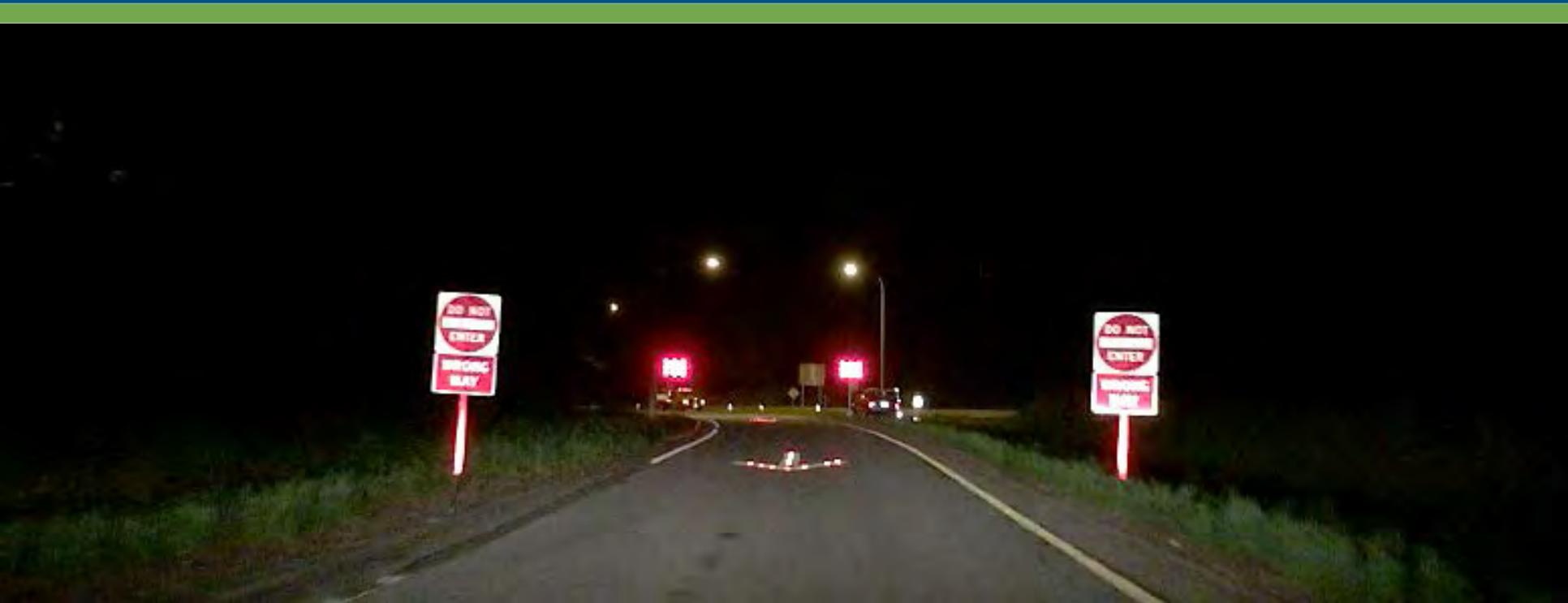




# RIDOT's Wrong-Way Driving Mitigation Program

Institute of Transportation Engineers – 2015 Annual Joint Meeting  
November 2, 2015 | 6:00 PM



Dedicated to Dan Waugh – RIDOT's Wrong Way Driving Program Project Manager



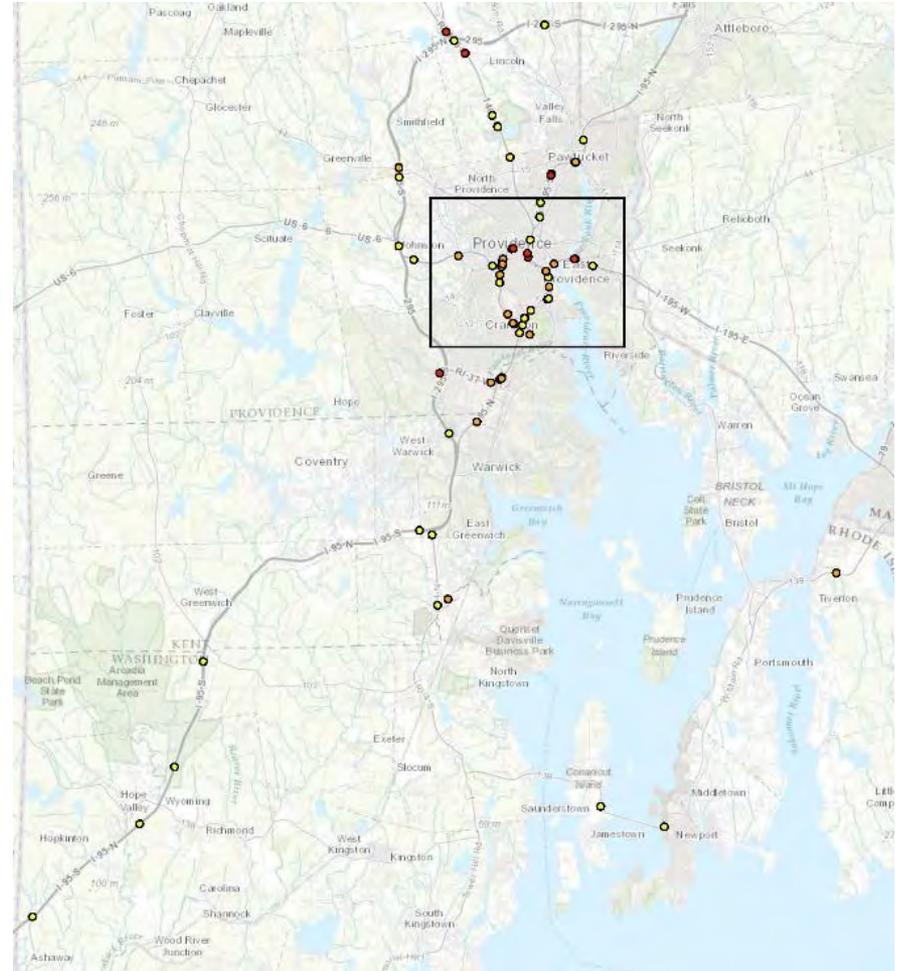
- What are the wrong-way driving issues?
- Where are these issues occurring?
- When are these issues occurring?
- What is RIDOT doing about these issues?
- Effectiveness of efforts to date
- Continued efforts



- Nationwide Issue
  - 360 fatalities in 260 wrong-way crashes occurs annually
  - 2.8% of all fatalities involve a wrong-way driver
- Rhode Island – January 2010 to August 2015
  - 91 wrong-way driving occurrences reported
  - 34 crashes (37%) resulting in 56 injuries
  - 13 fatalities resulting from 10 crashes
  - 30% of all wrong-way driving crashes result in a fatality
  - 3.7% of all fatalities involve a wrong-way driver
  - 7 (54%) of the 13 fatalities were the “right-way” vehicle

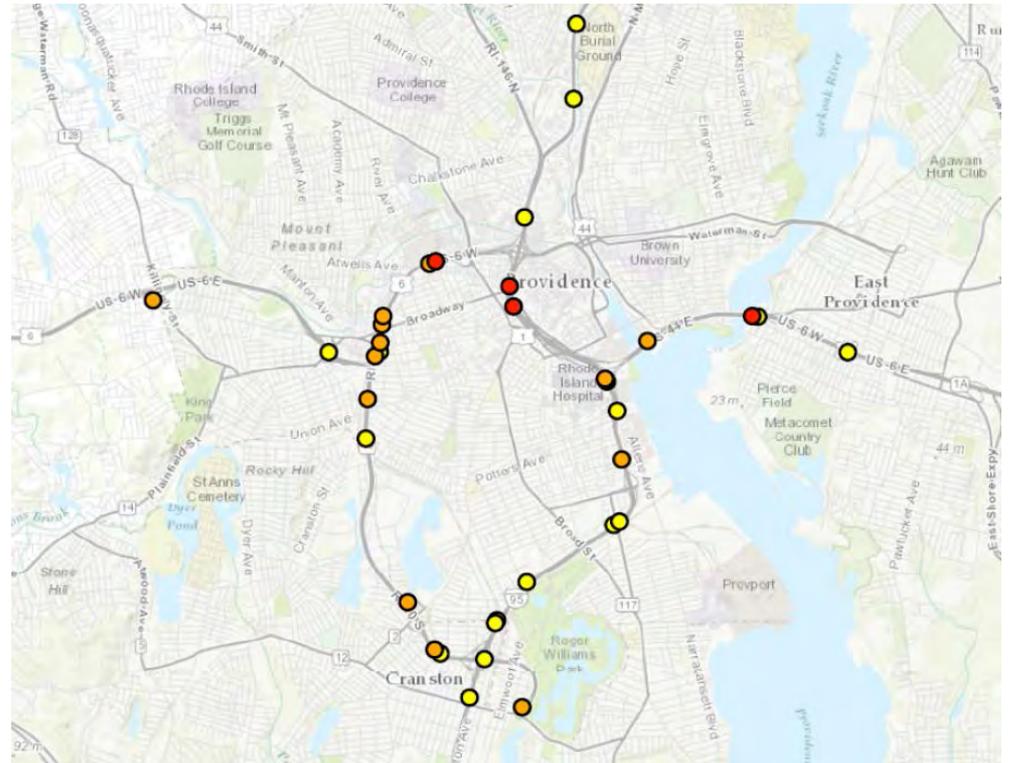
## Where are the Wrong-Way Driving Incidents Occurring?

- 80% of wrong-way driving incidents occur in:
  - Providence
  - Pawtucket
  - Cranston
  - Warwick
  - Lincoln

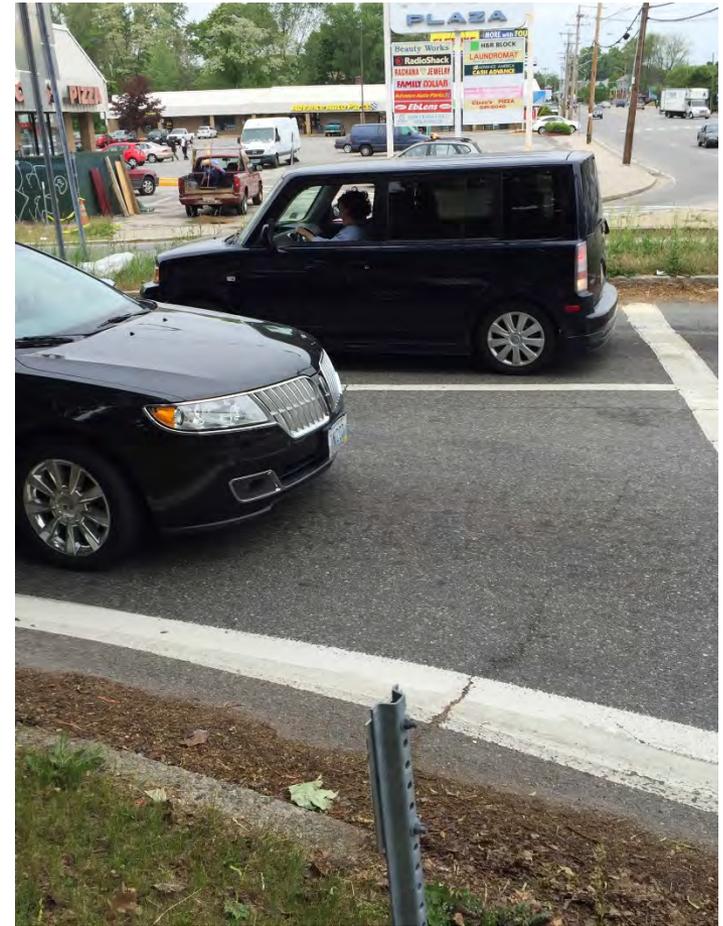


## Where are the Wrong-Way Driving Incidents Occurring?

- 80% of wrong-way driving incidents occur on:
  - Interstate 95
  - Route 6/10
  - Route 10
  - Interstate 195



- Possible entrance points for wrong-way vehicles:
  - 41% occur at “Isolated” ramps
  - 23% occur at Partial Cloverleaf ramps (side-by side)
  - 12% occur at these special situation ramps:
    - Route 6/10 at Memorial Blvd
    - Interstate 95 at Thurbers Avenue
    - Route 146 Full-Access Segment



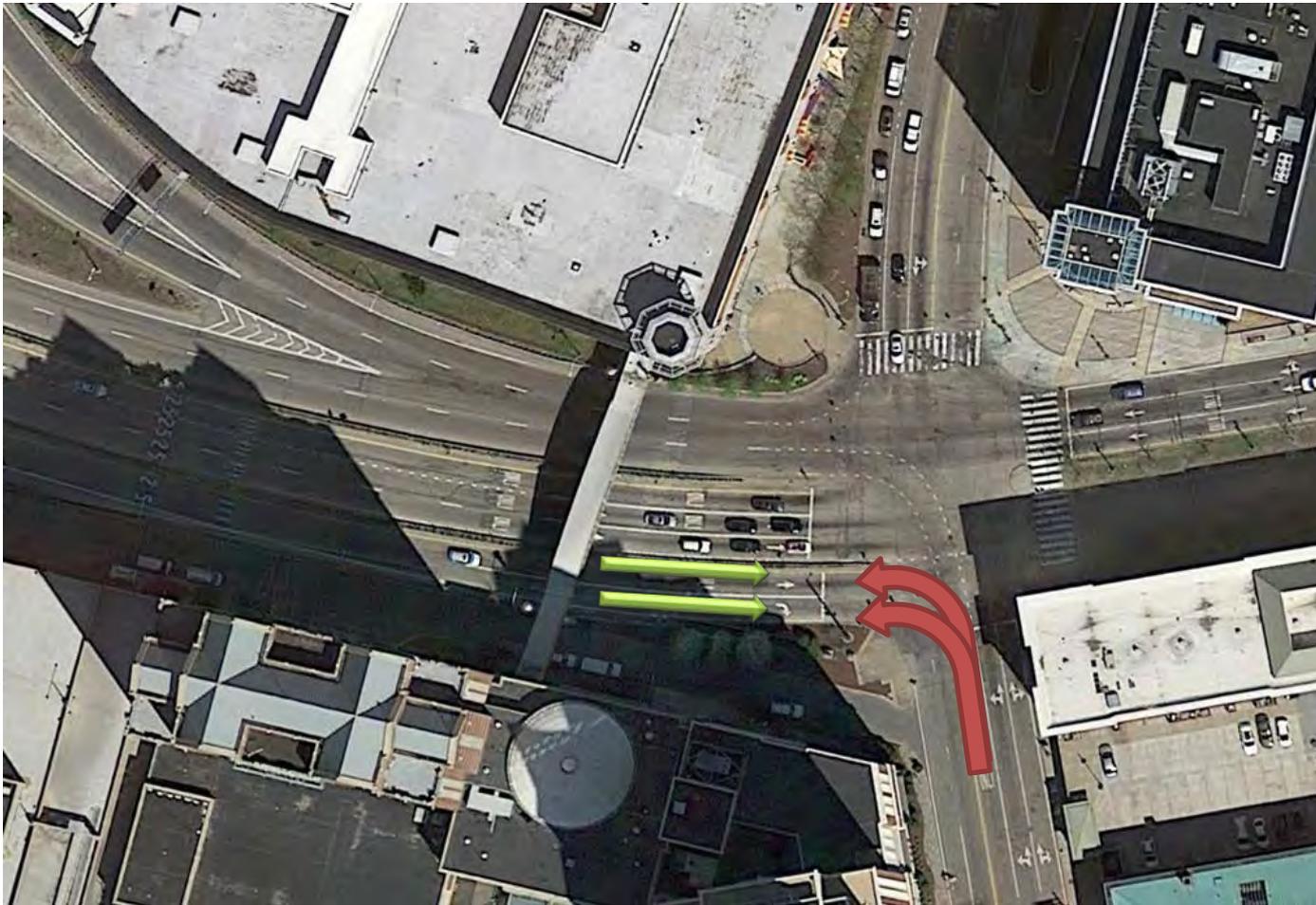
- “Isolated” off-ramps: Interstate 95 NB at Exit 26 - Pawtucket

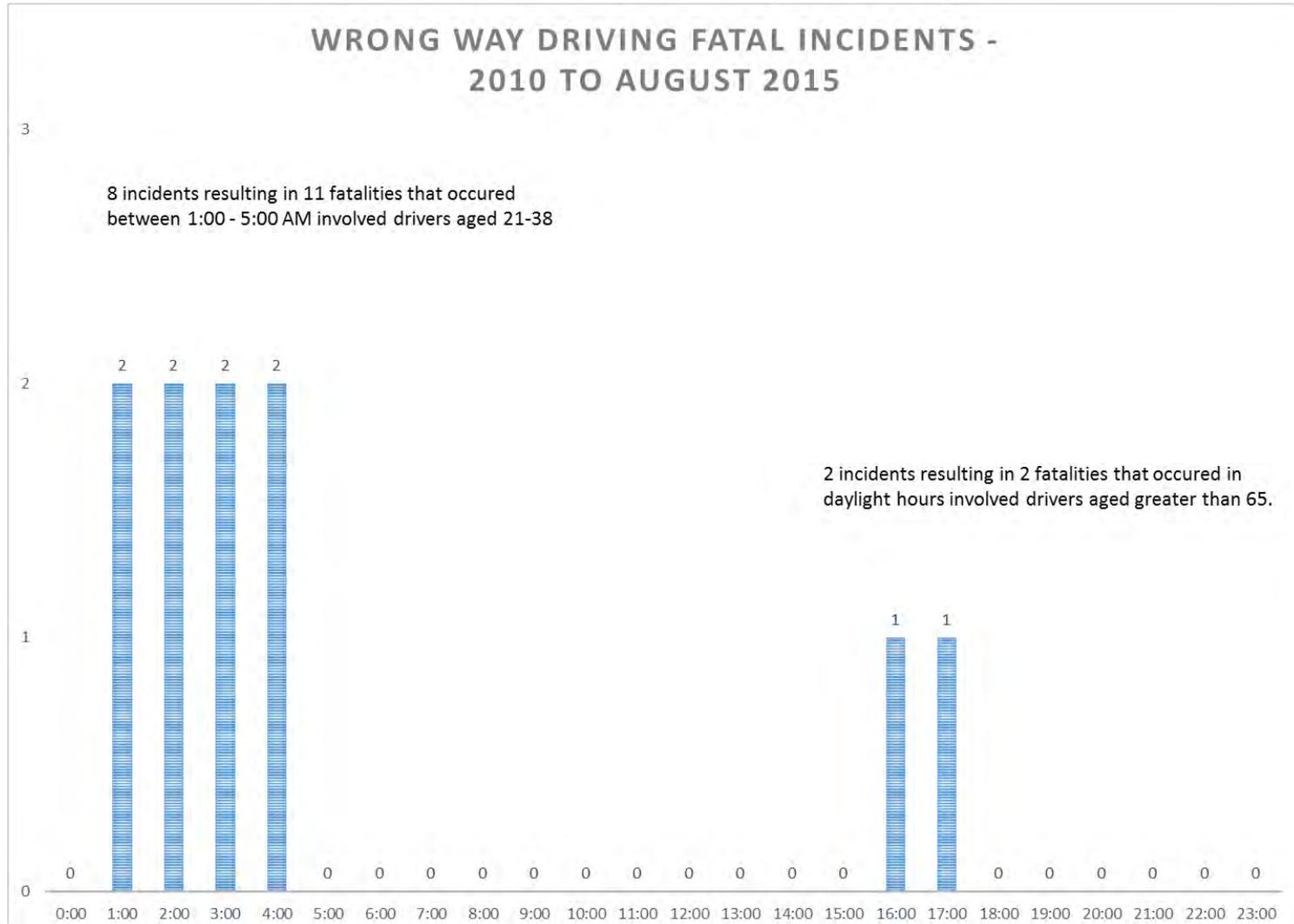


- Partial Cloverleaf (side-by-side) ramps: Route 10 NB at Reservoir Avenue – Providence

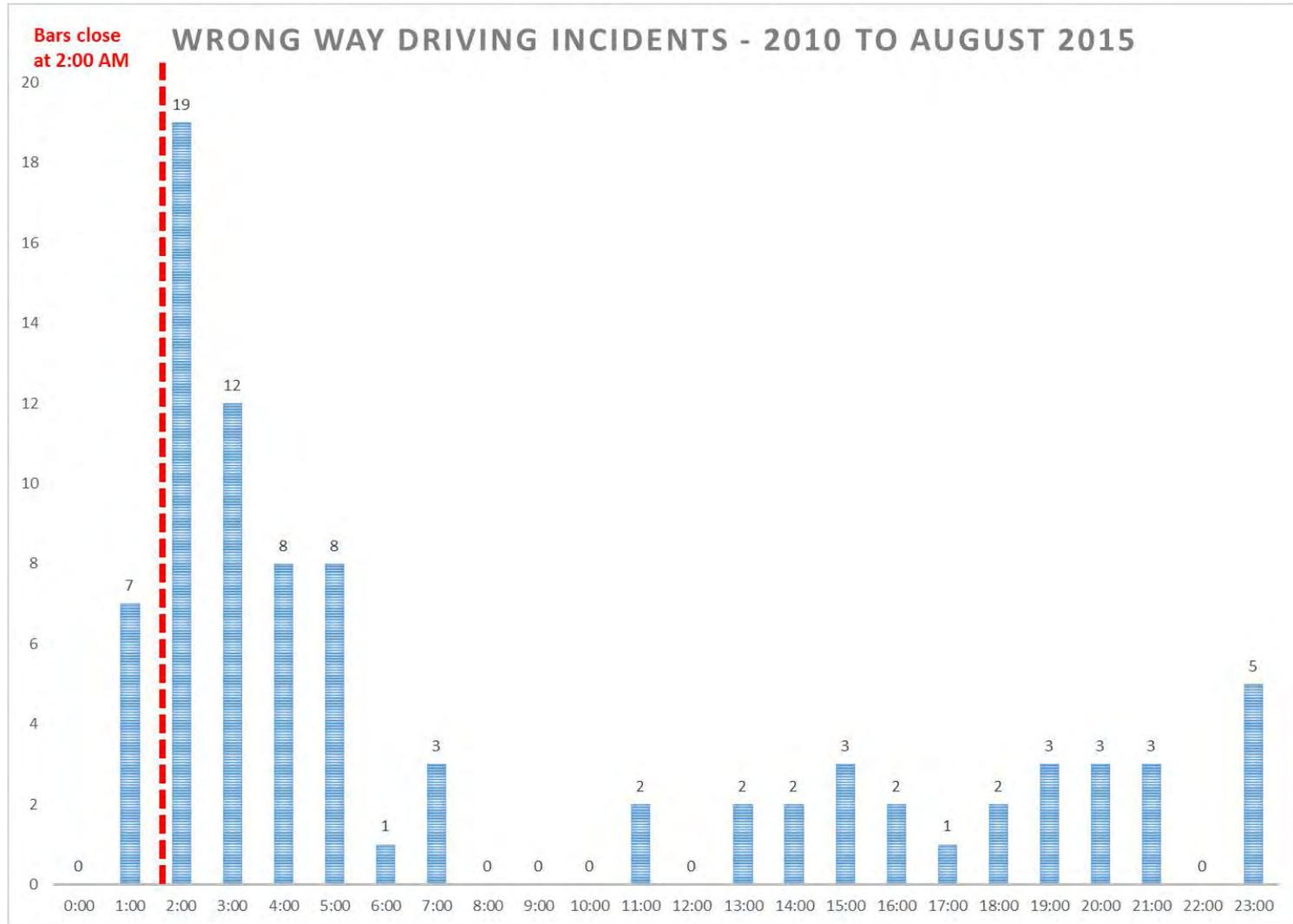


- Special Situation ramps: Route 6/10 at Memorial Blvd/Francis Street –Providence





# When are Wrong-Way Driving Incidents Occurring?



- Ages of driver in fatal wrong-way crash:
  - 8 (80%) between 21 – 40
  - 2 (20%) over 65
- DUI suspected for driver in fatal wrong-way crash:
  - 8 (80%) between 21 – 40
  - 2 (20%) over 65

- NTSB reached out to all 50 states to respond to recommendations issues in Special Ingestion Report:
  - FHWA
    - Develop assessment tool for problematic locations
    - Revisions to MUTCD
    - WWD Monitoring Programs in state's HSIPs
  - NHSTA
    - Accelerate use of Driver Alcohol Detection System for Safety
    - Reduce Older Driver Involvement
  - AASHTO
    - Revision to Green Book
  - 50 States
    - Inclusion of Older Drivers into SHSP
    - Use of Alcohol Ignition Interlock Devices on DUI offenders

## Develop Program

- Partner with RI State Police
- Review nationwide best practices

## Field Inventory

- Field inventory all 220+ ramps in RI (excluding freeway to freeway interchanges)

## Implement Low-Cost Countermeasures

- Signing, striping, and minor signal enhancements

## Pilot Detection Systems

- Test sites based on data and RISP input

## Policy Changes

- Revise Standard Details

## Increased Enforcement

- Strategically target enforcement areas based on data

## Implement High-Cost Countermeasures

- Geometric improvements/Additional detection

- Partnered with RI State Police
- Researched nationwide efforts on potential wrong-way driving countermeasures
  - Focus on older drivers, unfamiliar drivers, and intoxicated drivers
  - Enhanced awareness through signing, striping, and delineation at a minimum
  - States moving towards technology to combat the wrong-way driving issue

### San Antonio Wrong Way Driver Initiative



Brian G. Fariello, P.E.  
Traffic Management Engineer-  
TransGuide  
San Antonio District- TxDOT  
[brian.fariello@txdot.gov](mailto:brian.fariello@txdot.gov)

### Curbing Wrong Way Movements onto Michigan's Freeways

Tracie Leix, P.E.  
Supervisor, Safety Programs Unit  
Michigan DOT

SDITE/GLDITE Annual Meeting  
April 16, 2012

- Program added to RIDOT's Highway Safety Improvement Program that focuses on engineering countermeasures to mitigate wrong-way driving occurrences

The three (3) initiatives are to:

- Reduce the likeliness of a vehicle entering a freeway ramp the wrong-way
- Alert vehicles who have entered a ramp the wrong-way prior to entering the freeway
- Alert police and right-way drivers of a wrong-way driver that has entered the freeway

- Created a Inventory Sheet
  - Signing
  - Striping
  - Delineation
  - Lighting
  - ITS

**WRONG WAY ENTRY CHECKLIST  
FIELD INSPECTION SHEET**

REVISOR:	DATE:
ROUTE:	TIME:
DESCRIPTION:	

**SIGNING**

ID	SIGN	PRESENT		COMMENTS
		YES	NO	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

**MARKING & DELINEATION**

ID	LINE/ARROW/DELINEATION	PRESENT		COMMENTS
		YES	NO	
A	STOP			
B	YIELD			
C	DOUBLE YELLOW			
D	SINGLE YELLOW			
E	SINGLE WHITE			
F	LANE LINE EXTENSION			
G	WRONG WAY ARROW			
H	LANE USE ARROW			
I	INPAVEMENT MARKERS			
J	GUARDRAIL/POST REFLECTORS			
K	PAINTED MEDIAN NOISE			

**LIGHTING**

ID	LIGHTING	PRESENT		COMMENTS
		YES	NO	
L	LIGHTING			

**ITS**

ID	WRONG WAY DETECTION	PRESENT		COMMENTS
		YES	NO	
M	ACT. FLASHING BEACON			
N	ACT. INPAVEMENT MARKER			
O	ACT. AUDIBLE WARNING			

**ADDITIONAL NOTES**

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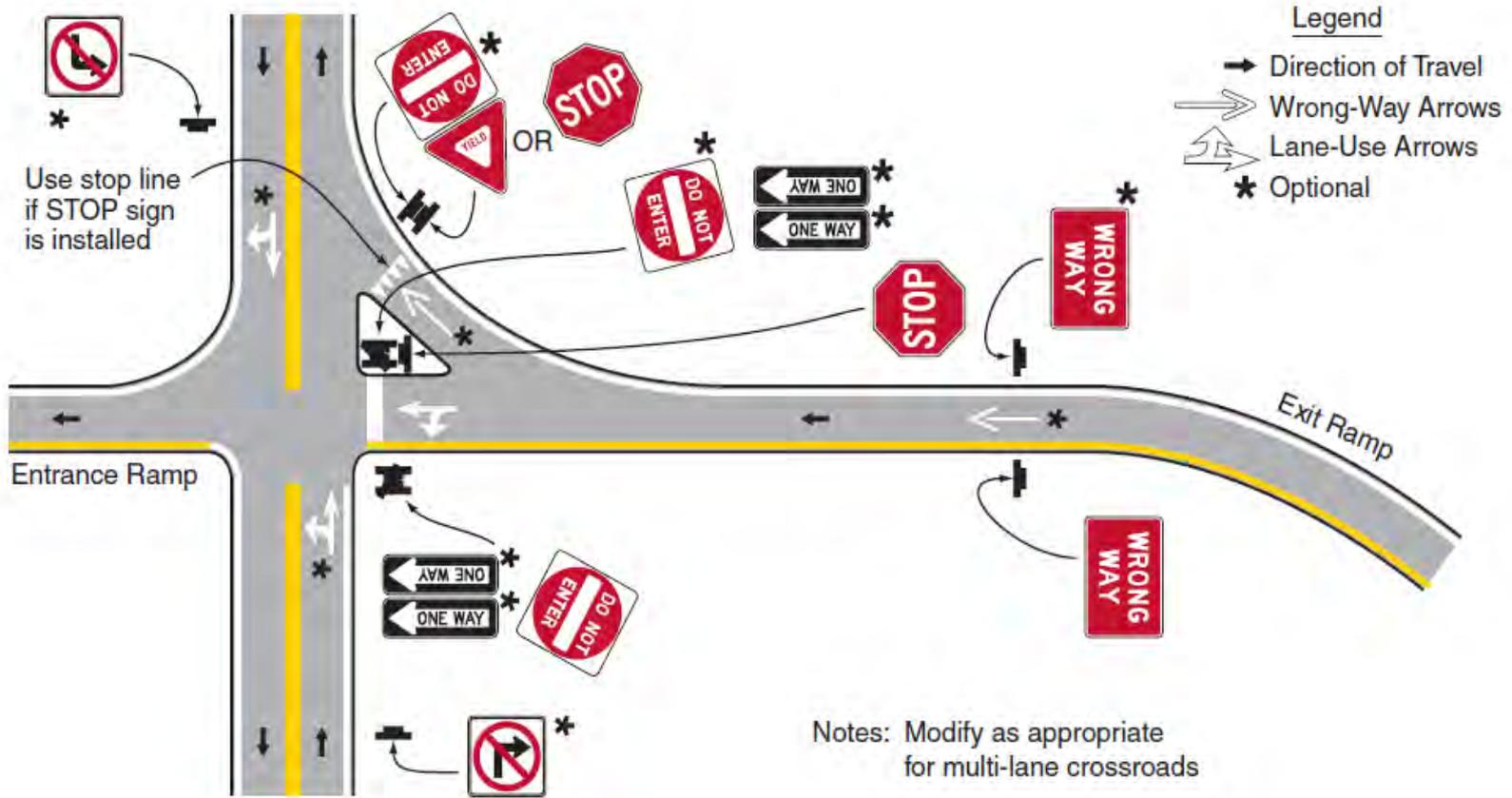


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- Field visited ramps on:
  - Interstates
  - Other limited access freeways
  - Right-in/right-outs along limited access facilities
  - Did not inventory freeway to freeway ramps
- Recorded on inventory sheet and photo log



- Majority of ramps meet **minimum** MUTCD recommendations



- **Minimum** MUTCD recommendations not applicable at adjacent on-off ramp intersections



- Some ramps missing Bi-Direction Arrow
- Majority of Bi-Directional Arrows missing reflectors and reflectors painted over



- TWLTL arrows direct vehicles to off-ramp



- TWLTL arrows direct vehicles to off-ramp



- About half of traffic signals have no turn restriction signage
- Majority of signal indications do not have straight arrow where applicable



- Develop construction contract that will treat all 220+ ramps statewide
- Ensure all ramps meet minimum MUTCD requirements
- Consider supplemental countermeasures:
  - Sign post reflectors
  - Lowering mounting height
  - Lane line extensions
  - Double up signage down the ramp
  - Eliminate unnecessary turn arrows leading to off-ramps (TWLTL)
  - Enhanced Bi-Directional Arrow
  - Straight Arrow Signal Indications



- Supplemental DO NOT ENTER and WRONG WAY signs
- NO TURN signs
- Reflective sign post strips
- Lower mounting height



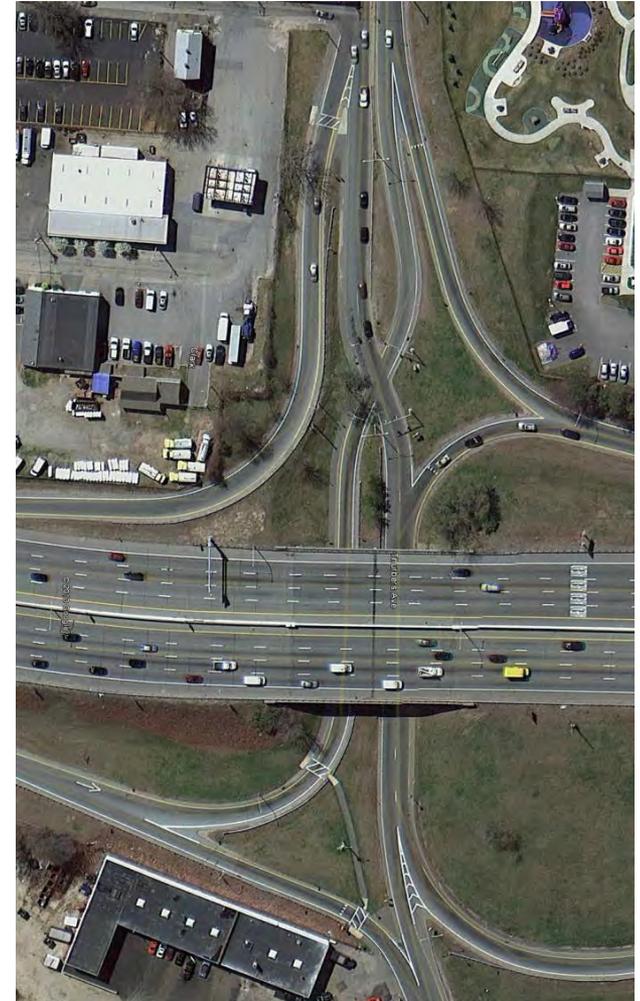
- Delineate vehicle path
- Additional Bi-Directional and Lane Use Arrows



- Delineate vehicle path
- Additional Bi-Directional and Lane Use Arrows



- Wrong Way Detection Systems on 24 locations
  - Worked with State Police to pinpoint locations with the most incidents.
  - Side-by-side ramps, isolated off-ramps, and confusing geometry.
  - All solar powered/wireless systems
  - Confirm that systems would work at each proposed location
- Goal – to provide active feedback to the:
  - Wrong-way driver via flashing signage
  - Right-way drivers via Dynamic Message Signage
  - RI State Police

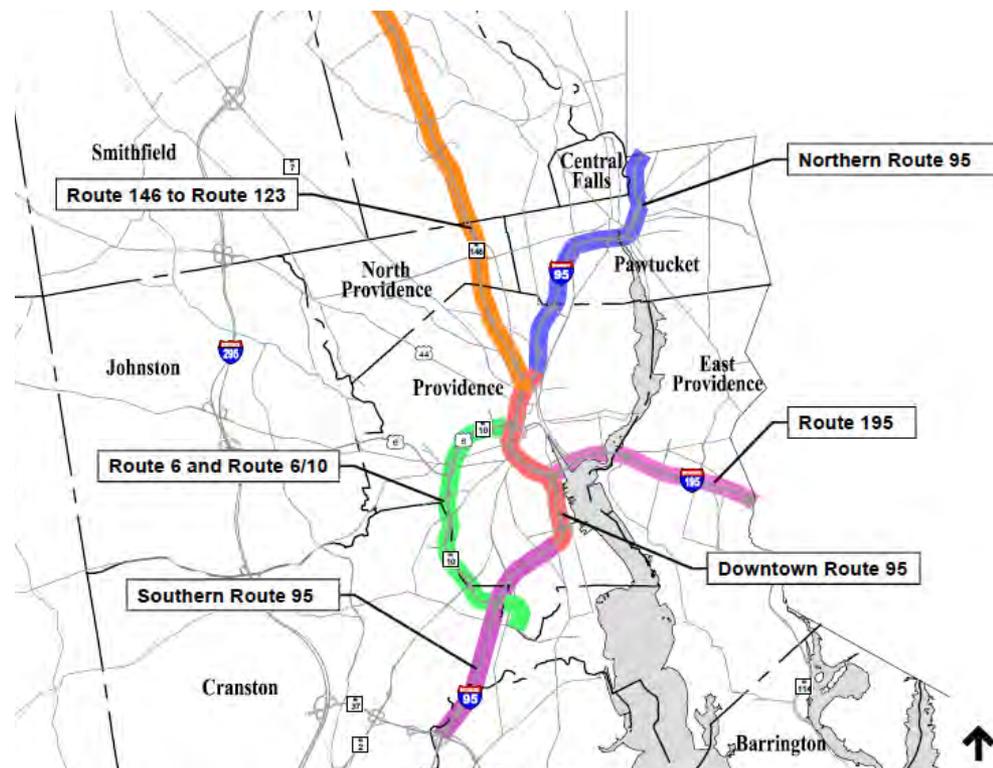


- Active Systems - 23 Locations

- Interstate 95 – 9 Locations
- Route 146 – 9 Locations
- Route 10 – 2 Locations
- Interstate 195 – 1 Location
- Route 4 – 1 Location
- US Route 6 – 1 Location

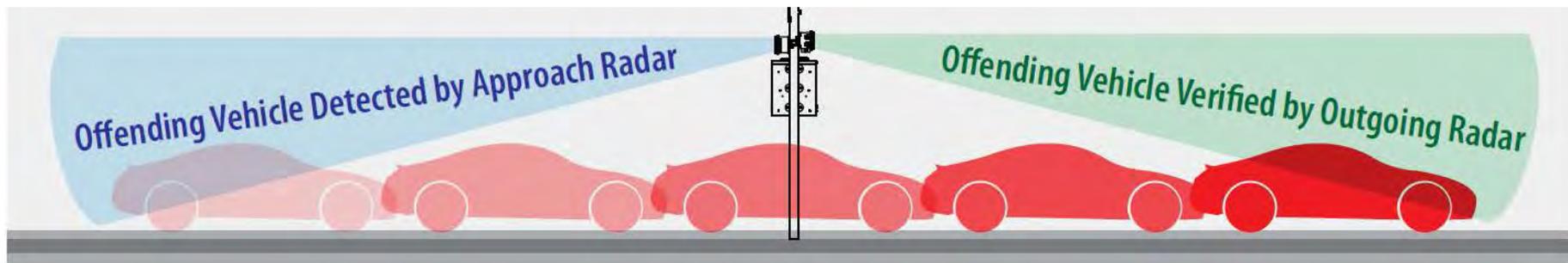
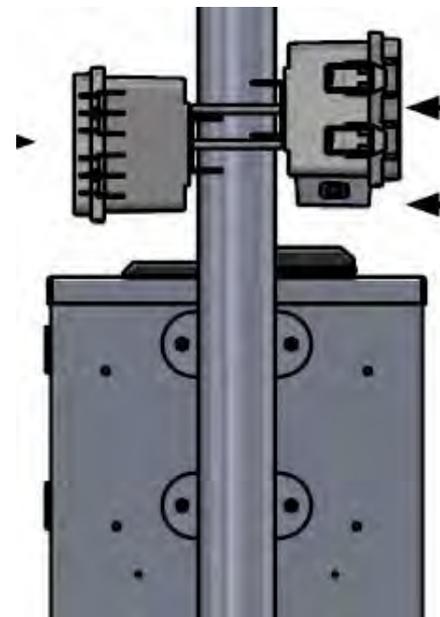
- Passive System – 1 Location

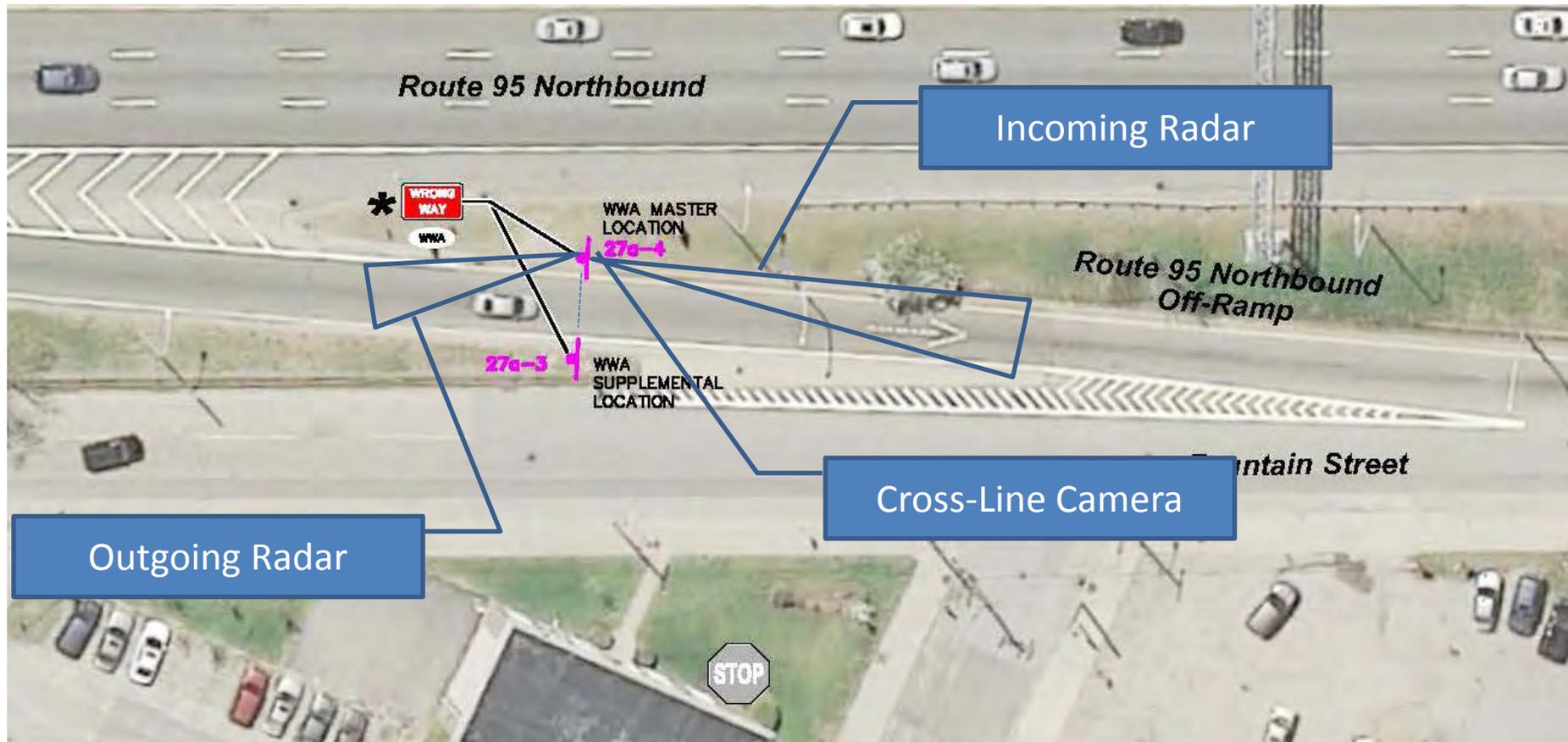
- Route 6/10 at Memorial Blvd
  - Passive chosen due to insufficient solar coverage



- Basic Active System Components

- Incoming Radar
- Cross-line Camera
- Outgoing Radar
- BlinkLink 2.0







- Wrong-Way Sign activation
  - Offending vehicles detected by incoming radar
  - LED activated on both primary sign and “dummy” supplemental sign

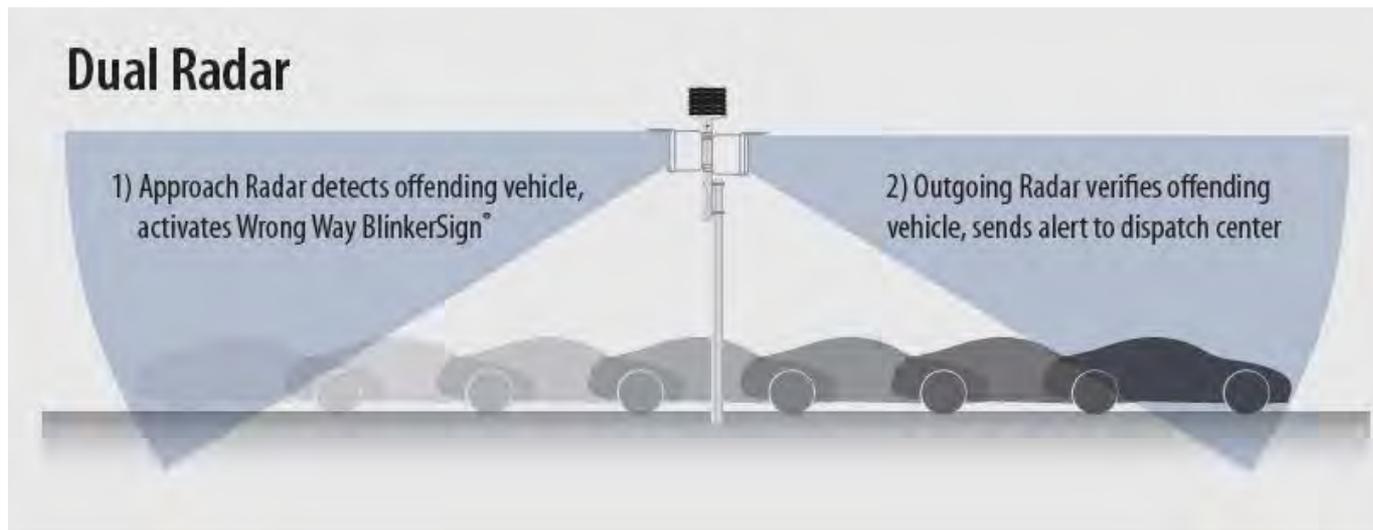


## Single Radar

1) Approach Radar detects offending vehicle, activates Wrong Way BlinkerSign®



- Wrong-Way Alert Generated
  - Offending vehicle tracked 100' by incoming radar
  - Offending vehicle crosses camera trip line
  - Offending vehicle detected by outgoing radar
- Once all three conditions are satisfied, a wrong-way alert is sent



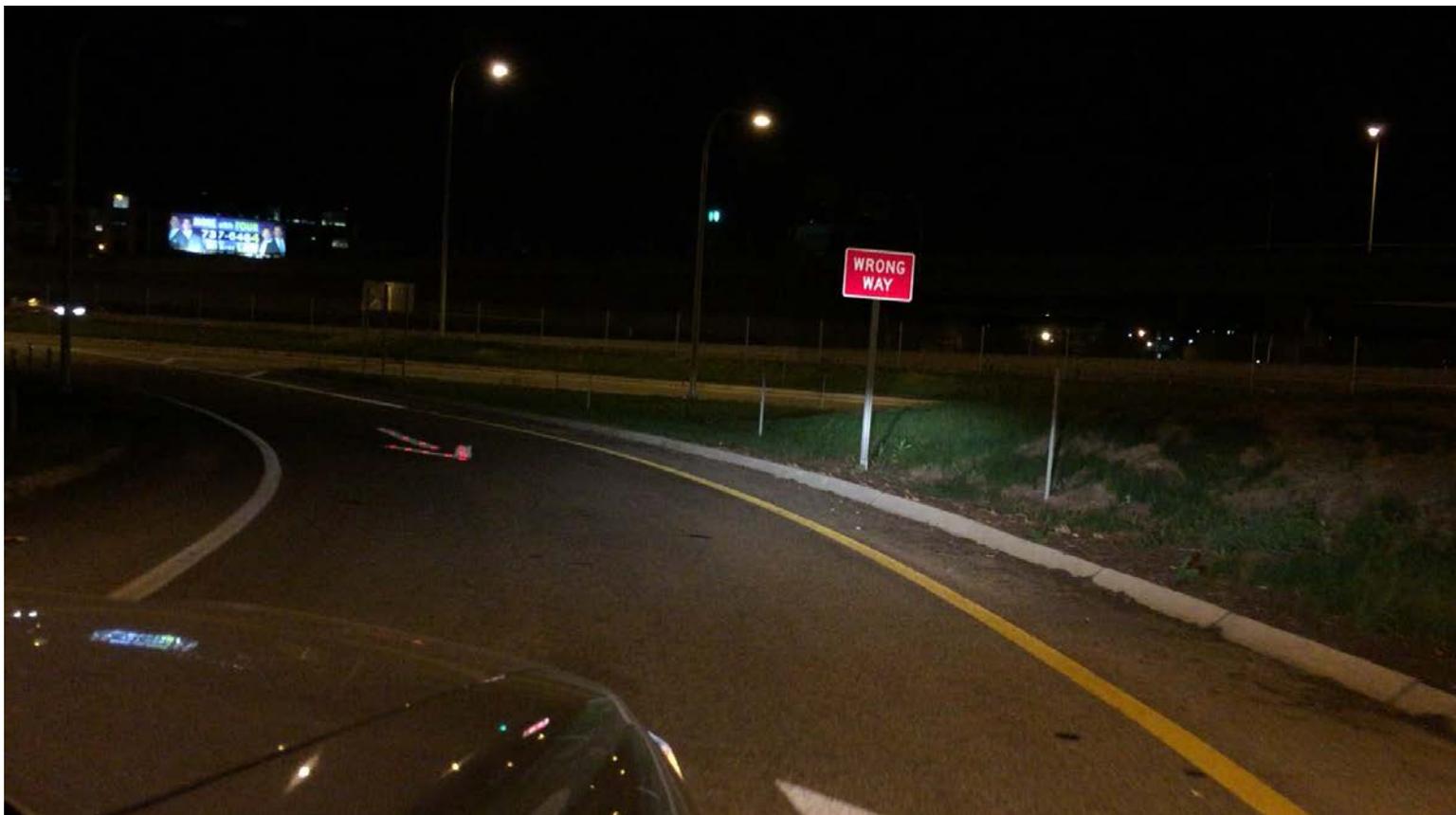
- Detection System Testing – Route 146 SB at Mineral Spring Avenue



- Detection System Testing – Route 146 NB at Route 116



- Detection System Testing – Interstate 95 SB at Eddy Street/Exit 19



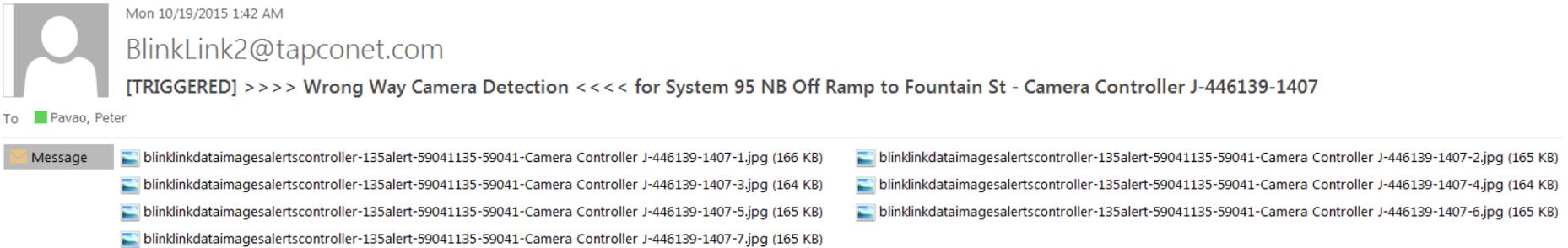
- Wrong-Way Vehicle Alert – Web-Based System Alert

The screenshot displays the BlinkLink web interface. The top navigation bar includes 'BlinkLink', 'Systems', 'Alerts!' (with a red notification badge showing '8'), 'Reports', and 'Admin'. A 'My Account' link is in the top right. Below the navigation bar, the breadcrumb trail shows 'Systems / System'. The main heading is 'System Details', with a 'Manage' button on the right. The system name is '821 NB OFF 35-US 27', identified as a 'Wrong Way BlinkerSign System' for 'Florida DOT'. An 'Alerts' section shows data for the last 7 days:

All	Alert Type	Daily Breakdown
3	Wrong Way Camera Detection	
0	Low Voltage	

Buttons for 'All Active Alerts' and 'All Past Alerts' are located below the table. To the right is an aerial satellite view of the road intersection with a red 'WRONG WAY' marker.

## Wrong-Way Vehicle Alert – Sample Email



BlinkLink triggered a(n) Wrong Way Camera Detection event for the following System.

System Details:           95 NB Off Ramp to Fountain St  
Asset Name:               Camera Controller J-446139-1407  
Alert Time:               2015-10-19T05:41:33Z

Go to <http://blinklink.tapcoapps.com> to view this notification in BlinkLink.

Contact BlinkLink Support at 866-753-6255 or email to [blinkersupport@tapconet.com](mailto:blinkersupport@tapconet.com).

- Wrong-Way Vehicle Alert – Route 10 NB at Reservoir Avenue



Correct Traffic Flow: 

BlinkLink 

System: 10 NB Off Ramp to Reservoir Ave Alert Time: 8/30/2015 4:20:50 PM Powered by TAPCO

- Wrong-Way Vehicle Alert – Route 10 NB at Reservoir Avenue



Correct Traffic Flow: 

**BlinkLink** 

System: 10 NB Off Ramp to Reservoir Ave Alert Time: 8/30/2015 4:20:50 PM Powered by TAPCO

- Wrong-Way Vehicle Alert – Route 10 NB at Reservoir Avenue



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System: 10 NB Off Ramp to Reservoir Ave Alert Time: 8/30/2015 4:20:50 PM Powered by TAPCO

- Wrong-Way Vehicle Alert – Route 10 NB at Reservoir Avenue

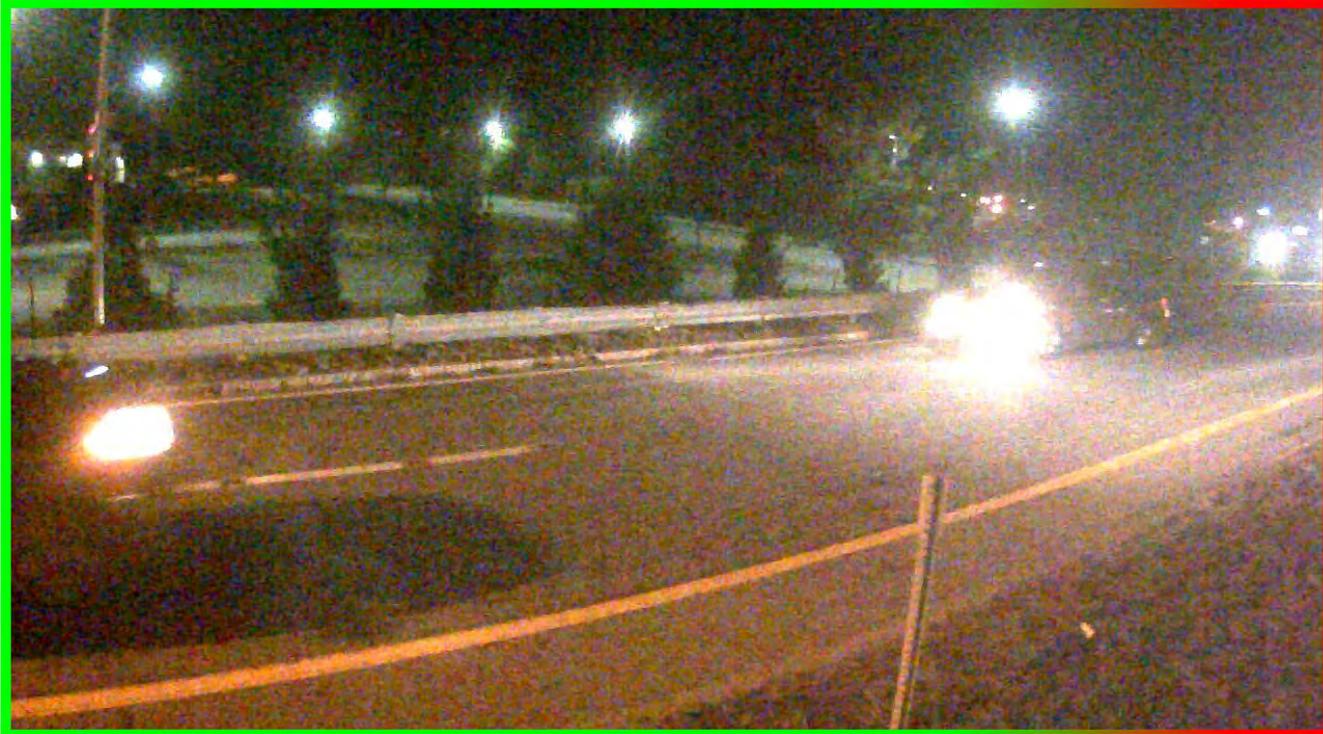


Correct Traffic Flow: 

**BlinkLink** 

System: 10 NB Off Ramp to Reservoir Ave Alert Time: 8/30/2015 4:20:50 PM Powered by TAPCO

- Wrong-Way Vehicle Alert – Interstate 95 SB at Thurbers Avenue



Correct Traffic Flow: 

BlinkLink 

System: 95 SB Off Ramp to Thurbers Ave Alert Time: 10/10/2015 2:45:09 AM Powered by TAPCO

- Wrong-Way Vehicle Alert – Interstate 95 SB at Thurbers Avenue

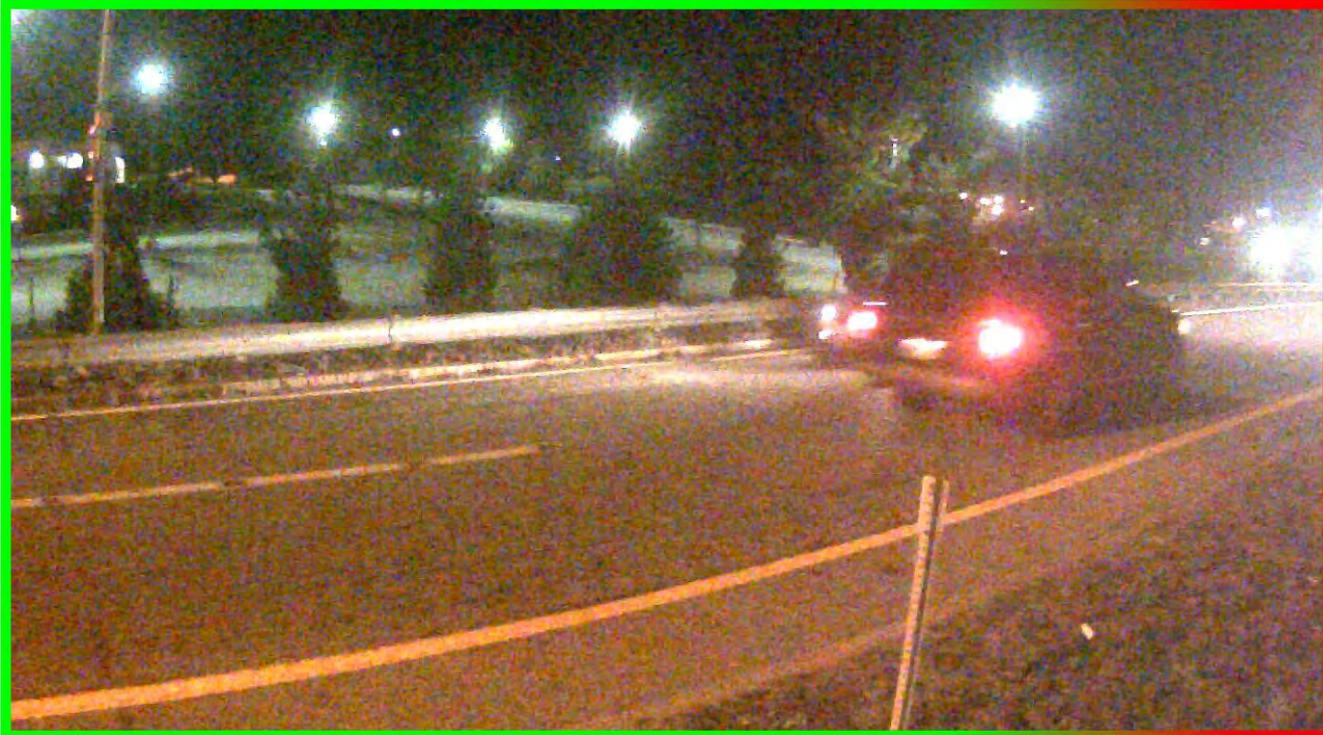


Correct Traffic Flow: 

**BlinkLink** 

System: 95 SB Off Ramp to Thurbers Ave Alert Time: 10/10/2015 2:45:09 AM Powered by TAPCO

- Wrong-Way Vehicle Alert – Interstate 95 SB at Thurbers Avenue



Correct Traffic Flow: 

BlinkLink 

System: 95 SB Off Ramp to Thurbers Ave Alert Time: 10/10/2015 2:45:09 AM Powered by TAPCO

- Wrong-Way Vehicle Alert – Interstate 95 SB at Thurbers Avenue

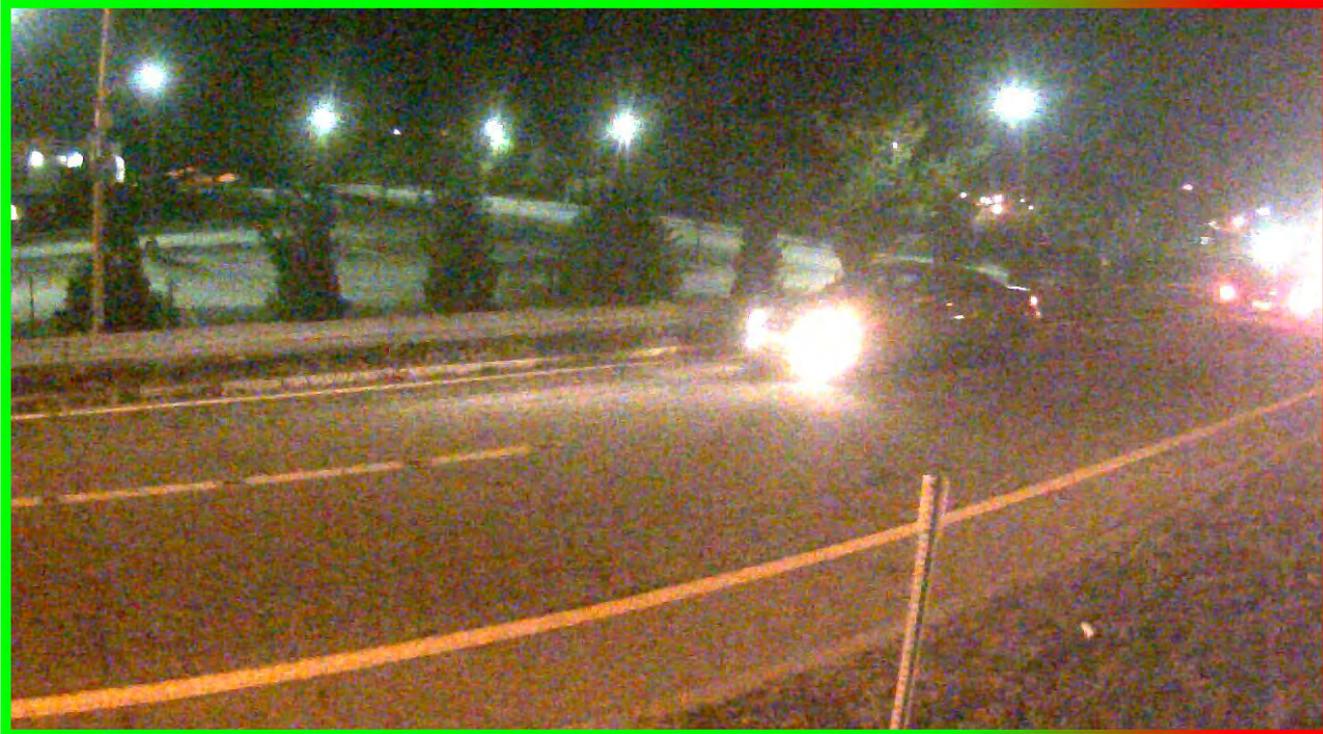


Correct Traffic Flow: 

BlinkLink<sup>SM</sup>

System: 95 SB Off Ramp to Thurbers Ave Alert Time: 10/10/2015 2:45:09 AM Powered by TAPCO

- Wrong-Way Vehicle Alert – Interstate 95 SB at Thurbers Avenue

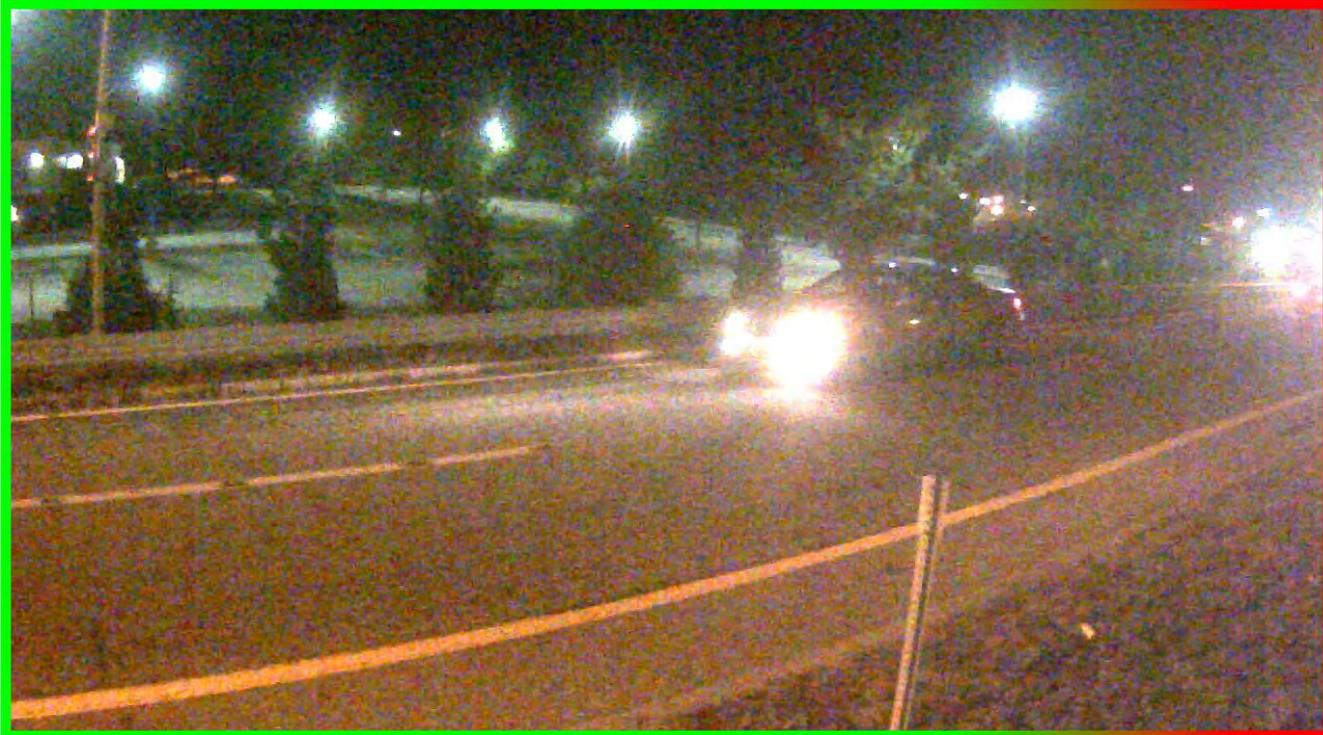


Correct Traffic Flow: 

BlinkLink<sup>™</sup>

System: 95 SB Off Ramp to Thurbers Ave Alert Time: 10/10/2015 2:45:09 AM Powered by TAPCO

- Wrong-Way Vehicle Alert – Interstate 95 SB at Thurbers Avenue



Correct Traffic Flow: 

BlinkLink 

System: 95 SB Off Ramp to Thurbers Ave Alert Time: 10/10/2015 2:45:09 AM Powered by TAPCO

- Protocol to react to wrong-way alerts
  - Email sent to TMC, State Police, and Municipal police
  - TMC locate vehicle on overhead camera (if available)
  - TMC and police make phone contact
  - Police dispatched
  - TMC activates DMS sign (if available)
  - Police and TMC coordinate resolution
- Dispatch police ASAP
- Alert right-way drivers of potential wrong-way driver approaching



- Median mounted signs at side-by-side ramps confused right-way drivers
  - Rotated all median signs



- Parallel Traffic and False Flashing
  - Include shields and attenuators for directing radar



- False Alerts – Truck Traffic
  - Place system farther from roadway (2' offset to 8' offset)



- False Alerts
  - 62 real wrong-way alerts
    - 29 non-event  
(police, maintenance)
    - 33 real wrong-way events
  - 1,800 false calls

System Name	Last Test Alert #	Certified Date	Days Online	Positive Wrong Way	Actual Wrong Way	False Calls	False per Day
10 NB Off Ramp to Reservoir Ave	53705	5/12/2015	163	0	21	55	0.34
146 SB Off Ramp to Lousiquisset Pike	53900	5/14/2015	161	0	2	19	0.12
95 NB Off Ramp to Jefferson Blvd	53632	5/12/2015	163	0	2	266	1.63
10 NB Off Ramp to Niantic Ave	52508	4/22/2015	183	0	1	36	0.20
146 NB Off Ramp to Mineral Spring Ave	53763	5/13/2015	162	2	1	24	0.15
146 SB Off Ramp to George Washington Hwy	53877	5/13/2015	162	0	1	10	0.06
146 SB Off Ramp to Mineral Spring Ave	53772	5/13/2015	162	0	1	24	0.15
4 SB Off Ramp to Division Road	53649	5/12/2015	163	5	1	258	1.58
95 NB Off Ramp to Fountain St	53754	5/13/2015	162	0	1	19	0.12
95 SB Off Ramp to Thurbers Ave	53713	5/12/2015	163	1	1	253	1.55
146 NB Off Ramp to Breakneck Hill Road	53850	5/13/2015	162	0	0	0	0.00
146 NB Off Ramp to George Washington Hwy	53865	5/13/2015	162	0	0	14	0.09
146 NB Off Ramp to Twin River Road	53791	5/13/2015	162	1	0	3	0.02
146 SB Off Ramp to Breakneck Hill Road	53885	5/13/2015	162	0	0	0	0.00
146 SB Off Ramp to Twin River Road	53895	5/14/2015	161	1	0	10	0.06
195 EB Off Ramp to Warren Ave	54138	5/21/2015	154	8	0	2	0.01
6 WB Off Ramp to Atwood Ave	52322	4/22/2015	183	0	0	0	0.00
95 NB Off Ramp to Branch Ave	53734	5/12/2015	163	0	0	44	0.27
95 NB Off Ramp to Lonsdale Ave	53742	5/13/2015	162	0	0	121	0.75
95 NB Off Ramp to Thurbers Ave	53726	5/12/2015	163	2	0	94	0.58
95 NB/195 EB Off Ramp to Point Street	52314	4/21/2015	184	3	0	23	0.13
95 SB Off Ramp to Eddy St	53910	5/14/2015	161	1	0	79	0.49
95 SB Off Ramp to Jefferson Blvd	53617	5/11/2015	164	5	0	442	2.70

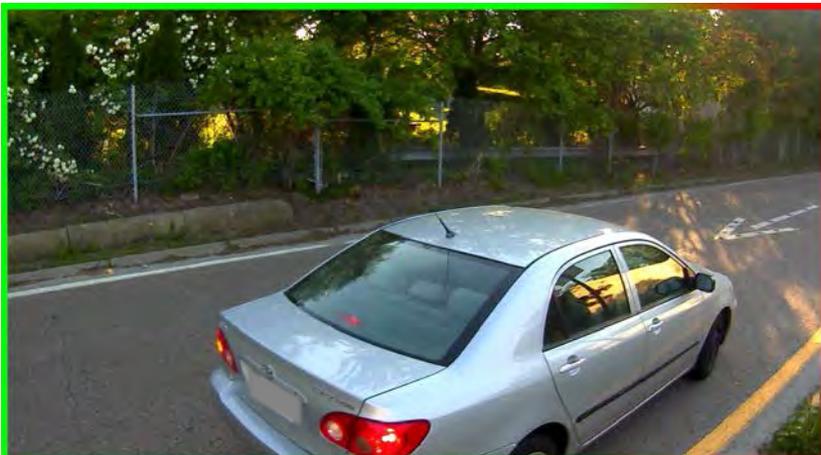
- Wide, multi-lane ramps
  - Consider loop detection to replace radar



- Limited Verizon or AT&T LTE coverage
- Short Ramp Layouts - Need to track 100' minimum
- Little or No Ambient Light - Camera analytic effectiveness

- Statewide Signing & Striping Project
  - Recently completed
  - RIDOT will track incidents over the next year to determine effectiveness
- Pilot Detection Project
  - 33 real wrong-way events since May
  - Resulted in NO crashes
  - 18 occurred between 11:00 PM – 6:00 AM
  - 15 occurred between 6:00 AM – 11:00 PM
  - Visible brake lights/vehicles turned around on camera
  - Data allows RIDOT to focus on additional improvements at trouble ramps

- Vehicle Turn-Around On Ramp



Correct Traffic Flow: 

BlinkLink

System: 10 NB Off Ramp to Reservoir Ave Alert Time: 5/23/2015 6:39:03 PM Powered by TAPCO



Correct Traffic Flow: 

BlinkLink

System: 10 NB Off Ramp to Reservoir Ave Alert Time: 5/23/2015 6:39:03 PM Powered by TAPCO

- Vehicle Braking



- Strategically targeted enforcement based on wrong-way driving data
  - Targeted ramps/segments
  - 1:00 AM – 4:00 AM
- Policy Changes
  - Revised standard details for signing and striping
  - Revised traffic signal indications
  - Revised Bi-Directional Arrow
  - Consideration for geometric improvements to deter wrong-way movements on all applicable projects



- Consideration of higher-cost improvements at high-risk ramps:
  - Geometric improvements
  - Additional locations for detection
  - Different detection (loops vs radar)
  - Enhanced DMS coverage



- Route 10 NB at Reservoir Avenue – Providence
  - 21 of the 33 alerts occurred at this location



- Route 10 NB at Reservoir Avenue – Providence



- Immediate Mitigation via RIDOT Maintenance
  - Install ENTER HERE signage
  - Relocate stop bar closer to intersection



- Immediate Mitigation via RIDOT Maintenance
  - Install ENTER HERE signage
  - Relocate stop bar closer to intersection



# Questions?



Correct Traffic Flow: ←

BlinkLink

System: 10 NB Off Ramp to Reservoir Ave Alert Time: 8/30/2015 4:20:50 PM Powered by TAPCO