June 2025

State Traffic Engineering and Operations

TRANSPORTATION SYMPOSIUM

Wrong-Way Driving Program Update

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Rick Jenkins, P.E.

Transportation Symposium Website

SCAN ME

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Agenda

1. **Wrong-Way Driving (WWD) Program Overview**
2. **Research to Implementation**
3. **Freeway**
   i. Countermeasures
   ii. Wrong-Way Vehicle Detection Systems
4. **Arterial Countermeasures**
5. **Education**
6. **Latest Design Updates**

Confirmed Wrong-Way Driver - Image from FDOT Approved Detection Device

What is Wrong-Way Driving?

- Wrong-Way driving is when a driver enters a one-way or divided roadway travelling the wrong direction
- Wrong-way driving crashes on freeways are 35x more likely to end in fatalities than average crashes
- One fatality is too many!

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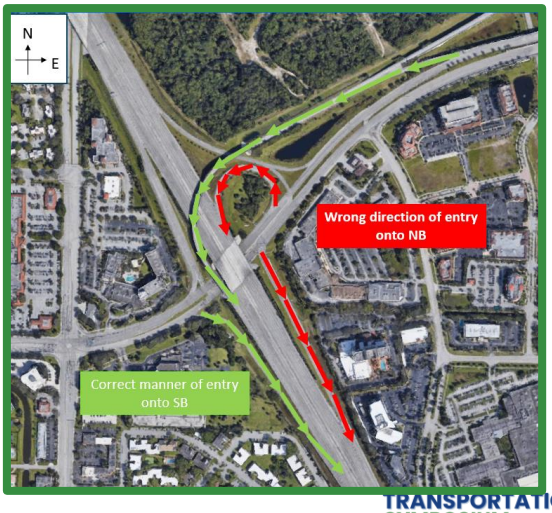
What causes wrong-way driving?

- Common causes for wrong-way driving:
  - Driver intoxication
  - Older drivers
  - Driver mental health Incidents
  - Driver confusion caused by:
    - Low lighting
    - Lack of or confusing signing
    - Roadway geometry
    - Etc.



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History

NEWS

Tallahassee teacher killed in crash with bus on Interstate 10

Courts / Law

Driver In Wrong-Way Crash That Killed 5 Was Intoxicated

Tampa Officer Hit By Wrong Way Driver

The crash was the latest in an unsettling trend in the Tampa area in which wrong-way drivers have caused crashes, many of them fatal. In most of the cases, alcohol played a role, authorities said.

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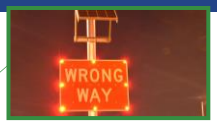
FDOT's WWD Timeline & Initiatives



SEPTEMBER 2014
Request to Experiment (RTE) - D3 Red Internally Illuminated Raised Pavement Markings

JULY 2019
Bulletin – Implement LED highlighted WRONG WAY signs at exit ramps

November 2021
2022 FDM Published with Traffic Design Ch. 230 S&PM Updated

February 2025
5-Year WWD Strategic Plan Published

2014 | 2016 | 2018 | 2020 | 2022 | 2024

OCTOBER 2014
RTE - D7 Red Rectangular Rapid Flashing Beacon (RRFB)

APRIL 2015
Bulletin - Signing and Pavement Marking at Ramp Intersections

MARCH 2016
RTE- Florida Turnpike Red- RRFB

MARCH 2019
Countermeasure Implementation Plan

JUNE 2021
Bulletin – Countermeasures for Arterials and Collectors

November 2022
2023 FDM Published with Traffic Design Ch. 230 S&PM Updated

Future Updates...
Pending updates to arterial sections of FDM 230

Request to Experiment **Bulletin**

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Initial Research vs Current Data

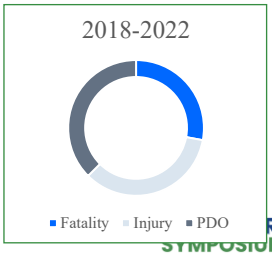
- **280 Statewide freeway wrong-way crashes (2009-2013)**

2009-2013 F+SI% 70%

- **269 Statewide freeway wrong-way crashes (2018-2022)**

2018-2022 F+SI% 63%

- Reduction in overall and combined rate of fatal plus serious injury crashes



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Research

Data-Driven Decisions for WWD Program

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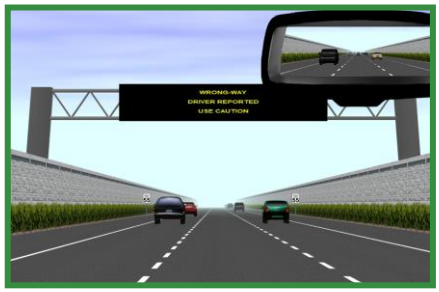
Florida Wrong-Way Driving Research

- **Statewide Wrong-Way Driving Crash Study (Apr 2015)**
- **Florida State University**
  - Driving Simulator Studies on Human Factor (Nov 2015)
- **University of South Florida CUTR**
  - Comparing Seven Countermeasures (March 2017)
  - Testing and Evaluating Video Detection Systems for Freeway Mainlines (Nov 2018)
- **Florida International University**
  - Data-Driven Approach for Identifying Hotspots (Nov 2018)
  - Strategies to Mitigate Wrong-Way Driving Incidents on Arterials (Nov 2019)
  - Evaluating the Strategic Response Plan to WWD Events on Freeways **(April 2025)**



Driving Simulator (FIU)

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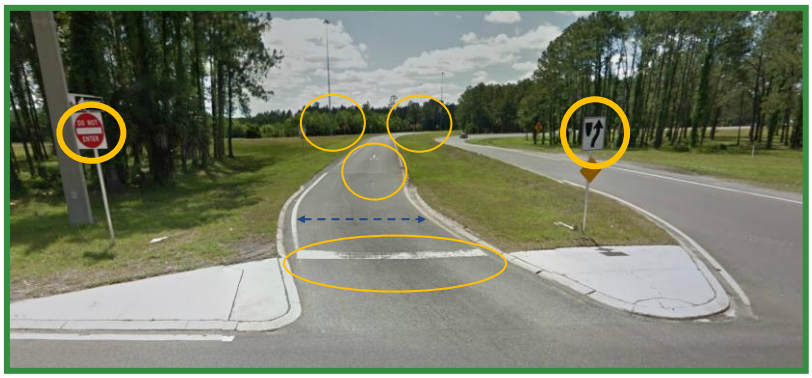
Florida State University Research

Driving Simulator Studies of the Effectiveness of Countermeasures to Prevent Wrong-Way Crashes



Driver Cues

- Alcohol impairment limits the number of cues and make them harder to recognize

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Evaluated WWD Countermeasures

Updated Signing and Pavement Marking

Red Rectangular Rapid Flashing Beacons (RRFB)

Internally Illuminated Raised Pavement Markers

Light-Emitting Diode (LED) Highlight WRONG WAY signs

Blank-out signs that flash WRONG WAY

Delineators along exit ramps

Wig-wag Flashing Beacons

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FIU Research and Implementation

Hotspot Research Analysis for advanced countermeasures

- **Identified locations for prioritized deployment**
- **Evaluated demographic and land-use factors including:**
  - Impaired Driving
  - **Drivers > 65 years old**
  - Tourist
  - **Density of alcohol establishments**
  - Density of Health care facilities
- **Evaluated crash event response plans and driver reaction to DMS messaging**

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Freeway Countermeasures

Countermeasures at Ramps and Intersecting Arterials


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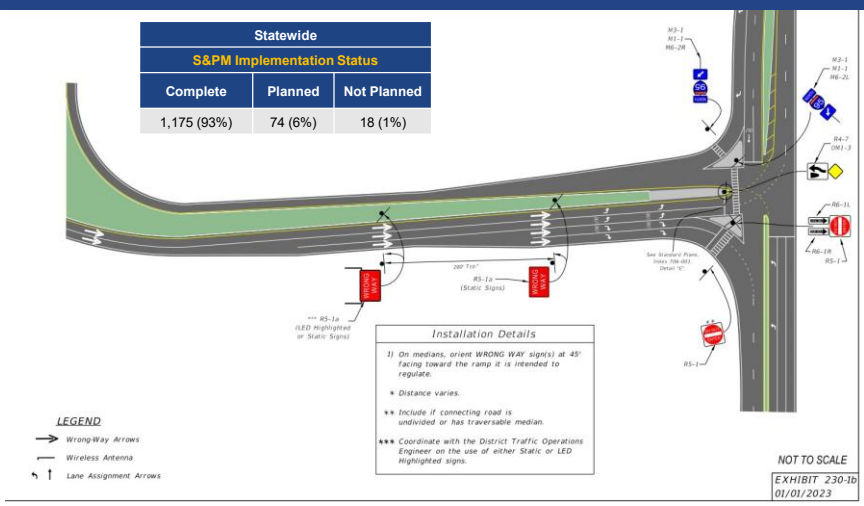
Signing and Pavement Marking (S&PM) Countermeasures Deployments –FDM 230.4

Statewide		
S&PM Implementation Status		
Complete	Planned	Not Planned
1,175 (93%)	74 (6%)	18 (1%)



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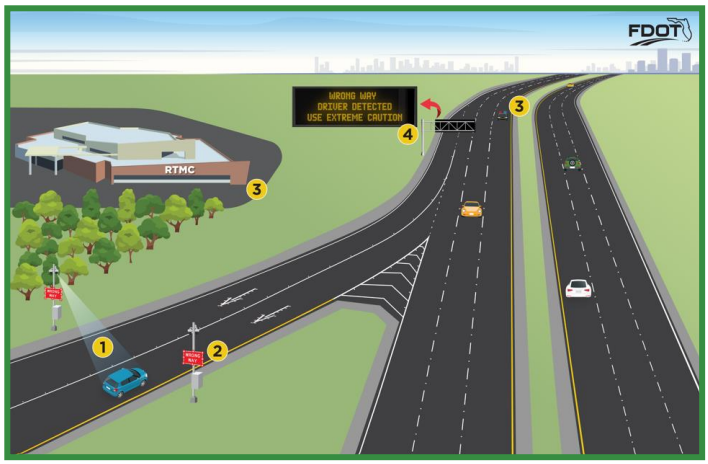
Wrong-Way Vehicle Detection System (WWVDS)

How Wrong-Way Vehicle Detection System Works

1. Detects Vehicle
2. Triggers Lights
3. Notifies Officials
4. RTMC Alerts Other Drivers



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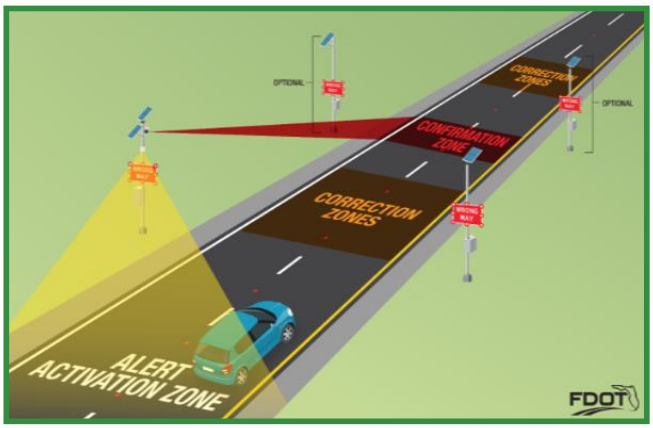
Wrong-Way Vehicle Detection System (WWVDS)

Statewide		
WWVDS Implementation Status		
Complete	Planned	Not Planned
367 (30%)	650 (53%)	211 (17%)

January 2025 Standard Specification

660-2.2.1.4 Wrong-Way Vehicle Detection Systems

- Produces an alarm
- One or more detection zones
- Mainline or Ramps
- Must include shoulder monitoring



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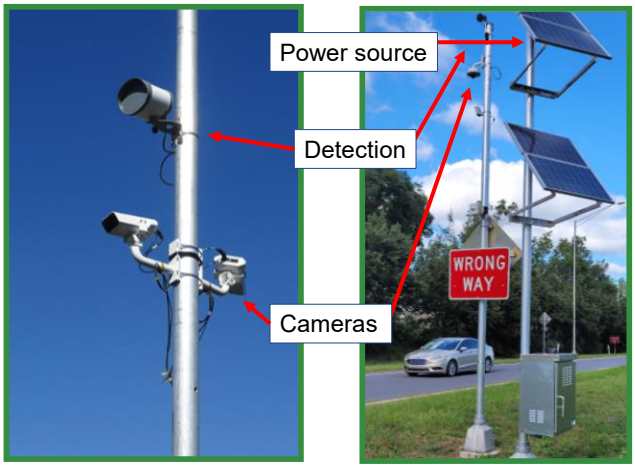
Common Features of WWVDS APL Products

- **Suppliers must be on FDOT's WWVDS Approved Products List (APL)**
- **Suppliers' product features:**
  - Utility or Solar Power
  - Thermal, Radar, Camera, or LiDAR Detectors
  - Cameras for Verification
  - Alert System

Wrong Way Vehicle Detection System



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Countermeasures in Action

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Arterial Countermeasures

Countermeasures on Divided and One-way Arterials


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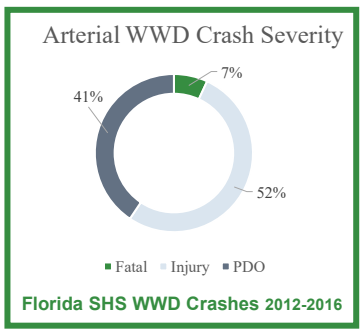
Reasons for Arterial Countermeasures

Arterial (1,890 crashes)

- Over **six** (>6x) **times more likely** to be in a crash compared to freeway WWD
- About 6 out of 10 crashes end with a person harmed
- **Three** (3x) **times** less likely to be in **fatal** crash compared to freeway WWD



Florida SHS WWD Crashes 2012-2016

WWD on Arterials

- WWD crashes are more frequent on arterial streets than freeways
- Factors include dark conditions, unfamiliarity, unclear signage, and lower traffic volumes

Design Considerations

- Arterial roadway characteristics could be targeted to mitigate crashes
- Additional countermeasures at points of entry may reduce wrong-way driving

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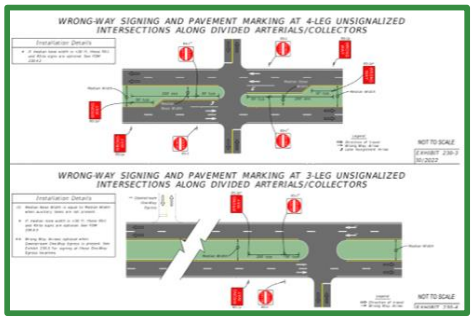
Arterial Design Guidance to Deter WWD

Summary of changes to FDOT Design Manual (FDM):

230 Signing and Pavement Marking:

- Wrong-way became branded as FDM 230.4 including the following arterial subsections:

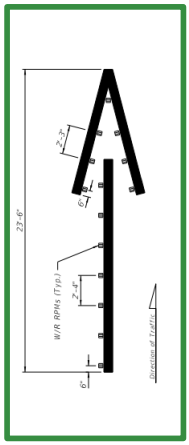


230.4.3 **Divided Arterials and Collectors**

230.4.4 **One-Way Pairs and Divided Arterials/Collectors with One-Way Egress**

230.4.5 **Undivided One-Way Streets**

230.4.6 **Two-Way Signalized Intersections**



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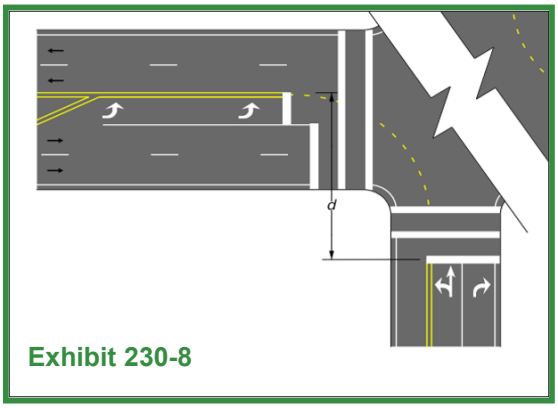
Section 230.4.6 Two-Way Signalized Intersections

Intersection in Florida Panhandle Region



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Education

Use of Media Outlets and Social Media



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Communications and Education

Types of Communications

- Interviews with Media
- FDOT WWD Website (fdot.tips/wrongway)
- Public Service Announcements and 30-second videos
- Print and digital educational materials
- Social Media

Content Shared

- Functionality and deployment of engineering countermeasures
- WWD Crash data/history
- Educational tips for road users

Distribution Methods

- Safe Mobility for Life Resource Center and Social Media
- Data-driven targeted outreach
- Tax Collector toolkits

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Example PSA

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Types of Communications: Website

Sections

- Research
- Countermeasures
- Education
- Frequently Asked Questions

FDOT Wrong-Way Driving Website

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Content Shared: Educational Tips for Road Users

- **FDOT's Safe Mobility or Life Insider Newsletter**
  - Focus on Handling WWD Situations
  - Distributed print and digitally
  - Reached over 3500 people
- **Safe Mobility for Life Social Media Campaigns**

Social Media Posts on X/Twitter (Above) and Facebook (Right)

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Future

Future: Future Efforts and Plans

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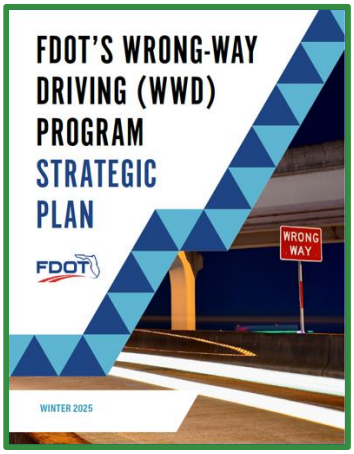
Future Efforts

- Continued deployment of countermeasures and coordination with stakeholders
- Development of alternative countermeasures to maximize system coverage
- Further exploration of computer vision to assist in detection of wrong-way drivers
- Full before-after study on currently implemented countermeasures on both freeways and arterials

FDOT Remains Open to New Innovative Ideas and Countermeasures



FDOT WWD Strategic Plan

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Latest Design Updates

Rick Jenkins, P.E. – Roadway Design Office

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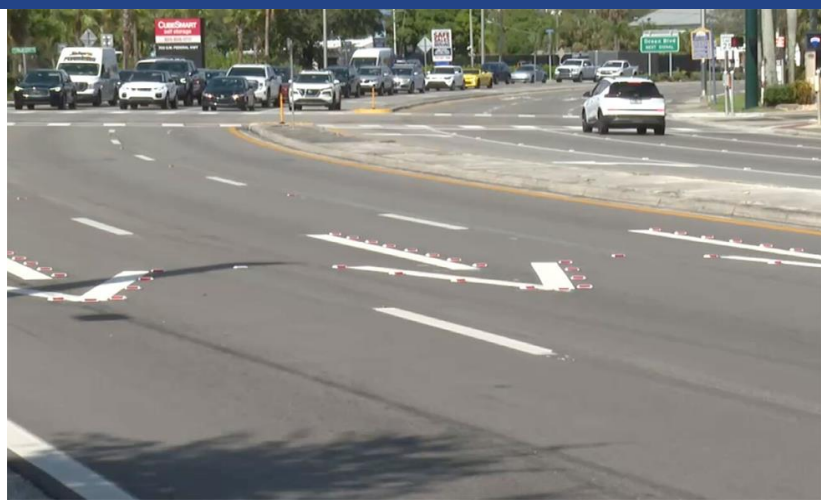
Lessons Learned

We are Listening!

- RPMs in Tire Path
- Changed in June 2023



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Lessons Learned

- RPMs moved to inside of Arrows

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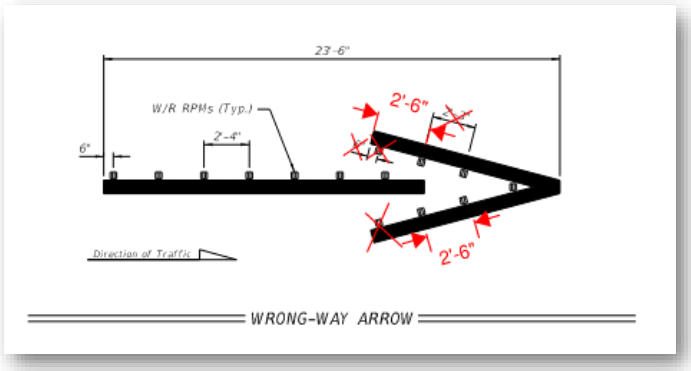
Standard Plans Index 706-001



Index 706-001 – Typical Placement of Raised Pavement Markers

- Reducing number of RPMs

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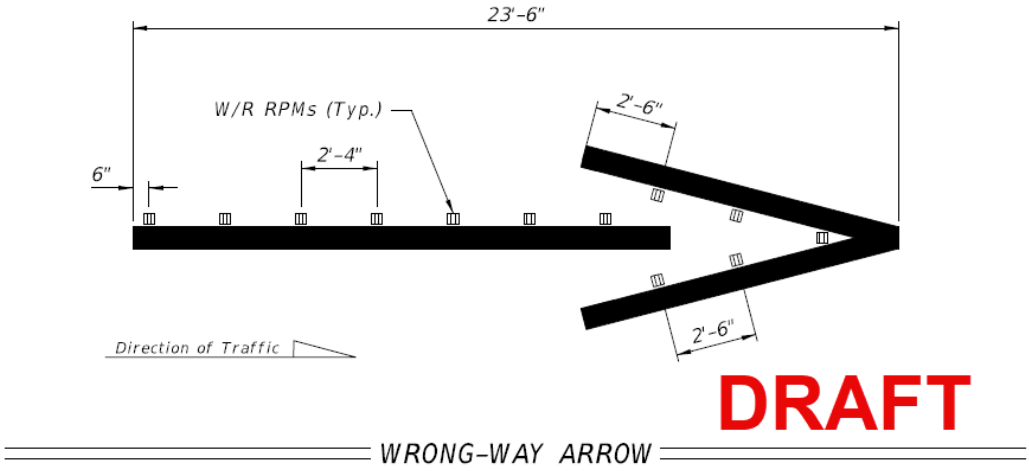
Standard Plans Index 706-001



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Lessons Learned

We are Listening!

- Too Many Signs
- More Flexibility

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FDOT Design Manual (FDM) Chapter 230

- FDM Chapter 230 Updates
- Clarify when and where to use criteria
- Markings no closer than 450 feet apart (300 for high risk)
- Guidance for sign placement

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FDM 230.4 Wrong-Way Signs and Pavement Markings

230.4 Wrong-Way Signs and Pavement Markings

Deploy the enhanced signing and pavement markings in this section to improve positive guidance, to minimize driver confusion, and to reduce wrong-way movements. The height of WRONG WAY (R5-1a) signs must be in accordance with ***Standard Plans, Index 700-101***. Include red retroreflective strips for enhanced conspicuity on DO NOT ENTER (R5-1) and static WRONG WAY (R5-1a) sign columns in accordance with ***MUTCD Section 2A.~~18~~***. Include white retroreflective strips for enhanced conspicuity on standalone ONE WAY (R6-1) sign columns in ***Exhibits 230-5, 230-6, and 230-7*** in accordance with ***MUTCD Section 2A.~~18~~***. Orient wrong-way signs in the direction they are intended to regulate. Avoid placement of wrong-way signs in locations that are visible to drivers traveling the appropriate direction. These wrong-way prohibitive signs and pavement markings are used to enhance driver awareness. They are in addition to other required signs and pavement markings that are not shown in exhibits.

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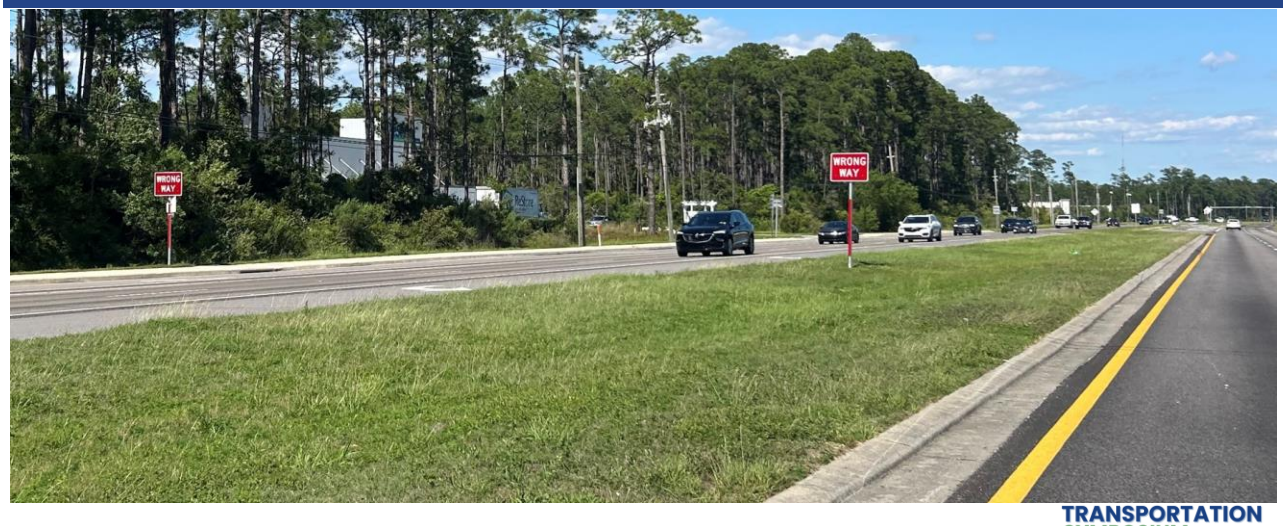
Lessons Learned



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Arterials and Collectors

Topic #625-000-002
FDOT Design Manual

230.4.3 Divided Arterials and Collectors

This section is intended for unsignalized, stop-controlled connections (i.e., a two-way or one-way side street, commercial driveway, or driveway) along divided arterials or collectors with a full median opening. For connections without a median opening, see ***FDM 230.4.4.*** ~~Provide Wrong-Way Arrow pavement markings at unsignalized intersections with median widths of 20 feet or greater.~~

Provide DO NOT ENTER (R5-1) signs and WRONG WAY (R5-1a) signs on the outside shoulder at all unsignalized intersections. Provide DO NOT ENTER (R5-1) signs and WRONG WAY (R5-1a) signs on the median at unsignalized intersections with median nose widths of 30 feet or greater (See ***Exhibits 230-3*** and ***230-4***). Orient each median sign face at 45 degrees toward the connection it is intended to regulate. For median nose widths less than 30 feet, the median DO NOT ENTER (R5-1) and WRONG WAY (R5-1a) signs are optional. Place each sign as close to the wrong-way roadway as possible while meeting the placement criteria of ***Standard Plans, Index 700-101***.

~~See ***Exhibits 230-3*** and ***230-4*** for recommended configurations of Wrong-Way Arrow pavement markings, DO NOT ENTER (R5-1) signs, and WRONG WAY (R5-1a) signs.~~

- FDM 230.4.3 Edits
- Clarification on Section
- Median Nose Widths Less than 30 ft (Signs are Optional)

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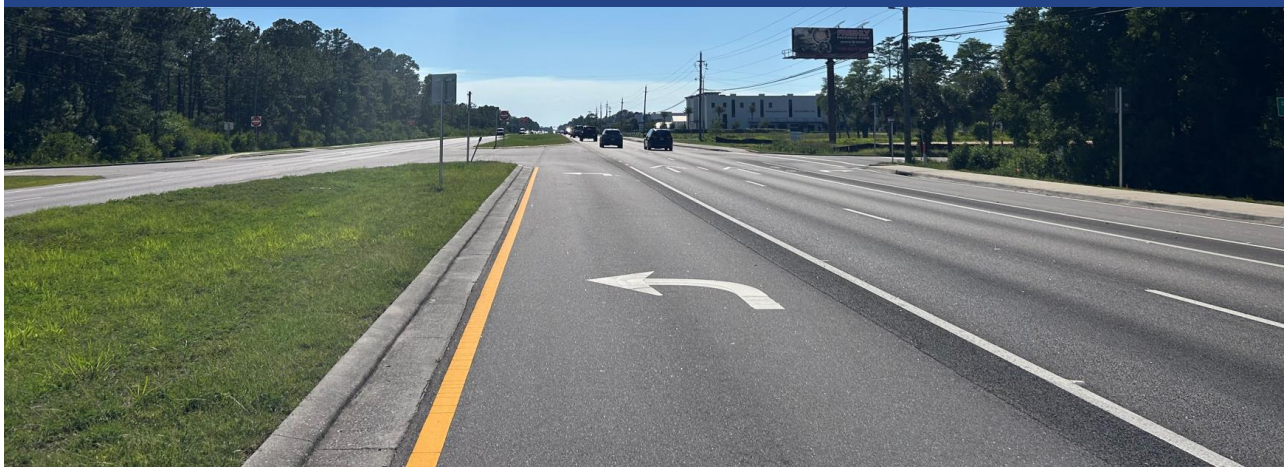
Arterials and Collectors



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Engineering Judgement

Commentary: For median nose widths less than 30 feet, median DO NOT ENTER (R5-1) and WRONG WAY (R5-1a) signs should only be considered in high-risk locations (as described below). If placed in these narrower medians, ensure details in the plans clearly specify 45-degree rotation of each sign toward the wrong way movements to reduce visibility to those making proper turning movements.

At intersections with positive offset left-turns, use DO NOT ENTER (R5-1) signs with dimensions of 48 inches by 48 inches in the median. The outside shoulder DO NOT ENTER is to meet the minimum size per Table 2B-1 of the MUTCD that corresponds to the mainline roadway classification. See ***FDM 212.14.4*** for further information on offset left turn lanes.

For Context Classifications C1, C2, C3C, and C4 place Wrong-Way Arrow pavement markings in all lanes prior to unsignalized, stop-controlled connection (i.e., side streets, commercial driveways, or driveways) with median widths of 20 feet or greater. For roadways with multiple, closely spaced connections, use engineering judgement to place Space Wrong-Way Arrow pavement markings, ~~no closer than 300 feet.~~ The placement of Wrong-Way Arrow pavement markings must be spaced at 450 feet or greater, except in high-risk locations where the minimum spacing can be reduced to 300 feet. For all other

230 - Signing and Pavement Marking

- FDM 230.4.3 Edits
- Use Engineering Judgement

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FDM 230.4.3 Divided Arterials and Collectors

Topic #625-000-002
FDOT Design Manual

Context Classifications, consider placing Wrong-Way Arrow pavement markings as described above where high-risk locations are present.

~~Coordinate with the District Traffic Operations Engineer (DTOE) to evaluate~~ Hhigh-risk locations are typically identified in Safety Studies using factors such as land-use, presence of lighting, history of impaired driving, crash history, and an over-represented population of licensed drivers 25 or younger and 65 or older. Determination of high-risk locations is at the discretion of the District Traffic Operations Engineer (DTOE).

See ***Exhibits 230-3*** and ***230-4*** for recommended configurations of Wrong-Way Arrow pavement markings, DO NOT ENTER (R5-1) signs, and WRONG WAY (R5-1a) signs.

At ~~intermediate~~ ends of medians, consider the use of KEEP RIGHT assemblies (R4-7 and OM1-3) ~~sign~~ for ~~median~~ nose widths less than 30 feet.

- FDM 230.4.3 Edits
- Coordinate with District Traffic Operations Engineers

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FDM 230.4.4 One-Way Pairs

230.4.4 One-Way Pairs and Divided Arterials/Collectors with One-Way Egress

One-Way Egress is a condition where a two-way or one-way side street, commercial driveway, or driveway connects to a one-way arterial/collector or divided arterial/collector without a median opening.

See ***Exhibit 230-5*** for recommended configurations.

Place a ONE WAY (R6-1) sign at signalized and unsignalized, stop-controlled connection (i.e., side streets, commercial driveways, or driveways) with one-way egress. ONE WAY (R6-1) sign shall be placed on far side median or shoulder depending on facility type.

At driveways controlled by a non-signalized traffic control device with one-way egress, place a Right Turn Lane-Use Arrow in the approach lane, and a RIGHT TURN ARROW (FTP-55R-06) sign or a LEFT TURN ARROW (FTP-55L-06) sign below the STOP (R1-1) sign. Verify this sign has not already been installed by District driveway permit. At side street connections, place a Mandatory Lane Control (R3-5) sign below the STOP (R1-1) sign.

For Context Classifications C1, C2, C3C, and C4 place Wrong-Way Arrow pavement markings in all lanes prior to signalized and unsignalized, stop-controlled connection (i.e., side streets, commercial driveways, or driveways) with one-way egress. For roadways with multiple, closely spaced connections, space Wrong-Way Arrow pavement markings based on engineering judgement. Space Wrong-Way Arrow pavement markings ~~no closer than 300~~at 450 feet or greater, except in high-risk locations where the minimum spacing can be reduced to 300 feet. For all other Context Classifications, consider placing Wrong-Way Arrow pavement markings as described above where high-risk locations are present.

~~Coordinate with the District Traffic Operations Engineer (DTOE) to evaluate H~~high-risk locations are typically identified in Safety Studies using factors such as land-use, presence of lighting, history of impaired driving, crash history, and an over-represented population of licensed drivers 65 and older. Determination of high-risk locations is at the discretion of the District Traffic Operations Engineer (DTOE).

- Arterials/Collectors without Median Openings

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FDM 230.4.5 Undivided One-Way Streets

230.4.5 Undivided One-Way Streets

For two-way street approaches, place the following signs and pavement markings as illustrated in ***Exhibit 230-6***:

(1) Place the corresponding turn prohibition (R3 Series) symbolic sign on the right-hand side of the approach street.

(2) Place DO NOT ENTER (R5-1) signs on both sides of the one-way street.

(3) Place Wrong-Way Arrow pavement markings in all lanes upstream of side street. Space Wrong-Way Arrow pavement markings no closer than 450 feet apart.

(4) Add turn and through lane-use arrow on approaches to the one-way street.

(5) For one-way approaches, place the following signs and pavement markings as illustrated in ***Exhibit 230-7***:

(6) Place the corresponding turn prohibition (R3 Series) symbolic sign. Where overhead structures exist, consider placement of a secondary turn prohibition sign over the lane or closest to the direction it is prohibiting.

(7) Place DO NOT ENTER (R5-1) signs on both sides of the one-way street.

(8) Place Wrong-Way Arrow pavement markings in all lanes prior to the side street. Space Wrong-Way Arrow pavement markings no closer than 450 feet apart.

- Undivided One-Way Streets
- WWD Arrows No Closer than 450 ft

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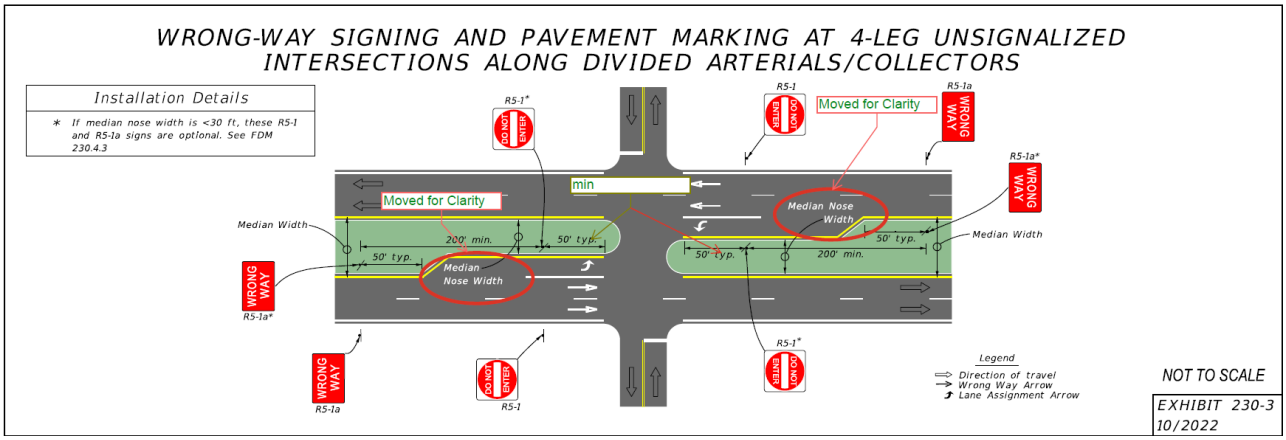
FDM Exhibit 230-3 Redline



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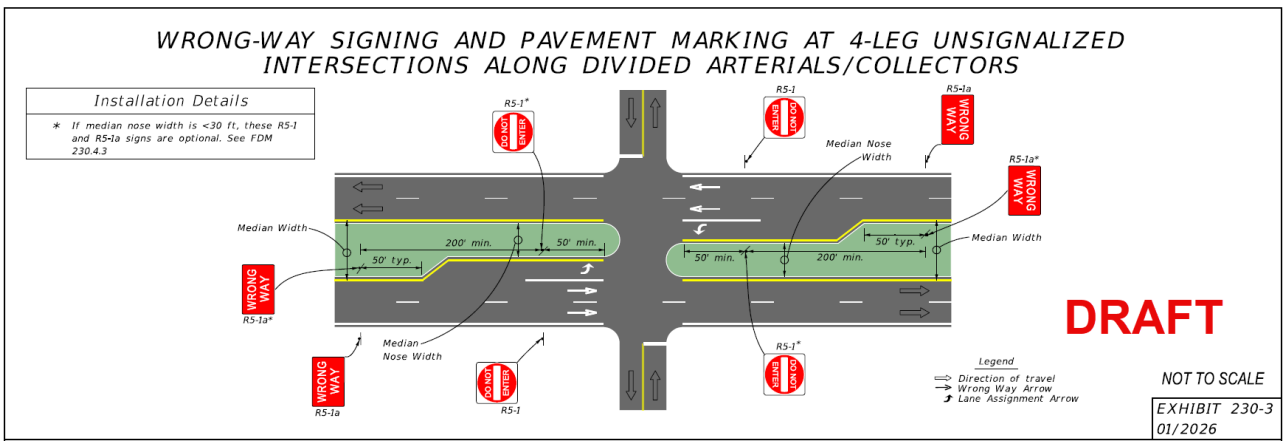
FDM Exhibit 230-3 DRAFT



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Q&A

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Contact Us

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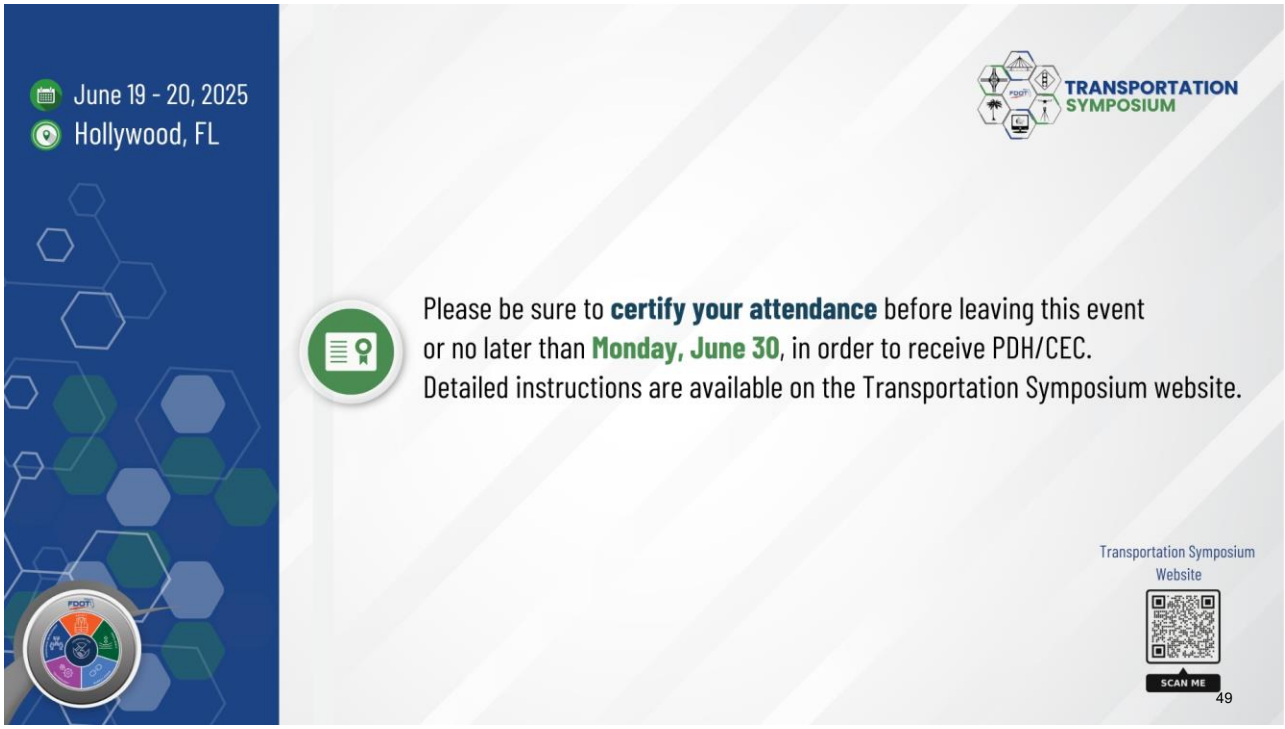
TRANSPORTATION SYMPOSIUM


June 19 - 20, 2025
Hollywood, FL
TRANSPORTATION SYMPOSIUM
Please be sure to certify your attendance before leaving this event
or no later than Monday, June 30, in order to receive PDH/CEC.
Detailed instructions are available on the Transportation Symposium website.
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