Overview of Work Zone ITS

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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

![Graph showing traffic data for FRA 70 Eastbound]
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
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
Case Studies
Evaluation Reports
Information on Technologies
Links to other WZ ITS resources
Links to general ITS resources

Intelligent Transportation Systems in Work Zones
A CASE STUDY

Work Zone Travel Time System
Reducing Congestion with the Use of a Traffic Management Contract Incentive During the Reconstruction of Arizona State Route 68
October 2004
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