Smarter Work Zones
Overview of Queue Warning Systems
What are Smarter Work Zones?

_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
### Project Coordination

Coordination within a single project and/or among multiple projects within a corridor, network, or region, and possibly across agency jurisdictions

### Technology Applications

Deployment of Intelligent Transportation Systems (ITS) for dynamic management of work zone traffic impacts, such as queue and speed management

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**Today’s Focus**
Types of Technology Applications Include...

- Real-Time Traveler Information
- Queue Warning
- Dynamic Lane Merge
- Incident Management
- Variable Speed Limits
- Automated Enforcement
- Entering/Exiting Construction Vehicle Notification
- Performance Measurement

For more information check out the SWZ TA website
https://www.workzonesafety.org/swz/swztechnology-application/types-of-applications/
Several States are already Utilizing SWZ!

- Over **40 states** have implemented technology applications, including:
  - Formalizing processes for planning and operating technology applications
  - Implementing “on-call” regional ITS SWZ contracts
  - Implementing steps towards institutionalizing technology:
    - Developing systems engineering documents
    - Developing specs to bid on technology
    - Piloting technology applications
    - Evaluating pilot to determine effectiveness for wider implementation
    - Fully implementing technology applications
    - Utilizing project funds to implement ITS – leading to institutionalization
Why Implement SWZ?

Capabilities of Technology Application

• **Improved driver awareness**
  - Changing traffic patterns
  - Downstream congestion
  - Construction vehicle ingress/egress
  - Expected delay / travel time

• **Dynamic and actionable guidance to drivers**
  - “Road work ahead” vs “Traffic Stopped 1 mile ahead”
  - “Road work – expect delays” vs. “Road Work I-95 past Exit 52 Use Alternate Routes”

• **Enhanced tools for on-site traffic management**
  - Speed monitoring
  - Automated speed enforcement
  - Queue formation
Why Implement SWZ?
Benefits of Technology Application

• Empowers drivers to be proactive in responding to work zones
  ▪ Awareness of downstream hazards
  ▪ Facilitates real-time decision-making and trip planning

• Streamlines traffic management functions through partial automation
  ▪ Speed enforcement
  ▪ Data collection
  ▪ Performance measurement

• Information increases customer satisfaction
  ▪ The More you Know...
Smarter Work Zones

Queue Warning Systems
Queue Warning Systems (QWS)

• **What is it?**
  - Technology used to alert drivers to traffic conditions (e.g., stopped traffic, slowing traffic) ahead using automated work zone monitoring

• **How does it work?**
  - Uses technology (Sensors, Portable Changeable Message Signs (PCMS), Cameras, Rumble Strips) to:
    - Collect real-time vehicle data
    - Analyze data via software
    - Alert drivers of conditions (e.g., delay times, stopped traffic conditions, alternate route options)

• **End Result:**
  - Reduces the number and severity of rear-end crashes
  - Eliminates driver surprise at stopped or slowing traffic
When is QWS Needed?

• Lack of driver awareness
  – Varying/temporary lane closure locations
  – Rural locations

• Increased severity risk
  – Locations with a high proportion of trucks
  – Work zones with loss of shoulders

• Others...
QWS Considerations

• **Project-Specific**
  – Estimated traffic volumes at location
  – Duration of delay due to project

• **Hardware/Software**
  – Sensor spacing
  – Sensor location
  – System update frequency
  – Logic thresholds for queue detection

• **Weather**
  – Equipment degradation due to inclement weather (precipitation, fog, darkness, dust, road debris)

• **Power and Communication**
  – Availability of power/alternate power sources (e.g., solar-powered)
  – Availability of communication (e.g., cellular, hardwired)
QWS Messaging

Sign Location
• Primary location should allow travelers to choose alternate route based on displayed information
• Additional locations could be added to provide road user addition information

Sign Message
• Alternating messaging when traffic slowed beyond specified threshold, for example:
  – “STOPPED TRAFFIC AHEAD / BE PREPARED TO STOP”
  – “STOPPED TRAFFIC / 8 MILES AHEAD”
• Anticipated delay times at approach to work zone and decision points
### Examples of QWS Signage

<table>
<thead>
<tr>
<th>Traffic Conditions</th>
<th>Phase I Message</th>
<th>Phase II Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Congestion</td>
<td><strong>NO DELAY TO US51</strong></td>
<td><strong>ROADWORK XX MILES AHEAD</strong></td>
</tr>
<tr>
<td>Speeds &lt; XX mph</td>
<td><strong>SLOW SPEEDS AHEAD</strong></td>
<td><strong>PREPARE TO STOP</strong></td>
</tr>
<tr>
<td>Significant Delays</td>
<td><strong>XX MIN DELAY</strong></td>
<td><strong>NEXT XX MILES</strong></td>
</tr>
<tr>
<td>Even Greater Delays</td>
<td><strong>XX MIN DELAY</strong></td>
<td><strong>CONSIDER ALT ROUTE</strong></td>
</tr>
<tr>
<td>Delays &gt; Threshold Value</td>
<td><strong>EXPECT MAJOR DELAYS</strong></td>
<td><strong>ALT ROUTE EXIT 163</strong></td>
</tr>
</tbody>
</table>

Example QWS Messages

1. Watch for slow traffic ahead.
2. Speed ahead 30 MPH.
3. 30 MPH traffic in 5 mi.
4. Hastings River Bridge 25 min delay.
5. Stopped traffic 2 miles.
Additional QWS Resources

Guidelines and Training
• End-of-Queue Training Module https://www.workzonesafety.org/training_courses/atssa_back_of_queue_training_module/player.html

Case Studies and Fact Sheets
• QWS in Texas https://www.workzonesafety.org/publication/innovative-end-of-queue-warning-system-reduces-crashes-up-to-45/
• QWS in Illinois http://www.ops.fhwa.dot.gov/publications/fhwahop14007/chap2.htm

Bid Specifications
• QWS in Michigan https://www.workzonesafety.org/files/documents/SWZ/special_provision_12OF800%28A020%29_rev1_Michigan_0.pdf

Deployment Plans
Implementation Guidance
Work Zone ITS Implementation Guide

- Provides 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


Source: FHWA
Implementation Guidance
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

 Applies to any WZ ITS deployment regardless of scale
Smarter Work Zones
RESOURCES
## Funding Opportunities

<table>
<thead>
<tr>
<th>State Transportation Innovation Councils (STIC) Incentive Program</th>
<th>Accelerated Innovation Deployment (AID) Demonstration Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Funds activities which turn innovations into standard practices</td>
<td>• Projects may be any aspect of highway transportation</td>
</tr>
<tr>
<td>• All states are eligible</td>
<td>• Max of $1,000,000 (up to full cost of project)</td>
</tr>
<tr>
<td>• Up to $100,000 available to each STIC annually</td>
<td>• Monitoring, assessment, and technology transfer commitments</td>
</tr>
<tr>
<td>• Can be used to fund multiple initiatives</td>
<td>• Current grants include ABC, high surface friction treatments, and ATMS/A.</td>
</tr>
<tr>
<td>• Use to pay consultants to develop standards, specifications, design manuals, evaluations, implementation plans, workshops, training, and more!</td>
<td></td>
</tr>
</tbody>
</table>

[www.fhwa.dot.gov/stic](http://www.fhwa.dot.gov/stic)  
[https://www.fhwa.dot.gov/accelerating/grants/](https://www.fhwa.dot.gov/accelerating/grants/)
Visit FHWA’s SWZ Interactive Toolkit

https://www.workzonesafety.org/swz/
Utilize Various Learning Opportunities!

- In-Person Workshops
- Virtual Peer Exchanges
- In-Person Peer Exchanges
- Demonstration Site Visits

Contact Jawad Paracha for more information
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Free educational opportunities are available!

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