Smarter Work Zones Webinar Series

Webinar #10: Designing Intelligent Transportation Systems (ITS) Based on Identified Needs

Todd Peterson, Solomon Haile, and Jon Jackels

February 24, 2016 1:00-2:30pm EST

Efficiency through technology and collaboration

Every Day Counts (innovation, ingenuity, invention, imagination)

U.S. Department of Transportation
Federal Highway Administration

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 tenth in a series of bi-weekly 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
- 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:
  - Wednesday, March 23rd, 1:00-2:30pm EDT – Webinar #11: Topic TBA

Purpose of Today's Webinar

Provide a comprehensive overview of the Work Zone Intelligent Transportation Systems (ITS) Implementation Guide Steps 1-3 and real-world examples of how agencies have completed these steps.

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 Steps 1-3
   - Explain Steps 1-3 of the Work Zone ITS Implementation Guide and the tasks/activities associated with each step
3. SWZ Real-World Examples
   - Provide real-world examples of how two different agencies completed Steps 1-3 of the Work Zone ITS Implementation Guide.

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

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

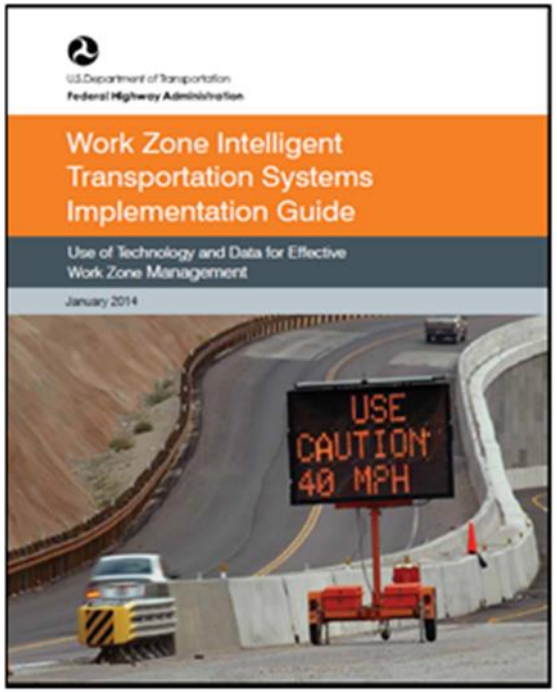
- **What does this mean?**
  - Consideration of the six step process explained in the WZ ITS implementation guide to plan and implement ITS strategies
  - Identify and use ITS strategies such as speed and/or queue management on at least one project for dynamic management of work zone impacts

Smarter Work Zones

Work Zone ITS Implementation Guide

Focus of the Guide

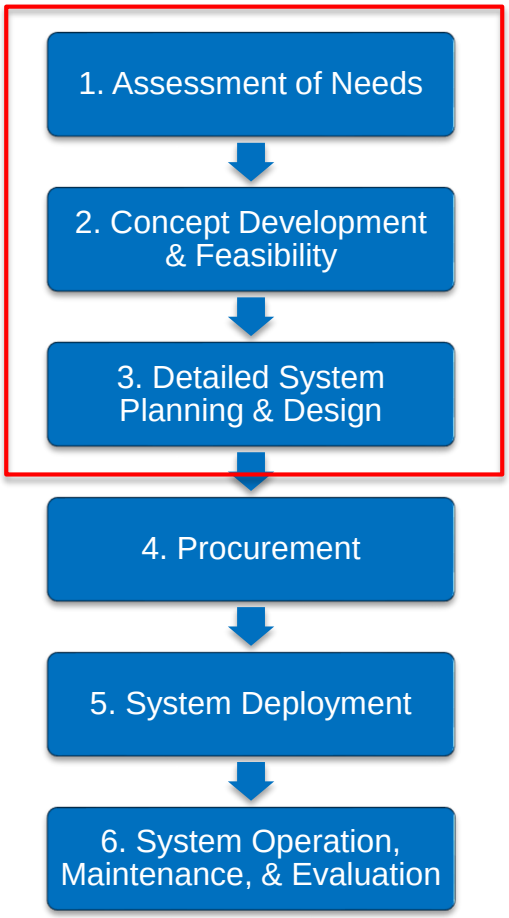
- Provide guidance on implementing ITS in work zones to assist public agencies, design and construction firms, and industry stakeholders
- Presented through a 6-step Systems Engineering Approach to WZ ITS implementation
- Available for download at: **http://ops.fhwa.dot.gov/publications/fhwahop14008/index.htm**



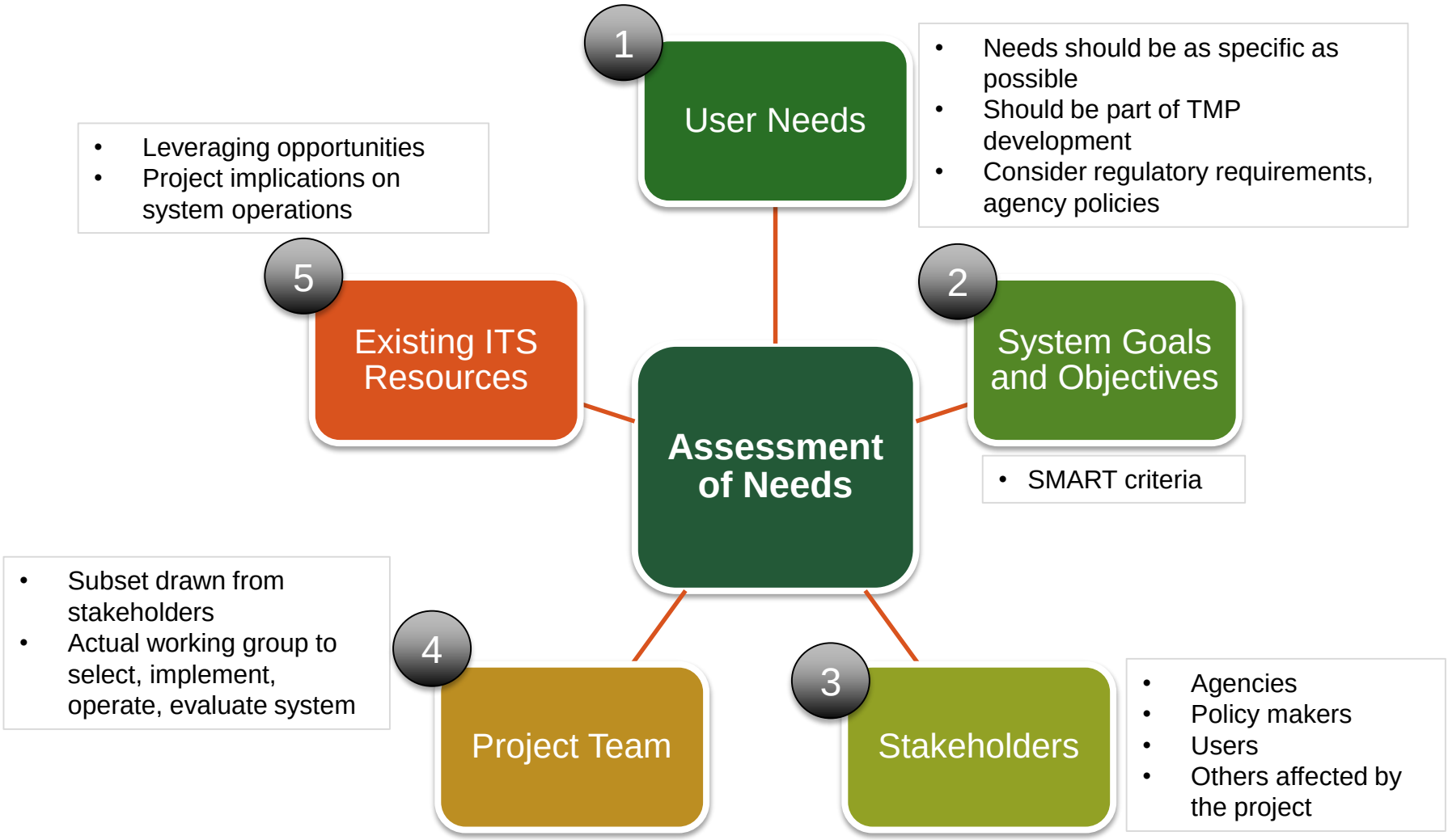
Source: FHWA

Focus of Today's Webinar

- Steps 1-3 of the 6-step approach



Step 1: Assessment of Needs



Step 1: Key Takeaways

- Plan with the end goal in mind
- “Want to use ITS” is not a need
- Use a coordinated approach – consider issues in the context of impacts assessment and TMP development

Step 1 Outcome

- Define needs that must be addressed by the concept of operations
- Stakeholders and project team identified
- Available assets & major constraints identified

Step 2. Concept Development and Feasibility

- Answers the question - "How does the agency envision that the system will operate within WZ?"
- May include multiple sub-systems
- Solution-agnostic

- Is the system permitted in the current laws and regulations?
- What is the potential increased liability for placing ITS equipment in the work zone?
- What are possible liability issues regarding how warnings and messages are given?

- Peer-to-peer contact Cross-training
- "What's in it for me?"

Three main categories of ITS
- Stand-alone, COTS
- Customized WZ ITS solutions
- Services or data only (no equipment)

Examples of Benefits for Various WZ ITS

Work Zone ITS	Issue(s) being Addressed	States with Studies of Example Deployments[1]	Example of Benefits
Real-time Traveler Information	• Congestion • Delay • Safety	CA, DC, NE, OR	16-19% reduced traffic volumes (diversion) on affected route (CA)
Queue Warning	• Safety (crashes)	IL	Significantly reduced speed variance; reduced vehicle conflicts; queuing crashes reduced 14% despite an increase in both lane closures and vehicle exposure.
Dynamic Lane Merge (early merge, late merge)	• Delay • Aggressive driving behavior • Travel speed • Safety • Queue length	FL, MI, MN	Reduced forced and dangerous merges by factors of 7 and 3, respectively (MI)
Incident Management	• Incident clearance time • Delay	NM	Reduced average time to respond and clear incident from 45 minutes to 25 minutes (NM)
Variable Speed Limits (VSL)	• Speed management • Safety	VA, UT	Greater speed compliance vs. static signs; reduced average speed and variation (UT)
Automated Enforcement	• Speed management	MD, IA, IL, OR	Significantly reduced speeds by 3-8 mph (IL)
Entering/Exiting Vehicle Notification	• Safety	MN, PA	Signs warn drivers of a slow-moving construction or emergency vehicle entering or exiting the roadway to reduce crash risk.

Step 2: Key Takeaways

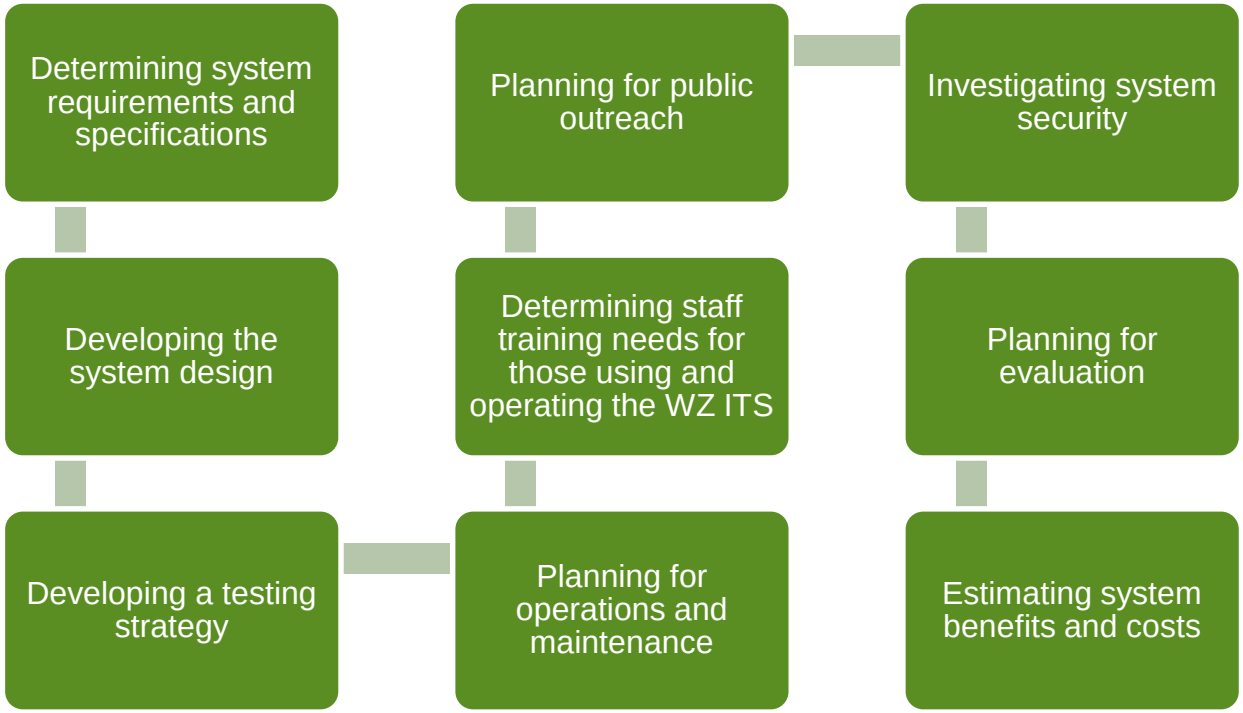
- Engage ITS staff as a source of expertise
- Achieving a broad level of consensus in this step is a prerequisite to moving to Step 3
- Presenting results of Step 2 to stakeholders is essential

Step 2 Outcome

- Concept of Operations Report

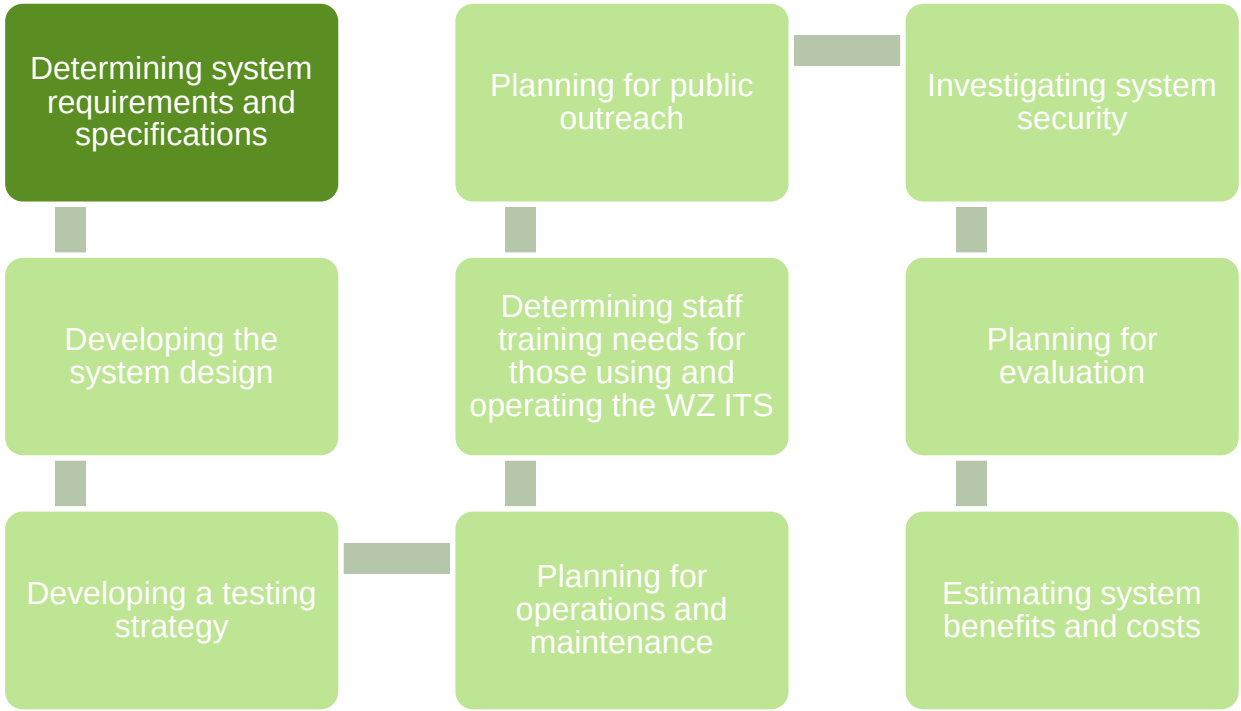
Step 3: Detailed System Planning and Design

Develop system requirements and specifications, develop performance measures for the system objectives, and prepare plans for deployment and subsequent operations and maintenance.



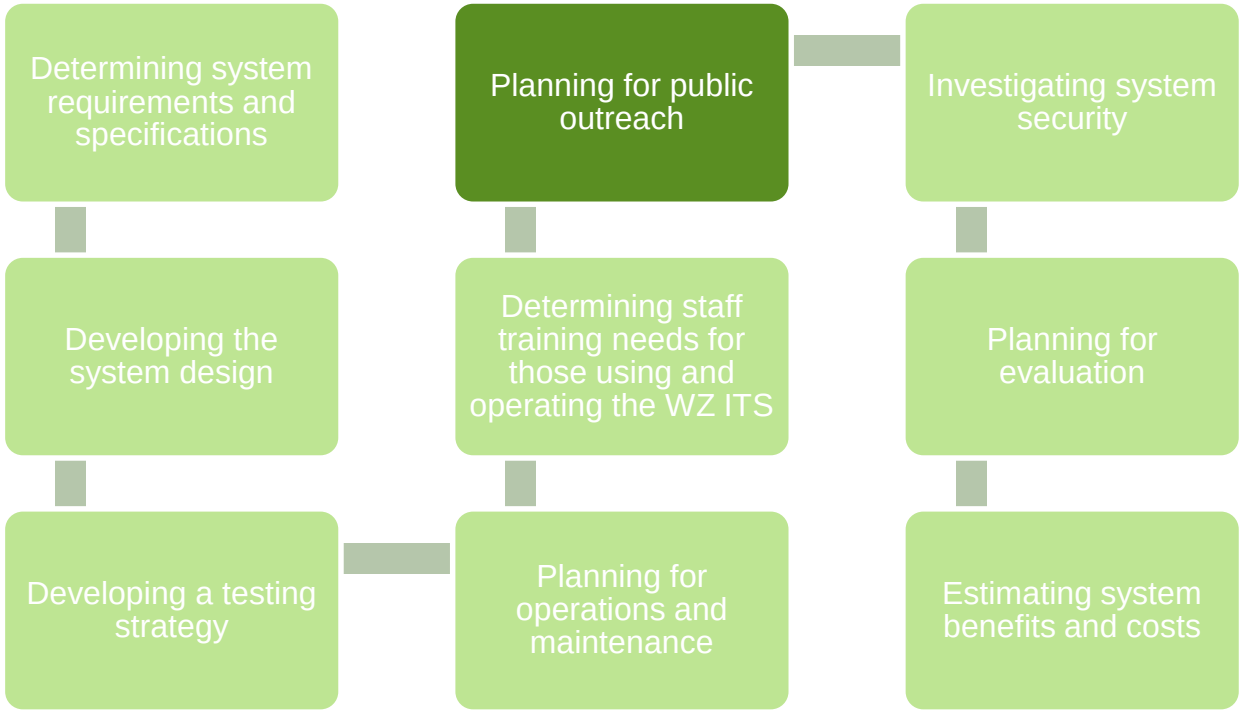
System Requirements

- Performance vs. technical specifications
- Requirements should link to a user need
- Requirements should be verifiable and performance monitored



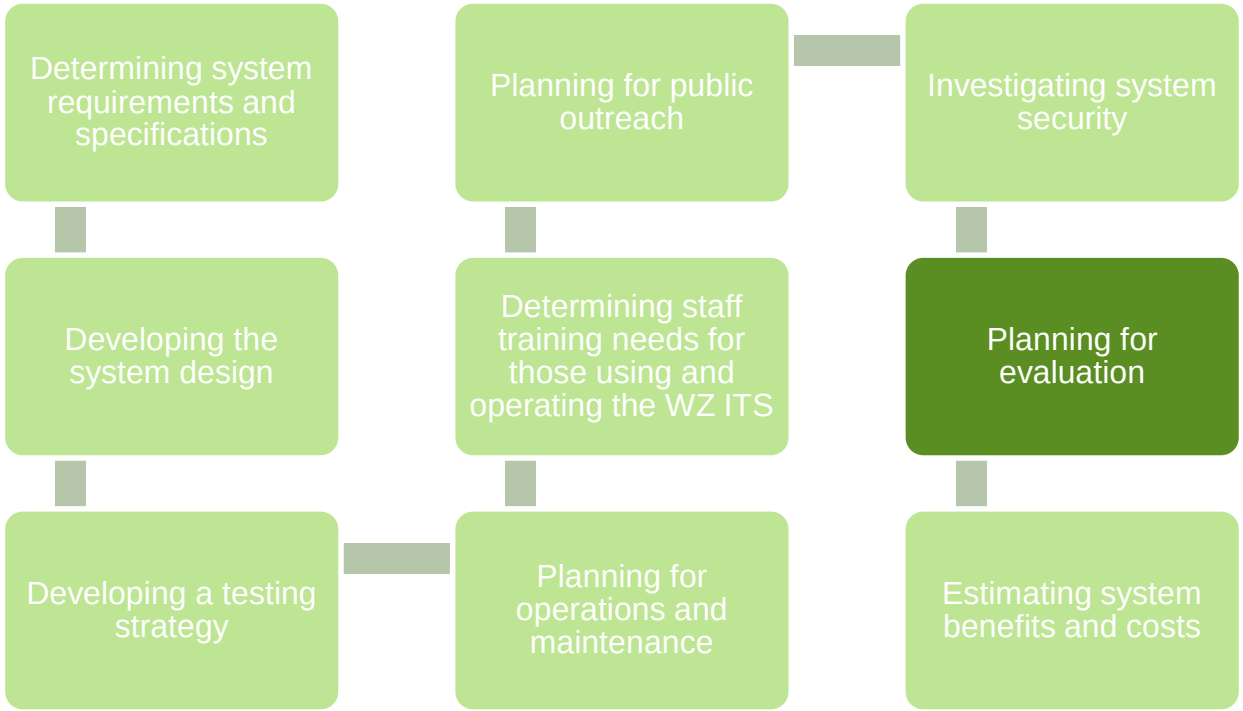
Public Outreach

- Outreach must speak the language of the audience
- How will system output feed outreach strategies



Planning for Evaluation

- Identify changes needed to optimize operation and improve performance
- Understand and quantify benefits of the system
- Document lessons learned



Example Evaluation Criteria

Evaluation Objective	Hypothesis	Measures of Effectiveness	Required Data
Mobility – Reduce delay and optimize travel times through the construction corridor by providing advanced traveler information**.**	The ITS will reduce travel time through the corridor during construction.	• Change in travel time over baseline conditions in the primary direction during construction. • Change in the overall corridor-wide travel time reliability • Change in travel time on recommended or viable alternate routes	• Observed corridor travel time during construction • Observed travel time variability • Observed alternate route travel times during construction • Observed queue lengths before and after ITS on mainline routes

Example Evaluation Criteria

Evaluation Objective	Hypothesis	Measures of Effectiveness	Required Data
Safety – Improve traveler safety in the construction corridor	The ITS implementation will reduce crash risks during construction.	• Changes in the number of crashes or crash severity occurring in the corridor • Changes in speed variability along the corridor during construction • Change in the number of conflicts that occur in the corridor during construction	• Historical crash data • Real-time crash data • Observed speed variability during construction • Observed number of conflict situations occurring during construction

Step 3: Key Takeaways

- Documentation should include plans for system testing, operation, staffing, public outreach, security, and evaluation throughout duration
- Must plan for each of these aspects to avoid issues with system deployment and ensure data will be available for system evaluation
- Most effective evaluations occur when the goals and objectives are explicitly stated, measurable, and agreed to by all stakeholders

Step 3 Outcome

- Systems Plan, Specifications, and Estimate (built off of ConOps)

Smarter Work Zones

Colorado DOT I-70 Veterans Memorial Tunnel Project

Project Fact Sheet

- The first capacity expansion project on the corridor in nearly 40 years.
- Project was created to improve safety and mobility in the I-70 corridor by adding one eastbound lane.
- The highway has 45,000 AADT with 7% trucks.
- $100 million project required innovative contracting and partnership.
- Economical impact on the corridor $2.5 billion.
- Traffic was detoured on a narrow frontage road, 24 hours a day from April 1 – November 15, 2013.
- Several blasting sequences per day. Traffic needed to stop 20-30 minutes with all traffic cleared within one hour of the closure.

SWZ Background

- First introduced in July 2012 at the Western Association of State Highway and Transportation Officials (WASHTO) conference in Colorado Springs.
- CDOT saw the potential traffic benefits of SWZ and were very interested in the significant traffic benefit after TxDOT implemented the concept along I-35.
- Stantec Inc. was tasked by CDOT to design and write specifications as a standalone project.
- Project was awarded to TK Construction for $342,000 with PDP Associates and Yourway, Inc. as subcontractors.
- Project was set to go before FHWA's publications of the Work Zone ITS Implementation Guide.

Project Objective and Need

- Effective work zone management and operations.
- Improved work zone safety, mobility.
- Reduced travel times and queue lengths.
- Improved speed management.
- Real-time queue warning.
- Current travel time information.
- To relate expected construction delay information.
- To provide local residents, regional and long distance travelers with information about what is happening.
- To provide something better beyond and above traditional MUTCD traffic control capabilities.
- Gives control back to the driver to choose an alternate route.

Public outreach – How to cope with construction?

- Smarter Work Zone.
- Two lanes of traffic in each direction.
- A courtesy patrol and heavy tow.
- Keeping coming to the mountains for recreation, shopping, and dining.
- Save money and minimize air pollution by turning off your care while you are idling during closures.
- Call the project hotline.
- View cameras on your phone and computer.

Smarter Work Zone Implemented

- Project VMS placement location from Golden to Silverthorne (56 miles).

Source: Colorado DOT

Smarter Work Zone field implementation

- Project included:
  - 8 VMS panels
  - 10 portable, non-intrusive Wavetronix
  - 9 portable pan-tilt-zoom cameras
  - CO for additional 2 Bluetooth sensors

Source: Colorado DOT

Source: Colorado DOT

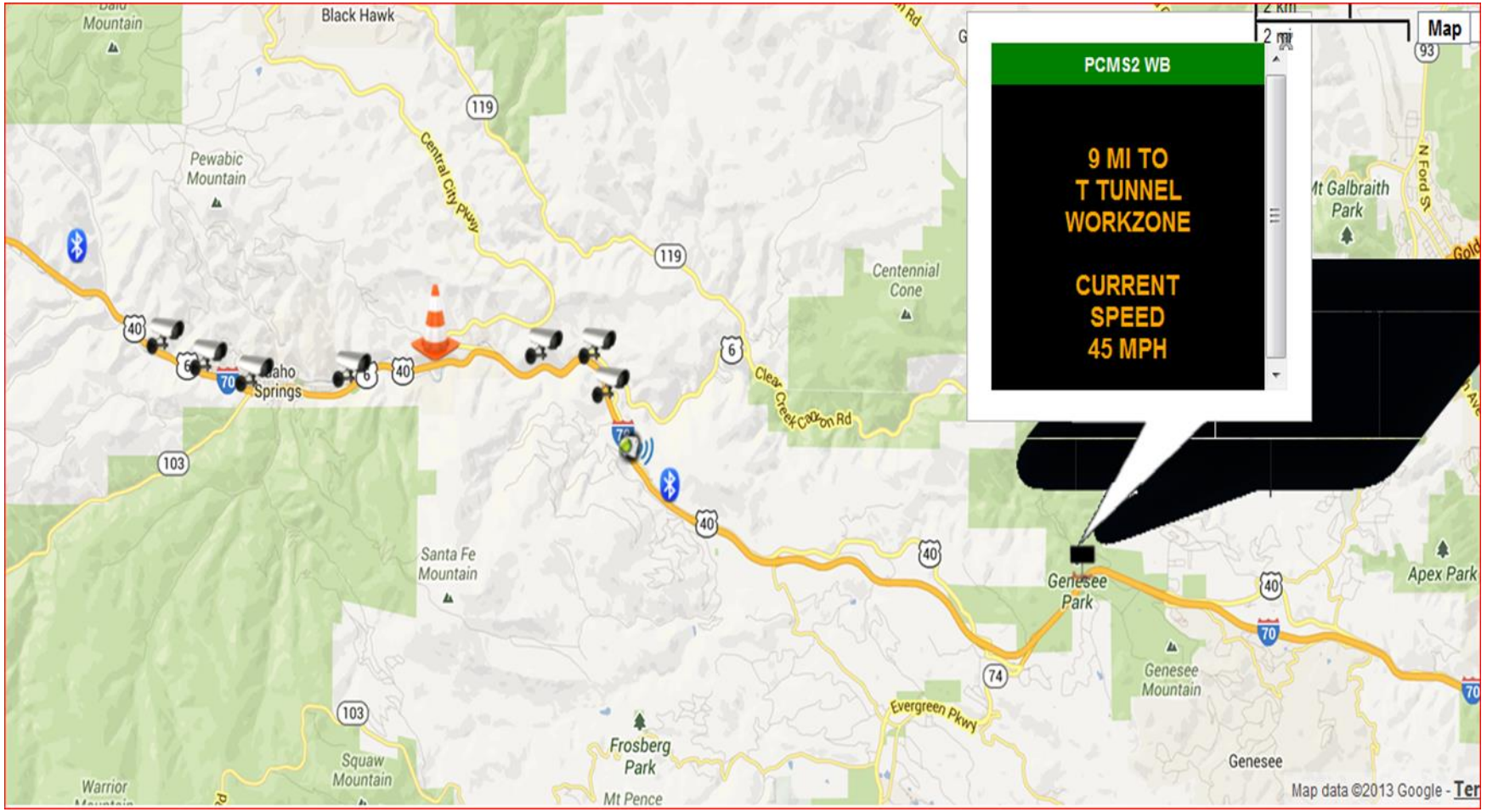
Project Objective

- The objective was for the system to relay the construction delay information via the VMS and the website every 2-3 minutes.
  - For example, the eastbound VMS located at MP203 (Frisco) or 37 miles away would display the following messages on two alternating panels:

Source: Colorado DOT

The other **4 eastbound VMS** located at Silverthorne (34 miles), Herman's Gulch (22 miles), Empire, and US-40 (12 miles) and **3 westbound VMS** located at Chief Hosa (13 miles), US-6 (Golden) and C-470 (37 miles) would display their respective distances to the work zone and the current construction delay at the work zone at the time.

Project website information



Source: Colorado DOT/Google

Major Observation #1

- The public apparently misunderstood the delay message, which was exclusively for the 7.6 miles, not the entire 37 miles of travel.
  - The Eastbound VMS, at Silverthorne (35 miles away) would display the eastbound travel time between sensor EB-S1 and S2 at 4 miles apart from actual construction site and Sensor WB-S3 & S4 at 4 miles apart, shows similar messages (37 miles way).
  - Confusion arose when motorists understood the travel time being shown as the travel time from the moment the message was read (at Silverthorne or Golden) to the end of the work zone.
  - In reality, it was showing the travel time at the work zone, measured between the sensors.

Major Observation #2

- A nearby rock fall mitigation project challenge
  - The I-70 eastbound rock fall mitigation site was at Georgetown (14 miles away from the tunnel project).
    - All vehicles must be stopped (approximately 20 minutes) during the rock fall procedure.
    - This stoppage created a significant traffic delay from Georgetown and backed up to the west for a few miles.
    - Eastbound traffic delay being monitored did not show any delay.
    - While the system found no delay at the 7.6 miles Twin Tunnels work zone, the eastbound VMS at Silverthorne relayed minimal travel time.
    - Aggravated the misperception of many motorists who after seeing minimal minutes through the Twin Tunnels work zone, then found themselves in standstill traffic at the rock fall mitigation project.

Major Observation #3 and words of choose

- Twin Tunnels project staff expressed concern regarding the word “delay” because it created a negative perception of the Twin Tunnels project.
- System Adjustments: Based on feedback received from CDOT public relations, Region 1 traffic and Twin Tunnels project staff, system adjustments were made. Because of the word “Delay & Tunnel”

Source: Colorado DOT

Source: Colorado DOT

System Changes

- Bluetooth sensor were added at locations.
- Began the process of integrating CO Trip sensor data into the system.
- Four system changes were introduced.
- Maximum (reported) speeds EB through the work zone were restricted to 35mph (the speed limit) or below.
- Maximum (reported) speed WB through the work zone were restricted to 45mph (the speed limit) or below.

Source: Colorado DOT

Source: Colorado DOT

System Changes - Condition #1

- Condition #1 is the most restrictive.
- Happens when traffic is stopped, which we have defined as the 3 minute average speed less than 20mph at the sensor closest to the tunnel.

Source: Colorado DOT

Source: Colorado DOT

System Changes - Condition #2

- Happens when the sensor closest to the tunnel measures greater than 20mph and the 3-minute average speed of any other sensor is less than 20mph.

Source: Colorado DOT

Source: Colorado DOT

System Changes - Condition #3

- Happens when traffic is moving better than 20mph everywhere, but there is a delay of more than 4 minutes above the average transit speed for that direction.
- Eliminated “no delay” messages, but still have this delay message programmed.

Source: Colorado DOT

Source: Colorado DOT

System Changes - Condition #4

- Happens when traffic none of the other conditions are true.
  - Now display the lowest 3 minute average sensor speed, but are limited to the applicable posted work zone speed limit.
    - *This will change once we have CDOT data and then we will display the lowest average sensor speed including all sensors en-route and the message will change to indicate "en-route" instead of "work zone."*

Source: Colorado DOT

Source: Colorado DOT

Major System Change #2 – Condition #1

- CDOT management demanded the change for the word “delay” to be dropped and another system change.
- Condition 1 change:
  - Happens when traffic is stopped, which is defined as 3-minute average speed less than 10mph at the sensor closest to the tunnel.

Source: Colorado DOT

Source: Colorado DOT

Major System Change #2 – Condition #2

- Happens when the speed closest to the tunnel is greater than 10 mph and the 3 minute speed measurement of any other sensor is less than 10mph.

Source: Colorado DOT

Source: Colorado DOT

Source: Colorado DOT

Major System Change #2 – Condition #3

- Happens when none of the other conditions are true.
  - Instead of displaying “no delay”, now display the lowest 3 minute average sensor speed, limited to the applicable speed limit.

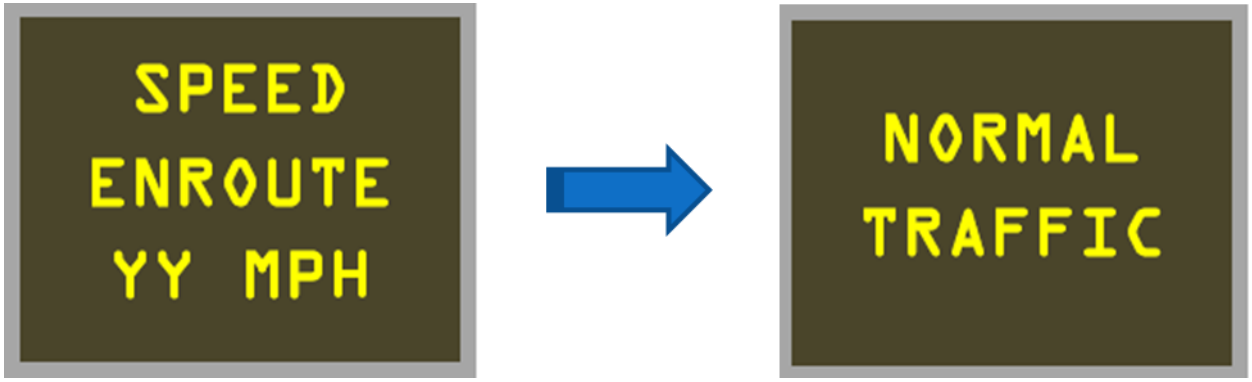
Source: Colorado DOT

Source: Colorado DOT

Source: Colorado DOT

Major System Change #2 – Condition #4

- En-route speeds introduced and COTrip data was integrated.
- During non-stop and go times, the message will now read:



Source: Colorado DOT

Source: Colorado DOT

Lessons Learned & Conclusions

- Type of hardware requirements was not specified on project documents.
- Lack of Department or FHWA implementation guide SWZ.
- Driver confusion due to lack of conceptual design.
- Capability to integrate existing ITS data and hardware.
- Project selection methods for implementation of SWZ.
- Establishing funding mechanism and bid items.
- Comprehensive information rather than just the work zone impacts.

For More Information:

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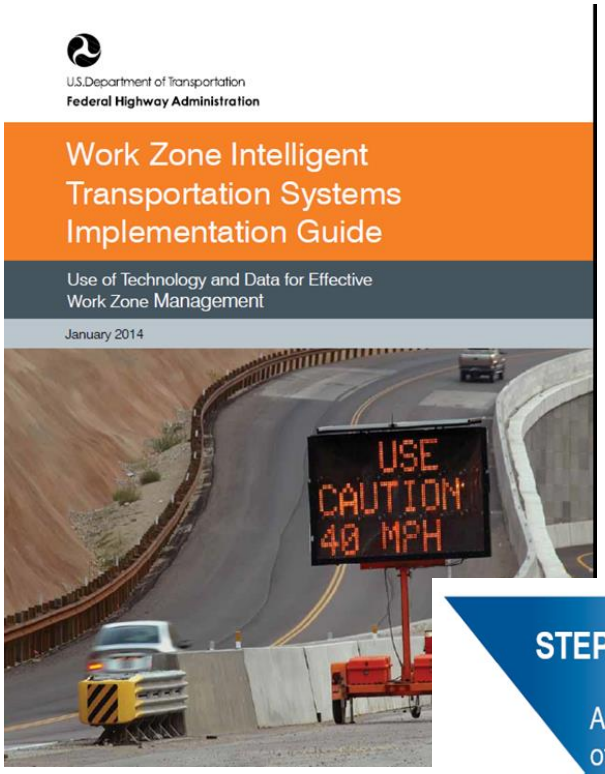
Smarter Work Zones

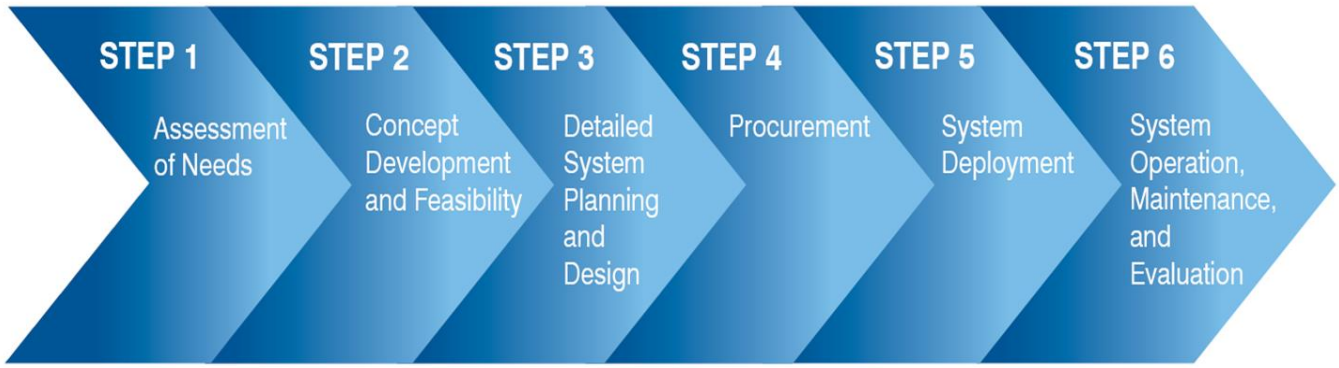
Needs Based Designs for ITS in Work Zones – The Iowa Experience

Work Zone ITS Implementation Guide



Source: FHWA

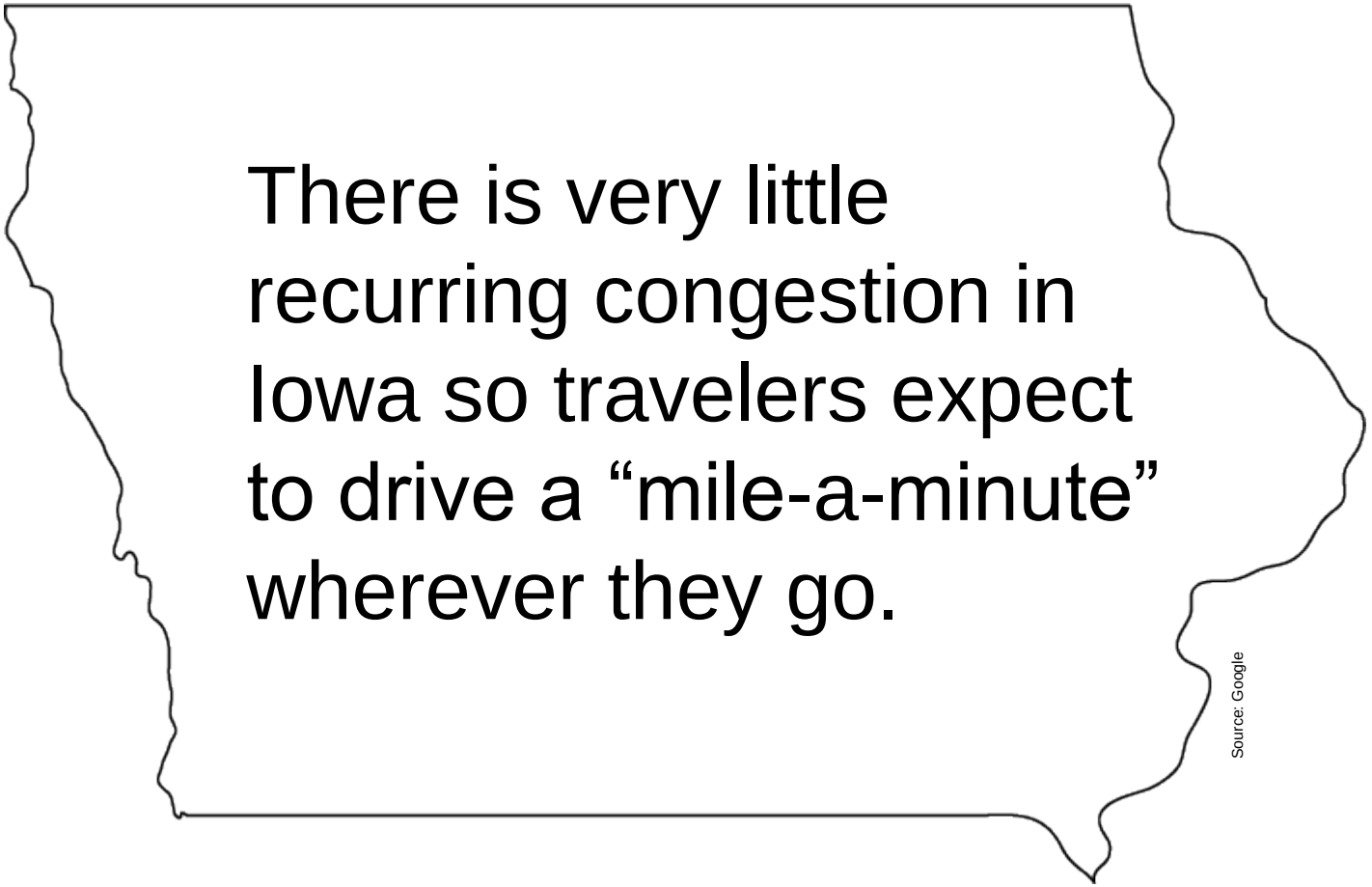
Available for download at:
http://ops.fhwa.dot.gov/publications/fhwahop14008/fhwahop14008.pdf



Source: Battelle

Figure 4. Overview of the implementation process.

Background


There is very little recurring congestion in Iowa so travelers expect to drive a “mile-a-minute” wherever they go.
Source: Google

Non-Recurring Congestion in Iowa

- There are three major causes for non-recurring congestion in Iowa
  - Weather
  - Traffic crashes and incidents
  - Road construction and maintenance activities
- The first two (weather and traffic incidents) can be planned for, but not controlled.
- The third one (road construction and maintenance activities) can be planned for and controlled.
- This is the root of the effort initiated by the Iowa DOT to identify Traffic Critical Projects.

Source: Iowa DOT

Source: Iowa DOT

Iowa DOT Traffic Critical Projects (TCP) Program (1 of 2)

- The TCP program identified key construction projects across the state that may cause significant safety or mobility issues to the traveling public.
- Using various mitigation methods, the TCP program works to reduce or eliminate any potential safety or mobility concerns.

Source: Iowa DOT

Source: Iowa DOT

Iowa DOT Traffic Critical Projects (TCP) Program (2 of 2)

- Vision
  - Provide safe, reliable, and efficient travel through construction and maintenance work zones throughout Iowa's highway system.
- Mission
  - Identify and implement traffic management strategies that address safety and mobility challenges encountered in construction and maintenance work zones.
- Goals
  - Identify upcoming projects during the planning and design stage that have potential to cause significant safety or mobility impacts.
  - Apply various mitigation strategies to address potential safety or mobility concerns, including quick recovery from traffic incidents or queueing.
  - Evaluate TCP mitigation efforts to determine if they are reliable, timely, and effective.
  - Develop performance measures that can be used to establish safety goals and travel time delay targets in Iowa and apply performance measures to quantify the safety and mobility impacts of the TCP program.
  - Develop support throughout Iowa DOT for the TCP program by establishing easily understood and implementable program procedures.

Stakeholders

Source: Iowa DOT

Source: Iowa DOT

Source: Iowa DOT

TCP Program Project Teams

- Iowa DOT Executive Committee
  - Top Administrators and District Engineers and Staff that provide direction for the program, guide efforts, and communicate program value
- TCP Program Working Group
  - Supports the program by implementing and coordinating efforts supported by DOT management
- Intelligent Work Zone (IWZ) Team
  - Addresses day-to-day design, operation and maintenance issues of Intelligent Work Zone applications
  - Includes real-time systems evaluation efforts

IWZ Team

- Program Manager – Iowa DOT

Source: Iowa DOT

- TCP Program Support Consultant – SRF Consulting Inc.

Source: SRF Consulting

- IWZ Vendor – Street Smart Rental, Inc.

Source: Street Smart Rental

- Intelligent Transportations Systems Maintenance Vendor and Traffic Management Software Integrator/Vendor - TransCore

Source: TransCore

- TMC Operations – Schneider Electric

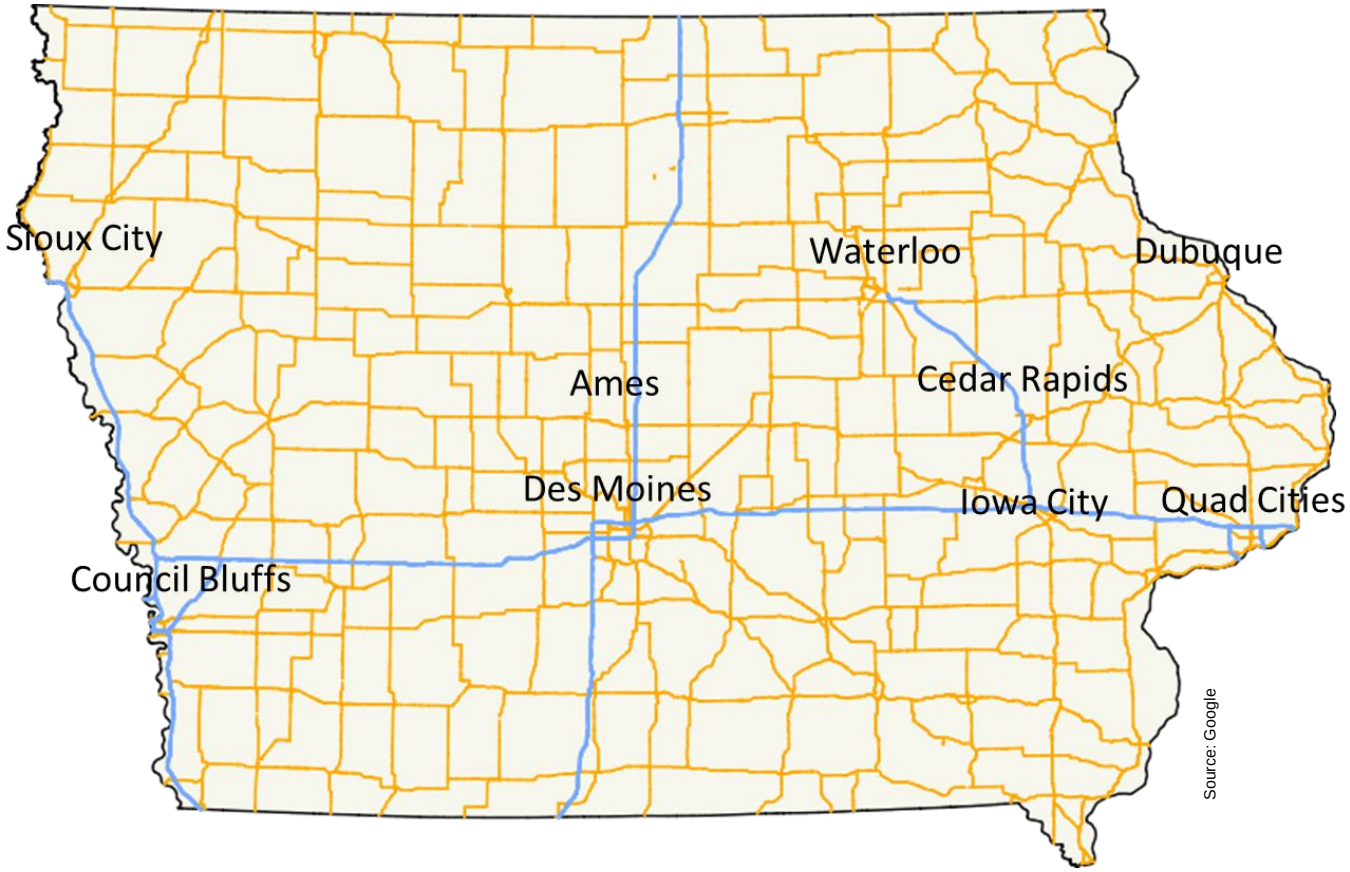
Source: Schneider Electric

- IWZ Evaluator – Center for Transportation Research and Education (CTRE) at Iowa State University

Source: CTRE

ITS Resources

- 9 “Metro” Areas (over 50,000 population)



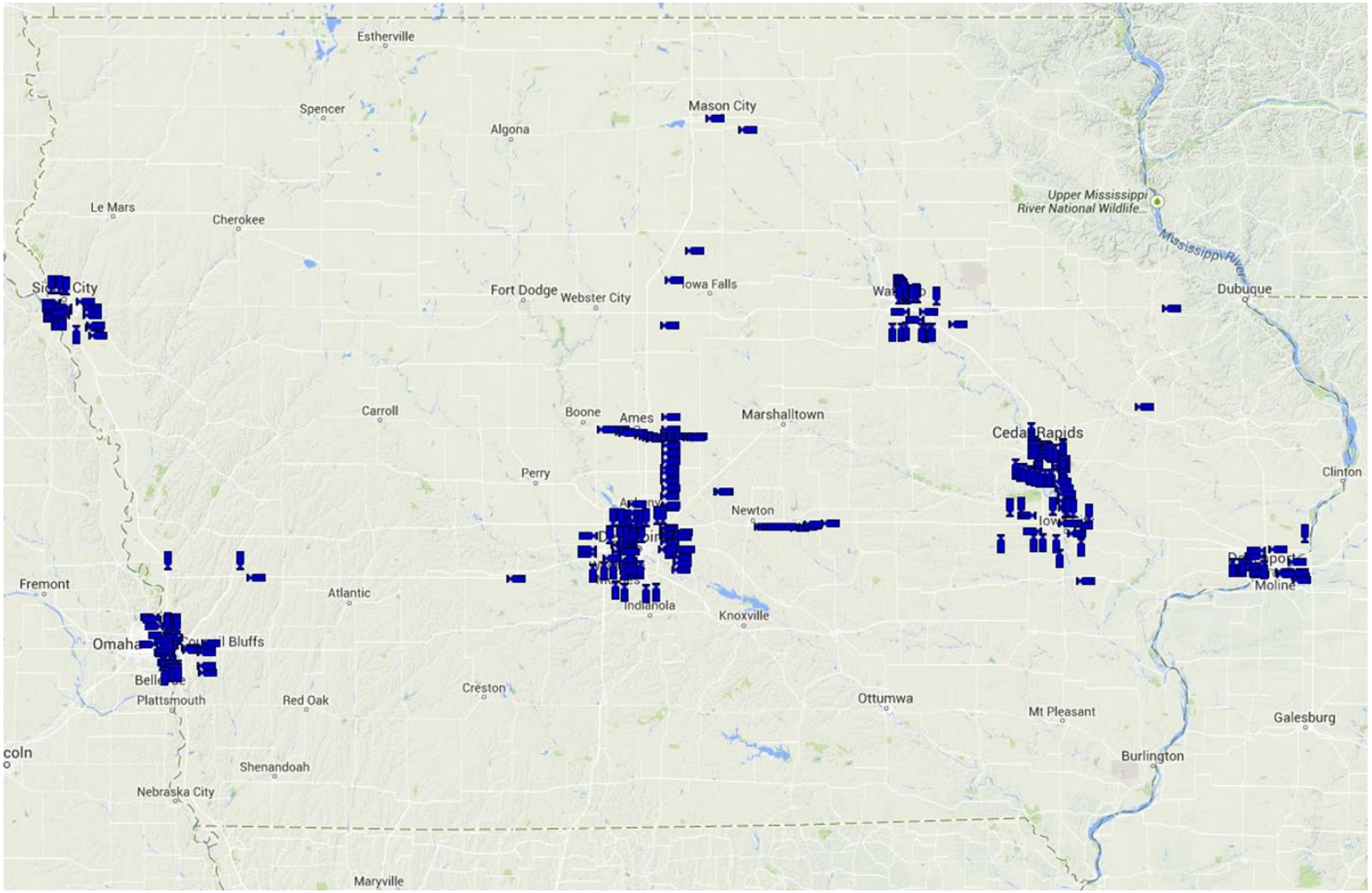
ITS Resources –
Statewide Traffic Management Center (TMC)

- 24/7/365
- Camera, Sensor, and DMS Management

Source: Iowa DOT

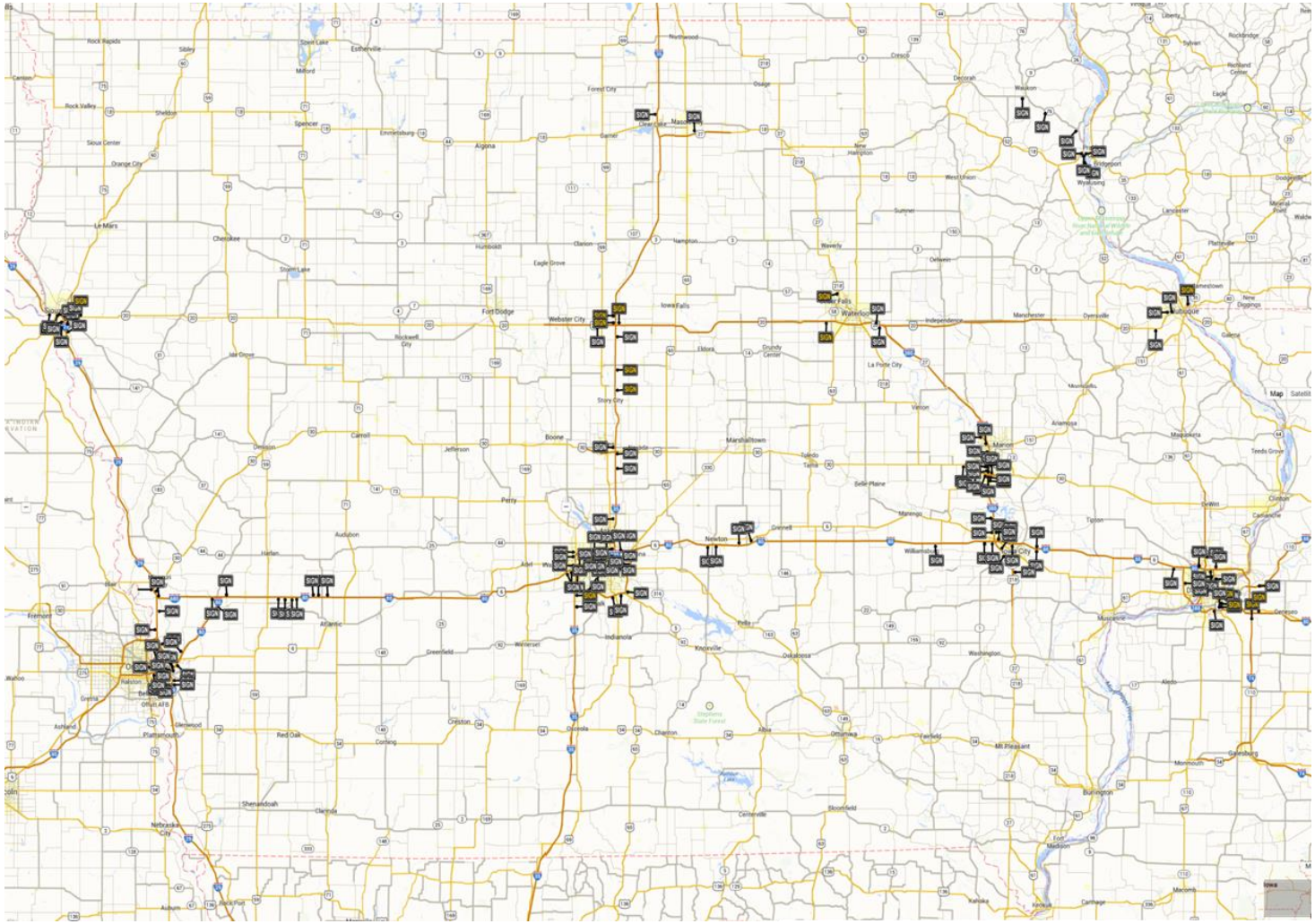
Source: Iowa DOT

ITS Resources – 300+ cameras



Source: Iowa DOT/Google

ITS Resources – Statewide DMS Plan



Source: Iowa DOT

What is the general concept for a TCP?

- Includes a variety of strategies to maintain reliable travel during a project.
- In addition to traditional options, such as night work, limiting work hours, and traffic incident planning, a TCP may include deployment of IWZ equipment, which constantly monitors traffic performance.
  - This equipment primarily includes, cameras, Dynamic Message Signs (DMS), traffic sensors, queue detection systems, and speed feedback signs.

Source: Google

Portable Dynamic Message Signs (PDMS)

Source: Street Smart Rental

Traffic Sensors

Source: Iowa DOT

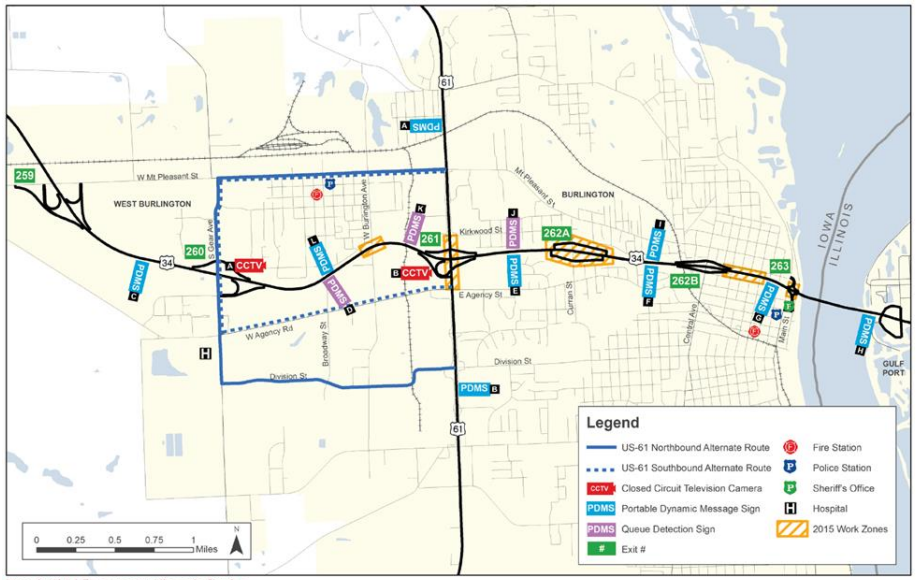
CCTV Cameras

Available IWZ Mitigation Systems

- End of queue warning
- Travel Time
- Truck Entering/Exiting
- Alternate Route Travel Times
- Dynamic Late Merge

Source: Iowa DOT

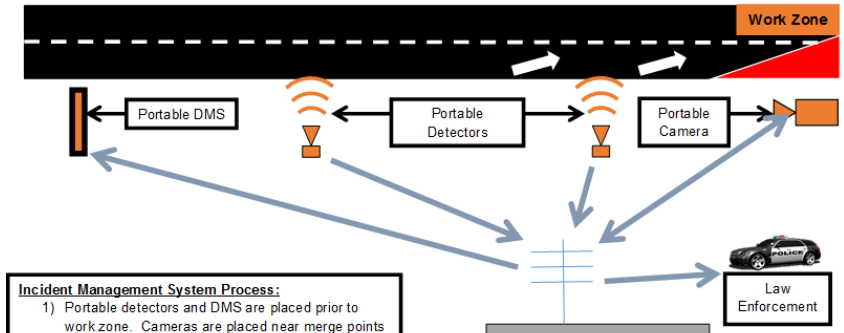
Traffic Incident Management Plans and IWZ



Map 1: US-61 Emergency Alternate Routes

Source: Iowa DOT

Expanded Incident Management System Overview Diagram



Incident Management System Process:

1) Portable detectors and DMS are placed prior to work zone. Cameras are placed near merge points or within work zone.
2) Detectors and cameras communicate to Operations Center for traffic monitoring.
3) Logic from central server posts automated alert messages to portable DMS and sends alert e-mails to TOC when slow traffic is detected.
4) TOC verifies slow traffic detections via portable cameras and dispatches appropriate response team, following project's TMP/TIM.

Source: Iowa DOT

Benefits of IWZ Systems

- Provide safe, reliable, and efficient travel through construction and maintenance work zones throughout Iowa's highway system.
- Identify and implement strategies that address safety and mobility challenges encountered in construction and maintenance work zones including quick recovery from traffic incidents or queueing.
- Provide operational data to aid in developing performance measures that can be used to establish safety goals and travel time delay targets.

IWZ System Costs

- Urban IWZ Project – Average Cost: $40,000
- Rural IWZ Project – Average Cost: $43,000

- 2015 IWZ Projects
  - 27 IWZ Projects
  - 18 projects with End-of-Queue Warning Systems
- Total IWZ Project Cost $1,386,000

Challenges Faced in Iowa

Source: Google

- Many stakeholders and team members
  - Shared responsibilities
  - Program and project ownership
- Changing the way of doing business at the Iowa DOT
  - Shifting construction dollars to TCP mitigation efforts
  - Developing new policies and procedures
- Engaging, listening, and responding to all stakeholders and team members
- Demonstrating the value of IWZ systems and mitigations

Road to Success

- Management support to achieve goals
- Desire to cooperate to “get the job done”
  - Input into policies and procedures
  - Critical evaluation of procedures
- Showing value through evaluation
  - Determining effectiveness of mitigation efforts
  - Establishing user costs
- Communicating value of all stakeholder and team member input
- Utilizing existing personnel and qualified IWZ vendor

Source: Google

What is different about a TCP?

- Includes a variety of strategies to maintain reliable travel during a project.
- In addition to traditional options such as night work, limiting work hours, and traffic incident planning, a TCP may include deployment of IWZ equipment which constantly monitors traffic performance.
  - Equipment primarily includes cameras, DMS, traffic sensors, queue detection systems, and speed feedback signs.

For example:

Source: Iowa DOT

Stopped traffic

Source: Street Smart Rental

is detected

Source: Google

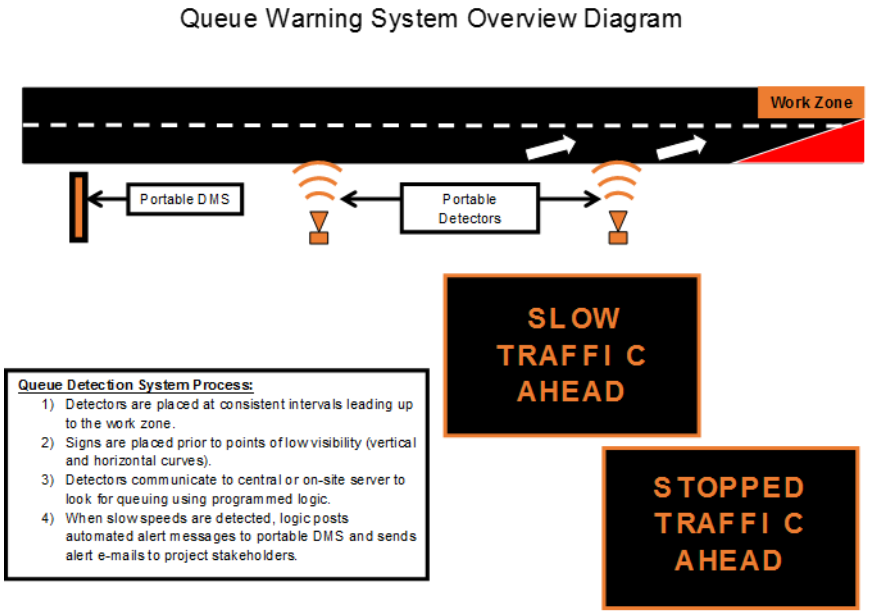
warning goes out

Source: Google

to approaching drivers

System Design

- Based on design and requirements of ATMS and Statewide TMC
- Uses similar or identical equipment
- Integration of system logic into ATMS
- Develop and use testing plans and procedures with well-defined responsibilities and metrics



Portable DMS

- TMC controlled rentals since 2013

Source: Google

Portable Traffic Sensors

- Same as permanent sensors
- Traffic counts and speeds every 20 seconds

Source: Street Smart Rental

Source: Street Smart Rental

Temporary Cameras

- Great within reach of ITS communications network
  - Same as permanent cameras
  - On 511
- Different requirements when cellular modems are needed.

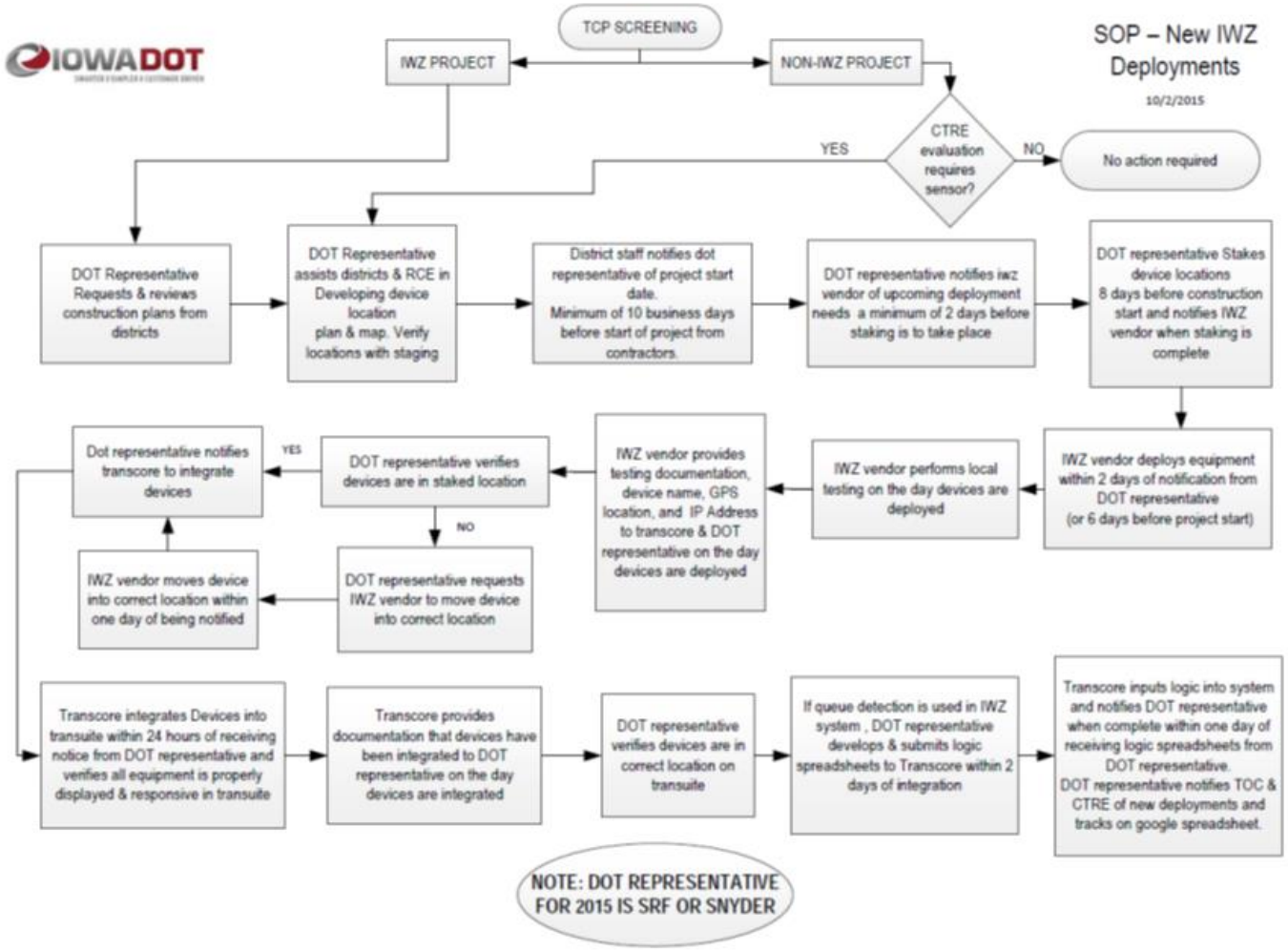
Source: Iowa DOT

IWZ Contract

- Statewide contract to provide equipment and services on selected TCP.
- Qualifications and cost-based selection
  - Street Smart Rentals – Minnesota
- Integration Support from TransCore
- Operations by Schnieder/Telvent

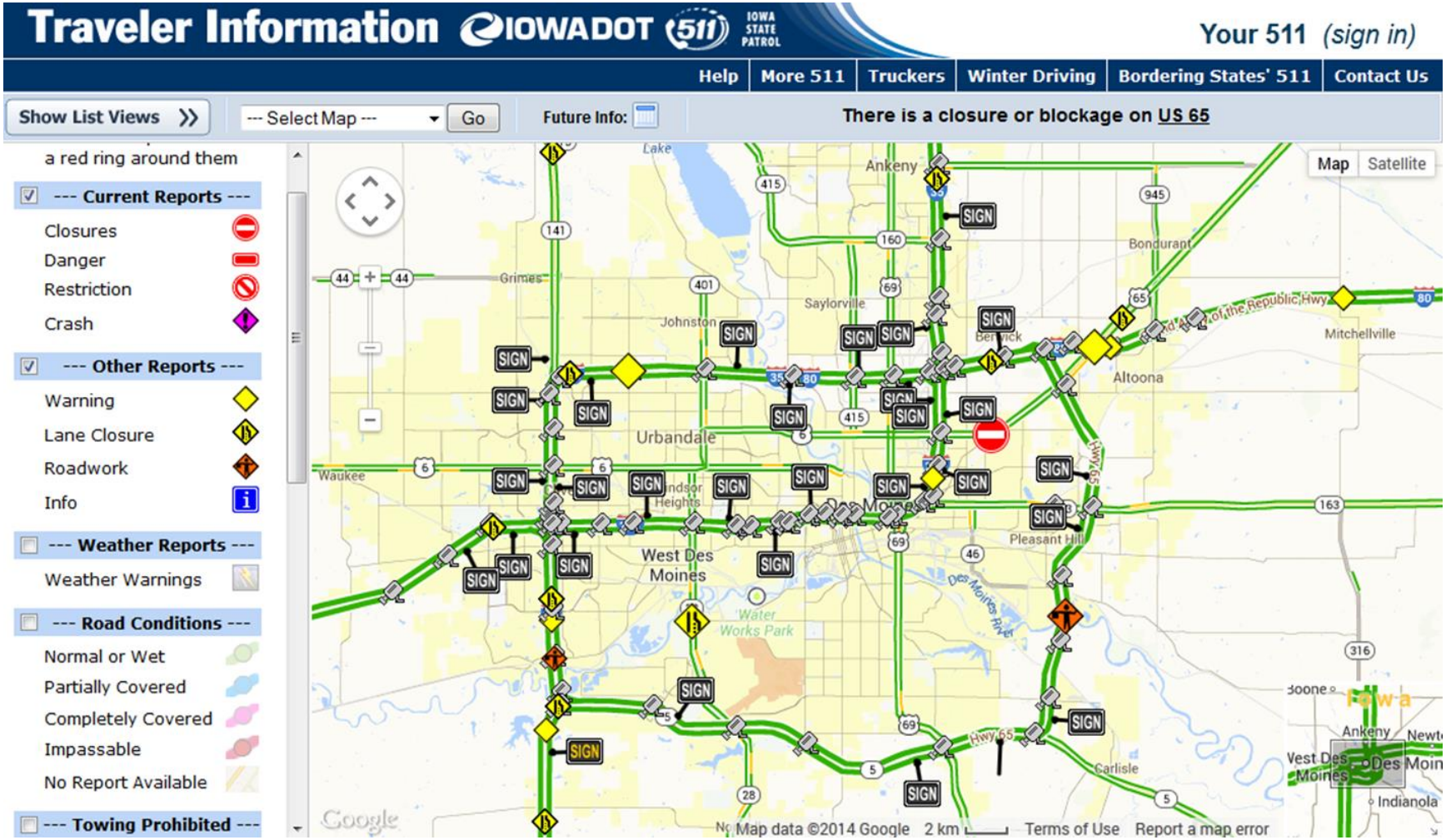
Planning for Operation and Maintenance

- Develop Standard Operating Procedures
- Determine staff training needs



Source: Iowa DOT

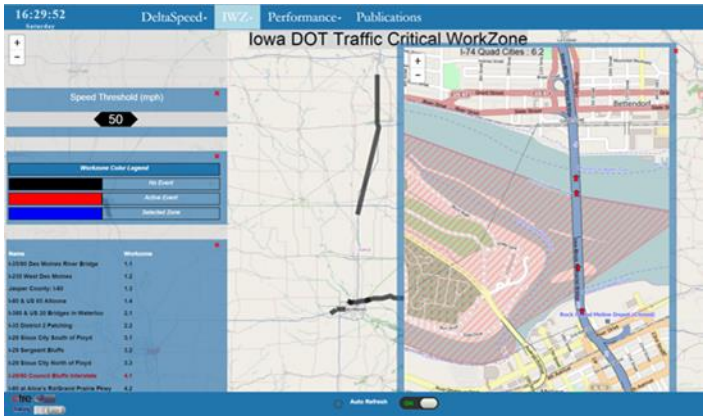
ITS Resources – 511ia.org



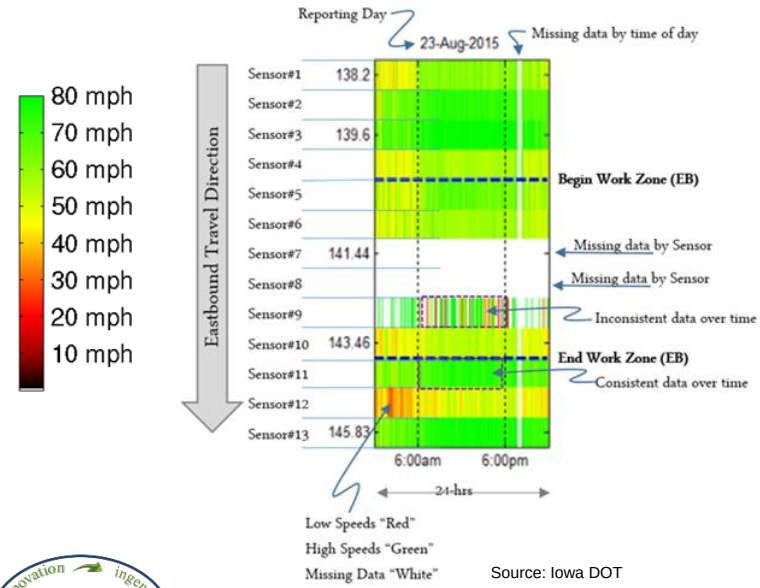
Source: Iowa DOT

Real-time Monitoring and Evaluation

Traffic Performance

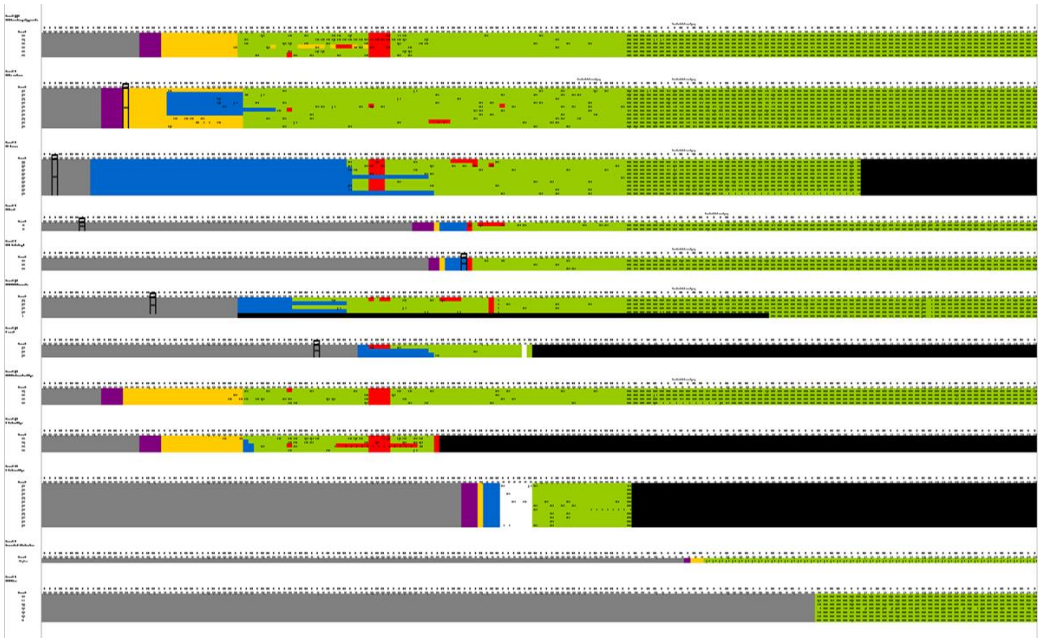


Source: Iowa DOT



Source: Iowa DOT

Equipment Performance



Source: Iowa DOT

Exploring Additional IWZ Technology Needs

- Speed Management/Feedback
- Trucks Entering Systems
- Additional Data Collection/Analysis for Future Projects

Source: Iowa DOT

For More Information:

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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 http://www.ops.fhwa.dot.gov/wz/its/index.htm • FHWA Work Zone Mobility and Safety Program – Peer-to-Peer Program http://www.ops.fhwa.dot.gov/wz/p2p/index.htm • Work Zone ITS Implementation Guide http://www.ops.fhwa.dot.gov/publications/fhwahop14008/fhwahop14008.pdf • Work Zone ITS Case Studies http://www.ops.fhwa.dot.gov/publications/fhwahop14007/ • Work Zone ITS Overview Webinar http://www.ops.fhwa.dot.gov/wz/webinars/itsoverview013014/ullman/index.htm

Thanks for joining us!

- **Upcoming Events**
  - Webinar #11: Wednesday, March 23, 2016, 1:00-2:30pm EST
  - Check The National Work Zone Safety Information Clearinghouse website for updates https://www.workzonesafety.org/SWZ/main

- **Questions or Comments?**
  - Jawad Paracha (FHWA Operations, WZ Team) jawad.paracha@dot.gov