Smarter Work Zones
Webinar Series

Webinar #9: Technology Application Strategies: Performance Measures and System Health Monitoring

Todd Peterson, Skylar Knickerbocker, Nikola Ivanov, and Robert Brydia

January 21, 2016 1:00-2:30pm EST
Smarter Work Zones

INTRODUCTION AND TODAY’S SPEAKERS
Today’s Speakers

Todd Peterson, P.E., PTOE
Transportation Specialist
FHWA Office of Operations

Skylar Knickerbocker, P.E.
Research Engineer
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Iowa State University

Nikola Ivanov, PMP
Deputy Director
Center for Advanced Transportation Technology Laboratory,
University of Maryland

Robert Brydia
Senior Research Scientist
Texas A&M Transportation Institute
Smarter Work Zones (SWZ) Webinar Series

• This is the ninth in a series of bi-weekly SWZ webinars
• Topics based on what matters most to you!
• Previous Webinars include:
  – Webinar #1: A Comprehensive Overview of the SWZ Initiative (9/9/2015)
  – Webinar #2: Implementing Technology Application Solutions (9/29/2015)
  – Webinar #3: SWZ Corridor-Based Project Coordination (10/15/15)
  – Webinar #4: SWZ Technology Showcase – Queue Warning Systems (10/26/15)
  – Webinar #5: SWZ Program-Based Project Coordination (11/2/15)
  – Webinar #6: Technology Application Case Studies: Variable Speed Limit and Dynamic Lane Merge (11/12/15)
  – Webinar #7: Work Zone Project Coordination Guide and Examples (12/2/15)
  – Webinar #8: Integrating Project Coordination & Technology Applications: Iowa DOT (12/15/15)
• Recordings and materials for previous webinars are available on The National Work Zone Safety Information Clearinghouse website: https://www.workzonesafety.org/swz/webinars
• Coming Up:

  February 2016  2/24  Webinar #10: Designing ITS Systems Based on Identified Needs
Purpose of Today’s Webinar

*Discuss applying SWZ Technology Application principles towards performance measurement and system health monitoring as part of agency transportation systems management and operation (TSM&O) strategies and provide real-world examples of agency use of these strategies to maintain work zone safety and mobility.*

Topics include:

1. SWZ Technology Application Initiative
   - Show how the SWZ Technology Application initiative can be used by agencies to enhance their current work zone management practices

2. Performance Measures and System Health Monitoring
   - Provide real-world examples of the performance measurement and system health monitoring, which can help maintain work zone safety and mobility.
Smarter Work Zones
SWZ OVERVIEW & TECHNOLOGY APPLICATION INITIATIVE
What are Smarter Work Zones (SWZ)?

Innovative strategies designed to optimize work zone safety and mobility

• Policies and practices used to incrementally and continuously improve WZ operations
• Tools to reduce WZ crashes and delays
• Tools to enhance WZ management strategies
Two Identified SWZ Initiatives:

**Project Coordination**
Coordination within a single project and/or among multiple projects within a corridor, network, or region, and possibly across agency jurisdictions

**Technology Application**
Deployment of Intelligent Transportation Systems (ITS) for dynamic management of work zone traffic impacts, such as queue and speed management

*Today’s Focus of Discussion*
SWZ Technology Application Goals:

Goal 1A

By December 2016, 35 State DOTs have implemented business processes for work zone ITS technologies as identified in the Work Zone ITS Implementation Guide

• What does this mean?
  – Well-documented agency policies and processes to streamline consideration and use of work zone ITS technologies to minimize traffic impacts
SWZ Technology Application Goals:

Goal 1B

By December 2016, 35 State DOTs have utilized at least one work zone ITS technology application for dynamic management of work zone impacts

- What does this mean?
  - Consideration of the six step process explained in the WZ ITS implementation guide to plan and implement ITS strategies
  - Identify and use ITS strategies such as speed and/or queue management on at least one project for dynamic management of work zone impacts
Smarter Work Zones

IOWA DOT EVALUATION OF TRAFFIC CRITICAL WORK ZONES
Traffic Critical Projects (TCP) Program Objectives

• Focused on:
  – Improving traffic safety in work zones
  – Maintaining traffic mobility
  – Providing high quality traveler information

• TCP “features”
  – Incorporation of Traffic Mitigation Elements into project design
  – Intelligent Work Zones (IWZ)
  – Traffic Incident Management Planning
Traffic Critical Project Selection

• “Traffic Critical Network”
  – Expressways over 17,000 vehicles/day
• Projects that can repeatedly or quickly lead to significant travel delays
• Projects where an incident could have severe traffic impacts
• Iowa DOT District Input
• Border Bridges
IWZ Resources

- Statewide Traffic Operations Center (TOC)
- Existing ITS Devices:
  - Cameras, sensors, and Dynamic Message Signs (DMS)
- ATMS Software (TransSuite)
  - “Queue Detection”
- ITS Communication Networks
- Integrations of Rental (Portable ITS) Devices

Source: Iowa DOT
Queue Detection Systems (Southbound I-35)

RED = Portable DMS
GREEN = Portable Sensor
2015 Traffic Critical Projects

Red = IWZ & TIM  Orange = IWZ  Yellow = TIM

Source: Google
CTRE 2015 Evaluation

• Used performance measures developed from 2014 evaluation
• Need for real-time monitoring
  – Include performance measures in bi-weekly reports
    • Would allow for sensors/signs to be moved during project
  – Weekly review of sensors data quality
  – Review queue detection logic as needed
• Creating online portal to see/monitor work zone
  – Allowed for real time review of alerts and system performance
Traffic Critical Work Zone Performance Reporting

- Performance Measures Categories
  - Exposure
  - Traffic Queuing
  - Traveler Delay
## Work Zones and Related Routes (1 of 2)

<table>
<thead>
<tr>
<th>Group</th>
<th>IWZ</th>
<th>Roadway and Location Reference</th>
<th>Begin Date</th>
<th>Estimated End Date</th>
<th>Roadways</th>
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<tr>
<td>1</td>
<td>1.3</td>
<td>I-80 from Des Moines to Newton</td>
<td>4/13/2015</td>
<td>5/26/2016</td>
<td>I-80</td>
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<td>2</td>
<td>1.2</td>
<td>I-235 in Des Moines</td>
<td>7/20/2015</td>
<td>10/30/2015</td>
<td>I-80 and I-235, I-35</td>
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<td></td>
<td>1.5</td>
<td>West mix-master in Des Moines</td>
<td>6/12/2015</td>
<td>10/2/2015</td>
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<td></td>
<td>4.2</td>
<td>I-80 at Alice's Road near DSM</td>
<td>3/16/2015</td>
<td>11/20/2015</td>
<td>I-35</td>
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<td>3</td>
<td>5.1</td>
<td>I-35 at MO Border</td>
<td>6/22/2015</td>
<td>11/15/2015</td>
<td>I-35</td>
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<tr>
<td>4</td>
<td>2.2</td>
<td>I-35 near Mason City</td>
<td>4/1/2015</td>
<td>11/6/2015</td>
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<td>5</td>
<td>4.1</td>
<td>I-80/29 in Council Bluffs</td>
<td>3/30/2015</td>
<td>11/25/2015</td>
<td>I-29, I-80</td>
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<td></td>
<td>3.2</td>
<td>I-29 in Sioux City</td>
<td>3/11/2015</td>
<td>11/1/2015</td>
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<td></td>
<td>3.3</td>
<td>I-29 in Sioux City</td>
<td>4/15/2015</td>
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<td>7</td>
<td>2.1</td>
<td>I-380 in Waterloo</td>
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<td>US 20 and I-380</td>
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<td>8</td>
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<td>I-74</td>
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<td>9</td>
<td>6.3</td>
<td>I-280 in the Quad Cities</td>
<td>3/30/2015</td>
<td>11/1/2015</td>
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Work Zones and Related Routes (2 of 2)
IWZ Performance Summary

<table>
<thead>
<tr>
<th>IWZ Group and Related Roadways</th>
<th>Direction</th>
<th>Exposure</th>
<th>Event</th>
<th>Traffic Queue</th>
<th>Delay</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ADT (1000 veh)</td>
<td>Number of Events</td>
<td>Max Duration (min)</td>
<td>Avg Duration (min)</td>
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<td>Group 1 - 1.3 - 180</td>
<td>EB</td>
<td>202.05</td>
<td>90</td>
<td>295</td>
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<tr>
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<td>201.76</td>
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<td>395</td>
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<tr>
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<td>92</td>
<td>440</td>
<td>21.47</td>
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<td>EB</td>
<td>523.60</td>
<td>307</td>
<td>450</td>
<td>32.07</td>
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<tr>
<td>Group 2 - 1.2 - 1.5 - 4.2 - 180/1235</td>
<td>WB</td>
<td>627.48</td>
<td>184</td>
<td>430</td>
<td>15.71</td>
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<tr>
<td>Group 2 - 1.5 - 135</td>
<td>NB</td>
<td>385.43</td>
<td>21</td>
<td>245</td>
<td>27.14</td>
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<td>Group 2 - 1.5 - 135</td>
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<td>388.70</td>
<td>62</td>
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<td>18.23</td>
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<td>Group 3 - 5.1 - 135</td>
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<td>Group 3 - 5.1 - 135</td>
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<td>113.65</td>
<td>81</td>
<td>15</td>
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<td>Group 4 - 2.2 - 135</td>
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<td>Group 5 - 4.1 - 129</td>
<td>NB</td>
<td>217.98</td>
<td>209</td>
<td>105</td>
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<td>Group 5 - 4.1 - 129</td>
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<td>Group 5 - 4.1 - 180</td>
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<td>314.22</td>
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<td>60</td>
<td>9.30</td>
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<td>Group 6 - 3.1 - 3.2 - 3.3 - 129</td>
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<td>234.80</td>
<td>381</td>
<td>660</td>
<td>22.35</td>
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<tr>
<td>Group 6 - 3.1 - 3.2 - 3.3 - 129</td>
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<td>212.21</td>
<td>679</td>
<td>670</td>
<td>25.00</td>
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<td>Group 6 - 3.1 - 3.2 - 3.3 - US20</td>
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<td>123.29</td>
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<td>555</td>
<td>50.29</td>
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<td>Group 6 - 3.1 - 3.2 - 3.3 - US20</td>
<td>SB</td>
<td>128.43</td>
<td>25</td>
<td>550</td>
<td>58.40</td>
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<td>Group 7 - 2.1 - US20/1380</td>
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<td>163.32</td>
<td>84</td>
<td>455</td>
<td>20.89</td>
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<td>Group 7 - 2.1 - US20/1380</td>
<td>EB</td>
<td>170.59</td>
<td>130</td>
<td>455</td>
<td>29.92</td>
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<td>Group 8 - 6.2 - 174</td>
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<td>306</td>
<td>580</td>
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<td>Group 8 - 6.2 - 174</td>
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<td>273.91</td>
<td>602</td>
<td>1440</td>
<td>28.56</td>
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<td>Group 9 - 6.3 - 1280</td>
<td>SB</td>
<td>132.75</td>
<td>68</td>
<td>425</td>
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<tr>
<td>Group 9 - 6.3 - 1280</td>
<td>NB</td>
<td>126.53</td>
<td>258</td>
<td>465</td>
<td>7.95</td>
</tr>
</tbody>
</table>

* All calculations are made assuming the provided sensor data is correct.

An event is defined as the occurrence of speed lower than 45mph on any of the segments in the work zone.
Bi-weekly Reports

Daily Tracking

Source: Iowa DOT
Daily Reports

Data Completeness

Daily Heat Map

Source: Iowa DOT
Sensor Health

Source: Iowa DOT
Real-Time Monitoring

Source: Iowa DOT
Monitoring Alerts

Alert Viewer

Source: Iowa DOT
Confirming Alerts (1 of 2)

Would spot check alerts that were identified as false alerts by the Statewide Traffic Management Center.

Review speeds from corresponding sensors, DMS messages and nearby cameras.

Source: Iowa DOT
Confirming Alerts (2 of 2)

- Confirming messages types and validity of messages
- During 2015 season, a high volume of messages were being generated. Some messages were being generated due to low volume in traffic and single slow speed reading.
Future of TCP in Iowa

• 2015 Evaluation of Traffic Critical Performance
• Evaluate effectiveness of each strategy
  – Queue Detection
  – Lane Rental
  – Night Work
• Expand to other forms of IWZ
  – Travel Times
  – Probe Sensors
  – Count down timers
• Provide information by project type
  – Collect data to make informed decisions for next year
  – Involve designers to suggest IWZ for future work
For More Information:

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Center for Transportation Research and Education,
Iowa State University
sknick@iastate.edu
Smarter Work Zones
MARYLAND WORK ZONE PERFORMANCE MONITORING
Background

• Motivation
  – Compliance with Final Rule on Work Zone Safety and Mobility

• Funding
  – In 2013, Maryland State Highway Administration (SHA) and FHWA funded a project to develop a real-time performance monitoring tool for work zones using INRIX probe vehicle data and event data
Context

Source: Maryland SHA
Data Sources and Key Definitions

- Active work zone information provided by SHA CHART system in real-time
- Probe vehicle speed information from INRIX

User Delay Cost (UDC)

Calculated using:
- ADT (AADT with adjustment factor)
- Passenger/commercial vehicle percentages
- Speed reduction factor
- Delay
Audience and Goals

- **Audience:** Project Engineers and Managers
- **Goals:**
  - Real-time performance
  - Alerts when thresholds exceeded
  - Potential actions based on identified performance

- **Audience:** Public Relations
- **Goals:**
  - Real-time and historical performance
  - Responding to complaints and inquiries

- **Audience:** Planners and Decision Makers
- **Goals:**
  - Closure costs
  - Review of previous performance

Source: Maryland SHA

Regional performance

Individual work zone performance
Work Zone Dashboard

Overview List

Map

Delay

Source: Maryland SHA
Overview List

Source: Maryland SHA
Work Zone Dashboard

Source: Maryland SHA
## Critical Work Zones

### TOP CRITICAL WORKZONES

<table>
<thead>
<tr>
<th>SEVERITY/EVENT</th>
<th>LANE STATUS</th>
<th>QUEUE LENGTH (MI)</th>
<th>USER DELAY COST ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical (1)</td>
<td>![Lane Status Icon]</td>
<td>2.35</td>
<td>$7,781.00</td>
</tr>
<tr>
<td>I-695 INNER LOOP BETWEEN EXIT 12 MD 372 WILKENS AVE AND EXIT 13 MD 144 FREDERICK RD</td>
<td>![Lane Status Icon]</td>
<td>2.35</td>
<td>$7,781.00</td>
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<tr>
<td>Major (2)</td>
<td>![Lane Status Icon]</td>
<td>2.51</td>
<td>$9,527.00</td>
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<tr>
<td>RIVERDALE RD WEST BETWEEN 67TH PL AND MD 410</td>
<td>![Lane Status Icon]</td>
<td>1.01</td>
<td>$5,507.00</td>
</tr>
<tr>
<td>I-695 OUTER LOOP WEST OF EXIT 1 MD 173 HAWKINS POINT RD (CURTIS CREEK DRAWBRIDGE)</td>
<td>![Lane Status Icon]</td>
<td>1.5</td>
<td>$4,020.00</td>
</tr>
</tbody>
</table>

Source: Maryland SHA
Critical Work Zone Parameters

Source: Maryland SHA
Work Zone Dashboard

Source: Maryland SHA
## User Delay Cost (UDC) Information

### Table: User Delay Cost by Corridor and Day of Week

<table>
<thead>
<tr>
<th>Day</th>
<th>I-95</th>
<th>I-695</th>
<th>US-50</th>
<th>I-70</th>
<th>Daily Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wed 4/09/2014</td>
<td>$2,678,358.64</td>
<td>$626,606.88</td>
<td>$229,861.28</td>
<td>$48,652.15</td>
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<td>Thu 4/10/2014</td>
<td>$1,239,852.54</td>
<td>$1,050,702.81</td>
<td>$301,406.33</td>
<td>$77,104.65</td>
<td>$2,669,066.33</td>
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<tr>
<td>Fri 4/11/2014</td>
<td>$1,806,342.05</td>
<td><strong>$1,105,801.53</strong></td>
<td>$474,634.47</td>
<td>$107,010.25</td>
<td>$3,493,788.29</td>
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<tr>
<td>Sat 4/12/2014</td>
<td>$3,367,462.77</td>
<td>$1,070,675.02</td>
<td>$83,927.57</td>
<td>$6,721.70</td>
<td>$3,660,917.46</td>
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<td>Sun 4/13/2014</td>
<td>$2,548,281.11</td>
<td>$993,937.37</td>
<td>$8,015.17</td>
<td>$2,677,692.82</td>
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<td>Mon 4/14/2014</td>
<td>$2,661,674.56</td>
<td>$1,198,868.28</td>
<td>$184,730.13</td>
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<td>$4,634,004.76</td>
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<td>Tue 4/15/2014</td>
<td>$2,838,798.60</td>
<td>$905,736.49</td>
<td>$258,710.91</td>
<td>$125,311.87</td>
<td>$4,128,557.87</td>
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<tr>
<td>Wed 4/16/2014</td>
<td>$2,937,018.16</td>
<td>$500,186.92</td>
<td>$212,687.02</td>
<td>$83,203.90</td>
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<tr>
<td>Corridor Totals</td>
<td><strong>$20,077,788.75</strong></td>
<td><strong>$4,729,538.59</strong></td>
<td><strong>$1,867,770.87</strong></td>
<td><strong>$641,749.82</strong></td>
<td><strong>$27,315,848.03</strong></td>
</tr>
</tbody>
</table>

**Source:** Maryland SHA
## UDC Options and Corridor Selection

### User Delay Cost by Corridor and Day of Week

<table>
<thead>
<tr>
<th></th>
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<td>$83,203.90</td>
<td>$640,749.82</td>
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**Total User Delay Cost**

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Total</th>
<th>Cost Per User</th>
<th>Total Delay</th>
<th>Delay Per User</th>
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<td>I-95</td>
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<td>$27,315,848.03</td>
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</tbody>
</table>

Source: Maryland SHA
Work Zone Dashboard

Current Workzones in Maryland

Top Critical Workzones

User Delay Cost by Corridor and Day of Week

Source: Maryland SHA
Map Layers and Options
Individual Work Zone Profile

Map

Lanes

Settings

Performance Charts

Delay

Source: Maryland SHA
Settings and Map

Planned Closure @ US 29 SOUTH AT INDUSTRIAL PKW

Settings

Data Type...
- Measured Speeds
- Comparison to Historical Average

Show...
- Work Zone Bounds
- Posted Speeds
- Associated DMS
- Nearby Cameras
- Nearby Incidents
- Lane Status
- Bottlenecks (when available)

5 miles upstream
5 miles downstream

Permit Information
Project Information
Site Details

Configure Alerts

Source: Maryland SHA
Lane Profile

Segment Speeds

Live CCTV & DMS

Bottlenecks & Nearby Events
Individual Work Zone Profile

Source: Maryland SHA
Performance Charts (1 of 2)
Performance Charts (2 of 2)

Source: Maryland SHA
Adjusting Parameters

Source: Maryland SHA
Filtering Results

Source: Maryland SHA
### Individual Work Zone UDC

<table>
<thead>
<tr>
<th></th>
<th>12AM - 4AM</th>
<th>4AM - 8AM</th>
<th>8AM - 12PM</th>
<th>12PM - 4PM</th>
<th>4PM - 8PM</th>
<th>8PM - 12AM</th>
<th>Daily Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thu 4/17/2014</td>
<td>$11.52</td>
<td>$183.00</td>
<td>$9,306.97</td>
<td>$16,405.23</td>
<td>$2,958.90</td>
<td>$67.58</td>
<td>$28,933.20</td>
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<tr>
<td>Fri 4/18/2014</td>
<td>$6.17</td>
<td>$29.46</td>
<td>$82.00</td>
<td>$221.35</td>
<td>$127.06</td>
<td>$50.00</td>
<td>$516.04</td>
</tr>
<tr>
<td>Sat 4/19/2014</td>
<td>$27.17</td>
<td>$7.65</td>
<td>$3.12</td>
<td>$22.42</td>
<td>$17.28</td>
<td>$46.01</td>
<td>$123.66</td>
</tr>
<tr>
<td>Sun 4/20/2014</td>
<td>$39.81</td>
<td>$24.66</td>
<td>$0.00</td>
<td>$6.13</td>
<td>$26.78</td>
<td>$18.42</td>
<td>$115.80</td>
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<tr>
<td>Mon 4/21/2014</td>
<td>$2.46</td>
<td>$48.75</td>
<td>$788.33</td>
<td>$103.20</td>
<td>$899.54</td>
<td>$131.35</td>
<td>$1,973.63</td>
</tr>
<tr>
<td>Tue 4/22/2014</td>
<td>$25.38</td>
<td>$264.46</td>
<td>$1,819.85</td>
<td>$8,771.39</td>
<td>$2,675.70</td>
<td>$189.00</td>
<td>$13,745.58</td>
</tr>
<tr>
<td>Wed 4/23/2014</td>
<td>$20.52</td>
<td>$477.24</td>
<td>$12,525.82</td>
<td>$13,993.07</td>
<td>$16,213.27</td>
<td>$80.23</td>
<td>$43,310.14</td>
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<tr>
<td>Hourly Totals</td>
<td>$133.04</td>
<td>$1,035.22</td>
<td>$24,515.89</td>
<td>$39,522.78</td>
<td>$22,918.53</td>
<td>$582.59</td>
<td>Grand Total: $588,718.06</td>
</tr>
</tbody>
</table>

Source: Maryland SHA
Work Zone Alerts (1 of 2)

Source: Maryland SHA
Work Zone Alerts (2 of 2)

[Diagram of Work Zone Alert Creation Process]

1. Alert me if...
   - An accident happens near this work zone.
   - There is a bottleneck that's head or queue includes this work zone.
   - Speeds in the work zone fall below or exceed a certain range.

2. Alert me by...
   - Send me an email
   - Send me a text message

3. Alert me when...
   - Time zone: US/Eastern
   - Time period:
     - Days: Sun - Sat
     - Hours: 6:00 AM to 5:00 PM

Source: Maryland SHA
Next Steps

• **I-95 Corridor Coalition Expansion**
  – I-95 CC awarded $300,000 to deploy to as many agencies as possible
  – Backend re-architecture for scalability across 17 states
  – Data collection to support the application

• **Improvements**
  – Increased spatial granularity of probe vehicle data
  – Multiple probe vehicle data providers

Source: Maryland SHA
For More Information:

Nikola Ivanov
CATT Laboratory, University of Maryland
ivanovn@umd.edu
Smarter Work Zones
I-35 CENTRAL TEXAS

By The Numbers…

*How multiple data sources and performance measures keep I-35 travelers and engineers better informed…*
Overview

TxDOT is committed to finishing the widening of Main Street Texas (I-35) to six lanes from San Antonio to Hillsboro.

Current scope of I-35 Widening. (South of Salado to Hillsboro)

Source: Texas DOT
I-35 Demographics

- $2.1 billion
- Coordination of 17
- 96-MILE
- Corridor construction project cost
- Source: Texas DOT

- 55,000 to 111,000
- 30 million
- 25% to 35%
- Peak construction
- 200 directional
- MILES

- Different Projects
- Vehicles
- Travelers
- Truck
- Traffic
- 2012-2014
- Estimated complete 2017
- Central Texas

- Per day
- Per year

Source: Texas DOT
Data Sources

- Social Media Analytics
- Incidents
- CCTV
- PCMS
- Wavetronix
- Bluetooth
- Lane Closures
- Surveys

Source: Texas DOT
Traveler Information Surveys

- Initial survey to determine traveler’s needs

- Follow-up surveys to determine traveler satisfaction

Source: Texas DOT
Traveler Information PM’s:
Public Perception of Information Accuracy

- Nearly Always: 87%
- Most of the Time: 55%
- More than Half the Time: 9%
- Less than Half the Time: 3%
- Almost Never: 1%

Information is accurate...
Lane Closures

• Lane closure information submitted daily
• Basis for email distributions (Daily, 7-Day, High Impact)

• Updates as necessary
Lane Closure PM’s: Lane Closure Subscription Distribution Numbers

Source: Texas DOT
Bluetooth

- Travel times and segment delay
- Comparative travel times
- Section delay
- Daily post-mortem
- Detector heartbeats
- O&M database

Source: Texas DOT
Bluetooth PM’s
Travel Time Analysis

Source: Texas DOT
Wavetronix

- Volume / Classification / Spot Speed
- Sustained closure analyses
- Historical volumes and % trucks
- Detector heartbeats
- O&M database

Rolling 10-Week Average Volume (SSID 9196, Tuesdays, Northbound)
Wavetronix PM’s: Consistency of Information Over Time

Source: Texas DOT
PCMS PM’s:  On-line cycle counts / communication issues

- Message logging
- Error logging
- Cycle/Daily performance
- O&M database
CCTV

- Support traveler information
- Support incident management
- No PM’s / archive
- O&M database
## Incidents

- Incident alerts
- Incident impacts
- Detours
- Safety summit

### Incident Details

**I-35 at S Loop 363/US 190, Temple**

**MILE MARKER:** MM 299 (Bell County)

**VEHICLE(S):** Unknown

**SEVERITY:** Unknown

**AFFECTED:**

**TYPE:** Vehicle Collision

**EST. TIME TO CLEAR:** Undetermined

**EST. BACKUP:** 2-4 miles

**MAP:** [Click to see map](#)

**SB ALT. ROUTE:**
1. Exit 304 to Loop 363
2. Turn right and drive 6.0 miles to I-35
3. Turn right and drive to on-ramp.

**ALT. ROUTE INFO:** [Click to see alternate route info](#)

**LAST UPDATE**

JAN 9 10:20 PM Queue Cleared

Source: Texas DOT
### Incident PM’s: FHWA National Measures / Crash Rates

#### Roadway Clearance Time Overall

<table>
<thead>
<tr>
<th>Minutes</th>
<th>1st Quarter</th>
<th>Percent of Total Crashes</th>
<th>2nd Quarter</th>
<th>Percent of Total Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 30</td>
<td>5</td>
<td>11%</td>
<td>1</td>
<td>7%</td>
</tr>
<tr>
<td>31-90</td>
<td>15</td>
<td>33%</td>
<td>8</td>
<td>57%</td>
</tr>
<tr>
<td>&gt;90</td>
<td>26</td>
<td>57%</td>
<td>5</td>
<td>36%</td>
</tr>
<tr>
<td>Total</td>
<td>46</td>
<td></td>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>

#### Queue Clearance Time Overall

<table>
<thead>
<tr>
<th>Minutes</th>
<th>1st Quarter</th>
<th>Percent of Total Crashes</th>
<th>2nd Quarter</th>
<th>Percent of Total Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 30</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>31-90</td>
<td>5</td>
<td>38%</td>
<td>3</td>
<td>75%</td>
</tr>
<tr>
<td>&gt;90</td>
<td>8</td>
<td>62%</td>
<td>1</td>
<td>25%</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td></td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Source: Texas DOT
Incident PM’s:
FHWA National Measures / Crash Rates

Crash Rate
Before, During and After Construction
All Types, All Severity

Source: Texas DOT
Closures / Wavetronix

- Trip delay predictions
- EOQ recommendations

Source: Texas DOT
Closures / Bluetooth PM’s

- Monthly performance measures report

**Closure Impacts**
Percent of Closure Nights by Maximum Delays (Corridor)

Source: Texas DOT
O&M Database (1 of 3)

- All site issues recorded
- Short- / Long-term trends analysis

Source: Texas DOT
O&M Database (2 of 3)

Source: Texas DOT
O&M Database (3 of 3)

Source: Texas DOT
• One site, responsive to device / screen size
• All lane closure and incident notices dynamically link to event on site
• Tracking event clicks tells designers what information customers are looking at

Source: Texas DOT
Real-Time Map (2 of 2)

Source: Texas DOT
Social Media PM’s

- Email subscription rates
- Real-time map statistics
- Event clicks
- Twitter impressions

Source: Texas DOT
I-35: Connected Vehicles – Large Trucks

• Industry cooperation
• Fleets embrace technology / information
• Trucks over represented in crashes
• Partnered with USDOT FRATIS work efforts
  – Move beyond drayage to corridor optimization
  – Pre-trip planning for routes / loads
• Locational based awareness of:
  – Closures, Delays, Queues, Incidents, Speed Reductions
  – Audio alerts / voice interaction
• Independent evaluation
For More Information:

Robert Brydia
Texas A&M Transportation Institute
r-brydia@tti.tamu.edu
Smarter Work Zones

FHWA RESOURCES
SWZ Interactive Toolkit Available!

https://www.workzonesafety.org/SWZ/main

Source: FHWA
## Other Resources – Technology Application

| FHWA | • FHWA Work Zone Mobility and Safety Program – ITS and Technology  
|      | • FHWA Work Zone Mobility and Safety Program – Peer-to-Peer Program  
|      | • Work Zone ITS Implementation Guide  
|      | • Work Zone ITS Case Studies  
|      | • Work Zone ITS Overview Webinar  
Thanks for joining us!

• Upcoming Events
  – **Webinar #10**: Designing ITS Systems Based on Identified Needs
    • Wednesday, February 24, 2016, 1:00-2:30pm EST
  – Check The National Work Zone Safety Information Clearinghouse website for updates [https://www.workzonesafety.org/SWZ/main](https://www.workzonesafety.org/SWZ/main)

• Questions or Comments?
  – Jawad Paracha (FHWA Operations, WZ Team) [jawad.paracha@dot.gov](mailto:jawad.paracha@dot.gov)