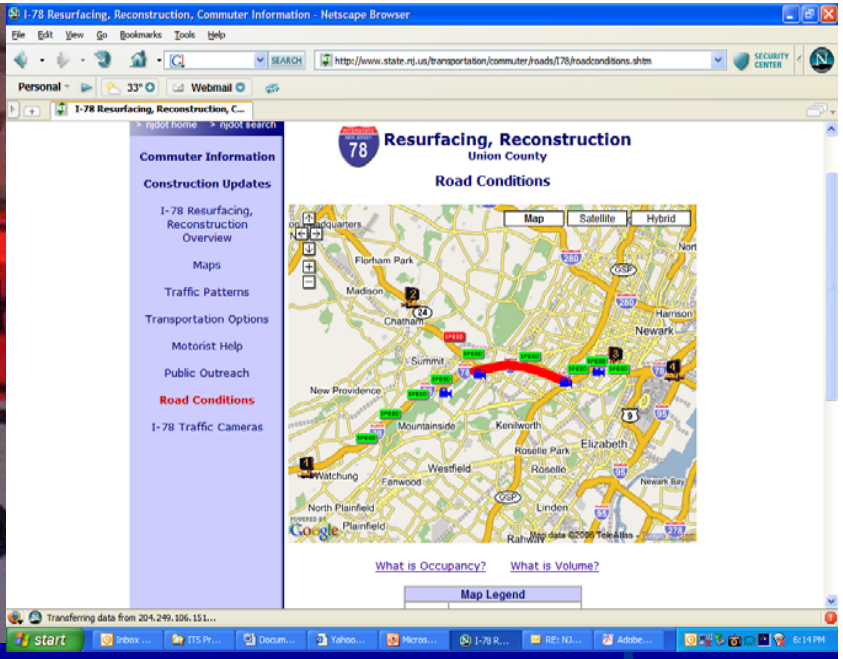


Overview of Work Zone ITS

Tracy Scriba, FHWA

May 2013

Presentation Outline

- What is WZ ITS?
- History and Evolution
- Why Use WZ ITS?
- WZ ITS Applications
- FHWA WZ ITS Efforts
- Information Resources

What is Work Zone ITS?

- Use of technology to support effective work zone management and operations
- Used both in and around work zones
- Can have a safety or mobility focus, but often supports ***both***
- Portable and temporary in ***most*** cases
- May be leased or purchased

What is Work Zone ITS?

- Use of technology and data to support effective work zone management and operations
- Used both in and around work zones
- Can have a safety or mobility or customer satisfaction focus, but often supports ***all 3***
- Has portable and temporary components in ***most*** cases that may be combined with permanent
- May be leased or purchased or acquired indirectly

WZ ITS Components

- Sensors that collect data on traffic conditions
- Communications equipment to transfer the data
- Software to process/analyze the data and data storage
- Electronic equipment to:
  - Disseminate information to end users
  - Implement traffic control/management decisions

History

- Handful of companies, each with one to a few products
- Products tended to be systems → Not very flexible
- Each deployment an adventure/experiment
- Lots of learning
- Not enough thought into systems
- As many failures as successes

WZ ITS Has Evolved

- Broader range of products and technologies
- More scalable and flexible
- Better planned (usually)
- More applications
- Leveraging of permanent ITS
- Sometimes accomplished by purchasing data
- Less adventure
- More successes

Why Use Work Zone ITS?

- Effects of road work on road users and workers are increasing.
- We are seeing:
  - More congestion on our roads
  - More work zones
  - More lost lives
  - Growing exposure
  - Growing public frustration

WZ Challenges and ITS

- Congestion
  - End-of-queue crashes
  - Delay
  - Dissatisfied motorists (private & commercial)
  - Difficulty in emergency vehicle access and response
  - Delayed contractor vehicle access (reduced efficiency)
- ➢ Speed detection and warning systems
- ➢ Traveler information systems, active diversion
- ➢ Data on best times to work and for deliveries

WZ Challenges and ITS

- Speeding/Speed Management
  - Setting speed limits
  - Compliance with speed limits
  - Limited areas for law enforcement officer stationing
  - Limited areas to pullover speeders

- Speed monitoring systems
- Variable speed limit systems
- Automated enforcement systems

WZ Challenges and ITS

- Crashes
  - Timeliness of incident detection and response
  - Congestion
  - Secondary crashes
  - Intrusions
  - Work vehicle access/egress

- ➢ Cameras and queue detection systems
- ➢ Intrusion alarms
- ➢ Signs warning of entering/leaving roadway

WZ Challenges and ITS

- Performance Monitoring
  - Lack of data
  - Limited personnel to gather data
  - Difficulty in assessing impacts and estimating performance
  - Unknowns about appropriate work windows
  - Unknown effectiveness of WZ strategies

- Systems gather lots of data automatically (archiving)
- Exposure/volumes, travel speeds (delays, queues) can help assess impacts on conditions
  - Determine best times to work
  - Document effects of different WZ strategies

How Does WZ ITS Fit In?

- WZ management strategies include:
  - Project Coordination and Scheduling
  - Contracting
  - Construction Methods
  - Transportation Management
  - Public Information
- Need a combination of strategies
- Choose strategies to solve specific problems
- WZ ITS is one strategy in the toolbox

ITS Applications in Work Zones

- Traffic monitoring and management
- Traveler information
- Incident detection & management
- Tracking/evaluation of contract incentive/disincentives
- Worker safety/protection
- Speed management and enforcement
- Performance monitoring
- Assessing/setting allowable work hours

Traffic Monitoring and Management

Dynamic Lane Merge Systems:

- Monitor traffic and regulate merging approaching lane closures
- Intended to smooth traffic flow and improve safety by increasing consistency in merge behavior
- Can be used to encourage early merge or late merge

Dynamic Early Merge System

Creates a dynamic no-passing zone based on detected traffic volume and back-ups

- Sensors detect traffic conditions
- Next upstream sign activated when traffic threshold met
- "Do Not Pass When Flashing"
- Signs are regulatory and enforceable

I-94 North of Detroit, Michigan

- Used to improve traffic flow, prevent dangerous merging
- System reduced travel time delays, number of crashes, aggressive driving during AM and PM peak periods
- Average travel speed increased from 40mph to 46 mph during morning peak period

- **Before system: 1.2 crashes per month**
- **After: No crashes reported**
- **Effective for roads with moderate traffic volumes**

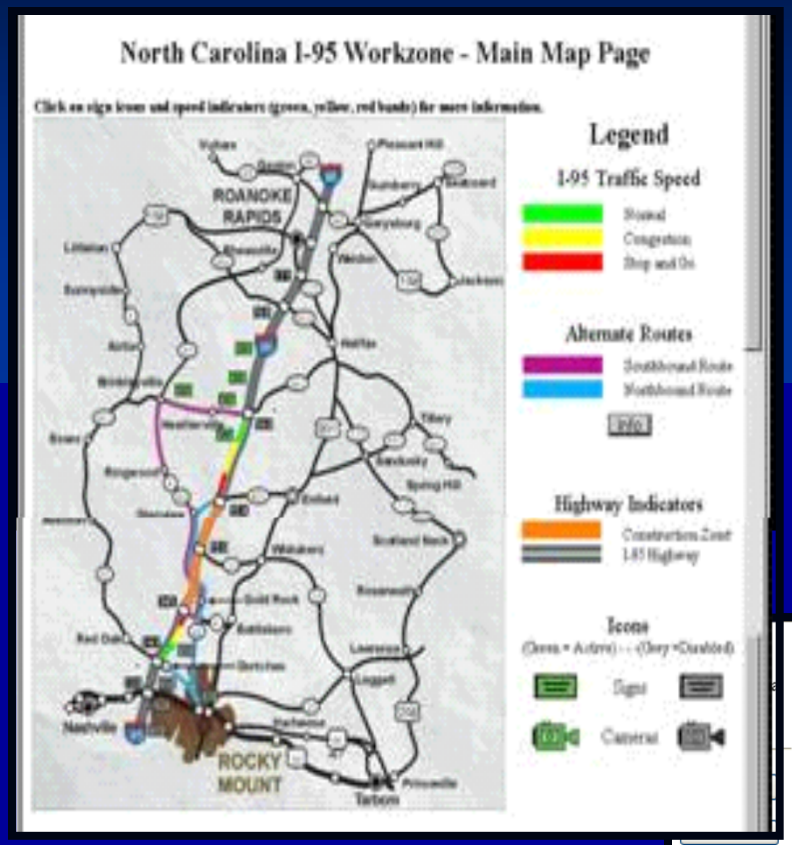
Dynamic Late Merge - Minnesota

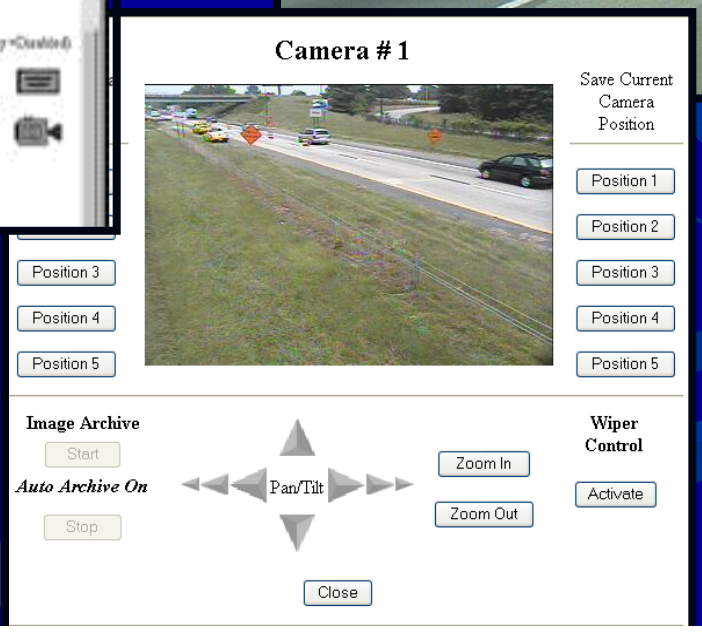
- System monitors traffic conditions
- During congestion, encourages use of both lanes to merge point
- System:
  - Equalized use of lanes and speeds between lanes
  - Eliminated confusion over lane use and correct merge point
  - Reduced aggressive driving
  - Did not change throughput
  - Shortened queue length by 35%

Traveler Information

- Sensors to monitor real-time traffic conditions
- Data used to calculate delay/speed/travel time
- Info automatically displayed on CMS and website (map, CMS messages)
- Info can also be distributed via HAR
- Cameras to gather additional condition info

Traveler Information





ITS for Traffic Mgmt/Route Choice

- Provide travel times along arterial and Interstate
- Enable route choice

Sequencing Travel Time Sign on State Street Northbound

ITS to Mitigate End-of-Queue Crashes

- Acquire volume/speed data
- Detect slowed/stopped traffic
- Select PCMS messages automatically
- Display to drivers

ITS for Traffic Performance Spec

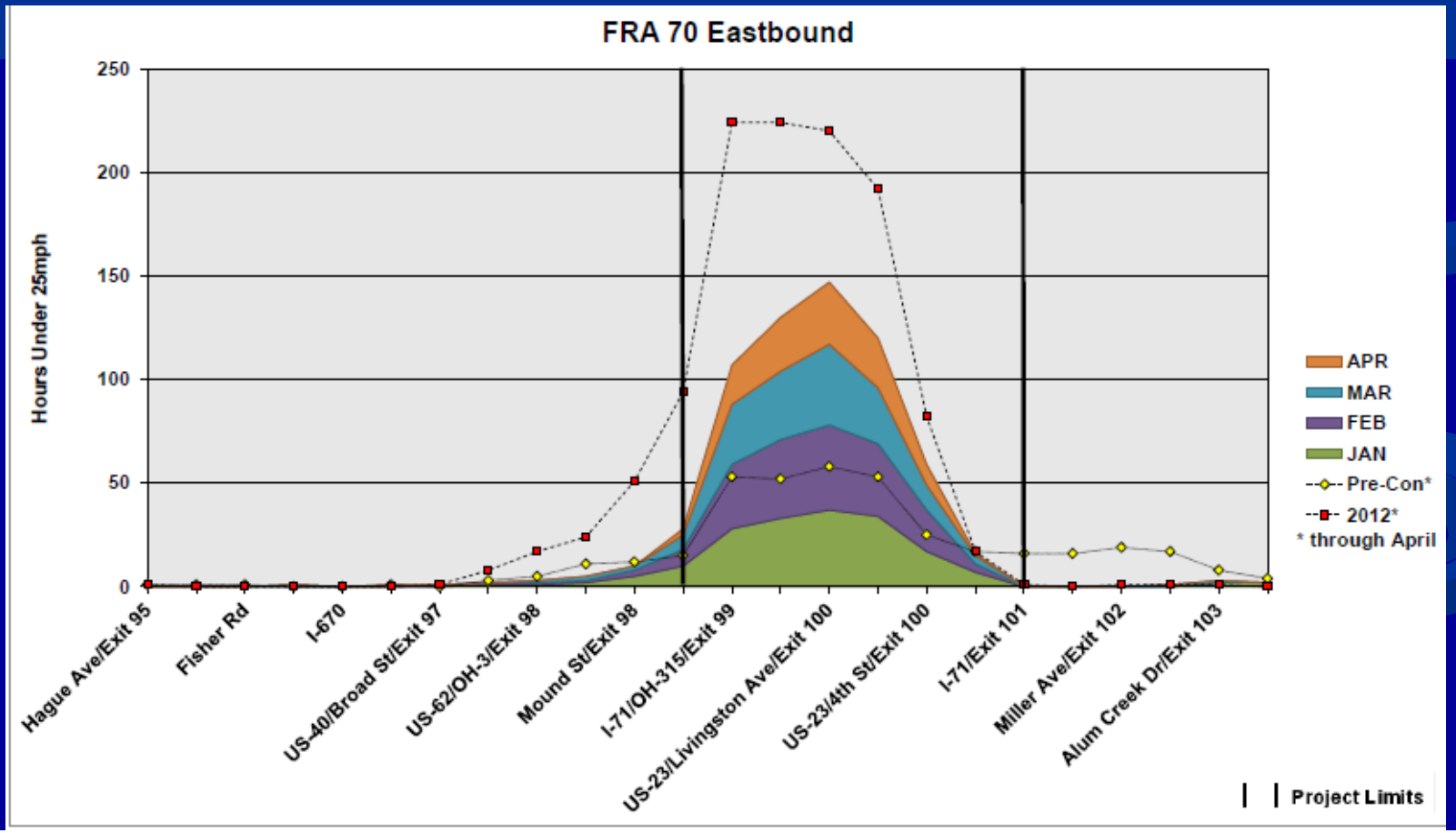
- Pilot of performance-based spec for delay
- Compared to usual prescriptive MOT spec
- ITS used to monitor traffic conditions and estimate delays - multiple routes, turning movements
- Similar results for both specs
  - Prescriptive specification: $75k penalty
  - Performance spec: $68-69k penalty
- Used data to relax some lane closure restrictions

Automated/Technology Assisted Enforcement

- Illinois
- Maryland
- Oregon
- Washington State
- Under development:
  - Pennsylvania
  - California
- Others?

Performance Monitoring/Management

- Slightly historical Inrix Data
- Identify mobility issues, investigate in the field, make changes to address or notify drivers

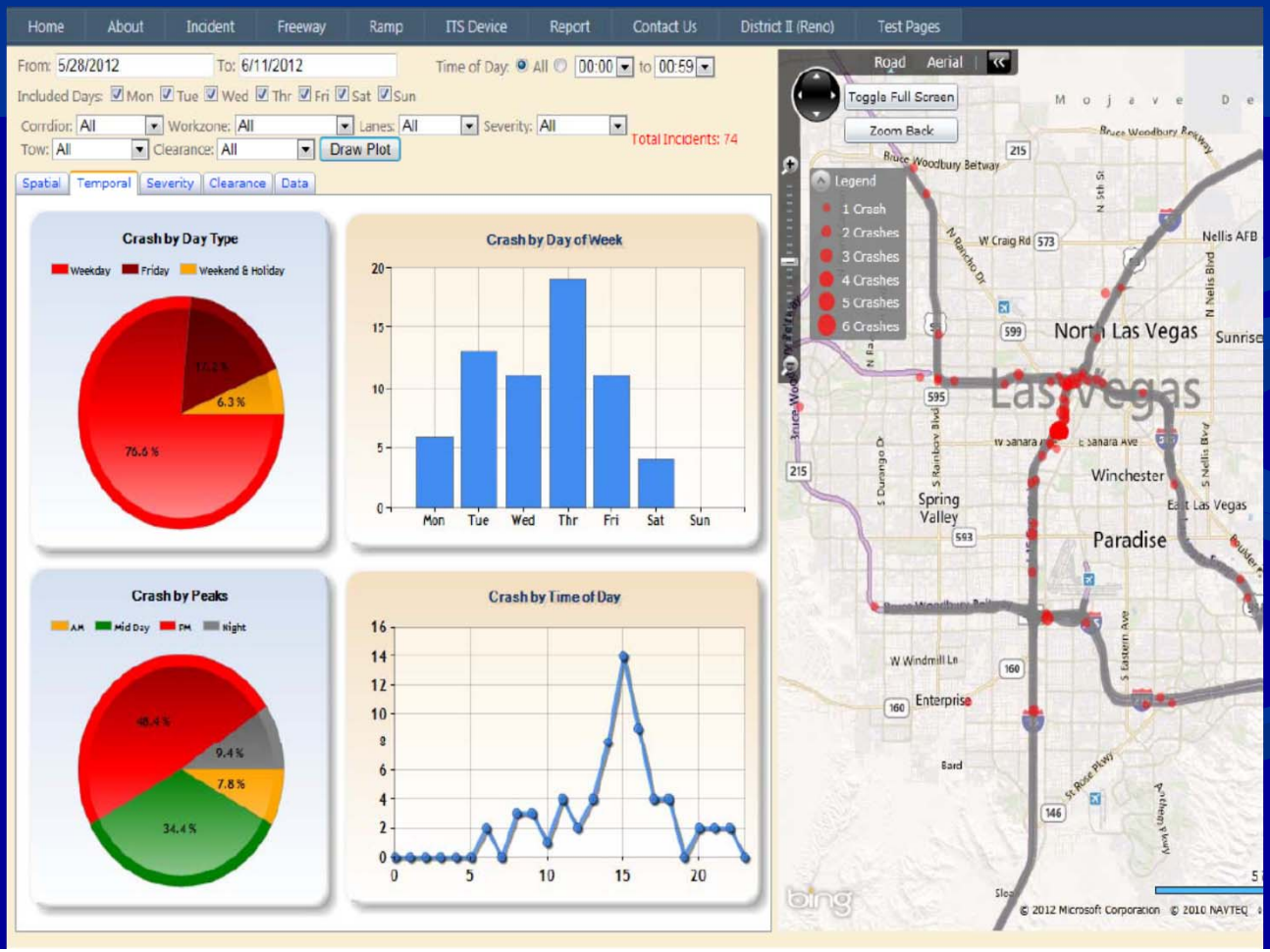


Las Vegas FAST for WZ Management

- Freeway and Arterial System for Transportation
  - Multi-jurisdictional
  - Las Vegas metro area freeways and many arterials
  - Primary purpose: incident management
- Other uses include:
  - WZ traffic management planning
    - Data sharing, strategies
  - WZ operations during construction
    - Signal timing adjustments
    - Traveler information: lane closures, delays
  - WZ performance measurement

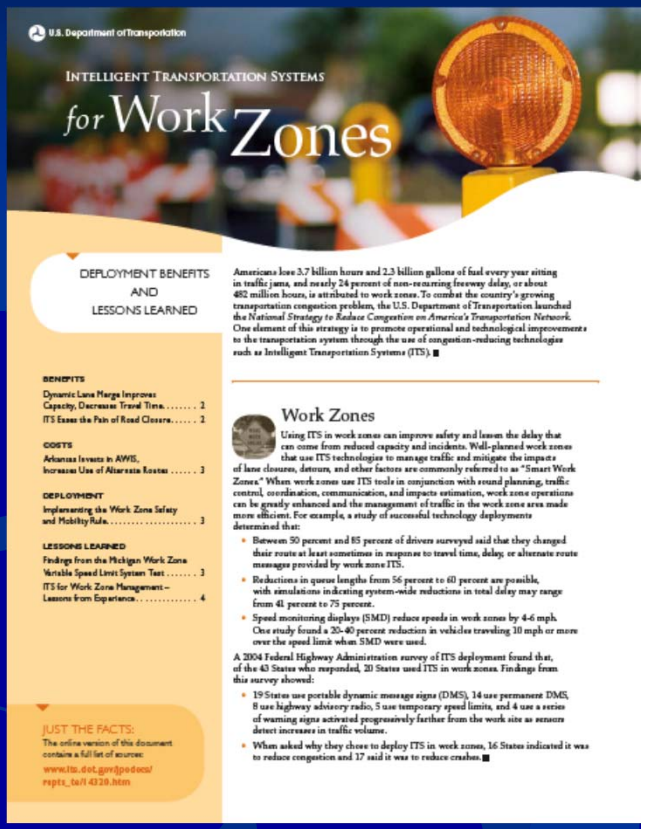
Performance Monitoring Example

- Las Vegas FAST Crash Performance Dashboard
- Can be tailored by type of crash, including WZ



FHWA ITS in WZ Efforts

- Implementation Guide
- Case Studies
- Peer Exchange
- SBIR Phase I on Delivering WZ Info into Vehicles
- WZ ITS Leaflet
- Assessment of Effectiveness
- Cross-cutting study


U.S. Department of Transportation

INTELLIGENT TRANSPORTATION SYSTEMS
for Work Zones

DEPLOYMENT BENEFITS AND LESSONS LEARNED

BENEFITS
Dynamic Lane Merge Improves Capacity, Decreases Travel Time 2
ITS Eases the Pain of Road Closure 2

COSTS
Arkansas Invests in AWIS, Increases Use of Alternate Routes 3

DEPLOYMENT
Implementing the Work Zone Safety and Mobility Rule 3

LESSONS LEARNED
Findings from the Michigan Work Zone Variable Speed Limit System Test 3
ITS for Work Zone Management – Lessons from Experience 4

JUST THE FACTS:
The online version of this document contains a full list of sources:
www.its.dot.gov/ppodocs/rept_to/1 4328.htm

Americans lose 3.7 billion hours and 2.3 billion gallons of fuel every year sitting in traffic jams, and nearly 24 percent of non-recurring freeway delay, or about 482 million hours, is attributed to work zones. To combat the country's growing transportation congestion problem, the U.S. Department of Transportation launched the *National Strategy to Reduce Congestion on America's Transportation Network*. One element of this strategy is to promote operational and technological improvements to the transportation system through the use of congestion-reducing technologies such as Intelligent Transportation Systems (ITS).

Work Zones

Using ITS in work zones can improve safety and lessen the delay that can come from reduced capacity and incidents. Well-planned work zones that use ITS technologies to manage traffic and mitigate the impacts of lane closures, detours, and other factors are commonly referred to as "Smart Work Zones." When work zones use ITS tools in conjunction with sound planning, traffic control, coordination, communication, and impacts estimation, work zone operations can be greatly enhanced and the management of traffic in the work zone area made more efficient. For example, a study of successful technology deployments determined that:

- Between 50 percent and 85 percent of drivers surveyed said that they changed their route at least sometimes in response to travel time, delay, or alternate route messages provided by work zone ITS.
- Reductions in queue lengths from 56 percent to 60 percent are possible, with simulations indicating system-wide reductions in total delay may range from 41 percent to 75 percent.
- Speed monitoring displays (SMD) reduce speeds in work zones by 4-6 mph. One study found a 20-40 percent reduction in vehicles traveling 10 mph or more over the speed limit when SMD were used.

A 2004 Federal Highway Administration survey of ITS deployment found that, of the 43 States who responded, 20 States used ITS in work zones. Findings from this survey showed:

- 19 States use portable dynamic message signs (DMS), 14 use permanent DMS, 8 use highway advisory radio, 5 use temporary speed limits, and 4 use a series of warning signs activated progressively farther from the work site as sensors detect increases in traffic volume.
- When asked why they chose to deploy ITS in work zones, 16 States indicated it was to reduce congestion and 17 said it was to reduce crashes.

WZ ITS Implementation Guide

- Help practitioners effectively use WZ ITS as one of many tools for WZ management
  - Assessing the Need for WZ ITS
  - Detailed System Planning and Design
  - Procurement
  - System Deployment
  - System Operation and Maintenance
  - Evaluation

WZ ITS Case Studies

- Show how ITS can be used to address WZ safety and mobility issues
  - Mitigating End-of-Queue Crashes: Illinois
  - Enhancing Route Choice During Construction: Utah
  - Permanent ITS to Manage WZ Traffic: Las Vegas
  - Performance Specification Monitoring: Utah

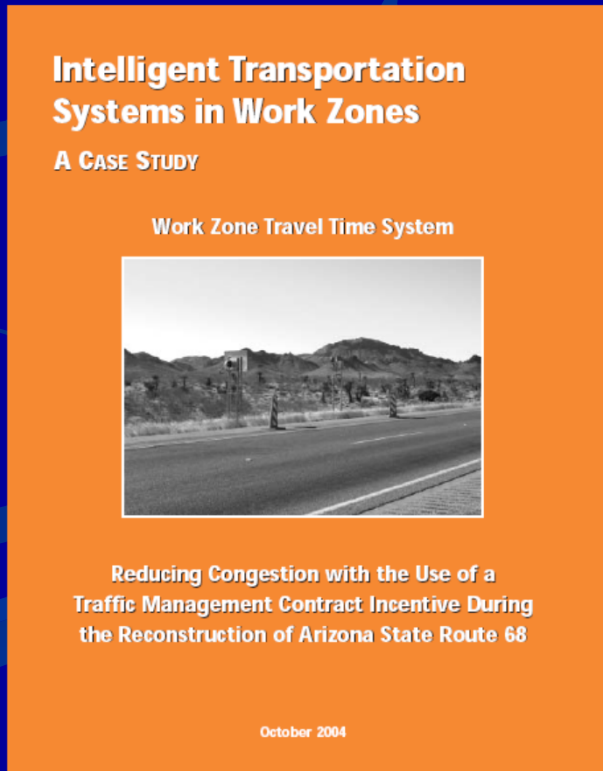
Expected completion of guide/case studies:

Late summer 2013

FHWA WZ Website – ITS Section

www.fhwa.dot.gov/workzones

- Case Studies
- Evaluation Reports
- Information on Technologies
- Links to other WZ ITS resources
- Links to general ITS resources



AASHTO WZ ITS Website

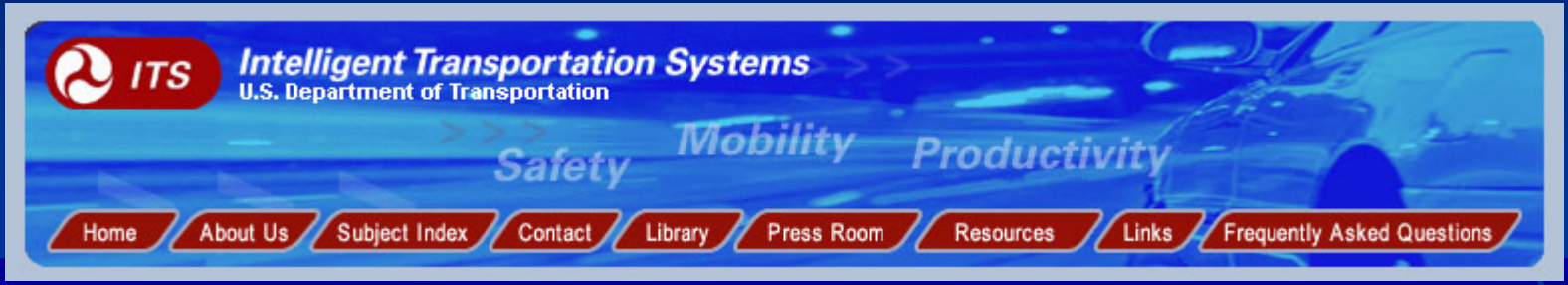
www.transportation.org/?siteid=42&pageid=1939

- Maintained by SSOM
- Content:
  - Evaluation reports
  - Specs/Standards
  - Presentations
  - Papers/Articles

ATSSA ITS Council working on similar site

US DOT ITS Website

www.its.dot.gov



- Applications Overview
- Cost Database
- Benefit Database
- Lessons Learned
- Deployment Statistics
- Document Library
- Technical Resources

Smart WZ Deployment Initiative

www.ctre.iastate.edu/smartwz

- Pooled Fund Study since 1999
- Conducts studies on WZ topics including ITS
- Contains Evaluation Reports on topics such as:
  - Real-time Integrated Systems (dynamic merge, traveler info, speed advisory)
  - Stand Alone Warning Systems (e.g., CB Wizard)

Why Consider Using WZ ITS Now?

- More ITS options available
  - Technologies, costs, how it is provided
- Matured from earlier stage
  - Greater reliability
  - Better understanding
  - More permanent ITS
  - Wiser use
- Work zone challenges remain

Why Use Work Zone ITS?

A study of successful deployments showed that:

- 50-85% of drivers surveyed said they changed their route in response to WZ ITS info
- Queue length reductions up to 56-60% are possible
- Speed monitoring displays reduced speeds by 4-6 mph
- One study found a 20-40% reduction in vehicles traveling $\geq$ 10 mph over the speed limit when SMDs are used

Potential Benefits of WZ ITS

- Improved mobility and traffic management
- More informed public
- Quicker incident response
- Greater safety of workers and travelers
- Better PR and relationships with other stakeholders
- Enhanced speed management
- Better understanding of traffic conditions
- One study showed a benefit-cost ratio of 2:1 and another showed a B-C ratio of 6:1