FDOT'S WRONG-WAY DRIVING (WWD) PROGRAM STRATEGIC PLAN

WINTER 2025

1. BACKGROUND

1.1 FDOT'S WWD PROGRAM TIMELINE

The intent of this strategic plan is to outline FDOT's activities to continue delivery of the WWD countermeasure deployment program to provide a safe transportation system for its road users. FDOT has a robust wrong-way driving (WWD) countermeasures implementation program comprised of enhanced signing and pavement markings (S&PM) and advanced Wrong-way Vehicle Detection Systems (WWVDS) along exit-ramps and ramp terminals. FDOT has been mainstreaming WWD countermeasure deployments since 2014 and is considered a national leader in its systemic approach to WWD countermeasure deployments. **Figure 1** highlights the milestones centered around wrong-way driving since 2014.

This plan outlines the implementation strategy for WWD countermeasures over the next five years along with other actions to be taken by central office and the districts over the next five years.

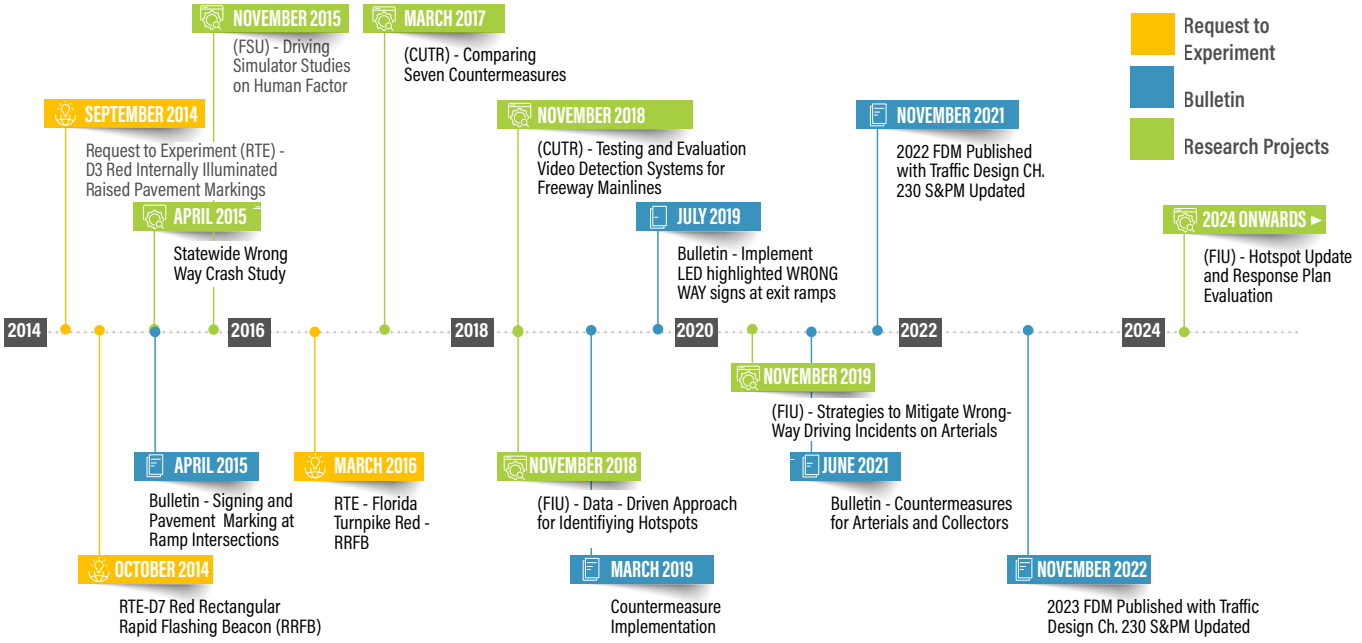


Figure 1. FDOT's Wrong-Way Driving Program Milestone Timeline

1.2 PAST RESEARCH

- **April 2015 Wrong Way Crash Study** | Studied wrong-way crashes on Florida's limited access roadways from 2009-2013.
- **November 2015 Driving Simulator Studies of the Effectiveness of Countermeasures to Prevent Wrong-Way Crashes** | Explored countermeasures to reduce wrong-way entries and crashes by analyzing their characteristics and studying how human factors affect countermeasure perception.
- **March 2017 Comparing Countermeasures for Mitigating Wrong-way Entries onto Limited Access Facilities** | Compared seven Intelligent Transportation Systems (ITS) technologies using data, road user surveys, and driver simulations to reduce wrong-way movements.
- **November 2018 Data Driven Approach for Implementing Wrong-way Driving Countermeasures** | Analyzed wrong-way crashes and identified hotspots to support countermeasure deployments. The research developed the WWD hotspots in the state considering factors such as demographics, land-use, and historical WWD crashes.
- **November 2018 Testing and Evaluation of Freeway Wrong-way Driving Detection Systems** | Evaluated the use of existing CCTV cameras to detect wrong-way drivers on freeways.
- **November 2019 Strategies to Mitigate Wrong-way Driving Incidents on Arterials** | Developed the list of hotspot locations on the arterial roadways for WWD crashes and recommended applicable countermeasures to prevent WWD crashes.

1.3 CRASH TRENDS

FDOT has a verified WWD crash database spanning from 2011 to the beginning of 2020 for both freeways and arterials. FDOT is currently working on updating the crash database with data from late 2020 to 2022.

Commonly observed patterns of freeway WWD crashes:

- 90% of freeway WWD crashes occur when it is dark outside (2022)
- 59% of freeway WWD crashes involve alcohol (2022)
- About 25% of freeway WWD crashes result in a fatality

Commonly observed patterns of arterial WWD 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 (52% injury and 7% fatal)
- Three (3x) times less likely to be in fatal crash compared to freeway WWD (7% fatal)

2. FDOT'S APPROACH TO PREVENT WWD CRASHES

2.1 FREEWAY /LIMITED ACCESS ROADWAY WWD COUNTERMEASURES

SIGNING AND PAVEMENT MARKINGS

As introduced through the **April 2015 Traffic Operation Bulletin (03-15),** FDOT requires enhanced signing and pavement markings (as compared to the MUTCD requirements) at freeway exit-ramps. FDOT enhancements consist of the following:

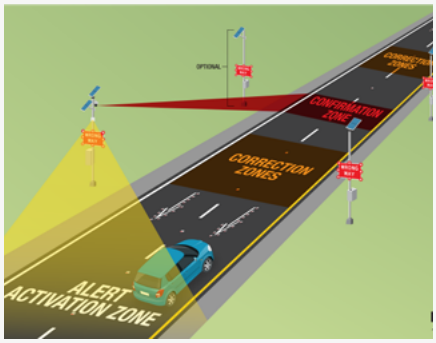
- Include MUTCD "optional" signs:
  - *Second DO NOT ENTER sign*
  - *Second WRONG WAY sign*
  - *ONE WAY signs*
- Include NO RIGHT TURN and NO LEFT TURN signs.
- Use 3.5 ft. by 2.5 ft. WRONG WAY signs mounted at 4-foot height with retroreflective strip on sign supports.
- Include 2-4 dotted guideline striping for left turns between ramps entrances/exits and cross-streets.
- Include retroreflective paint (yellow) on ramp median nose where applicable.
- Include a straight arrow and route interstate shield pavement marking in left-turn lanes extending from the far-side ramp intersection through the near-side ramp intersection to prevent premature left turns.
- Include a straight arrow and ONLY pavement message in outside lane approaching the ramp exit.

WRONG-WAY VEHICLE DETECTION SYSTEM

Also known as advanced countermeasures. these were introduced through the **July 2019 Traffic Engineering and Operations Bulletin (19-03).** The WWVDS include (see **Figure 2**):

- Flashing "WRONG WAY" signs only visible by a wrong way driver.
- Wrong-Way sensors that activate the signs and send alerts and images to the nearby Regional Transportation Management Center (RTMC) so operators/dispatchers can alert first responders and locate the wrong-way driver.
- Dynamic Message Signs to warn motorists of a wrong-way driver.

Figure 2. Typical WWVDS Operation



INNOVATIVE COUNTERMEASURE

FDOT continues to explore innovative countermeasures that can be effective in deterring WWD events.

To address specific scenarios FDOT will ideate, test, and deploy innovative countermeasures. The scenarios may include and not limited to:

- Mainline detection and warning system,
- Expediting awareness of events to the first responders,
- Communicating with motorists through navigation application and FL 511, etc.
- Other options for detection and driver feedback

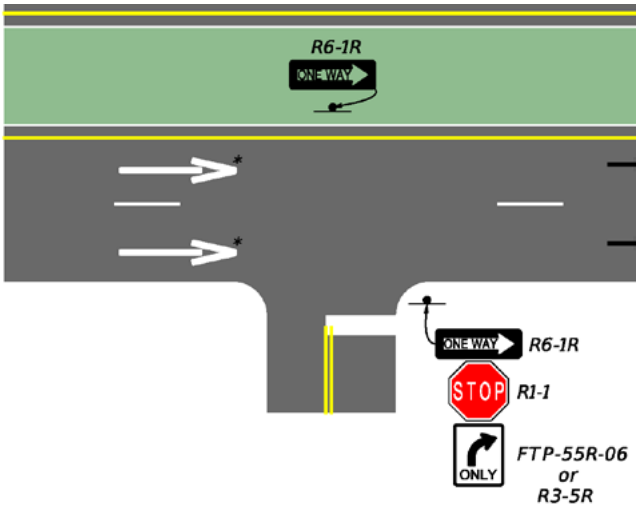
Refer to Section 7.1 for the implementation criteria for innovative countermeasures.

2.2 ARTERIAL WWD COUNTERMEASURES

Arterial WWD countermeasures were introduced through the **June 2021 Traffic Engineering and Operations Bulletin (21-03)** to provide enhanced signing and pavement marking requirements for arterial roadways. FDOT countermeasures have included the MUTCD "optional" signs and additional pavement markings to provide clearer directional navigation. See **Figure 3**. These countermeasures are often installed through corridor-long resurfacing, restoration and rehabilitation (RRR) projects, unlike the freeway WWVDS which are often installed by TSM&O projects. Some pavement-only projects (POP) projects may install just the pavement markings but neglect the signs, in such cases the District must create a plan to install the signs at a later date. Common arterial countermeasures can include:

- WRONG WAY Signs
- DO NOT ENTER Signs
- ONE WAY Signs
- RIGHT/LEFT TURN ARROW Signs
- Mandatory Lane Control Signs
- Turn Prohibition Signs
- Wrong-Way Arrow Pavement Markings
- Dotted Guide Center Lines for left turns

Figure 3. Sample of FDOT Design Manual Arterial WWD Graphics



3. COUNTERMEASURE DEPLOYMENT TRACKING

3.1 WWD RAMP IMPLEMENTATION AND PERFORMANCE DATA

FDOT provides resources for the Districts to update the countermeasure status of ramps as well as performance data (e.g., WWD events, self-corrections, crashes, and false events) for each WWVDS equipped ramp. The SharePoint site also assists with funding tracking and needs identification. The performance of WWVDS equipped locations is tracked quarterly.

3.2 WWD VISUALIZATION AND DEPLOYMENT STATUS

FDOT has visual tool that allows users to view historical freeway and arterial crash data as well as up-to-date countermeasure deployment status information.

4. STANDARDS AND GUIDANCE

4.1 CURRENT STANDARDS AND GUIDANCE

FDM section 230.4 contains guidance on wrong-way signing and pavement markings. It contains guidance and visuals for exit ramp intersections, diverging diamond intersections, divided arterials and collectors, one-way pairs, undivided one-way streets, and two-way divided intersections. **Table 1** shares the section and indices numbers of applicable standard specifications and plans.

Table 1. Current WWD Standard Specifications and Standard Plan locations

Standard Specifications sections 995-2.12 and 660-4.4	Contain minimum performance requirements for WWVDS before they can be added to the Approved Products List (APL) or receive final acceptance on a project site.
Supplemental Requirements 995-2.1-01	Establishes the software requirements to connect WWVDS into the SunGuide software. An update to this requirement is currently underway.
FDOT Standard Plans section 700-010 and 711-001	Contain requirements for signing and pavement markings. There are currently no standard plans for WWVDS setup.

4.2 EMERGING GUIDANCE

FDOT is going to develop solutions leveraging new technologies, such as computer vision, new uses of current technologies, and applying lessons learned to develop solutions to meet the District specific needs that are responsive to the field conditions. While hotspot ramps are going to be equipped with WWVDS, FDOT remains open to implement innovative solutions as applicable.

5. EDUCATION AND OUTREACH

An important overarching strategy in Florida's Strategic Highway Safety Plan is education. FDOT strives to improve public awareness of highway safety and increase motorists' understanding of the engineering solutions and best practices that can reduce the injury severity and number of crashes. Both the Central and District Safety Offices coordinate outreach campaigns which include efforts such as graphic publications, public service announcement (PSA) videos, news interviews, outreach events, etc. FDOT has significant outreach materials developed for the WWD Program. See the example in **Figure 4**.

FDOT's WWD program was recognized as an **AASHTO Innovative Initiative** and FDOT has presented its WWD program at multiple national conferences, symposiums, and webinars. This recognition has led to multiple states inquiring directly to help shape their own programs based on FDOT's. FDOT has held information exchanges with Kentucky, Maine, Massachusetts, Michigan, Wisconsin, and Washington and is willing to share information to help reduce WWD crashes nationwide.

As the industry evolves, training materials will need to be developed for new staff to ensure ease of knowledge transfer and the continued progress of the program.

Figure 4. Example Arterial WWD Education Graphic

6. RESEARCH

6.1 CURRENT RESEARCH

Evaluating the Strategic Response Plan to WWD Events on Freeways [December 2022- April 2025] (FIU): This research project aims to conduct a comprehensive evaluation of the FDOT's strategic response plan to WWD events on freeways. The study will also attempt to measure the effectiveness of the response plan in having a consistent and well-coordinated response to WWD events.

WWD Crash Database Update and Hotspot Model Update [April 2024- June 2025] (FIU): This research project reviews the police reports of all WWD crashes that occurred on the freeway and arterial network within the state highway system. Police reports of all WWD crashes from 2020-2022 will be extracted and reviewed in detail as part of each task. After reviewing the crash reports, the research team will run the hotspot analysis to identify WWD hotspots. FIU will also conduct before-after studies on WWVDS-equipped locations alongside this research.

6.2 FUTURE RESEARCH GOALS

Future research should focus on evaluating the effectiveness of current WWD solutions and identifying new countermeasures to help eliminate WWD. A potential topic area includes WWVDS Evaluation and research involving connected vehicles or other emerging technologies.

Identifying Locations with High WWD Risk and Effective Methods to Reduce WWD at Nonconventional Access Points and Construction Zones on Limited Access Roadways (UCF): Research collaboration between District 5 and UCF that will work to identify high risk locations for WWD as well as identifying the role that work zones play with WWD incidents. This research project is still under consideration.

7. ACTION ITEMS FOR PROGRAM MANAGEMENT

FDOT's WWD program will continue to support WWD countermeasure deployment throughout the state including, but not limited to, new WWVDS APL support, internal coordination for sharing best practices, and external communication to tell the story of what FDOT is doing to provide a safer transportation system for its road users. Action items are not meant to be limited to the following list below as FDOT's WWD program must be nimble to take on new actions when conditions change.

7.1 IMPLEMENTATION PLAN:

FDOT is working to maximize the coverage of WWD safety countermeasures and is investigating innovative ways to achieve this goal. Defining an implementation plan to ensure a consistent deployment strategy across the state is essential. The key aspects of the statewide WWD countermeasure implementation plan are defined below:

i. Per FDM 230.4, FDOT will deploy enhanced S&PM at all exit ramps.

ii. All hotspot locations defined in 2018 (BDV29-977-36) must have WWVDS implemented. All projects must be programmed for construction to start no later than FY 30

- Alternatively, if a District is unable to fund all hotspots locations for WWVDS construction no later than FY 30, detection-triggered LED-highlighted WRONG WAY signs must be deployed by June 2027, followed by camera installation for verification and communication to the RTMC by June 2032.

iii. Detection-triggered, LED-highlighted WRONG WAY signs, similar to those used as part of the WWVDS excluding the connection to the RTMC, can be installed at non-hotspot locations upon Districts' discretion.

iv. Developmental specifications will be developed for the detection-triggered, LED-highlighted WRONG WAY signs, whether they will be an intermediate countermeasure for the hotspots or an additional countermeasure for the non-hotspot exit ramps.

v. All innovative solutions need to be evaluated following the APL field and TERL testing criteria before implementation.

Table 2. Action Items of Wrong-Way Driving (WWD) Program Strategic Plan

ACTIVITY	STATUS	RESPONSIBILITY
1. Continue deployment of the enhanced S&PM at all off ramps and ramp terminals.	Underway	Districts
2. Continue deployment of the WWVDS at exit ramps with priority given towards hotspot locations. At hotspot locations where full WWVDS funding is planned in later years of the WWD Program's implementation, Department may explore innovative solutions to be deployed and monitored as intermediate countermeasure while working towards full WWVDS implementation.	Underway	Districts, TERL
3. Department to explore innovative solutions to be deployed as additional countermeasures if WWVDS is not going to be implemented for the non-hotspot locations.	Underway	Districts, TERL
4. If a WWVDS-equipped ramp undergoes construction activities, maintain existing WWVDS during the construction period	As needed	Districts
5. Implement Performance Measurement Management Plan through SunGuide enhancement to automate the process by making part of operators' response plan. Prior to SunGuide enhancement is made, the Districts are requested to provide performance updates through spreadsheet in a SharePoint site.	Underway	Districts, Central Office
6. Maintain/modify SunGuide supplemental requirements for various vendors including SunGuide Enhancement/ Automation processes.	As needed	TERL and SunGuide Team

ACTIVITY	STATUS	RESPONSIBILITY
7. Support device vendor testing for the APL process, new vendor onboarding, Standard Specifications update.	As needed	TERL
8. Update standards like FDM and Standard Plans	As needed	Central Office
9. Document the process for approval of innovative countermeasures (e.g., Off-Ramp Entrance Prevention System (OREPS)).	Underway	Central Office
10. Continue WWD crash analysis notified by Executive Alerts; support in-reach through the WWD Working Group meetings and outreach.	Underway	Central Office
11. WWD crash database update and hotspot model update (new hotspots to be added to existing target list).	Underway	Central Office
12. Maintenance and certification of existing WWVDS.	Planned	Districts
13. Implement Connected Vehicle and FL 511 Application messaging to motorist.	Planned	Central Office, Districts
14. Explore deploying WWD mainline detection systems.	Planned	Districts, Central Office
15. Continue research efforts to evaluate the effectiveness of WWD countermeasures	Planned	Central Office
16. Develop training materials on WWD Program for FDOT Staff	Planned	Central Office
17. Identify future funding sources for WWD countermeasures	As Needed	Central Office, Districts
18. Continue to develop initiatives that strengthen relationship between FDOT and law enforcement/first responder agencies	As Needed	Districts