP-208A-25***) signs, shown in ***Figure 2.15-3***, to warn motorists that smoke from wildfires may be encountered ahead. These signs communicate that visibility may be intermittently reduced.

Do not use this sign when incident management measures are warranted. The sign is not intended to provide advance notice of a specific prescribed burn activity or to serve as a temporary traffic control device when smoke creates an active visibility hazard. When smoke from a prescribed burn warrants temporary traffic control measures, use the *REDUCE SPEED SMOKE AHEAD* (***TTC-019-25*** and ***TTC-019A-25***) sign in accordance with ***TEM Section 2.15.2***.

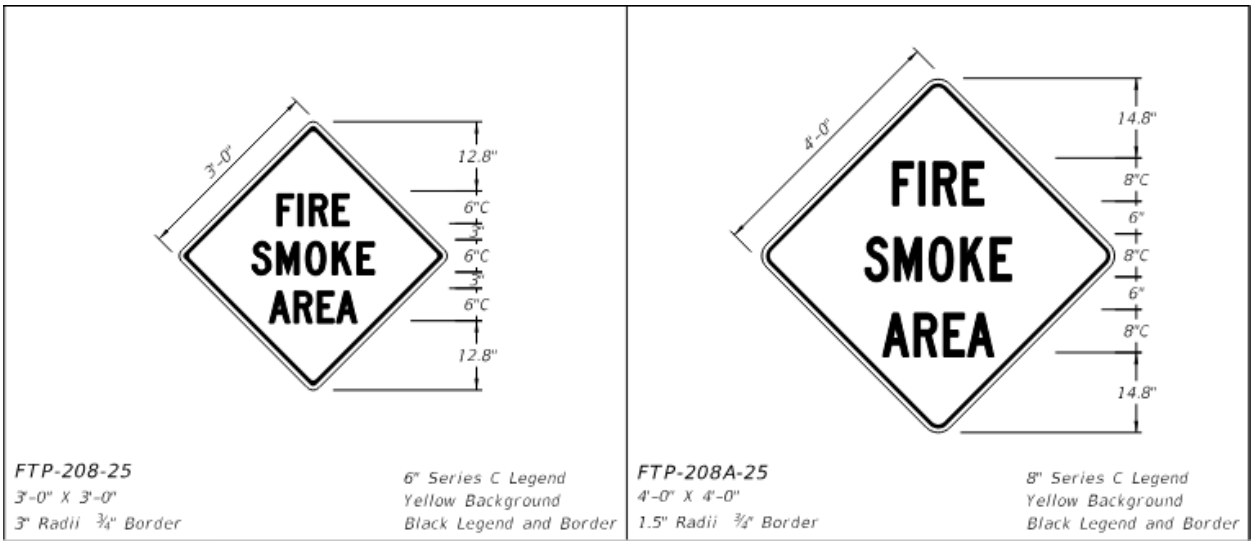
The signs and support hardware must comply with FDOT standards. Sign details are available in the ***Standard Plans, Index 700-102***.

Choose sign materials that comply with the current edition of the ***Standard Specifications, Section 994***.

Mount signs in accordance with the current edition of the ***Standard Plans, Index 102-600***.

Adhere to mounting heights and lateral clearances specified in the current edition of the ***Standard Plans, Index 700-101***.

Figure 2.15-3. *FIRE SMOKE AREA* Signs



SECTION 2.16

SUPPLEMENTAL GUIDE AND MOTORIST SERVICES SIGNS

This section has been rescinded since it was adopted as Florida's Highway Guide Sign Program in ***Rule 14-51, F.A.C.***

SECTION 2.17

EMERGENCY HIGHWAY TRAFFIC PLAN

This section has been rescinded and replaced with the ***Emergency Management Program (Topic Number 956-030-001)***, sponsored by the Emergency Management Office.

SECTION 2.18

*FHP HIGHWAY ASSISTANCE PROGRAM SIGNS

2.18.1 PURPOSE

This section sets standards for the use of Florida Highway Patrol (FHP) signs. *FHP (347) Highway Assistance Program is a statewide program that allows motorists to use their cellular phones to report highway-related information to the FHP or summon roadside assistance in a Road Ranger service area. **FHP* signs (***FTP-413-25***) are posted to inform motorists of the phone number. The signing program extends to all Interstate, Toll, U.S. Routes, and other major roadways on the State Highway System.

2.18.2 SIGN LOCATION

Install these signs where cellular service is available. Service is available in all Florida counties, but some areas are not covered.

2.18.3 SIGN DESIGN AND INSTALLATION

The **FHP* sign (***FTP-413-25***) has a white legend on blue background. Sign details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library***.

The **FHP* sign shows the numbers associated with the letters “FHP” (347) to enable quicker calls. Use this sign design for all installations and sign replacements.

Adhere to mounting heights and lateral clearances specified in the ***Standard Plans, Index 700-101***. Select support systems that meet or exceed FDOT standards of frangibility. The ***District Traffic Operations Offices*** use the following guidelines to determine specific sign placement details.

Table 2.18-1. *FHP Sign Placement Guidelines

Facility Type	Location	Frequency	Placement
Limited-Access	At state and county lines	30-mile intervals	Following major freeway-to-freeway interchanges
Major Arterial	At state and county lines	30-mile intervals	Downstream from junctions between major SHS facilities

SECTION 2.19
MOTORCYCLES USE CAUTION SIGNS

2.19.1 PURPOSE

This section guides the use, design, and installation of *MOTORCYCLES USE CAUTION* signs in both permanent (***FTP-206-25***, ***FTP-206A-25***, and ***FTP-206B-25***) and temporary (***TTC-020-25***, ***TTC-020A-25***, and ***TTC-020B-25***) traffic control settings.

The sign alerts all motorists to roadway conditions or work zone hazards that may pose increased risk to motorcyclists.

2.19.2 BACKGROUND

The *MOTORCYCLES USE CAUTION* sign is a Florida-specific word message sign that supplements ***MUTCD*** guidance. ***MUTCD Sections 2A.06 and 6F.02*** permit the use of word message signs for conditions not addressed by existing symbols when supported by engineering judgment. These signs are intended for conditions that present a heightened risk to motorcyclists beyond the warning given by standard hazard signs.

2.19.3 CONDITIONS FOR USE

Permanent/Warning Conditions

Install the *MOTORCYCLES USE CAUTION* sign (***FTP-206-25***, ***FTP-206A-25***, ***FTP-206B-25***) in advance of locations with permanent conditions to reduce motorcyclist risks. Such conditions include, but are not limited to:

- Metal grates on bridges
- Unsigned or unexpected surface condition changes
- Locations where motorcycle crashes are more likely to occur (e.g., horizontal or vertical curves, high-friction-demand sites)

Temporary Traffic Control (TTC)

Use the *MOTORCYCLES USE CAUTION* sign (***TTC-020-25***, ***TTC-020A-25***, ***TTC-020B-25***) in advance of temporary hazards to reduce motorcyclist risks in work zones. Such hazards include, but are not limited to:

- Loose material on the roadway
- Linear/longitudinal pavement cuts (utility work, lane rerouting, lane edge milling)

- Metal plates
- Slippery or wet conditions
- Chicaning traffic patterns or other temporary alignments

Remove TTC signs after the hazard or work operation ceases. Do not leave motorcyclist warning signs in place when there is no longer a hazard or motorists could become desensitized to them.

2.19.4 SIGN DESIGN

MOTORCYCLES USE CAUTION signs, whether for permanent or temporary traffic control conditions, have black text and a border and can be installed in three sizes (18 x 18, 36 x 36, or 48 x 48).

However, the permanent *MOTORCYCLES USE CAUTION* signs (***FTP-206-25***, ***FTP-206A-25***, ***FTP-206B-25***) have a yellow background.

The temporary *MOTORCYCLES USE CAUTION* signs (***TTC-020-25***, ***TTC-020A-25***, ***TTC-020B-25***) have an orange background.

Sign details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library***.

2.19.5 PLACEMENT AND INSTALLATION

Mount the sign on the right-hand side of the roadway unless conditions justify supplemental placement. Place the sign far enough in advance of the hazard to allow adequate reaction time for motorcyclists, using spacing from ***MUTCD Part 2C*** and ***MUTCD Part 6*** (advance warning sign spacing).

Use supplemental plaques (e.g., "*NEXT XX FEET*") where the hazard extends for some distance. Repeat the sign if needed after intersections or over long approach distances.

Mounting heights and lateral clearances are specified in the ***Standard Plans, Index 700-101***. Use support systems that meet or exceed FDOT's frangibility standards. Meet or exceed the standards shown in ***Standard Specifications, Section 700*** for support systems.

SECTION 2.20

CALL BOX/MILE MARKER SIGNS

This section has been rescinded in accordance with the Department's ***DME Memo 13-05***, Call Box Removal Plan. Information on the use of reference markers can be found in ***TEM Section 2.28***.

SECTION 2.21
FLORIDA LITTER LAW SIGNS

2.21.1 PURPOSE

This section guides the use of the *FLORIDA LITTER LAW* sign (***FTP-015-25*** or ***FTP-015A-25***), in compliance with ***Section 403.413(4), F.S***.

2.21.2 SIGN DESIGN AND PLACEMENT

Install the *FLORIDA LITTER LAW* sign (***FTP-015-25*** or ***FTP-015A-25***), shown in ***Figure 2.21-1*** on interstate off-ramps as required by ***Section 403.4131(2), F.S.*** Install these signs a minimum of 100 feet in advance of the first motorist services sign, or a minimum of 100 feet in advance of directional signs on off-ramps without motorist service signs.

Figure 2.21-1. *FLORIDA LITTER LAW* Sign



At off-ramps, install the 30 x 36-inch *FLORIDA LITTER LAW* sign (***FTP-015-25***) with a white background and black legend.

On interstate stretches where littering is a concern, districts may install the 42 x 48-inch *FLORIDA LITTER LAW* sign (***FTP-015A-25***) with a white background and black legend.

Sign details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library***.

2.21.3 SIGN INSTALLATION

The District Maintenance Office coordinates with the Sign Shop and installs the *FLORIDA LITTER LAW* sign once the District Traffic Operations Office confirms the need for these signs.

Adhere to the mounting heights and lateral clearances specified in the ***Standard Plans, Index 700-101*** and select support systems that meet or exceed FDOT frangibility standards .

Local government may request to install the *FLORIDA LITTER LAW* sign (***FTP-015-25*** or ***FTP-015A-25***) on the State Highway System through FDOT's permit process.

SECTION 2.22

FUTURE SECTION

SECTION 2.23
FLORIDA'S TURNPIKE AND TOLL ROAD NUMBERING AND SIGNING PROGRAM SIGNS

2.23.1 PURPOSE

This section establishes standards for systematic numbering and signing of Florida's toll road system.

2.23.2 BACKGROUND

Florida's toll road system was originally made up of a complex network of locally-developed expressways and the Florida Turnpike in accordance with ***Section 338.01, F.S.*** Local expressway authorities developed toll roads to serve regional needs, seldom extending service into adjacent counties. The expressway authorities developed a sense of community ownership for the toll roads and gave them locally pleasing names. They are still best known by these names even though they now have assigned state road numbers.

FDOT uses a systems approach when connecting with other roadway systems. These include local streets, county roads, state system routes, and other limited-access facilities. An integral part of this interconnected system is the road numbering and signing program.

2.23.3 SIGN DESIGN

For guide sign needs and the use of regulatory and warning signs, the toll system functions as an access-controlled roadway with corresponding criteria for clear zones, letter height, sign placement, and other items (see ***MUTCD Section 2E.02***). Toll road signing is purposely kept simple, using large lettering and concise messages motorists can comprehend and act on while traveling at high speeds.

Use supplemental guide signs for traffic generators as directed by ***Rule 14-51.020, F.A.C.***

2.23.4 ROAD NUMBERING PROGRAM

As the toll system has expanded, identifying toll roads only by local names has become confusing for tourists and other motorists unfamiliar with the area. Where one expressway joins another, a roadway's route name can suddenly change. Similar to

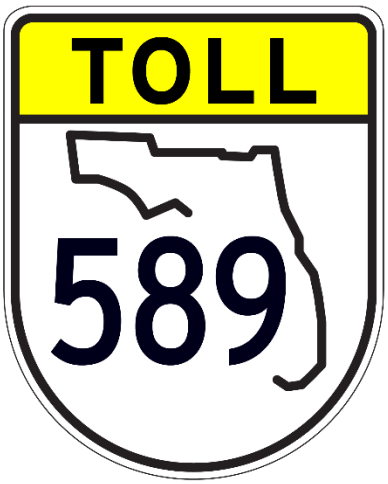
interstate routes, U.S. routes, and other state highways, using a route numbering system prevents confusion.

Retain local names and logos for identification and a local sense of ownership. Motorists unfamiliar with the local system rely on the consistent numbering system to navigate the statewide facilities.

The statewide numbering system is consistent for all state and county roads. In most cases, toll roads adopt the existing state road numbers. For new toll roads, the Transportation Data and Analytics Office assigns a number consistent with the official numbering program. In cases where future facilities complete a loop or beltway, connecting a series of shorter toll road segments, a single road number is retained, often requiring a change of road numbers on older links.

Toll routes are identified by a toll route marker sign (***FTP-611-25, FTP-611A-25, FTP-611B-25***), shown in ***Figure 2.23-1***, depicting the route number on a unique sign shape. This sign resembles an interstate shield and is part of the trailblaze assembly. The toll route marker indicates a roadway's membership in the statewide toll system and provides a consistent method of identification throughout the state.

Figure 2.23-1. Toll Route Marker Sign



2.23.5 SIGNING PROGRAM

The toll route marker sign (***Figure 2.23-1***) is available in three sizes, depending on the application. Sign details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library***.

Mainline Application: Use a 48 x 60-inch toll route marker sign (***FTP-611B-25***). Post this sign in view of motorists leaving the toll plaza to confirm the route and periodically

along the mainline. Use trailblazing confirmation assemblies beyond junctions with numbered routes.

A combination of route number signs and expressway names or logos may be used to maintain the toll road's local identity and aid local area motorists, but the principal identification is the toll route marker sign (***FTP-611B-25***). The local toll road name or logo may be installed on a confirmation guide sign downstream from the mainline toll plazas. Logo panels, if used, are furnished by the local expressway authority. Local name or logo signs are for identification purposes only. Do not use only the local toll road name or logo in guide signing, direction signing, or trailblazing to the facility.

Freeway-to-Freeway Interchange Application: Use the 40 x 48-inch toll route marker sign (***FTP-611A-25***) as both the advance guide sign and exit direction guide sign. This sign size is also available as an overlay. Apply it to other freeway-type guide signs and overhead direction sign applications. Local agencies may add the local toll road name or 36-inch logo panel as a guide or direction sign. Logo panels are furnished by the local expressway authority.

Toll Facility Differentiation from a Conventional Road: Use a 24 x 30-inch toll route marker sign (***FTP-611-25***) along state, county, or local roads with the appropriate cardinal direction information, directional arrows, and junctions. Local agencies may install the local toll road name or a 24-inch logo panel in conjunction with the toll route marker sign. The local expressway authority furnishes these logo panels.

2.23.6 TRAILBLAZE ASSEMBLY PLACEMENT

Trailblaze signing's purpose is to guide motorists. Consider the following guidelines as maximum distances to install trailblaze sign assemblies from a toll facility to parallel routes for rural and urban density development.

Rural density	5 miles
Urban density	2 miles

Use engineering judgment in locating these sign assemblies to avoid overloading the motorist with information and incurring unnecessary expenses. Acceptable locations are along major parallel routes and at the junction of roadways with exits on the toll road.

SECTION 2.24

CRIME WATCH SIGNS ON THE STATE HIGHWAY SYSTEM

2.24.1 PURPOSE

This section establishes guidelines to evaluate and respond to requests to install *CRIME WATCH* signs within the State Highway System. A *CRIME WATCH* sign is commonly used to identify a neighborhood, community, or other geographical area with a Crime Watch program.

CRIME WATCH signs are not official traffic control devices and are not governed by the ***MUTCD***. However, they do aid law enforcement and contribute to public safety.

2.24.2 REQUESTS FOR SIGNING

The ***DTOE*** reviews requests submitted by local government traffic engineering or law enforcement agencies for permission to install *CRIME WATCH* signs within the State Highway System. Refer other requests to the corresponding local governmental traffic engineering or law enforcement agencies.

2.24.3 SIGN LOCATIONS

The DTOE may approve *CRIME WATCH* signs along a state highway only in the vicinity of residential or commercial development directly and exclusively accessed from the state highway.

Exercise judgment in reviewing signing strategies with respect to the spacing of successive signs. For example, on highways passing through isolated small rural or suburban communities, single signs at the community limits may be appropriate. In heavily developed areas, moderately spaced additional signs may be needed.

Do not block the view of existing traffic control devices or place *CRIME WATCH* signs where they might otherwise compete for the motorists' attention.

2.24.4 SIGN DESIGN AND PLACEMENT

Since *CRIME WATCH* signs do not control traffic, FDOT does not design or establish standards for them. However, the ***DTOE*** reviews sign designs proposed for use on the State Highway System. FDOT does not approve the installation of *CRIME WATCH* signs resembling ***MUTCD***-established signage or that motorists may misunderstand or find confusing.

Design signs to be simple, devoid of advertising, and legible under anticipated environmental conditions, both day and night.

Adhere to the mounting heights and lateral clearances specified in the ***Standard Plans, Index 700-101*** and meet or exceed FDOT standards of frangibility for support systems.

Do not affix *CRIME WATCH* signs to any sign support maintained by FDOT.

2.24.5 INSTALLATION AND MAINTENANCE

A local governmental agency must assume full responsibility for the installation and maintenance of *CRIME WATCH* signs permitted by FDOT for installation on the State Highway System.

FDOT reserves the right to remove any *CRIME WATCH* signs that do not conform to these instructions or are not properly installed or maintained.

2.24.6 SPECIAL CONSIDERATIONS

Discuss unusual requests, designs, or problems associated with *CRIME WATCH* signs on the State Highway System with the DTOE, who will coordinate with the ***STOE*** prior to permitting.

SECTION 2.25

DISTANCE SIGNING FOR NON-LIMITED-ACCESS HIGHWAYS

2.25.1 PURPOSE

This section establishes a consistent distance signage system for all non-limited-access highways in accordance with ***MUTCD Sections 2D.35, 2D.43, and 2D.44***.

2.25.2 PROCESS

Distance signs are intended to provide route guidance using communities, significant geographic locations, route junctions, and control cities on non-limited-access highways.

The statewide distance signing system is not intended to identify tourist attractions, recreational destinations, individual facilities, businesses, or other special-interest destinations.

Distance signing on non-limited-access highways is implemented through normal construction projects. The ***DTOE*** oversees and approves corridor distance signage plan development for inclusion into existing work program projects. FDOT does not require or desire stand-alone distance signage projects.

2.25.3 SIGN DESIGN

Include the names of up to three cities, towns, significant geographic locations, routes, or communities on distance signs, and the distance (to the nearest mile) to those places.

At the top, list the next place on the route having a post office or railroad station; a route number (name) of an intersecting highway; or another significant geographic location.

Name a community along the route or an important route junction as the middle destination. This name may be varied on successive distance signs to give motorists maximum information concerning communities along the route to the next control city.

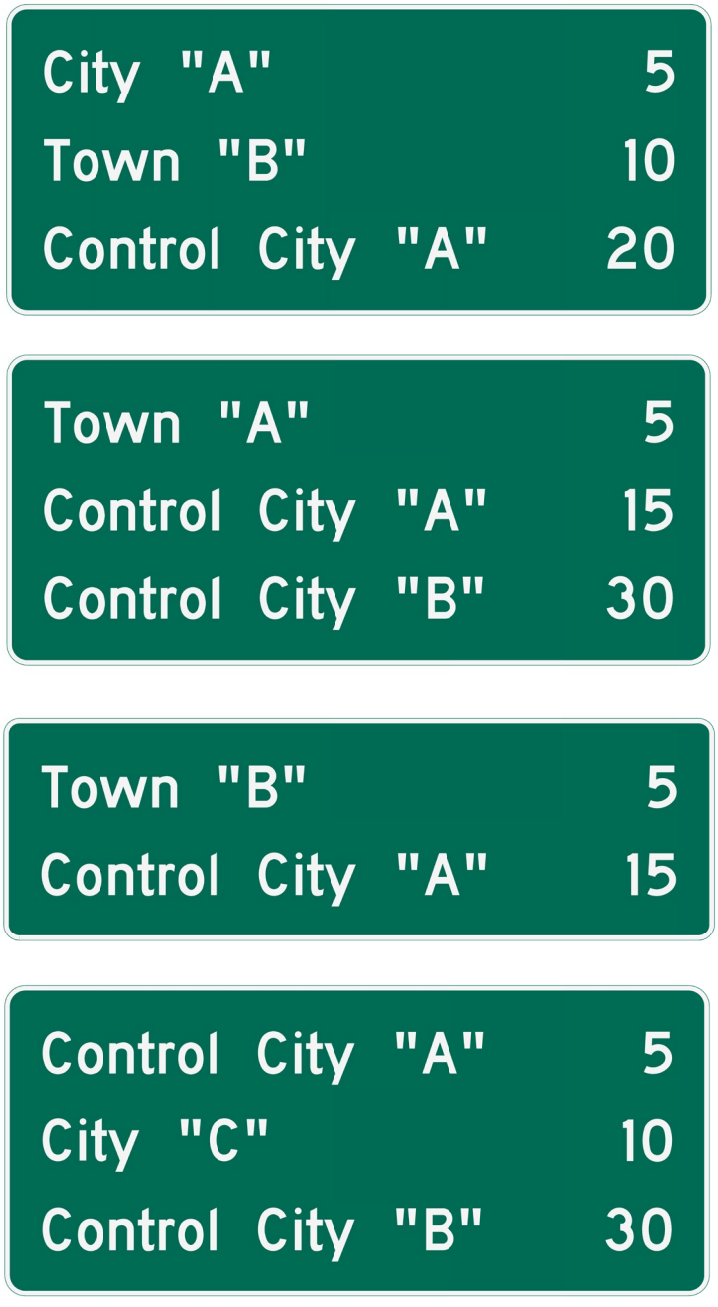
Always name a major destination control city in the bottom destination. Maintain the control city on all successive distance signs throughout the length of the route until that destination qualifies to be the top or middle name on the distance sign. Once the control city moves up, show the next control city as the bottom name.

Control cities have a minimum population of 10,000 and include county seats. A matrix that includes the centroid defined for each municipality on the list can be found on the

Intercity Mileage Spreadsheet maintained by the Transportation Data and Analytics Office.

Figure 2.25-1 provides examples of distance signs for non-limited-access highways. See ***MUTCD Section 2D.44*** for the placement of distance signs.

Figure 2.25-1. Distance Signs for Non-Limited Access Highways



SECTION 2.26
ADVANCE GUIDE SIGNS ON LIMITED-ACCESS FACILITIES

2.26.1 PURPOSE

This section sets uniform statewide advance guide sign applications to give motorists advance notification of interchange exits on limited-access facilities.

2.26.2 BACKGROUND

According to FDOT's ***International Signing Practices Study***, the problem most frequently cited by international visitors navigating Florida is the lack of information about exits. This issue extends to every motorist in unfamiliar territory and to older motorists. See ***MUTCD Section 2E.21*** for the application of interchange guide signs

2.26.3 DEFINITIONS

The following ***MUTCD Section 2E.23*** definitions apply to this section:

Intermediate Interchange: An interchange with urban and rural routes not in the category of major or minor interchanges.

Major Interchange: Major interchanges are subdivided into two categories: (a) interchanges with other expressways or freeways, or (b) interchanges with high-volume multi-lane highways, principal urban arterials, or major rural routes where the volume of interchanging traffic is heavy or includes many motorists unfamiliar with the area.

Minor Interchange: An interchange where traffic is local and very light, such as interchanges with land service access roads; where the sum of the exit volumes is estimated to be lower than 100 vehicles per day in the design year.

2.26.4 PROCEDURE

For urban areas, two advanced guide signs are required for every major and intermediate interchange on the Interstate Highway System, Florida's Turnpike System, and other limited-access facilities.

Place the two advance guide signs 1/2 mile and 1 mile upstream of the exit. If interchange spacing prohibits the placement of these two advance guide signs, use the interchange sequential series signs (***MUTCD Section 2E.24***). For left-hand exit interchanges, use diagrammatic signs.

For major and intermediate interchanges, mount the two advance guide signs overhead in urban areas. For rural interchanges, either cantilever or ground-mounted signs are adequate.

For major interchanges in the rural area and freeway-to-freeway interchanges, provide three advance guide signs located approximately 1/2 mile, 1 mile, and 2 miles upstream of the exit. For rural intermediate interchanges, install two advance guide signs.

The advance guide sign program is implemented through construction projects scheduled in the work program. The ***DTOE*** develops a list of interchanges to be included in work program projects. FDOT does not require stand-alone advance guide sign projects to comply with this standard.

SECTION 2.27
COMMUTER ASSISTANCE SIGNS

2.27.1 PURPOSE

This section sets consistent statewide sign design standards for FDOT's Commuter Assistance Program, ***Topic Number 725-030-008***.

2.27.2 BACKGROUND

The State's Commuter Assistance Program fosters a public/private partnership to provide carpool, vanpool, express bus service, subscription transit service, group taxi service, heavy and light rail, and other systems that can increase vehicle occupancy services to employers and individuals.

The Commuter Assistance Program focuses on reducing single-occupant commuter trips, which are the greatest cause of peak-hour highway congestion. A coordinated effort to provide alternatives to these commuters, using existing or low-cost resources, can be beneficial to the development of a transportation demand management program and public transit statewide. Coordinating the use of existing transportation resources is also a low-cost way to alleviate highway congestion and improve air quality, reducing the frequency of highway maintenance projects.

2.27.3 SIGN DESIGN AND INSTALLATION

MUTCD Section 2I.14 offers guidance for installing a carpool information sign.

FDOT's Public Transit Office or local transit agencies must send signing requests to ***DTOEs*** for approval. District Traffic Operations determines sign placement based on field review and available space.

FDOT's Commuter Assistance Program also has vanpooling and transit services, which each have different signs.

There are two different sizes for each sign design. The arterial sign is 36 x 24 inches. The interstate sign is 78 x 48 inches. All signs have a blue reflective background and white lettering.

Details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library*** for the *TRY CARPOOLING* (***FTP-418-25*** and ***FTP-418A-25***), *TRY VANPOOLING* (***FTP-419-25*** and ***FTP-419A-25***),*TRY TRANSIT* (***FTP-420-25*** and ***FTP-420A-25***) signs.

Adhere to the mounting heights and lateral clearances specified in the ***Standard Plans, Index 700-101*** and use support systems that meet or exceed FDOT frangibility standards.

SECTION 2.28

REFERENCE LOCATION SIGNS (MILE MARKERS)

2.28.1 PURPOSE

The section establishes consistent criteria and signing methods for reference location signs (mile markers) on both limited-access and non-limited-access facilities.

2.28.2 STANDARDS

Reference location signs are described in ***MUTCD Sections 2H.11 and 2H.12***. The sign is a vertical panel with a green reflective background and the mile marker number in 6-inch-high white letters. Place reference location signs on the right side of the roadway at 1-mile or 1/2-mile intervals, as described in Sections ***2.28.3*** and ***2.28.4***.

Set the zero distance at the southern or western state line or at the junction where the route begins. Follow ***MUTCD*** standards for overlap routes.

2.28.3 CRITERIA FOR LIMITED-ACCESS FACILITIES

Use reference location signs and enhanced reference location signs on limited-access roadways with the following criteria:

- Place reference location signs (***MUTCD Section 2H.11***) every 1 mile on limited-access roadways outside urban boundaries.
- Use enhanced reference location signs (***MUTCD Section 2H.12***) every half mile on limited-access roads within urban boundaries.

2.28.4 CRITERIA FOR NON-LIMITED-ACCESS FACILITIES

While reference location signs are helpful on many roadways, those with good building numbers, adequate landmarks, signed cross streets, or other positioning systems will not benefit significantly. Use the following criteria to determine where to use reference location signs:

- The roadway crosses at least two municipalities or two county jurisdictions within three miles.
- The roadway has relatively few named landmarks, cross streets, or building addresses that would help motorists navigate the area.

- The roadway can be identified by local emergency medical services (911) programs to assist in address location.
- The proposed reference location sign will not interfere in any way with other traffic control devices.

In all cases, local jurisdictions must initiate requests to the ***DTOE*** for reference location signing that meet all the criteria listed above.

Local jurisdictions install and maintain reference location signs on state system roadways through the permit process, but the ***DTOE*** is responsible for the route signing plan.

SECTION 2.29

USE OF FLUORESCENT YELLOW-GREEN SIGN SHEETING

This section was rescinded on 11/1/18 and is now included in ***Standard Specifications, Section 700***.

SECTION 2.30

ONE-STOP CAREER CENTER SIGNS

2.30.1 PURPOSE

This section guides the installation of *ONE-STOP CAREER CENTER* signs (***FTP-606-25***). These signs help Floridians locate full-service, One-Stop Career Centers statewide.

2.30.2 BACKGROUND

Since 1995, Florida has committed significant resources to the growth and integration of its workforce development system. The One-Stop Career Centers are the keystone of this system. These centers offer universal services to all Floridians, not just those eligible for specific programs.

2.30.3 DEFINITIONS

Full-Service One-Stop Career Center: A physical location designated by the Regional Workforce Development Board that provides public access to legislatively-mandated partner agencies delivering core services on site. Services include job search, placement assistance, skills assessment, and information on supportive resources.

2.30.4 SIGN DESIGN AND INSTALLATION

The *ONE-STOP CAREER CENTER* sign (***FTP-606-25***) is 36 x 36 inches with a green background and white lettering. Sign details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library***.

Sign requests must be submitted by a local representative of the ***Workforce Regional Development Boards*** to the appropriate ***DTOE***. FDOT will only sign for full-service, One-Stop Career Centers as defined in ***Section 2.30.3***.

FDOT installs and maintains *ONE-STOP CAREER CENTER* signs (***FTP-606-25***) on non-limited-access highways only.

FDOT places a sign, based on available, suitable space, at the State Highway System intersection nearest to the One-Stop Career Center.

Adhere to the mounting heights and lateral clearances specified in the ***Standard Plans, Index 700-101***, and select support systems that meet or exceed FDOT frangibility standards.

SECTION 2.31

UNIQUE TRANSPORTATION SYMBOL SIGNS

2.31.1 PURPOSE

This section sets standards for using FHWA-approved transportation symbol signs on the State Highway System.

2.31.2 BACKGROUND

Because of the many domestic and international tourists in Florida, an unusually high number of motorists using our roadways are not familiar with them.

FDOT's ***International Signing Study*** found that motorists unfamiliar with an area respond well to symbol signs.

FDOT enhanced its signing program by adding the following symbol signs representing transportation-related services or destinations.

2.31.3 SIGN DESIGN

Adhere to the criteria for motorist services signing established in ***Rule Chapter 14-51, F.A.C., Florida's Highway Guide Sign Program***; more specifically, ***Rule 14-51.021(1)(f), F.A.C.*** for limited-access highways and ***Rule 14-51.031(1)(f), F.A.C.*** for non-limited-access highways to use of the symbol signs in this section.

For unique transportation symbol signs, use a 30 x 30-inch sign panel on limited-access facilities and a 24 x 24-inch panel on non-limited-access facilities.

Sign details are available in ***FDOT's Sign Library***.

2.31.4 INSTALLATION AND PLACEMENT

Where these signs are approved for trailblazing use, adhere to the mounting heights and lateral clearances specified in the ***Standard Plans, Index 700-101***, and select support systems that meet or exceed FDOT frangibility standards.

Where these signs are approved as general service signs appended to freeway guide signs, conform to the ***Standard Plans, Index 700-104***.

2.31.5 *PASSENGER SHIP* SIGN

Passenger ships are an important destination for Florida residents and visitors. The *PASSENGER SHIP* symbol sign (***FTP-616-25*** and ***FTP-616A-25***), shown in ***Figure 2.31-1***, is used throughout Florida to trailblaze routes to passenger seaports and cruise ship ports that meet the criteria specified in ***TEM Section 2.31.3***.

The *PASSENGER SHIP* sign has a white symbol on a green background.

Figure 2.31-1.
***PASSENGER SHIP* Sign**



2.31.6 AMTRAK SIGN

The *AMTRAK* symbol sign (***FTP-614-25*** and ***FTP-614A-25***), shown in ***Figure 2.31-2***, is approved for use on guide signs and trailblazing to Amtrak stations that meet the criteria specified in ***TEM Section 2.31.3***.

The *AMTRAK* sign is a white symbol on a green background.

Figure 2.31-2.
***AMTRAK* Sign**

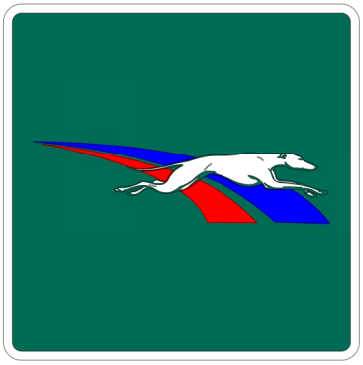


2.31.7 *GREYHOUND* SIGN

The *GREYHOUND* symbol sign (***FTP-615-25*** and ***FTP-615A-25***), shown in ***Figure 2.31-3***, is used as a motorist service sign and to trailblaze to intracity bus stations. This symbol sign will make it easier to trailblaze to small bus stations in a shared building that meets the criteria specified in ***TEM Section 2.31.3***.

The GREYHOUND sign is a three-color symbol with a white border on a green background.

Figure 2.31-3.
***GREYHOUND* Sign**



SECTION 2.32

Florida Travel Info Call 511 Sign

2.32.1 PURPOSE

This section defines criteria and guidelines for installing *FLORIDA TRAVEL INFO CALL 511* signs (***FTP-414-25*** and ***FTP-414A-25***) (***Figure 2.32-1***). The *511 Telephone Service* is part of a nationwide program that provides motorists with access to traffic and transportation information by dialing 511 from their cellphones or landlines, where the service is available. The sign extends to all major roadways on the State Highway System with 511 Telephone Service.

2.32.2 SIGN DESIGN

The *TRAVEL INFO CALL 511* sign, as shown in ***MUTCD Section 2I.12***, comes in two standard sizes. On limited-access highways, install the 66 x 72-inch *FLORIDA TRAVEL INFO CALL 511* signs (***FTP-414A-25***). On non-limited-access highways, install the 48 x 60-inch *FLORIDA TRAVEL INFO CALL 511* signs (***FTP-414-25***).

Figure 2.32-1. FLORIDA TRAVEL INFO CALL 511 Sign



The *FLORIDA TRAVEL INFO CALL 511* signs (***FTP-414-25*** and ***FTP-414A-25***) have a white legend and border on a blue background. Sign details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library***.

When the 511 Telephone Service becomes available in an area, specific sign placement details are reviewed by the corresponding ***District Traffic Operations Office*** using the guidelines shown in ***TEM Section 2.32.3***.

2.32.3 SIGN PLACEMENT

Use the following guidelines for sign placement:

- At state and county lines
- At approximately 10 mile-intervals in urban/metro areas
- At approximately 30-mile intervals in rural areas
- **On limited-access facilities:** preceding major freeway-to-freeway interchanges
- **On major arterial routes:** recommend locations upstream from intersections formed by junctions of U.S./major State Highway System roadways at the ***DTOE's*** discretion.

SECTION 2.33
NATURE-BASED TOURISM AND HERITAGE TOURISM TRAIL SIGNS

2.33.1 PURPOSE

This section informs prospective sponsors of nature-based or heritage trails about the type of support FDOT can offer and the appropriate signs to install along public roadways.

2.33.2 BACKGROUND

Nature-based and heritage tourism is best described as a statewide effort to promote Florida's natural and historic resources. These resources include state parks, lakes, rivers, beaches, and woodlands, as well as the rich historical and cultural sites across Florida.

FDOT actively participates in the effort to promote Florida's natural assets through nature-based tourism and heritage tourism programs by providing a mechanism to use public right-of-way for the needed signs. FDOT also provides engineering guidance to create effective signing plans.

Some examples of approved trails are the Historic Heritage Trail sponsored by the Department of State, the Birding Trail sponsored by the Fish and Wildlife Conservation Commission, and the Gulf Coast Heritage Trail sponsored by the Sarasota Bay National Estuary Program.

2.33.3 PILOT PROGRAM

The Gulf Coast Heritage Trail was the first regional nature-based tourism trail program in Florida, and FDOT approved its signing plan as a pilot program. It is a true trail system in that trailblazing signs identify the route to follow to access the sites, which are also described in the auto tour map and brochure. The program was pioneered and coordinated by the Sarasota Bay National Estuary Program in Sarasota and Manatee Counties.

The pilot was a success, and FDOT is using the Gulf Coast Heritage Trail as a model for other regional plans to follow.

2.33.4 CRITERIA FOR SIGNING PROGRAM

The sponsor of a proposed nature-based or heritage tourism trail must follow several criteria in developing a trail system:

(a) The sponsor must develop grassroots support, including local input into establishing routes.

(b) The program must use a land-based brochure with an auto tour map—the signs are not to be the primary guidance method.

(c) Attractions are to be publicly owned and not for profit. If there's an admission fee, the attraction's purpose needs to be primarily educational (this includes museums and art galleries).

(d) Promotional posters, website, social media presence, and promotional campaigns are strongly recommended.

2.33.5 FDOT PARTICIPATION

FDOT will participate in developing nature-based and heritage tourism programs by advising as the programs are proposed, offering preliminary route recommendations, and approving routes along which signs may be installed.

Contact the ***State Traffic Engineering and Operations Office*** early in the process to promote proper coordination with all districts affected by the proposed trail.

Upon final route selection, the District Traffic Operations Office determines appropriate locations for trailblazing signs and marks the locations so a sign contractor can install the signs. The sponsor takes responsibility for having the signs manufactured and installed through FDOT's general use permitting process. FDOT staff can provide the names of sign manufacturers and contractors experienced in providing these services.

2.33.6 Sign Approval and Design

Sign designs must receive ***STOE*** approval prior to use for this program. Logo signs are encouraged for this program, and several criteria apply:

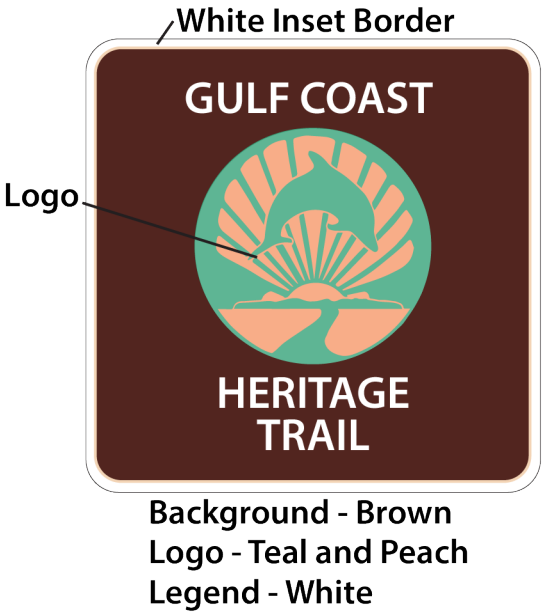
(a) On non-limited-access highways, install 24x24-inch signs. Print the name of the trail in white highway sign type, uppercase lettering (Helvetica). A sample logo is shown in ***Figure 2.33-1***.

(b) No advertising on logo signs.

(c) Sign logos may use colors, but must have a brown background of Type III retro-reflective sheeting, per ***Standard Specifications, Section 994***. Inks must be transparent highway sign types.

(d) Install signs along the State Highway System route with an arrow pointing toward cross streets that access the attraction. Post confirmation signs with straight-ahead arrows at appropriate intervals to let motorists know they are on the right path (usually 3 to 5 miles, depending on route segment length).

Figure 2.33-1. Logo for Gulf Heritage Trail



2.33.7 Sign Maintenance

The sponsors of proposed nature-based or heritage trails are responsible for maintaining all signs directing users to access points.

Sponsors must have a contract with a private sign installation contractor or a maintenance agreement with local government for signs on the State Highway System.

Present the contract or agreement to the corresponding ***District Traffic Operations Office*** before installing the signs.

SECTION 2.34
FLORIDA SCENIC HIGHWAYS PROGRAM AND NATIONAL SCENIC BYWAYS PROGRAM SIGNS

2.34.1 PURPOSE

This section establishes statewide signing standards for designated Florida Scenic Highways and National Scenic Byways.

2.34.2 BACKGROUND

The intent of both the Florida Scenic Highways Program (FSHP) and the National Scenic Byways Program (NSBP) is to designate paved public roads as scenic corridors and preserve, enhance, and maintain their intrinsic resources for the enjoyment of the traveling public.

For a roadway to be designated under either or both programs, it must possess at least one of the following intrinsic resources:

(a) **Cultural Resources:** The traditions, values, customs, and arts of social groups

(b) **Historical Resources:** Sites or structures that reflect human actions evident in past events

(c) **Archaeological Resources:** The physical evidence or remains of human life, activities, or cultures

(d) **Recreational Resources:** Sites for activities dependent upon the natural elements of the landscape

(e) **Natural Resources:** Landscapes showing little or no disruption by humans

(f) **Scenic Resources:** Combinations of natural and manmade features that give the visual landscape remarkable character and significance

Benefits of designation as a Florida Scenic Highway or a National Scenic Byway include:

(a) **Resource Protection:** FSHP/NSBP designation allows preservation and enhancement of the significant intrinsic resources along public roads.

(b) **Community Recognition:** The FSHP/NSBP logo signage along designated highways identifies the corridors as special places with important resources worth noting.

(c) **Economic Development/Tourism:** Designation invites the millions of tourists traveling by car in Florida to visit the communities along a designated highway corridor.

(d) **Community Visioning:** The FSHP/NSBP designation can complement and support a community's vision, instilling a sense of pride.

(e) **Partnering:** Cooperation between public agencies and private corporate sponsors provides support to the community and the overall corridor's focus.

2.34.3 PROGRAM COORDINATION

FDOT's ***Office of Environmental Management*** oversees the Statewide FSHP.

Each FDOT district office has a designated District Scenic Highways Coordinator who represents the district in all matters pertaining to the FSHP or NSBP. The coordinators are the initial point of contact for questions about the program and serve as a link between FDOT and the community.

2.34.4 SIGN CRITERIA

When signing a designated Florida Scenic Highway (FSH) or National Scenic Byway (NSB), use the following criteria:

(a) Install signs where they will not interfere with or distract from adjacent traffic control devices or the area's resources.

(b) Design signs that conform with the ***MUTCD***, which is incorporated by reference in ***Rule 14-15.010, F.A.C.***

(c) Highways that lose designation under the FSHP or the NSBP will have all FSH and NSB signs removed.

Sign designated FSHs and NSBs (as applicable) at entrance points to a route. Install signing along a designated highway approximately every five miles in both directions. The ***District Traffic Operations Office*** can make exceptions based on intersection frequency or directional needs during their review.

Install signs for both FHS and NSB according to the approved sign standards in ***TEM Sections 2.34.5*** and ***2.34.6***.

2.34.5 FLORIDA SCENIC HIGHWAY SIGNS

2.34.5.1 Coordination

FDOT advises local agencies when highway corridors are proposed for eligibility or designation to the FSHP. Once the highway corridor is designated, the District Scenic Highways Coordinator(s) coordinate the sign implementation process.

The proper sign coordination process for an FSH is detailed below:

(a) The district coordinator(s) will coordinate the preferred location(s) for the FSHP signs with the ***District Traffic Operations Office***, along with the Corridor Management Entity.

(b) The ***District Traffic Operations Office*** will finalize the sign location(s) and send a work request to the appropriate district maintenance yard for installation.

(c) Order one additional sign along with the others. This sign is to be used as a display at the ceremony and is not to be placed along the corridor.

(d) The Corridor Management Entity and its partners may host a dedication ceremony to celebrate the designation of a particular corridor as an FSH.

2.34.5.2 Sign Detail

The standard sign design to designate an FSH is shown in ***Figure 2.34-1***. There are two sign sizes available, to be used as specified in ***TEM Section 2.34.5.3***.

Sign details are available in ***FDOT's Sign Library***.

2.34.5.3 Sign Installation and Maintenance

FDOT is responsible for installing and maintaining *FSH* signs (***FTP-802-25*** and ***FTP-802A-25***) on the State Highway System, and the local government is responsible for installing and maintaining FSH signs on its system.

Install the 36 x 24-inch *FSH* sign (***FTP-802A-25***), shown in ***Figure 2.34-1***, at the entrance points to a designated Florida Scenic Highway route, along with a supplemental panel with the scenic highway's name.

Figure 2.34-1. Florida Scenic Highway Sign Design



When appropriate, co-locate the *FSH* sign with existing route confirmation signs. Install the 24 x 16-inch sign panel (***FTP-802-25***) or on top of the route confirmation sign, as shown in ***Figure 2.34-2***.

Figure 2.34-2. Co-Location on Route Confirmation Marker



When the designated scenic highway intersects with another state road, install the 16 x 24-inch sign panel on the existing route directional sign, as shown in ***Figure 2.34-3***.

Figure 2.34-3. Co-location on Route Direction Marker



2.34.6 NATIONAL SCENIC BYWAY SIGNS

2.34.6.1 Coordination

FDOT advises local agencies proposing highway corridors for eligibility or designation to the NSBP. Once a highway corridor is designated, the District Scenic Highway Coordinator(s) initiates the sign implementation process. This is similar to the FSH process outlined in ***TEM Section 2.34.5.1***, but in this case, no extra *NSB* sign (***D6-4*** or ***D6-4a***) is needed for the dedication ceremony.

The District Scenic Highways Coordinator(s) work with the Statewide Scenic Highways Coordinator to submit applications for NSB or All-American Road designation to FHWA.

Once the corridor is designated as an NSB or All-American Road, the District Scenic Highway Coordinator(s) facilitate the following process:

(a) The District Scenic Highway Coordinator(s) coordinate *NSB* (***D6-4*** or ***D6-4a***) sign locations with the ***District Traffic Operations Office***.

(b) The District Traffic Operations Office identifies sign placement and sends a work request to the appropriate district maintenance yard to install them.

(c) The District Scenic Highway Coordinator(s) contact the respective District Maintenance Office or local government to coordinate installing the signs along the corridor.

2.34.6.2 Sign Detail

FHWA developed and approved the *AMERICA'S BYWAYS* (***D6-4*** and ***D6-4a***) sign shown in ***MUTCD Section 2D.57***. This sign is approved for use on NSBs.

See FHWA's ***Standard Highway Signs Manual*** for exact details for the *NSB* sign.

2.34.6.3 Installation and Maintenance

Install the *NSB* sign at the entrance points to a designated byway. When possible, mount the sign below the *FSH* sign on a standard sign pole. See ***Standard Plans, Index 700-010*** for single-column ground sign design requirements.

When an FSH becomes an NSB, the District Traffic Operations Office reviews the signing on the designated roadway for possible ways to accommodate both designations on the corridor. If it's not possible to place both, the *FSH* signs (***FTP-802-25*** and ***FTP-802A-25***) take priority.

FDOT is responsible for installing and maintaining *NSB* (***D6-4*** or ***D6-4a***) signs on the State Highway System, and local governments are responsible for installing and maintaining *NSB* signs (***D6-4*** or ***D6-4a***) on their systems.

SECTION 2.35

MEMORIAL ROADWAY DESIGNATION SIGNS

2.35.1 PURPOSE

This section provides FDOT districts with guidance on installing signs when a road on the State Highway System is designated as a memorial roadway by the Florida Legislature.

2.35.2 BACKGROUND

Over the years, the Florida Legislature has dedicated, named, and otherwise titled roadways in Florida. The designated roads can be under the jurisdiction of either FDOT or the local government.

The earliest dedicated roadway is the W.W. Clark Memorial Bridge on State Road 580 between Safety Harbor and Oldsmar. It was dedicated by the State Road Board on July 6, 1922, according to Department of Systems Implementation records. The ***FDOT Map Viewer*** provides a GIS layer of memorial roadway designations; select *Add Layer* and search for the "*Memorial Roadway Designations*" layer.

2.35.3 SIGNING PROCESS

The Florida Legislature designates memorial roadways based on recommendations by city or county commissions, individual state agencies, or civic groups.

Once the Florida Legislature officially designates a memorial roadway on the State Highway System, legislative sponsors must obtain a local resolution in accordance with ***Section 334.071(3), F.S.***

After receiving a copy of the local resolution, FDOT begins the process of installing appropriate memorial roadway designation signs on the State Highway System.

The sign installation process involves the following FDOT offices:

(a) State Traffic Engineering and Operations Office

(b) Transportation Data and Analytics Office

(c) District Traffic Operations Office

(d) District Maintenance Office

(e) District Public Information Office

Each district has its own signing process, so the district office that initiates the process varies. However, all offices listed above must be kept informed of the status of roadway designations within their districts after each legislative session.

Each district coordinates sign installation with the designation's legislative sponsor.

Do not show memorial names on guide signs or any other sign other than the standard sign, as directed by ***MUTCD Section 2M.10***.

2.35.4 SIGN INSTALLATION AND MAINTENANCE

Install one *MEMORIAL HIGHWAY* sign (***FTP-800-25*** or ***FTP-800A-25***) per direction in accordance with ***MUTCD Section 2M.10***. FDOT maintains signs installed on the State Highway System.

2.35.5 SIGN DESIGN

The memorial roadway designation signs (***FTP-800-25*** or ***FTP-800A-25***) are brown panels with yellow lettering, as shown in ***Figure 2.35-1***.

Sign details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library***.

Figure 2.35-1. Memorial Roadway Designation Sign



SECTION 2.36

COMMUNITY WAYFINDING GUIDE SIGNS

2.36.1 PURPOSE

This section describes the process for approving community wayfinding guide signs on the State Highway System for the districts.

2.36.2 BACKGROUND

FDOT, in cooperation with the Florida League of Cities, has developed statewide criteria for community wayfinding guide signs on the State Highway System. These standards give local governments the flexibility to design their own community wayfinding guide sign systems while still maintaining federal and state sign standards to safely guide motorists to their destinations. The criteria are laid out in ***Rule 14-51, Part V, F.A.C.*** (Florida's Highway Guide Sign Program).

The standards shown in ***Rule 14-51, Part V, F.A.C.*** offer local governments a better understanding of what FDOT will and will not approve for use on the State Highway System based on ***MUTCD*** requirements.

2.36.3 STANDARDS

All community wayfinding guide signs must conform to ***Rule 14-51, Part V, F.A.C.*** to be installed on the State Highway System.

Local governments are responsible for designing, installing, and maintaining community wayfinding guide signs on the State Highway System per ***Rule 14-51.051(8), F.A.C.***

2.36.4 REVIEW PROCESS

FDOT recommends a pre-planning meeting between the District Traffic Operations Office and the local government to help the local government comply with ***Rule 14-51, Part V, F.A.C.***

After a local government completes its community wayfinding guide sign system plan, it must provide a copy of the plan to the appropriate ***District Traffic Operations Office***.

The ***District Traffic Operations Office*** reviews the community wayfinding guide sign system plan for compliance with ***Rule 14-51, F.A.C.***

If the plan is not compliant, the District Traffic Operations Office will contact the local government with the changes it needs to make to meet the criteria shown in ***Rule 14-51, F.A.C.***

Once the community wayfinding guide sign system plan is approved, the ***District Traffic Operations Office*** issues a letter of compliance signed by the ***DTOE*** to the local government.

SECTION 2.37
ADVANCE STREET NAME SIGNS

2.37.1 PURPOSE

The section describes the design, placement, and installation criteria for advance street name signs on the State Highway System.

2.37.2 BACKGROUND

FDOT recommends advance street name signs to improve roadway safety in the ***FDOT Safe Mobility for Life Program***. These signs give motorists advance notification to help them make safer roadway decisions. FDOT recommends this improvement based on ***FHWA's Handbook for Designing Roadways for the Aging Population***.

In 2002, FDOT conducted an effectiveness study on the roadway improvements implemented through its aging road user program, including advance street name signs. Data from that study show that advance street name signs with larger lettering were read farther from the signed intersection, giving motorists more time to make a decision. This research supports FDOT's decision to continue using advance street name signs as part of its ***Safe Mobility for Life Program***.

2.37.3 DEFINITIONS

Critical or Significant Cross Street: A signalized or unsignalized intersection or cross street classified as a minor arterial or higher that gives access to a traffic generator or has other physical or traffic characteristics that make it critical or significant. This type of street has an average annual daily traffic (AADT) rate greater than 2000.

2.37.4 STANDARDS

The standards in this section apply to each of the three different application types for advance street name signs. Specific criteria for installing advance street name signs at signalized intersections (*NEXT SIGNAL*) are shown in ***TEM Section 2.37.5***, for non-signalized intersections (*NEXT INTERSECTION*) in ***TEM Section 2.37.6***, and for advance street name plaques on intersection warning signs in ***TEM Section 2.37.7***.

Use advance street name signs and plaques only to identify critical or significant cross streets. They are not intended to identify destinations such as cities, facilities, or residential neighborhoods.

Whenever possible, abbreviate the roadway type (e.g., Blvd rather than Boulevard), reduce letter height to conserve sign panel length, or delete the roadway type altogether. Do not delete the roadway type if doing so would cause confusion. For example, if an area has both an Orange Street and an Orange Avenue, or when a subdivision or community in the area goes by the same name as the street, do not delete the roadway type.

When a cross street is known by both a route number and a local name, use the local name on the advance street name sign. The route number is identified on markers along the route.

When minor cross streets intersect a state highway between the advance street name and the intersection, consider adding a legend such as *NEXT SIGNAL* or *XX FEET* to the advance street name sign.

Make the legend on the advance street name sign or plaque consistent with the legend on either the overhead street name or post-mounted street name sign.

Sign sheeting materials must comply with the current edition of the ***Standard Specifications, Section 994***.

For mounting heights and lateral clearances, adhere to those specified in the ***Standard Plans, Index 700-101***. Support systems must meet or exceed FDOT's standards of frangibility.

Install signs in advance of the intersection at the distances shown in the ***MUTCD***, ***Table 2C-3, "Condition A"***. Consider these distances the minimum for a single lane change maneuver and measure from the begin taper point for the longest auxiliary lane designed for the intersection. Also, consider the degree of traffic congestion and the potential number of lane change maneuvers that may be required when determining the advance placement distance.

2.37.5 Advance Street Name Signs at Signalized Intersections

The District Traffic Operations Office initiates requests to install advance street name signs (***Figure 2.37-1***). The local agency with jurisdiction over the approaching cross street may submit such requests to the District Traffic Operations Office. The ***DTOE*** reviews and approves these requests.

Advance street name signs have white lettering on a green background and are designed according to ***MUTCD Section 2D.04*** and ***Section 2D.46***.

Figure 2.37-1. Advance Street Name Sign at a Signalized Location



FDOT recommends installing advance street name signs at signalized intersections as a safety countermeasure under any of the following conditions:

(a) Documented history of sideswipe or rear-end crashes

(b) High-volume approaches

(c) High population of people 65 and older

(d) Roadways with four or more lanes

(e) Rural high-speed roadways (50 mph or greater)

(f) Intersections located in a ***Safe Mobility for Life Priority County***.

Minimum letter heights (legend) are shown in ***Table 2.37-1***. When street name legends are lengthy or there is limited right-of-way, modify the sign font from ***Table 2.37-1*** using the standard font sizes shown in ***Figure 2.37-4***.

Table 2.37-1. Design Guidelines for Advance Street Name Signs

Posted Speed Limit	STREET NAME LEGEND	NEXT SIGNAL or NEXT INTERSECTION
	Letter Size (inches) Upper/Lower Case Letters	Letter Size (inches) Upper Case Letters
35 mph or less	8EM	6D
40 mph or greater	10.67EM	8E

Install a single post sign (***Figure 2.37-2***) on roadways posted at 35 mph or less or when limited right-of-way is available.

Figure 2.37-2. Advance Street Name Sign Design (Single Post)

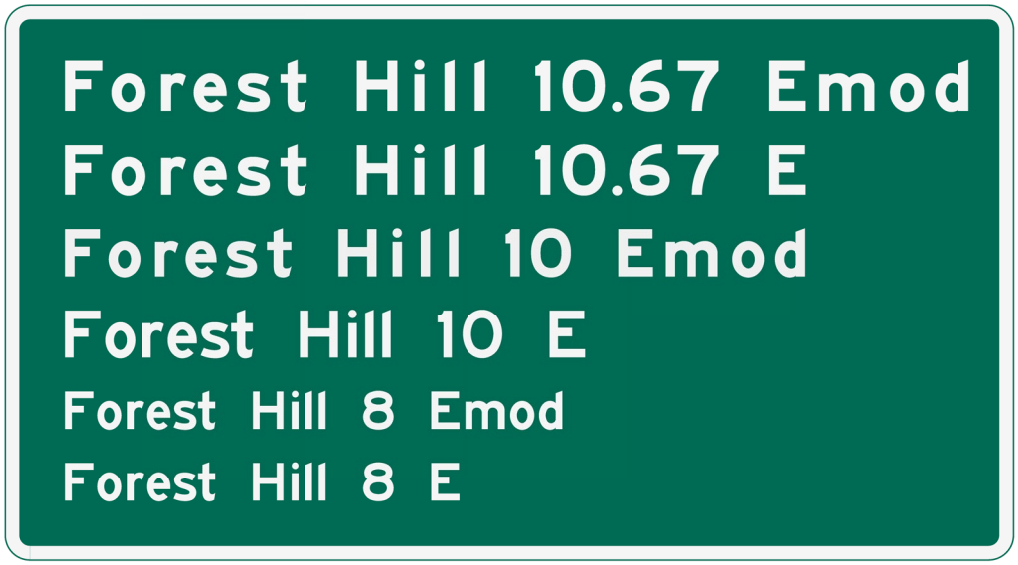


Install a double post design (***Figure 2.37-3***) on roadways posted at 40 mph or greater where right-of-way is not limited.

Figure 2.37-3. Advance Street Name Sign Design (Double Post)



Figure 2.37-4. Standard Font Sizes for Advance Street Name Sign Legends



When a cross street has a different name on each side of the intersection, show both names on the advance sign with an arrow beside each name to designate direction (***Figure 2.37-5***).

Figure 2.37-5. Advance Street Name Sign Using Different Names



2.37.6 ADVANCE STREET NAME SIGNS AT NON-SIGNALIZED INTERSECTIONS

The District Traffic Operations Office initiates requests to install advance street name signs (***Figure 2.37-6***) at non-signalized intersections. The local agency with jurisdiction over the approaching cross street may submit such requests to the District Traffic Operations Office. The ***DTOE*** reviews and approves these requests.

Consider installing these signs on multi-lane divided highways with a posted speed of at least 45 mph and a dedicated left-turn lane, not just a median opening for the approaching critical or significant cross street.

Design advance street name signs in accordance with ***MUTCD Section 2D.04*** and ***Section 2D.46*** and the ***Standard Highway Signs Manual***.

Use the minimum legend letter heights shown in ***Table 2.37-1, Design Guidelines for Advance Street Name Signs.***

Figure 2.37-6. Advance Street Name Signs at Non-Signalized Locations



2.37.7 ADVANCE STREET NAME PLAQUES ON INTERSECTION WARNING AND ADVANCE TRAFFIC CONTROL SIGNS

Install *INTERSECTION WARNING* signs (***W2*** series) (***Figure 2.37-7***) and *ADVANCE TRAFFIC CONTROL* signs (***W3*** series) (***Figure 2.37-8***) when there is a documented need based on sight restriction, crash history, or engineering judgment. Sign details are available in ***FDOT's Sign Library***.

Install advance street name plaques (***MUTCD Section 2C.65***) on these warning signs under the following conditions:

(a) A minimum of 2000 AADT

(b) No street lighting along the main arterial

(c) A documented history of turning, entering, or side-swipe crashes

(d) Limited sight distance due to horizontal or vertical curves

(e) A high population of people 65 and older

(f) The intersection is in a ***Safe Mobility for Life Priority County***.

When installing a new or replacement *INTERSECTION WARNING* sign (***W2*** series) on a rural roadway, accompany it with an advance street name plaque designed in accordance with this section.

Requests can be initiated by the District Traffic Operations Office or the local agency with jurisdiction over the approaching cross street.

Advance street name plaques have black lettering on a yellow background. Use 8-inch D series lettering mounted below a 48-inch warning sign panel with upper/lowercase lettering in accordance with the FHWA's ***Handbook for Designing Roadways for the Aging Population***. If this is not structurally possible, decrease lettering size to a minimum of 5-inch D series.

The DTOE may consider roads not currently signed with an advance route marker for an *INTERSECTION WARNING* sign (***W2*** series) and an advance street name plaque when they meet the criteria referenced in this section.

On roads with an advance route marker (JCT shield) (***Figure 2.37-9***), the designer may place the street name plaque below to better identify the roadway to travelers unfamiliar with the area. Match the panel color to the route marker and make the lettering on the street name plaque no smaller than 4-inch C series. Sign details are available in ***FDOT's Sign Library***.

Figure 2.37-7. Advance Street Name Plaque on Intersection Warning Sign



Figure 2.37-8. Advance Street Name Plaque on Advance Traffic Control Warning Sign



Figure 2.37-9. Advance Street Name Plaque on Advance Route Marker



SECTION 2.38
GENERATORS AND PORTABLE STOP SIGNS AT NON-FUNCTIONING SIGNALIZED INTERSECTIONS

2.38.1 PURPOSE

This section sets guidelines for deploying generators and portable (folding) stop signs at non-functioning signalized intersections after an emergency event. FDOT's guiding principles for this conform to ***Section 316.1235, F.S.*** and the ***MUTCD***.

2.38.2 CONDITIONS FOR USE

The ***DTOE*** requests that generators be deployed or portable stop signs placed after an emergency event at locations where a signalized intersection is not functioning. A non-functioning signalized intersection is one equipped with traffic signals that are damaged or without power after an emergency event.

When the signalized intersection is without power, and it is not possible to restore power using a generator, place portable stop signs as directed by the ***DTOE***.

When using portable stop signs at a signalized intersection that is not functioning due to a power outage, disconnect the power to avoid traffic control conflicts when power is restored.

When power is restored at a signalized intersection using generators, traffic signals must continue to function in the same operating mode. If the traffic signals were in flashing operation, they must continue in flashing operation. If they were in normal cycle and phasing operations, they must continue in normal operation.

2.38.3 LOCATION AND PLACEMENT

The ***DTOE*** determines the locations for placement of generators or portable stop signs. in coordination with local agencies, the ***DTOE*** develops and maintains a list of critical signalized intersections to establish a priority for generator or portable stop sign installation.

Place portable stop signs in accordance with ***Figures 2.38-1*** through ***2.38-6***. If signs need to be placed for any intersection design not represented in ***Figures 2.38-1*** through ***2.38-6,*** place them as directed by the ***DTOE*** in accordance with the ***Standard Plans, Index 102*** and the ***MUTCD***.

Wire each critical signalized intersection control cabinet with a transfer switch so it can be switched to an alternate generated power source in the event of a power outage. Install as directed in the ***Standard Specifications, Section 676***.

2.38.4 STORAGE AND DISTRIBUTION

Each district has access to and is able to deploy portable generators to provide an alternate power source to 12 percent of the signalized intersections on the State Highway System within its boundaries. The District Maintenance Office determines the deployment locations.

The District Maintenance Office maintains and stores the generators.

Each district has access to and can deploy portable stop signs to non-functioning signalized intersections on the State Highway System within its boundaries that are not equipped with a generator.

2.38.5 REMOVAL AND RECOVERY

Remove the generators when power and proper signal operation are restored. Remove portable stop signs before normal traffic control signal operations resume. Deploy district emergency response teams or emergency contractors to recover generators and portable stop signs by doing one of the following:

(a) Completely remove them from each intersection

(b) Stockpile the portable stop signs in one corner of the intersection for removal later

Each district determines the recovery method and develops a recovery plan for its intersections.

Figure 2.38-1. Temporary Signing for Power Outage—Left and Right Turn Lanes Intersection

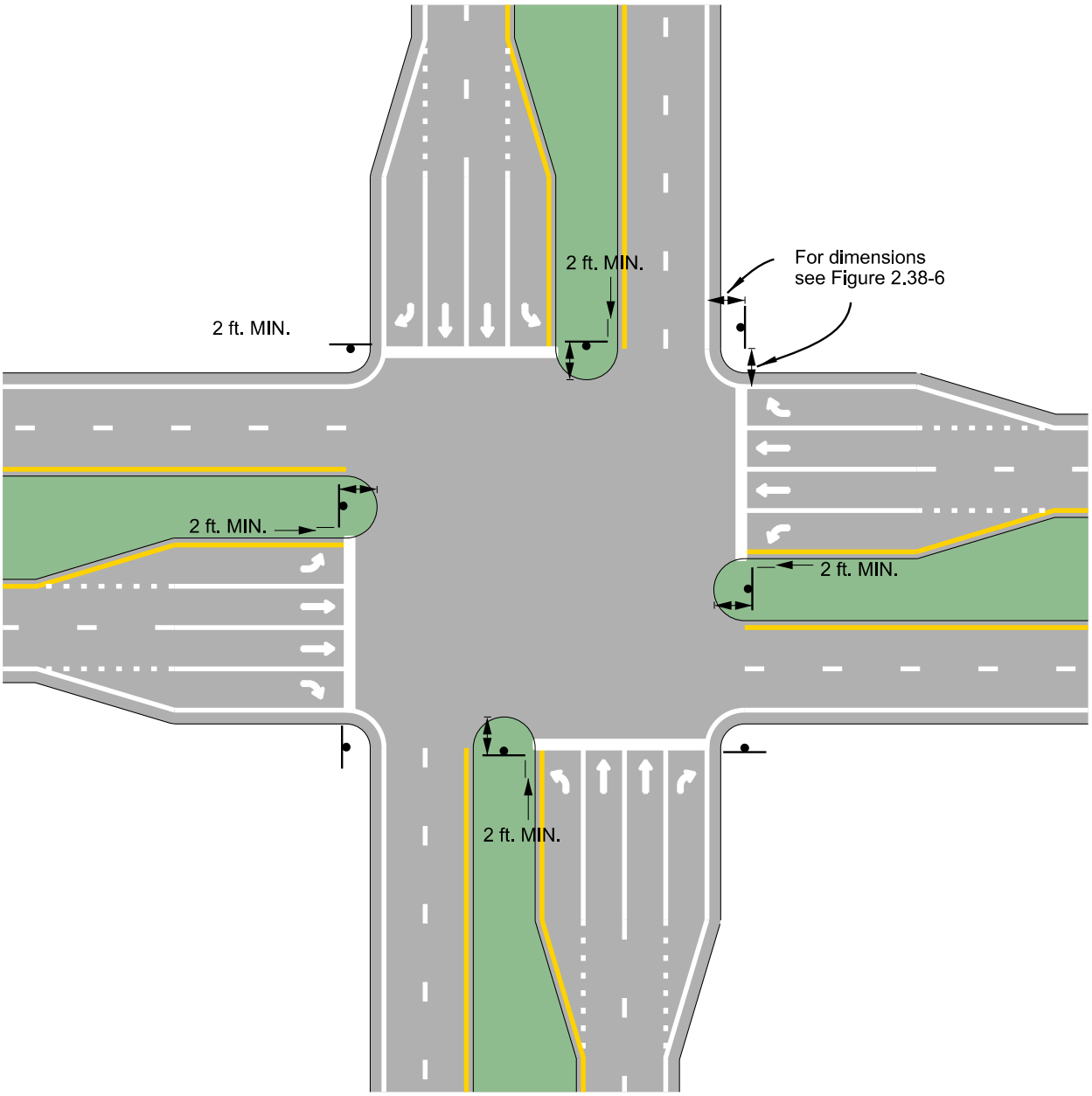


Figure 2.38-2. Temporary Signing for Power Outage—Major Single Left Intersection

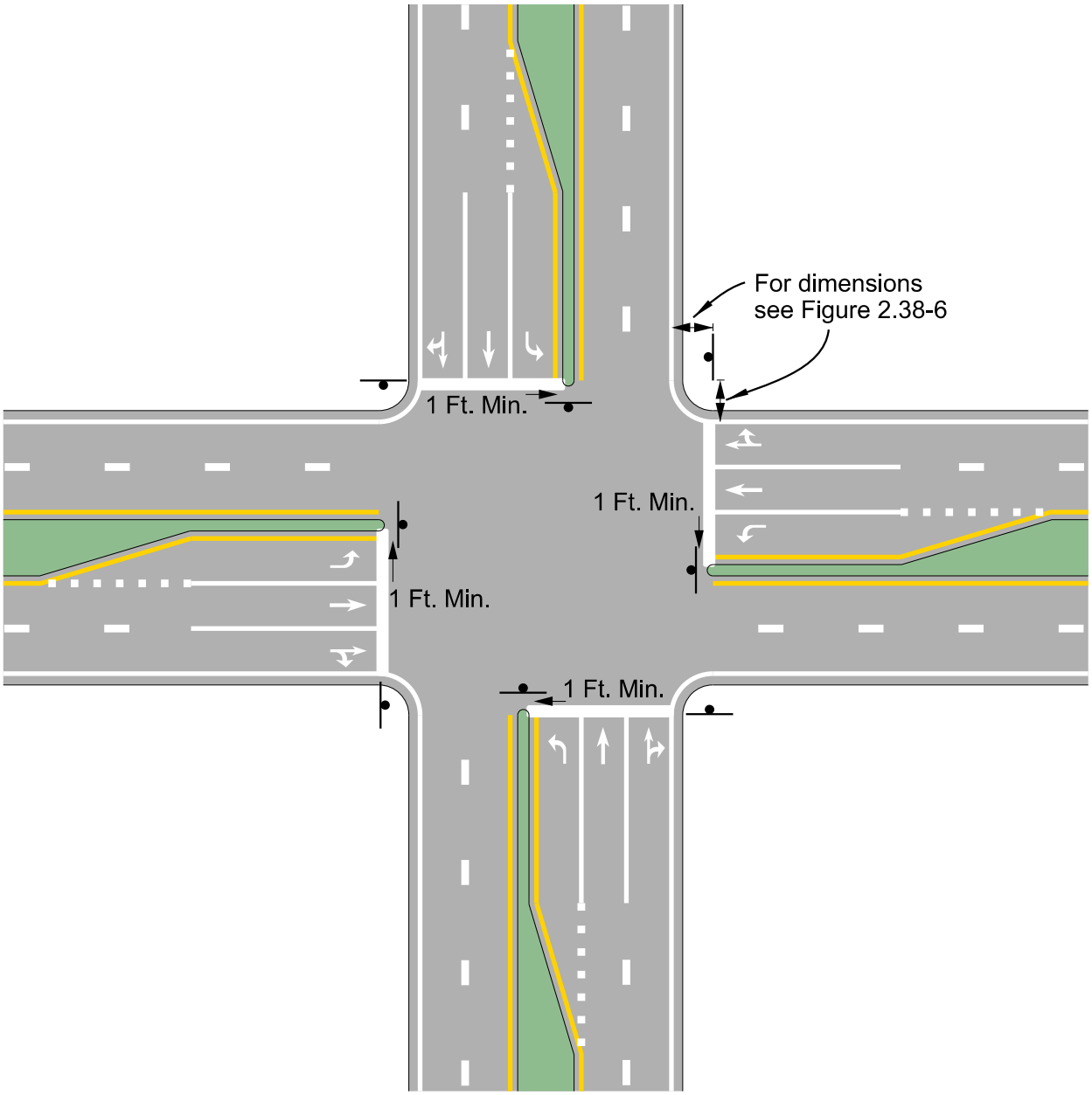


Figure 2.38-3. Temporary Signing for Power Outage—Major Through Intersection

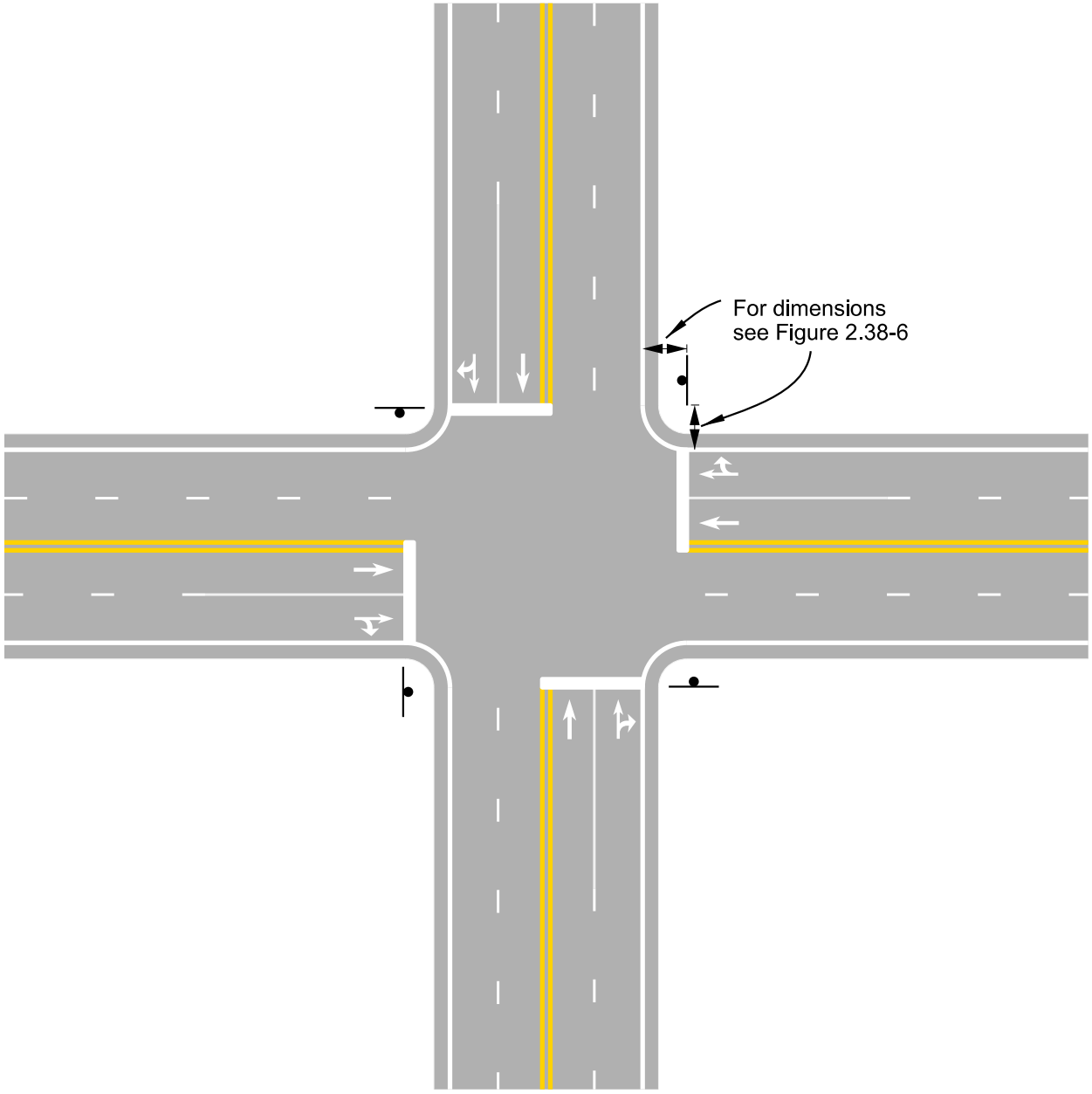


Figure 2.38-4. Temporary Signing for Power Outage—Major to Minor Intersection

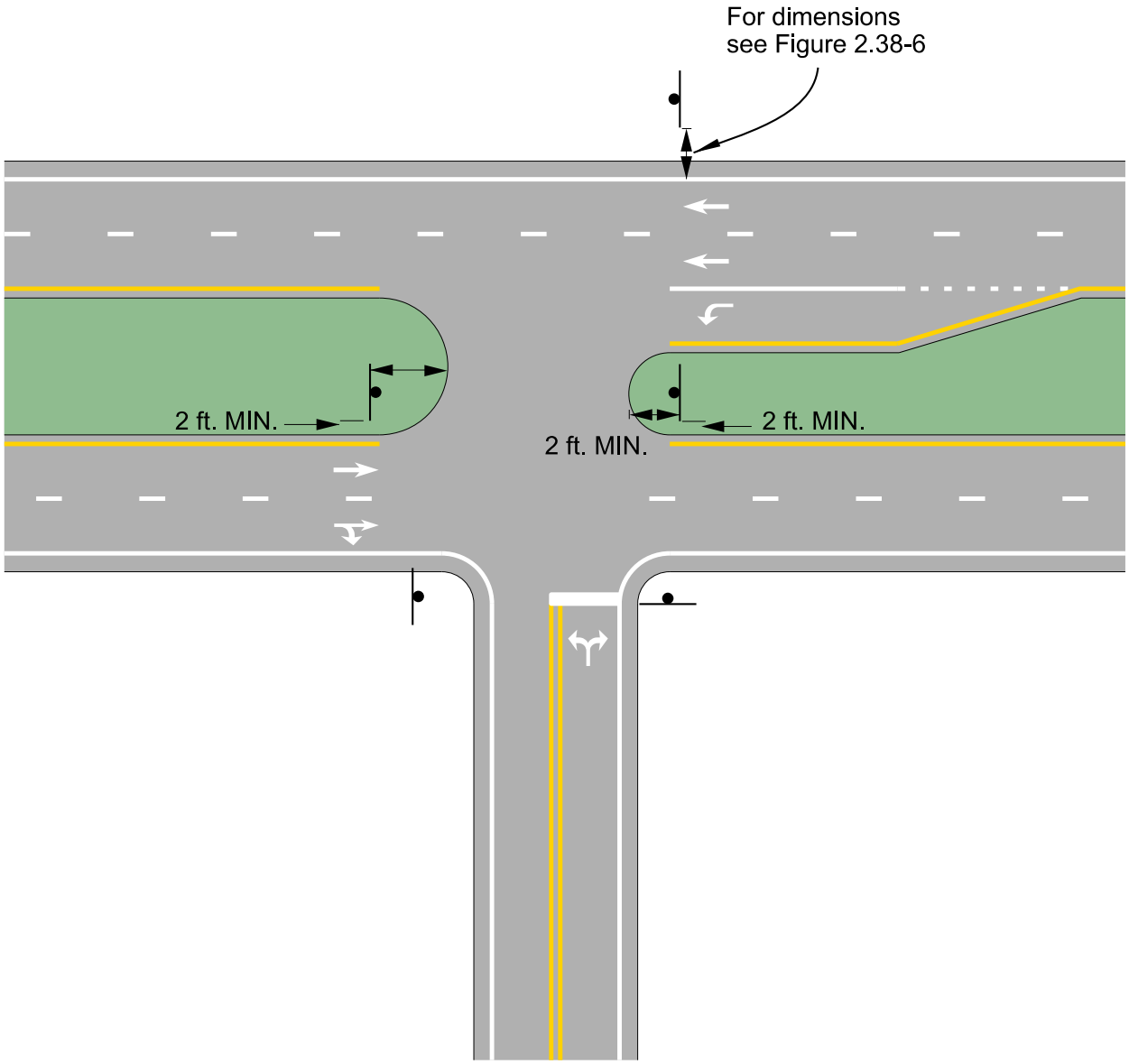


Figure 2.38-5. Temporary Signing for Power Outage—Minor Intersection

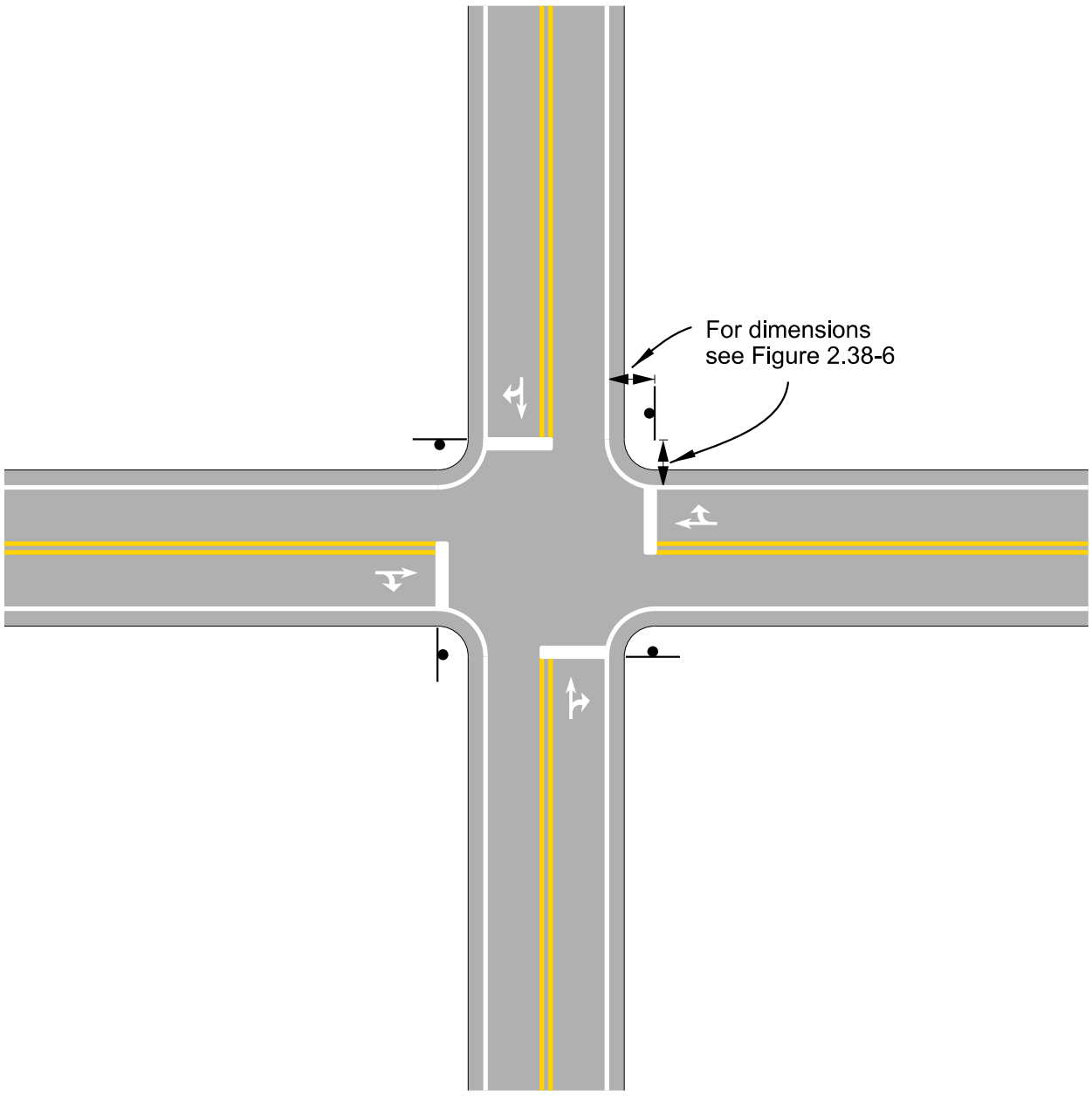
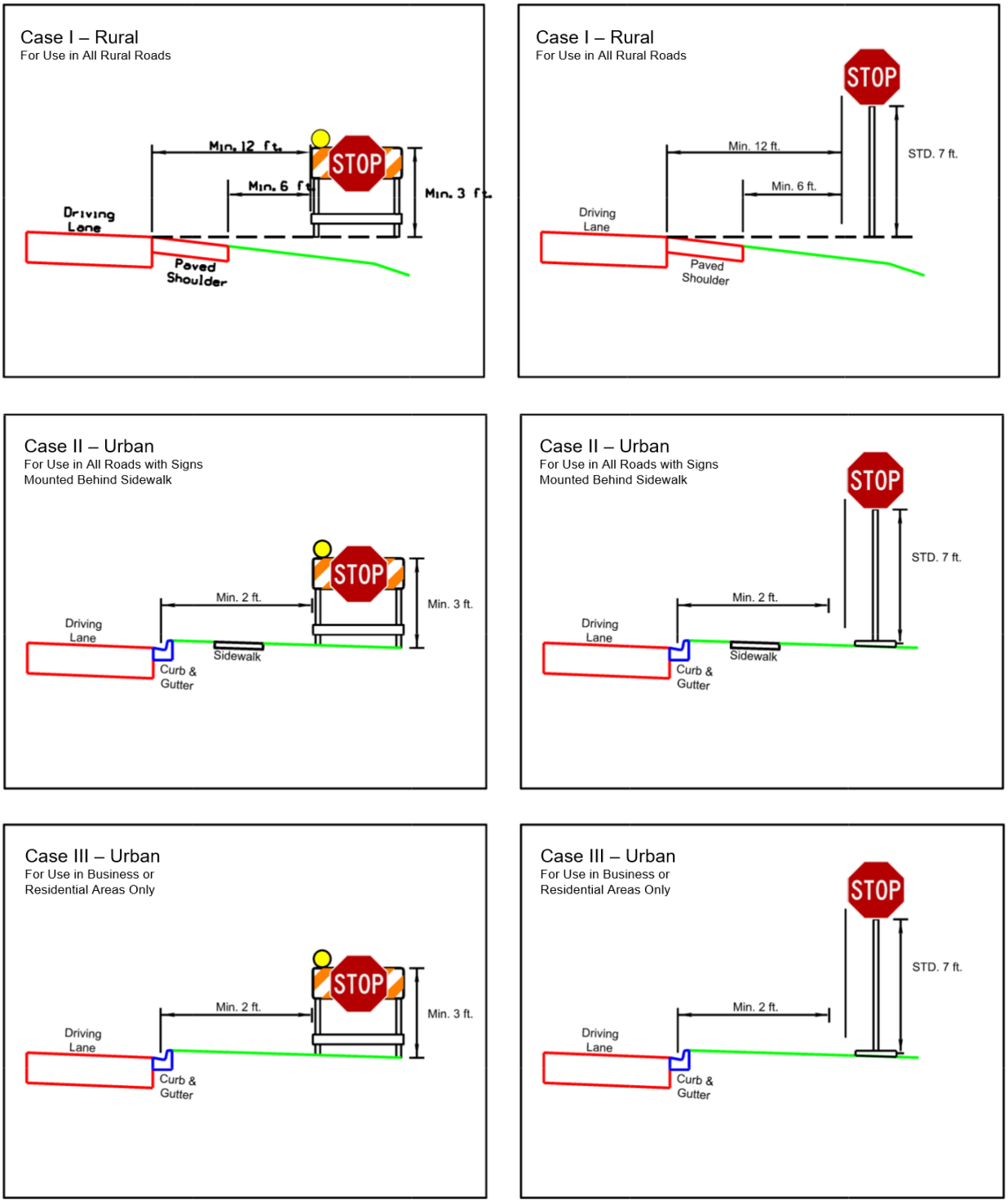


Figure 2.38-6. Temporary Signing for Power Outage—Sign Dimensions



The above sign offset distances and height measurements are from the ***MUTCD***. During a Governor's emergency declaration, these distances may vary at the ***DTOE's*** discretion.

SECTION 2.39

WARNING, STOP, AND YIELD SIGN SIZES

2.39.1 PURPOSE

This section provides guidance on sizing warning (***W Series***), *STOP (**R1-1**)*, and *YIELD* (***R1-2***) signs. Older adult motorists (65 years and older) may experience declining vision and slower reaction time. Reduced visual acuity is associated with higher crash rates. Warning, *STOP*, and *YIELD* signs are critical to the safe operation of motor vehicles by all motorists.

2.39.2 BACKGROUND

The ***State Traffic Engineering and Operations Office*** conducted a study to determine the appropriate sizes for warning (***W Series***), *STOP (**R1-1**)*, and *YIELD (**R1-2**)* signs.

To obtain a Florida driver's license, corrected visual acuity must be at least 20/70. Warning (***W Series***), *STOP (**R1-1**)*, and *YIELD (**R1-2**)* signs are sized to reflect that requirement.

The minimum sign sizes referenced in this section are to be used for all future projects and when replacing signs that have been damaged or worn out.

2.39.3 RECOMMENDED WARNING SIGN SIZES

Follow the symbol warning sign sizes in ***Table 2.39-1*** to meet the design goal for 20/70 visual acuity.

Table 2.39-1. Recommended Symbol Warning Sign Sizes

SIGN SYMBOL	SIGN CODE	SIGN SIZE (inches)
Stop AHEAD	W3-1	36
Yield AHEAD	W3-2	36
Signal AHEAD	W3-3	36
Speed Reduction	W3-5	36
TRUCK CROSSING	W11-10	36

For word message warning signs, follow the sign sizes shown in ***Table 2.39-2*** to meet either the minimum design goal of 20/70 visual acuity or the greatest acuity available by using a 48-inch diamond-shaped sign.

Table 2.39-2. Recommended Word Message Warning Sign Sizes

SIGN MESSAGE	SIGN CODE	SIGN SIZE (Inches)	LETTER SERIES	PRIMARY LETTER HEIGHT (Inches)	MINIMUM REQUIRED ACUITY 20/x
ROAD NARROWS	W5-1	48	D	8	64
NARROW BRIDGE	W5-2	48	D	8	64
ONE LANE BRIDGE	W5-3	48	C	8	54
BUMP	W8-1	36	D	10	80
DIP	W8-2	36	E	10	88
PAVEMENT ENDS	W8-3	48	C	8	54
SOFT SHOULDER	W8-4	48	C	8	54
TRUCK CROSSING	W8-6	48	C	8	54
LOOSE GRAVEL	W8-7	48	D	8	64
ROUGH ROAD	W8-8	48	D	8	64
LOW SHOULDER	W8-9	48	C	8	54
RIGHT LANE ENDS	W9-1	48	D	8	64
LANE ENDS MERGE LEFT	W9-2	48	D	8	64
35 MPH	W13-1	24	E	10	88
EXIT 25 MPH	W13-2	36 x 48	E	12	106
RAMP 30 MPH	W13-3	36 x 48	E	12	106
DEAD END	W14-1	48	D	9	72

A *NO PASSING ZONE* sign (***W14-3***) is 48 x 36 inches with 5-inch Series D lettering for the words *NO* and *PASSING* and 5-inch Series C lettering for the word *ZONE*.

Right-of-way constraints may limit warning sign size. When this occurs, use the largest sign that will fit.

Any sign not designed for 20/70 visual acuity will be legible to most motorists at a shorter distance, allowing less time for them to perceive and understand the message before passing the sign. However, by adding the following additional distances to the sign placement distances shown in ***MUTCD Table 2C-4***, the same total distance from the point where the sign is just legible to the condition must be maintained.

Add 25 feet for 8-inch Series C and 8-inch Series D letters; 50 feet for 5-inch Series D, 6-inch Series C, and 6-inch Series D letters; and 75 feet for 5-inch Series C letters.

2.39.4 RECOMMENDED STOP SIGN SIZES

The 48-inch *STOP* sign requires a minimum visual acuity of 20/45, and using the larger *STOP* signs in areas with restricted right-of-way may present problems. Installing the *STOP AHEAD* symbol warning sign alleviates both problems.

Follow ***Table 2.39-3*** to determine the required size for the *STOP* (***R1-1***) and *STOP AHEAD* (***W3-1***) signs and the sign placement distance for the *STOP AHEAD (**W3-1***) sign.

Table 2.39-3. *STOP* and *STOP AHEAD* Sign Sizes and Placement

POSTED SPEED (mph)	STOPPING SIGHT DISTANCE (feet)	STOP SIGN SIZE[1] (inches)	STOP SIGN RECOGNITION DISTANCE (20/70) (feet)	STOP AHEAD SYMBOL SIGNS[2] (inches)	STOP AHEAD SIGN PLACEMENT DISTANCE (feet)
20	150	30	178	–	–
25	200	30	222	–	–
30	250	36	267	36*	125*
35	300	36	267	36*	175*
45	450	36	267	36	325
50	550	48	356	36	425
55	625	48	356	36	500

*If needed for urban locations with restricted sight distance.

[1] On state highways with a speed limit of 45 mph or greater, consider the 48-inch *STOP* sign (***R1-1***). *STOP* signs (***R1-1***) on roads intersecting the state highway are usually replaced as needed during FDOT construction projects. The sizes in this section are recommended for the replacement signs. Motorists traveling on local roads in urban areas expect to encounter *STOP* signs (***R1-1***). Use a *STOP* sign (***R1-1***) larger than 36 inches when greater emphasis or visibility is needed.

[2] On state highways in rural areas, motorists may not expect to encounter a *STOP* sign (***R1-1***). As an enhancement, use the *STOP AHEAD* sign *(**W3-1***) for speeds equal to or greater than 45 mph. On rural local roads, motorists usually expect to stop before crossing a state highway. Where sight distance restrictions exist, use a *STOP AHEAD* sign *(**W3-1***).

The stopping sight distances shown in ***Table 2.39-3*** were calculated using the equation on Page 113 of AASHTO's ***A Policy on Geometric Design for Highways and Streets*** (Green Book, 2004 edition), and are for level, wet pavement. The brake reaction time was increased from 2.5 to 3.5 seconds to accommodate motorists 65 years and older.

Increase both the stopping sight distance and the *STOP AHEAD* sign (***W3-1***) placement distance to compensate for longer stopping sight distance on downgrades.

The results in ***Table 2.39-3*** do not change for downgrades as steep as 6 percent at speeds up to and including 35 mph. ***Table 2.39-4*** gives the required additional distance due to downgrade. Add this increase to both the stopping sight distance and the *STOP AHEAD* sign (***W3-1***) placement distance in ***Table 2.39-3***.

Place the *STOP AHEAD* symbol sign according to ***Table 2.39-3***, rather than ***MUTCD Table 2C-4*** for Condition B (Stop). The 36-inch sign is legible at 141 feet for people with at least 20/70 visual acuity, which is greater than the required 125 feet.

If restricted right-of-way requires a *STOP* sign (***R1-1***) smaller than shown in this table, use the largest possible size and place a 36-inch *STOP AHEAD* symbol sign according to ***Table 2.39-3*** and ***Table 2.39-4***.

If restricted right-of-way demands a *STOP AHEAD* symbol sign smaller than 36 inches, the 30-inch sign is legible at approximately 117 feet. Place this sign 10 feet further from the *STOP* (***R1-1***) sign than the distance shown in ***Table 2.39-3*** and ***Table 2.39-4***.

Table 2.39-4. Additional Stopping Sight Distance and *STOP AHEAD* Sign Placement Distance Due to Downgrade

POSTED SPEED (mph)	ADDITIONAL DISTANCE (3% GRADE) (feet)	ADDITIONAL DISTANCE (6% GRADE) (feet)
45	25	50
50	50	75
55	50	100

When flashing beacons are used on the *STOP* (***R1-1***) sign, the *STOP AHEAD* (***W3-1***) sign is optional unless required because of restricted sight distance.

2.39.5 RECOMMENDED YIELD SIGN SIZES

The sizes for *YIELD* (***R1-2***) signs are shown in ***MUTCD Table 2B-1***.

SECTION 2.40
APPROVED SAFETY MESSAGES FOR PERMANENTLY MOUNTED DYNAMIC MESSAGE SIGNS

2.40.1 PURPOSE

This section lists approved standard safety messages that can be displayed on permanently-mounted dynamic message signs.

2.40.2 DEFINITIONS

Dynamic Message Sign (DMS): Dynamic, changeable, or variable message signs are programmable traffic control devices that electronically display messages composed of letters, symbols/graphics or both. DMS are used to convey timely and important en route and roadside information to motorists and travelers about changing highway conditions to improve operations and reduce crashes. DMS may inform motorists to change travel speed, change lanes, divert to a different route, or be aware of a change in current or future traffic conditions.

2.40.3 APPROVED STANDARD SAFETY MESSAGES FOR DISPLAY ON PERMANENTLY MOUNTED DMS

Approved standard safety messages for display on a permanently mounted DMS can be found on ***FDOT's Highway Signing Program*** website.

SECTION 2.41
RETROREFLECTIVE STRIPS

2.41.1 PURPOSE

This section specifies how to use retroreflective strips on signposts or sign columns when required or when there is a documented need to draw attention to the sign, especially at nighttime. Retroreflective strips can make signs more visible and conspicuous.

2.41.2 CONDITIONS FOR USE

Retroreflective strips are required for the following static signs:

(a) *DO NOT ENTER* signs (***R5-1***) per ***FDM 230.4***

(b) *WRONG WAY* signs (***R5-1a***) ***per FDM 230.4***

(c) *ONE WAY* signs (***R6-1***) per ***FDM 230.4***

(d) Crossbuck sign blades at rail crossings and posts at passive rail crossings

Use retroreflective strips on signposts where there is a documented need or their application has proven to significantly reduce crashes for a given condition. Consider using retroreflective strips on the following sign types based upon engineering judgement:

(a) *CURVE WARNING* signs (***W1-1 through W1-15***) (***MUTCD Section 2C.05***)

(b) *STOP* (***R1-1***), *YIELD* (***R1-2***), or other regulatory signs

For critical signs that are placed in undesirable locations (on curves where headlamps don't align optimally, etc.), engineering evaluations may lead to the sign being upgraded with retroreflective strips. Engineering judgment includes considering high-crash locations where the use of retroreflective strips on sign supports could improve sign visibility and provide better guidance to motorists.

2.41.3 SIGN DESIGN

Refer to the specifications for retroreflective requirements in ***Standard Specifications, Section 700***.

SECTION 2.42
EXPRESS LANES SIGNING

2.42.1 PURPOSE

This section establishes a uniform basis for designing express lanes signing.

2.42.2 BACKGROUND

Design express lanes signs in compliance with ***MUTCD Section 2G***. Express lanes are referred to as *Priced Managed Lanes* in the ***MUTCD***.

2.42.3 CRITERIA

Express lanes signs include the following sign types:

(1) Regulatory Signs

- **(a)** Vehicle Eligibility sign
- **(b)** Express Lanes Termination sign
- **(c)** Toll Amount sign
- **(d)** Priced Managed Lane Operation sign *(**R3-44**)*

(2) Advanced Guide Signs

- **(a)** Point of Entry/Ingress signing
- **(b)** Point of Exit/Egress signing

2.42.3.1 Vehicle Eligibility Sign

This sign conveys the vehicle eligibility criteria established in ***Rule 14-100.003, F.A.C.***, regarding the number of axles and vehicle types permitted to use the express lanes. Mount this sign overhead above the applicable lane. An example of the vehicle eligibility sign is shown in ***Figure 2.42-1***.

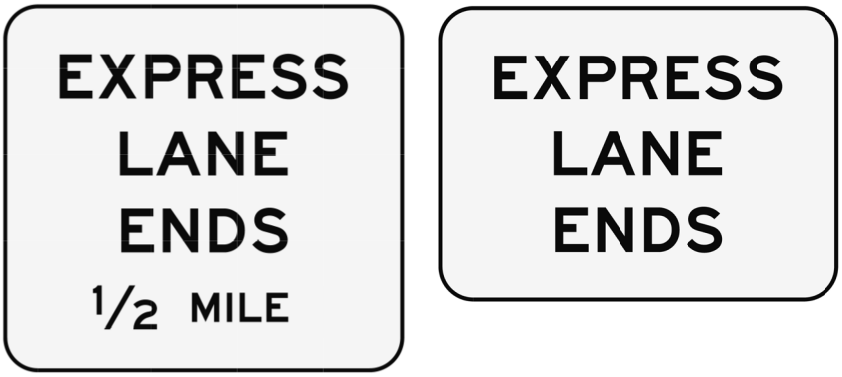
Figure 2.42-1. Vehicle Eligibility Sign



2.42.3.2 Express Lanes Termination Sign

This sign informs motorists that the express lanes are ending. Mount this sign overhead above the applicable express lane. Mount three signs at sequential spacing if space permits. Use an increased 15-inch letter height to improve visibility for motorists 65 and older. Examples of the Express Lane Termination sign are shown in ***Figure 2.42-2***.

Figure 2.42-2. Express Lane Termination Signs



2.42.3.3 Toll Amount Sign (TAS)

The Toll Amount sign (TAS) displays real-time toll amount information, identifying the cost of using the express lanes to a specific destination and the fee for toll violations, as required by ***Rule 14-100.003, F.A.C***. Since the TAS posts information that influences motorist decisions to use the express lane, it is important that the sign be clear, legible, and straightforward. Examples of the TAS are shown in ***Figure 2.42-3***.

Do not display more than three destinations on the TAS.

The toll violation message is black on white and displayed on the TAS.

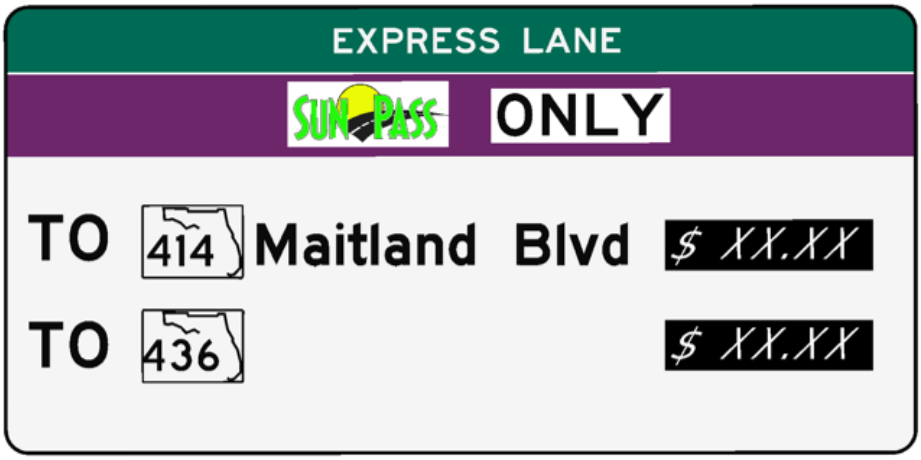
Mount the TAS overhead above the applicable lane. See ***TEM Section 2.42.4*** for TAS sign placement and sequencing.

Design the TAS sign structures to hold the maximum-size panel of three destinations.

Do not repeat destinations on any TAS within the express lanes.

Install two TASs (space permitting) indicating the toll amounts for the next set of toll destinations over the express lanes prior to the last point of egress to the general-purpose lanes before beginning the new sequence of tolling trips.

Figure 2.42-3. Toll Amount Sign



2.42.3.4 Priced Managed Lane Operation Sign

The Priced Managed Lane Operation sign (***R3-44***) informs motorists of the beginning or entry point of an access-restricted express lane. Install this sign at the beginning or entry point to the express lane in accordance with ***MUTCD Section 2G.18***. An example of the Periods of Operation sign is shown in ***Figure 2.42-4***.

Use the physical gore as the point of reference for the distance message on advance guide signs except when the physical gore and theoretical gore are separated by more than 500 feet. Use the theoretical gore as the point of reference when the physical gore and theoretical gore are separated by more than 500 feet.

Figure 2.42-4. Priced Managed Lane Operation Sign



2.42.3.5 Advance Guide Signs

If the entry/ingress or exit/egress is on the left side of the roadway, add a *LEFT* plaque to the top left edge of the advance guide signs, as shown in ***MUTCD Section 2G.10***. If the entry/ingress or exit/egress is a lane drop situation, install the *ONLY* panel with a down arrow.

Add a *NO TRUCKS* black-on-white panel to the top of the advance guide signs as shown in ***Figure 2.42-5***.

SunPass and other interoperable transponders are the only forms of payment for the express lane. Include the *SUNPASS ONLY* panel with purple background on advance guide signs.

2.42.3.6 Point of Entry/Ingress Signs

The access types for managed lanes are defined in ***FDM 211***. Install point-of-entry/ingress signs at each access point. Examples of point of entry/ingress signs are shown in ***Figure 2.42-5***.

When the point of entry is the initial entrance to the express lane network, start the advance overhead signing two miles before the express lane entrance, space permitting. In addition to the initial entry/ingress express lane signing, locate sequential overhead guide signs at one mile, half a mile, and at the express lane point of entry. For intermediate express lane entry/ingress points, begin advance signing one mile before the express lane ingress and continue with the remaining sequence of signs.

Figure 2.42-5. Examples of Ingress Signing



2.42.3.7 Point of Exit/Egress Signs

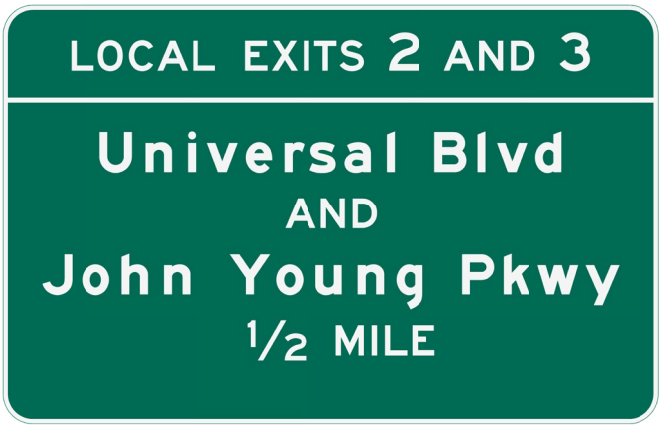
Intermediate point of exit/egress guide signs, or local exit signs, inform express lane users which express lane egress ramp serves their destination. Mount local exit signs overhead and over the lanes to which they apply.

Display the destinations on the general use exit sign the same as on the corresponding TASs.

If there are three or more general-purpose lane exits before the next opportunity to exit the express lane, indicate this on the egress signing, as shown in ***Figure 2.42-6***.

Figure 2.42-6. Examples of Egress Signing





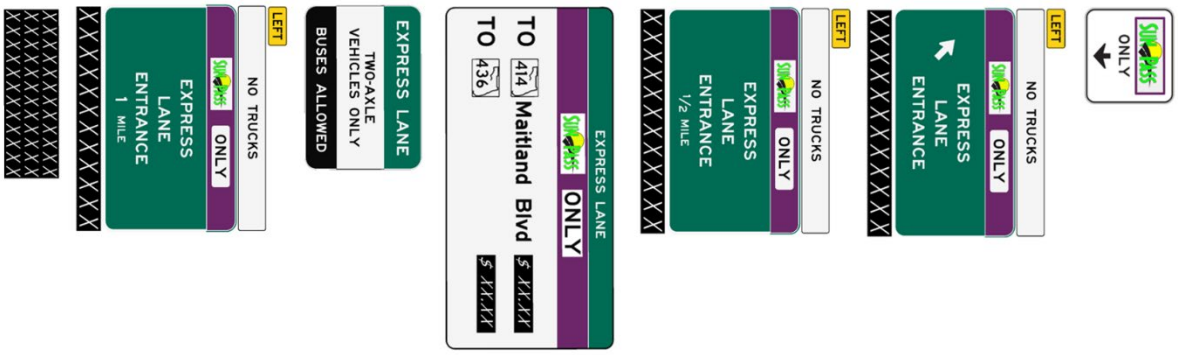


2.42.4 SIGN SEQUENCE

There are seven signs that need to be installed at an express lane entrance: three advance guide signs, two TASs, one vehicle eligibility sign, and one regulatory Priced Managed Lane Operation sign (***R3-44)*** (*MUTCD Section 2G.18*). Include one three-line full-matrix dynamic message sign (DMS) if space is available. Install the signs in the order shown in ***Figure 2.42-7.***

Install the Priced Managed Lane Operation sign (R3-44) last in the sequence. Install the DMS, if included, first in the sequence.

Figure 2.42-7. Express Lanes Entrance Sign Sequence



Install a minimum of two TASs with the legend showing the destination and price before the express lane entrance. The *MUTCD* gives minimum spacing requirements for express lane signs, including TASs.

If the sign information is intended for the general use lanes, install the sign above the general use lanes. If it is intended for the express lane, install the sign above it.

2.42.5 SPECIAL CONSIDERATION FOR ARTERIAL ENTRANCE/INGRESS CONNECTIONS WITH EXPRESS LANES

For direct entrance/ingress access into the express lanes from an arterial road, one TAS for each travel direction is acceptable, provided the sign includes a one-line DMS to serve as a backup with separate power and separate communication.

The letter height for arterial signs may be reduced per the ***MUTCD***.

If there are right-of-way constraints and the vehicle eligibility sign cannot be placed on multi-post supports, mount it on a single post.

SECTION 2.43

RAMP ONLY SIGN PANEL

2.43.1 PURPOSE

This section establishes a uniform basis for incorporating the *RAMP ONLY* sign panel. Use this guidance for signing a lane drop on an arterial approaching an interchange onto a limited-access facility.

2.43.2 BACKGROUND

MUTCD Section 2E.28 provides signing guidance for when an expressway and freeway lane drops at an interchange exit that does not have an optional exit lane. ***MUTCD Section 2D.49*** encourages consistent sign application for conventional road approaches to freeway or expressway interchanges. Using the *RAMP ONLY* sign panel supports consistency for motorists on an arterial with a through lane drop that carries an interchange entrance ramp.

Apply the design details for the *EXIT ONLY* (down arrow) (***E11-1***) sign panel provided in the ***FHWA Standard Highway Signs Manual*** to design *RAMP ONLY* sign panels. The number of arrows displayed on the sign panel corresponds to the number of terminated lanes at each sign's location. Place the down arrow as directed by ***MUTCD Section 2E.18***.

2.43.3 CONDITIONS FOR USE

Install the *RAMP ONLY* sign panel (***Figure 2.43-1***) when it is important to inform motorists on an arterial that the through lane is being dropped at the interchange entrance ramp. Mount this sign overhead and above the lane to which it applies.

Coordinate use of the *RAMP ONLY* sign panel with the ***DTOE***.

Figure 2.43-1. *RAMP ONLY* Sign Panel



SECTION 2.44

TURNING VEHICLES STOP FOR PEDESTRIANS SIGN

2.44.1 PURPOSE

This section has guidelines for using the *TURNING VEHICLES STOP FOR PEDESTRIANS* sign (***R10-15a***) on the State Highway System.

Use of these signs supports ***Section 316.130(7), F.S.***, which requires a motorist to stop before entering the crosswalk to allow pedestrians to cross at a signalized intersection or a free-flow channelized turn lane. The *TURNING VEHICLES STOP FOR PEDESTRIANS* sign (***R10-15a***) is designed to reduce the potential for vehicle-pedestrian conflicts by increasing motorist awareness.

2.44.2 GENERAL

Per ***MUTCD Section 2B.59***, use the *TURNING VEHICLES STOP FOR PEDESTRIANS* sign (***R10-15a***) at signalized intersections where turning motorists might face pedestrian conflicts that are not immediately apparent.

2.44.3 GUIDANCE

Install the *TURNING VEHICLES STOP FOR PEDESTRIANS* sign (***R10-15a***) at signalized intersections with a dedicated turn lane or at intersections with a free-flow channelized turn lane.

Use a fluorescent yellow-green background for the ***R10-15a*** sign in accordance with ***FDOT Standard Specifications Table 700-2***. Use a yellow background when the sign is installed as part of an existing pedestrian-related signing application that uses yellow-background signs. Do not mix fluorescent yellow-green and yellow pedestrian-related signs at the same intersection or within the same signing application.

Replace existing *TURNING VEHICLES YIELD TO PEDESTRIANS* signs (***R10-15***) with the *TURNING VEHICLES STOP FOR PEDESTRIANS* signs (***R10-15a***) during routine sign replacement activities. Examples from the ***R10-15*** sign series are shown in ***Figure 2.44-1***. ***R10-15a*** sign details are available in ***FDOT's Sign Library***.

Figure 2.44-1. R10-15 Sign Series



R10-15
(replace with ***R10-15a***)



R10-15a for left turns *



R10-15a for right turns *

* R10-15a signs can use fluorescent yellow-green sheeting in accordance with the Standard Specifications for pedestrian-related signing.



CHAPTER
3

Signals

SECTION 3.1
USING FLASHING MODE AT SIGNALIZED INTERSECTIONS AND DEPLOYING FLASHING BEACONS

3.1.1 DEFINITIONS

Flashing Beacon: A highway traffic signal with one or more signal sections that light up intermittently. It can be used at an intersection to control traffic or elsewhere as a warning beacon.

Signal Face: An assembly of one or more signal sections that controls traffic movements on a single approach.

Signal Indication: The illumination of a signal lens.

Non-Programmed Flashing Mode Signal Operations: The shift from an intersection signal's normal operating mode (stop-and-go, steady red-yellow-green) to flashing mode (stop or caution, flashing yellow-red or red-red) because of a signal controller malfunction, conflict in signal displays, or maintenance personnel or police manually selecting the flashing mode.

Programmed Flashing Mode Signal Operations: The shift from an intersection signal's normal operating mode (stop-and-go, steady red-yellow-green) to flashing mode (flashing yellow-red or red-red) at set times during the day, with the exclusion of a programmed flashing yellow or red arrow.

Emergency Flashing Signal Operations: The temporary shift from an intersection signal's normal operating mode (stop-and-go, steady red-yellow-green) to flashing mode (flashing yellow-red or red-red) activated in response to an emergency condition. Emergency flashing mode may be activated when conditions such as severe weather, major incidents, evacuation operations, or other emergencies require simplified traffic control to enhance safety and facilitate emergency response.

3.1.2 RECOMMENDATIONS FOR SIGNALIZED INTERSECTIONS

3.1.2.1 Programmed Flashing Mode Operation

Signals set to normal operating mode (cycling through steady red, green, and yellow phases) can help maintain signal progression and be used as a speed management technique. While flashing mode can be energy efficient, research has shown switching from normal signal operations to late-night flashing can increase crashes. Consider the following before using this mode at a signalized intersection:

- Yellow-red flashing mode may be used when two-way traffic volumes on the main street are below 200 vehicles per hour.
- Yellow-red flashing mode may be used at any hour of the day or night when ***Manual on Uniform Traffic Control Devices (MUTCD) Warrants 1 and 2*** are not met and two-way main street volume is greater than 200 vehicles per hour, provided the ratio of main street to side street volume is greater than 4:1.
- Use flashing mode only at intersections where side street drivers can easily see approaching main street traffic. Avoid using it at intersections with more than four legs, skewed intersections (greater than 15 degrees), or preempted signals.

Limit flashing signal mode to a maximum of three non-consecutive time windows of flashing operation within 24 hours. If crashes at an intersection increase after changing to flashing mode or crash severity increases, return the signal to normal operation.

3.1.2.2 Non-Programmed Flashing Mode

When a signal at an intersection malfunctions during normal operation, it will immediately switch to flashing mode without a clearance interval.

3.1.3 FLASHING MODE APPLICATIONS

Use the following signal flashing mode and start-up sequences:

3.1.3.1 Yellow-Red Flashing Mode

Main Street: Flashing yellow during flashing mode, then steady green on start-up sequence.

Arrow Turn signals: Flashing red signal arrows during yellow-red flashing mode, then steady red arrow on start-up sequence.

Side Street: Flashing red during flashing mode, then steady red on the start-up sequence.

3.1.3.2 Red-Red Flashing Mode

Main Street: Flashing red during flashing mode, then steady green on the start-up sequence.

Arrow Turn signals: Flashing red signal arrows during red-red flashing mode, then steady red arrow on start-up sequence.

Side Street: Flashing red during flashing mode, then steady red on the start-up sequence.

3.1.4 SIGNAL FACES IN FLASHING MODE

MUTCD Section 4G.03 requires all signal faces on an approach (including yellow or red turn signal indications) to be flashed when the signal is in flashing mode.

Do not illuminate pedestrian signal indications (*WALK* and *DON'T WALK*) at a signalized intersection when flashing mode is on.

3.1.5 FLASHING INDICATION COLORS

Consider the following when determining whether to flash red or yellow circular or arrow:

- Set flashing display for each signal-controlled approach, including separately-controlled turn movements.
- Flash the same color on all signal faces at an approach. Separate signal faces for separately-controlled turn movements may be flashed as described in ***MUTCD Section 4G.03***.
- There is no need to shield or position flashing yellow indications for through traffic from drivers in separately-controlled turn lanes but do shield separate protected turn movement signals from through traffic. See ***MUTCD Section 4F.10***, ***Section 4F.11***, ***Section 4F.12***, ***Section 4F.13***, ***Section 4F.14***, and ***Section 4F.15*** for additional guidance.
- When programming a signal with only arrow indications to flashing mode, flash the appropriate red or yellow arrow indication.
- When a signal face includes both circular and arrow indications of the desired color, flash only the circular indication of that color. When a five-section head is used, flash the same color as for the approach through lanes. When the traffic signal is in flashing mode, only circular red or circular yellow indications will flash.
- Do not immediately follow a steady green or flashing yellow indication with a steady or flashing red indication without displaying the steady yellow indication. Transitioning from a steady green to a flashing yellow indication is acceptable without displaying the steady yellow indication. This applies to both the circular and arrow indications. A transition from stop-and-go to flashing mode, whether initiated by a signal conflict monitor or a manual switch, may be made at any time.

Main Street, Through Traffic: From flashing yellow to steady green.

Main Street, Separate Left Turn: From flashing red to steady red.

Side Street, Through Traffic: From flashing red to steady red.

Keep green arrow indications that are continuously illuminated during normal operations continuously illuminated during flashing mode.

3.1.6 INTERSECTION CONTROL BEACONS INSTALLATION AND OPERATION REQUIREMENTS

When replacing or installing new intersection control beacons (ICB), design the traffic control devices with a minimum of two 12-inch signal indications for all approaches. Place the indications facing each intersection approach, and center them within the approach lanes as much as possible. Separate the approach indications laterally by a minimum of 8 feet. Flash the horizontally-aligned indications simultaneously to avoid confusion with grade crossing signals.

Treat each intersection approach independently. For instance, on a divided highway, use a single dual-indication beacon assembly for each approach.

Two vertically-aligned signal faces for each ICB signal indication may be used and flashed alternately to improve driver awareness of the intersection control.

Figure 3.1-1. Intersection Control Beacon



3.1.7 OTHER FLASHING BEACON APPLICATIONS

Flashing beacons may be used to make warning, posted speed limit, and stop signs more conspicuous as detailed in ***MUTCD Section 4S.03***, ***Section 4S.04***, and ***Section 4S.05***, respectively. These beacons may have one or more signal sections of a standard traffic signal control face and flash accordingly.

Section 3.2

GUIDELINES FOR LEFT TURN TREATMENTS

3.2.1 PURPOSE

This section provides guidelines for selecting the type of left-turn treatment, as defined in ***MUTCD Section 4F.02***.

3.2.2 LEFT-TURN TREATMENT STRATEGIES

Permissive-Only Mode: Drivers can turn after yielding to opposing traffic and pedestrians. When a circular green indication is displayed, both directional turns are permitted unless otherwise prohibited by another traffic control device. A flashing yellow arrow may be displayed to indicate a permissive turning movement in either protected/permissive mode or permissive-only mode. When a flashing yellow or red arrow is displayed, the turn indicated by the arrow is permitted.

Protected-Only Mode: Drivers can turn when a green arrow indication is displayed. When protected-only mode is used with a single left-turn lane, center a three-section signal head over the lane. From top to bottom—or left to right on a horizontal signal head—display the left-turn arrows in the following order: red, yellow, and green. For two or more left-turn lanes, use at least two three-section signal heads, as described above, centering one signal head over each left-turn lane.

Protected/Permissive Mode: A combination of protected and permissive modes can occur during the same cycle. Turning vehicles have the right-of-way during the protected phase and can complete the turn "permissively" when the adjacent through movement receives its circular green indication.

Use a four-section signal head with flashing yellow arrow (FYA) for protected/permissive mode. Use arrows with red, yellow, and green signal faces with a four-section signal head. See ***TEM Section 3.10*** for additional guidance on FYA display. A five-section signal head centered over the lane line between the left-turn lane and the leftmost through lane can be used for protected/permissive mode. The five-section signal head can serve as one of the two required through traffic signal heads.

Split Phasing: Assigns right-of-way to all movements on a particular approach, followed by all the movements on the opposing approach. For split phasing, a four-section signal head can be centered over the lane line between the left-turn lane and the leftmost through lane to serve as one of the two required through traffic signal heads. Do not provide supplemental signing.

Variable Left-Turn Mode: The operating mode changes among protected-only, protected/permissive, or permissive-only modes during different periods of the day or as

traffic conditions change. Follow the display guidance above dependent on the programmed left-turn modes (permissive-only, protected/permissive, or protected-only).

3.2.3 LEFT-TURN SIGNAL PHASING

When selecting the type of left-turn phasing at an intersection approach with an established need for this type of control, apply the following guidelines and exercise sound traffic engineering judgment.

Use the protected/permissive mode for all intersection approaches requiring a left-turn phase unless there is a compelling reason to use another mode. This may include a crash history with permissive left turns and motorcycles, pedestrians, or bicyclists. If it is not obvious whether protected/permissive or protected-only mode is best, use protected/permissive mode on a trial basis. If operations are satisfactory, retain it. If they are not, convert to protected-only mode.

Engineers may vary the left-turn mode on an approach throughout the day between the permissive-only, protected/permissive, or protected-only left-turn modes, where an engineering study shows this type of operation can improve safety and operations.

Apply protected-only mode at an intersection approach if any of the following conditions are present:

- There are two or more left-turn-only lanes.
- Geometric condition requirements cannot be met (e.g., horizontal and vertical curve, intersection skew angle, cone of vision), and the resulting sight distance makes protected-only mode necessary.
- The approach is the lead portion of a lead/lag intersection phasing sequence.
- There is a positive offset left-turn lane (see ***FDM 212.14.4*** for its definition). These typically do not meet the ***MUTCD Section 4D.07*** cone-of-vision requirements for a shared signal display.

Consider a protected-only mode under any of the following conditions:

- The opposing traffic speed limit is higher than 45 mph.
- Left-turning traffic must cross three or more lanes of opposing through traffic.
- A protected/permissive mode or permissive-only mode is in use and there are six or more left-turn crashes on the approach within a 12-month period.
- When permissive left turns may be confusing or hazardous. This can be caused by unusual intersection geometry or negative offset left-turn lanes.

A permissive/protected mode can be used for some intersection approaches if the traffic engineer determines that better progression, as demonstrated in a traffic signal analysis, justifies violating driver expectations. However, limit the use of this type of left-

turn phasing and restrict it to the following situations, which will not create a left-turn trap:

- T-intersections where U-turns are prohibited.
- Four-way intersections where the opposing approach prohibits left turns or has protected left-turn phasing.
- Four-way intersections where left-turn volumes from opposing approaches do not change substantially throughout a normal day, so overlap phasing is not beneficial or required.

Split phasing can be used effectively if any of the following conditions apply:

- Opposing approaches are offset so far from each other that simultaneous left turns from opposing directions are not viable or are hazardous.
- Left-turn volumes are extremely heavy on opposing approaches, and both are nearly equal to the adjacent through movement critical lane volume.
- Left-turn volume is extremely heavy on an approach that does not have a separate left-turn lane.
- Drivers can turn left from more than one lane and may also use the rightmost left-turn lane to travel through.

3.2.3.1 Left-Turn Signal Phasing Engineering Study

Conduct an engineering study at signalized approaches with an existing or proposed permissive-only or protected/permissive left-turn operation when all the following conditions exist:

- Before the scoping of a project involving signalized intersection improvements.
    - Including but not limited to Resurfacing, Restoration, and Rehabilitation (RRR), capacity, and traffic operations improvement projects (e.g., signal retiming activities).
- The context classification is C3C, C3R, or C4.
- The posted speed limit is 40 mph or 45 mph.
- Left-turning traffic must cross three or more opposing through lanes

In the engineering study, analyze conversion to, or use of, protected-only mode, or variable mode with protected-only and protected/permissive during different periods of the day. Additionally, analyze the feasibility of the improvements. This may include a structural capacity analysis as directed by ***FDM 261***.

Implement the improvements identified in the study when determined to be feasible and appropriate by the Engineer of Record.

3.2.4 SIGNAL DISPLAY FOR EXCLUSIVE LEFT-TURN LANE

Do not place a three-section (red, yellow, and green) signal head over an exclusive left-turn lane unless the signal phasing sequence allows a protected left-turn movement during the cycle.

3.2.5 LEFT-TURN PHASES FOR SEPARATED LEFT AND THROUGH LANES

Left-turn lanes at signalized intersections separated from through lanes by raised islands or painted gores may operate in several modes: protected-only, protected/permissive, or permissive-only. When choosing protected/permissive mode, use a five-section signal or a four- or three-section FYA signal. Make it clear the signal is shared by placing it overhead on the lane line between the through lane and the island. In all cases, follow the cone-of-vision requirements in ***MUTCD Section 4D.07***.

Figure 3.2-1 uses standard lane widths for a four-lane divided highway. ***Table 3.2-1*** shows the maximum island or gore width allowed for the indicated signal head distance from the stop line without shifting the signal head.

Figure 3.2-1. Signal Head/Left-Turn Treatment

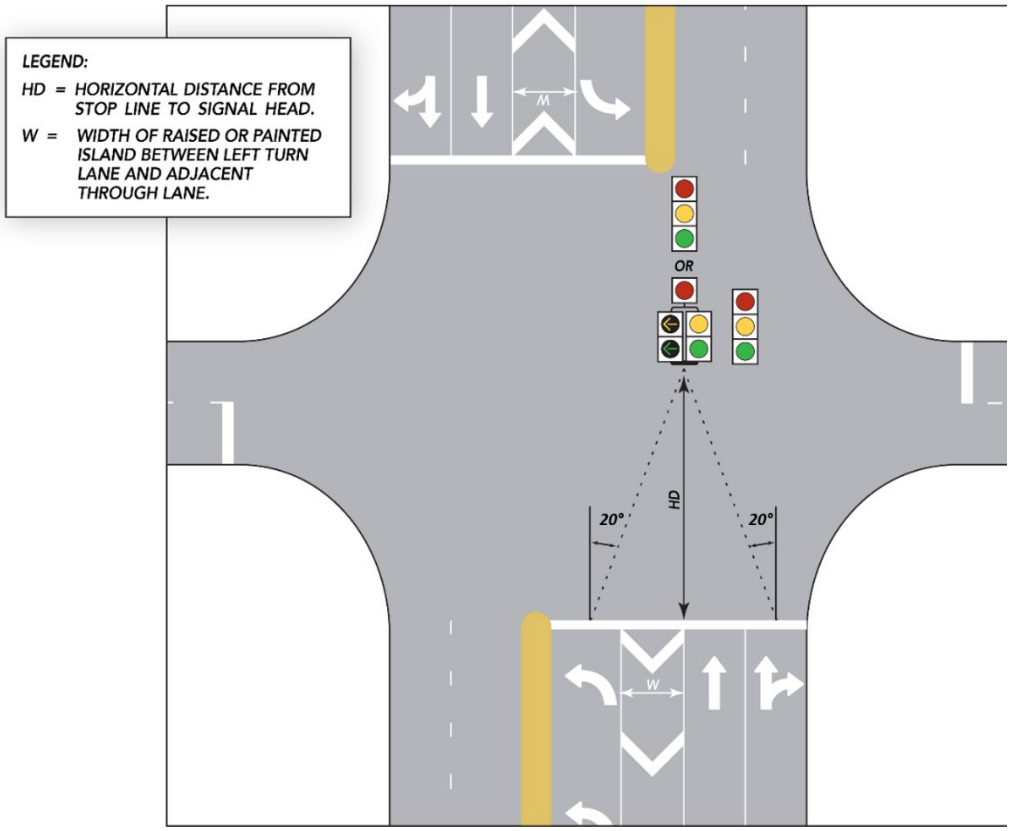


Table 3.2-1. Maximum Width of Island or Gore Without Shifting Signal Head

Horizontal Distance (feet)	Width (feet)
40	8
50	12
60	15
70	19
80	23
90	26
100	30
110	34
120	37
130	41
140	44
150	48

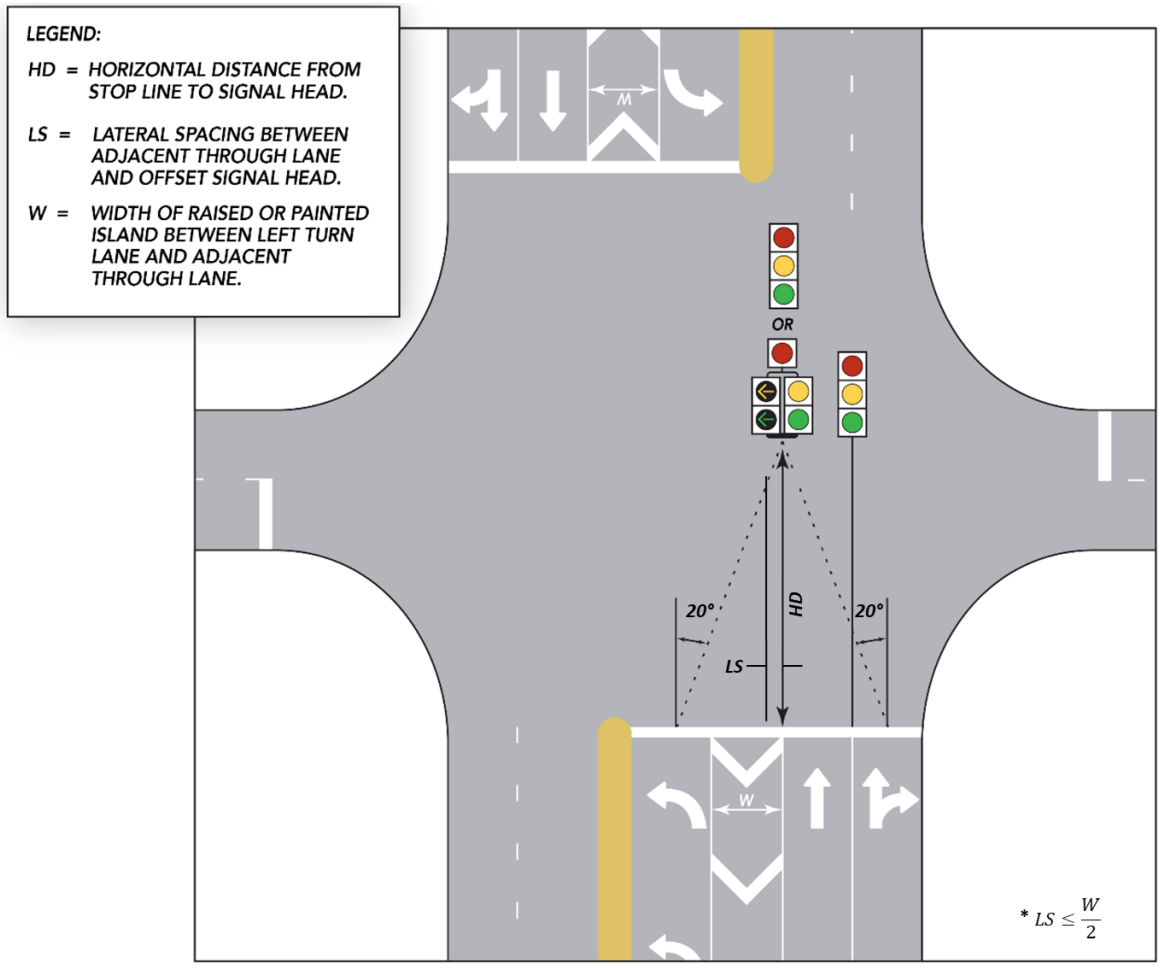
Do not use signals with circular green indications above an exclusive left-turn lane or the extension of the lane for a permissive-only left turn. Do not post-mount signals on the far-side median in front of the left-turn lane.

If positioning a shared signal head on the lane line adjacent to the nearest through lane does not meet cone of vision requirements due to an offset left-turn lane's separation or geometric conditions, the shared signal face may be offset to the left from the adjacent through lane line. This will ensure the cone of vision requirements are met for the rightmost through lane and the left-turn lane. See ***Figure 3.2-2*** for a schematic representation of this offset.

Use this lateral offset spacing only after considering other options, such as increasing the horizontal distance to the signal heads. Place the signal so it is obvious to drivers that it is shared. Generally, keep the lateral offset spacing of the shared signal head from the adjacent through lane no greater than one-half the island's width (½W).

If the lateral shift is too great, the cone of vision may not be adequate for the driver in the rightmost through lane. This may be due to a large parallel offset left-turn lane or a tapered or curved offset left-turn lane. When the cone of vision requirements cannot be met, use a protected-only mode.

Figure 3.2-2 Left-Turn Lane Signal Head Shift



3.2.6 PERMISSIVE-ONLY MODE IN MULTI-LEFT-TURN-LANE APPROACHES

Do not use a permissive green interval for two or more left-turn lane approaches.

Section 3.3

SCHEDULING TRAFFIC SIGNAL STUDIES AND SECURING FUNDING

3.3.1 PURPOSE

This section establishes criteria for responding to requests to install traffic signals, conducting related studies to determine need and appropriate intersection control strategy; and securing funding and arranging implementation for warranted signals.

3.3.2 GENERAL

FDOT is responsible for developing statewide guidelines and maintaining uniform traffic control devices to regulate, manage, guide, and protect all users of the State Highway System. FDOT must respond uniformly to all signal requests and schedule and conduct traffic studies accordingly.

3.3.3 RESPONSE TO SIGNAL REQUESTS AND SCHEDULING TRAFFIC SIGNAL STUDIES

Before committing resources for a signal warrant study, the ***District Traffic Operations Office*** reviews all traffic signal installation requests received by FDOT. This initial screening includes reviewing existing information and local knowledge of the intersection and may require a brief site visit to confirm field conditions. All data collected during the initial screening is kept on file in writing. Reviewers will attempt to relate all data and analysis to ***MUTCD*** standards.

If the initial screening prompts FDOT to conduct a signal warrant study, the appropriate District Traffic Operations Office will contact the local maintaining agency, advise them of FDOT's decision, and obtain their views and input.

If FDOT decides not to further consider a signal warrant study based on the initial screening results, the District Traffic Operations Office will document the reasons and share a copy of the findings with the requestor and local maintaining agency.

Though local government support is ideal, FDOT may commit resources to a signal warrant study.

The District Traffic Operations Office normally conducts signal warrant studies for intersections on the State Highway System, but a local maintaining agency may conduct a signal warrant study and submit it to the District Traffic Operations Office for review. All studies must follow the procedure and standards in this document and be signed and sealed by a Florida-licensed professional engineer.

Formal legal resolutions from local agencies may form the basis of their concurrence in the need for a signal warrant study. However, such documents are required by FDOT as a prerequisite to scheduling the study. Implementation funds do not need to be available before assessing traffic signalization needs (conducting a study).

The District Traffic Operations Office keeps a log of requests for signal warrant studies and their outcomes. To the extent practical, they will prioritize signal warrant study scheduling based on request date, traffic volumes, crashes (frequency, type, injury levels), and the degree of local government interest.

3.3.4 TRAFFIC SIGNAL STUDIES

Traffic signal studies and other required planning and engineering services for traffic signals or alternative intersections on the State Highway System can be undertaken by FDOT staff, local agency engineers, or qualified consulting engineers. FDOT, however, is responsible for requiring and overseeing all such work.

Complete all traffic signal studies as described in FDOT's ***Manual on Uniform Traffic Studies (MUTS), Chapter 2***. Plans and specifications, if required, need to comply with established FDOT procedures.

The developer must cover the cost of traffic signal studies or engineering analyses for new private access points to major traffic generators or proposals to significantly revise access points. Qualified traffic engineers must conduct all studies. These studies are typically part of the Driveway Permit Application, as required by ***Rule 14-96, F.A.C.***

In addition to evaluating the need for signal control at unsignalized intersections, studies must also consider enhanced features at upstream and downstream signalized intersections as needed. All studies and reports must be signed and sealed by a Florida-licensed professional engineer.

The developer is also normally responsible for engineering costs associated with preparing implementation plans and specifications. In some cases, specific critical design needs may require FDOT staff to perform engineering work. In these cases, the District Secretary may direct FDOT staff to complete the engineering work at no cost to the developer.

Engineering studies at existing private access points due to normal traffic growth are usually made by qualified traffic engineers hired and paid by the requestor. In extraordinary situations, FDOT may elect to do this work.

3.3.5 FUNDING ARRANGEMENTS FOR WARRANTED NEW SIGNAL INSTALLATIONS

Funding for new traffic signals or alternative intersections on the State Highway System may come from any combination of private, local, state, or federal sources.

If the improvements are required by a new or revised Driveway Permit or local government Development Order, the developer must fully fund them. This includes planning, engineering, and construction for any new traffic signal, alternative intersection, or enhancements to existing traffic signals specified in the Permit or Order.

If the developer's proposal to install signals, alternative intersections, or modify existing signalization exceeds the minimum improvements required by the Permit or Order and improves the State Highway System substantially beyond mitigating development impacts, FDOT may consider assuming some of the cost. In that event, district secretaries will determine an appropriate financial participation formula and assign a percentage to the developer related to the specific conditions at each site.

FDOT is responsible for installing traffic signals and constructing alternative intersections on the State Highway System, but local maintaining agencies can voluntarily cover some or all of the costs based on their cooperative agreements with FDOT's District Offices. Local funds are most often used to advance the implementation schedule. When local funds are accepted by FDOT, both parties must execute a formal joint project agreement.

Most local governments in Florida's urban areas have qualified traffic engineering units with experienced traffic signal field crews. Local agency crews have installed new signals on the State Highway System using FDOT-supplied control hardware. The Department encourages this approach when the local maintaining agency is agreeable. Since most of these agencies maintain and operate these sites themselves, this partnership is encouraged. No formal agreement is needed since no money is changing hands, but FDOT needs to request a letter from the local maintaining agency agreeing to install FDOT-supplied hardware.

3.3.6 OTHER CONSIDERATIONS

Follow the ***Approved Product List Submittal Process*** provisions before purchasing, using, or installing traffic signals.

If a local agency agrees to maintain the signal, add the signal to ***Exhibit A*** of the ***Traffic Signal Maintenance and Compensation Agreement*** with that agency.

Section 3.4

EMERGENCY TRAFFIC CONTROL SIGNALS

3.4.1 PURPOSE

This section gives guidance for warranting, designing, and operating emergency traffic control signals at locations where emergency vehicles—most commonly fire trucks—enter the street system.

3.4.2 BACKGROUND

FDOT's district offices often receive local agency requests for traffic signal control for departing emergency vehicles. This section offers comprehensive guidance to determine if an emergency signal is warranted.

3.4.3 PROCEDURE

An emergency traffic control signal shall be considered necessary if an engineering study finds that one of the following warrants is met:

- When minimum traffic volumes are met for the peak hour or for 24 hours (both travel directions based on Signal Warrant 2), as shown in **Table 3.4-1**.

Table 3.4-1. Minimum Traffic Volumes

Roadway	Peak Hour (VPH)	24 Hours (ADT)
Two lanes	750	7,500
Four lanes	900	9,000
Six lanes or more	1,200	12,000

Note: For roads with four lanes or six or more lanes, increase the VPH and ADT values by one-third when the arterial has traffic signal system coordination with signals located within 1,000 feet in both directions of the emergency signal location.

- When the emergency vehicle facility requires returning emergency vehicles to back in, blocking the roadway, and emergency vehicle lights and flaggers are inadequate to control traffic volume or speeds.

- When the emergency vehicle driveway is consistently blocked by traffic queues from adjacent signalized intersections. Consider using a *DO NOT BLOCK INTERSECTION* sign (***R10-7***) in conjunction with installing the emergency signal.

- On all approaches when vertical or horizontal curvature or other obstructions do not provide adequate stopping sight distance for traffic approaching an emergency vehicle driveway.

3.4.4 EMERGENCY SIGNAL CONFIGURATION AND OPERATION

MUTCD Section 4M defines the requirements for locating an emergency signal mid-block. The ***MUTCD*** allows either a steady green or flashing yellow signal when emergency vehicles are not entering the roadway.

For new or reconstructed emergency signal installations, apply the following criteria:

- Provide dual signal faces for each roadway approach. Install two signal faces for the emergency vehicle driveway; the minimum required is one signal face.

- If the emergency service is off the main roadway and emergency vehicles access it by the minor street, emergency signals may be installed at the intersection of these roadways. Use dual signal faces on the minor street, with the signals resting in flashing red mode.

- Operate mid-block emergency signals in flashing yellow mode when emergency vehicles are not entering the roadway. Use a three-section roadway signal head operated as shown in ***Figure 3.4-1***.

- At signalized intersections pre-empted by emergency vehicles, determine signal operations on an individual basis.

During the evaluation of an emergency signal, consider site-specific factors for its implementation. These may include the route distance between the intersection and emergency vehicle driveway, intersection geometrics, number of lanes, normal queue length, and traffic volumes.

3.4.5 *EMERGENCY SIGNAL* SIGN (*R10-13*)

As emergency signals are installed along major arterials where emergency vehicles enter the roadway, place *EMERGENCY SIGNAL* signs (***R10-13***) on the span wire or mast arm to alert drivers to the signal's purpose.

Mount the *EMERGENCY SIGNAL* sign (***R10-13***) between the dual signal faces on each roadway approach.

No sign is required for the emergency vehicle driveway approach.

3.4.6 OTHER REQUIREMENTS

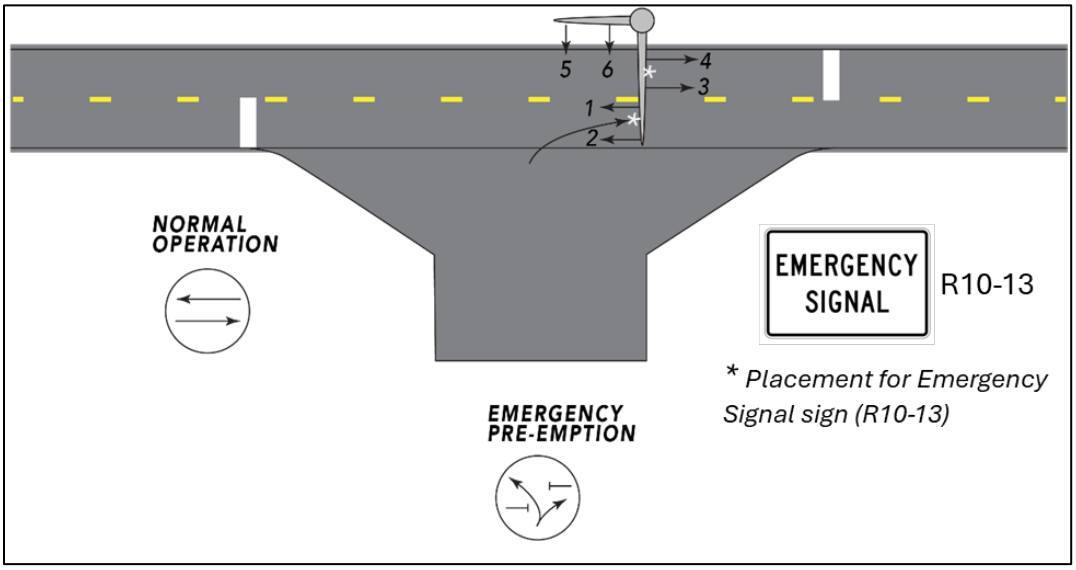
Include a controller timing chart in the contract plans.

FDOT requires a Traffic Signal Maintenance and Compensation Agreement for all emergency signals on the State Highway System.

FDOT requires a signal timing study to determine proper clearance intervals.

A Warning Sign assembly consisting of an Emergency Vehicle (***W11-8***) sign with an *EMERGENCY SIGNAL AHEAD* (***W11-12P***) supplemental plaque is required in advance of all emergency vehicle traffic control signals. See ***MUTCD Section 2C.54***, Paragraph 14 and ***Section 4M.02***, Paragraph 2.

Figure 3.4-1. Mid-Block Emergency Signal Operation



NORMAL OPERATION	CHANGE TO EMERGENCY PREEMPTION	EMERGENCY PREEMPTION	CHANGE FROM EMERGENCY PREEMPTION	RELEASE
Signal 1, 2, 3, 4 FY	Signal 1, 2, 3, 4 Y	Signal 1, 2, 3, 4 R	Signal 1, 2, 3, 4 R	Signal 1, 2, 3, 4 FY
Signal 5, 6,	Signal 5, 6,	Signal 5, 6, G	Signal 5, 6,	Signal 5, 6,

Section 3.5

TRAFFIC SIGNAL MAST ARM SUPPORT BOUNDARIES

3.5.1 GENERAL

Comply with the Mast Arm Structures Boundary Maps when selecting the appropriate support for traffic signal installations on the State Highway System. See ***FDM 232.8.1*** for more information.

3.5.2 IMPLEMENTATION

3.5.2.1 Mast Arm Structures Boundary Maps

The Mast Arm Structures Boundary Map follows an alignment of state roads to the coastline. Official mapping of district-specific boundaries can be found on ***FDOT's website***.

Section 3.6

YELLOW CHANGE AND RED CLEARANCE INTERVAL STANDARDS FOR SIGNALIZED INTERSECTIONS

3.6.1 PURPOSE

This section outlines standards for timing yellow change and red clearance intervals at signalized intersections. These intervals provide a consistent transition between conflicting traffic signal phases. A yellow change interval warns drivers they will soon need to stop and allow conflicting traffic the right-of-way. A red clearance interval allows time for drivers to clear the intersection before conflicting traffic is given a green indication.

Program a yellow change interval to last 3 seconds at a minimum but no more than 6 seconds, as described in ***MUTCD Section 4F.17***. Program a red clearance interval not to exceed 6 seconds. These standards apply to the following conditions on the State Highway System:

- New traffic signal installations
- All traffic infraction detector installations
- Signal phasing changes
- Geometric changes affecting timing or phasing
- Corridor retiming projects

3.6.2 STANDARD

Section 316.075(3)(a), F.S. prohibits the use of any traffic control signal that does not display a yellow or "caution" indication between the green or *GO* indication and the red or *STOP* indication. The statute is silent on how long the yellow indication should last and does not mention or mandate the use of a red clearance interval.

3.6.2.1 Yellow Change Interval

To calculate the yellow change interval, FDOT uses a formula developed by the Institute of Transportation Engineers (ITE) in its ***Determining Vehicle Signal Change and Clearance Intervals*** publication. This is shown in ***Formula 3.6-1***.

Formula 3.6-1 was used to calculate the Florida yellow change intervals shown in ***Table 3.6-1***. These intervals are the required standard minimum values. The calculations use a perception-reaction time of 1.4 seconds and a grade of 0%. Do not

use a perception-reaction time shorter than 1.4 seconds per ***Traffic Engineering and Operations Bulletin 02-13***.

The approach speed in ***Table 3.6-1*** and ***Formula 3.6-1*** is the posted speed limit for the approach being analyzed.

If ***Formula 3.6-1*** produces a value lower than the one in ***Table 3.6-1*** for a given posted speed limit, use the corresponding value in ***Table 3.6-1***. Do not program yellow change intervals shorter than the standard values in ***Table 3.6-1***. Yellow change intervals longer than the standards for posted speed limits in ***Table 3.6-1*** are allowed, but base them on ***MUTCD Section 4F.17***, engineering practice, and ***Formula 3.6-1***. Do not program a yellow interval longer than 6 seconds.

Do not use the extended kinematic model, referenced in ITE's ***Guidelines for Determining Traffic Signal Change and Clearance Intervals*** publication, to calculate the minimum yellow change interval.

Round up yellow change and red clearance interval times to the nearest 0.1 second.

Table 3.6-1. Florida Yellow Change Interval (0.0% Grade) Standard *

Approach Speed (mph)	Yellow Interval (seconds)
25	3.4
30	3.7
35	4.0
40	4.4
45	4.8
50	5.1
55	5.5
60	5.9
65	6.0

* For approach grades other than 0%, use ***Formula 3.6-1***.

Formula 3.6-1

$$Y = t + \frac{1.47v}{2(a + Gg)}$$

Where:

Y = Length of yellow interval, in seconds

t = Perception-reaction time (use 1.4 seconds)

v = Speed of approaching vehicles, in mph

a = Deceleration rate in response to the onset of a yellow indication (use 10 ft/sec^2)

g = Acceleration due to gravity (use 32.2 ft/sec^2)

G = Grade, with uphill positive and downhill negative (percent grade/100)

3.6.2.2 Red Clearance Interval

Always include a red clearance interval at a signalized intersection. Allowing enough time for drivers to clear the intersection after their signal phase turns red can reduce angle crashes, even if some drivers run the red indication.

Compute the red clearance intervals using the appropriate formula from ITE's ***Determining Vehicle Signal Change and Clearance Interval***, which is shown as ***Formula 3.6-2.***

Formula 3.6-2

$$R = \frac{W + L}{1.47v}$$

Where:

R = Length of red interval, in seconds

W = Width of the intersection, in feet, measured from the near-side stop line to the far edge of the conflicting traffic lane along the actual vehicle path

L = Length of vehicle (use 20 feet)

v = Speed of approaching vehicles, in mph

The red clearance interval must be between 2 and 6 seconds long. Engineers may program red clearance intervals longer than the values calculated using ***Formula 3.6-2*** at their discretion. A longer red clearance interval may be appropriate for wide or

complex intersections or those with a crash history or limited sight distance. Any interval extension must meet the minimum/maximum guidance for red clearance intervals.

National Cooperative Highway Research Partnership (NCHRP) ***Report 731: Guidelines for Timing Yellow and All-Red Intervals at Signalized Intersections*** recommends using a modified ITE formula that allows for a 1.0-second reduction in the red clearance interval values computed using ***Formula 3.6-2***. This accounts for reaction time delay from conflicting traffic. Use engineering judgment when exercising this option, but do not program a red clearance interval shorter than 2.0 seconds.

Section 3.7

ACCESSIBLE PEDESTRIAN SIGNALS

3.7.1 PURPOSE

This section establishes criteria for installing and operating accessible pedestrian signals (APS) on the State Highway System. These traffic control devices provide non-visual information using audible tones, speech messages, or vibrating surfaces.

3.7.2 GENERAL

The standards for APS on public roadways are set in ***MUTCD Sections 4K.01 to 4K.05***. Additional guidance for their installation is available in ***MUTCD Section 4I.06***. Review these ***MUTCD*** sections when addressing requests to install APS.

3.7.3 PROCEDURE

Obtain ***DTOE*** approval to install APS at signalized intersections and signalized midblock crossings on the State Highway System.

The DTOE reviews requests from the public, maintaining agencies, public agencies, and support groups for people with visual impairments to install APS. The DTOE may request input from public agencies and organizations that support people with visual impairments to determine if a given APS installation would be effective and safe for users.

An engineering study will follow if the DTOE's preliminary review supports installing APS. When conducting the engineering study, consider the needs of all pedestrians, not just those with visual impairments.

Consider the following features when reviewing requests to install APS:

- Potential demand for APS
- Right-on-red movements
- Free-flow right-turn movements
- Signal phasing complexity
- Intersection geometry complexity
- Traffic volumes during times when pedestrians might be present
- Audible tones or sounds that may cause confusion

- Verbal messages instead of tones or sounds
- Vibrotactile pedestrian devices
- Pushbutton versus passive pedestrian detectors
- APS automatic volume adjustment, not to exceed 100 dBA (decibels), in response to ambient traffic sound level
- Additional geometrics, operations, and pedestrian safety considerations at locations with more than four lanes or posted speed limits greater than 35 mph

3.7.4 APS REQUEST REVIEW PROCESS

DTOEs review all requests for APS installations on the State Highway System, either directly or through engineering studies. The ***DTOEs*** consider the needs of all pedestrians in the review, not just those with visual impairments.

The initial review may require site visits to verify field conditions. FDOT records and maintains all data gathered during the initial screening. Reconcile all data and analysis with ***MUTCD Sections 4K.01 to 4K.05*** standards. Although local government concurrence is desirable, it is not a prerequisite for committing FDOT resources for an APS installation.

If the ***DTOE*** denies an APS installation after the initial review, document the reasons, advise the requestor of the review findings, and provide the local government with a copy.

Section 3.8
CALCULATING RAILROAD TRAFFIC SIGNAL PREEMPTION TIME

3.8.1 PURPOSE

This section describes how to determine the required preemption time for a traffic signal adjacent to a highway rail grade crossing with an active warning system.

3.8.2 GENERAL

This comprehensive guidance on calculating signal preemption time adheres to ***Rule 14-57.013(5), F.A.C.*** For more information on when a preemption study is needed, refer to ***FDM 220.2.4.1 – Preemption***.

Before implementation, consult and coordinate with the appropriate railroad agency, the ***District Rail Office***, and the ***DTOE***.

3.8.3 DEFINITIONS

Advance Preemption (AP): The length of time before activation of railroad warning devices that a highway traffic signal controller unit or assembly is notified of an approaching train.

Clear Storage Distance (CSD): The distance available for vehicle storage measured between 6 feet from the rail nearest the intersection to the intersection stop line or the normal stopping point on the highway. At skewed grade crossings and intersections, the 6-foot distance shall be measured perpendicular to the nearest rail either along the center line or edge line of the highway, as appropriate, to obtain the shorter distance. Where exit gates are used, the distance available for vehicle storage is measured from the point where the rear of the vehicle would be clear of the exit gate arm. In cases where the exit gate arm is parallel to the track(s) and is not perpendicular to the highway, the distance is measured either along the center line or edge line of the highway, as appropriate, to obtain the shorter distance.

Controller's Equipment Response Time to Preempt (CERTP): The time that elapses while the controller electronically registers the preempt call.

Design Vehicle (DV): The longest vehicle permitted by statute of the road authority (State or other) on a given roadway.

Design Vehicle Clearance Distance (DVCD): How far, in feet, the design vehicle must travel to enter and completely pass through the highway rail grade crossing's minimum

track clearance distance. This is the sum of the minimum track clearance distance and the total design vehicle's length. Design vehicle length can be found in ***FDM 201***.

Design Vehicle Clearance Time (DVCT): How long it takes for the design vehicle to accelerate from a stop and travel through and clear of the minimum track clearance distance.

Desired Minimum Separation Time (DMST): A time buffer between the departure of the last vehicle (the design vehicle) from the highway rail grade crossing and the arrival of the train.

Maximum Highway Traffic Signal Preemption Time (MHTSPT): The maximum time a highway traffic signal needs after initiating the preemption sequence to finish timing the right-of-way transfer time, queue clearance time, and separation time.

Minimum Green Time During Right-of-way Transfer (MGTRT): The minimum number of seconds any existing phase will display a green indication before the controller unit terminates the phase through its yellow change and red clearance intervals and transitions to the track clearance green interval. A 5-second interval is recommended to make the transition to the track clearance green interval as rapid as possible.

Minimum Track Clearance Distance (MTCD): The length along the highway at one or more railroad tracks, measured from the portion of the highway rail grade crossing automatic gate arm farthest from the near rail to a point downstream from the track(s) on the departure from the grade crossing. The length along the highway between the two points is the minimum track clearance distance.

Minimum Walk Time During Right-of-way Transfer (MWTRT): The minimum pedestrian *WALK* indication time before the preemption sequence begins. FDOT recommends a 5-second interval to make the transition to the track clearance green interval as rapid as possible.

Other Green Time During Right-of-way Transfer (OGTRT): Any additional green time beyond the preempt minimum green time for the worst-case vehicle phase.

Pedestrian Clearance Time During Right-of-way Transfer (PCTRT): The pedestrian clearance (i.e., flashing *DON'T WALK* indication) time for the worst-case pedestrian phase. A zero value is allowed for the most rapid transition to the track clearance green interval.

Preemption: The transfer of normal traffic control signal operation to a special control operation mode.

Preempt Delay Time (PDT): The number of seconds the traffic signal controller is programmed to wait from the initial receipt of a preempt call until the call is verified and considered a viable request for transfer into preemption mode.

Preempt Trap: A potential hazard condition that happens when the gates do not block vehicle access to the crossing before the expiration of the track clearance green. Vehicles can continue to cross the tracks and possibly stop on the tracks. In a preempt trap, the track clearance green interval has already expired, so there will be no further opportunity to clear the tracks.

Preempt Verification and Response Time (PVRT): The number of seconds between when the controller unit receives a preempt call from the railroad's grade crossing warning equipment and the controller software begins to respond to the preempt call.

Queue Clearance Time (QCT): The time it takes the design vehicle to start up, move through, and clear the entire minimum track clearance distance when it is stopped just inside.

Queue Start-up Time (QST): Time from the beginning of the track clearance green until the design vehicle can start moving.

Red Clearance Time (RCT): The required red clearance interval time during right-of-way transfer before transitioning to track clearance.

Required Preemption Time (RPT): The time provided by the engineer of record to the railroad signal designer.

Right-of-way Transfer Time (RTT): The maximum amount of time needed for the worst-case condition, prior to display of the track clearance green interval. This includes any railroad or light rail transit or highway traffic signal control equipment time to react to a preemption call, and any traffic control signal green, pedestrian walk and clearance, yellow change, and red clearance intervals for conflicting traffic.

Separation Time (ST): The portion of maximum highway traffic signal preemption time when the minimum track clearance distance is clear of vehicles before the arrival of a train.

Track Clearance Distance (TCD): The length along a highway at one or more railroad tracks, measured from the highway stop line, warning device, or 12 feet perpendicular to the track center line, to 6 feet beyond the track(s) measured perpendicular to the far rail, along the center line or edge line of the highway, as appropriate, to obtain the longer distance.

Track Clearance Time (TCT): Time needed to travel through the track clearance distance plus a 4-second separation time.

Vehicle-Gate Interaction: When the automatic gate descends on a stationary or slow-moving vehicle as it moves through the minimum track clearance distance.

Yellow Change Time (YCT): The required yellow change interval time during right-of-way transfer prior to the track clearance.

3.8.4 PROCEDURE

Engineers may calculate the maximum preemption time for highway-rail grade crossings as follows.

Calculate the Right-of-Way Transfer Time.

The components of right-of-way transfer time include the *preempt verification* and *response time* and *the worst-case conflicting vehicle or pedestrian time*. Calculate these through the following steps:

Step 1: Calculate *preempt verification* and *response time* (seconds).

Collect the preempt delay time (seconds) and the controller response time to preempt (seconds). Calculate the preempt verification and response time by adding the preempt delay time and the controller response time.

Step 2: Calculate the *worst-case conflicting vehicle time* (seconds).

Add the minimum green time during right-of-way transfer (seconds), other green time during right-of-way transfer (seconds), yellow change time (seconds), and red clearance time (seconds). The worst-case conflicting vehicle time is the total.

Step 3: Calculate the *worst-case conflicting pedestrian time* (seconds).

Add the minimum *WALK* time during right-of-way transfer, pedestrian clearance time during right-of-way transfer, vehicle yellow change time, and vehicle red clearance time. The worst-case conflicting pedestrian time is the total.

Step 4: Determine the worst-case conflicting vehicle or pedestrian time.

The worst-case conflicting vehicle or pedestrian time is whichever is longer between the worst-case conflicting vehicle time (**Step 2**) and the worst-case conflicting pedestrian time (**Step 3**).

Step 5: Calculate the right-of-way transfer time.

The right-of-way transfer time is the sum of the *preempt verification* and *response time* (**Step 1**) and the worst-case conflicting vehicle or pedestrian time (**Step 4**).

Calculate the queue clearance time.

The queue clearance time includes the time it takes the design vehicle to start moving and to accelerate through the clearance distance. Calculate this through the following steps:

Step 1: Determine the queue start-up distance.

Measure the clear storage distance and minimum track clearance distance for the highway-rail grade crossing. Calculate the queue start-up distance, L (feet), by adding the clear storage distance to the minimum track clearance distance.

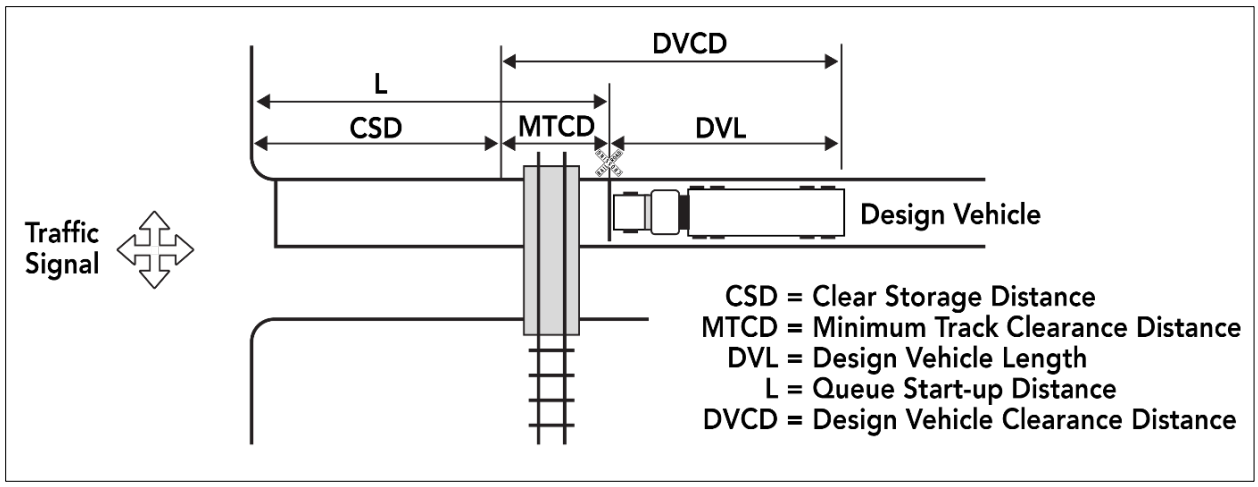
Step 2: Calculate the time the design vehicle needs to start moving.

Calculate the time the design vehicle needs to start moving, in seconds, as 2 plus the queue start-up distance, L, divided by the speed of 20 feet per second.

Step 3: Determine the design vehicle clearance distance.

Combine the minimum track clearance distance and the total design vehicle's length, as shown in ***Figure 3.8-1***.

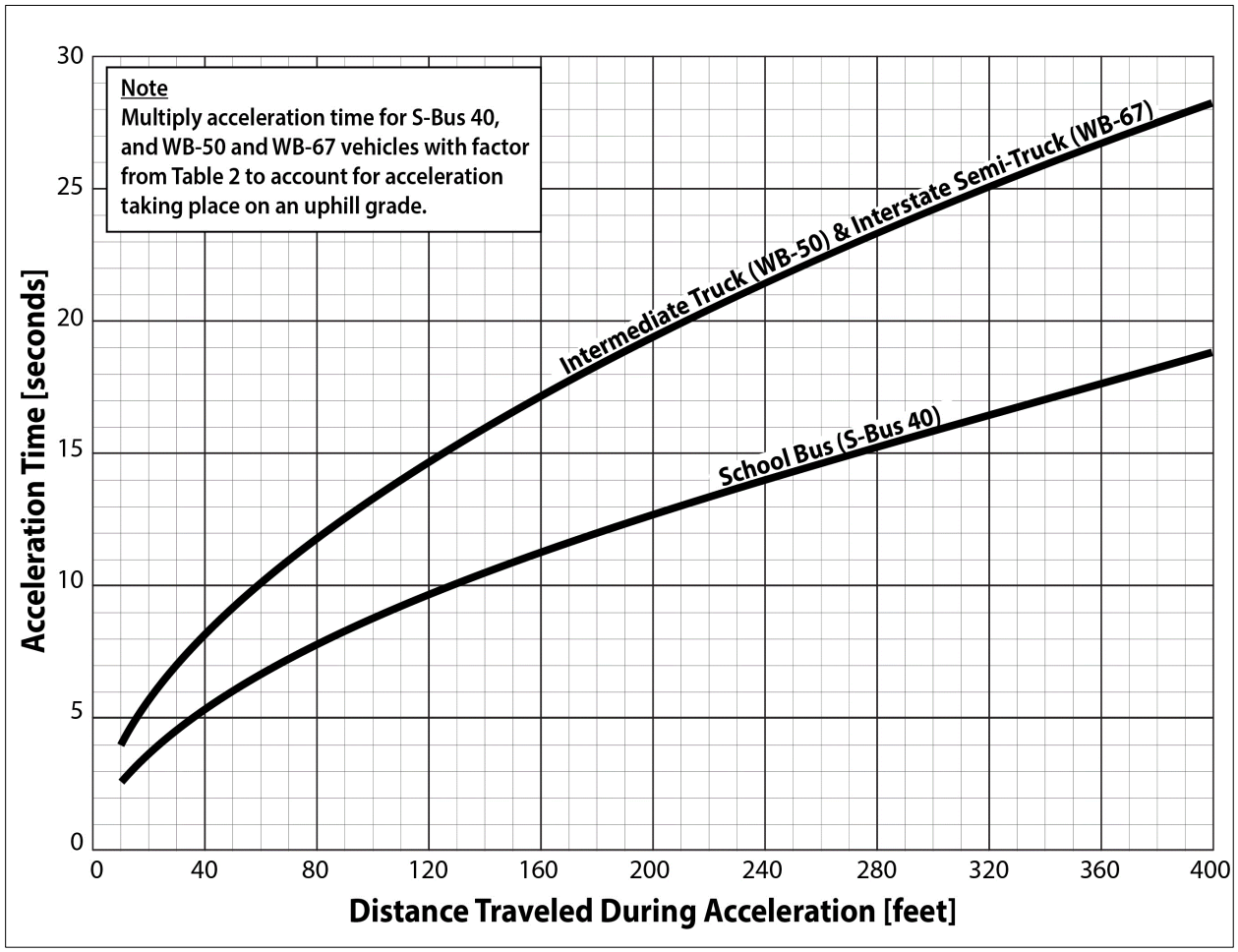
Figure 3.8-1. Geometric Data at the Highway-Rail Grade Crossing



Step 4: Calculate the time the design vehicle needs to accelerate through the design vehicle clearance distance on level terrain.

Select the design vehicle for the analysis. Use ***Figure 3.8-2*** to determine the time the design vehicle needs to accelerate through the design vehicle clearance distance on level terrain.

Figure 3.8-2. Acceleration Time Over a Fixed Distance on a Level Surface



Step 5: Calculate the time the design vehicle needs to accelerate through the design vehicle clearance distance on an uphill grade.

If the design vehicle clearance distance is on an uphill grade, calculate the approach grade factor to account for slower acceleration. Determine the approach grade factor, shown in ***Table 3.8-1***, based on design vehicle clearance distance, design vehicle, and slope grade.

To calculate the time needed for the design vehicle to accelerate through the design vehicle clearance distance on an uphill grade, multiply the time it needs to accelerate through the design vehicle clearance distance on level terrain by the approach grade factor.

Table 3.8-1. Factors to Account for Slower Acceleration on Uphill Grades

Acceleration Distance (feet)	Design Vehicle and Percentage Uphill Grade									
	School Bus (S-BUS 40)					Intermediate Truck (WB-50) and Interstate Semi-Truck (WB-67)				
	≤1%	2%	4%	6%	8%	0%	2%	4%	6%	8%
25	1.00	1.01	1.10	1.19	1.28	1.00	1.09	1.27	1.42	1.55
50	1.00	1.01	1.12	1.21	1.30	1.00	1.10	1.28	1.44	1.58
75	1.00	1.02	1.13	1.23	1.33	1.00	1.11	1.30	1.47	1.61
100	1.00	1.02	1.14	1.25	1.35	1.00	1.11	1.31	1.48	1.64
125	1.00	1.03	1.15	1.26	1.37	1.00	1.12	1.32	1.50	1.66
150	1.00	1.03	1.16	1.28	1.40	1.00	1.12	1.33	1.52	1.68
175	1.00	1.03	1.17	1.29	1.42	1.00	1.12	1.34	1.53	1.70
200	1.00	1.04	1.17	1.30	1.43	1.00	1.13	1.35	1.54	1.72
225	1.00	1.04	1.18	1.32	1.45	1.00	1.13	1.35	1.56	1.74
250	1.00	1.04	1.19	1.33	1.47	1.00	1.13	1.36	1.57	1.76
275	1.00	1.05	1.20	1.34	1.49	1.00	1.14	1.37	1.58	1.77
300	1.00	1.05	1.20	1.35	1.50	1.00	1.14	1.37	1.59	1.79
325	1.00	1.05	1.21	1.36	1.52	1.00	1.14	1.38	1.60	1.81
350	1.00	1.05	1.22	1.37	1.54	1.00	1.15	1.39	1.61	1.82
375	1.00	1.06	1.22	1.38	1.55	1.00	1.15	1.39	1.62	1.84
400	1.00	1.06	1.23	1.40	1.57	1.00	1.15	1.40	1.63	1.85

Step 6: Calculate the queue clearance time.

The queue clearance time is the sum of the time the design vehicle needs to start moving and the time it needs to accelerate through the design vehicle clearance distance.

Select the desired minimum separation time (seconds).

The separation time is added for safety reasons and to avoid driver discomfort. ITE (in an article by Marshall and Berg in February 1997) recommends a minimum separation time of 4 seconds. This value may be reduced to as low as 0 seconds if the necessary warning time is not available.

Calculate the maximum preemption time.

To get the required preemption time, add the right-of-way transfer time, queue start-up time, and desired minimum separation time. If using advance preemption, check, using the worst-case scenario, that the preemption phase does not end before the activation of the grade crossing warning devices. Consider variability in train arrival times. Submit the calculated maximum preemption time to the ***DTOE*** and ***District Rail Office*** for approval.

Coordinate with the appropriate railroad agency and the railroad signal designer.

After approval by the ***DTOE*** and ***District Rail Office***, provide the required preemption time to the railroad signal designer so they can determine the required rail warning system and timings.

3.8.5 PREEMPT TRAP CHECK

A preempt trap happens when the track clearance phase ends before the active railroad grade crossing warning lights start to flash or the gates start to descend. Vehicles may cross or stop in the crossing after the end of the track clearance phase without the opportunity to clear before a train arrives. Variable actual warning time or insufficient track clearance green interval cause preempt traps.

A preempt trap can be checked using the following procedures.

Request the advance preemption time from the railroad.

Use the actual value provided by the railroad. If no advance preemption time is provided, you can use a value of 0 seconds.

Determine a multiplier for maximum advance preemption time due to train handling.

Use field measurements. Divide the longest advance preemption time observed by the advance preemption time provided by the railroad.

If no field observations are available or the advance preemption time is not provided, the multiplier for maximum advance preemption time can be estimated as 1.60 if warning time variability is high or 1.25 if warning time variability is low. High warning time variability is typical in the vicinity of switching yards, branch lines, or anywhere low-speed switching maneuvers take place.

Calculate maximum advance preemption time.

Multiply advance preemption time by the multiplier for maximum advance preemption time.

Calculate the minimum duration for the track clearance green interval.

Subtract the minimum time for a flashing-light signal before the arrival of any train from the minimum time between the gate arm reaching its horizontal position and the arrival of a train.

Calculate the time for gates down after start of preemption.

Add the maximum advance preemption time to the minimum duration for the track clearance green interval.

Calculate the minimum right-of-way transfer time.

Add preempt verification and response time with best-case conflicting vehicle or pedestrian time. The best-case conflicting vehicle or pedestrian time is usually 0 seconds.

Calculate the minimum track clearance green interval.

Subtract the minimum right-of-way transfer time from the time for gates down after preemption begins. The minimum track clearance green interval has to be as long as it takes for a car to clear the tracks after the gates are lowered to avoid a preempt trap.

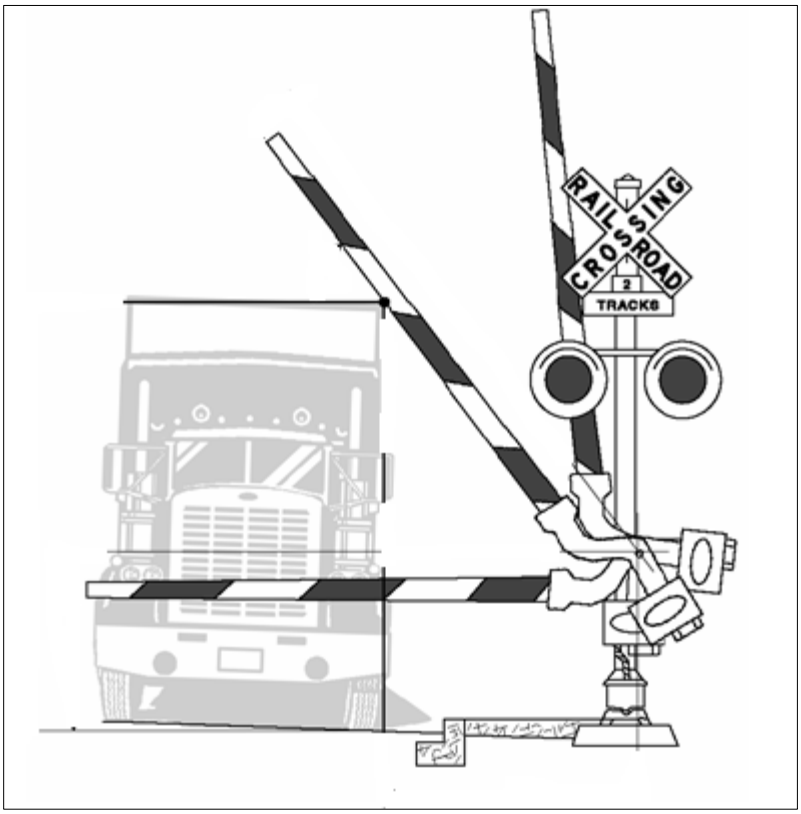
If the actual track clearance green interval is shorter than the minimum track clearance green interval, a preempt trap will occur.

3.8.6 VEHICLE-GATE INTERACTION CHECK

Even if there is sufficient warning time and the preempt trap has been addressed, the automatic gates may still descend on slow-moving or stationary vehicles, causing panic, confusion, or other unsafe actions from drivers.

Long, high vehicles that accelerate slowly, such as tractor-trailers, are most exposed. The gates may “clip” the rear of the trailer as the vehicle crosses the track during the clear track phase. ***Figure 3.8-3*** shows the passing vehicle-descending gate relationship. The vehicle-gate interaction can be checked as follows:

Figure 3.8-3. Relationship between Descending Gate and Passing Vehicle



Calculate the time the design vehicle needs to clear the descending gate.

Collect the right-of-way transfer time and the time the design vehicle needs to start moving from previous steps. Calculate the time the design vehicle needs to accelerate through the design vehicle length using ***Figure 3.8-2*** and ***Table 3.8-1***.

Add the right-of-way transfer time, time the design vehicle needs to start moving, and time the design vehicle needs to accelerate through the minimum track clearance distance.

Collect the flashing light duration before the gate starts to descend.

This value typically ranges from 3 to 5 seconds and must be obtained from the railroad. The railroad's value may be verified through field observations.

Calculate non-interaction gate descent time.

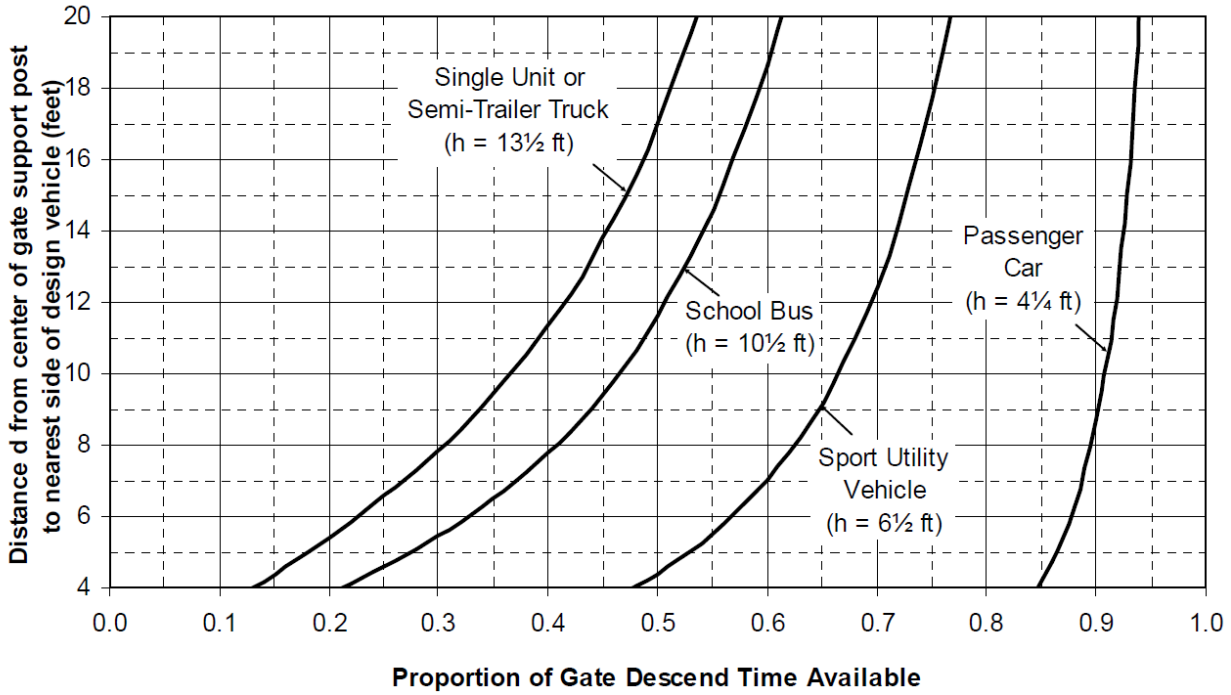
Step 1: Collect the full gate descent time from the railroad.

The value obtained from the railroad may be verified through field observations. In the case where multiple gates descend at different speeds, use the descent time of the gate that reaches the horizontal position first.

Step 2: Determine the proportion of non-interaction gate descent time.

Select the distance from the center of the gate mechanism to the nearest side of the design vehicle, *d*, on the vertical axis of ***Figure 3.8-4***, draw a horizontal line until you reach the curve that represents the design vehicle (*h* is the vehicle height). Next, draw a vertical line down to the horizontal axis and read off the value of the proportion of non-interaction gate descent time.

Figure 3.8-4. Proportion of Gate Descent Time Available



Step 3: Calculate the non-interaction gate descent time.

Multiply the full gate descent time with the proportion of non-interaction gate descent time.

Calculate time available for the design vehicle to clear the descending gate.

Add the duration of flashing lights before gate descent starts with the non-interaction gate descent time.

Vehicle-gate interaction check.

Compare the time the design vehicle needs to clear the descending gate with the time available.

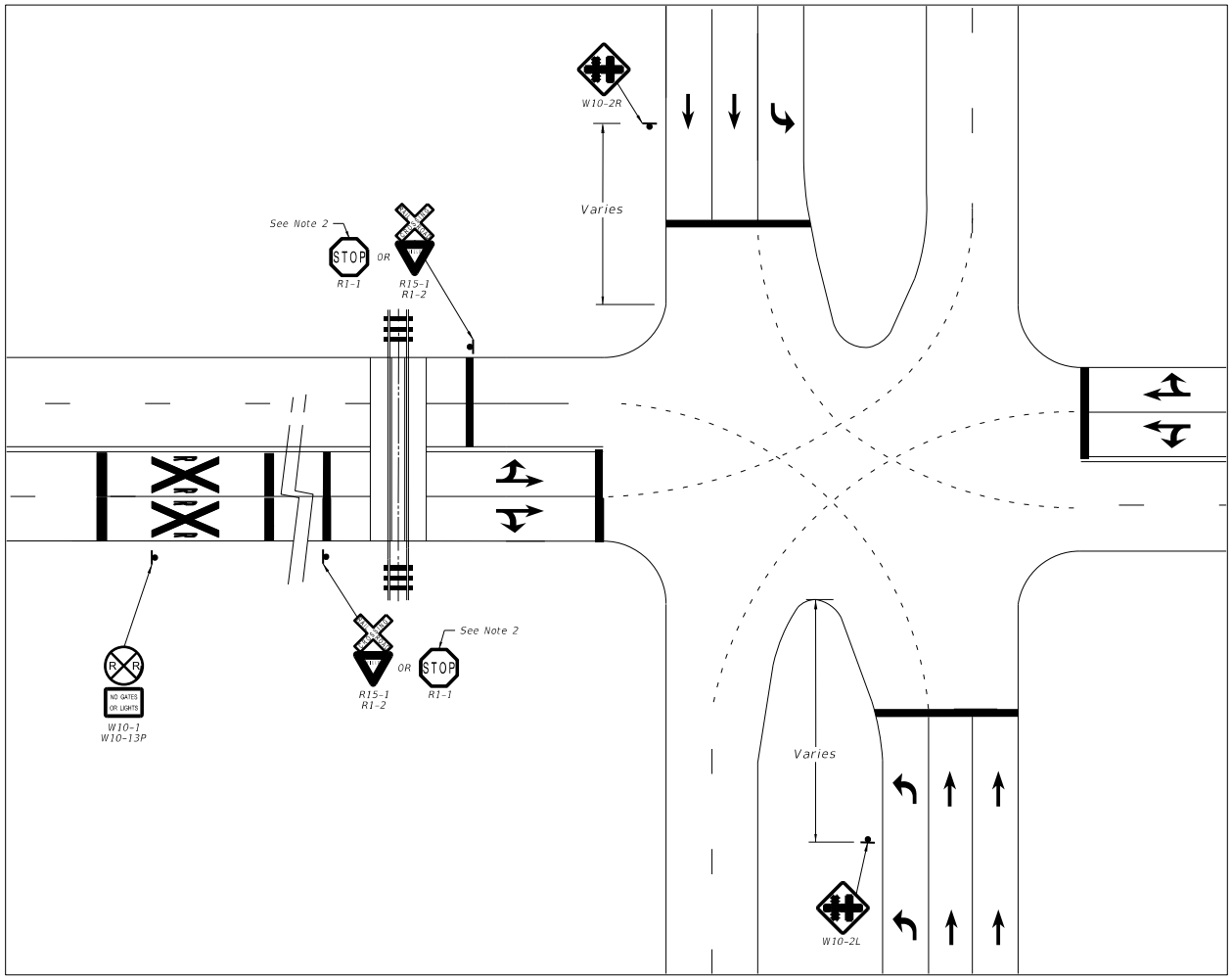
If the time available is greater than or equal to the time needed, there will be no vehicle-gate interaction.

If the time available is less than the time needed, provide advance preemption time to avoid vehicle-gate interaction.

3.8.7 EXAMPLE

This example illustrates the step-by-step procedure for calculating the preemption time for a highway-rail grade crossing. The crossing shown in ***Figure 3.8-5*** is within 200 feet of an existing signalized intersection and requires a preemption phase.

Figure 3.8-5. Intersection for Preemption Time Calculation



Calculate the Right-of-Way Transfer Time

Step 1: Calculate the preempt verification and response time.

The preempt delay time is 0 seconds. The controller response time to preempt provided by the controller manufacturer is 0 seconds. The preempt verification

and response time is 0 seconds, which is calculated by adding the preempt delay time and controller response time.

Step 2: Calculate the worst-case conflicting vehicle time.

The worst-case conflicting vehicle phase number is *Phase 8* for this intersection. The minimum green time during right-of-way transfer is 5 seconds. The other green time during right-of-way transfer is 1 second. The yellow change time for *Phase 8* is 4 seconds, and the red clearance time for *Phase 8* is 1 second. The worst-case conflicting vehicle time is 11 seconds.

Step 3: Calculate the worst-case conflicting pedestrian time.

The worst-case conflicting pedestrian phase number is *Phase 8* for this intersection. The minimum walk time during right-of-way transfer is 5 seconds. The pedestrian clearance time during right-of-way transfer is 0 seconds. The vehicle yellow change time is 4 seconds, and the vehicle red clearance time is 1 second. The worst-case conflicting pedestrian time is 10 seconds.

Step 4: Determine the worst-case conflicting vehicle or pedestrian time.

The worst-case conflicting vehicle or pedestrian time is 11 seconds based on results from **Steps 2** and **3**.

Step 5: Calculate the right-of-way transfer time.

The right-of-way transfer time is 11 seconds based on results from **Steps 1** and **4**.

Calculate the queue clearance time.

Step 1: Determine the queue start-up distance.

The measured clearance storage distance is 54 feet. The measured minimum track clearance distance is 55 feet. The queue start-up distance is 109 feet.

Step 2: Calculate the time the design vehicle needs to start moving.

$$2+109\div20=8 \text{ seconds}$$

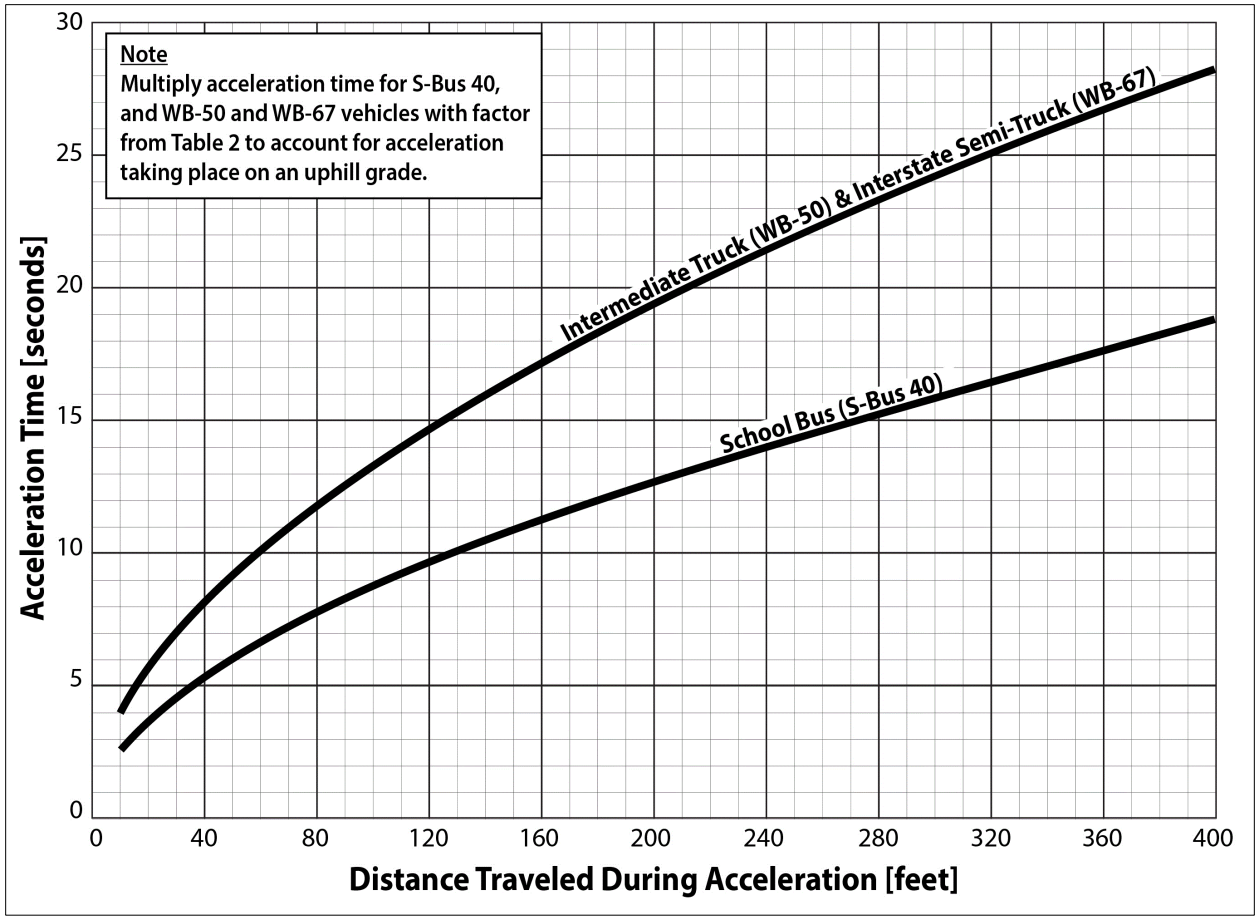
Step 3: Determine the design vehicle clearance distance.

The minimum track clearance distance is 55 feet, and the design vehicle length is 48 feet. The design vehicle clearance distance is 103 feet based on the minimum track clearance distance and design vehicle length.

Step 4: Calculate the time the design vehicle needs to accelerate through the design vehicle clearance distance on level terrain.

The design vehicle is WB-50 & WB-67. The time the design vehicle needs to accelerate through the design vehicle clearance distance on level terrain is 14 seconds, based on ***Figure 3.8-6***.

Figure 3.8-6. Calculation of Time for Design Vehicle to Accelerate through the Design Vehicle Clearance Distance on Level Terrain



Step 5: Calculate the time the design vehicle needs to accelerate through the design vehicle clearance distance on an uphill grade.

The terrain for the selected intersection is level, so there is no need to calculate acceleration time for an uphill grade.

Step 6: Calculate the queue clearance time.

The time the design vehicle needs to start moving (**Step 2**) is 8 seconds, and the time it needs to accelerate through the design vehicle clearance distance on level terrain (**Step 4**) is 14 seconds. The queue clearance time is 22 seconds based on results in **Steps 2** and **4**.

Select the desired minimum separation time.

The minimum separation time is 4 seconds, based on ITE's recommendation.

Calculate the maximum preemption time.

The right-of-way transfer time is 11 seconds. The queue clearance time is 22 seconds. The desired minimum separation time is 4 seconds. The maximum preemption time is 37 seconds.

The final calculated maximum preemption time is 37 seconds for this intersection.

Section 3.9

INSTALLING RETROREFLECTIVE SIGNAL BACKPLATES ON EXISTING STRUCTURES

3.9.1 PURPOSE

This section describes how to retrofit existing signal structures on the State Highway System with retroreflective signal backplates. Follow the guidelines in this section for installing flexible retroreflective backplates (FRBs) and rigid retroreflective backplates (RRBs) on existing mast arm and span wire structures at signalized intersections without backplates.

3.9.2 BACKGROUND

Rigid and flexible retroreflective signal backplates improve the contrast between the traffic signal indications and their surroundings, making them easier to see during both day and night conditions and during power outages.

Installing retroreflective signal backplates can enhance safety at intersections. This countermeasure has a crash modification factor in FHWA's ***Crash Modification Factor (CMF) Clearinghouse***.

Include rigid retroreflective backplates on all new or reconstructed traffic signal structures.

Some existing signal support structures have unknown structural capacity limits, and retrofitting their signal heads with rigid retroreflective backplates would require structural analysis. Research and structural evaluations using FRBs have shown negligible wind-loading impacts to mast arm and span wire support structures, making them suitable for signal retrofits.

3.9.3 DEFINITIONS

Flexible Retroreflective Backplate (FRB): A signal backplate that allows portions of the panels to fold back when subjected to high winds and return to their original position when the wind subsides.

Mast Arm: A structure that is rigidly attached to a vertical pole and used to provide overhead support for highway traffic signal faces or grade crossing signal units.

Rigid Retroreflective Backplate (RRB): A signal backplate that remains fixed in one position when subjected to wind loading.

Signal Face: An assembly of one or more signal sections that controls traffic movements on a single approach.

Signal Head: An assembly of one or more signal faces that controls traffic movements on one or more approaches.

3.9.4 PROCEDURE

For existing mast arm and span wire structures, the use of FRBs listed on FDOT's ***Approved Product List (APL)*** is exempt from the ***FDM 261*** structural capacity analysis requirements. This exemption applies only when the elements to be added to an existing signal structure are FRBs.

The ***District Traffic Operations Offices*** track and document locations and implementation dates within the signalized assets by district found in ***eTraffic***.

All other signal hardware, features, and attachments proposed for retrofitting existing traffic signal structures must undergo structural analysis in accordance with ***FDM 261*** to determine if structural capacity is adequate. These include, but are not limited to:

- Rigid retroreflective backplates
- Signal heads
- Overhead street name signs
- Static signs
- Blank-out signs

Perform any required structural analysis of existing traffic signal structures in accordance with ***FDM 261***. Refer to FDOT's ***Structures Manual, Volume 3, Section 18*** for additional information regarding the analysis of existing structures.

SECTION 3.10
FLASHING YELLOW AND RED ARROW SIGNAL APPLICATION

3.10.1 PURPOSE

This section provides criteria, guidelines, and best practices for installing and operating flashing yellow arrow (FYA) and flashing red arrow (FRA) signals as directed by ***MUTCD Section 4F.04*** and ***Section 4F.08***.

3.10.2 BACKGROUND

For many years, engineers have been concerned that drivers turning left on a permissive circular green signal will mistakenly believe they have the right-of-way over opposing traffic. Geometric conditions can contribute to this impression.

FYA and FRA have been used to mitigate the “yellow trap” condition, where a left-turning driver completes their turn on a yellow, assuming oncoming traffic also has a yellow.

Based on the intuitive understanding of FYA for permissive turning movements and to ensure uniformity across the state, FDOT encourages the use of FYA over FRA. Per ***MUTCD Section 4F.04***, FRA may be used during the permissive left-turn movement for unusual geometric conditions, such as wide medians with offset left-turn lanes, but only when an engineering study determines that each and every vehicle must successively come to a full stop before making a permissive left turn.

Right-turn FYA treatments may be used, according to the ***MUTCD*** and this ***TEM*** section.

In 2003, ***NCHRP*** published ***Report 493: Evaluation of Traffic Signal Displays for Protected/Permissive Left Turn Control***. Its key findings are as follows:

- The FYA is a good overall alternative to the circular green as the permissive signal display for a left-turn movement.
- Left-turn drivers are highly likely to understand and correctly respond to the FYA. The FYA has a lower fail-critical rate than the circular green signal display.
- Making the FYA display a separate signal face for the left-turn movement allows more versatility in field application. It can be operated in any of the various modes of left-turn operation by time of day and is easily programmed to avoid the yellow trap associated with some permissive turns at the end of the circular green signal display.

FHWA's ***Crash Modification Factor (CMF) Clearinghouse*** reports a CMF for the installation of left-turn FYA signals and supplemental traffic signs.

3.10.3 OPERATIONAL REQUIREMENTS

The following design and operational requirements apply, according to ***MUTCD Section 4F.07***, when a separate left-turn signal phase operates in a protected/permissive left-turn mode, and a flashing left-turn yellow arrow signal is provided.

Left-Turn Operation Mode(s):

The FYA signal may be displayed to indicate a permissive left-turn movement in either protected/permissive or permissive-only modes.

Engineers may vary the left-turn operation mode (i.e., permissive-only, protected-only, or protected/permissive) during different periods of the day when the following conditions apply:

- The calculated critical gap is a minimum of 7 seconds during non-peak hours. FDOT's ***Manual on Uniform Traffic Studies (MUTS)*** provides additional guidance on conducting vehicular critical gap studies.
- Fewer than 240 vehicles turn left per hour, or the product of left-turning vehicles and opposing through vehicles is fewer than 50,000 (one opposing through lane) or 100,000 (two or three opposing through lanes). Product is defined as the multiplication of one hour of left-turning volume times the corresponding opposing through hourly volume.
- There are no fatalities and two or fewer left-turn crashes per year attributed to permissive left-turning movements.

Signal Head Arrangement: Provide at least one separate four-section signal head for the left-turn movement in addition to the minimum of two signal heads for other traffic on the approach. The signal face must be able to display, from top to bottom (or left to right), a steady left-turn red arrow, steady left-turn yellow arrow, flashing left-turn yellow arrow, and steady left-turn green arrow.

Signal Head Location: In an exclusive left-turn lane, center the signal head over the lane or its extension.

Signal Displays: Signal displays must meet the following requirements:

- Display the following signal heads: Steady left-turn red arrow, steady left-turn yellow arrow, flashing left-turn yellow arrow, and left-turn green arrow. Display only one of the four indications at any given time.
- During the protected left-turn movement, display a left-turn green arrow signal.
- Display a steady left-turn yellow arrow signal following the left-turn green arrow signal.
- During the permissive left-turn movement, display a flashing left-turn yellow arrow signal.
- Display a steady left-turn yellow arrow signal after the flashing left-turn yellow arrow signal if the permissive left-turn movement is ending, and the separate left-turn signal head will subsequently display a steady left-turn red arrow indication. At locations where a history of drivers failing to yield to pedestrians during permissive left-turn phases has been documented, the following countermeasures may be implemented:
  - Omit the FYA when the pedestrian phase is actuated.
  - Implement leading pedestrian interval (LPI) in accordance with ***TEM 3.11***.
- The engineer may choose to display a flashing left-turn yellow arrow signal for a permissive left-turn movement while the signal heads for the adjacent through movement display steady circular red indications, and the opposing left-turn signal heads display left-turn green arrow signals for a protected left-turn movement.
- Before the FYA begins, provide a start-up delay (2 seconds) for all opposing through movements to establish position in the intersection.
- When changing phase from a permissive left-turn movement to a protected left-turn movement, display a left-turn green arrow signal immediately after the flashing left-turn yellow arrow indication. Do not display a steady left-turn yellow arrow signal between the display of the flashing left-turn yellow and the display of the steady left-turn green arrow indications. See ***TEM 3.10.4*** for further guidance.
- During steady mode (stop-and-go), the signal section that displays the steady left-turn yellow arrow signal during change intervals must not be used to display the flashing left-turn yellow arrow signal for permissive left turns.
- During flashing mode operation where a four-section signal face is used, display a flashing left-turn yellow arrow signal only from the signal section that displays a steady left-turn yellow arrow signal during steady mode (stop-and-go) (see ***MUTCD Section 4G.03***).

- Use a four-section signal head unless constrained by height or loading capacity limitations, or lateral positioning limitations for a horizontally mounted signal head. In constrained conditions, the engineer may use a three-section signal head with a green arrow for the protected left-turn movement and a yellow arrow for the steady or flashing indications. The DTOE must approve installation of three-section FYA signal heads.

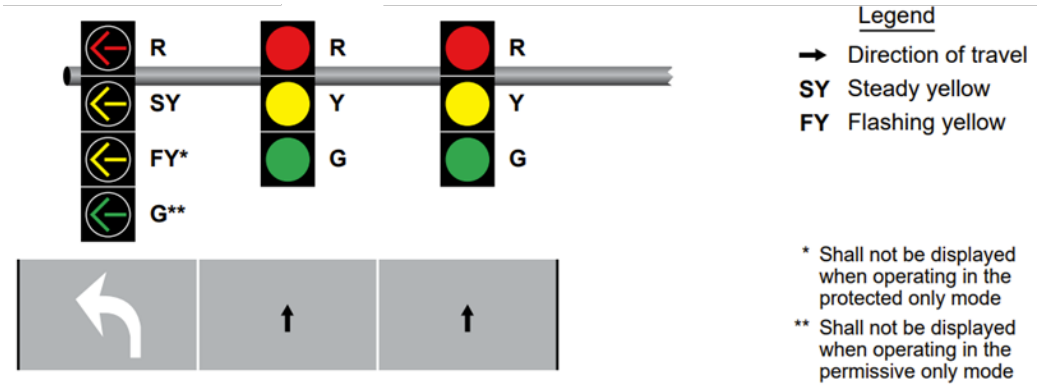
Yellow Trap: FYA can be used to mitigate yellow-trap concerns associated with permissive left-turn operations by providing a separate permissive indication for the left-turn movement. The signal timing sequence may allow the permissive left-turn movement (solid green) to continue operating with a flashing yellow arrow until the opposing through movement ends, even if the adjacent through phase has ended. However, the use of FYA alone does not eliminate the need to evaluate signal sequencing for potential yellow-trap conditions.

When implementing FYA, review all potential sequencing combinations to determine if a yellow trap could occur. Include those that skip phases due to lack of demand and special patterns such as preemption. If a yellow trap appears possible, modify the sequencing and controller programming parameters as necessary to eliminate it. The design engineer has primary responsibility for including adequate information in design plans for others who may establish sequences and program controllers.

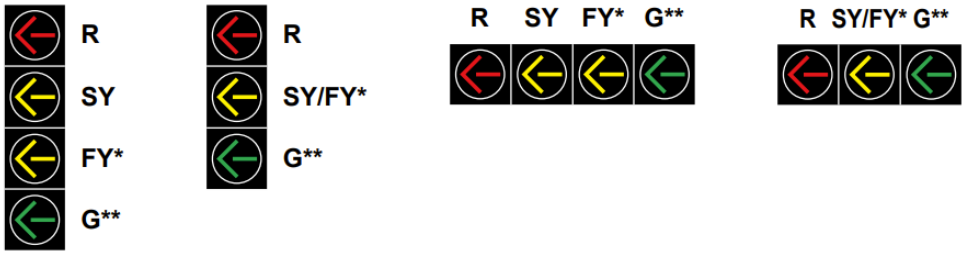
For a protected/permissive left-turn mode with FYA, the signal faces' typical position and arrangements are shown in ***Figure 3.10-1*** (***MUTCD Figure 4F-7*** excerpt).

Figure 3.10-1. Flashing Yellow Arrow for Protected/Permissive Left-Turn Mode

A – Typical Position



B – Typical Arrangements



Installation Guide:

The FYA is an option for permissive/protected left-turn phasing. However, as with protected/permissive operations in general, careful consideration is needed when deciding where to install the FYA.

It is recommended that districts obtain local maintaining agencies' agreement before recommending and installing FYA at a signalized intersection.

To ensure statewide consistency for FYA installation:

- Consider and prioritize four-section FYA signal displays for new signal installations and candidate retrofit locations that meet the following criteria:
    - Corridors where changing to lead/lag from lead/lead left-turn phasing would improve progression.
    - Locations where left-turn demand is low during off-peak periods and variable modes of left-turn phasing will improve safety and operations.
- Center the signal display for the left-turn movement over the corresponding exclusive left-turn lane for new and retrofitted FYA installations.
- For locations with high populations of people 65 years or older or intersections in a ***Safe Mobility for Life Priority County***, conduct an intersection operations and crash history evaluation before implementing FYA.
- The supplemental *LEFT-TURN YIELD ON FLASHING YELLOW ARROW* sign (***R10-12a***) may be used to educate motorists about FYA operations.
- If the structural loading capacity meets the minimum requirements to withstand the wind loading under FDOT's established design criteria, engineers may install the supplemental *LEFT TURN YIELD ON FLASHING YELLOW ARROW* sign (***R10-12a***). See ***TEM 3.10.4*** for additional guidance on loading.
- If using FYA for permissive-only, protected/permissive, or permissive/prohibited phasing, consider time-of-day applications.
- When recommending replacing a five-section signal head with a four-section FYA signal head for the left-turn lane and a three-section signal head for the inside through lane, the engineer must confirm FDOT's structural loading capacity requirements are met.
- Avoid FYA installation under the following conditions:
    - Crash patterns involve left-turning vehicles and could be attributed to drivers' misunderstanding of shared signal indications.
    - Frequent railroad or emergency vehicle preemption activations happen, resulting in a higher risk of a left-turn trap condition.

3.10.3.1 Flashing Yellow Arrow Engineering Study

Conduct an engineering study at existing or proposed signalized intersections without FYA when all the following conditions exist:

- Before the scoping of a project involving signalized intersection improvements.
  - Including but not limited to Resurfacing, Restoration, and Rehabilitation (RRR), capacity, and traffic operations improvement projects.
- The context classification is C3C, C3R, or C4.
- The posted speed limit is 40 mph or 45 mph.
- Left-turning traffic crosses one or two opposing through lanes.

In the engineering study, analyze the use of left-turn FYA signal displays for permissive-only, protected/permissive, or variable left-turn operations mode with FYA during different periods of the day. Additionally, analyze the feasibility of the improvements with the existing infrastructure (e.g, signal support structures, turn lane capacity, signal cabinet, signal controller). The feasibility analysis may include a structural capacity analysis as directed by ***FDM 261***.

Implement the improvements identified in the study when determined to be feasible with the existing support infrastructure and appropriate by the Engineer of Record. In RRR and capacity projects, if the use of FYA is found to be infeasible with existing infrastructure, consider including infrastructure changes in the project scope to allow for the use of FYA.

3.10.4 INSTALLATION CRITERIA

Unless required from the engineering study in ***TEM 3.10.3.1***, FYA may be considered under the following characteristics:

- FYA installation is facilitated by intersection geometry and traffic operations characteristics, including:
  - Opposing left-turn paths that do not conflict.
  - Available sight distance greater than the required sight distance based on approach speeds and left-turn lane offset conditions.
  - The approach has only one left-turn bay.
  - The opposing traffic speed limit is 45 mph or lower.
  - There are one or two opposing through lanes. Engineers may consider intersections with three opposing through lanes on a case-by-case basis, supported by an engineering study. Review ***TEM Section 3.2.3*** for signal phasing considerations.
- The intersection has a protected/permissive mode, and less than three left-turn-related crashes per year have been recorded over a three-year period, which may have been avoided with protected-only phasing.

- Fewer than 240 vehicles turn left per hour, or the product of left-turning vehicles and opposing through vehicles is fewer than 50,000 (one opposing through lane) or 100,000 (two or three opposing through lanes). The product is defined as the multiplication of one hour of left-turning volume times the corresponding opposing through hourly volume.
- Signal coordination plans indicate operations improved with the installation of FYA permissive-protected operation based on volume criteria and crash patterns during peak periods.

Using a consistent left-turn treatment along a corridor makes it easier for drivers to navigate, but it may not be practical due to potential implementation costs . FYA left-turn protected/permissive mode often requires installing an additional left-turn signal head and could require a mast arm replacement (e.g., wind loading requirements are not met, longer mast arms are needed). The cost of replacing signal poles to accommodate FYA can be prohibitive.

Some FYA implementations have resulted in a mix of FYA and five-section circular green display protected/permissive operation. In these cases, FDOT recommends installing FYA at any new signalized intersection on the corridor that meets the criteria for protected/permissive left-turn mode operation without immediately modifying the other intersections along the corridor. Avoid installing FYA at intersections that are within view of other intersections with the five-section circular green display.

At locations with a protected-only mode, consider using FYA protected/permissive mode only after conducting an intersection engineering study. Do not remove protected-only left-turn phasing if opposing sight distance is inadequate for permissive left turns, high operating speeds are reported, roadway geometry is complicated, or there are too many opposing through lanes. For more information on sight distance, refer to the ***FDM 212***.

3.10.5 VARIABLE MODE

Variable mode operation—changing between protected-only and protected/permissive mode or between protected/permissive and permissive-only mode by time of day—is possible with the four-section FYA signal head. It can be applied where an engineering study shows this type of operation can improve safety and operations. It is important to ensure the traffic signal controller can switch between modes so the flashing yellow arrow indication and the opposing through movement indication terminate together.

When switching between protected/permissive and permissive-only, ensure that the controller can reassign the left-turn detectors to call the associated through phases by time of day.

3.10.6 PUBLIC NOTIFICATION

Coordinate installation of a FYA left-turn operation with the ***District Public Information Office***. Consider issuing press releases letting the public know when they can expect to

see the new indications. Send out press releases at least two weeks before implementation.

3.10.7 EDUCATION

When implementing a new FYA installation, conduct location-specific education. Use portable changeable message signs to display the following alternating messages both before implementation (minimum one week) and after implementation (maximum six weeks):

- Phase 1: *NEW SIGNAL DISPLAY*
- Phase 2: *YIELD ON FLASHING ARROW*

FDOT has developed educational and outreach resources to support FYA implementation efforts and increase public awareness of appropriate driver responses to the signal display.

Educational materials include print and digital graphics designed to help motorists understand how to respond when encountering an FYA. These resources were developed using human factors research and plain language principles and are intended to support consistent, research-based public education and outreach efforts.

The FYA tip card (***Figure 3.10-2***) is part of the Roadway Safety Series and is designed for district staff to use during public outreach activities.

Download or order free copies of the FYA tip card from the ***Safe Mobility for Life Resource Center***, or download digital graphics from the ***Safe Mobility for Life Digital Resource Center***.

Figure 3.10-2. Flashing Yellow Arrow Tip Card



3.10.8 SIGNAL RETROFIT CHECKLIST

Use the following checklist to examine hardware conditions at an intersection before programming a FYA signal in the field. Knowing the hardware conditions makes a smooth FYA implementation more likely.

Signal Retrofit Checklist:

- Check that the mast arm is long enough to center the FYA signal head over the exclusive left-turn lane.
- Check replacement head size/mounting. Raising wire spans to install vertical four-section signal heads may be necessary to replace five-section signal heads.
- Ensure signal equipment is in working order. A malfunctioning load switch or bad load switch socket may lead to problems during FYA implementation.

- Make sure the available cables are sufficient to install FYA signals. Protected/permissive left-turn phasing often uses a circular green display for the permissive interval, which is illuminated by the same means as the green through phase. Additional cabling may be needed to control the flashing yellow display with its own circuit.

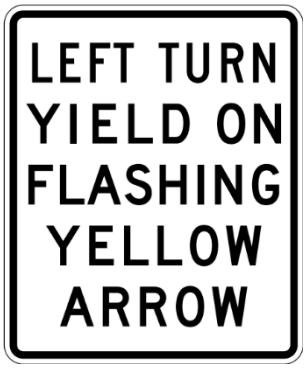
- Verify with the signal equipment manufacturer that the controller and management malfunction unit are applicable and confirm the programming method. Leading signal equipment manufacturers have developed new controller models and management malfunction units that support FYA signal operations. Controllers must have the correct firmware to enable FYA operations.

- Check if the controller cabinet needs modification. The industry has not standardized FYA controllers. Contact the manufacturer representative for information. The controller make and model will determine whether the cabinet needs modification. Make sure the management malfunction unit you select supports FYA operation. Install a management malfunction unit recommended by the controller manufacturer. Modify the cabinet flash programming.

- A *LEFT TURN YIELD ON FLASHING YELLOW ARROW* sign (***R10-12a***), shown in ***Figure 3.10-3***, can be installed adjacent to the FYA signal head to help reduce conflicts. If the FYA signal module is to be installed at a location with a five-section head, verify that the sign can be installed and remove conflicting signs, such as the *LEFT TURN YIELD ON GREEN* sign ***(R10-12)***.

    - Do NOT use other FYA signs as an alternative to ***R10-12a***, including sign variations that replace the text with symbols.

Figure 3.10-3. Flashing Yellow Arrow Sign (*R10-12a*)



Section 3.11
SIGNAL TIMING APPLICATIONS FOR PEDESTRIAN MOVEMENTS

3.11.1 PURPOSE

This section defines signal timing applications to improve safety and enhance pedestrian mobility. It covers considerations for implementing a leading pedestrian interval (LPI), a flashing yellow arrow (FYA) omit by ped, and delayed turn applications at signalized intersections.

3.11.2 BACKGROUND

Signal timing features are used to make traffic easier to see and enhance pedestrian safety. ***NCHRP*** ***Report 812: Signal Timing Manual*** and ***Report 969: Traffic Signal Control Strategies for Pedestrians and Bicyclists*** highlight signal timing applications for pedestrian movements. Signal timing and signal timing adjustments are evaluated, determined, and documented by a traffic engineer.

3.11.3 DEFINITIONS

Concurrent Yet Protected: A variation on the *Delayed Turn* timing treatment, where left and right-turning movements are not permitted during the conflicting *WALK* and *flashing DON'T WALK* intervals. This treatment requires exclusive turn lanes, signal heads, and *NO TURN ON RED* signage.

Delayed Turn: A signal controller option that releases through vehicles and pedestrians concurrently while holding turning movements with a red indication and *NO TURN ON RED* signage. This treatment requires exclusive turn lanes, signal heads, and *NO TURN ON RED* signage.

Flashing *DON'T WALK*: A warning to pedestrians that the *WALK* indication has ended and the *DON'T WALK* indication is active.

Flashing Yellow Arrow Omit by Ped (FYA Omit by Ped): A signal controller option that omits a permissive left-turn movement during the conflicting *WALK* and *flashing DON'T WALK* intervals.

Lagging Pedestrian Interval: The pedestrian *WALK* interval starts several seconds after the adjacent through movement phase. This option allows a waiting right-turn queue to clear before the *WALK* indication is presented and reduces conflicts with right-turning vehicles. It is applicable at intersections where there is either an exclusive right-turn lane (or lanes) or the two intersecting roads have one-way traffic.

Leading Pedestrian Interval (LPI): A pedestrian interval option, also known as "pedestrian head start" or "delayed vehicle green," which gives pedestrians an advance *WALK* indication before a green signal is provided to vehicles. This allows pedestrians to establish a presence in the crosswalk, reducing conflicts with turning vehicles. LPI is a proven safety countermeasure to reduce vehicle-pedestrian crashes at signalized intersections.

Pedestrian Detector Call: An input into the associated phase of the controller when a pedestrian is detected that actuates service of the pedestrian *WALK* indication.

Pedestrian Omit: A command that ignores pedestrian calls for service and prevents a pedestrian phase. This feature is a consideration at intersections with rail preemption. Activation does not affect a pedestrian movement in the process of timing.

Pedestrian Recall: This mode eliminates the need for a push button or passive detection and ensures that pedestrian *WALK* and clearance intervals are provided in each cycle.

Pedestrian Recycle: A signal controller option that allows a pedestrian phase to be served multiple times within the same vehicle phase when pedestrian demand exists and the split time remaining is greater than or equal to the time needed to serve the pedestrian phase.

- In the actuated mode, if a serviceable pedestrian call exists on the subject and the *Hold* input is active, the pedestrian movement is recycled when the *Pedestrian Recycle* input is active, regardless of whether a serviceable conflicting call exists.
- In the non-actuated mode, if the subject phase has reached the *Green Dwell/Select* state, the *Pedestrian Omit* is not active on the phase, and a serviceable conflicting call does not exist, the pedestrian movement is recycled when the *Pedestrian Recycle* input is active.

Pedestrian Scramble/Barnes Dance: An exclusive pedestrian phase with no concurring vehicular movement in any direction. Pedestrians may cross all intersection legs or cross diagonally. Walking time is extended for diagonal movement. Ped heads, accessible pedestrian signals, and pavement markings indicate pedestrians may cross diagonally.

Pedestrian Walk Interval: A signal providing initial right-of-way to pedestrians during a pedestrian phase and prior to the pedestrian clearance interval.

Rest in Walk: The pedestrian phase is set to rest in the *WALK* interval to maximize the *WALK* display during a vehicle green. This pertains to whether the *WALK* signal is initially activated by the pedestrian push button, passive pedestrian detection, or automatic pedestrian recall. The flashing *DON'T WALK* interval times prior to the yield point.

Walk Rest Modifier: When activated, it modifies non-actuated operation only. Upon activation, the non-actuated phase(s) remain in the timed-out *WALK* state (*Rest In Walk*) in the absence of a serviceable conflicting call, regardless of the *Hold* input status. With the input inactive, non-actuated phase(s) do not remain in the timed-out *WALK* state unless the *Hold* input is active. The controller recycles the pedestrian movement when reaching the *Green Dwell/Select* state in the absence of a serviceable conflicting call.

3.11.4 ENGINEERING STUDY

Conduct an engineering study at signalized intersections with marked crosswalks without LPI when all the following conditions exist:

- Before the scoping of a project involving signalized intersection improvements.
    - Including but not limited to Resurfacing, Restoration, and Rehabilitation (RRR), capacity, and traffic operations improvement projects (e.g., signal retiming activities).
- The context classification is C3C, C3R, or C4.
- The posted speed limit is 35 mph to 45 mph.

In the engineering study, analyze the use of LPIs at individual approaches or signalized marked crosswalks. Additionally, analyze the feasibility of the improvements, including operational impacts to signal timing, coordination, and existing signal infrastructure.

Implement the improvements identified in the study when determined to be feasible and appropriate by the Engineer of Record.

3.11.5 LPI CONSIDERATIONS

To reduce wait times and increase compliance with pedestrian signals, avoid lengthy traffic signal cycles. Consider automatic pedestrian recall that allows vehicles at least the same amount of time as the sum of the *WALK* and flashing *DON'T WALK* intervals.

Comply with ***MUTCD Section 4I.06*** when considering LPI signal applications.

Review all new signalized intersections and existing intersections as timing changes are made for LPI implementation. See ***TEM 3.11.5.1*** for considerations that indicate an LPI may be appropriate.

LPI implementation is at the discretion of the ***DTOE***. Document the LPI implementation decision process in the project file as an email or technical memorandum.

3.11.5.1 LPI LOCATION SCREENING CONSIDERATIONS

LPIs are generally used for pedestrian phases timed concurrently with a conflicting right turn. Research has demonstrated that LPIs can be beneficial at intersections with pedestrian activity.

The following conditions indicate an LPI may improve conditions for pedestrians. LPI may be considered for implementation under the following conditions:

- Field observations, citizen complaints, crash history, near misses, or risk analysis indicate conflicts between turning vehicles on green and pedestrians.
- Marked school crossings.
- Drivers' view of pedestrians is blocked due to obstructions or poor sight distance. At a minimum, consider the following:
  - Intersection geometry that obscures pedestrians from motorists or vice versa.
  - Lighting problems that cannot be adequately addressed through standard lighting requirements.
  - Sun angle that blocks drivers' view at certain times of day or times of the year.
- Approaches where the time needed to serve vehicular demand is less than the associated *WALK* and flashing *DON'T WALK* intervals.

Consider the following at intersections with low to medium pedestrian volumes:

- LPIs can improve pedestrian conspicuity within the crosswalk where drivers may be less likely to expect pedestrian activity.
- At crosswalks with actuated pedestrian phases, LPIs can provide pedestrian safety benefits when pedestrians are present without introducing additional delay during cycles when no pedestrian call is received.

Consider the following points at intersections with low to medium pedestrian volumes:

- LPIs can increase visibility in areas where pedestrian volume is low, and drivers may not expect to see them.
- Where the pedestrian phase is actuated, LPIs can benefit pedestrians when they are present without timing every cycle.
- Combining LPI with automatic pedestrian recall for low pedestrian volume phases may increase vehicular impacts of the LPI with limited added benefit for pedestrians.
- With medium pedestrian volume (particularly on corridors with more signals), actuated LPIs delay vehicular traffic as progression is lost. Implementing automatic pedestrian recall with an LPI in these cases can generally recover the vehicle delay, as it is often not caused by capacity constraints but by lack of progression.

Consider the following points at high pedestrian volume intersections:

- Vehicular impacts of LPIs may be lower where a high volume of crossing pedestrians may inhibit right-turn movements.

- LPIs may not provide the desired level of protection at very high-volume pedestrian crossing locations. A pedestrian scramble may be more appropriate where any of the following conditions exist:
  - Very high volume of pedestrian crossings.
  - High volume of right turns.
  - High demand for diagonal pedestrian crossings.

3.11.5.2 LPI IMPLEMENTATION CONSIDERATIONS

Most modern controllers support LPI natively. At intersections where the controller does not support LPI programming, consider replacing the controller. For information on how to program an LPI, refer to FDOT's ***Leading Pedestrian Interval Programming Primer***.

Set LPI timing to allow pedestrians to clear at least the width of one lane in the direction of moving traffic, including the width of a parking and bicycle lane, to increase pedestrians' visibility to turning traffic. A minimum 3-second LPI duration is required by the ***MUTCD***.

A maximum LPI duration limits drivers' tendency to disobey the signal.

- With an actuated pedestrian phase, the optimal maximum LPI duration is 10 seconds. If more time is needed, either based on Formula 3.11.5.2-1 or due to sight distance concerns, consider geometry updates such as curb bulb-outs to shorten the distance pedestrians need to cross to get through one through lane. Alternatively, consider using an exclusive pedestrian phase or concurrent yet protected signal timing if site conditions allow.
- With a pedestrian phase on automatic recall, the maximum LPI time is 7 seconds.

Consider a 3-second LPI duration when an intersection operates close to capacity.

Use ***Formula 3.11.5.2-1*** to calculate the LPI duration for each crosswalk:

Formula 3.11.5.2-1

$$LPI = \frac{ML + B}{W} + PS$$

Where:

LPI = Number of seconds rounded up to the nearest interval allowed by the controller between the onset of the *WALK* signal for pedestrians and the green indication for vehicles.

ML = Distance on the crosswalk to clear the width of one through lane from the edge of the curb, in feet. Consider large corner radii as per ***MUTCD Section 4I.06 (22)***.

B = Distance from the pedestrian detector location to the edge of curb, in feet. Use 6 feet if no pedestrian detector is present. This measures the distance a pedestrian travels to arrive at the curb.

W = Walking speed (3.5 ft/s for pedestrian clearance interval calculation suggested by the ***MUTCD***). The ***Manual on Uniform Traffic Studies (MUTS)*** provides additional guidance on conducting individual pedestrian walking speed studies.

PS = Pedestrian start-up lost time (FDOT recommends using 1.6 seconds). This term can be omitted if an accessible pedestrian signal is provided.

Consider using an accessible pedestrian signal (***MUTCD Sections 4K.01 to 4K.05***) with LPI applications, as vision-impaired pedestrians use the sound of moving traffic to decide when to start crossing. Accessible pedestrian signals alert pedestrians that the *WALK* indication has initiated. Refer to ***TEM Section 3.7*** for accessible pedestrian signal applicability and implementation.

When an LPI is used, consider concurrent turning movements across the crosswalk.

Right Turn

Use either of the following options:

- A static or dynamic *NO TURN ON RED* sign (***R10-11***) to prohibit turns on red. If using a dynamic sign, display the message during the LPI interval and the preceding yellow and red intervals.
- A shared lane with through vehicles totaling more than two-thirds of the traffic within the lane.

Protected Left Turn

Do not time LPIs concurrent with the opposing protected left-turn interval. Protected left turns may be leading or lagging, but lagging the opposing left-turn movement is preferred to reduce pedestrian conflicts with late-turning vehicles.

For opposing leading left-turn movement, time the LPIs after the opposing protected left-turn movement and before the green through vehicle interval. For opposing lagging left-turn movement, time the LPIs before the green interval for through-vehicle movements.

Protected/Permissive Left Turn

Do not time LPIs concurrent with the opposing protected left-turn interval. Protected/permissive left turns may be leading or lagging. Lagging the opposing left-turn movement is preferred to reduce pedestrian conflicts with late-turning vehicles.

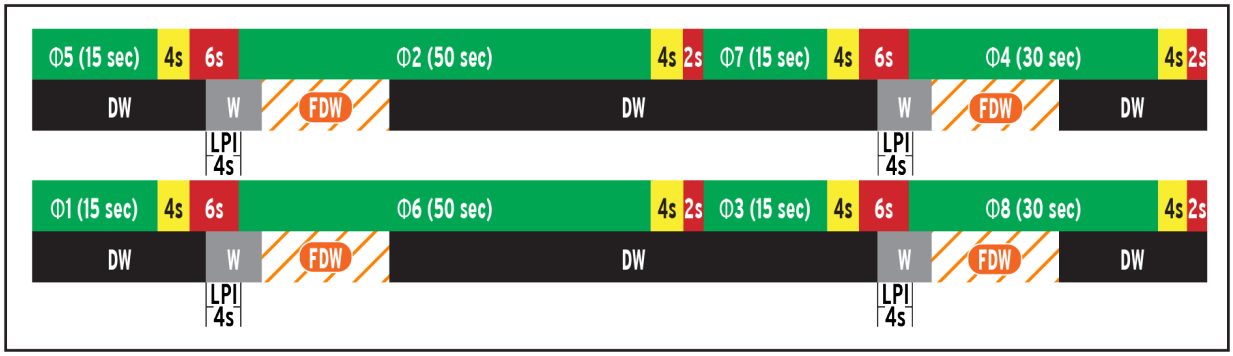
Time the pedestrian phases with LPIs concurrently unless FYA signal heads are used for the conflicting left-turn movements. This prohibits permissive left-turning movements during the LPI.

Permissive Left Turn

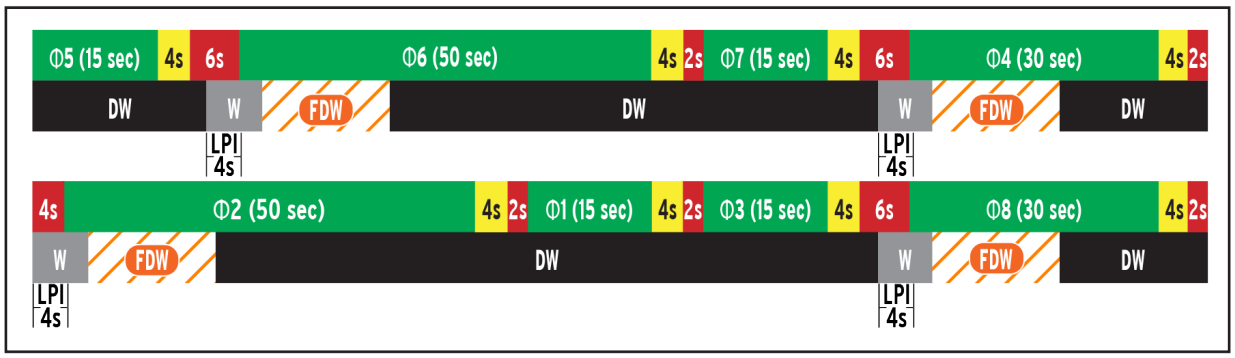
LPIs may be implemented with permissive left turns. Time the pedestrian phases with LPIs concurrently unless FYA signal heads are used for the conflicting left-turn movements. This prohibits permissive left-turning movements during the LPI. See ***Figure 3.11-1*** for examples.

Figure 3.11-1. Schematic Diagram for Signal Timing with LPI

A - Lead/Lead Left Turn



B - Lead/Lag Left Turn





For corridors with LPIs at multiple intersections, consider using automatic pedestrian recall in conjunction with LPIs to maintain progression along the corridor.

FDOT recommends conducting field observations to evaluate improvements to safety and overall intersection operations after implementing LPI. Engineers may adjust signal timing further based on safety needs and engineering judgment.

3.11.6 FYA OMIT BY PED

Consider implementing *FYA Omit by Ped* at locations with protected/permissive signal phasing and four-section signal heads.

Engineers may program *FYA Omit by Ped* for times of day with higher pedestrian volumes that can inhibit permissive left turns. This may be useful in the following cases:

- Intersections with high permissive left-turning conflicts with pedestrians
- School arrival and dismissal periods

- Arrival and dismissal periods at event venues

Use of *Rest in Walk* is not recommended with *FYA Omit by Ped* as it results in a protected-only left-turn phase.

3.11.7 DELAYED TURN

Consider implementing *Delayed Turn* on approaches with dedicated lanes and signal heads for turning movements. This treatment also requires *NO TURN ON RED* signage. Left- and right-turn movements may be held for the duration of the *WALK* and flashing *DON'T WALK* intervals to achieve concurrent yet protected phasing. Use ***Formula 3.11.5.2-1*** and engineering judgment to calculate turning movement duration.

Section 3.12

TRAFFIC SIGNAL RETIMING

3.12.1 PURPOSE

This section provides guidance on how frequently to retime a traffic signal to reduce travel delays, crash frequency, and pollution from fuel consumption and emissions.

3.12.2 GENERAL

Signal retiming is a low-cost approach to keeping traffic moving safely and smoothly while also helping:

- Reduce traffic congestion.
- Reduce aggressive driving behavior/red light running.
- Reduce the number of fatalities and serious injury crashes.
- Reduce fuel consumption and emissions.
- Reduce the need to increase road capacity through construction.
- Reduce speeding along a corridor through context-sensitive considerations.

Retiming traffic signals every three to five years has become standard practice. Signal timing may need to be reexamined due to:

- Increased capacity or turning movements.
- Increased traffic congestion.
- More trucks as a percentage of traffic.
- Construction activities (road or development).
- New traffic signals along the corridor.

3.12.3 PROCEDURE

Signals are retimed every three to five years. Retiming occurs in cycles, where approximately 25% of signals are scheduled to be retimed each year. Traffic signals do not need be retimed every three to five years if an analysis finds the existing timing to be optimized, or that retiming would have negative safety impacts.

Signals may be retimed outside of the scheduled retiming cycle, including but not limited to the when any of the following conditions exist:

- A traffic study indicates performance loss (e.g., queues not fully discharged, spillback, unused green time).
- A traffic study finds safety benefits from retiming.
- Signal timing software finds that the existing timing may be optimized to improve performance.

SECTION 3.13
BICYCLE SIGNALS

3.13.1 PURPOSE

This section outlines criteria, guidelines, and best practices for planning, designing, and operating bicycle signals along the SHS.

3.13.2 BACKGROUND

Before 2013 and the release of MUTCD Interim Approval for Optional Use of a Bicycle Signal Face (IA-16), bicycle signals in the United States were limited to a few locations with experimental approval. Since 2013, bicycle signal applications across the United States have greatly increased as agencies have come to understand the benefits of bicycle signals.

The release of the ***MUTCD 11th Edition (Chapter 4H)*** revised and expanded the previously approved Interim Approval guidance on bicycle signals. However, due to a combination of factors such as its nationwide application and the novelty of bicycle signals, MUTCD standards and guidance on many aspects of bicycle signals, including implementation, detection, phasing, and design, are limited.

To provide more detailed bicycle signal standards and guidance, and to support Florida-specific implementation, this TEM section was developed using research and other agency resources on bicycle signals.

3.13.3 DEFINITIONS

Bicycle Green Wave: A coordinated traffic signal strategy designed to allow bicyclists traveling at a consistent speed to encounter a series of bicycle signal green lights along a corridor without stopping. This application is a viable control strategy option on a corridor with high bicycle volumes and lower vehicle volumes.

Bicycle Scramble: An exclusive bicycle phase with no concurrent vehicular movement in any direction. Bicyclists may cross all intersection legs or simultaneously in any direction. A bicycle scramble is disallowed per the ***MUTCD 4H.02 P01***.

Bicycle Signal Face: An assembly of signal indications specifically designed for bicycle movements, displaying standard bicycle signal indications (Green Bicycle, Yellow Bicycle, and Red Bicycle).

Bicycle Two-Stage Turn Queue Box: A designated area outside of the path of vehicles and other bicycles for bicyclists to queue to make a left turn at a signalized intersection.

Leading Pedestrian Interval (LPI): See ***TEM Section 3.11.3.***

Passive Bicycle Detection: A system that detects the presence and direction of a bicycle and activates the traffic control device without manual actuation. Common passive detection technologies include:

- Inductive Loop Detectors: Wire loops embedded in the pavement that detect the metal mass of a bicycle when it stops or passes over the loop.
- Video Cameras: Use image processing to detect bicyclist presence and movement within a defined detection zone.
- Radar or Microwave Sensors: Emit radio waves and detect changes in the reflected signals caused by moving or stationary bicyclists.
- Infrared Sensors: Use heat signatures or motion detection to sense the presence of bicyclists.

Signal Head: See ***TEM Section 3.9.3.***

Signal Indication: See ***TEM Section 3.1.1***.

3.13.4 BICYCLE SIGNAL LOCATION AND IMPLEMENTATION

Vehicle signals may control bicycle movements (***MUTCD 4H.01 P10***). However, when separated bicycle facilities are present, and there is a desire to separate bicycle movements from vehicle movements with different phases, implement bicycle signals in accordance with the ***MUTCD (Chapter 4H)***. The ***MUTCD 4H.01 P10*** recommends using bicycle signals only when motorized traffic and bicycles making the same movement may receive different instructions.

The subsections in this section outline recommended locations for bicycle signal implementation and vehicular turning volume thresholds for bicycle signal implementation.

3.13.4.1 Recommended Bicycle Signal Locations

Recommended locations for bicycle signal implementations are further described in the following sections and include:

- Two-Way Separated Bicycle Facility on a Two-Way Street
- Two-Way Separated Bicycle Facility on a One-Way Street
- One-Way Bicycle Lane or Separated Bicycle Facility to the Right of a Right Turn Only Lane
- One-Way Bicycle Lane or Separated Bicycle Facility to the Left of a Left Turn Only Lane on a One-Way Street
- Counter-Flow Bicycle Lane on a One-Way Street
- Shared Use Path/Trail Crossings

Please refer to ***FDM 223*** for definitions of bicycle lane, separated bicycle facilities, and shared-use paths. Do not use bicycle signals for facilities such as paved shoulders and shared lanes (with sharrows) as defined in ***FDM 223***.

Other considerations as determined by engineering judgment include sight distance issues and complex intersections.

Bicycle signals are not recommended at bicycle diagonal crossings, bicycle left turns across conflicting vehicle movements, and the connection of a one-way bicycle lane to a two-way bicycle lane (or vice-versa). These situations can be better addressed with a two-stage turn queue box.

All locations require restrictions on permissive left and/or right turns for vehicles, as well as right-turn-on-red operations, across the bicycle direction during bicycle green.

Figure 3.13-2 illustrates bicycle signals installed at a signalized intersection along a two-way street with a two-way separated bicycle facility. This location would require a no-right-turn-on-red restriction for vehicles during bicycle green.

Figure 3.13-2. Two-Way Separated Bicycle Facility on a Two-Way Street



Note: The figure illustrates a two-way separated bicycle facility on a two-way street intersecting a two-way street. The intersection shown is currently operating at red for the major and side streets while the bicycle is green. This location requires a NO RIGHT TURN ON RED (R3-1, R10-11, R10-11a, or R10-11b) blank-out sign restriction for vehicles from the major and side streets during bicycle green. Bicycles may make permissive turns and yield to pedestrians during WALK and flashing DO NOT WALK indications. Counter-flow bicycles can also make a permissive left turn while yielding to opposing bicycle traffic.

Figure 3.13-3 illustrates bicycle signals installed at a signalized intersection along a one-way street with a two-way separated bicycle facility.

Figure 3.13-3. Two-Way Separated Bicycle Facility to the left of traffic on a One-Way Street



Note: The figure illustrates a two-way separated bicycle facility on a one-way street intersecting a two-way street. The intersection shown is currently operating with green for the major street and red for the side street, while the bicycle is green. This location would require a left-turn restriction for the major street. Bicycles traveling in the same direction as the one-way street can make a permissive left turn while yielding to pedestrians during WALK and flashing DO NOT WALK indications, and during counter-flow bicycle movements. Counter-flow bicycles can make a permissive right turn while yielding to pedestrians during WALK and flashing DO NOT WALK indications.

Figure 3.13-4 depicts bicycle signals at a location where a one-way bicycle lane or separated bicycle facility is positioned to the right of a right-turn-only lane. Vehicular right turns shall not conflict with bicycle movement and require a right-turn indication and a no-right-turn-on-red restriction during bicycle green.

Figure 3.13-4. One-Way Bicycle Lane or Separated Bicycle Facility to the Right of a Right Turn Only Lane



Note: The figure illustrates a one-way bicycle lane on a two-way street intersecting a two-way street. The intersection shown is currently green for the major street and red for the side street, while the bicycle is green. The major street has an exclusive right-turn lane operating with a red arrow and a NO RIGHT TURN ON RED (R3-1, R10-11, R10-11a, or R10-11b) blank-out sign for vehicles during bicycle green. Vehicles on the side street have a NO RIGHT TURN ON RED (R3-1, R10-11, R10-11a, or R10-11b) blank-out sign for vehicles during bicycle green. Bicycles can make a protected through movement and permissive right turns and yield to pedestrians during WALK and flashing DO NOT WALK indications.

Figure 3.13-5 shows bicycle signals applied at a signalized intersection where a one-way bicycle lane or separated bicycle facility is located to the left of a left-turn-only lane on a one-way street. The vehicle left turn shall not conflict with the bicycle, and a green left-turn indication or flashing yellow arrow is not permitted during bicycle green. If the cross street is one-way, include a NO TURN ON RED (R10-11) sign to prohibit left or right turns during the bicycle green.

Figure 3.13-5. One-Way Bicycle Lane or Separated Bicycle Facility to the Left of a Left Turn Only Lane on a One-Way Street



Note: The figure illustrates a one-way bicycle lane on a one-way street intersecting a two-way street. The intersection shown is currently green for the major street and red for the side street, while the bicycle is green. The major street has an exclusive left-turn lane operating with a red arrow. Vehicles on the side street have a NO RIGHT TURN ON RED (R10-11, R10-11a, or R10-11b) blank-out sign during bicycle green. Bicycles can make a protected through movement and left-turn movement while yielding to pedestrians during WALK and flashing DO NOT WALK indications.

Figure 3.13-6 presents a single counter-flow bicycle lane to the left of a one-way street. The figure also shows a one-way bicycle lane to the right of the one-way street flowing with traffic. The bicycle signals manage bicycle movements operating both with and against motor vehicle traffic. It is important to note that vehicle right turns and left turns are not permitted during the bicycle green, which is being illustrated using turn restriction blank-out signs in the figure (*). If the cross street is one-way, include a NO TURN ON RED (R10-11) blank-out sign to prohibit left or right turns during the bicycle green.

Figure 3.13-6. Counter-Flow Bicycle Lane on a One-Way Street



Note: The figure illustrates a one-way counter-flow bicycle lane on a one-way street intersecting a two-way street. The intersection shown is currently green for the major street and red for the side street, while the bicycle is red. The major street has a shared through/left-turn lane and shared through/right-turn lane operating with a TURNING VEHICLES STOP FOR PEDESTRIANS (R10-15a) blank-out sign. During bicycle green, the blank-out signs change to NO RIGHT TURN OR NO LEFT TURN (R3-1 or R3-2). Vehicles on the side street have a NO RIGHT TURN ON RED (R10-11, R10-11a, or R10-11b) blank-out sign for vehicles during bicycle green. Bicycles can make protected through movements and permissive right turns while yielding to pedestrians during WALK and flashing DO NOT WALK indications.

Figure 3.13-7 illustrates bicycle signals used at shared-use path or trail crossings to enhance safety at a signalized midblock crossing. Bicycle and pedestrian signal timing do not need to match. Separate signal indicators allow tailored green, yellow, and red times based on each user group's unique needs.

Figure 3.13-7. Shared Use Path/Trail Crossings at Signalized Midblock Crossing



Note: The figure illustrates a shared use path at a signalized midblock crossing. The vehicle signal is red and outside the image frame. The bicycle and pedestrian signals allow different signal timings for different users. The bicycle and pedestrian signals may be placed on separate pedestals or a shared pedestal, as shown.

3.13.4.2 Vehicle Turning Volume Thresholds for Bicycle Signal Consideration

Consider bicycle signal implementation when right-turn and/or left-turn motor vehicle movements that cross a Bicycle Lane or Separated Bicycle Facility, on either two-way street or one-way street, exceed the following volume thresholds during one hour period (comprising any four consecutive 15-minute increments), and shown in ***Table 3.13-2***.

Table 3.13-2. Consideration for Time-Separated Bicycle Movements at Bicycle Signals

Bicycle Facility Operation	Motor Vehicles per Hour Turning across Separated Bicycle Facilities or Bicycle Lane (veh/hr)			
	Two-Way Street			One-Way Street
	Right Turn	Left Turn Across One Vehicular Lane	Left Turn Across Two or More Vehicular Lanes	Right or Left Turn
One-Way	150	100	50	150
Two-Way	100	50	0	100

Note: These volume thresholds also apply for counter-flow bicycle facilities.
Source: Massachusetts Department of Transportation (MassDOT) publication ***MassDOT Separated Bike Lane Guide (2015) Exhibit 6A***

3.13.5 BICYCLE SIGNAL SIGNAGE AND DESIGN

3.13.5.1 Bicycle Signal Signage

Bicycle signal signage follows ***MUTCD (4H.03)***.

3.13.5.2 Bicycle Signal Face Layout

Bicycle signal indications are to follow ***MUTCD Sections 4H.06 through 4H.08*** and use a bicycle symbol signal with bicycles facing to the left. Mount the primary bicycle signal head vertically on the far side of the intersection. If the bicycle signal head is mounted on the mast arm, orient it the same as vehicular signals.

3.13.5.3 Place near-side bicycle signals vertically. Bicycle Signal Indication Size

The primary bicycle signal section uses 8-inch or 12-inch diameter signal indications, with a preference for 12 inches. Use a 12-inch diameter primary bicycle signal section if the bicycle signal is over 120 feet from the stop line.

When a supplemental near-side bicycle signal is provided, use 8-inch or 12-inch diameter signal indications, preferably 8 inches.

Use the same size for all sections and signal modules in a signal assembly.

3.13.5.4 Supplemental Near-Side Signals

Include supplemental near-side bicycle signals when the primary bicycle signal face is greater than 120 feet from the bicycle stop line (***MUTCD 4H.08 P01 (C)***).

Include supplemental near-side bicycle signals when the primary bicycle signal face is located more than 80 feet and up to 120 feet from the bicycle stop line (***MUTCD 4H.08***

P02). Consider supplemental near-side bicycle signals at smaller intersections if there is a history of bicycle-vehicle crashes, at complex intersections or bicycle movements, or if bicycle volumes exceed 150 in an hour (comprising any four consecutive 15-minute increments).

3.13.5.5 Bicycle Signal Mounts

Bicycle signals should use dedicated pedestal mounts and not be installed over the roadway. However, if a bicycle signal must be installed over the roadway, ensure a vertical clearance of no less than 17 feet-6 inches and no more than 19 feet. Do not place bicycle signals below pedestrian signal heads when bicycle and pedestrian signals are on the same pedestal facing the same direction. Per ***FDOT Standard Plans 653-001***, the pedestal-mounted pedestrian signal assemblies are between 8 feet and 10 feet above the sidewalk. Mount the bicycle signal to the right of the bicycle lane where possible.

The minimum mounting height of the primary pedestal-mounted signal head, measured from the elevation of the near edge of pavement to the bottom of the signal housing, may be 10 feet if placed directly above a shared-use path (per the shared-use path vertical clearance in ***FDM 224.8***) or 7 feet above sidewalks (not traveled way of roadway or shoulders/auxiliary lanes) per ***FDM 222.2.1.2***. If an 8-inch or 12-inch supplemental near-side pedestal-mounted signal is used, place it between 7 feet and 8 feet above the ground/sidewalk. If located directly above a shared-use path, place the supplemental near-side pedestal-mounted signal 10 feet above the pavement (per the shared-use path vertical clearance in ***FDM 224.8***) with an 8-inch signal head.

Mount the primary bicycle signal on a pedestal or the vertical support of a mast arm in a vertical position on the far side of the intersection. When sharing a pedestal with a pedestrian signal, position the bicycle signal above the pedestrian signal. The signal housing shall be black or yellow and equipped with a black or yellow backplate with a retroreflective border. Bicycle signal faces are to display bicycle indications only. Where feasible, mount the signal head to the right of the bicycle lane.

3.13.6 BICYCLE SIGNAL EQUIPMENT AND DETECTION

3.13.6.1 Bicycle Signal Detection Types

Install bicycle detection consistent with ***MUTCD 4H.12*** and ***MUTCD 9B.20*** whenever the vehicular signal is actuated. Use passive detection for bicycle signals whenever possible.

Push buttons for bicycles are not passive detection. Push buttons may supplement other forms of passive detection or replace passive detection where a bicyclist is more likely to expect a push button to indicate presence at the intersection. Such locations include:

- Where bicycles cross the intersection approaching from a sidewalk, and a bike signal is provided.

- Multi-use path crossings where bicycle signals are provided.

If push buttons are used for bicycle detection, place the R10-24 or R10-26 sign adjacent to the push button (***MUTCD 4H.12 P04***). Place push buttons so they meet all accessibility requirements.

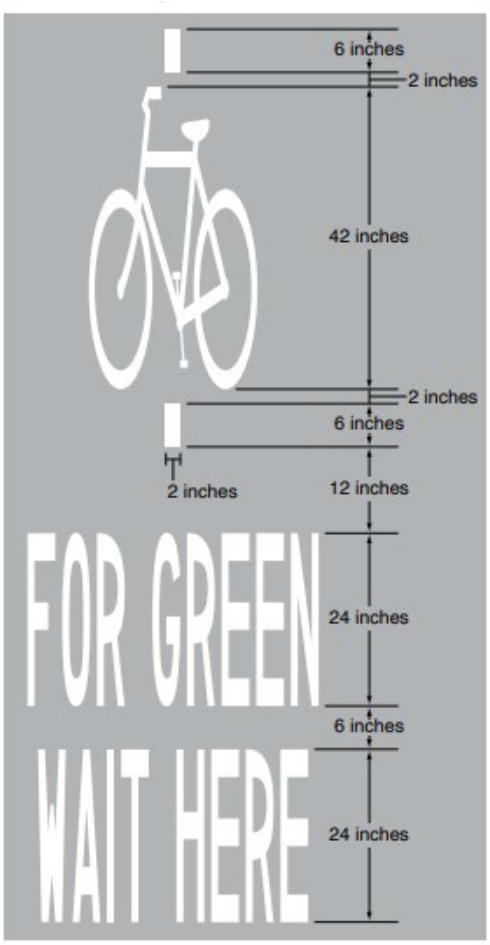
Bicycles can be detected, and the bicycle signal actuated where vehicle signals are pre-timed. When the bicycle signal is actuated and green, a NO RIGHT TURN ON RED (R10-11, R10-11a, or R10-11b) sign is required. A NO RIGHT TURN (R3-1) blank-out sign can be used to prohibit conflicting turns from a pre-timed signal phase during bicycle green.

3.13.6.2 Bicycle Signal Zone/Markings for Passive Detection

Place the bicycle detection zone behind the stop line of the intersection leg/approach in the bicycle facility, except when bicycle boxes are used. If bicycle boxes or two-stage turn queue boxes are used, the detection zone should be present in those areas. The detector(s) should differentiate between bicyclists and vehicles.

The detection zone at the intersection includes the pavement marking shown in ***MUTCD Figure 9E-16*** (***Figure 3.13-8***) and the Bicycle Detector R10-22 sign to instruct bicyclists where to wait. Place the pavement marking on top of a green rectangular pavement marking for greater emphasis. The “WAIT HERE FOR GREEN” text may be included with the pavement marking.

Figure 3.13-8. Bicycle Detector Pavement Marking (*MUTCD Figure 9E-16*)

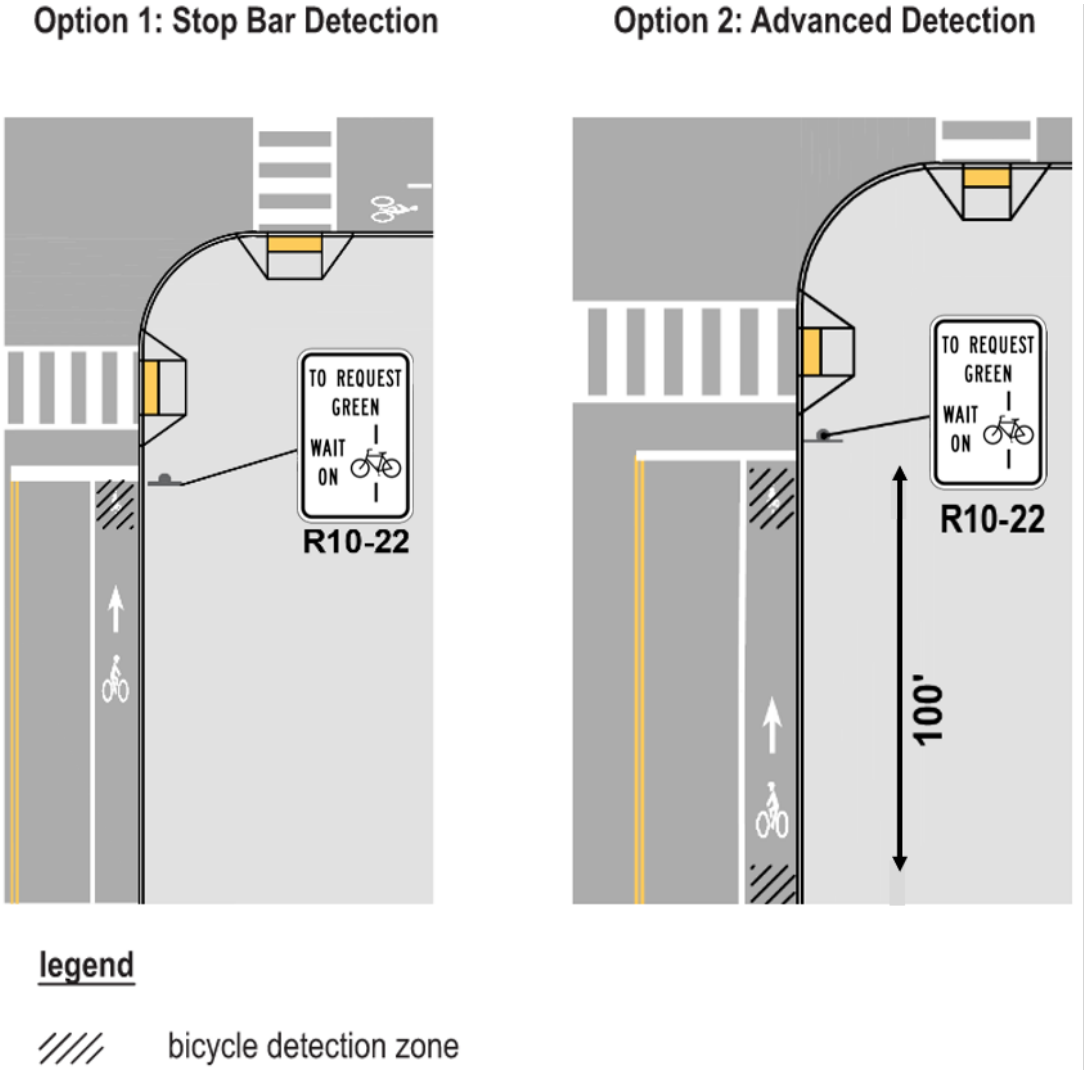


Note: The word pavement markings are optional.

Advanced detection may be used up to 100 feet behind the stop line of a bicycle facility.

When available, program the detection zone to be adjacent to a curb. Detection zone locations are shown in the figure from the AASHTO publication ***AASHTO Guide for the Development of Bicycle Facilities*** (2024) and shown as ***Figure 3.13-9*****.**

Figure 3.13-9. AASHTO Recommended Bicycle Detection Zone Locations



3.13.7 BICYCLE SIGNAL PHASING

3.13.7.1 Bicycle Travel Speed

Bicycle travel speed may be measured in the field to determine a bicycle operational speed appropriate for local conditions, similar to a Walking Speed Study outlined in the ***Manual on Uniform Traffic Studies (MUTS) Section 9.6***. In the absence of data, use context-based bicycle travel speed prioritizing travel speeds for the slower bicyclists, as shown in ***Table 3.13-3*** and ***Table 3.13-4***. ***Table 3.13-3*** is more appropriate to be used on non-State Highway System (SHS) roadways which do not have a context classification. ***Table 3.13-4*** is more appropriate to be used on SHS facilities.

Table 3.13-3. Non-SHS Bicycle Travel Speed by Bicycle Class

Bicycle Class	Description	Bicycle Travel Speed
1	High-Speed Athletic Bicyclists	18 – 25+ MPH
2	Experienced Commuters & Recreational Riders	12 – 18 MPH
3	Casual & Everyday Commuters	10 – 12 MPH
4	Children & Less Confident Riders	8 – 10 MPH

Table 3.13-4. SHS Bicycle Travel Speed by Context Class

Context Classification	Bicycle Class Usage	Recommended Bicycle Travel Speed
C1 – Natural C2 – Rural	1	18 MPH
C2T – Rural Town C3R – Suburban Residential C3C – Suburban Commercial	1, 2, 3	10 MPH
C4 – Urban General C5 – Urban Center C6 – Urban Core	1, 2, 3, 4	8 MPH

For shared-use paths in C2T, C3R, and C3C, assume bicycle class usage of 1, 2, 3, and 4 with a recommended travel speed of 8 MPH unless field data determine bicycle speed.

Adjust travel speed and bicycle acceleration values as appropriate at locations, based on observed field data, where the typical bicyclist may move slower or faster (e.g., at locations with grade). Consider using a higher bicyclist travel speed for yellow change intervals and a slower bicycle travel speed for red clearance time calculations. Do not confuse bicycle travel speed with bicycle design speed.

3.13.7.2 Bicycle Minimum Green/Phase Length Timing

The minimum green time for a bicycle signal includes: (1) 1.5 seconds of start-up time, (2) the time required to accelerate to the average bicycling travel speed, and (3) the time needed to travel half the intersection width at that speed.

Use ***Formula 3.13-1*** to determine the minimum green for bicycles at a bicycle signal:

$$G_{min} = t + \frac{1.47v}{a} + \frac{d}{1.47v} \qquad \textbf{Formula 3.13-1}$$

Where:

G_{min} = minimum green time (s)

v = Bicycle travel speed (mph)

t = Perception-reaction time (assumed 1.5 s)

a = Bicycle acceleration rate (assumed 2.5 ft/s^2)

d = Distance from bicycle stop line to middle of intersection (ft)

3.13.7.3 Yellow Change Interval Timing

The yellow change intervals warn approaching bicyclists that their protected bicycle interval is about to end. A 3-second yellow change interval is preferred. For bicycle facilities on C1/C2 facilities or those with predominantly bicycle class 1 riders and higher bicycle travel speeds, a 3.4-second yellow change interval is suggested. However, longer yellow change intervals of up to 6 seconds may be used if necessary. Please refer to ***TEM Section 3.6.2.1*** for Florida Yellow Change Interval of vehicular signal operations. It is recommended to use the upper end of anticipated bicycle travel speed for yellow time computation.

3.13.7.4 Red Clearance Interval Timing

The red clearance interval provides sufficient time for the bicyclist to complete their crossing, traveling from the stop line to the far side of the intersection, if they enter at the end of the yellow phase. It is recommended to use the lower end of anticipated bicycle travel speed for red time computation.

Because bicyclists are traveling at slower speeds than motor vehicles, a red clearance interval based on motor vehicle speeds will typically not be sufficient for a bicyclist entering at the end of yellow to clear an intersection completely. For this reason, use ***Formula 3.13-2*** to determine the bicycle red clearance interval:

$$R_{clear} = \frac{W+L}{1.47v} \qquad \textbf{Formula 3.13-2}$$

Where:

R_{clear} = Red clearance interval time (s)

W = Width of intersection from bicycle stop line to far side of travel lane (ft)

L = Bicycle length (assumed 6 ft)

v = Bicycle travel speed (mph)

In locations with bicycle signals, change the vehicular red clearance interval to match the bicycle red clearance interval if both the vehicle phase and bicycle phase terminate together.

Apply engineering judgment if the computed red clearance interval exceeds 6 seconds. For large intersections, the maximum all-red interval is 6 seconds. The bicycle red clearance interval does not have to coincide with the vehicular red clearance interval.

For very large or complex intersections or areas with sight distance issues, designers may consider implementing a red extension for bicyclists. A red extension would require appropriate detection.

Please refer to ***TEM Section 3.6.2.2*** for Red Clearance Interval Timing of vehicular signal operations.

3.13.7.5 Bicycle Green Waves

Consider bicycle green waves in a signalized bicycle network with a separated bicycle facility and relatively high bicycle volume during peak hours (i.e., at least 75 bicyclists per hour). Consider the impacts of vehicular traffic, as the coordination priority will be given to bicyclists. If vehicular coordination is also desired along the same corridor, engineers must ensure that the coordinated vehicular speed aligns with the selected bicycle progression speed. Because typical bicycle and vehicle travel speeds differ substantially, concurrent coordination for both modes is often not feasible.

Consider bicycle green waves for all signalized intersections in the corridor at an appropriate bicycle travel speed.

3.13.7.6 Signal Phasing Schemes

Where bicycle signals are used, develop signal schemes compliant with ***MUTCD Chapter 4H*** and do not allow permissive vehicular turns across the path controlled by a bicycle signal during bicycle green (***MUTCD 4H.01 P09***).

Do not use bicycle signals to create a bicycle scramble operation or use them to simultaneously give green bicycle indications to perpendicular conflicting bicycle movements (***MUTCD 4H.02, P01***). Bicycles may make permissive right turns and left turns across other bicycle lanes while yielding to conflicting bicycle movements on a two-way separated bicycle facility.

Signal cycle lengths of 60-90 seconds are recommended for intersections serving heavy bicycle traffic for quicker serviceability.

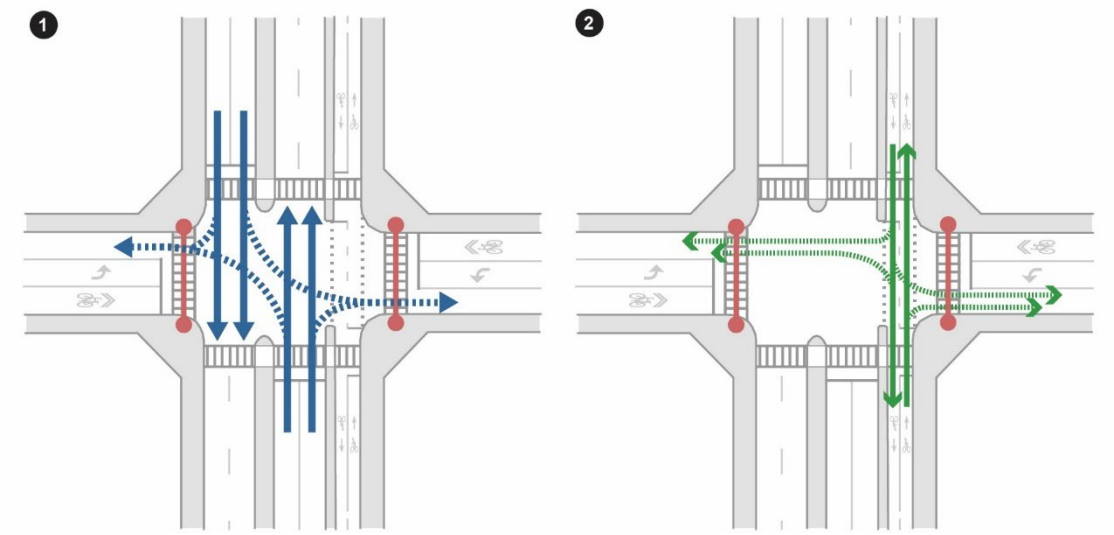
Bicycle signals may be used for a protected bicycle signal phase or a leading bicycle interval as permitted by ***MUTCD Chapter 4H***. MUTCD 4H.01 does not allow bicycle operations in the same capacity as a leading pedestrian interval (LPI) because permissive vehicle turns during bicycle greens are not allowed. A dedicated right-turn signal indication, along with a NO TURN ON RED (R10-11) sign, can restrict conflicting vehicle turns during the bicycle green and help increase driver compliance. This can also be achieved with a NO RIGHT TURN (R3-1) blank-out sign that turns off when the conflicting bicycle green is not active.

Exclusive Bicycle Phase

An exclusive bicycle phase provides complete separation between motor vehicle movements and bicycle movements within the signal cycle. This phasing strategy is particularly beneficial at intersections where bicyclists need to turn across vehicular lanes, as it minimizes conflict points and enhances safety. However, an exclusive phase may increase overall delay for all users, including motor vehicles and bicyclists, and typically requires a longer signal cycle to accommodate the additional phase.

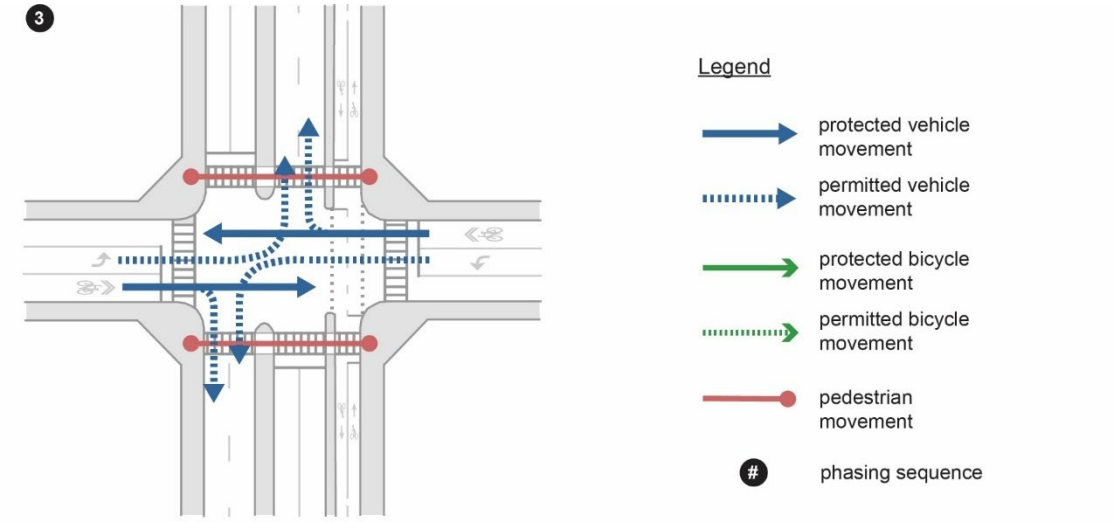
An example of a compliant signal phasing scheme of an exclusive bicycle phase is shown in ***Figure 3.13-10***.

Figure 3.13-10. Two-Way Bicycle Lane on Major Approach of Two-Way Street



Phase 1 (left) shows protected through movement and permissive turns for the major street, with walk for the parallel pedestrian movements. The bicycle signal is red.

Phase 2 (right) shows an exclusive bicycle phase with walk for the parallel pedestrian movements. Bicycles may make permissive right and/or left turns while yielding to pedestrians and conflicting bicycle movements. The major streets and side streets are operating with a NO RIGHT TURN ON RED (R10-11) blank-out sign to restrict turning movements across bicycle green



Phase 3 shows protected through movement and permissive turn movements for the side street with walk for the parallel pedestrian movements. The bicycle signal is red.

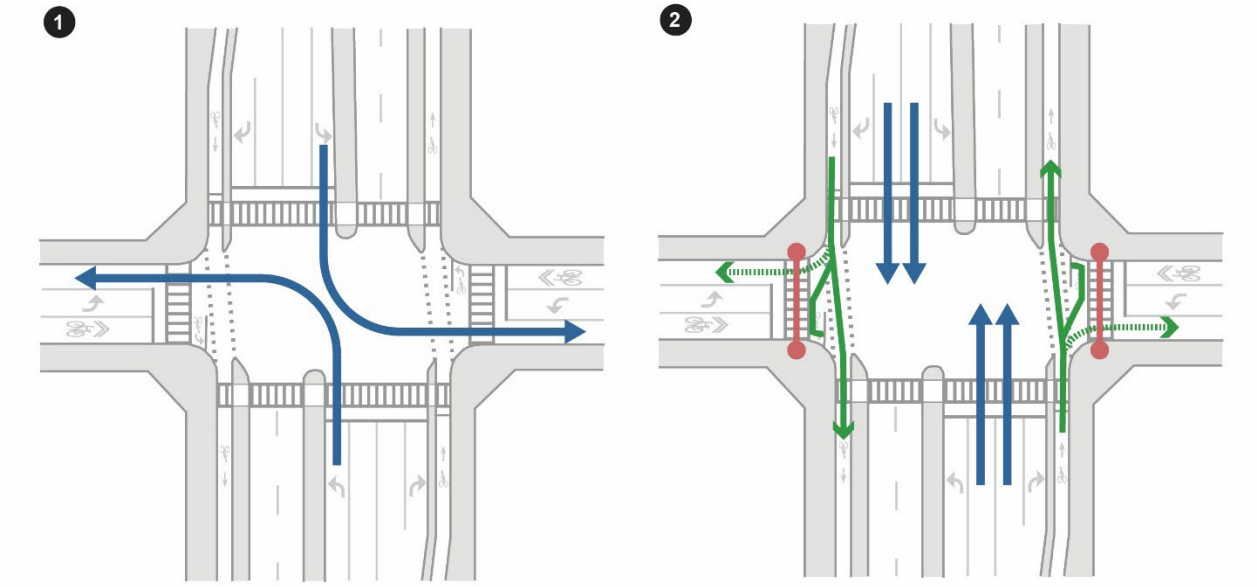
Note: Based on ***AASHTO Guide for the Development of Bicycle Facilities***, Figure 10-4.

Concurrent Bicycle Phase and Protected Turn Movement

A concurrent bicycle phase with a protected turn movement allows through bicycle movements to occur simultaneously with non-conflicting protected vehicle turns. This approach fully separates turning vehicles from through bicyclists, removing the need for motorists to yield to bicycles or pedestrians during turns and improving vehicle flow through the intersection. Despite these operational benefits, this strategy requires an additional signal phase, which may increase cycle length and delay. It also requires a dedicated right-turn signal indication, along with a NO TURN ON RED (R10-11) sign or a NO RIGHT TURN (R3-1) blank-out sign that turns on when the conflicting bicycle green is active to reinforce turn restrictions and encourage driver compliance.

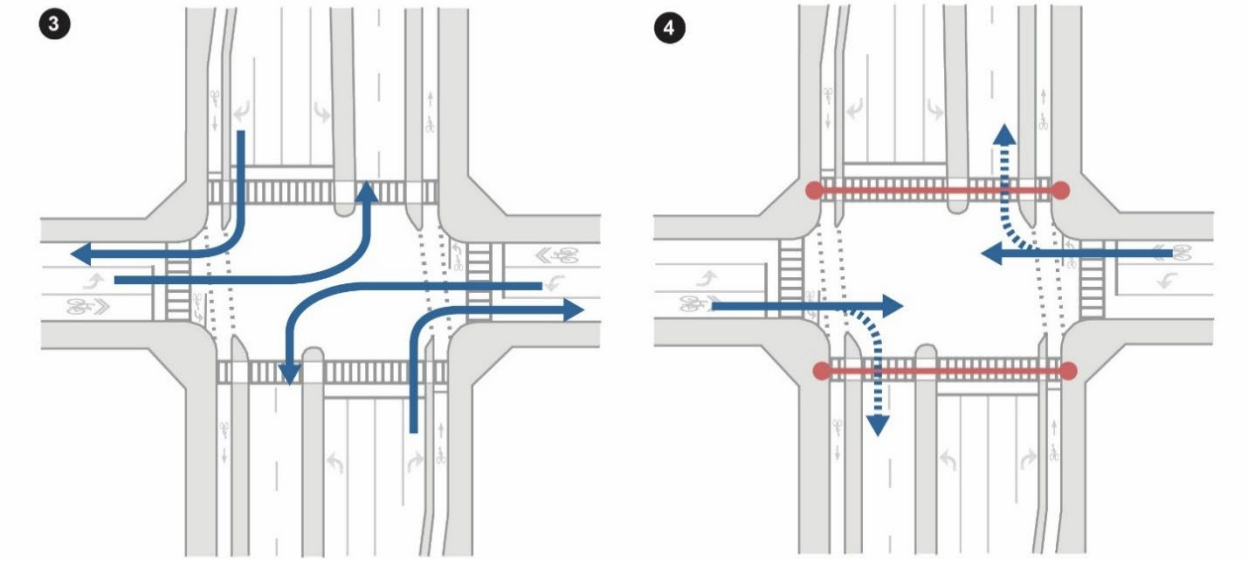
Examples of compliant signal phasing schemes for concurrent bicycle phase and protected turn movement are shown in ***Figure 3.13-11***, ***Figure 3.13-12***, ***Figure 3.13-13***, and ***Figure 3.13-14***

Figure 3.13-11. One-Way Bicycle Lanes on Major Approach of Two-Way Street



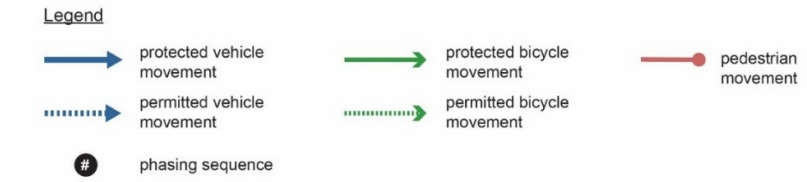
Phase 1 (left) shows protected left turns for the major street. The bicycle signal is red.

Phase 2 (right) shows a green signal for vehicles moving through the major street. The bicycle signal is green, allowing permissive right turns while yielding to pedestrians during WALK and DO NOT WALK indications. Bicyclists can also access the two-stage bicycle turn box on the side-street approach. The major streets and side streets are operating with a NO RIGHT TURN ON RED (R10-11) blank-out sign to restrict turning movements across bicycle green.



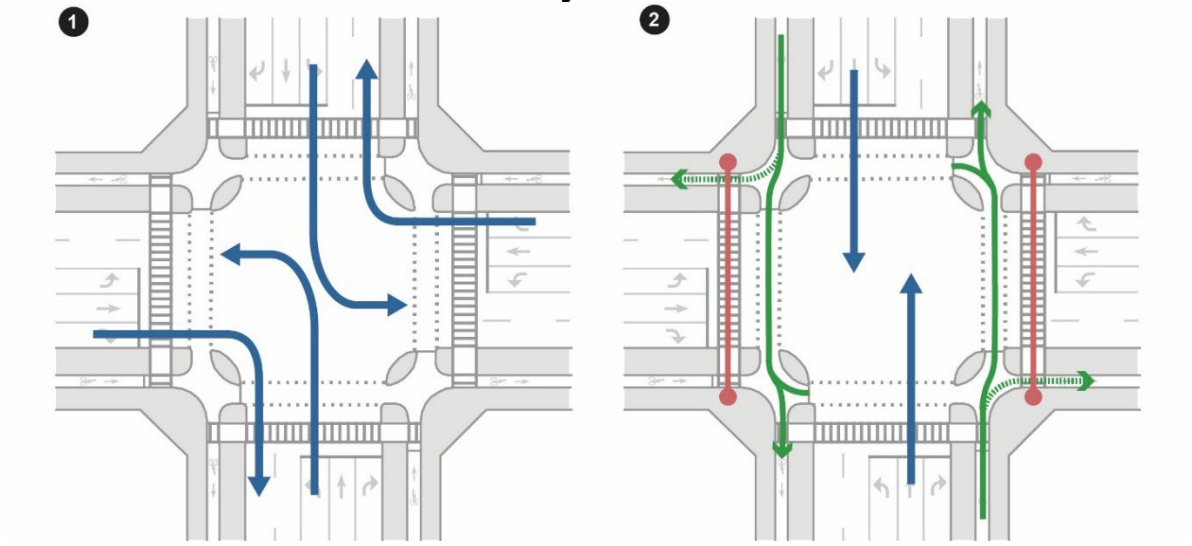
Phase 3 (left) shows protected left-turn movement for the side street and protected right-turn movement for the major street. The bicycle signal is red.

Phase 4 (right) shows protected through movement and permissive right-turn movements for the side street with walk for the parallel pedestrian movements



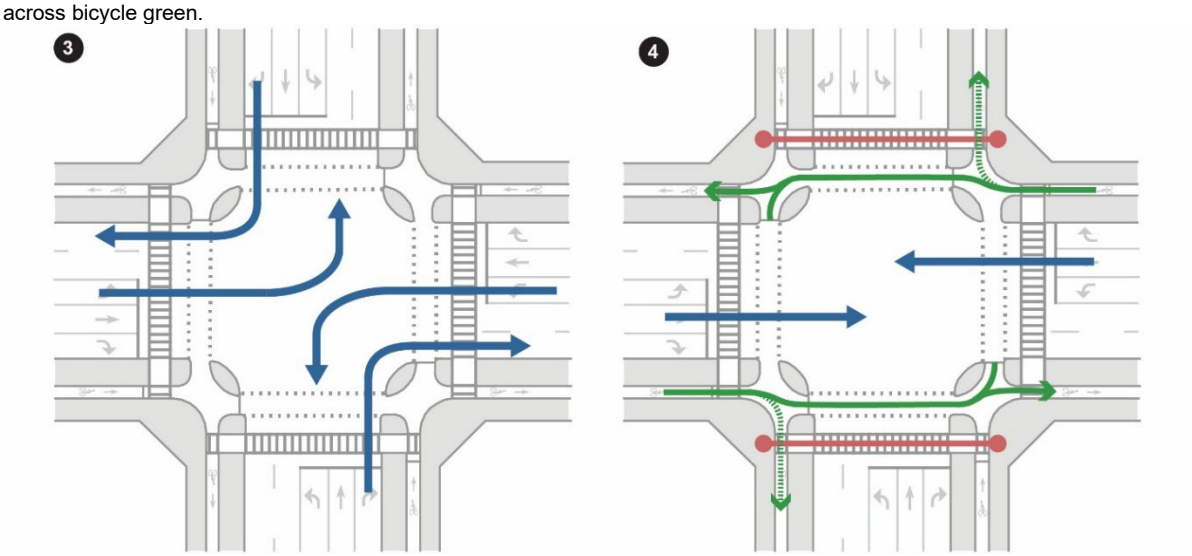
Based on the ***AASHTO Guide for the Development of Bicycle Facilities***, Figure 10-5.

Figure 3.13-12. One-Way Bicycle Lanes on Major and Minor Approaches of a Two-Way Street



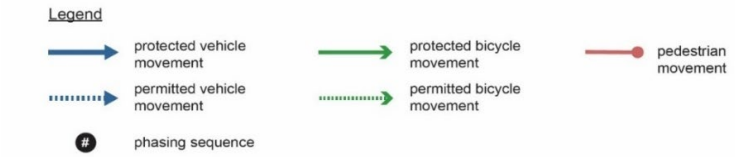
Phase 1 (left) shows a protected intersection with protected left turns for the major street and protected right turns for the side streets. The bicycle signal is red.

Phase 2 (right) shows a protected intersection with green for the vehicle through movements on the major street. The bicycle signal is green, allowing for permissive right turns while yielding to pedestrians during WALK and DO NOT WALK indications. The major streets and side streets are operating with a NO RIGHT TURN ON RED (R10-11) blank-out sign to restrict turning movements across bicycle green.



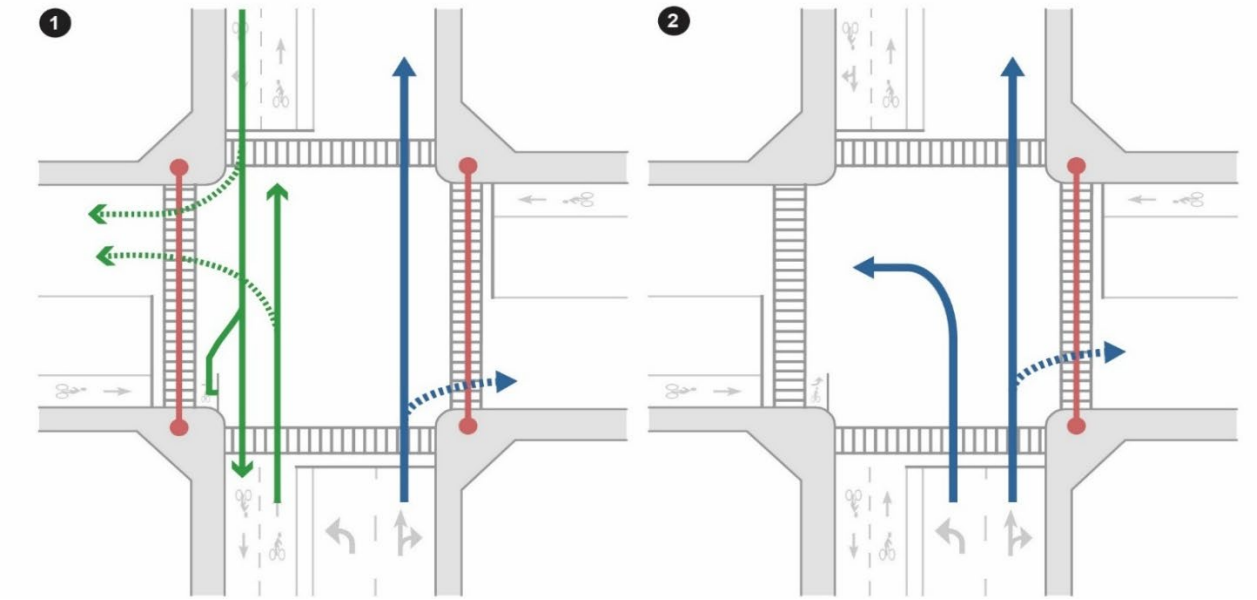
Phase 3 (left) shows a protected intersection with protected left-turn movement for the side street and protected right-turn for the major street. The bicycle signal is red.

Phase 4 (right) shows a protected intersection with green for the vehicle through movements on the side street. The bicycle signal is green, allowing for permissive right turns while yielding to pedestrians during WALK and DO NOT WALK indications. The major streets and side streets are operating with a NO RIGHT TURN ON RED (R10-11) blank-out sign to restrict turning movements across bicycle green.



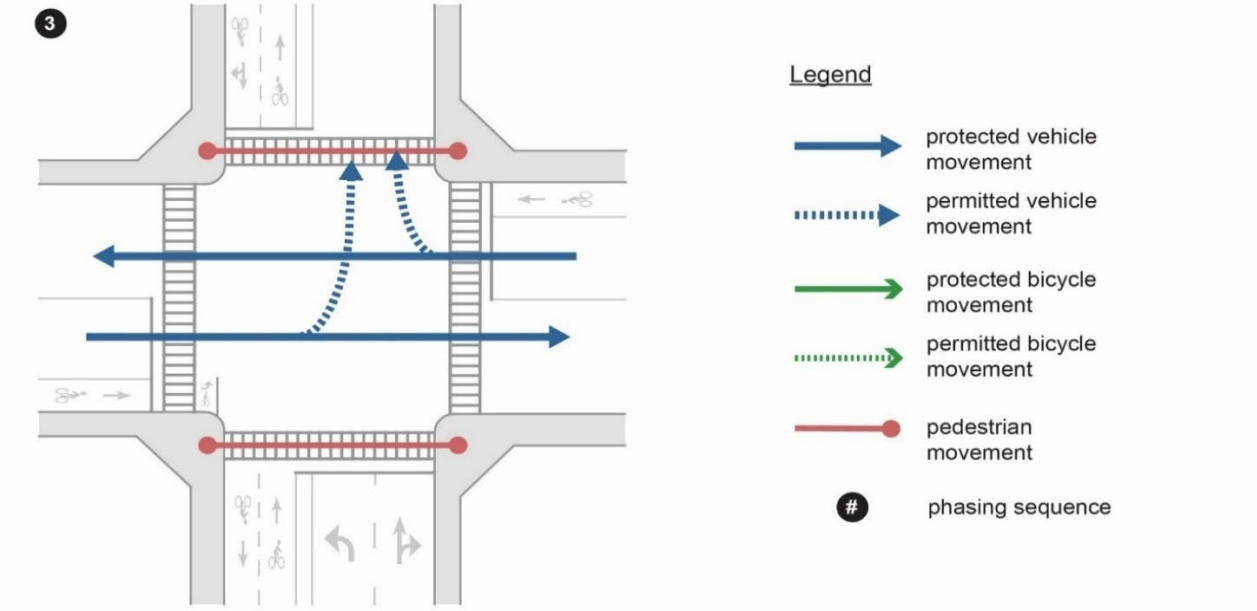
Note: Based on ***MassDOT Separated Bike Lane Planning & Design Guide,*** Exhibit 6J.

Figure 3.13-13. Two-Way Bicycle Lane on Major Approach of One-Way Street



Phase 1 (left) shows a protected through movement for the one-way major street and permissive right-turns yielding to parallel pedestrian movement. The bicycle signal is green, allowing protected through movement, and permissive northbound left-turn and permissive southbound right-turn yielding to confliction pedestrian and bicycle movements. The major streets and side streets are operating with a NO RIGHT TURN ON RED (R10-11) blank-out sign to restrict turning movements across bicycle green. The southbound bicyclists looking to make a left-turn are able to access the two-stage bicycle turn box on the side street approach.

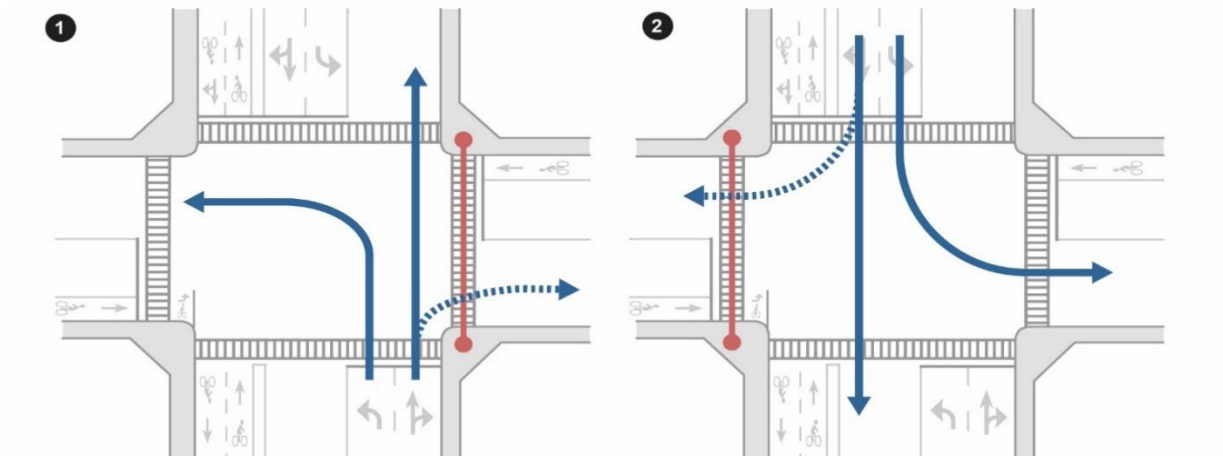
Phase 2 (right) shows a protected-through and left movement for the one-way major street and permissive right turns yielding to parallel pedestrian movement. The bicycle signal is red



Phase 3 shows protected through movements for the side street and permissive right and left turns onto the one-way major street, yielding to conflicting pedestrian movements. The bicycle signal is red.

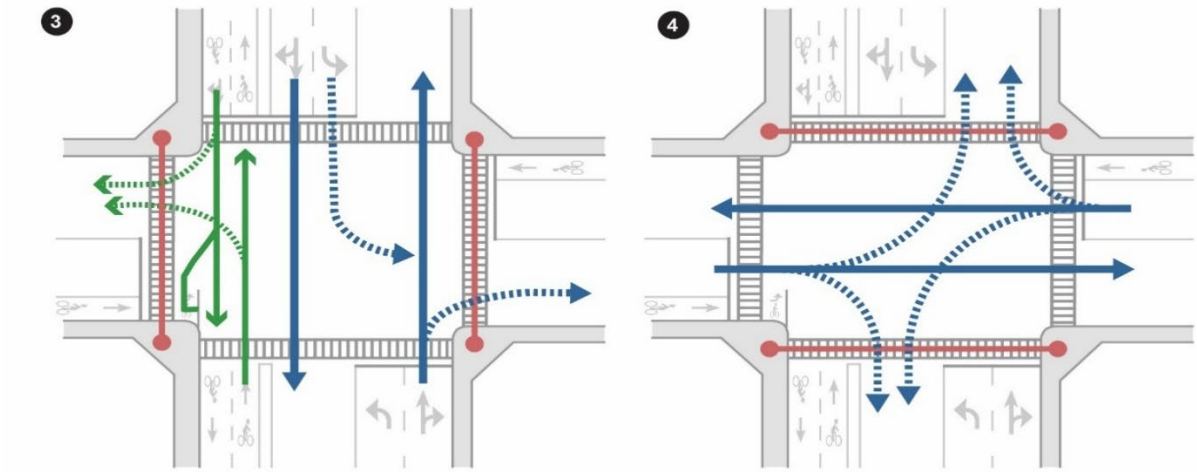
Based on the ***FHWA Separated Bike Lane Planning & Design Guide***, Signal Phasing Example 5.

Figure 3.13-14. Two-Way Bicycle Lane on Major Approach of Two-Way Street



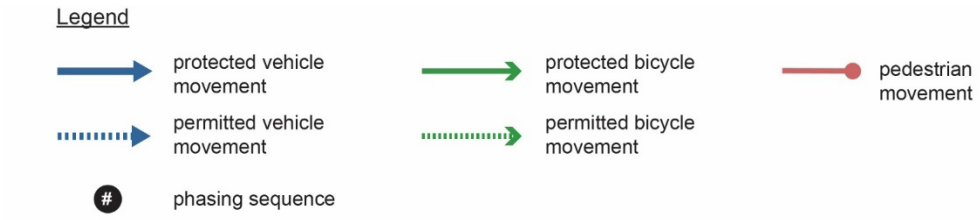
Phase 1 (left) shows a protected through and left movement for the northbound major street and permissive right-turns yielding to parallel pedestrian movement. The bicycle signal is red.

Phase 2 (right) shows a protected through and left movement for the southbound major street and permissive right-turns yielding to parallel pedestrian movement. The bicycle signal is red.



Phase 3 (left) shows a protected through movement for the major street and permissive northbound right turns and southbound left turns, yielding to parallel pedestrian movement. The bicycle signal is green, allowing protected through movement and permissive northbound left turns and permissive southbound right turns, yielding to conflicting pedestrian and bicycle movements. The major streets and side streets are operating with a NO RIGHT TURN ON RED (R10-11) blank-out sign to restrict turning movements across bicycle green. Southbound bicyclists looking to make a left turn can access the two-stage bicycle turn box on the side street approach.

Phase 4 (right) shows protected through movements for the side street and permissive right and left turns to the major streets, yielding to conflicting pedestrian movements. The bicycle signal is red.



Note: Based on the ***FHWA Separated Bike Lane Planning & Design Guide***, Signal Phasing Example 3.



CHAPTER

4

Markings

SECTION 4.1

CROSSWALKS IN AREAS WITH HEAVY PEDESTRIAN TRAFFIC

4.1.1 PURPOSE

This section provides guidelines for applying pavement markings and signing near marked crosswalks.

Engineers may consider adding crosswalks at locations other than intersections to provide a defined pedestrian crossing path near busy destinations along the State Highway System, such as beaches or hotels. When locating marked crosswalks, consider nearby sidewalks, paths, guardrails, retaining walls, or shrubbery.

4.1.2 MARKINGS

Design crosswalks as two parallel 1-foot-wide white lines. Place these lines no less than 6 feet apart at intersections and no less than 10 feet apart at midblock locations. Locate the crosswalk where it provides the shortest crossing distance whenever practical. Use special emphasis markings to make the crosswalk more visible to pedestrians and motorists. See ***Standard Plans, Index 522-002*** for sidewalk curb ramp design, and ***Standard Plans, Index 711-001*** for crosswalk pavement marking details.

4.1.3 SIGNING

Install a *PEDESTRIAN CROSSING* sign (***W11-2***) with a downward diagonal arrow plaque (***W16-7p***) immediately adjacent to each marked pedestrian crossing. This sign can be ground-mounted or mounted overhead on a mast arm or span wire.

Install a *PEDESTRIAN CROSSING* sign (***W11-2***) with an *AHEAD* plaque (***W16-9P***) before a marked crosswalk. Engineers may install these in advance of each crosswalk in areas with heavy pedestrian activity. Use engineering judgment to determine if advance crossing sign assemblies are needed. Consider crosswalk spacing, roadside development, and other factors. Consult ***FDOT Design Manual (FDM) Exhibit 230-9*** for the suggested sign placement distance based on approach speeds.

Engineers may install an *END PEDESTRIAN CROSSING* sign to notify motorists that the pedestrian zone has ended. Use 8-inch letters on an 8 x 4-foot sign panel for overhead-mounted signs. Use 4-inch letters on a 3 x 2.5-foot sign panel for ground-mounted signs. Install the sign approximately 200 to 300 feet downstream of the last marked crosswalk.

SECTION 4.2

PAVEMENT WORD, SYMBOL, AND ARROW MARKINGS

4.2.1 PURPOSE

This section provides guidelines on applying roadway pavement word, symbol, and arrow markings to supplement existing highway signing and emphasize regulatory, warning, or guidance messages (***Figure 4.2-1*** and ***Figure 4.2-2***).

Figure 4.2-1. Pavement Word Markings



Consult ***MUTCD Section 3B.20*** for the minimum requirements for roadway pavement word, symbol, and arrow markings. For additional requirements, consult the ***Manual on Speed Zoning for Highways, Roads, and Streets in Florida*** and ***Standard Plans, Indexes 711-001*** and ***711-002***.

Design route shields in accordance with ***Standard Plans, Index 711-001***.

Roadway pavement word, symbol, and arrow markings can substitute vertical signs when overhead signing is impractical or impossible to install, such as when it would impose on navigable airspace.

To apply non-standard word or symbol pavement markings, complete the following:

1. Conduct an engineering study documenting how these markings would improve safety or operations efficiency and submit it to the ***District Traffic Operations Engineer (DTOE)*** for concurrence.
2. Once the ***DTOE*** has concurred, the ***District Traffic Operations Office*** will submit the study to the ***State Traffic Operations Engineer (STOE)*** for concurrence.
    - Once the STOE has concurred, the ***State Traffic Engineering and Operations Office*** will submit an FHWA Request to Experiment (RTE) for approval.
    - If the RTE is approved by FHWA, the ***District Traffic Operations Office*** recommending the design will be responsible for submitting the required interim and final reports to the ***State Traffic Engineering and Operations Office*** for review and submission to FHWA.

Figure 4.2-2. Pavement Symbol and Arrow Markings



4.2.2 LANE USE ARROW AND 'ONLY' PAVEMENT MARKINGS ON INTERSECTION APPROACHES

Use lane use arrow symbols only in through lanes at intersections with overhead lane use control signs, or where unusual geometrics or through lane alignment may confuse motorists. In the latter case, use a straight arrow symbol in through lanes as additional guidance.

The roadway pavement word *ONLY* is not required for an exclusive turn lane if the arrow symbol is used under the following conditions:

- Lane is developed at a midblock location
- Lane is clearly delineated by appropriate channelization
- Lane requires lateral vehicle movement from an established lane for proper positioning to execute the turn

Use the roadway pavement word *ONLY* with the roadway pavement arrow symbol where unusual geometrics or exclusive turn lane alignment may confuse motorists.

Where an established through lane becomes an exclusive turn lane, use the roadway pavement word *ONLY* with the roadway pavement arrow symbol indicating the allowed turning movement.

When using the roadway pavement word *ONLY* with an arrow symbol, pair the pavement markings with the appropriate signs specified in ***MUTCD Section 2B.26***, ***Section 2B.27***, ***Section 2B.28***, ***Section 3B.20***, and ***TEM Sections 2.3.2*** and ***2.3.3***.

Design and placement details for roadway pavement arrows and the *ONLY* message are available in the ***Standard Plans, Index 711-001***.

4.2.3 ROUTE SHIELD PAVEMENT MARKINGS

Install route shield pavement markings as follows:

- Use pre-formed thermoplastic.
- Use 20-foot-long shields for limited access roadways and 15-foot-long shields for arterials and collectors, according to ***Standard Plans, Index 711-001***.
- Align a route shield in the center of the lane.
- Install the route shields horizontally across the roadway; do not stagger them. See ***Figure 4.2-3***.
- If arrows or messages are included to supplement a route shield (*TO*, *LEFT*, *RIGHT*, *NORTH*, *SOUTH*), place them downstream of the route shield. See ***Figure 4.2-4***.

- Leave an 80-foot gap between markings, including sequential route markings for multiple destinations. Reduce this spacing to 20 feet for lower-speed applications, such as left-turn lanes at diamond interchanges, as shown in ***Figure 4.2-6***. Cardinal directions may be 40 feet from a route shield marking.

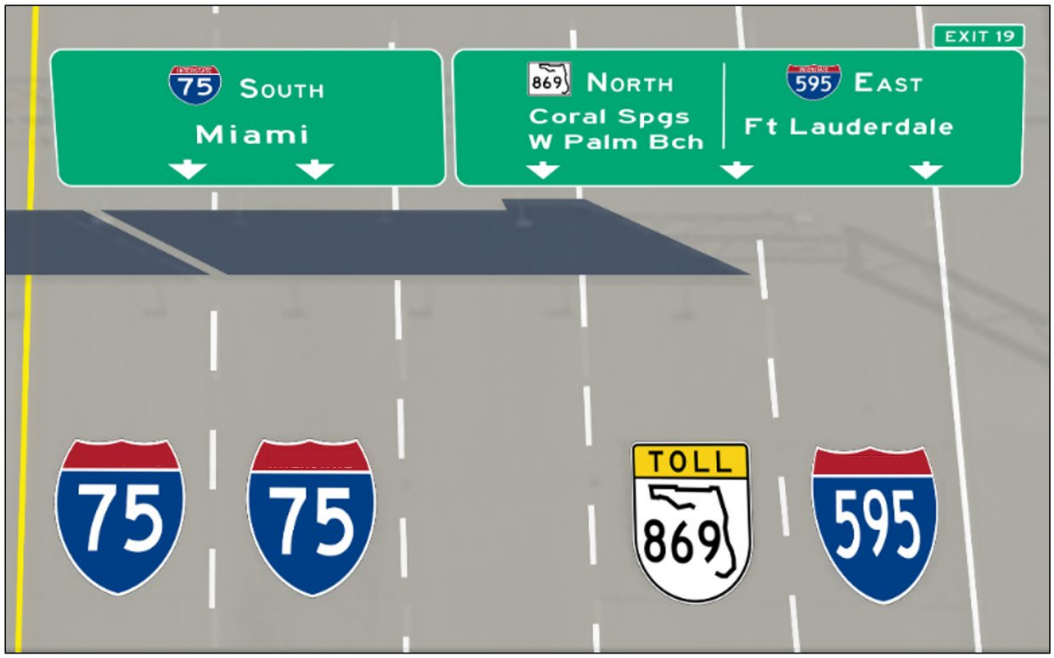
4.2.3.1 Mainline

Coordinate with the ***District Maintenance Office*** before requesting ***DTOE*** approval to install route shield pavement markings on mainlines (***Figure 4.2-3***).

Route shield pavement markings are justified under any of the following conditions:

- There is a reported increase in crash frequency as a result of complex lane assignments such as lane drops, double lane exits with optional lanes, gores where crash cushions are frequently hit, or unusual geometries.
- The optional or excess lane is underutilized, and weaving maneuvers may cause unexpected congestion identified by volume/capacity analyses.
- Lane assignments are complex, or alignment shifts are present.
- An overhead sign structure is not practical, and the turn lane from an arterial to a limited-access on-ramp may appear to provide access to other destinations.

Figure 4.2-3. Route Shield Pavement Markings for Mainline

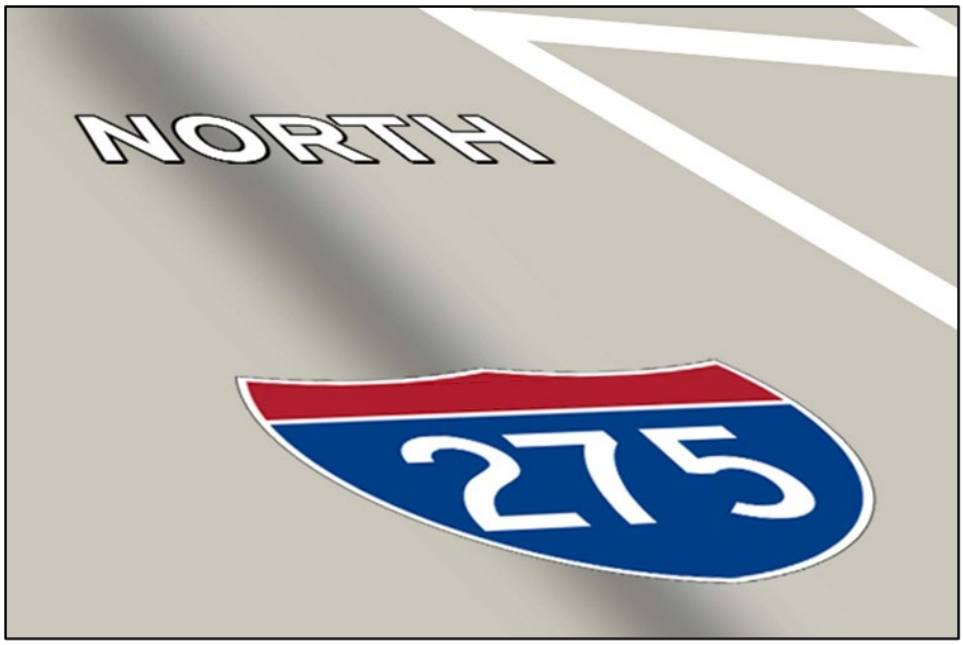


Consider the following when deciding where to install route shield pavement markings:

- Install route shield pavement markings where they will be most visible to motorists.

- Place the markings after at least one interchange overhead guide sign.
- Install the markings within 1 mile upstream of the decision point to allow motorists to safely change lanes, considering existing signs and other traffic control devices.
- Limit installations to two sets of markings (shield with arrow or message) before the gore or decision point.
- Avoid placing the markings under or immediately adjacent to overpasses, as these can cast shadows on the shields. Placing markings on downhill slopes may reduce their effectiveness.

Figure 4.2-4. Cardinal Direction Markings

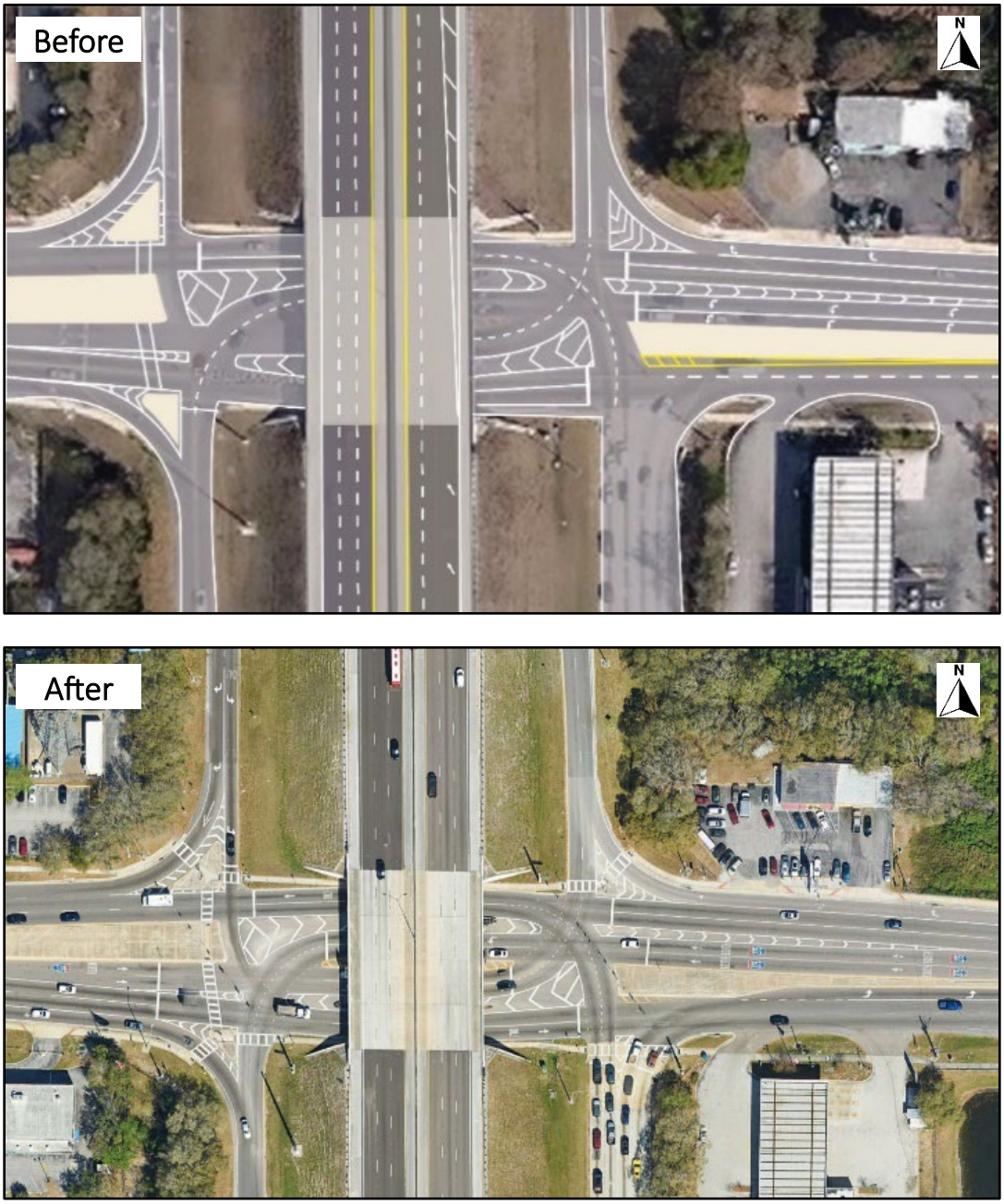


4.2.3.2 Interchange Access

Route shield pavement markings can help prevent wrong-way driving as motorists navigate arterials connected to limited-access facilities. A common example is diamond interchanges, or where turn lane(s) are developed at signals and the actual turning movement occurs at a downstream signal. Apply these treatments in conjunction with appropriate geometric design (e.g., signing, lighting, supplemental channelization) to prevent potential wrong-way driving.

Figure 4.2-5 shows before-and-after plan views at the E Bearss Avenue and I-275 interchange. The “before” image shows the conditions with dual westbound left-turn arrow markings east of the northbound off-ramp. The “after” image shows an interstate shield, cardinal direction, and straight-arrow pavement markings on the eastbound and westbound left-turn lanes. These pavement marking improvements inform motorists that the limited-access on-ramp entrance is available at the downstream signal.

Figure 4.2-5. Before and After Plan View of E Bearss Avenue and I-275 Interchange



Arterial left-turn lane(s) feeding into an interchange on-ramp may have a median opening to allow turning movements from conflicting approaches. When a median opening is present along the arterial left-turn lane(s), install one set of pavement markings per lane (including the interstate shield, cardinal direction, and straight arrow). An example is shown in ***Figure 4.2-6***. Pavement markings for interchange access do not require ***DTOE*** approval.

Figure 4.2-6. Pavement Markings for Interchange Access



SECTION 4.3

SPECIAL RAISED PAVEMENT MARKERS

4.3.1 PURPOSE

This section describes how to uniformly apply blue and internally-illuminated raised pavement markers (IIRPMs) on the State Highway System.

4.3.2 DEFINITIONS

Raised Pavement Marker (RPM): A traffic control device that enhances nighttime and wet weather visibility of roadway striping. RPMs are typically made of plastic, ceramic, or thermoplastic paint, which retroreflects automotive headlights.

Internally-Illuminated Raised Pavement Marker (IIRPM): A steady-burn internally-illuminated RPM. IIRPMs are permitted for use by ***MUTCD Chapter 3B*** as an equivalent alternative to RRPMs. The IIRPMs mentioned in this section are also known as Class F RPMs in ***Standard Specifications, Section 706***.

4.3.3 INTERNALLY-ILLUMINATED RAISED PAVEMENT MARKERS

The retroreflective RPM is FDOT's standard type of raised pavement marker. Limit IIRPM use to mitigation strategies for curves with any of the following:

- Substandard horizontal alignment or superelevation.
- Substandard lane widths.
- Substandard shoulder widths.

Space IIRPMs that supplement or substitute for longitudinal line markings as described in ***MUTCD Sections 3B.15 through 3B.17***. IIRPM installation on roadways within the State Highway System requires a signed and sealed traffic engineering and safety study. Submit the study to the District Traffic Operations Office for approval. ***DTOEs*** will coordinate with the District Maintenance Engineer to determine installation locations.

4.3.4 BLUE RAISED PAVEMENT MARKERS TO IDENTIFY FIRE HYDRANTS

Refer to ***Standard Plans, Index 706-001*** for placement applications.

SECTION 4.4
ROUNDABOUT MARKINGS

FDOT's standards for this section are shown in ***MUTCD Chapter 3C*** and ***FDM 213***.

SECTION 4.5

MANAGED LANES MARKINGS

4.5.1 PURPOSE

This section provides guidance on pavement markings for express or managed lanes. It supplements the standards defined in the ***FDM 211***, ***FDOT Managed Lanes Guidebook***, and ***MUTCD***.

4.5.2 DEFINITIONS

Contiguous Separation: The space between managed lane(s) and general-purpose lanes. Single 8-inch longitudinal pavement markings delineate this space.

Separation Width: The lateral gap between the managed lane(s) and the general-purpose lanes. This area includes the two single 8-inch longitudinal pavement markings and the space in between. The maximum contiguous separation width allowed is 36 inches.

Slip Ramp: An exclusive lane that connects managed lane(s) and general-purpose lanes by using breaks in the separation type.

Toll Gantry: Truss structure supporting toll equipment over the roadway.

Tolling Area: Section of roadway underneath the toll gantry.

Weave Lane: A lane accommodating weaving movements and speed changes as vehicles merge between managed lane(s) and general-purpose lanes.

Weave Zone: Provides simultaneous ingress and egress access between managed lane(s) and general-purpose lanes using a break in the separation type.

4.5.3 *EXPRESS* AND *ONLY* WORD PAVEMENT MARKINGS IN EXPRESS LANES

Install the *EXPRESS* and *ONLY* roadway pavement words before managed lane access points and co-locate them with overhead advance guide signs under the following conditions:

- When a general-purpose lane transitions directly into a managed lane(s).
- When a general-purpose lane directly connects from a surface street (see ***MUTCD Figure 2G-28***).

Install the *EXPRESS* roadway pavement word at the immediate point of entry under the following conditions:

- When the slip ramp transitions directly into a managed lane(s).
- When the slip ramp from a general-purpose lane merges directly into a managed lane(s).

Do NOT install the *ONLY* roadway pavement word under the following conditions:

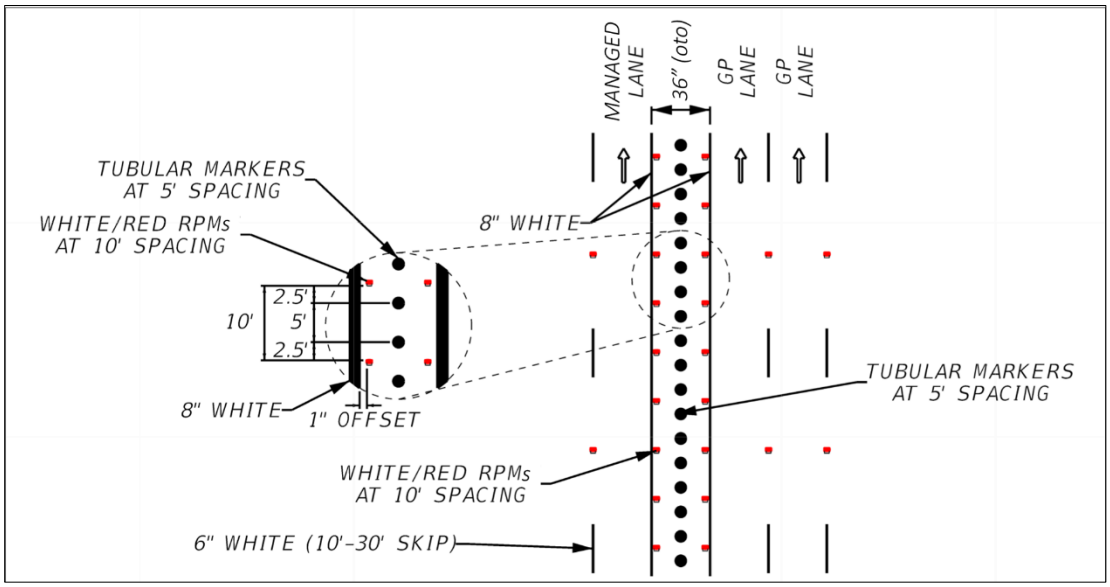
- When the managed lane is accessed by a weave zone.
- When the managed lane is accessed by a weave lane.
- At any point beyond the entry gore where there is no legal option to exit or enter a managed lane(s).

4.5.4 CHEVRONS AND MARKERS

Follow the ***FDM 211*** requirements for chevrons' and pavement markers' placement. Install chevron crosshatch markings with tubular markers (***Figure 4.5-1***) in buffers greater than 4 feet as follows:

- Place 18-inch white chevrons spaced 100 feet apart as follows in buffers 4 feet and wider:
  - **Slip Ramps:** within the slip ramp transition.
  - **Weave Lanes:** within the weave lane transition.
  - **Weave Zones:** extend 1,000 feet on both ends of the weave lane.

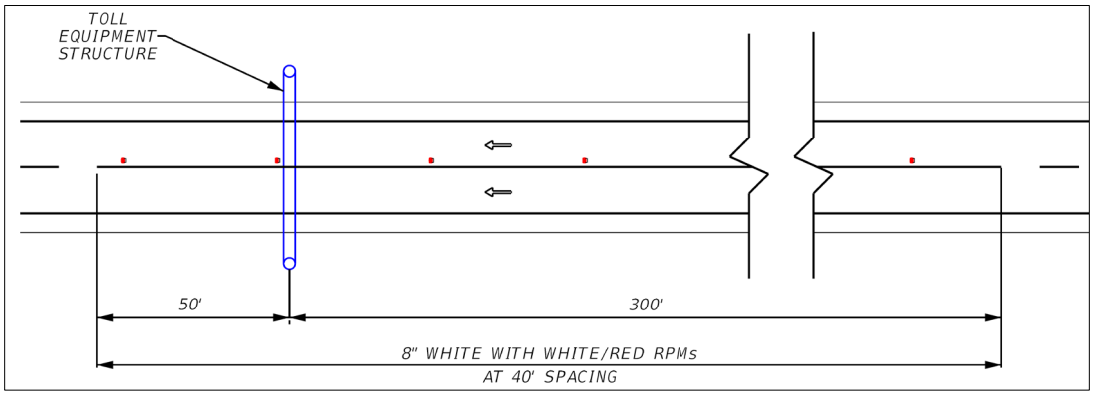
Figure 4.5-1. Separation Detail



4.5.5 PAVEMENT MARKINGS WITHIN THE TOLLING AREA

Where there is more than one managed lane, separate the lanes with a solid 8-inch white stripe 300 feet ahead of the toll gantry and 50 feet past it, as shown in ***Figure 4.5-2***.

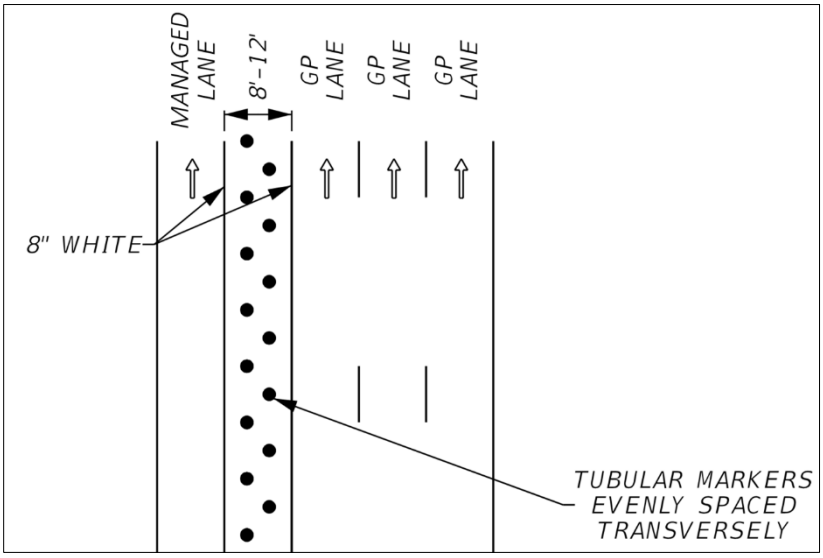
Figure 4.5-2. Striping Under the Toll Gantry

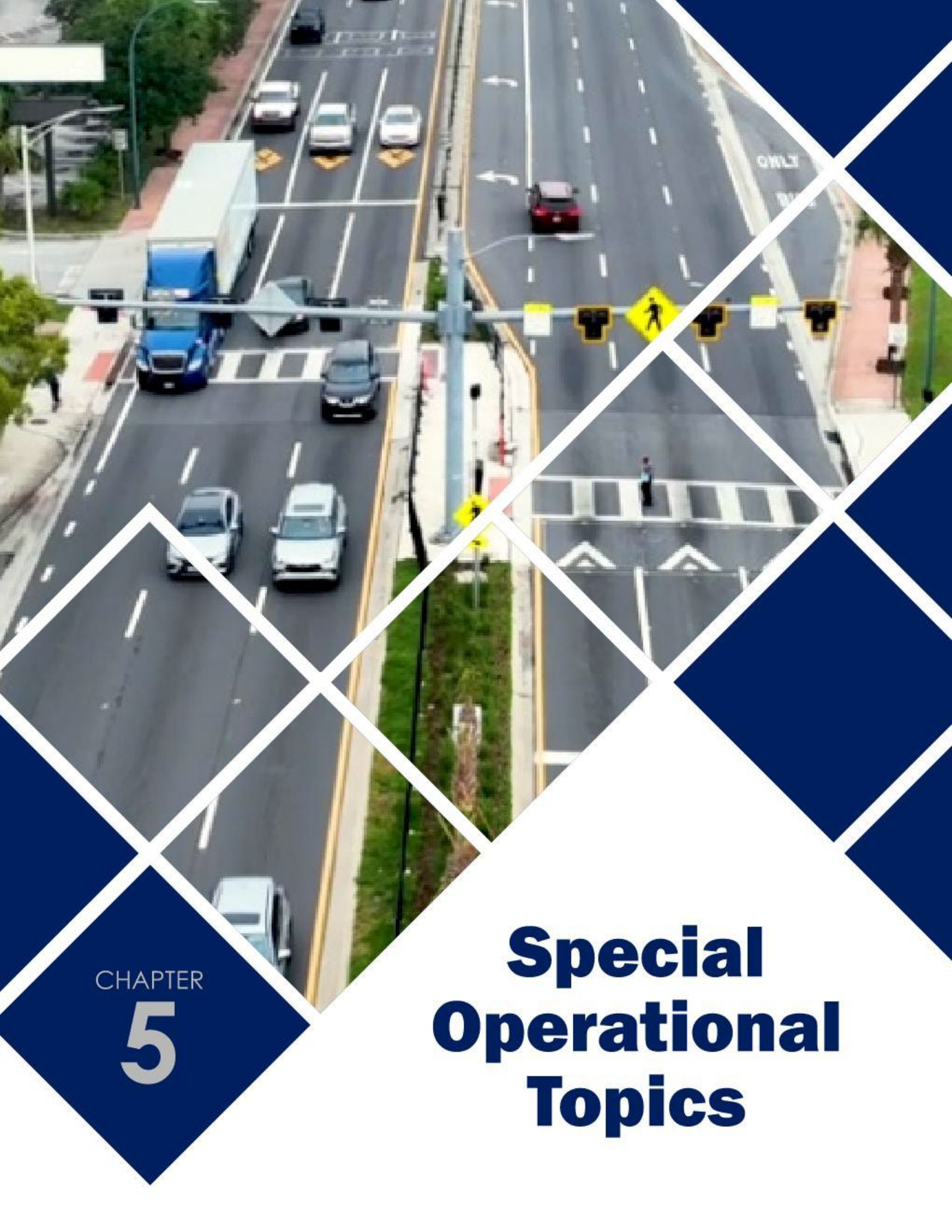


Place tubular markers within the tolling area according to the ***FDM 211*** requirements:

- **Up to 8 feet:** Place one tubular marker, as shown in ***Figure 4.5-1***.
- **Between 8 and 12 feet:** Evenly space two tubular markers transversely, as shown in ***Figure 4.5-3***.
- **12 feet and greater:** Evenly space three tubular markers transversely.
- Do not install tubular markers or raised pavement markers on top of vehicle detection loops or their corresponding lead-in saw cut or sealant.

Figure 4.5-3. Tubular Marker Placement within the Tolling Area for Buffer Widths between 8 and 12 feet





CHAPTER

5

Special Operational Topics

SECTION 5.1
GOLF CART CROSSING AND OPERATION ON THE STATE HIGHWAY SYSTEM

5.1.1 PURPOSE

This section establishes criteria and guidelines for safe golf cart operation on authorized portions of the State Highway System and for uniform crossings at designated locations.

This section also provides safety recommendations for counties and municipalities that wish to enact ordinances authorizing golf cart use on the State Highway System or adjacent sidewalks within their jurisdictions.

5.1.2 GENERAL

Golf carts can be used for short trips from residential neighborhoods to shopping, social, and recreational destinations. These small passenger vehicles offer several advantages, including comparatively low cost and energy-efficient mobility at lower speeds.

Florida authorizes golf cart use and operation on public roads only under certain circumstances, as described in ***Section 316.212, F.S.*** and the ***Guide to Safe and Legal Golf Cart Operation in Florida***.

5.1.3 DEFINITIONS

Golf Cart: A motor vehicle that cannot exceed 20 mph and is designed and manufactured to operate on a golf course for sporting or recreational purposes.

Grade-Separated Crossing: A crossing of two facilities (roadways, railroad, or pedestrian pathways) at different levels.

Local Government: The governing body of a unit of local general-purpose government, such as a county agency, municipality, tourist development council, county tourism promotion agency, or special district, as defined in ***Section 189.012, F.S.*** and ***Section 11.45 (g), F.S.***

State Roadway: Road within the State Highway System (owned and maintained by the State of Florida). This includes roads signed as interstate highways, U.S. routes, and state roads.

5.1.4 PROCEDURE

Local governments are required to obtain ***District Traffic Operations Engineer (DTOE)*** approval before installing a golf cart crossing on the State Highway System. FDOT prefers that golf cart crossings on state roads be grade-separated facilities.

Non-governmental entities seeking authorization for a golf cart crossing may do so through the local government with jurisdictional authority.

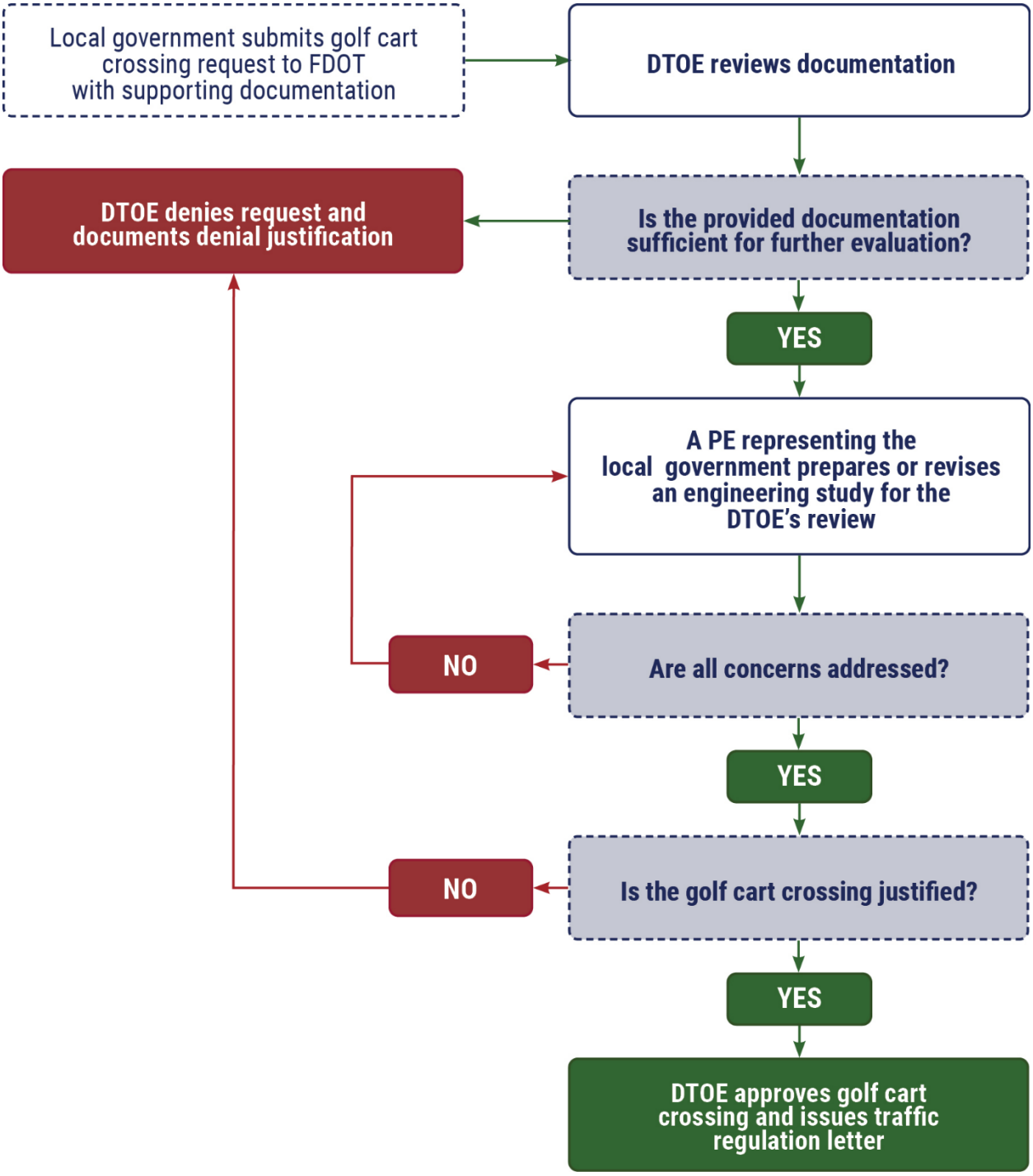
If the ***DTOE*** supports installing a golf cart crossing based on ***TEM 5.1.5*** criteria, the requester must have a Professional Engineer licensed in the State of Florida conduct an engineering study that documents:

- The need for a golf cart crossing based on conditions outlined in ***Section 316.212, F.S.*** and verifies that:
    - 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 both sides of the state road.
- All safety considerations at the proposed location, including 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***.
- The proposed golf cart crossing; roadway segment location (roadway ID and milepost); and corresponding signing, marking, and signal treatments, as applicable. Provide a schematic layout over aerial imagery or survey to show the proposed signs, markings, and other treatments and existing traffic control devices nearby.
- A minimum of five years of crash data within the influence area of the proposed crossing.

If the ***DTOE*** decides not to authorize the golf cart crossing, they will document the reasons and advise the local government of their findings. Meeting the minimum criteria outlined in this section does not guarantee approval for a golf cart crossing.

Before a golf cart crossing can be approved, the local government must coordinate with the appropriate ***District Traffic Operations Office*** and ***District Maintenance Office*** to determine permitting requirements and review existing maintenance agreements to determine if adjustments are needed.

Figure 5.1-1. Procedure Flowchart



5.1.5 CRITERIA FOR CROSSINGS

Florida-specific sign details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library***.

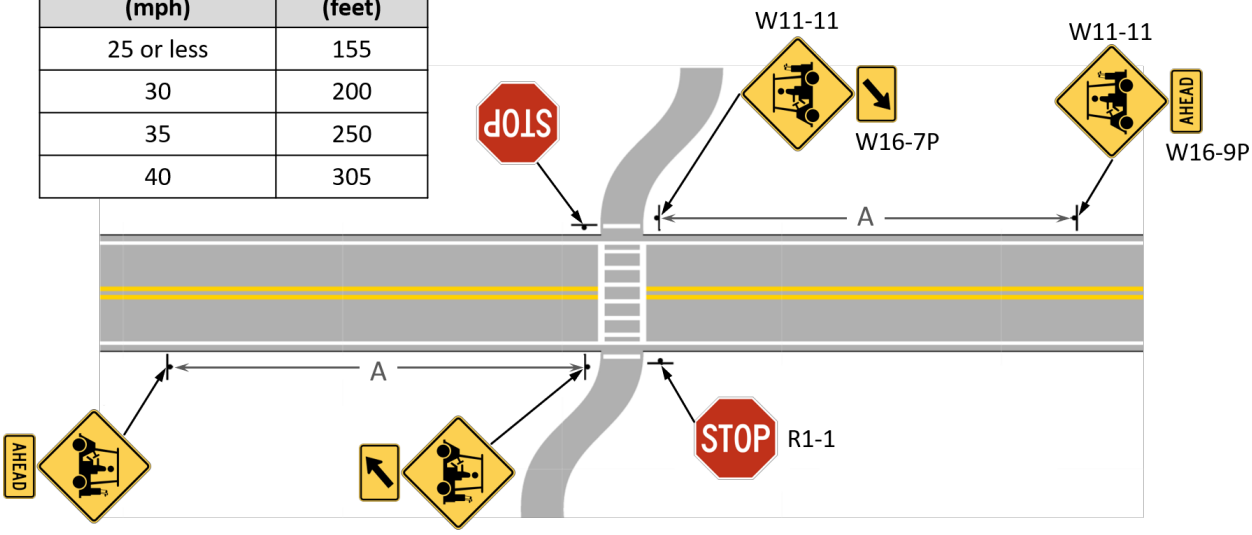
5.1.5.1 Midblock Crossing

Golf carts may cross a state road at a midblock location where there is a golf course or a single mobile home park on both sides of the road if the following criteria are met:

- Roadway segment vehicular volume of 15,000 Average Daily Traffic (ADT) or less.
- 40 mph posted speed limit or less.
- Crossing distance is three lanes or less, excluding bike lanes.
- 15 feet median width or less.
- The minimum distance to the nearest driveway, access point, or crosswalk is 350 feet.
- The crossing must be on a straight road segment, with the nearest point of curvature at least 350 feet away.
- Clear and unobstructed view of the roadside on the approach to the crossing.
- Place *GOLF CART* signs (***W11-11***), *AHEAD* plaques (***W16-9P***), and downward arrow plaques (***W16-7P***) on the street approach, as shown in ***Figure 5.1-2***.
- Golf carts are the only motor vehicles permitted to use the designated crossing or traverse the State's right-of-way.

Figure 5.1-2. Midblock Crosswalk

Posted Speed Limit (mph)	Distance A (feet)
25 or less	155
30	200
35	250
40	305



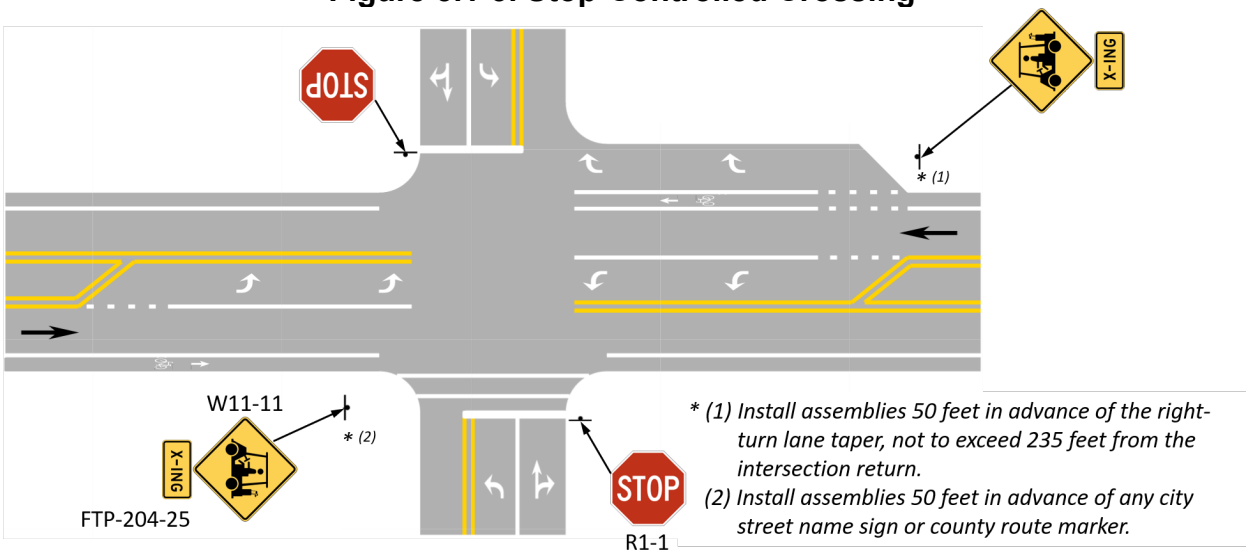
Note: *See FDOT Standard Plans, Index 711-001 for pavement marking application details.*

5.1.5.2 Side Street Stop-Controlled Intersections

Golf cart crossings at roadway intersections with side street stop control along any state road must meet the following criteria:

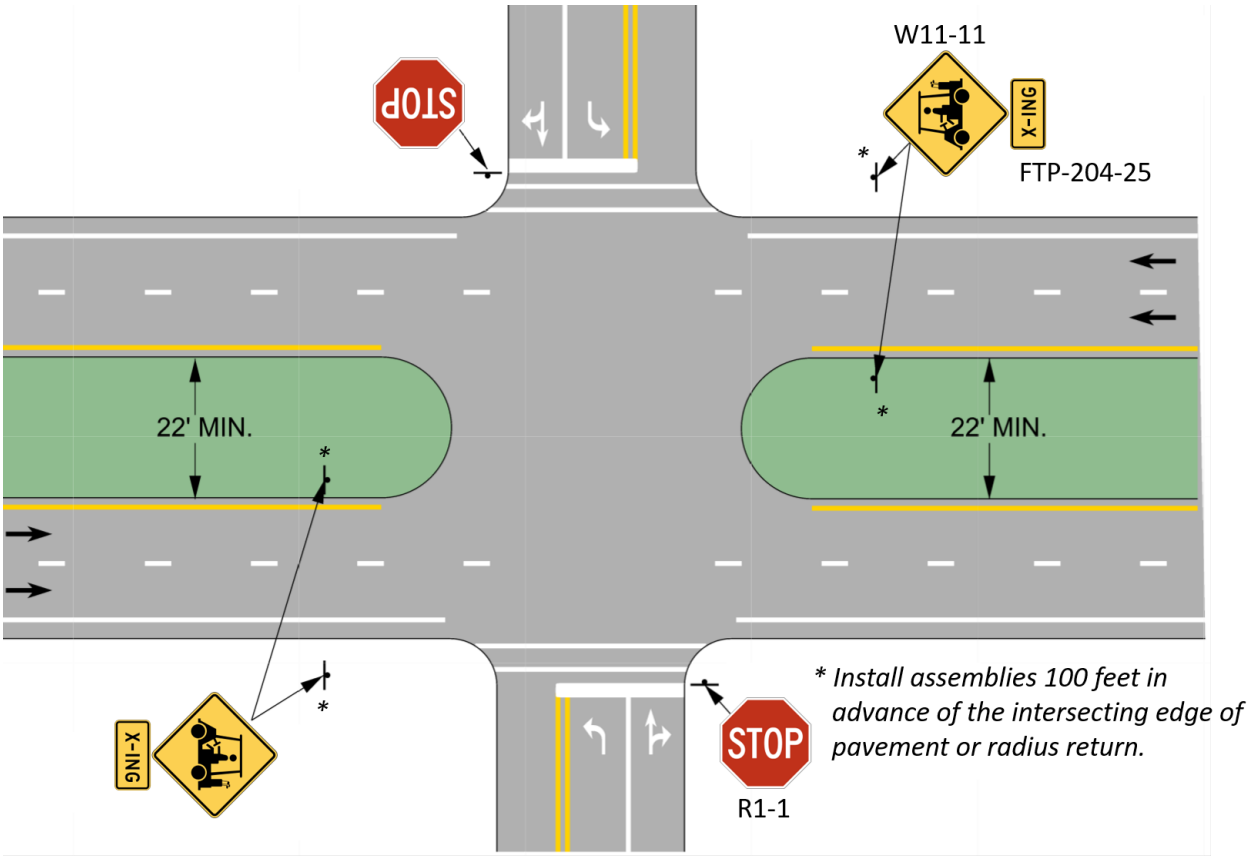
- Side street vehicular volume of 1,200 ADT or less.
- Side street vehicular volume of 110 vehicles per hour or less per approach during the AM and PM peak hours.
- Side street approaches have an exclusive left-turn lane.
    - Side street alignment angle to the mainline tangent is 90 degrees (±15 degrees).
    - Offset intersections are not considered for golf cart crossings.
- Crossing distance for undivided roadways is three lanes or less, excluding right-turn lanes, bike lanes, and crosswalks (***Figure 5.1-3***). For divided roadways of four lanes or fewer, a 22-foot minimum median width is required.
- Main street's posted speed limit is 35 mph or less.
- Place *GOLF CART* signs (***W11-11***) and *X-ING* plaque (***FTP-204-25***) on the mainline approach, as shown in ***Figure 5.1-3*** and ***Figure 5.1-4***.

Figure 5.1-3. Stop-Controlled Crossing



Note: *See FDOT Standard Plans, Index 711-001 for pavement marking application details.*

Figure 5.1-4. Four-Lane Stop-Controlled Crossing



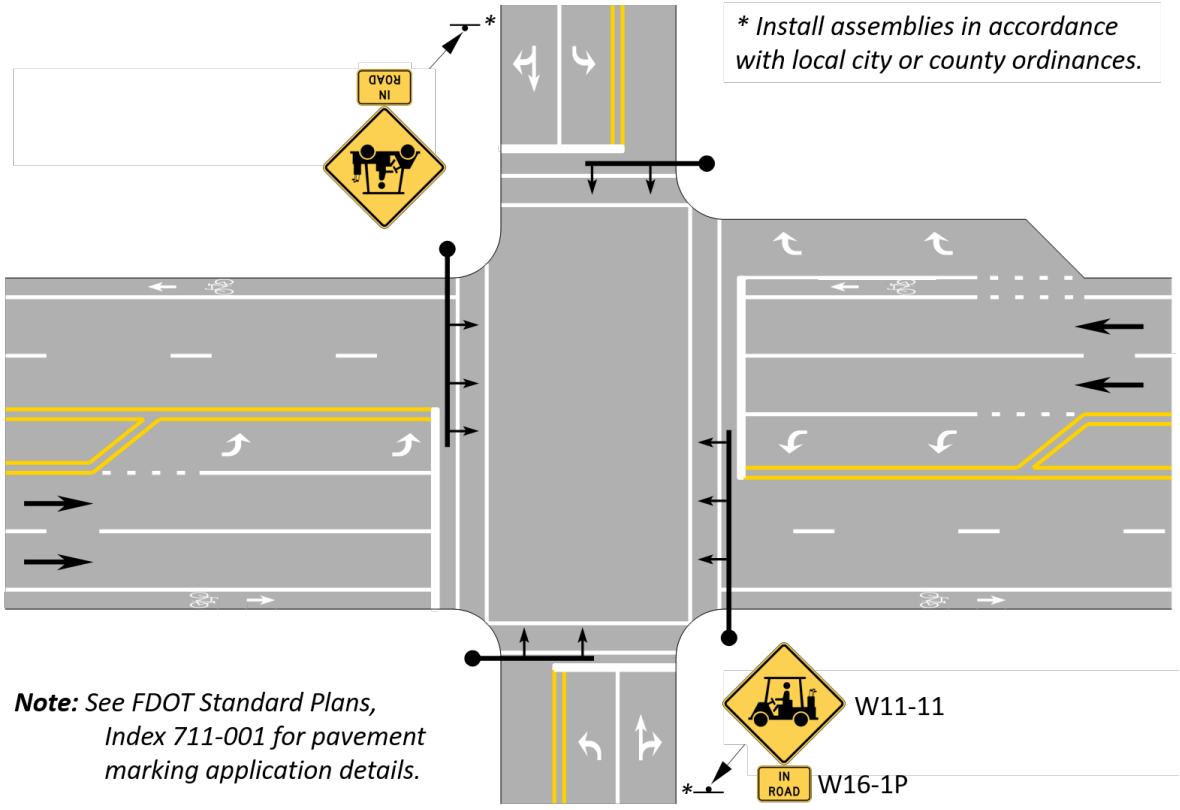
Note: *See FDOT Standard Plans, Index 711-001 for pavement marking application details.*

5.1.5.3 Signalized Intersections

Golf cart crossings at signalized intersections must meet the following criteria:

- Side street vehicular volume of 1,500 ADT or less.
- Side street vehicular volume of 200 vehicles per hour or less per approach during the AM and PM peak hours.
- Side street posted speed limit is 35 mph or less.
- Side street approaches have an exclusive left-turn lane.
- Side street alignment angle to the mainline tangent is 90 degrees (±15 degrees).
- Offset or T-intersections are not considered for golf cart crossings. A proposed fourth leg at signalized T-intersections for exclusive golf cart use will not be considered.
- Crossing distance is five lanes or less, excluding right-turn lanes, bike lanes, and crosswalks.
- Golf carts are not allowed to use crosswalks or sidewalk ramps to cross the mainline.
- Place *GOLF CART* signs (***W11-11***) and *IN ROAD* plaques (***W16-1P***) 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

Title 23 of the United States Code, Section 217 prohibits using motorized vehicles, such as golf carts, on existing and proposed non-motorized trails and pedestrian walkways that use federal transportation funds. However, the Federal Highway Administration can authorize exceptions through a framework it developed.

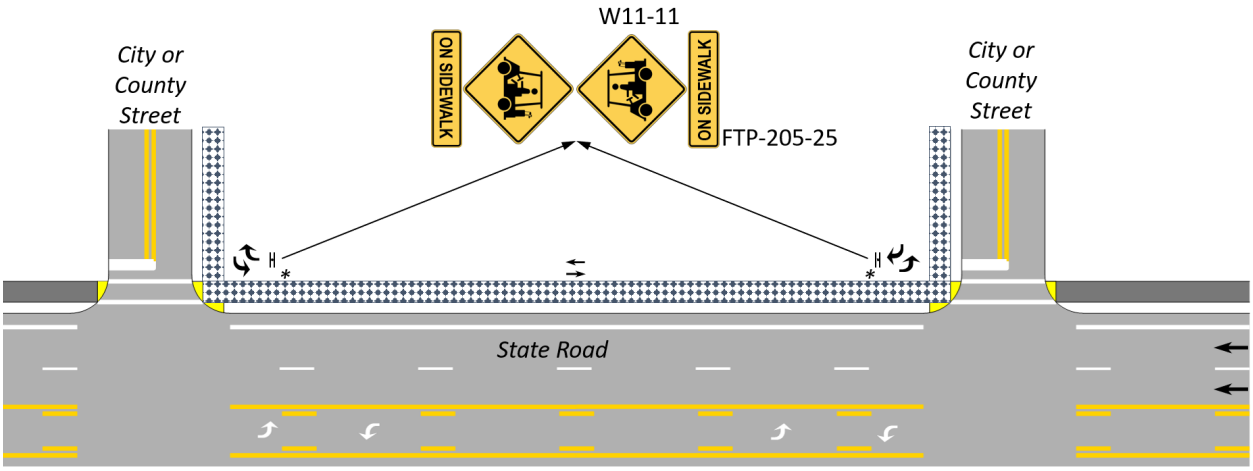
5.1.6.1 Safety and Operational Recommendations

Consider the following when requesting approval of golf cart operation on sidewalks adjacent to a state road by local government ordinance:

- Golf carts are only allowed to access State-maintained sidewalks from sidewalks along county- or city-maintained side streets intersecting the State Road. They are not allowed to access State-maintained sidewalks from county- or city-maintained streets using curb ramps.
    - FDOT will not approve golf cart crossings on a State Road from county- or city-maintained streets to State-maintained sidewalks.
- Provide a minimum unobstructed sidewalk width of 8 feet; separation from the back of curb or edge of shoulder by at least 5 feet is recommended. Provide a minimum 4-foot width of grassed or stabilized, relatively flat area beyond the outside edge of sidewalks for recovery or stalled golf carts. Do not include adjacent drainage features or fencing in the minimum requirement.
- Terminate golf cart operation on State-operated sidewalks at a connecting county- or city-maintained sidewalk.
- Install *GOLF CART* signs *(**W11-11**)* and *ON SIDEWALK* plaques (***FTP-205-25***) along state-operated sidewalks, as shown in ***Figure 5.1-6***.
- Per ***Section 316.212, F.S.***, golf carts' speeds are not to exceed 15 mph when operated on sidewalks.

Refer to ***FDM 222*** for Pedestrian Facilities or ***FDM 224*** for Shared Use Paths design, including horizontal and vertical clearances.

Figure 5.1-6. Golf Cart Operation on Sidewalks Example



** Install double-sided, post-mounted sign assemblies at 200-foot intervals. Use the same configuration at T-intersections and driveways.*

Section 5.2
CROSSWALK TREATMENTS AT MIDBLOCK LOCATIONS AND UNSIGNALIZED INTERSECTIONS

5.2.1 PURPOSE

This section establishes criteria and guidelines for installing and operating pedestrian treatments at midblock locations and unsignalized intersections on the State Highway System. Treatments can include marked crosswalks, signs, beacons, and signals, among other traffic control devices. Crosswalk details at roundabouts can be found in the ***FDOT Design Manual (FDM), Chapter 213.***

5.2.2 GENERAL

A crosswalk is a designated location for pedestrians to cross a roadway, concentrating crossing activity. Crosswalks and other pedestrian treatments at midblock locations and unsignalized intersections are designed to enhance pedestrian connectivity, reduce confusion, and decrease unpredictable crossings, reducing collisions between pedestrians and motorists.

Consider context classification and documented pedestrian demand when deciding whether to install a crosswalk at a midblock location or an unsignalized intersection. Pedestrians risk crossing at unmarked locations when the nearest controlled crossing feels far away. They may cross unexpectedly, creating unexpected crossings and increasing the potential for crashes. Adding marked crosswalks and other supplemental treatments at these locations may be appropriate.

Supplemental signage can improve safety and compliance at marked crosswalks regardless of the control type. Crosswalk design treatments, including refuge islands, curb extensions, street lighting, and raised crosswalks, also support pedestrian visibility and safety. ***Table 5.2-1*** summarizes some of these treatments and their application.

Despite their safety and connectivity benefits, crosswalks are not suitable for every location. Before requesting to install a crosswalk on a state road, evaluate the context classification and expected levels of pedestrian crossing demand, the safety characteristics of the crossing location, and design considerations for the crossing control type.

5.2.3 DEFINITIONS

Alternative Pedestrian Crossing Location: A controlled crossing with a *STOP* sign (***R1-1***), traffic signal, or grade-separated pedestrian bridge or tunnel.

Average Day: A day with traffic volumes normally and repeatedly found at an intersection or location. Weekdays, with volumes influenced by travel to and from work, and weekend days, with volumes influenced by entertainment or recreation, represent two types of average days. Weather is also a factor to consider.

Context Classification: Description of a roadway's general land use characteristics, development patterns, and roadway connectivity. Roadways are designed to match the characteristics and demands of their context classification. See ***FDM 200*** for additional information.

Controlled Approach: All directional traffic lanes moving toward an intersection or a midblock location (including adjacent parking lanes) controlled by a sign, traffic signal, marking, or other traffic control device.

In-Roadway Warning Lights (IRWLs): A traffic control device installed on the roadway surface to warn users they are approaching a condition on or adjacent to the roadway that might not be readily apparent and require the road user to slow down or stop.

Marked Crosswalk: A portion of a roadway segment designated as a pedestrian crossing by pavement markings. Marked crosswalks guide pedestrians, define and delineate crossing paths, and define intersections. Pavement markings may be supplemented by contrasting pavement structure, style, or color.

Midblock Crosswalk: A location with a marked crosswalk (signalized or unsignalized) between intersections.

Midblock Pedestrian Signal (MPS): A hybrid non-motorist-actuated traffic control device that alternately directs traffic to stop and flashes a *RED* indication during the pedestrian clearance interval. This traffic control device is currently under an FHWA Request to Experiment (RTE) and requires prior approval coordinated through the State Traffic Engineering and Operations Office before installation.

Midblock Traffic Control Signal: A non-motorist-actuated traffic signal used to warn and control traffic at midblock crosswalks.

Passive Detection: A system that detects the presence and direction of non-motorists and activates the traffic control device without manual actuation.

Pedestrian Attractor: A residential, commercial, office, recreational, or other location that is expected to be a destination for pedestrian trips.

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

Pedestrian Hybrid Beacon (PHB): A non-motorist-actuated traffic control device used to warn and control traffic at an unsignalized location when pedestrians cross a marked crosswalk. It is also known as a High-Intensity Activated Crosswalk (HAWK). A PHB is typically installed on mast arms above the controlled roadway. The PHB faces consist of

three signal sections: two horizontally aligned circular red indications and a circular yellow indication centered below. A PHB installation requires a minimum of two faces for each major street approach.

Rectangular Rapid Flashing Beacon (RRFB): A non-motorist-actuated traffic control device with two rapidly and alternately flashing rectangular yellow indications 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. A shared-use path can be located within the right-of-way or have an independent alignment. Shared-use paths are used by pedestrians (including skaters, users of manual and motorized wheelchairs, and joggers), bicyclists, and other authorized users.

Two-Stage Pedestrian Crossing: A marked crosswalk with a median refuge island and an RRFB, PHB, MPS, or midblock traffic control signal. A two-stage pedestrian crossing may have less impact on vehicle delay than a single-stage crossing since the traffic control device serves each direction independently, while the median lets pedestrians pause midway before completing their crossing.

Uncontrolled Approach: All directional traffic lanes moving toward an unsignalized intersection or a midblock location (including any adjacent parking lane) that are not controlled by signs, signals, markings, or other traffic control devices.

Unmarked Crosswalk: The legal crossing area at an intersection (as defined in ***Section 316.003(17)(a), F.S.***) connecting opposite sides of the roadway without pavement markings or signs.

Unsignalized Intersection: An at-grade junction of two or more public roads where a traffic signal does not control the right of way for motorists, bicyclists, or pedestrians.

5.2.4 PROCEDURE

These procedures apply to midblock and unsignalized intersection marked crosswalks:

- Contact the ***District Traffic Operations Office*** to request an evaluation of a marked crosswalk or other treatments.
- The ***DTOE*** reviews and approves proposed marked crosswalks or treatments at midblock locations or unsignalized intersections on the State Highway System.
    - Coordinate with the ***District Access Management Engineer or Administrator*** on potential access management impacts.
- For existing midblock or unsignalized intersection marked crosswalks, conduct an engineering study or warrant analysis to justify installing midblock traffic control signals or PHBs. Refer to ***TEM 5.2.5*** for guidance.

- Before approving a proposed marked crosswalk or treatment for an existing crosswalk, the ***District Traffic Operations Office*** will coordinate with the local agency responsible for the maintenance agreement.

5.2.5 SELECTION CRITERIA

5.2.5.1 Marked Crosswalk

Validate the need for marked crosswalks at midblock and uncontrolled approaches with an engineering study, as described in ***TEM 5.2.6***. When available, review the local strategic plan for non-motorist connectivity needs. Consider marked crosswalks under the following conditions:

- Proximity to significant pedestrian generators and attractors
    - Locations with either of the following characteristics:
        - A well-defined spatial pattern of pedestrian generators, attractors, and flow (across a roadway) between them
        - A well-defined pattern of existing pedestrian crossings
    - Identify and document pedestrian generators and attractors in an engineering study to illustrate potential pedestrian routes in relation to proposed marked crosswalk locations, as described in ***TEM 5.2.6***.
- Pedestrian Demand
    - The pedestrian volume threshold for a proposed marked crosswalk is 20 or more pedestrians during a single hour (any four consecutive 15-minute periods) of an average day. Collect average-day pedestrian volume data using the methods outlined in ***TEM 5.2.6***.
    - Pedestrian demand data is not required to be collected under school zones or under the following Context Classifications:
        - C2T - Rural Town
        - C3C - Suburban Commercial
        - C4 - Urban General
        - C5 - Urban Center
        - C6 - Urban Core
- Shared-use path connection at midblock locations or unsignalized intersections
    - Supports the use of a shared-use path
    - Proposed marked crosswalks connecting to a shared-use path may apply a 50 percent reduction to the pedestrian demand threshold.

- Nature-based trail crossings
    - Before the ***DTOE*** approves a new nature-based trail crossing, evaluate whether installing the crossing on the State Highway System is appropriate
    - See ***TEM 2.33*** and ***FDM 230*** for additional information on nature-based trail crossings
- Location Characteristics
    - Vehicular volume of 2,000 ADT or greater along the roadway segment
    - The distance from the proposed crosswalk to the nearest intersection (or crossing location) is at least 300 feet, per ***FDM 222***
        - FDOT may consider a proposed crossing location between 100 and 300 feet from an alternative crossing or intersection if it is more practical for non-motorist use; document this justification in the engineering study
- Adjacent signalized intersection
    - The proposed location is outside the functional influence area of adjacent signalized intersections. This includes auxiliary turn lanes and associated tapers. See ***FDM 212*** for additional information.

5.2.5.2 Beacons and Signals

Use yellow flashing beacons to make standard signs more conspicuous, in accordance with ***MUTCD Section 2A.11***.

Rectangular Rapid Flashing Beacon (RRFB)

Limit RRFB use to roadways with the following conditions:

- Posted speed limit of 35 mph or lower
- Marked crosswalks with special emphasis pavement markings
- Four through lanes (both directions) or less regardless of median presence, or five lanes with a median refuge island. For facilities with five lanes, including a two-way left-turn lane, a refuge island or raised median must be present for RRFB application.

For use of RRFBs at locations that do not meet the minimum requirements stated above, obtain approval for a variation from the ***State Traffic Engineering and Operations Office***. Include the following information in the request for variation:

- AADT
- Sight distance
- Speed data

- Five years of crash data
- Supplemental information, including location description, Context Classification, and observations

Pedestrian Hybrid Beacon (PHB)

When installing a PHB, place it at least 100 feet away from side streets or driveways controlled by *STOP* (***R1-1***) or *YIELD* (***R1-2***) signs. Install *STOP HERE ON RED* (***R10-6a***) and *CROSSWALK - STOP ON RED* (***R10-23***) signs to inform motorists of the crossing. Avoid installing PHBs at intersections.

If the location is less than 100 feet from side streets or driveways controlled by a stop sign, install additional treatments to reduce the risk of pedestrian-vehicle conflicts. Side street and driveway treatments may include blank-out signs, static signs, and pavement markings.

Consider installing a PHB when an engineering study, per ***MUTCD Section 4J.01***, identifies the following conditions:

- Where a midblock traffic control signal is not justified under ***MUTCD Chapter 4C*** signal warrants and gaps in traffic are not adequate to permit pedestrians to cross.
- Where the approaching vehicle speed on the major street is too high to permit pedestrians to cross.
- Where pedestrian delay is excessive.

See ***MUTCD Chapter 4J*** for PHB volume guidance. This guidance is summarized in ***Figure 5.2-1***. At a location under C2T, C4, C5, or C6 context classification that meets the PHB warrants stated above, the PHB may be substituted with a midblock traffic control signal using ***MUTCD Warrant 8, Roadway Network***.

Follow ***MUTCD Section 4J.02*** for a PHB sequence; ***MUTCD Figure 4J-3*** provides a visual. Follow ***MUTCD Section 4J.03*** for PHB operation. Apply the following timing requirements for PHB operations:

- Keep the signal dark outside the activation window.
    - Follow ***TEM 3.6.2.1*** for the duration of the flashing yellow.
- Determine the steady yellow change interval using engineering practices with a minimum duration of 3 and a maximum of 6 seconds (see ***MUTCD Section 4F.17***). Use longer intervals on approaches with higher speeds.
    - Make the minimum duration of steady red equal to the pedestrian walk interval.
- Make the duration of the alternating flashing red equal to or greater than that of the pedestrian clearance interval.

Midblock Traffic Control Signal

To provide a safe pedestrian crossing, traffic control signals at midblock crosswalks must be positioned at least 300 feet away from side streets or driveways with *STOP* (***R1-1***) or *YIELD* (***R1-2***) signs. For midblock crosswalks over 300 feet from the nearest signalized intersection, consider the distance to adjacent signals and available gaps for pedestrian crossing to determine whether a signal is required.

To meet the criteria for safe pedestrian crossing, traffic control signals at midblock crosswalks must comply with ***MUTCD Warrant 4, Pedestrian Volume***. ***Figure 5.2-1*** summarizes this warrant for **(a)** 35 mph or less and **(b)** greater than 35 mph roadways.

The minimum pedestrian volume threshold under ***MUTCD Warrant 4*** may be reduced:

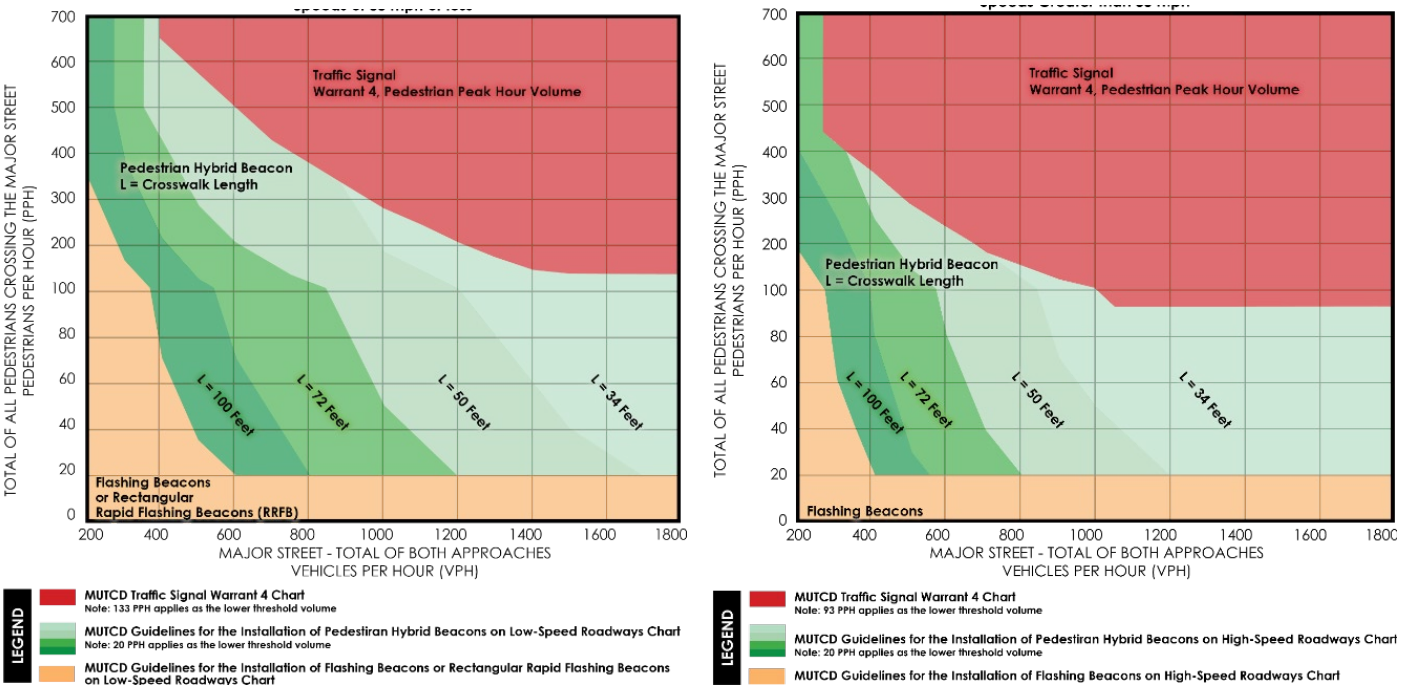
- Up to 50 percent when the 15th percentile crossing speed is below 3.5 feet per second.
- Up to 30 percent when the 85th percentile speed on the major street is greater than 35 mph or when the midblock crosswalk is in a built-up area of an isolated community with fewer than 10,000 inhabitants.

The 30 and 50 percent reductions can be combined when both corresponding criteria are met. Apply the applicable pedestrian volume thresholds shown in ***MUTCD Figures 4C-5 through 4C-8***.

For details on requirements for traffic control signals at intersections, refer to ***TEM 3.3***.

Figure 5.2-1. Guidelines for the Installation of Pedestrian Treatments

(a) 35 mph or Less **(b) Greater than 35 mph**



5.2.6 ENGINEERING STUDY

Conduct an engineering study before installing a marked crosswalk or other pedestrian treatments at a midblock location or unsignalized intersection. Identify treatments based on pedestrian and vehicular volumes, roadway characteristics, and environmental factors documented in the study. Consider alternative control strategies to resolve the need for an intersection or midblock crosswalk. Include the following information in the engineering study:

- Field data demonstrating the need for a marked crosswalk based on pedestrian volumes.
    - Collect pedestrian crossing volumes outside of marked crosswalks at or in the vicinity of the proposed location when required in ***TEM 5.2.5.1***. Other non-motorists, including bicyclists, can be included in the pedestrian demand when crossing the roadway at the proposed crossing location. Do not include non-motorists traveling parallel to the roadway unless they cross at the proposed location.
        - The ***FDOT TDA Non-Motorized Traffic Monitoring*** Dashboard may be used as a resource for volume data.
    - Consider obtaining pedestrian group size and vehicle gap size to assess opportunities for safe crossings. See FDOT's ***Manual on Uniform Traffic Studies (MUTS)*** for data collection methodologies.
    - Consider collecting individual pedestrian walking speeds, pedestrian speed cumulative curve, and the 15th percentile pedestrian crossing speed when evaluating a PHB or midblock traffic control signal. See ***MUTS Chapter 9*** for data collection methodologies.
- Potential links between pedestrian generators and attractors to confirm existing pedestrian crossing patterns. Identify generators and attractors on an aerial to illustrate potential pedestrian routes in relation to the proposed marked crosswalk location.
- When recommending an RRFB, PHB, MPS (RTE approval required), or midblock traffic control signal, document the necessary location characteristics following ***TEM 5.2.5.2***
- Proximity to intersection conflict areas and safety considerations, including:
    - Stopping sight distance
    - Sidewalk connectivity
    - Adequate lighting and illumination levels at the crosswalk
    - Refuge island or raised median for roads with five or more lanes to facilitate two-stage crossing
    - Suitable bus stop location to minimize conflicts with transit vehicles

- Proposed crossing location and corresponding traffic control devices:
    - Provide a schematic layout over aerial imagery or survey to show the proposed signs, pavement markings, approach traffic control devices, other treatments (e.g., bulb-outs), and existing traffic control devices within the influence area of the proposed crosswalks.
    - Treatments are dependent on site context, vehicle operating speeds, roadway cross-section, pedestrian volumes, and other variables. Treatments may include midblock traffic control signals or other warning devices to enhance motorist-yielding behavior. Other treatments, such as median refuge islands, curb extensions, raised crosswalks, and supplemental signing and pavement markings, may also be applicable at some locations to reduce crossing distance and enhance pedestrian visibility. See ***TEM 5.2.7*** for treatment options and selection guidance.
- Document the latest five years of non-motorist-vehicle crashes in the vicinity of the proposed crosswalk, including frequency, crash type, lighting, and pavement conditions. Refer to the ***FDOT State Safety Office*** ***Crash Data Guidance*** for additional crash attribute considerations. Supplement the crash summary with any information regarding the nature of conflicts based on field observations.
- Transit route data and the location of transit stops in the vicinity of the proposed crosswalk.

5.2.7 TREATMENT OPTIONS

5.2.7.1 Pavement Markings

See ***Standard Plans, Index 711-001*** for pavement marking details. See ***FDM 230*** for typical pavement marking applications for midblock crosswalks.

Marked Crosswalks

Install special emphasis crosswalks at midblock crossings and uncontrolled approaches. Follow ***TEM 5.2.4*** procedure to install marked crosswalks on the State Highway System.

Install standard crosswalks at stop-controlled approaches, consistent with ***FDM 230***. An engineering study is not required to install standard crosswalks at stop-controlled approaches.

In-Pavement Warning Marking

In-pavement warning markings can supplement existing signage where high vehicular volumes and high operational speeds are reported approaching a marked crosswalk. These markings can use the *BICYCLE* (***W11-1***), *PEDESTRIAN* (***W11-2***), and *COMBINED BICYCLE / PEDESTRIAN* (***W11-15***) crossing symbols, as shown in ***Figure 5.2-2***.

Complete an engineering study and obtain ***DTOE*** approval to install the in-pavement warning markings. Once approved, coordinate installation with the District Maintenance Office.

Consider installing in-pavement warning markings when the following conditions are present at a marked crosswalk.

- Multi-lane roadway with a posted speed of 45 mph or greater
- Rural two-lane roadway with a posted speed of 50 mph or greater
- Crosswalks with restricted sight distance due to obstructions (e.g., trees).
- Reports of motorists not yielding at the crosswalk.

When approved, install in-pavement warning markings as follows. For an example, see ***Figure 5.2-3***.

- Center the markings in the travel lane(s) on the approach to the crosswalk and in alignment with adjacent lanes when used on multi-lane approaches.
- Place no more than one set of markings on each approach and do not mix symbol and word in-pavement markings (see ***TEM 4.2***).
- Follow ***MUTCD Table 2C-3*** to determine how far in advance to place markings based on the posted or 85th percentile speed coming to a full stop.

Figure 5.2-2. In-Pavement Warning Marking Details

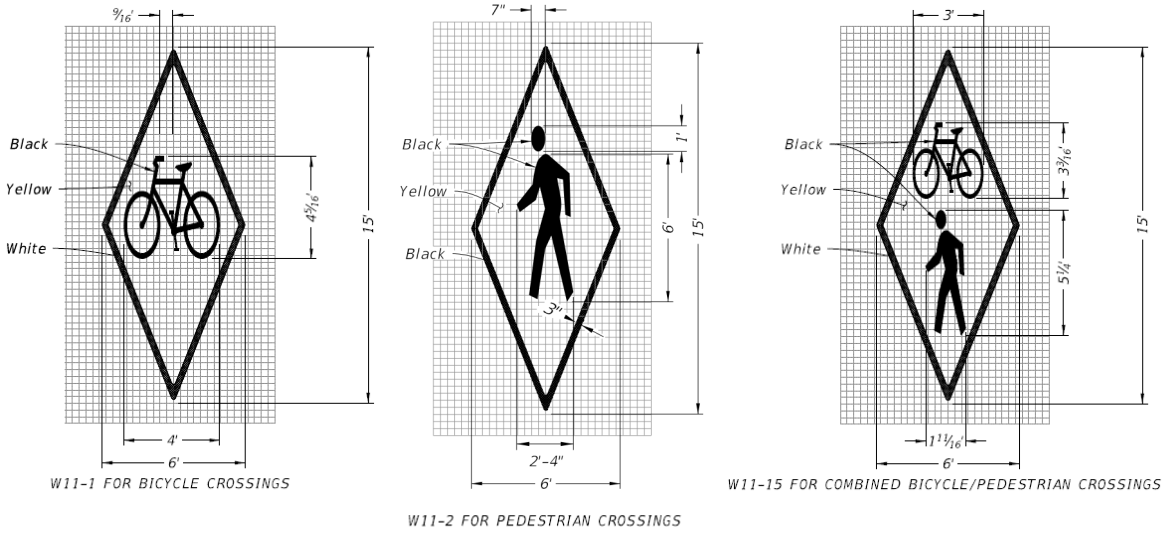


Figure 5.2-3. Pedestrian In-Pavement Warning (*W11-2*) Markings



5.2.7.2 Signs

Install the signs in this subsection at midblock crosswalks and unsignalized intersections to improve motorist yielding and stopping behavior at marked crosswalks. See ***FDM 230*** for sign placement details. Sign details are available in the ***Standard Plans, Index 700-102*** and ***FDOT's Sign Library***.

For greater visibility, install highlighted signs and flashing beacons, as described in ***MUTCD Sections 2A.11 and 2A.12***.

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

On multilane approaches, add a stop line with the *STOP HERE FOR PEDESTRIANS* sign (***R1-5b***), as directed in ***MUTCD Section 2B.19***. Place the stop line 40 feet before the marked crosswalk. Parking is prohibited between the stop line and the marked crosswalk. Use a solid lane line between the stop line and the crosswalk.

Regardless of the number of lanes, use the *STOP HERE FOR PEDESTRIANS* sign (***R1-5b***) with the *PEDESTRIAN CROSSING* sign (***W11-2***) and diagonal downward arrow plaque (***W16-7P***), as shown in ***Figure 5.2-4***. Do not use the *STOP HERE FOR PEDESTRIANS* sign (***R1-5b***) with a traffic signal or PHB.

The *STOP HERE FOR PEDESTRIANS* sign (***R1-5b***) may be added at existing midblock crosswalks where motorists routinely fail to stop for pedestrians. Install as follows:

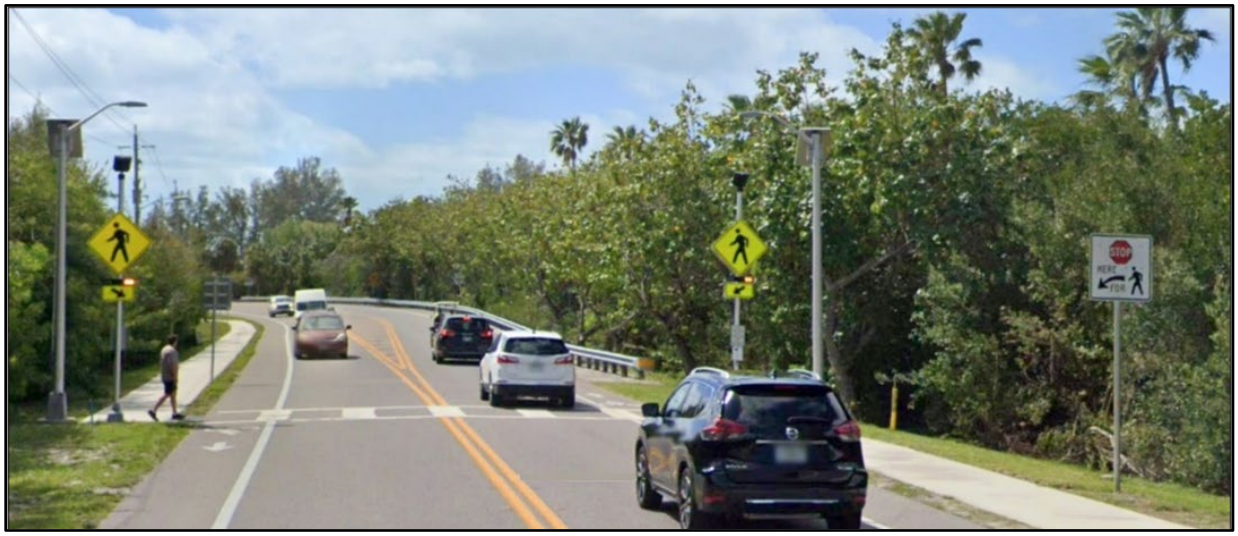
- One sign in each direction
- Install signs within 100 feet before the crosswalk

- Do not install these signs where they interfere with required signs

STOP HERE FOR SCHOOL CROSSING Sign (*R1-5c*)

For school crossings, use the *STOP HERE FOR SCHOOL CROSSING* sign (***R1-5c***) with the *SCHOOL* sign (***S1-1***) instead of the *STOP HERE FOR PEDESTRIANS* (***R1-5b***) and *PEDESTRIAN CROSSING* (***W11-2***) signs.

Figure 5.2-4. RRFB with *STOP HERE FOR PEDESTRIANS* (*R1-5b*) and *PEDESTRIAN CROSSING* (*W11-2*) Signs



IN-STREET PEDESTRIAN CROSSING Sign (*R1-6a*)

IN-STREET PEDESTRIAN CROSSING signs (***R1-6a***) are useful on low-speed roadways to remind motorists of right-of-way laws at midblock or unsignalized crosswalks. See ***Figure 5.2-5***. Engineers may use the *IN-STREET PEDESTRIAN CROSSING* sign ***FTP-029-25*** in lieu of ***R1-6a*** at locations with constrained geometric conditions. Use these signs on roadways with four or fewer through lanes and a posted speed of 35 mph or less.

Coordinate with the District Maintenance Office prior to requesting ***DTOE*** approval to use this sign type.

Do not post mount *IN-STREET PEDESTRIAN CROSSING* signs (***R1-6a*** or ***FTP-029-25***). Place them in one of the following locations:

- On a two-way road, place the sign in the roadway at the marked crosswalk location on the centerline
- On a one-way road, place the sign on a lane line
- Place the sign on a median island as allowed by ***MUTCD Section 2B.20***

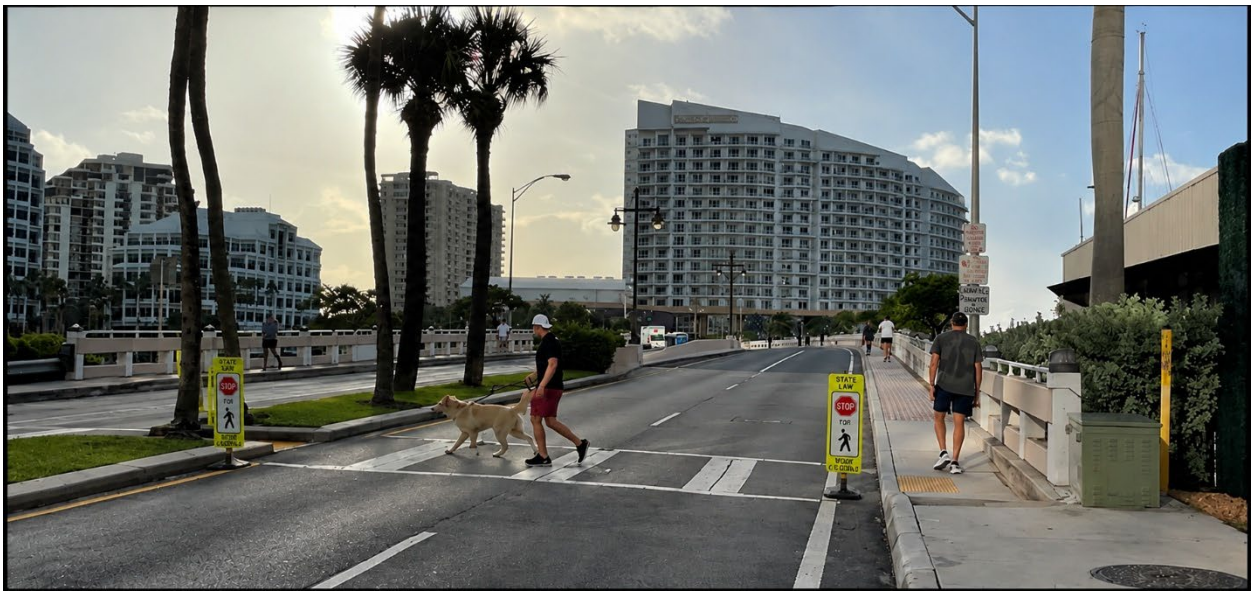
Tubular markers may be used to supplement *IN-STREET PEDESTRIAN CROSSING* signs (***R1-6a*** or ***FTP-029-25***) either on the centerline, lane line, or median island. When using tubular markers, do not install them on the same pavement marking line as the sign. Match tubular marker color to the pavement marking they supplement, in accordance with ***MUTCD Section 3I.01***.

IN-STREET PEDESTRIAN CROSSING signs (***R1-6a*** or ***FTP-029-25***) on lane lines may be substituted for tubular markers to reduce maintenance and replacement costs from motor vehicle impacts. For further guidance on tubular marker substitution, see ***TEM 5.2.7.2***.

IN-STREET SCHOOL CROSSING Sign (*R1-6c*)

For school crossings, use the in-street *SCHOOL CROSSING* sign (***R1-6c***) instead of the *IN-STREET PEDESTRIAN CROSSING* sign (***R1-6a***).

Figure 5.2-5. *IN-STREET PEDESTRIAN CROSSING* (*R1-6a*)

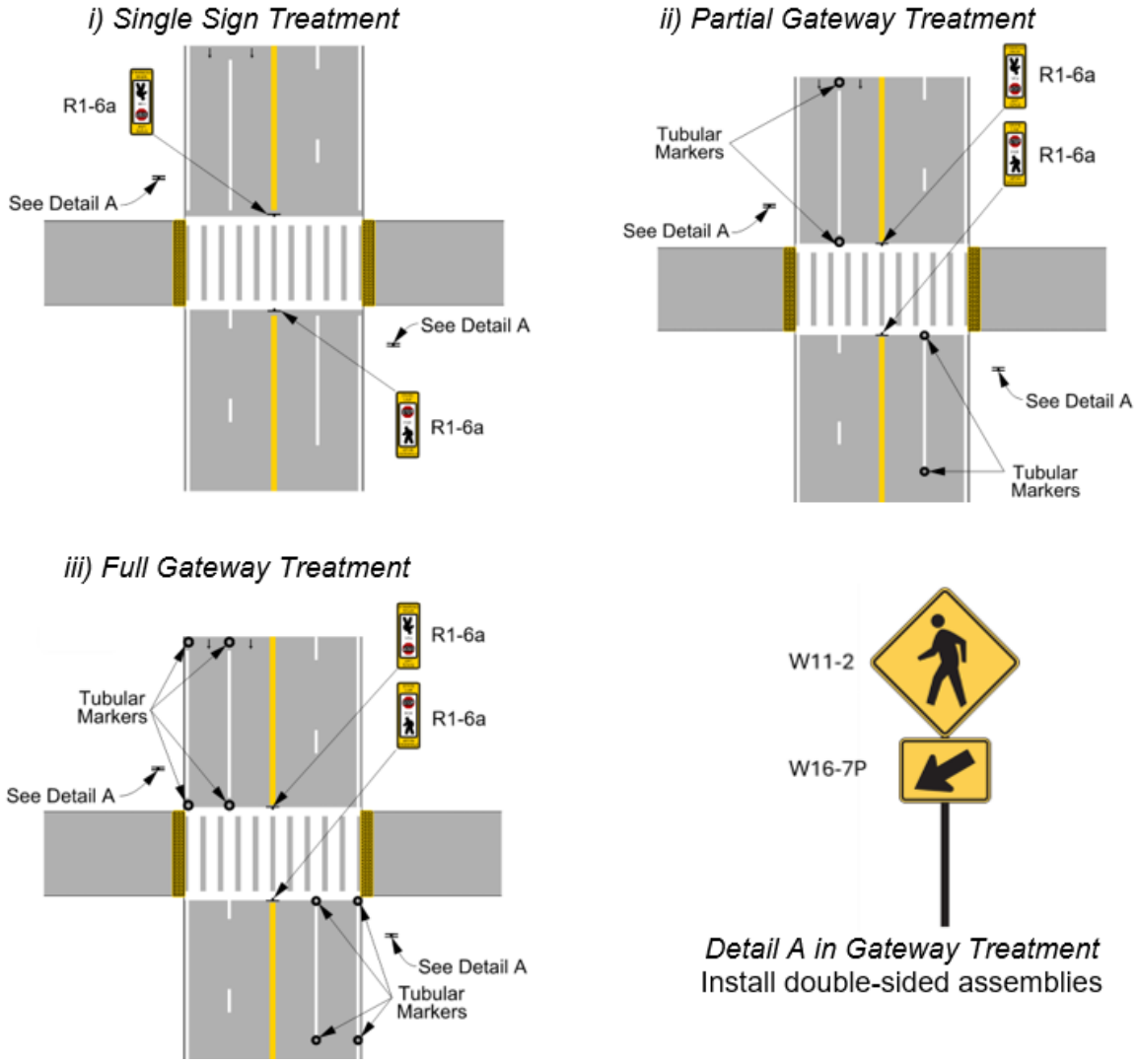


Tubular Marker Gateway Treatment

To further emphasize the midblock pedestrian crossing and to channelize and potentially calming traffic, supplement *IN-STREET PEDESTRIAN* and *SCHOOL CROSSING* signs (***R1-6a*** and ***R1-6c***) with tubular markers on the lane lines or edge lines. See ***Figure 5.2-6*** for illustrations of tubular markers used to supplement *IN-STREET PEDESTRIAN CROSSING* signs (***R1-6a***).

Tubular markers can supplement the ***R1-6*** gateway treatment per FHWA ***Official Ruling 3(09)-61 (I) – Channelizing Devices at Midblock Pedestrian Crossings in Conjunction with IN-STREET PEDESTRIAN CROSSING (R1-6 Series) Signs***.

Figure 5.2-6. R1-6 Gateway Treatments with Tubular Markers



STATE LAW STOP FOR PEDESTRIANS IN CROSSWALKS* Sign *(FTP-027-25)

Install the *STATE LAW STOP FOR PEDESTRIANS IN CROSSWALKS* sign ***(FTP-027-25)*** at marked, unsignalized crosswalks.

5.2.7.3 Beacons (Signal Warrant Analysis Not Required)

At locations without traffic signals or PHBs, engineers can use other pedestrian-activated devices to warn motorists and draw attention to people using marked crosswalks. Other treatments not listed here may be appropriate depending on the site's features.

Rectangular Rapid Flashing Beacons (RRFB)

RRFBs are activated by crosswalk users and installed in pairs below the *PEDESTRIAN CROSSING* sign (***W11-2***) and above the diagonal downward arrow plaque (***W16-7P***) for post-mounted RRFBs. They flash when activated by a non-motorist. An example of the RRFB treatment is shown in ***Figure 5.2-7***.

Figure 5.2-7. Rectangular Rapid Flashing Beacons (RRFB)



At school or trail crossings, a *SCHOOL CROSSING* sign (***S1-1***) or *TRAIL CROSSING* sign (***W11-15***) may be installed with RRFBs instead of a *PEDESTRIAN CROSSING* sign (***W11-2***).

Mount a pedestrian instruction sign (***FTP-033-25***) adjacent to the RRFB or integrate it with the corresponding pedestrian push button. Sign details are available in the ***Standard Plans, Index 700-102***. The instruction sign has a three-line legend, as shown in ***Figure 5.2-8***.

Figure 5.2-8. RRFB Push-Button Sign (*FTP-033-25)*



RRFB push buttons with an audible warning message are to state, "*WAIT FOR TRAFFIC TO STOP THEN CROSS WITH CAUTION"* when activated.

On multilane undivided roadways, consider installing overhead RRFBs unless design constraints or engineering documentation preclude overhead installation. Overhead RRFBs enhance visibility for approaching motorists and align with installing overhead school zone warning signs on multilane roadways. When overhead RRFBs are used, combine these with ground-mounted devices when feasible.

Consider advance warning signs with RRFBs on multilane approaches, especially those with higher traffic volumes and speeds.

Detailed conditions of use, including sign/beacon assembly, dimensions, placement, and flashing rates, are provided in ***MUTCD Chapter 4L***. Refer to the following resources for more guidance on the RRFB design:

- ***Standard Plans, Index 654-001***
- ***FDM 941***
- ***Standard Specifications, Section 654***

Flashing Yellow Beacons

At locations where traffic signals are not warranted, engineers may consider installing a flashing yellow beacon to supplement the appropriate warning or regulatory signs at a marked crosswalk. See ***MUTCD Chapter 4S*** for a complete list of requirements. Refer to ***Standard Plans, Index 700-120*** for design and installation details.

A flashing yellow beacon may be overhead or post-mounted. Post-mounting the beacon is preferred as it may prevent confusing it with a flashing traffic signal.

- Install post-mounted flashing yellow beacons with two vertically aligned beacons operating in an alternating flash pattern.
- Pair overhead-mounted, flashing yellow beacons with an overhead *STOP FOR PEDESTRIANS* sign (***R1-9a***), continuously lit at night.

In-Roadway Warning Lights (IRWLs)

IRWLs are installed in the pavement to warn road users they are approaching a condition that requires them to slow down or stop. Based on an engineering study, engineers may recommend installing IRWLs at marked crosswalks with applicable warning signs.

Operate IRWLs in a flashing pattern (50 to 60 flash periods per minute). When installing IRWLs with overhead or post-mounted LED-highlighted signs or flashing yellow beacons, match the flashing rates. See ***MUTCD Chapter 4U*** for detailed guidance on this treatment.

Consider installing IRWLs in locations where overhead lighting is not provided. Use the following criteria:

- Coordinate with the District Maintenance Office prior to seeking ***DTOE*** approval.
- Install only at marked crosswalks with applicable warning signs.
- Install along both sides of the crosswalk and span its entire length.
- Do not use IRWLs at crosswalks controlled by *STOP* signs (***R1-1***), *YIELD* signs (***R1-2***), PHBs, or traffic control signals.
    - A Request to Experiment (RTE) approval from FHWA is required to install IRWLs with traffic signals or PHBs.

Include an ***FTP-033-25*** sign or a *PUSH BUTTON TO TURN ON WARNING LIGHTS* sign (***R10-25***) on non-motorist-actuated installations.

5.2.7.4 Beacons and Signals (Warrant Analysis Required)

Pedestrian Hybrid Beacon (PHB)

A PHB is a special type of hybrid beacon that warns and controls traffic at an unsignalized location to assist pedestrians in crossing a roadway at a marked crosswalk. Install PHBs only at marked crosswalks. See ***Figure 5.2-9*** for a PHB example. See ***MUTCD Chapter 4J*** for PHB guidance and criteria.

For six-lane roadways or crossing distances exceeding 80 feet, consider a two-stage pedestrian crossing with a 6-foot minimum median refuge island where a warranted PHB controls the marked crossing.

Include the *CROSSWALK, STOP ON RED, PROCEED ON FLASHING RED WHEN CLEAR* sign (***FTP-028-25***) or the *CROSSWALK, STOP ON RED* sign (***R10-23***) in PHB treatments.

Figure 5.2-9. Pedestrian Hybrid Beacons (PHB)



Midblock Traffic Control Signal

Where pedestrian volumes meet ***MUTCD Signal Warrant 4***, engineers may install a midblock traffic control signal, as directed by ***MUTCD Section 4C.05, Warrant 4, Pedestrian Volume***. See FDOT's ***Manual on Uniform Traffic Studies (MUTS)*** for guidance on conducting Pedestrian Group Size and Vehicle Gap Size studies supporting the documentation for Warrant 4.

Install a signal that is compatible with the existing signal system along the corridor.

For six-lane divided roadways or crossing distances exceeding 80 feet, consider a two-stage pedestrian crossing with a 6-foot minimum median refuge island, where a warranted traffic control signal controls the proposed marked crossing.

Include pedestrian signal heads with midblock traffic control signals. See ***Standard Plans, Index 653-001*** for details on installing pedestrian control signals

To improve pedestrian compliance at the crosswalk, install a feedback device with the traffic control signal push button to confirm their call. See ***TEM 3.7*** for information on the use of accessible pedestrian signals.

A traffic control signal may not be needed at a midblock location if adjacent coordinated traffic control signals consistently provide adequate gaps for pedestrians to cross the roadway.

A midblock traffic control signal treatment example is shown in ***Figure 5.2-10.***

Figure 5.2-10. Midblock Traffic Control Signal



5.2.7.5 Other Treatments

In addition to raised medians, curb extensions, and raised crosswalks (see ***Figure 5.2-11***), the following treatments enhance visibility, support pedestrian travel, and increase motorist awareness of pedestrians at crossings. See ***FDM 222*** for pedestrian treatment design criteria. See ***FDM 202*** for other speed management treatments.

Figure 5.2-11. Raised Crosswalk



Pedestrian Refuge Islands

Pedestrian refuge islands allow pedestrians and bicyclists to stop midway before finishing a crossing. Provide pedestrian refuge islands as directed in ***FDM 210*** and ***FDM 222***. Refuge islands can also be used to manage speed, as discussed in ***FDM 202***.

Pedestrian refuge islands can facilitate two-stage pedestrian crossings. When pedestrian signal control is provided for a two-stage crossing, each stage should be operated independently, with pedestrian actuation or detection provided for each stage.

Minimize the delay between pedestrian actuation or detection at the median and activation of the second-stage pedestrian crossing. Consider pedestrian progression and expected pedestrian behavior (e.g., pedestrians tend to cross when they see a gap in traffic and may not wait for the WALKING PERSON signal indication) when establishing signal timing and detection for each stage.

Before installing a pedestrian refuge island, evaluate potential effects on vehicular operations, access management, and turning movements. Consider driveway access, median opening spacing, U-turn opportunities, and accommodating design vehicles,

transit vehicles, and emergency vehicles. Coordinate the design of proposed refugee islands with applicable access management requirements.

Crosswalk Illumination

Provide crosswalk illumination in accordance with ***FDM 222*** and ***FDM 231***.

For crosswalks serving environmentally sensitive areas or facilities that are open only during daylight hours, the engineer may omit lighting if ***DTOE*** approves. Consider IRWLs at crosswalk locations without illumination.

Passive Pedestrian Detection

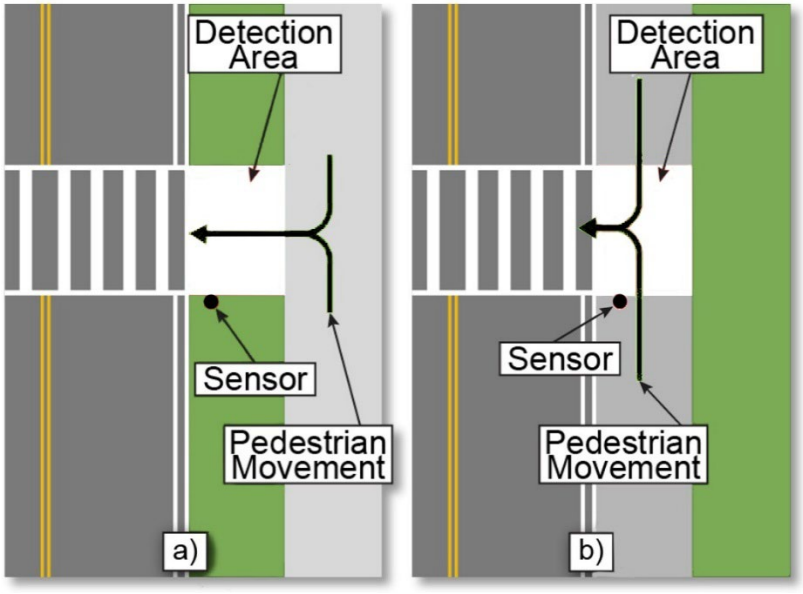
Passive pedestrian detection detects the presence and direction of pedestrians and activates the traffic control device. This system does not require manual actuation. Consider passive pedestrian detection where low actuation (push-button activation) has been documented. Passive pedestrian detection implementation may be particularly beneficial for crosswalks used by children, teenagers, or older adults, and those at school crossings.

In addition to pedestrian actuation, engineers may install passive pedestrian detection at RRFBs, PHBs, MPSs (RTE approval required), and midblock traffic control signals. When installing passive pedestrian detection:

- Provide adequate passing width around the waiting detection area on the sidewalk.
- Install overhead lighting to increase pedestrian visibility and detector accuracy.
- Provide adequate installation height, detection distance, and detector position/angle to recognize pedestrian features.
    - If there are no existing poles or infrastructure at the site, consider a supplemental pole or an extended arm from an existing pole.
- Calibrate the detector after installation to cover the pedestrian waiting area.
- Place the detector facing the sidewalk, as shown in ***Figure 5.2-12***.
    - If possible, maintain a buffer between the sidewalk and the road. The space leading towards the crosswalk can be used as the detection area.
    - If the sidewalk is adjacent to the curb without any buffer, pedestrians walking past the crosswalk may trigger false detections. Consider this limitation when implementing passive pedestrian detection.
- For shared-use paths where bicyclists are to be detected:
    - Place the passive detection devices adjacent to the expected path of bicyclists.
    - Supplement the detection with signing and pavement markings to inform bicyclists where to wait.

- At signalized shared-use path crossings, consider installing advance detection on the shared-use path approach to extend or actuate the signal phase and allow continuous through movements.
- Certain loop configurations are better at detecting bicyclists than others. Consider the amount of metal in typical bicycles when designing loop detectors. Adjust the loop detectors' settings to accurately detect bicycles.

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



Raised Rumble Strips

Raised rumble strips, also known as transverse rumble strips, can improve motorist awareness when placed ahead of rural stop-controlled intersections. Consider applying this treatment upstream of midblock crosswalks and unsignalized intersections where the other treatments described in this section have not improved motorist-yielding behavior. Install raised rumble strips according to ***Standard Plans, Index 546-001*** and ***Standard Specifications, Section 546***.

Consider the following factors when installing transverse rumble strips near midblock or unsignalized crosswalks:

- Evaluate the noise impact that transverse rumble strips would have on nearby residential areas before installation.
- Coordinate with the District Maintenance Office prior to ***DTOE*** approval for using transverse rumble strips.
- There are two basic layouts for transverse rumble strips: extending across the entire traffic lane or placed only in the wheel tracks. The wheel track layout is

preferred because it allows motorists who do not need any additional warning to avoid the rumbles without driving into adjacent lanes.

- Use the transverse rumble strips with *PEDESTRIAN CROSSING* signs (***W11-2***).

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 Section 5.2.4***, ***TEM Section 5.2.5***, and ***TEM 5.2.7***.

Table 5.2-1 has been designed to help engineers select treatment options. This matrix summarizes the procedures, selection criteria, and treatment requirements identified in ***TEM Section 5.2***.

5.2.9 OUTREACH COORDINATION

To promote smooth implementation in coordination with local agencies and law enforcement, follow these public notification procedures before installing a new RRFB, PHB, midblock traffic control signal, MPS (RTE approval required), flashing yellow beacon, or other midblock or uncontrolled crosswalk.

- Notify the District Public Information Office of the programmed treatment at least two weeks before activating the new traffic control device.

- Inform the District Community Traffic Safety Team (CTST) Coordinator about the new traffic control device. Request that they coordinate with local law enforcement, local government agencies, and the District Law Enforcement Liaison at least two weeks before activating the new traffic control device.

Portable Changeable Message Sign (PCMS)

Apply the following criteria when using a Portable Changeable Message Sign (PCMS):

- New RRFBs, PHBs, midblock traffic control signals, MPSs (RTE approval required), flashing yellow beacons, and any other type of midblock crosswalks require a PCMS to inform the traveling public of a new traffic control pattern.
- Display the following safety message on the PCMS, using standard abbreviations as needed to accommodate the available PCMS display:
    - *NEW SIGNAL mm/dd* or *NEW CROSSWALK mm/dd*
    - *PREPARE TO STOP*
- Deploy the PCMS two weeks prior to activating the new traffic control device and retain it in place for a minimum of one week after installing the marked crosswalk treatment.

Table 5.2-1. Guidance Matrix for Pedestrian Treatments at Midblock Crosswalks and Unsignalized Intersections

TEM 5.2 Midblock Crosswalks and Unsignalized Intersection Selection Guidance Matrix			Midblock and Unsignalized Intersections					Midblock		TEM SECTION
			Special Emphasis Crosswalk			RRFB		PHB	Traffic Signal	
			20 PPH for 1 hr. *or* Shared Use Path 50% PPH reduction *or* school zones			2, 3, or 4 lanes with no refuge island or median	3 or 5 lanes with refuge island or raised median	Florida warrants must be met		
			or C2T, C3C, C4, C5, and C6	40-45 mph	> 45 mph					
			≤ 35 mph			≤ 35 mph		All Speeds		
Pavement Markings	Special Emphasis Crosswalk	Midblock	M	M	M	M	M	M	M	5.2.7.1
		Intersection	M	M	M	M	M	N	N	
Signs	Stop Here for Peds sign (R1-5b) / Stop Here for Pedestrians Sign (R1-5c)	Enhance option: highlighted or beacon	O	O	O	M	M	N	N	5.2.7.2
	Pedestrian sign (W11-2) / Ahead plaque (W16-9P)		M	M	M	M	M	M	M	
	Push Button for Warning Lights, Wait for Traffic to Stop, Cross With Caution Sign (FTP-033-25)		O	O	O	M	M	O	O	
	Overhead Ped Crossing Sign (R1-9a)		O	O	O	O	O	O	O	
	Crosswalk, Stop on Red sign (R10-23a or FTP-028-25)		N/A	N/A	N/A	N	N	M	N	
	In-street Ped Crossing sign (R1-6a)		R	N	N	R	N	N	N	
Emphasis/ Enhancements	Audible message		N/A	N/A	N/A	R	R	O	O	5.2.7.3
	In-Road Warning Light (IRWL)		N/A	N/A	N/A	O	O	N	N	
	Passive pedestrian and bike detection	Shared Use Path	N/A	N/A	N/A	R	R	R	R	5.2.7.5
		All other locations	N/A	N/A	N/A	O	O	O	O	
TEM SECTION			5.2.5.1			5.2.5.2				

Legend

M Mandatory

R Recommended

O Optional

N Not to be Applied

N/A Not Available [1]

[1] Identifies where the treatment cannot be applied because the infrastructure is not there. Ex: Audible Message on a Marked Crosswalk.

Section 5.3
PEDESTRIAN AND BICYCLIST TREATMENTS ON MOVABLE BRIDGES

5.3.1 PURPOSE

This section establishes criteria and guidelines for the consistent installation and operation of pedestrian treatments on movable bridges. These treatments include swing-style pedestrian gates, signs, and advance detection systems such as LiDAR and thermal imaging cameras. See ***FDOT Structures Manual, Volume 1 - Structures Design Guidelines, Chapter 8.1.9*** for more design information.

5.3.2 GENERAL

Signs and swing-style pedestrian gates can significantly improve non-motorists' safety on movable bridges. Advance detection systems help bridge tenders detect non-motorists and prevent the bridge from opening when non-motorists are in the vulnerable zones of the movable span. See ***Figure 5.3-1*** for typical detection zones.

5.3.3 DEFINITIONS

Advance Detection System: A passive detection system that can identify, target, track, and alert if a moving or still person is spatially referenced within a predetermined area during any weather condition.

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 (Drawtender): Operator of the movable bridge according to U.S. Coast Guard regulations (***Code of Federal Regulations, Title 33, Part 117***) and ***Florida Statutes***.

Lift Bridge: A vertical-lift bridge, or just a 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. These include lift, bascule, and swing bridges.

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, usually at or near its center of gravity, and a swing span (turning span) that pivots horizontally around it.

Swing-Style Pedestrian Gate: A gate that opens and closes automatically by electronic, hydraulic, or mechanical means. Swing-style pedestrian gates open on the vertical axis, allowing them to swing toward or away from pedestrians.

Vulnerable Zones: Areas of high risk for pedestrians, bicyclists, and motorists during bridge openings.

5.3.4 TREATMENT OPTIONS

5.3.4.1 Swing-Style Pedestrian Gate

Install a swing-style pedestrian gate on a movable bridge in accordance with ***FDOT Structures Manual, Volume 1 - Structures Design Guidelines, Chapter 8.1.9***.

5.3.4.2 Signage

Install a *NO PEDESTRIANS OR BICYCLES BEYOND GATE* sign (***FTP-036-25***) on a movable bridge swing-style pedestrian gate as shown in ***TEM 2.6.7***. Sign details are available in the ***FDOT's Sign Library***.

5.3.4.3 Advance Detection Systems

These passive thermal or laser-based systems identify, target, track, and alert the bridge tender station if they detect pedestrians or bicyclists in the movable bridge's vulnerable zones.

- The thermal camera system is an advance detection system that uses infrared radiation to detect and locate objects with a heat signature.
- The LiDAR camera system is an advance detection system that uses **Li**ght **D**etection **a**nd **R**anging technology. It emits pulsed laser beams in a predetermined geographic space and measures the time each pulse takes to reflect off the environment and objects of interest, creating a 3D image of the target.

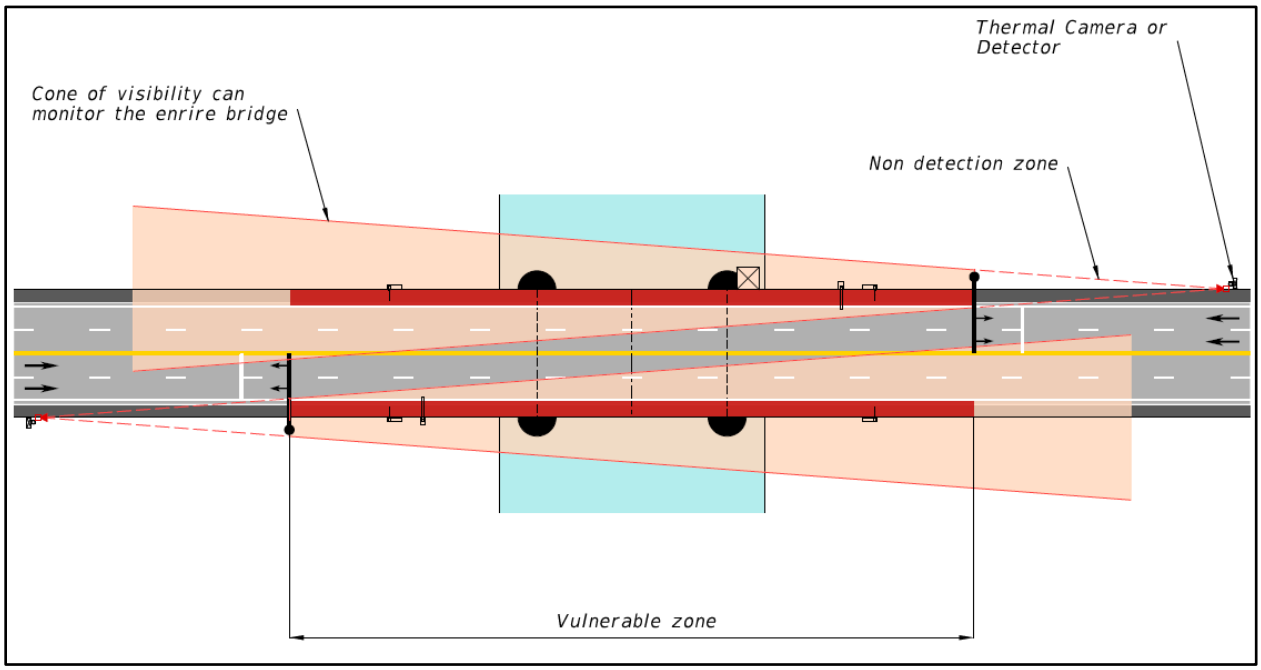
A computer in the bridge tender house with an uninterruptible power supply processes the sensor data from the advance detection system, and the feed is displayed. These systems, including all integrated components, are on the FDOT's ***Approved Products List (APL)***.

The ***DTOE*** approves the selection of the advance detection system technology. ***State Traffic Operations Engineer (STOE)*** approval is required to select technology not covered in this section.

Systems may include:

- Thermal camera, or LiDAR camera
- Controller or server cabinet
- Communication system (wired, 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



SECTION 5.4

TREATMENTS FOR DETERRING WRONG-WAY DRIVING

5.4.1 PURPOSE

This section establishes guidelines for applying treatments to deter wrong-way driving (WWD). This section complements the design criteria found in the ***FDM***. Refer to ***FDM 230*** for guidance on selecting and applying wrong-way driving traffic control devices.

5.4.2 GENERAL

FDOT installs the minimum required *DO NOT ENTER* (***R5-1***) and *WRONG WAY* (***R5-1a***) signs and pavement markings (e.g., Wrong-Way Arrow, etc.) as directed in ***MUTCD Sections 2B.46 through 2B.50***. As part of evolving efforts to deter wrong-way crashes, FDOT has released four bulletins:

- "Signing and Pavement Marking Standards at Ramp Intersections" (***Traffic Engineering and Operations Bulletin 03-15***).
- 'Wrong-Way Driving Advanced Countermeasures at Interchange Exit Ramps" (***Traffic Engineering and Operations Bulletin 19-03***).
- "Wrong-Way Driving Countermeasures for Arterials and Collectors" (***Traffic Engineering and Operations Bulletin 21-03***).
- "Wrong-Way Arrows with RPMs and Wrong-Way Signage in Median" (***Office of Design Bulletin 26-01***).

Appropriate WWD treatments vary depending on location. For new facilities, include geometric design elements that reduce WWD. To reduce WWD on existing facilities, prioritize signage and pavement marking enhancements and consider adding traffic control signals. In all cases, maintain adequate sight distance. Combine solutions to develop the most effective strategy before considering advanced countermeasures.

Use advanced countermeasures for locations with high-risk operational characteristics or an established history of WWD events at the ***DTOE***'s discretion. Consider applying advanced countermeasures at locations with land use (e.g., poorly aligned commercial driveways, proximity to tourist areas, etc.) or lighting issues, a history of impaired driving or crashes, or a high proportion of licensed motorists 25 and younger or 65 and older. Also consider social factors, such as proximity to establishments that serve alcohol, as noted in ***FDOT Research Report BDV29-977-36: A Data-Driven Approach to Implementing Wrong-way Driving Countermeasures***.

Consider interchange geometry when prioritizing treatments. Certain interchange geometry types, such as partial cloverleaf, are more susceptible to WWD incidents.

Frontage road type is another factor to consider, as one-way frontage roads that intersect with freeway off-ramps are more susceptible to causing freeway WWD incidents than standard frontage roads, according to ***NCHRP Research Report 1050: Wrong-Way Driving Solutions Handbook***.

FDM 230 describes strategies for deterring wrong-way driving on divided and one-way arterial and collector roadways.

5.4.3 TREATMENT OPTIONS

Consider the following treatment options to deter WWD on freeway ramps and arterials:

- Geometry
- Signs
- Pavement markings
- Traffic signal control
- Advanced countermeasures

5.4.3.1 Geometry

Consider the following geometric recommendations when designing a new interchange or addressing WWD at an existing interchange:

- Install red retroreflective linear barrier delineators, as shown in ***Figure 5.4-1***.

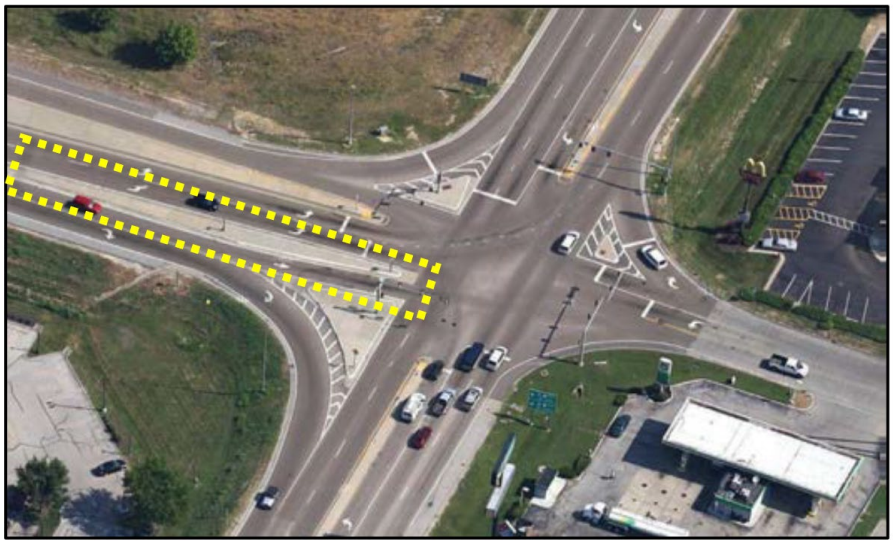
Figure 5.4-1. Linear Barrier Delineators



- Install non-traversable medians to discourage left-turn wrong-way entry onto exit ramps.
- Install tubular markers to prohibit left-turn wrong-way entry when no raised medians are present.

- Install raised medians or median barriers between ramps of trumpet interchanges.
    - Do not use raised medians to separate vehicles traveling in the same direction on exit ramps. This gives the impression of two-way traffic, as shown by the partial cloverleaf (parclo) entrance ramp in ***Figure 5.4-2***.

Figure 5.4-2. Raised Median Separating Same-Direction Vehicles



Channelize islands to reduce the approach width at the end of the exit ramp.

- Add a short-radius curve or angular break at the intersection of the left edge of exit ramps and the right edge of the street to discourage wrong-way right turns from the intersecting street.
- Provide open sight distance throughout the entire length of entrance and exit ramps, especially at the ramp terminal of the intersecting street.
- At the intersection of two-way ramps and intersecting streets (parclo interchanges), move stop lines for left turns from the intersecting street forward so motorists have a better view of the entrance ramp and a better turning radius.
- Do not extend median barriers to block the left-turning motorist's view of the entrance ramp where the entrance ramp and exit ramp are adjacent. See ***FDM 210*** for more design information on medians, islands, and hardened centerlines.
- Deter left-turn wrong-way movements with narrowed or directional median openings on arterial highways.

5.4.3.2 Signs

Consider the following WWD signage treatments on freeway ramps and arterials:

- Angled *DO NOT ENTER* (***R5-1)*** or *WRONG WAY* (***R5-1a****)* signs near intersections toward motorists traveling in the direction most likely to make the

wrong-way movement. Engineers may use alternative screening solutions to limit the signs' visibility to motorists traveling in the correct direction.

  - To enhance conspicuity, supplement WRONG WAY (R5-1a) signs with the DO NOT ENTER SIGNS on the same sign post. Additionally, consider using oversized signs. See ***MUTCD Section 2A.11*** for additional information.

- Utilize minimum mounting heights for *DO NOT ENTER* (***R5-1)*** and *WRONG WAY* (***R5-1a***) signs where no pedestrian access is permitted. See ***Standard Plans, Index 700-101-1***.
- Place turn prohibition signs to avoid wrong-way movements. This can be accomplished with *NO RIGHT TURN (**R3-1**) and NO LEFT TURN (**R3-2**)* signs.
- Consider using supplemental *WRONG WAY* (***R5-1a***) signs in the following scenarios:
  - Within 100 feet of the *DO NOT ENTER* (***R5-1***) sign(s).
  - Exit ramps with an extensive history of WWD may receive a third set of signs beyond the required set.
  - Along one-way frontage roads that lead from freeway exit ramps.

5.4.3.3 Pavement Markings

Consider the following recommendations regarding use of pavement markings as a treatment for WWD on freeway ramps or on arterials:

- Avoid placing lane-use arrows where they can be misunderstood and possibly cause wrong-way maneuvers. For example, do not put left-turn-only arrows in a through lane at an exit ramp intersection. Refer to ***TEM 4.2.3.2*** for additional information. See ***FDM 230*** for more design information.
- Move the stop lines forward for left turns from the intersecting road, especially at large intersections with adjacent entrance/exit ramps, as shown in ***Figure 5.4-3***.
- Provide lane line extensions at ramp terminals with large turning radii or adjacent entrance/exit ramps.

Figure 5.4-3. Cross Road Stop Bar That Has Been Moved Forward



5.4.3.4 Traffic Signals

The following recommended treatments can be applied to traffic signals at freeway ramps and intersections with one-way roads:

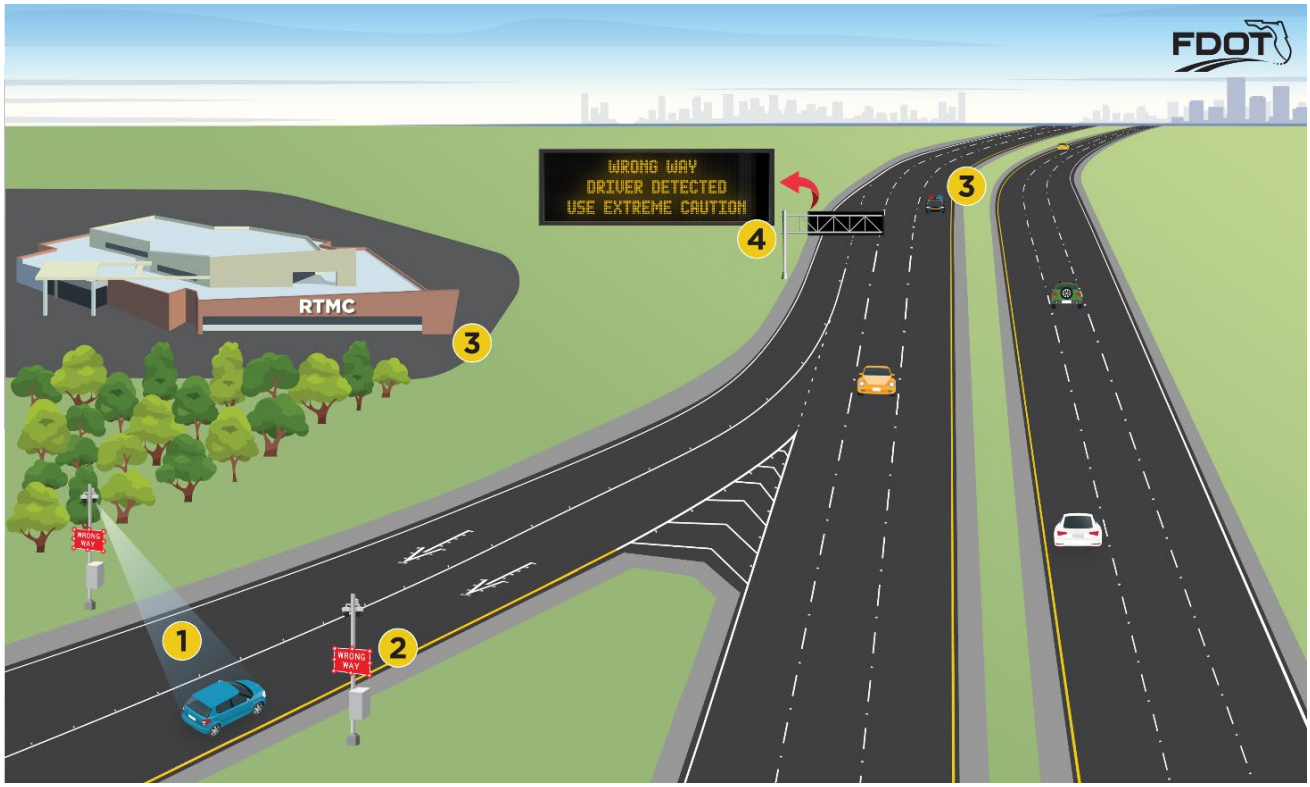
- To discourage wrong-way turns and supplement other wrong-way signing and pavement marking treatments, replace the circular green signal bulb with a green upward arrow on the signal face for the exclusive through-travel lane closest to the intersecting off-ramp or one-way road. See ***MUTCD Section 4F.01(05)*** for reference.
- Place a supplemental signal face with a green upward arrow on a pedestal in the median for left-turn storage that carries through the interchange ramp terminal to deter motorists from turning into the incorrect facility. This treatment is appropriate where additional storage for queueing to the entrance ramp is needed, as in a diamond interchange. This signal is not considered a primary signal face.

5.4.3.5 Advanced Countermeasures

Advanced WWD countermeasures use wrong-way vehicle detection systems (WWVDS), motorist awareness systems, and a centralized logic platform. A detection system may include thermal, radar, or video detection. A motorist awareness system consists of a *WRONG WAY* (***R5-1a***) sign highlighted by light-emitting diodes (LEDs), actuated by the WWVDS. The WWVDS may connect to a centralized logic platform that alerts the Regional Transportation Management Centers (RTMC) via SunGuide software when it detects a wrong-way motorist, as illustrated in ***Figure 5.4-4***.

Consider applying advanced countermeasures at on-ramps with extensive WWD history or that are geometrically prone to WWD. Apply advanced countermeasures at the ***DTOE***'s discretion. See ***FDM 230***, ***Standard Plans, Index 700-120***, ***Standard Specifications, Sections 660 and 995***, and ***Supplemental Wrong Way Vehicle Detection System SunGuide HTTP Protocol Requirements*** for more design information.

Figure 5.4-4. Visual Schematics of Advanced Countermeasures



How a Wrong-Way Vehicle Detection System Works

(1) Detects Vehicle: Signs located on the exit ramps use the system to detect vehicles traveling the wrong way.

(2) Triggers Lights: Flashing lights are turned on along the sign border to alert the motorist that he/she is traveling in the wrong direction.

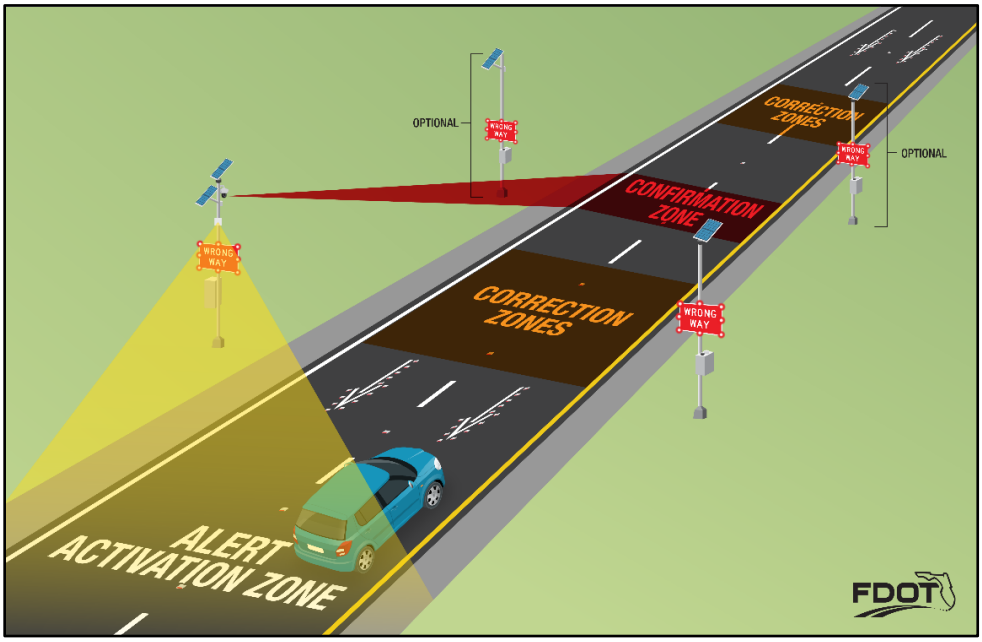
(3) Notifies Officials: The detection system sends an alert immediately to operators at an FDOT Regional Transportation Management Center (RTMC) and law enforcement officials.

(4) Alerts Other Motorists: The RTMC system broadcasts a wrong-way motorist alert on message boards along the freeway.

The following recommendations and considerations apply to adding advanced WWD countermeasures on freeway ramps:

- The vehicle detection system includes sensors capable of creating unique “detection” and “verification” zones, as shown in ***Figure 5.4-5***. Use utility power and fiber connections where possible rather than solar power because they perform better.
- The proposed sensor locations adequately cover vehicle detection across all lanes, shoulders, and slip ramps of the exit ramp.
- Each sensor can capture both detection and verification zones across all lanes and shoulders.

Figure 5.4-5. Typical Detection Zones



- For straight exit ramps, start the detection zone at least 25 feet before the stop line.
- On ramps with right-turn lanes or islands, begin the detection zone at the island gore point or the start of the tangent.
- Position detection zones to prevent false alerts from opposing or right-way traffic on nearby roads and entrance ramps.
- Keep sight lines clear, without obstructions like signs, lighting poles, vegetation, walls, or other physical features.
- The vehicle detection system can operate effectively in all weather and lighting conditions.
- Any additional hardware or equipment, such as illuminators, is provided as necessary components of the system.
- The setup of the vehicle detection subsystem depends on the roadway geometry and physical constraints at the specific location (e.g., primary and remote; primary, secondary, and remote).
- Place reflective stripes in yellow or white on the traffic-facing side of posts to reduce the chances of motorists knocking them down.
- Closed-circuit television (CCTV) cameras in freeway or arterial areas near the vehicle detection system help operators confirm and track wrong-way detections.

5.4.4 EDUCATION

FDOT has developed educational and outreach resources to support wrong-way driving (WWD) prevention efforts and increase public awareness of appropriate motorist responses to WWD events.

FDOT created print and digital materials to educate motorists on WWD countermeasures implemented on the Interstate Highway System. These materials inform motorists about what to do if they enter a ramp the wrong way or encounter a wrong-way motorist on the roadway.

Download or order free copies of tip cards from the ***Safe Mobility for Life Resource Center*** ***(Figure 5.4-6)***. Digital graphics can be downloaded from the ***Safe Mobility for Life Digital Resource Center*** ***(Figure 5.4-6).*** These resources provide consistent research-based WWD safety information to support public education and outreach efforts***.***

Figure 5.4-6. Wrong-Way Driving Educational Graphic

