Combining a Smarter Work Zone with Stakeholder Needs and Effective Communication

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FHWA Work Zone Activity Data

Figure 2. WZAD Use Categories

1. Work Zone Planning and Project Coordination
2. Work Zone Impact Analyses
3. Construction and Maintenance Contract Monitoring
4. Real-time System Management/Traveler Information Provision
5. Safety and Mobility Performance Measurement
6. Law Enforcement and Emergency Service Providers
7. CAV Hardware Needs and System Readiness
TxDOT is committed to finishing the widening of Main Street Texas (I-35) to six lanes from San Antonio to Hillsboro.
I-35 Waco Highlights

Highlights

✓ 96 mile corridor

Central Texas Waco District

✓ 10 Active Projects
  encompassing a length of 74 miles with 66 miles of work zone

✓ Costs: ~$2.0 B
  • Construction = $1.9B
  • Right-of-way = $450M+
  • Utility relocation = $110M

✓ Traffic Volumes
  • 55,000 – 115,000 veh/day
  • Trucks: 25 – 35%
I-35 Waco Demographics

- $2.1 billion
- Coordination of 17
- 55,000 to 111,000
- 30 million
- 25% to 35%
- Peak construction
- 200 directional
- 96-MILE
- DIFFERENT PROJECTS
- VEHICLES
- TRAVELERS
- TRUCK
- 2012–2014
- MILES
- corridor construction project cost
- with multiple contractors
- per day
- per year
- traffic
- estimated complete 2017
- Central Texas
The Communication Challenge

- More than 30 million travelers per year pass through this corridor.
- ~2/3 travel through the corridor.
- **1,000** businesses and 13 communities are located on these 96 miles.
Sean Boyle, head of the finance division for Amazon Web Services, is a strong proponent of leveraging the organization’s tremendous metrics. He states:

“Data creates a lot of clarity around decision-making. Data is incredibly liberating.”
A "smart work zone system" is the application of computers, communications, and sensor technology to freeway transportation and would possess the following general characteristics:

- **Real-time**: The system obtains and analyzes traffic flow data in real-time, providing frequently updated information to motorists.

- **Portable**: The system is portable, hence allowing its installation (with minor modifications as necessary) at different locations.

- **Automated**: The system operates in an automated manner with as minimal supervision as possible by human operators.

- **Reliable**: The system provides accurate and reliable information, keeping in mind the serious consequences of misinforming motorists in work zone situations.
Smart(er) Work Zones

These systems, if properly designed and implemented, will:

• Better inform motorists and reduce their frustrations;

• Encourage motorists to take alternate routes;

• Reduce congestion and allow more freely flowing traffic;

• Clear incidents more quickly, thereby reducing secondary incidents;

• Make work zones safer for highway workers and motorists.

FHWA Work Zone Mobility and Safety Program Website
Real-Time - Data Sources

- Incidents
- CCTV
- PCMS
- Wavetronix
- Bluetooth
- Lane Closures
- Surveys
• One site, responsive to device / screen size
• All lane closure and incident notices dynamically link to event on site
• Tracking event clicks tells designers what information customers are looking at
I-35 Corridor Construction Coordination
**Portable - I-35 Construction Traveler Information System**

- **Disseminate Traveler Info**
- **Monitor Traffic Conditions**
- **Estimate Construction Delay**

**Delay Estimation**

- **Delay Estimation Chart**

**Monitor Traffic Conditions**

**Disseminate Traveler Info**

**Estimate Construction Delay**

**Portable - I-35 Construction Traveler Information System**
Automated monitoring near a work zone
Warning of slow speeds
Warning of end of ‘stop and go’ traffic
Automated - Lane Closures

- Lane closure information submitted daily
- Basis for email distributions (Daily, 7-Day, High Impact)
• Trip delay predictions
• End of queue recommendations
Automated - Bluetooth

- Travel times and segment delay
- Comparative travel times
- Section delay
- Daily post-mortem
- Detector heartbeats
- O&M database

THRU WACO VIA

I-35
NW

Current Delays

MINUTES DELAY

Belton

Temple

XX

XX

XX

Waco (MM 334) to Hillsboro (MM 368)

Current Delay

0 minutes

As of 8:35 PM
Automated - Wavetronix

- Volume / Classification / Spot Speed
- Sustained closure analyses
- Historical volumes and % trucks
- Detector heartbeats
- O&M database

**Volume Sensor Location: Salado North (I-35@FM-2484)**
Southbound
Updated on 9-7-2015

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**Historical Hourly Volumes (6-month average)**

Mon 7 pm – Wed 7 am

**8958 Hillsboro South (I-35@CR-3133)(SH-81)**

- Last 6 months
- Previous week (10/18 - 10/24)
- Last week (10/25 - 10/31)
**Reliable**

- Message logging
- Error logging
- Cycle/Daily performance
- O&M database

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<th>C</th>
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<th>E</th>
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Closed on: 11/8/2015 12:03:55 AM

From: h-charara@tamu.edu
To: h-charara@tamu.edu; R.Brydia@tamu.edu
Cc: 
Subject: CITS:ITMG -- DisplayMsgError -- WAC.TT.PCMS.SB-9 -- Device Error

- **PCMSid:** WAC.TT.PCMS.SB-9
- **Priority:** 20
- **Message:** [ BJ][jt300o]SALADO[n]12 MILES[n]12 MIN
- **newmsgid:** 
- **Status:** Device Error
- **DisplayError:** 1
• Monthly performance measures report
Reliable - CCTV

- Support traveler information
- Support incident management
- No archive
- O&M database
• All site issues recorded
• Short- / Long-term trends analysis
Incidents

- Incident alerts
- Incident impacts
- Detours
- Crash analysis
- Safety summit
- Incident management plan
- FHWA national measures

Crash Rate
Before, During and After Construction
All Types, All Severity

Crashes/Month/Mile

Before, During, After
**Traveler Information Surveys**

- Initial survey to determine traveler’s needs
- Follow-up surveys to determine traveler satisfaction

<table>
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<tr>
<th>DELAYS</th>
<th>CURRENT TRAVEL TIMES</th>
<th>INCIDENTS</th>
<th>LANE CLOSURES</th>
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<td><img src="image1.png" alt="Delay Icon" /></td>
<td><img src="image2.png" alt="Travel Time Icon" /></td>
<td><img src="image3.png" alt="Incident Icon" /></td>
<td><img src="image4.png" alt="Closure Icon" /></td>
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<th>FORECASTED TRAVEL TIMES</th>
<th>DETOUR ROUTES</th>
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<td><img src="image6.png" alt="Detour Icon" /></td>
<td><img src="image7.png" alt="Speed Icon" /></td>
<td><img src="image8.png" alt="Snapshot Icon" /></td>
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</table>
Have You Changed Plans Based on the Information?

- Never: 38%
- Frequently: 28%
- Occasionally: 19%
- Once or Twice: 15%

62%
Traveler Information Outreach

- En-route
  - Travel times
  - Rest area signage (inside and out)
  - End-of-queue warning systems
  - Coordination with other TMCs

- Web
  - Real-time map (linked from front page of My35)
    - Closures, travel times, delays, trip planner
    - Show information by direction
  - Other web site coordination

- Email
  - Lane closures
  - Traffic alerts

- Social Media
  - Twitter
  - Facebook
Travel Time Signs

Approval rating of signs from those that have seen them

Have you seen the electronic travel time signs along I-35?

- 2012: 38% Yes, 62% No
- 2013: 11% Yes, 89% No
Comments on Travel Time Signs

• “LOVE LOVE LOVE these signs. Wish they were permanent.”

• “I know the “normal” times and this info lets me know how slow it’s going to be.”

• “They should state the reason for the delay and advise of alternate routes.”

• “These are extremely helpful during my daily drive.”

• “VERY HELPFUL. I can decide whether or not to use the feeder/access road.”

• “Love it! Helps me on time crunch.”
My35 Helpfulness

- Always (41%)
- Frequently (32%)
- Occasionally (19%)
- Not Helpful (8%)

Overall helpfulness: 92%
I-35 Real-Time Map Topic Selection

- **Planner** 16%
- **Incidents** 29%
- **Weather** 10%
- **Signs** 21%
- **Closures** 24%

Traveler Information - I-35 Waco District

- **Closures**
  - North of Hillsboro
  - I-35 Before FM 2959 (35W)
  - ROADWAY: I-35 W Mainlanes (starting at MM 3.5)
  - CLOSED: Various lanes closed
  - TIME: Continuously, Ends 10/10 @ 6AM
  - ACTIVITY: Traffic diversion to left side of existing pavement.

- **Picnic Area to TX 7/FM 107, Bruceville**
  - I-35 Frontage Road (starting at MM 318.0)
  - CLOSED: Various lanes closed
  - TIME: Continuously, Ends 12/1 @ 7AM
  - ACTIVITY: Traffic switch to one way.

- **I-35 at TX 7/FM 107, Eddy**
  - I-35 Exit Ramp (starting at MM 318.5)
  - CLOSED: Right lane

- **Closures** 24%
- **Signs** 21%
- **Weather** 10%
- **Planner** 16%
- **Incidents** 29%
Lane Closure E-Mail Subscriptions

Subscription growth, e-mail notifications

- Total
- Daily
- 7 Day
- High Impact

- Start – May 2012
- December 2012
- December 2013
- May 2014

2013
- 8%
- 13%
- 79%

92%
“Invaluable tool though most of my travel is leisure. Wonderful service provided by TxDOT.”

“I always check these before I plan a trip.”

“We use the information to help with our bus routes and trips. I also use the information for personal travel.”

“I rely heavily on the information provided when planning my daily trips from Waco to SMU in Dallas.”

“I don’t understand why they close all these exits.”

“Same info every day. I really need weather related info and cannot get it via the emails. Really disappointed about that.”
Public Perception of Information Accuracy

Information is accurate...
Have You Changed Plans Based on the Information?

- Never: 38%
- Once or Twice: 15%
- Occasionally: 19%
- Frequently: 28%

62%
Some of the Innovations…

• Comprehensive lane closure database
• Delay and queue assessment for each closure
• End of queue warning systems
• Solar / cellular basis for corridor wide ITS equipment base
• Portable Changeable Message Sign for travel times in construction zones
• Portable Changeable Message Sign for comparative travel times in construction zones
• Lane closure email notifications
• Incident alerting / updates
• Advanced traveler information real-time map
• Operational performance metrics
Mobility Coordinator

Role

- Project Ombudsman
- Engage and assist those impacted
- Technical advisor
- Keep internal / external stakeholders informed
- Facilitate flow of information (e.g., lane closures, maintenance work, traffic control changes, etc.)
- Assist Public Information Officer
- Examine mobility across all I-35 construction projects
- Mitigate traffic and access impacts
- Smart Work Zone Assistance
- Listen
- No Surprises/Manage Expectations
I-35 Mobility Coordination

- Maintain Mobility
  - Examine mobility across all I-35 construction projects
  - Mitigate traffic and access impacts
  - Serve as technical advisor
  - Listen

- Communicate – “Keep People Informed”
  - Facilitate flow of information (e.g., lane closures, frontage roads)
  - Assist PIO staff
    - Monthly newsletter
    - Flyers
    - Community Meetings
  - Meet with stakeholders
# I-35 Mobility Coordination

![I-35 Mobility Coordination Chart](image.png)

## Expected Delay Summary (in minutes)

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<th>Delay 1B</th>
<th>Delay 1C</th>
<th>Delay 2A</th>
<th>Delay 2B</th>
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<td>6 AM</td>
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<td>0</td>
<td>0</td>
<td>10</td>
<td>0</td>
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</tbody>
</table>
I-35 Smart Work Zones

- Automated monitoring near a work zone
- Warning of slow speeds
- Warning of end of ‘stop and go’ traffic
Crash Data Analysis

Crash Rate
by Construction Segment, Before, During and After Construction
All Types, All Severity

[Bar chart showing crash rates for different construction segments, with segments labeled 1A to 6B, and categories indicating before, during, and after construction.]
Traffic Engineering Solutions
Traffic Engineering Countermeasures

Typical Traffic Shift

~12 foot lanes and no shoulders
Examples of Support: Lane Closures

Historical Hourly Volumes on IH-35 Southbound at West South (Tokio Rd.)
(6-month average)
9202: Temple North (North of I-35@Industrial Blvd)

**Historical Hourly Volumes (6-month average)**

**Number of vehicles affected by a 15-hr closure**

Day and time when the closure starts
9202: Temple North (North of I-35@Industrial Blvd)

Historical Hourly Volumes (6-month average)

Number of vehicles affected by a 15-hr closure

Day and time when the closure starts
Best Time for 12-hour NB Closure in Temple

<table>
<thead>
<tr>
<th></th>
<th>SUN</th>
<th>MON</th>
<th>TUE</th>
<th>WED</th>
<th>THU</th>
<th>FRI</th>
<th>SAT</th>
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<tbody>
<tr>
<td>Closure Start Time</td>
<td>19:00</td>
<td>18:00</td>
<td>19:00</td>
<td>19:00</td>
<td>19:00</td>
<td>20:00</td>
<td>21:00</td>
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<tr>
<td>Affected Traffic Volume</td>
<td>9034</td>
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<td>8456</td>
<td>9094</td>
<td>9409</td>
<td>9243</td>
<td>6241</td>
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</tbody>
</table>

Historical Hourly Volumes (6-month average)
Oct 2016 – Mar 2017

Number of vehicles affected by closure

SAT 9 PM
Examples of Support: Working with Businesses / Research
Examples of Support: Business Access
**Results**

- Give a voice to travelers and stakeholders during construction
- Increase level of outreach
- Increase consideration and coordination for business owners
- Provide real-time information to the media, the public, businesses, and local municipalities
- Manage expectations
- Maintain balance between construction progress and the needs of the users of the corridor
- Refined Work Zone ITS initiatives
- Learn that Smarter Work Zone applications are project dependent
...to be continued