SMART WORK ZONE EXPERIENCE
AND RESEARCH IN TEXAS

AASHTO Subcommittee on
Construction Annual Meeting

Cincinnati, OH
August 17th, 2017
Smart Work Zones = Work Zone ITS

- Automated *detection* and *interpretation* of current traffic conditions
- Dissemination of accurate, *real-time* information to travelers
Will Work Zone ITS Help my Project?

Answer: It depends.....
Work Zone ITS Implementation Guide Steps

1. Assessment of Needs
2. Concept Development & Feasibility
3. Detailed System Planning & Design
4. Procurement
5. System Deployment
6. System Operation, Maintenance, and Evaluation

Keys to Success

Applies to any WZ ITS deployment regardless of scale
1. Assessing Needs

• What are the traffic issues?
  – Why will they occur?
  – Where will they occur?
  – When will they occur?
  – How often will they occur?
  – How large will they get?

• What are the constraints?
  – Availability of space?
  – Type/speed of construction?
  – Staffing to monitor/use?
I-35 Widening, Central Texas

- **$2.1 billion**: Coordination of 17 projects with multiple contractors
- **96-MILE**: Different projects per day
- **60,000 to 132,000**: Vehicles per day
- **30+ million**: Travelers per year
- **25% to 35%**: Truck traffic
- **Construction**: In progress
- **200 directional MILES**: Estimated complete in 2019

### I-35 Aggregate User Needs

<table>
<thead>
<tr>
<th>Travelers</th>
<th>Contractors</th>
<th>Mobility Coordinators</th>
<th>TxDOT</th>
<th>Traffic Management Centers</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Clock" /> Travel Time/Speed</td>
<td><img src="image" alt="Cone" /> Lane Closure Information</td>
<td><img src="image" alt="Exclamation Mark" /> Incident Information</td>
<td><img src="image" alt="Queue" /> Queue Warning</td>
<td><img src="image" alt="Chat" /> Information Pre-trip and En Route</td>
</tr>
<tr>
<td><img src="image" alt="Pie Chart" /> System Information</td>
<td><img src="image" alt="Gears" /> Management and Operations Devices</td>
<td><img src="image" alt="Cloud" /> Data Warehouse</td>
<td><img src="image" alt="Graph" /> System Reports</td>
<td><img src="image" alt="Upload" /> TMC Data Exchange</td>
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</tbody>
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*Texas A&M Transportation Institute*
Traffic Queues Especially Problematic...

...Cumulative Delays Were Also a Concern
2. Develop Concept/Assess Feasibility

What work zone ITS applications do I need?

- Real-time travel time/delay information
- Queue detection/warning
- Performance monitoring
- Dynamic late merge management
- Incident detection/management
- Variable speed limit management
- Work space access warning
- Over-height detection/warning

Applications can usually be combined into a single system if needed.
3. Design the System

- System layout and operation
- Develop plans for
  - Testing
  - Operations
  - Maintenance
  - Training
  - Security
  - Outreach
  - Evaluation
- Requirements and specifications
Types of Traffic Sensors

**Doppler Radar**
- Speed only (k-band)
- Measures all vehicles in detection zone regardless of lane, direction of travel
- Ground level
- Battery powered
- Simple to set up (point, turn on)

**Microwave Radar**
- Speed/volume/occupancy
- Lane-by-lane monitoring
- Trailer-based, pole-mounted
- Solar powered
- Takes time to set up and calibrate each sensor

**Bluetooth**
- Reads MAC addresses of devices
- Measures all vehicles in detection zone regardless of lane, direction of travel
- Matches MAC addresses between two reader locations
- Solar powered
- Takes time to set up and calibrate each sensor
I-35 Smart Work Zone Components

- Traffic volume count and Bluetooth sensors
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• Traffic volume count and Bluetooth sensors

• Current travel times via PCMS
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- Traffic volume count and Bluetooth sensors
- Current travel times via PCMS
- Comparative travel time messages
- Current delay messages
- Queue warning system
Traveler Information Website
System Requirements and Bid Specifications

- Performance specifications
- Physical requirements (equipment, layout, method of payment, etc.)
- Ensure that requirements are relevant to the functionality of the system

**Special Specification 6079 Automated Portable Smart Traffic Monitoring System**

1. **DESCRIPTION**
   Furnish, install, relocate, operate, service, and remove various components of an automated, quickly deployable, portable, real-time smart traffic monitoring system (STMMS) meeting the requirements related herein, and providing the maintenance of the complete system for the duration of the project or as directed by the Engineer.

   Furnish an on-site System Coordinator. The Contractor is to maintain the system and shall be locally available to service and maintain system components. These portable devices are necessary and respond to emergency situations. The Contractor has oversight responsible for directing placement of devices in the project area. The Contractor shall have the ability to access and deploy a system where and when it is deployed. The System Coordinator shall provide installation information to the system coordinator and other responsible personnel for maintenance of the system prior to installation of the system. The STMMS is to be maintained throughout the period of deployment.

   Furnish a system capable of providing advance traffic information to motorists when there is a slowing of traffic due to congestion resulting from lane reductions or other conditions. The condition-responsive utilization of the system occurs with the use of Portable Changeable Message Signs (PCMS) situated through real-time traffic data collected at the PCMS location. The equipment must be a packaged system that complies with the requirements of this Specification. Equipment shall include: a system capable of utilizing the information provided by the PCMSs at the PCMSs' location. The equipment must be capable of providing adequate solar and battery power. The equipment must include a system capable of providing adequate solar and battery power. The equipment must include a system capable of providing adequate solar and battery power. The equipment must include a system capable of providing adequate solar and battery power.

   Provide an STMMS that consists of the following field equipment, portable display (color optional) powered non-invasive vehicle detection devices and solar battery powered PCMS's. Provide a system capable of withstanding inclement weather conditions and that can continue to provide adequate solar and battery power. The system must include: a system capable of providing adequate solar and battery power. The system must include: a system capable of providing adequate solar and battery power. The system must include: a system capable of providing adequate solar and battery power. The system must include: a system capable of providing adequate solar and battery power.

2. **MATERIALS**
   Provide materials that comply with the requirements of this item and the details shown on the plans. All materials must meet the manufacturer’s specifications and recommendations. The Contractor must maintain an adequate inventory of parts to support maintenance and repair of the STMMS.
## 4. Procurement

<table>
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<tr>
<th>Type</th>
<th>Characteristics</th>
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| Bid item in construction contract     | • Traditional approach  
• Contractor commitment determines success  
• Challenging for small projects         |
| Separate system contract for project(s) | • Exclusive focus  
• Can split costs among multiple projects  
• Increased complexity                   |
| On-call system/system component contracts | • Most flexible  
• Exclusive focus  
• Can split costs among multiple projects  
• Increased complexity                   |
5. Deployment

• Implement plans developed in step 3
• Allow for adequate start-up and calibration time
• Significant resources may be required to remain on schedule; expect the unexpected
• New technologies may require longer testing times to achieve acceptable performance levels

- Health monitoring

- Health monitoring
- Performance monitoring

- Health monitoring
- Performance monitoring
- Document and share lessons learned
- Evaluate when possible

Queue Warning Systems

- 55-60% reduction in number of crashes that would otherwise occur

![Bar Chart]

- % of Crashes Involving Injuries
  - 50% (Without Queue Warning)
  - 16% (Queue Warning)
Resources are Available

• FHWA Everyday Counts Smarter Work Zone Toolkit (www.workzonesafety.org/swz)
Questions?

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