An Overview of RIDOT’s Successes in Implementing Low-Cost Safety Improvements
Agenda

- RIDOT’s Low-Cost Safety Improvements
  - Wrong Way Driving Mitigation Program
  - Safety Corridor Program
  - High Friction Surface Treatments
  - Horizontal Curve Delineation
  - Rumble Strip
  - Protected Left-Turn Phasing Program
  - Median Guardrail
  - Roadside Hazard Elimination
Wrong Way Driving Mitigation Program

- **Nationwide Issue**
  - 360 fatalities in 260 wrong-way crashes 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 on:
  - Interstate 95
  - Route 6/10
  - Route 10
  - Interstate 195
Where are the Wrong-Way Driving Incidents Occurring?

- 41% @ “Isolated” off-ramps: Interstate 95 NB at Exit 26 – Pawtucket
Where are the Wrong-Way Driving Incidents Occurring?

- 23% @ Partial Cloverleaf (side-by-side) ramps: Route 10 NB at Reservoir Avenue – Providence
Where are the Wrong-Way Driving Incidents Occurring?

- 12% @ Special Situation ramps: Route 6/10 at Memorial Blvd/Francis Street – Providence
Low Cost Countermeasures

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

- Delineate vehicle path
- Additional Bi-Directional and Lane Use Arrows
Pilot Detection Systems

- Wrong Way Detection Systems on 24 locations
  - Worked with **State Police** to pinpoint locations
  - Citation/incidents – corridors chosen
  - Side-by-side ramps, isolated off-ramps, and confusing geometry.
  - All solar powered/wireless systems
- Goal – to provide active feedback to the:
  - Wrong-way driver via flashing signage
  - Right-way drivers via Dynamic Message Signage
  - TMC/RI State Police
Pilot Detection Systems

- Basic Active System Components
  - Incoming Radar
  - Cross-line Camera
  - Outgoing Radar
  - BlinkLink 2.0
Pilot Detection Systems

- 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, alert is sent
Wrong-Way Vehicle Alert – Web-Based System Alert

System Details

821 NB OFF 35-US 27
Wrong Way BinkerSign System

Alerts (last 7 days)

<table>
<thead>
<tr>
<th>Alert Type</th>
<th>Daily Breakdown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrong Way Camera Detection</td>
<td>1</td>
</tr>
<tr>
<td>Low Voltage</td>
<td></td>
</tr>
</tbody>
</table>

All Active Alerts  All Past Alerts
Wrong-Way Vehicle Alert – Sample Email

BlinkLink2@tapconet.com

[TRIGGERED] >>>> Wrong Way Camera Detection <<<< for System 95 NB Off Ramp to Fountain St - Camera Controller J-446139-1407

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.tapconet.com to view this notification in BlinkLink.

Contact BlinkLink Support at 866-753-6255 or email to blinkersupport@tapconet.com.
Pilot Detection Systems

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

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

• **Protocol**
  • 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
Challenges

• Parallel Traffic and False Flashing
  • Include shields and attenuators for directing radar
Challenges

• False Alerts – Truck Traffic
  • Place system farther from roadway (2’ offset to 8’ offset)
Effectiveness

- **Statewide Signing & Striping Project**
  - Recently completed
  - RIDOT will track incidents over the next year to determine effectiveness

- **Pilot Detection Project**
  - 90+ wrong-way events since May 2015
  - Resulted in no fatalities or reported crashes
  - 60% occurred between 11:00 PM – 6:00 AM
  - 40% 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
• Added funds to existing on-call ITS Maintenance contract

• System Testing
  • Individual systems tested if no alert received within 60 days
  • All detection systems tested annually, regardless of alerts received
Project Costs

• Overall Project – $2.2 Million
  • Includes signing, striping, and detection systems
  • Wrong Way Detection Systems - $25,000 each
    (includes system, pole and foundation)
  • HSIP funded

• Maintenance
  • $100,000 allocated for as needed maintenance
  • HSIP funded
  • Added funds to existing on-call ITS Maintenance contract
Continued Efforts

- BAT Mobile
- Strategically targeted enforcement based on wrong-way driving data
  - Targeted ramps/segments (1:00 AM – 4:00 AM)
Continued Efforts

- What’s next???
  - Geometric improvements
  - Additional locations for detection
Continued Efforts

- Route 10 NB at Reservoir Avenue – Providence
  - 70% alerts occurred at this location
Continued Efforts

• Immediate Mitigation via RIDOT Maintenance
  • Install ENTER HERE signage
  • Relocate stop bar closer to intersection
Safety Corridor Program

- Past 5 years over 100 fatalities and 900 serious injuries at RI intersections
- 20% of fatalities and serious injuries are broadside angle crashes
- 20% of fatalities and serious injuries involve a pedestrian or bicycle
- Injury crash rate for urban arterial facilities is one of highest facility type crash rates in RI
Safety Corridor Program

- Implement near-term systemic safety improvements along all 4-lane undivided arterials
  - Consider lane reduction
  - If lane reduction not feasible, consider:
    - RRFB or HAWK signals at all uncontrolled crossings.
    - Flush median separating opposing travel lanes
Road Diet Initial Screening

• 76 corridors inventoried and categorized
• 24 locations installed/under study/design
• Remaining 52 locations
  • Consider Study (30 locations)
  • Removed for not meeting historical volume thresholds and/or pavement widths (22 locations)
• Consider Study – 3 lane or 5 lane section
• 22 locations not advanced are now considered for enhanced pedestrian crossing and other low cost countermeasures.
1. Incorporation into Pavement Projects
   - Review TIP/Pavement Project Pipeline

2. Crash History
   - Fatality/Serious Injuries, Vulnerable Road User

3. Bike/Ped Connectivity

4. Community Request/Support
Implementation

- Coordination with municipalities
- Consider performing RSA
- Conduct detailed capacity analysis at signalized locations (where applicable)
- Obtain Municipal approval of design
- Install through WO or contract
Road Diet Implementation Process

1. **ROAD DIET/TWLTL CANDIDATE**
2. Coordination with Town
3. Perform Road Safety Assessment (RSA)
4. Conduct a Detailed Signalized Intersection Capacity Analysis and Develop Preliminary Design
5. Public Input
6. Implementation

- **Work Order/MPA**
- **Incorporate into an Existing Planned Project (i.e., resurfacing project)**
- **Complete in a Stand Alone Project**
Road Diet Implementation Process

1. **Perform Road Safety Assessment (RSA)**
   - **<10,000 ADT**
     - **<750 DHV**
       - 1/2 mile + signal spacing
       - **Road Diet**
   - **10,000-20,000 ADT**
     - 750-875 DHV
     - 1/4 to 1/2 mile signal spacing
     - Key Intersection Analysis Required
     - **>750 DHV**
       - >200 VPHTL
       - **Synchro Model**
     - **<750 DHV**
       - <200 VPHTL
       - **Road Diet**
   - **20,000-25,000 ADT**
     - 875-1200 DHV
     - <1/8 mile signal spacing
     - Corridor Analyst Required
     - **Synchro Analysis**
   - **>25,000 ADT**
     - >1,200 DHV
     - <1/8 mile signal spacing
     - No Road Diet

2. **Public Input**
   - 30% + Travel Time
   - 2 + LOS Change
   - **Modify**
   - <30% + Travel Time
   - Corridor LOS = D or Better
   - < LOS E at Critical Approach
   - **Modify Design**
Safety Effectiveness Evaluation

- 5 year before and after crash analysis
- Decrease of over 50% of all crash types and severities
  - HSM and CMF Clearinghouse – CRF ranging from 29% - 53%
- Fatalities and serious injuries reduced on an average of 5 annually
- 7% average reduction in 85th percentile speed
- Develop CMFs to help “sell” to communities
Considerations/Lessons Learned

- “It’s just paint”
- Trial Period (before resurfacing)
- Existing signal head placement
- Parking lanes (shoulders too wide)
- Bike/Ped friendly (shoulders too narrow)
- Public Resistance to Bike Lanes
- Pavement condition
- Manholes in travel path
- Traffic Pattern Change
  - Use barrels/VMS signs 2 weeks before/after
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