Smarter Work Zones Webinar Series

Webinar #13: Implementing Work Zone ITS Applications – Procurement

Todd Peterson, Gerald (Jerry) Ullman, and Matthew Daeda

May 11, 2016        1:00-2:30pm EDT

Efficiency through technology and collaboration
Smarter Work Zones

INTRODUCTION AND TODAY’S SPEAKERS
Today’s Speakers

Todd Peterson, P.E., PTOE
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Smarter Work Zones (SWZ) Webinar Series

• This is the thirteenth in a series of monthly SWZ webinars
• Topics based on **what matters most to you!**
• Previous Webinar topics include:
  – Corridor-Based and Program-Based Project Coordination
  – Queue Warning Systems
  – Variable Speed Limits
  – Dynamic Lane Merge
  – Work Zone Project Coordination Guide and Examples
  – Integrating Project Coordination & Technology Applications: Iowa DOT
  – Lane Closure and Permitting Systems
  – Integrating Technology Applications: Massachusetts DOT
• Recordings and materials for previous webinars are available on The National Work Zone Safety Information Clearinghouse website: [https://www.workzonesafety.org/swz/webinars](https://www.workzonesafety.org/swz/webinars)

• **Coming Up:**
  – Webinar #14: *Leveraging Traffic Management Center Resources for Work Zone Management*
    Thursday, June 16th, 1:00-2:30pm EDT
Purpose of Today’s Webinar

Discuss the procurement of Work Zone Intelligent Transportation Systems (ITS) applications as highlighted in Step 4 of the Work Zone ITS Implementation Guide and real-world examples of procurement of Work Zone ITS applications.

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. Work Zone ITS Implementation Guide Step 4
   - Provide an overview of Step 4 of the Work Zone ITS Implementation Guide and the tasks/activities associated with this step

3. SWZ Real-World Examples
   - Provide real-world examples of how states have approached the procurement of Work Zone ITS applications.
Smarter Work Zones
SWZ OVERVIEW &
TECHNOLOGY APPLICATION INITIATIVE
What are Smarter Work Zones (SWZ)?

*I 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*
Technology Application – What is it?

Deployment of ITS for dynamic management of work zone traffic impacts, such as queue and speed management to provide actionable information to drivers and traffic managers.

Capabilities include:

- Improving driver awareness
- Providing dynamic and actionable guidance to drivers
- Enhancing tools for on-site traffic management

Source: FHWA
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
Work Zone ITS Implementation Guide

• Provide guidance on implementing ITS in work zones to assist public agencies, design and construction firms, and industry stakeholders
• Presented through a 6-step Systems Engineering Approach to WZ ITS implementation
• Available for download at: http://ops.fhwa.dot.gov/publications/fhwahop14008/index.htm
Focus of Today’s Webinar

• Step 4 for the 6-step approach

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

Procure the work zone ITS by first considering a number of options, based on the type of deployment being procured.

Steps include:

• Assessing procurement options
• Deciding direct or indirect procurement
• Determining the procurement award mechanism
• Issuing a request for proposals
• Selecting the preferred vendor, consultant, or contractor
Procurement Approaches

- Procurement options depend on the characteristics of the ITS
- Traditionally, WZ ITS procurement has primarily been for COTS or customized ITS solutions
- Potential now exists for agencies and contractors to purchase data collected by private-sector data providers for similar purposes
Procurement Considerations

• Direct Procurement
  – Purchase
  – Lease

• Indirect Procurement
  – Special Provision part of Contract
  – Change Order to Contract
  – Best Value or Design Build
  – Part of Performance Requirements
Direct Procurement (1 of 2)

• Purchase
  – Long Duration
  – Multiple Projects
  – Requires Agency Expertise and Control

• Lease
  – Qualified Contractor Required
  – Contractor Equipment Maintenance and Deployment
  – Contractor Risk
Direct Procurement (2 of 2)

- Contractor has ITS focus
- Direct oversight by DOT Traffic Operations
- Improved Contractor Response
- Requires Cooperation Provisions
- Best Value
- Pay for Performance
Indirect Procurement (1 of 2)

- Special provision part of contract
- Change Order to Contract
- Best Value or Design Build
- Part of Performance Requirements
Indirect Procurement (2 of 2)

- Easy – follows traditional contract development and administration
- Employees sub-contractor for ITS deployment
- Typically lump sum payments

Source: Google
Indirect Deployment Issues

- Lower Priority by Prime Contractor
- Startup time delays
- Subcontractor ability to integrate and manage
- Agency Oversight

Source: Minnesota DOT
Indirect Procurement Considerations

• Agency Expertise
• Available Qualified Contractor
• COTS or Customized System Needs
• Deployment Alternatives
  – Single Project
  – Multiple Projects
• Integration into TOC and Use of Existing ATMS
• Agency Needs and Experience
• Maintenance and Operation
• Evaluation
Step 4: Key Takeaways

• In procuring work zone ITS, there are three different perspectives:
  – Contracting agency that desires work zone ITS
  – Contractor responsible for the overall construction project
  – Vendor who supplies work zone ITS

Step 4 Outcome

• Procurement Type and Mechanism Determined
• RFP Issued
• Proposal Selected
Smarter Work Zones
MASSACHUSETTS DOT’S
PROCUREMENT PROCESS
Technology Applications: Existing Practices

- MassDOT has used Work Zone ITS applications on 12 projects to date
- Monitoring traffic conditions and providing real-time feedback helps to lessen driver frustration about travel conditions
- MassDOT’s Real-Time Traffic Monitoring System specification is a “living document”
- Sharing SWZ system access/data with partner agencies improves network mobility and credibility for project delivery
SWZ Equipment

- Portable Changeable Message Signs (PCMS)
- Portable Camera Trailers
- SWZ Operating System
- Speed Feedback Boards
- Radar/Doppler Sensors
- Bluetooth Sensors
- Probe Data
Step 4: Define SWZ Specifications

Lessons Learned

• Include detailed descriptions of the required equipment and expected functions
• Define expectations for system operations
• Document placement, calibration and testing expectations
• Define expected performance/deliverables
Step 4: Specifications for System Management

**Purpose:** Contractor/vendor shall supply the necessary equipment to monitor traffic, collect data, provide real-time reporting and remote messaging via the vendor supplied and maintained website

**Required Personnel:**

*Project Manager* – Overall project lead to manage RTTM project

*Local Systems Manager* – Experienced in managing day-to-day operation & maintenance of SWZ systems and equipment

*Local Field Maintenance/Repair Technicians* – maintain devices

*Software Specialist* – Configuration of system logic and calibration of algorithms to deliver real-time information
For More Information:

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Smarter Work Zones
TEXAS DOT’S PROCUREMENT OF
END-OF-QUEUE WARNING SYSTEMS
Lane Closure Monitoring System Plan 1

PCMS Operations Rules: Deployment Plan 1 (Max Design Queue ≤ 3.5 Miles)

<table>
<thead>
<tr>
<th>PCMS Message</th>
<th>Lane 1</th>
<th>Lane 2</th>
<th>Lane 3</th>
<th>Lane 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROAD WORK AHEAD</td>
<td>OR</td>
<td>OR</td>
<td>OR</td>
<td>OR</td>
</tr>
<tr>
<td>SLOW TRAFFIC 3 MILES</td>
<td>V = 55</td>
<td>V = 55</td>
<td>OR</td>
<td>OR</td>
</tr>
<tr>
<td>SLOW TRAFFIC 7 MILES</td>
<td>OR</td>
<td>OR</td>
<td>V = 0.0</td>
<td>V = 0.0</td>
</tr>
<tr>
<td>SLOW TRAFFIC 1 MILE</td>
<td>V = 55</td>
<td>40 ≤ V ≤ 55</td>
<td>V = 40</td>
<td>V = 40</td>
</tr>
<tr>
<td>SLOW TRAFFIC AHEAD</td>
<td>40 ≤ V ≤ 55</td>
<td>OR</td>
<td>40 ≤ V ≤ 55</td>
<td>V = 40</td>
</tr>
<tr>
<td>STOPPED TRAFFIC 3 MILES</td>
<td>OR</td>
<td>OR</td>
<td>OR</td>
<td>OR</td>
</tr>
<tr>
<td>STOPPED TRAFFIC 2 MILES</td>
<td>OR</td>
<td>OR</td>
<td>V = 0.0</td>
<td>V = 0.0</td>
</tr>
<tr>
<td>STOPPED TRAFFIC 1 MILE</td>
<td>OR</td>
<td>OR</td>
<td>0.0 ≤ V ≤ 40</td>
<td>Any value</td>
</tr>
<tr>
<td>STOPPED TRAFFIC AHEAD</td>
<td>0.0 ≤ V ≤ 40</td>
<td>Any value</td>
<td>Any value</td>
<td>Any value</td>
</tr>
</tbody>
</table>

Note: Location of the sensors and the PCMS can be adjusted slightly based on site conditions (ramp locations, other static signs, overpasses, etc.)

The seal appearing on this document was authorized by Larry J. Colclasure, P.E., 65936, on June 8, 2020.

Non-Intrusive Traffic Speed Detector
Portable Changeable Message Sign

Start of lane closure merge taper
Lane Closure Monitoring System Plan 2

PCMS Operations Rules: Deployment Plan 2 (Max Design Queue ≤ 7.5 Miles)

Note: Location of the sensors and the PCMS can be adjusted slightly based on site conditions (e.g., locations, other static signing, overpasses, etc.)
Benefits

- 44% decrease in crashes
- Avoiding $6,300 in crash costs per night
Procurement: Initial Concept

• Change-ordered into existing contracts
• Include as bid-item in upcoming contracts
• Bid as a per-use cost
  – Estimate remaining EOQ needs
  – Pro-rate equipment and labor accordingly
  – TxDOT to authorize when EOQ system was needed
• Created uncertainty and bid variation amongst contractors
Procurement: Final Approach

- Bid one-time mobilization costs for equipment
- Also bid per-night deployment for labor, maintenance, replacement, etc.
- Reduction of uncertainty yielded 28% lower total bid estimates
- “Sharing” of systems by contractors as needed

<table>
<thead>
<tr>
<th>Number of Deployments</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Plan 1 Deployments</td>
<td>237</td>
</tr>
<tr>
<td>Number of Plan 2 Deployments</td>
<td>82</td>
</tr>
<tr>
<td>Nights with:</td>
<td></td>
</tr>
<tr>
<td>1 Deployment</td>
<td>178 (74%)</td>
</tr>
<tr>
<td>2 Deployments</td>
<td>50 (21%)</td>
</tr>
<tr>
<td>3 Deployments</td>
<td>11 (5%)</td>
</tr>
<tr>
<td>4 Deployments</td>
<td>1 (0%)</td>
</tr>
</tbody>
</table>
## WZ ITS Cost Summary

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Mobilization Cost per Plan 2 System (8 systems procured for corridor)</td>
<td>$203,000</td>
</tr>
<tr>
<td>Per Deployment Cost (Plan 1)</td>
<td>$900</td>
</tr>
<tr>
<td>Per Deployment Cost (Plan 2)</td>
<td>$1,500</td>
</tr>
<tr>
<td>Total WZ ITS Deployment Costs to Date</td>
<td>$1.96 million</td>
</tr>
</tbody>
</table>
For More Information:

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Smarter Work Zones

IOWA DOT’S PROCUREMENT APPROACH
Intelligent Work Zone (IWZ) Goals

• Expanded Monitoring
  – Traffic Sensors, Portable Cameras
• Warn Drivers
  – Portable DMS, 511ia.org
• Automation
  – Queue Detection, Trucks Entering, Speed Warning

Statewide Integration
IWZ Resources

• Statewide Traffic Management Center (TMC)
• Existing ITS Devices:
  – Cameras, Sensors, DMS
• TransSuite Software
  – “Queue Detection”
• ITS Communication Network
• Integration of Rental Devices
Iowa DOT Statewide IWZ Project

- Procurement by leasing equipment and services
- Used pay for performance contract
- Selected based on previous contractor experience
Procurement Example

- Iowa Statewide IWZ Deployment
- Standalone Procurement
  - Assistance from SRF Consulting in writing contract and managing projects
  - Qualifications and Cost-based selection of Street Smart Rentals – Minnesota
  - Integration Support from TransCore
  - Operations by Schneider/Telvent

Source: Iowa DOT
IWZ Successes

• TMC Monitoring
• Flexible Statewide IWZ Contract
  – Very easily added or removed deployments
• Integration
  – Permanent vs. Portable; Owned vs. Rental
  – Cameras & DMS on 51ia.org
• Extensive Coordination
• Performance and Data Tracking Tools
For More Information:

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Smarter Work Zones
PROCUREMENT OF WORK ZONE ITS SYSTEMS AND ON-CALL SMART WORK ZONE SYSTEMS IN ILLINOIS
Procurement

- IDOT follows the ITS Implementation Guide Process when procuring Work Zone ITS
- IDOT has used the direct method in deploying ITS devices to supplement existing surveillance systems or monitor work zone conditions
- More typically, IDOT utilizes the indirect method when a Work Zone ITS is needed.
As Part of a General Construction Contract

- IDOT generally uses the indirect procurement method when utilizing work zone ITS.
  - Provisions for Work Zone ITS are included in an overall construction contract.

Source: Battelle
As a Change Order to an Existing Contract

- IDOT also has added ITS work zone systems as a change order to existing contracts.
  - General guidance on the number of devices, expected performance, and methods of measurement and payment in a special provision.
  - In such cases, the district would have required the prime contractor to seek bids from 2 or 3 smart work zone system providers, and likely would have accepted the low “bidder”.

Source: Battelle
In 2015 IDOT let on-call smart work zone contracts were developed.

- Standalone Work Zone ITS Contract
- General guidance on the number of devices, expected performance, and methods of measurement and payment in a special provision.
On-Call Smart Work Zone Systems in Illinois (1 of 2)

- IDOT awarded three on-call contracts in 2015.
- These are three year contracts.
- These contracts are targeted for use with short duration operations/activities.
- The systems provide queue detection and warning.
On-Call Smart Work Zone Systems in Illinois (2 of 2)

• Generally, operation/activity durations of no longer than approximately 2 weeks or less.
• Operations/activities involving lane closures on freeways/expressways where significant traffic impacts are anticipated.
• Most often their use has been on IDOT internal operations/maintenance projects, although some have been deployed on contractor-performed projects.
Current On-Call Contracts in Illinois (1 of 2)

• Pay Items:
  – Districts 1 and 8: consisting of four (4) portable changeable messages signs, smart traffic monitoring system which includes four (4) devices, and call-out per typical deployment
  – District 9: consisting of one (1) portable changeable message sign, smart traffic monitoring system, and four (4) smart traffic monitoring devices per typical deployment
Current On-Call Contracts in Illinois (2 of 2)

• Method of Measurement and Basis of Payment:
  – District 1 and District 8
    • Call outs are set on an each basis
    • Smart Traffic Monitoring System and Changeable Message Signs are per calendar day.
  – District 9 allows for the Smart Traffic Monitoring System and Changeable Message Signs per the calendar day, week, and monthly.
On-Call Contract Advantages

• Only pay for the system when needed to address queueing conditions.
• Work directly with the Vendors
• Staff has access to the system, direct monitoring
• Very valuable tool to use with other mitigation strategies.
# WORK ORDER
## DISTRICT 1 SMART TRAFFIC MONITORING SYSTEM

### Sheet 1 of 2

<table>
<thead>
<tr>
<th>WORK ORDER NO.</th>
<th>3</th>
<th>Date of Issue</th>
<th>3/7/2016 ROUTE</th>
<th>WB I-80</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION</td>
<td>WB I-80 at Des Plaines River in Will County, IL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONTRACT NO.</td>
<td>62A35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLAIM NO.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**HIGHWAY LIGHTING CABLE PRESENT**

<table>
<thead>
<tr>
<th>CODE NUMBER</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
<th>QUANTITY</th>
<th>UNIT PRICE</th>
<th>ITEM COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>X7010237</td>
<td>CHANGE MESSAGE SN SPL</td>
<td>CAL DA</td>
<td>16.00</td>
<td>100.00</td>
<td>$1,600.00</td>
</tr>
<tr>
<td>X8570001</td>
<td>SMART TRAF MONIT SYS</td>
<td>CAL DA</td>
<td>4.00</td>
<td>500.00</td>
<td>$2,000.00</td>
</tr>
<tr>
<td>Z0008759</td>
<td>CALL OUT</td>
<td>EACH</td>
<td>1.00</td>
<td>19,366.66</td>
<td>$19,366.66</td>
</tr>
</tbody>
</table>

**TOTAL COST**

| TOTAL COST   | $22,966.66 |

Source: Illinois DOT
SMART TRAFFIC MONITORING SYSTEM (CALL-OUT)
(TYPICAL EXAMPLE)

CHANGEABLE MESSAGE SIGNS EVERY 1 MILE
CHANGEABLE MESSAGE SIGNS TO START 1 MILE PRIOR TO WORK ZONE
APPROACH CLOSURE

1 MILE 1 MILE 1 MILE

TRAFFIC

1 MILE 1 MILE VARIABLE

SMART TRAFFIC MONITORING DEVICE LOCATIONS

WORK ZONE TRAFFIC CONTROL
COMPLETED W/ EXISTING DISTRICT
TRAFFIC CONTROL DEVICE CONTRACT

1 MILE APPROACH TO
LANE CLOSURE

TRAFFIC CONTROL STANDARD
"SEE APPROPRIATE STD. FOR
DETAILS OF LANE CLOSURE"
(BY OTHERS)

CLOSURE, MAINTENANCE
WORK, ETC.

Source: Illinois DOT

NOTES:

1. ACTUAL LOCATION OF SMART MONITORING DEVICES SHALL BE
BASED ON MANUFACTURER'S SPECIFICATIONS AND RECOMMENDATIONS
ALONG WITH THE SPECIAL PROVISIONS AND AS DIRECTED BY THE ENGINEER.

2. MODIFICATIONS MAY BE NECESSARY TO ACCOMMODATE SPECIFIC CLOSURES.
ALL CHANGES WILL BE APPROVED BY THE ENGINEER.

LEGEND

CHANGEABLE MESSAGE
SIGN LOCATIONS

SMART TRAFFIC MONITORING
DEVICE LOCATION

DRNM/BARRICADES
PER APP. STANDARD
(BY OTHERS)

Source: Illinois DOT
Lessons Learned and Future Considerations (1 of 2)

• It is recommended to:
  – Add provisions that require the vendor to install and text any software on IDOT computers within 1 month of contract execution
  – Provide greater flexibility by adding a pay item for individual sensors, if needed (similar to District 9)
  – Specify a required timeline for each of the work orders (issuance, system in place and functional, etc.)
Lessons Learned and Future Considerations (2 of 2)

– Provide clarification on how IDOT would pay for deployments that exceed 1 week, but less than 1 month
– Include an additional statement under “Cooperation Between Contractors” to avoid potential conflicts when deploying on-call systems on other contractor-performed projects
– Provide quantity for CCTV cameras
– Provide clarification on how to handle relocation of systems/devices under a single work order (payment or incidental)
Future of On-Call Smart Work Zone Systems in Illinois

• Success of initial on-call contracts has prompted IDOT to expand statewide.
• District 3 had an on-call contract on the April 22, 2016 letting.
• Districts 2 and 5 will have on-call contracts on the June 2016 letting.
For More Information:

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Smarter Work Zones

FHWA RESOURCES
SWZ Interactive Toolkit Available!

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

Source: FHWA
# Other Resources – Technology Application

Thanks for joining us!

• **Upcoming Events**
  – **Webinar #14: Leveraging TMC Resources for Work Zone Management**
    • Thursday, June 16, 2016, 1:00-2:30pm EST

• Registration: Coming Soon!
  – Check The National Work Zone Safety Information Clearinghouse website for updates
    [https://www.workzonesafety.org/SWZ/](https://www.workzonesafety.org/SWZ/)

• **Questions or Comments?**
  – Jawad Paracha (FHWA Operations, WZ Team)
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