

AASHTO Innovation Initiative

**FDOT's Wrong-Way Driving Initiative**

Nomination of Innovation Ready for Implementation

**Sponsor**

Nominations must be submitted by an AASHTO member DOT willing to help promote the innovation. If selected, the sponsoring DOT will be asked to promote the innovation to other states by participating on a Lead States Team supported by the AASHTO Innovation Initiative.

1. Sponsoring DOT (State): Florida Department of Transportation (FDOT)
2. Name and Title: Raj Ponnaluri, PhD, PE, PTOE, PMP

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**Innovation Description (10 points)**

The term "innovation" may include processes, products, techniques, procedures, and practices.

3. Name of the innovation:

FDOT Statewide Wrong-Way Driving (WWD) Countermeasures Deployment Program

4. Please describe the innovation.

Wrong-Way Driving (WWD) crashes occur randomly and less frequently than other crash types; however, they often involve multiple vehicles, resulting in multiple fatalities and/or serious injuries. FDOT installs the

required DO NOT ENTER and WRONG WAY signs and pavement markings (wrong-way arrow, etc.) per the Manual on Uniform Traffic Control Devices (MUTCD), as well as the higher Signing and Pavement Marking Standards per FDOT Design Manual (FDM) Section 230.4. Higher standards were added to the FDM for interstate exit ramps via a statewide bulletin in 2015 and 2019. The FDM was further modified in 2021 through another statewide bulletin to include arterial WWD S&PM standards. FDOT has also been exploring various WWD countermeasure systems for warning wrong-way drivers, verification of the wrong-way vehicles and sending alerts to Regional Transportation Management Center (RTMC)/ Traffic Management Center (TMC) upon the detection of wrong-way vehicles. To reduce the number of WWD crashes more aggressively, FDOT conducted a statewide study and based on a risk analysis, 520 off-ramps were found to occur in the WWD hotspots. FDOT evaluated several countermeasures and found the Light Emitting Diode (LED) highlighted WRONG WAY signs to be one of the most effective countermeasures to warn a wrong-way entering motorist, notify other motorists and send alerts to RTMC/TMC. FDOT has updated the FDM, the Standard Plans for Road and Bridge Construction (Standard Plans), the Standard Specifications for Road and Bridge Construction (Standard Specifications), and the Basis of Estimates Manual (BOE) with the details of the highlighted wrong-way signs through the publication of the 2019 statewide bulletin. Currently, the countermeasures are being deployed statewide with a significant number of off-ramps already completed. Besides mainstreaming freeway WWD countermeasures deployment, FDOT has also identified the arterial corridors that are hotspots for arterial WWD crashes. FDOT developed countermeasures to prevent arterial WWD crashes and updated the state's design guidelines for mainstreaming. FDOT Districts are now deploying the newly developed arterial countermeasures along the hotspot corridors. A final aspect of the Department's WWD initiative is education. The FDOT is being proactive with communicating with the public about the dangers of WWD, and their role in eliminating instances of it. In 2021, the Department updated its WWD website ([fdot.tips/wrongway](https://fdot.tips/wrongway)). This website highlights all the efforts described above, including research conducted by the Department, and the countermeasure deployment plan. Finally, the website contains an education portion to help drivers understand these new countermeasures simply and how they help prevent a WWD crash.

5. What is the existing baseline practice that the innovation intends to replace/improve?

Prior to the FDOT undertaking the WWD countermeasure deployment initiative, there was no consistent statewide guidance to specifically address wrong-way entry on freeway ramps or on arterial roadways. The FDOT initiated the practice with developing a comprehensive standard for signing and pavement markings (S&PM) by publishing a statewide [bulletin](#) and updating the FDM [Section 230.4](#) guidelines for freeway intersections. Based on conducted statewide studies, the FDOT has developed a countermeasure implementation plan for deploying LED highlighted WRONG WAY signs at 520 hotspot off-ramps and gradually all statewide off-ramps. FDOT issued a statewide [bulletin](#) to mainstream the deployment of LED highlighted WRONG WAY signs. This does not replace any existing baseline practice. To prevent arterial WWD crashes, FDOT issued another statewide [bulletin](#) for arterial WWD countermeasure deployment.

6. What problems associated with the baseline practice does the innovation propose to solve?

The baseline practice did not include a specific countermeasure to prevent wrong-way driving at freeway exit ramps or arterial roadways. The S&PM deployment ensures consistency at exit ramps across the state that benefits motorists. The LED highlighted sign countermeasures provide enhanced warning to wrong-way driving motorists, which previously did not exist. Moreover, adopting a consistent practice will enable the FDOT to create a consistent driving experience on freeways and arterials, as well as develop a competitive market to furnish countermeasures at a lower rate. The LED highlighted sign solution is also capable of detecting a wrong-way driver and sending alerts to the RTMC/TMC via a Wrong Way Vehicle Detection System (WWVDS). This enables the RTMC operators to quickly coordinate with law enforcement for dispatch and to activate dynamic message signs (DMS) to warn the right-way motorists to the presence of a WWD and advise them to use extreme caution. Additional WWD signing and pavement markings installed on arterial corridors will provide additional guidance to the motorists as they navigate and make any wrong-way movements.

7. Briefly describe the history of its development.

The essential feature of FDOT's WWD Initiative is that, in addition to engineering, education, and enforcement, a fourth 'E' is being employed. The FDOT also focuses on the 'evolution' of ways to mitigate WWD. The hallmark of creating an innovative, ongoing WWD effort rest in continual consultation, coordination, and communication. The first step in the process can be traced to two engineering-focused projects: one in the FDOT Panhandle region, in partnership with FDOT District 3 leadership, and one on Florida's Turnpike in partnership with the Florida Turnpike Enterprise (FTE). District 3 and FTE offices evaluated locations that would benefit from WWD countermeasure pilot deployments. The initial FTE pilot effort was deployed on an 18-mile section of the Homestead Extension in South Florida. Initially, FTE deployed DO NOT ENTER, WRONG WAY, ONE WAY, No Left/U Turns, and Keep Right signs. Additional wrong-way arrows were added to the pavement along the exit ramps. Later, driver-alerting technology was implemented along with mainline detection of a WWD movement. District 3, on the other hand, identified four I-10 interchanges for designing and implementing WWD countermeasures in the Tallahassee area. Similar to the FTE, this pilot project installed additional S&PM and vehicle-activated wrong-way blank-out signs. Interstate pavement shields with straight arrows were added to the adjoining arterial turn lanes to discourage improper turns. Concurrently, the Department was supporting the development and incorporation of a WWD response module into its SunGuide® freeway management system. These initial engineering pilot projects supported the evolution of WWD countermeasures in the state and spurred the further development of WWD mitigation measures. While these pilot projects were being deployed, several fatal WWD incidents occurred, which sparked media inquiries and suggestions from citizens. This propelled the Department forward with the initiative. The next step the FDOT took was experimenting with potential WWD warning devices and advanced countermeasures at the Department's Traffic Engineering Research Laboratory (TERL). The outcome of these device evaluations was to seek approval from the Federal Highway Administration (FHWA) on two requests from experiments. The first was for the red-RRFB, and the second for internally illuminated raised pavement markers (IIRPM). Testing these devices was another step in evolving the WWD initiative, as they could then be considered

for in-field countermeasure deployments. The WWD fatal crash occurrences also propelled District 7 leadership to take engineering action. The attention from the media and public generated by the crashes in the Tampa Bay area clearly articulated the need for stronger WWD mitigation efforts in the region. As a result, District 7 leadership conducted an inventory of exit ramps, upgraded S&PM districtwide, and installed red RRFBs via FHWA experiment. Statewide, more information on WWD was needed to make informed, engineering decisions on the matter. This drove the evolution of several Department research studies. A statewide study of the baseline situation of S&PM identified some specific signs and pavement marking that could potentially reduce wrong-way entries. Another human-factor study investigated the effectiveness of the S&PM in a simulation environment. The combined findings from both these studies were used to develop the new S&PM which have been deployed throughout state at all exit ramps. Another study compared the effectiveness of seven WWD countermeasures that were deployed in different pilot projects and compared their effectiveness using before and after crash data, field testing using focus groups, a public opinion survey, and a human factors approach using driving simulation. A comprehensive data driven study identified the WWD hotspots based on WWD crash data and other factors including impaired drivers, drivers aged 65 years and older, and tourists. The study identified 520 exit ramps in the state for priority deployment. All these engineering efforts led to the evolution of the WWD Countermeasure Deployment Program. Now knowing which countermeasures are most effective and where to prioritize deployment, the FDOT allocated \$15 million for deploying LED highlighted countermeasures at these 520 exit ramps. Gradually all exit ramps will be deployed with S&PM countermeasures and LED highlighted signs with warning systems and communication to the RTMC capabilities. The LED highlighted signs not only warn the WWD that they are proceeding in the wrong direction but also alert the RTMC of the WWD. This allows the RTMC staff to notify the Florida Highway Patrol (FHP), so they can intercept the WWD. The real-time notification of law enforcement allows for a shorter response time, increasing the likelihood the wrong-way vehicle being intercepted before causing a crash. The final, and most recent development is the education portion of the WWD initiative. Recognizing the fact that arterial WWD crashes are far more frequent than freeway WWD crashes, FDOT conducted a statewide study to identify arterial WWD crash hotspot locations and develop a set of countermeasures for various arterial roadway geometry. FDOT is currently deploying additional signs and markings developed for arterial WWD crashes along the hotspots. It is important to communicate with the public about the dangers of WWD, and how they can help eliminate it from our roadway. Also, it is important to educate drivers about the countermeasures being installed, as they are new and might not have been encountered before. The FDOT is achieving WWD education through the FDOT WWD initiative's webpage.

8. What resources—such as technical specifications, training materials, and user guides—have you developed to assist with the deployment effort? If appropriate, please attach or provide weblinks to reports, videos, photographs, diagrams, or other images illustrating the appearance or functionality of the innovation (if electronic, please provide a separate file). Please list your attachments or weblinks here.

FDOT's WWD initiatives webpage: <https://www.fdot.gov/traffic/its/projects-deploy/wrong-way-driving>

**Statewide Bulletins:** FDOT has issued three (3) statewide bulletins.

> Bulletin for deploying S&PM countermeasures at all off-ramps. *Bulletin link:*

[https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/traffic/traffic/doc\\_library/pdf/rdb15-08.pdf?sfvrsn=1caac098\\_0](https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/traffic/traffic/doc_library/pdf/rdb15-08.pdf?sfvrsn=1caac098_0)

> Bulletin to deploy LED highlighted wrong-way signs at 520 off-ramps on a priority basis and gradually all off-ramps in the state. *Bulletin link:* [https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/traffic/doc\\_library/pdf/wwd-joint-bulletin\\_revised-doc-310046356.pdf?sfvrsn=272ebb43\\_2](https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/traffic/doc_library/pdf/wwd-joint-bulletin_revised-doc-310046356.pdf?sfvrsn=272ebb43_2)

> Bulletin to arterial WWD countermeasures. *Bulletin link:*

[https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/traffic/doc\\_library/pdf/rbd-21-07-wrong-way-driving-countermeasures-for-arterials-and-collectors.pdf?sfvrsn=db036e4\\_0](https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/traffic/doc_library/pdf/rbd-21-07-wrong-way-driving-countermeasures-for-arterials-and-collectors.pdf?sfvrsn=db036e4_0)

**FDOT Design Manual Update:** The countermeasures for WWD are outlined in FDM Section 230.4.

*Link:* <https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/roadway/fdm/2021/2021fdm230spavtmarkings.pdf?>

**Standard Plans:** FDOT Standard Plans Index 700-120 outlines the design details of a typical wrong-way sign assembly. *Link:* [https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/design/standardplans/2021/idx/700-120.pdf?sfvrsn=f16272b8\\_2](https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/design/standardplans/2021/idx/700-120.pdf?sfvrsn=f16272b8_2)

**Standard Specifications:** In the FDOT Standard Specifications, the wrong-way vehicle detection system requirements are outlined under sections 660-2.2.1.4 Wrong Way Vehicle Detection Systems, 660-3.7 Wrong Way Vehicle Detection Systems (WWVDS) Installation, and 660-4.4 Wrong Way Vehicle (WWVDS) Detection System. The color of LEDs on the highlighted wrong-way signs is specified in Section 700-3.2.2 Highlighted Signs. Configuration and communication requirements for the highlighted wrong-way signs are outlined in Section 995-2.7 Wrong Way Vehicle Detection Systems (WWVDS).

Performance of the highlighted wrong-way sign assembly is outlined under Section 995-2.11 Wrong Way Vehicle Detection System (WWVDS) Performance. (*Link:*

<https://www.fdot.gov/programmanagement/implemented/specbooks/default.shtm>)

**Completed Research/Studies:**

**Title:** Statewide Wrong-way Crash Study (*Link:* [https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/research/reports/statewide-wrong-way-crash-study.pdf?sfvrsn=e905dafb\\_2](https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/research/reports/statewide-wrong-way-crash-study.pdf?sfvrsn=e905dafb_2))

**Title:** Driving Simulator Studies of the Effectiveness of WWD Countermeasures (*Link:* <https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/research/reports/fdot-bdv30-977-10-rpt.pdf>)

**Title:** Comparing Countermeasures for Mitigating Wrong-Way Entries onto Limited Access Facilities (*Link:* <https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/research/reports/fdot-bdv25-977-29-rpt.pdf>)

**Title:** Testing and Evaluation of Freeway Wrong-way Driving Detection Systems (*Link:*

<https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/research/reports/fdot-bdv25-977-40-rpt.pdf>

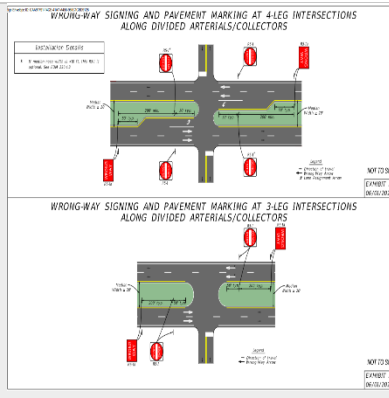
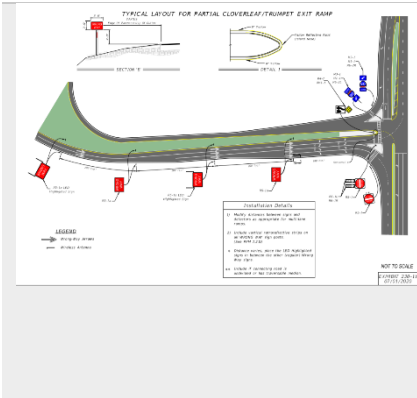
**Title:** A Data-Driven Approach to Implementing Wrong-way Driving Countermeasures (Link:

<https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/research/reports/fdot-bdv29-977-36-rpt.pdf>

**Title:** Strategies to Mitigate Wrong-way Driving Incidents on Arterials (Link:

<https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/research/reports/fdot-bdv29-977-50-rpt.pdf>

Attach photographs, diagrams, or other images here. If images are of larger resolution size, please provide as separate files.



**Florida Department of TRANSPORTATION**  
Integrity. Safety. Creativity. Mobility. Inclusive Innovation.

**Traffic Engineering and Operations Office**

**Wrong-way Driving**

**FDOT's Wrong-Way Driving (WWD) Initiative**

Research | Countermeasures | Education | Frequently Asked Questions

While wrong-way driving (WWD) crashes occur infrequently and less frequently than other types of crashes, they often involve more than one vehicle and can result in multiple fatalities and/or serious injuries.

FDOT initiates the maximum required FDOT WWD (WWD) and WWD (WWD) signs and pavement markings (wrong-way arrow, etc.) in accordance with the federal *Manual on Uniform Traffic Control Devices (MUTCD)*. However, there are other additional signage and pavement marking requirements as referenced in the following FDOT documents:

- Exit Ramp Intersections: Section 208.4 of the Florida Design Manual (FDM)
- Signing and Pavement Marking Standards at Ramp Intersections: Roadway Design Bulletin 18-08/Traffic Operations Bulletin 08-16
- Wrong Way Driving/Advanced Countermeasures at Interchange Exit Ramps: Traffic Engineering and Operations Bulletin 18-03
- Wrong-Way Driving Countermeasures for Arterials and Collectors: Traffic Engineering and Operations Bulletin 21-05

Supported by research, IJC's *Wrong-Way Driving Initiative* explores various WWD countermeasure systems to aid in reducing wrong-way driving, lowering fatalities, and other incidents and injuries, and encourages the transportation community to learn more about this initiative.

The WWD Initiative supports the FDOT's commitment to achieving zero fatalities and serious injuries on the State Highway System.



## State of Development (40 points)

Innovations must be successfully deployed in at least one State DOT. The All selection process will favor innovations that have advanced beyond the research stage, at least to the pilot deployment stage, and preferably into routine use.

9. How ready is this innovation for implementation in an operational environment? Please select from the following options. Please describe.

- Prototype is fully functional and yet to be piloted
- Prototype has been piloted successfully in an operational environment
- Technology has been deployed multiple times in an operational environment
- Technology is ready for full-scale implementation

FDOT identified 520 exit ramps for priority deployment of LED highlighted WRONG WAY signs with an allocation of \$15 million. Other exit ramps that are not included in the priority list will be eventually deployed with WWD countermeasures for mainstreaming. Newly developed arterial WWD countermeasures are also being deployed along WWD hotspot arterial corridors.

10. What additional development is necessary to enable implementation of the innovation for routine use?

The FDOT coordinated with the Federal Highway Administration and internal FDOT offices. The FDOT issued the Traffic Engineering and Operations Bulletin 19-03 on July 1, 2019, with additional minimum requirements for limited-access facility exit ramp interchanges throughout the State of Florida. FDOT has updated all standards and design guidelines. FDOT is now currently including vendor products in its Approved Product List. Already three (3) vendors successfully completed all testing to be included while several others are in the process. FDOT has also developed and distributed Standard Operating Guidelines for RTMCs for consistent practice across the state in the event of wrong-way driving notification. The FDOT issued another Traffic Engineering and Operations Bulletin 21-03 on June 1, 2021, with addition minimum requirements for arterial roadways throughout Florida. Even with this publication being so recent, these new countermeasure standards are already being deployed in the state.

11. Are other organizations using, currently developing, or have they shown interest in this innovation or of similar technology??  Yes  No

If so, please list organization names and contacts. Please identify the source of this information.



Organization	Name	Phone	Email
FDOT – District 7 Traffic Operations Engineer	Ronald Chin	813-975-6253	ronald.chin@dot.state.fl.us
FDOT – Central Office Safety	Lora Hollingsworth	850-414-4177	lora.hollingsworth@dot.state.fl.us
FDOT – Central Office Safety	Brenda Young	850-414-4146	brenda.young@dot.state.fl.us

## Potential Payoff (30 points)

Payoff is defined as the combination of broad applicability and significant benefit or advantage over baseline practice .

12. How does the innovation meet customer or stakeholder needs in your State DOT or other organizations that have used it?

FDOT has been able to improve safety at hotspot exit ramps by installing S&PMs and LEDs surrounding WRONG-WAY signs. A pilot study was conducted by the Florida’s Turnpike Enterprise on its 35 exit ramps. The exit ramps were equipped with LED highlighted wrong-way signs with detection technologies and communication to the RTMC. The countermeasures also included verification cameras to verify if the wrong-way vehicles have turned around or not. Turn-around rate was used as a measure of performance for the deployed systems. The deployed systems began operation in October of 2014. From the beginning of operation till March 2021, 159 confirmed cases of WWD entries were reported of which 155 (98%) turned around (self-corrected) after activation of the LEDs in the prohibition signs. Highlighted Wrong-Way signs have been proven to be one of the most effective wrong-way countermeasures. These detection-triggered signs provide warning to motorists driving the wrong-way on an exit ramp, send real-time alert to RTMCs for DMS activation and law enforcement dispatch, encourage wrong-way drivers to turn around and correct their path prior to entering the freeway thereby reducing fatalities and serious injuries resulting from WWD incidents.

13. Identify the top three benefit types your DOT has realized from using this innovation. Describe the type and scale of benefits of using this innovation over baseline practice. Provide additional information, if available, using quantitative metrics, to describe the benefits.

Benefit Types	Please describe:
Improved Safety	The advanced countermeasures reduced the risk of WWD events on high-risk exit ramps. LED highlighted WRONG WAY sign deployments along 35 FTE exit ramps resulted in 98% turn-around out of 159 wrong-way entries

<p>Cost Savings</p>	<p>Though infrequent, WWD crashes come at a high cost, as they are often associated with serious injuries and fatalities. Reducing these crashes at the exit ramps with the advanced countermeasures results in high benefit-cost ratios. Benefit-cost analyses were conducted for statewide implementation of advanced countermeasures at all exit ramp locations. If we assumed all WWD crashes within 0.5 mile of the ramp were mitigated, the B/C ratio is 8. If assumed all WWD crashes within 2 miles of ramp are mitigated, the B/C ratio is 13. Just an 9% crash reduction across the freeway system is the break-even point of the signing and pavement marking retrofit deployment.</p>
<p>Improved Operation Performance</p>	<p>The FDOT's WWD Countermeasure Implementation Plan provides specific guidance to proactively deploy WWD countermeasures, both on freeway ramps and arterials. Particularly, it provides guidance on a proactive approach for identifying locations that are prone to WWD incidents, and the WWD incident categories to be addressed at these locations. In addition to implementing engineering countermeasures that target specific WWD incident categories, knowing at-risk locations can assist law enforcement agencies and advocacy groups in identifying where to focus their efforts to deploy resources so that their efforts can be most effective.</p>

Provide any additional description, if necessary:

The FDOT has a webpage dedicated to WWD. Please visit <https://www.fdot.gov/traffic/its/projects-deploy/wrong-way-driving>

14 How broadly might this innovation be deployed for other applications. in the transportation industry (including other disciplines of a DOT, other transportation modes, and private industry)?

WWD crashes are not limited to Florida. States that would like to reduce WWD crashes on limited-access facility ramps and arterial corridors, can use the same process and documentation that the FDOT developed: determine the most predominant factors that could potentially contribute to WWD incidents at exit ramp locations, prioritize the exit ramp and arterial corridors for installing WWD countermeasures, and deploy the countermeasures according to the prioritization. The review of the performance of these countermeasures at the deployed sites and anecdotal evidence suggests close to 100% success in preventing WWD incidents. States will also know what institutional changes are needed to execute this project.

## Market Readiness (20 points)

The All selection process will favor innovations that can be adopted with a reasonable amount of effort and cost, commensurate with the payoff potential.

15. What specific actions would another organization need to take along each of the following dimensions to adopt this innovation?

Check boxes that apply	Dimensions	Please describe:
<input checked="" type="checkbox"/>	Gaining executive leadership support	The FDOT worked with the FHWA and FDOT internal Offices to issue joint bulletins for the arterial and freeway ramp countermeasures.
<input checked="" type="checkbox"/>	Communicating benefits	The FDOT prepared the WWD Performance Measurement and Management Plan (PMMP) to track the performance of the deployed countermeasures on exit ramps. The WWD PMMP details the performance measures and how to record and monitor the performance of the system periodically.
<input checked="" type="checkbox"/>	Overcoming funding constraints	The FDOT used the federal Highway Safety Improvement Program (HSIP) funds which sole purpose is to achieve a significant reduction in traffic fatalities and serious injuries on public roads. Also, by using a data driven approach to prioritize countermeasure deployment, the FDOT can maximize the impact of their investments.
<input checked="" type="checkbox"/>	Acquiring in-house capabilities	The FDOT used its Districts and research from Florida's

		universities to analyze the high-risk ramps and arterial corridors; and developed the countermeasures.
<input type="checkbox"/>	Addressing legal issues (if applicable) (e.g., liability and intellectual property)	No legal issues with deployment of LED highlighted signs.
<input checked="" type="checkbox"/>	Resolving conflicts with existing national/state regulations and standards	The FDOT worked with FHWA to ensure that the LED highlighted WRONG WAY signs conform to the MUTCD.
<input type="checkbox"/>	Other challenges	N/A

16. Please provide details of cost, effort, and length of time expended to deploy the innovation in your organization.

**Cost:** *Limited access facilities:* a total of \$15 million was allocated for priority deployment at 520 off-ramps out of 1,282 off-ramps statewide within WWD hotspots. The cost of deployments varies from area to area within the state and functionalities desired (e.g., availability of fiber optic connection or cellular back-haul, availability of AC power source or solar panels and detection technologies). If all these ramps were to be deployed with these countermeasures, this would incur a total cost of \$45 million. Cost for S&PM deployment per ramp vary from \$5,000 to \$10,000.

*Arterial facilities:* the cost of deployment along arterials varies depending on the arterial geometry. It will cost approximately \$5.9 million for installing arterial WWD signing and markings along 415 arterial hotspot miles.

**Level of Effort:** The level of effort has been moderate. All the FDOT Districts are actively implementing the advanced countermeasures

**Time:** The WWD implementation has been ongoing since 2014 on a pilot basis. However, statewide implementation of LED highlighted WRONG WAY signs is ongoing since 2019, and arterial S&PM began in 2021.

17. To what extent might implementation of this innovation require the involvement of third parties, including vendors, contractors, and consultants? If so, please describe. List the type of expertise required for implementation.

The innovation requires vendors to install the signing and pavement markings, and LED highlighted signs with wrong-way vehicle detection systems. The type of expertise would be technicians and system engineers skilled in intelligent transportation systems, configuration, and integration.