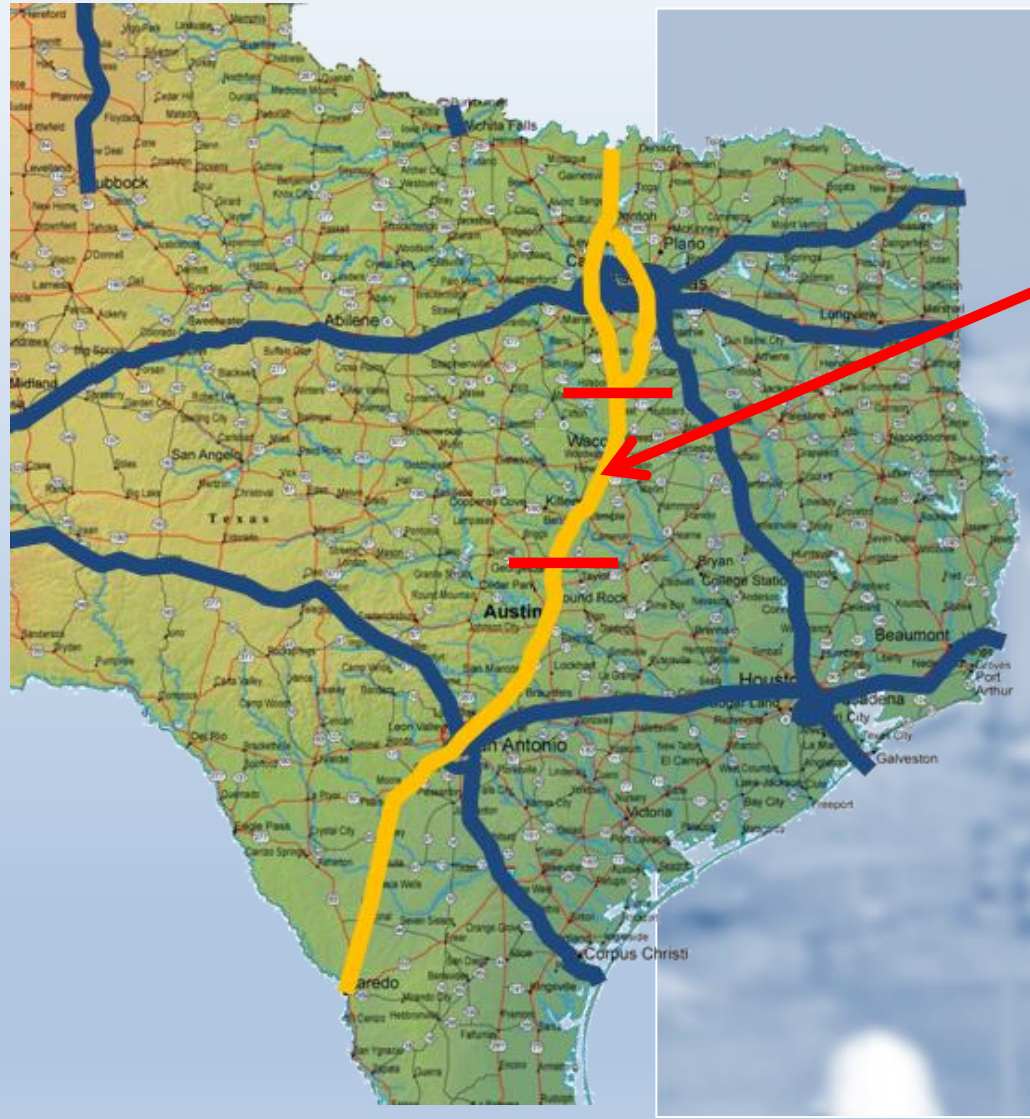
Combining a Smarter Work Zone with Stakeholder Needs and Effective Communication

Texas A&M Transportation Institute

JOHN HABERMANN • RESEARCH ENGINEER
J-HABERMANN@TTI.TAMU.EDU • (512) 994.9450

FHWA Work Zone Activity Data

Overview



Current scope of I-35 Widening. (South of Salado to Hillsboro)

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

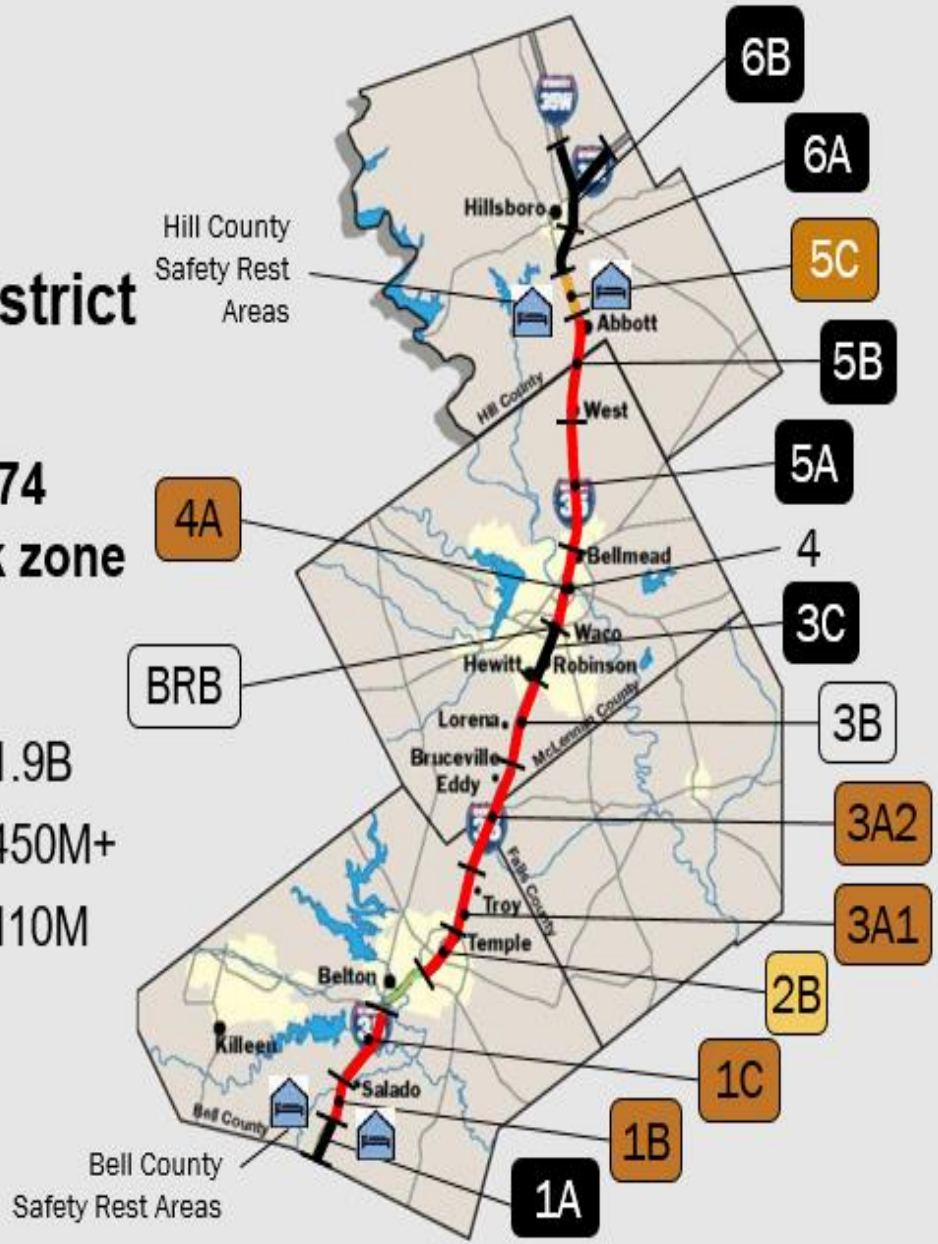
- ✓ **96 mile corridor**

  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

I-35 Waco Demographics

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.

Smart(er) Work Zones

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."

Smart(er) Work Zones

- 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:

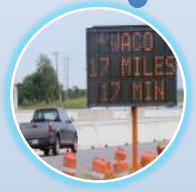
- Better inform motorists and reduce their frustrations;
- Encourage motorists to take alternate routes;
- Reduce congestion and allow more freely flowing traffic;
- Clear incidents more quickly, thereby reducing secondary incidents;
- Make work zones safer for highway workers and motorists.

FHWA Work Zone Mobility and Safety Program Website

Real-Time - Data Sources

Incidents

CCTV



PCMS

Wavetronix

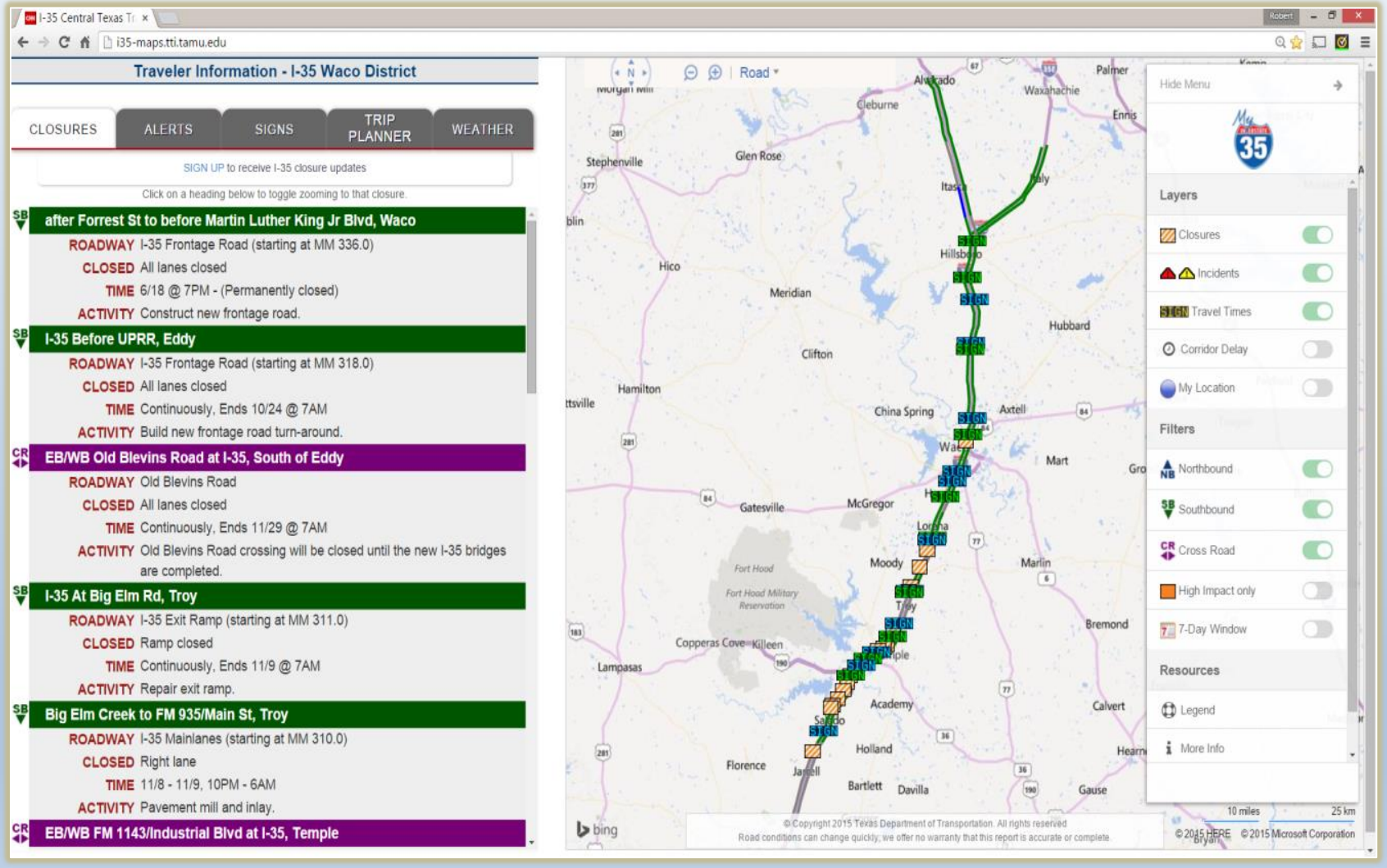
Bluetooth

Lane Closures

Surveys

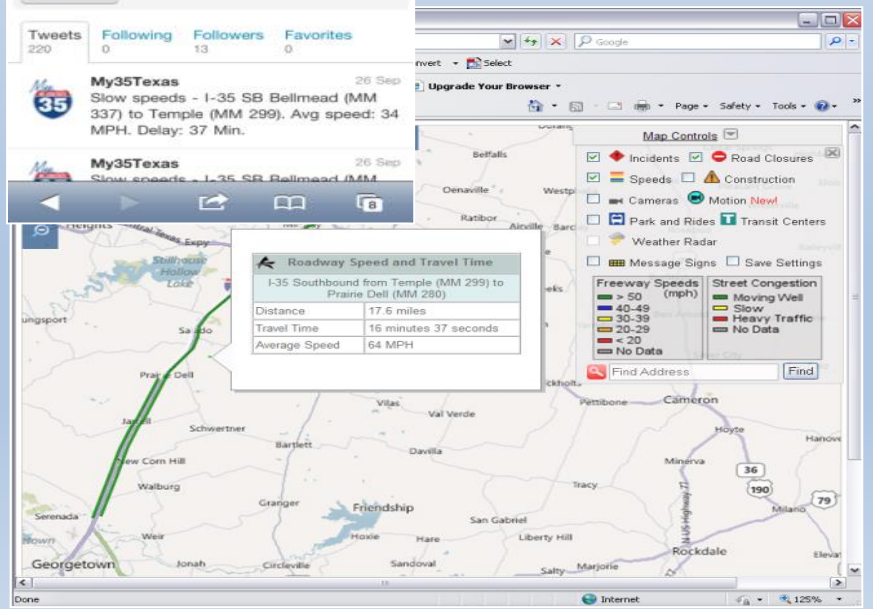

Real-Time Map

- 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

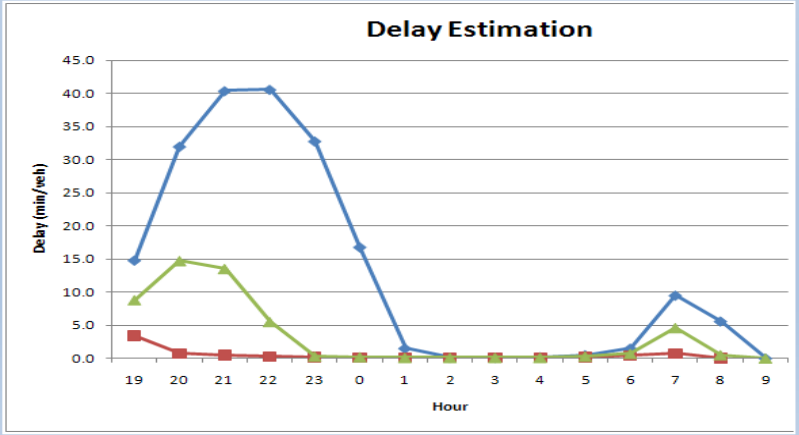
Portable - I-35 Construction Traveler Information System



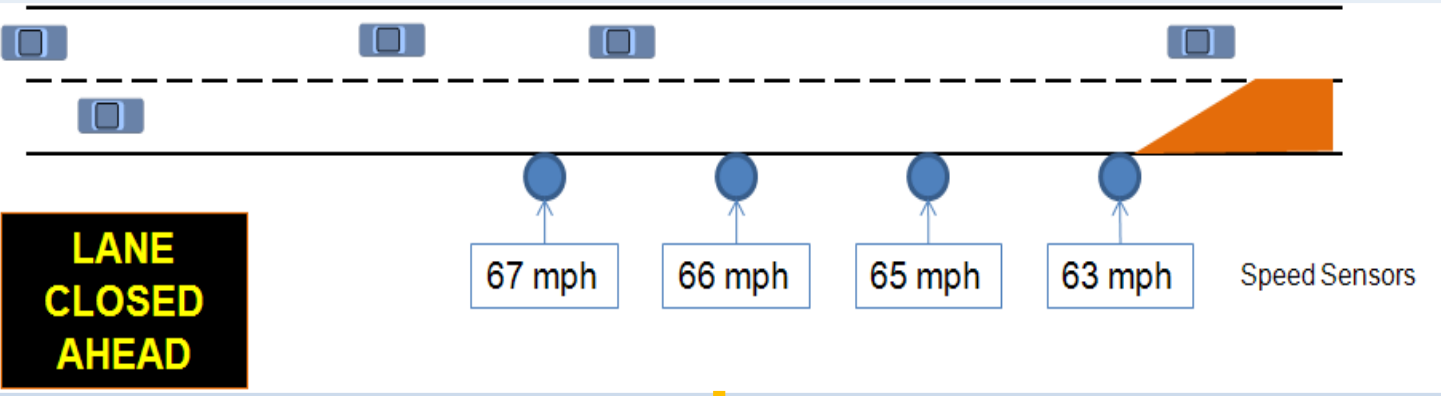
Disseminate Traveler Info

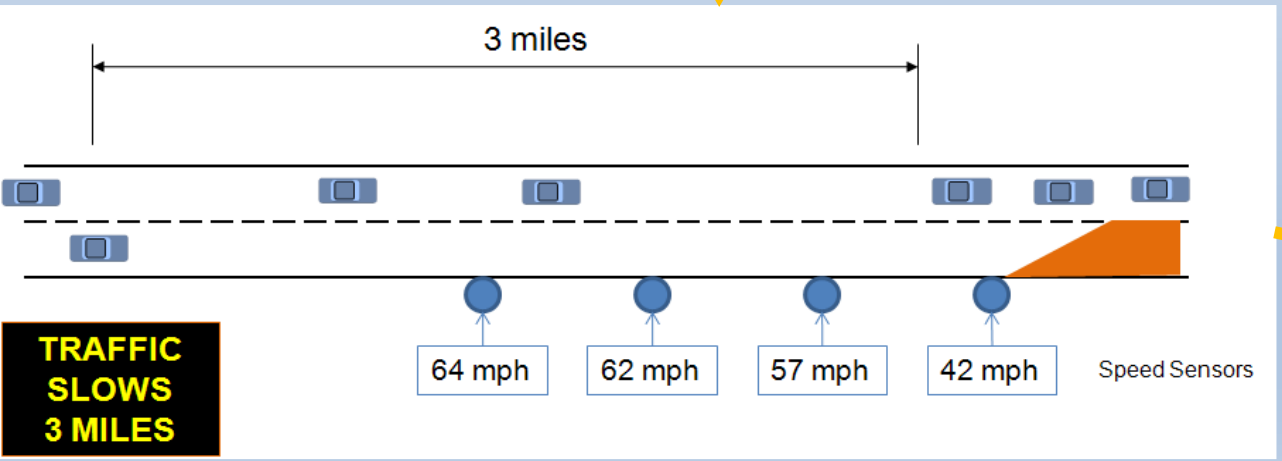
Monitor Traffic Conditions

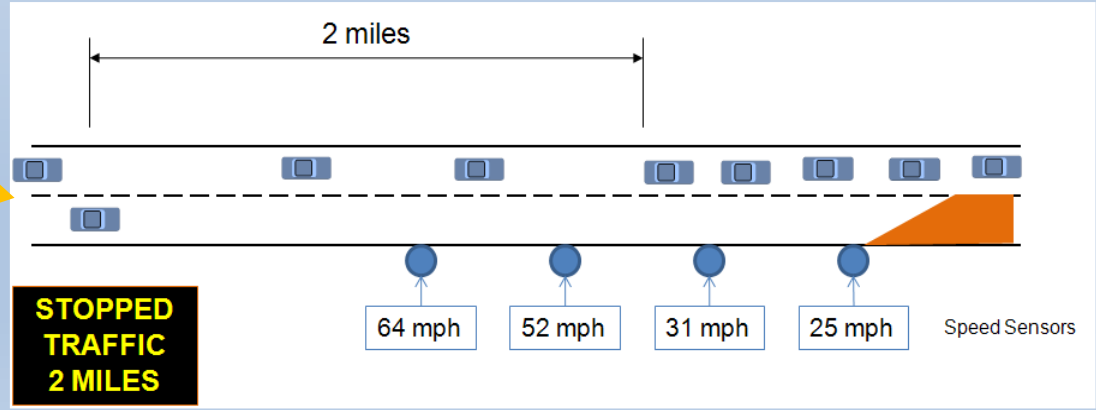
Estimate Construction Delay



Portable - I-35 End-of-Queue System







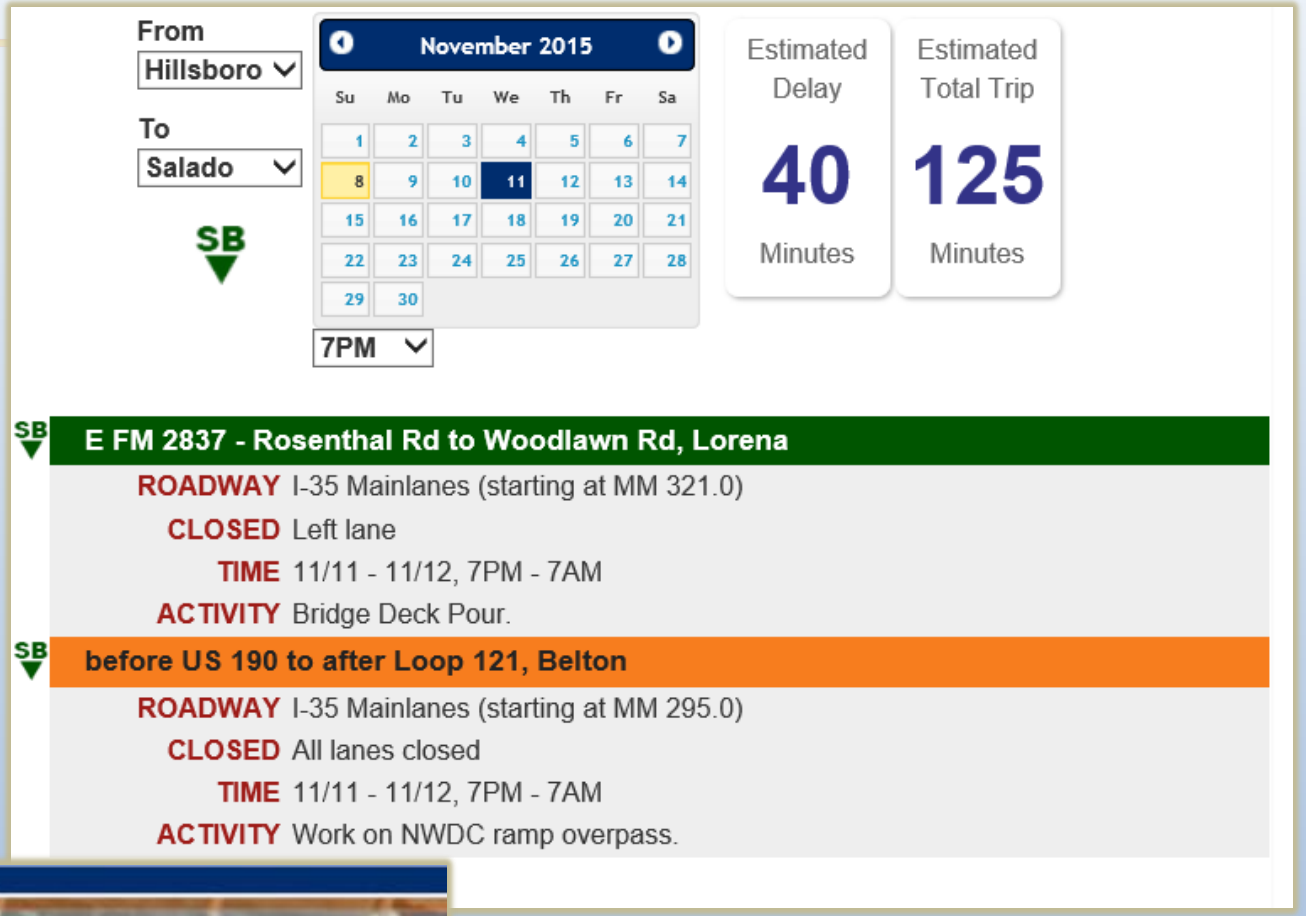
- Automated monitoring near a work zone
- Warning of slow speeds
- Warning of end of 'stop and go' traffic

Automated - Lane Closures

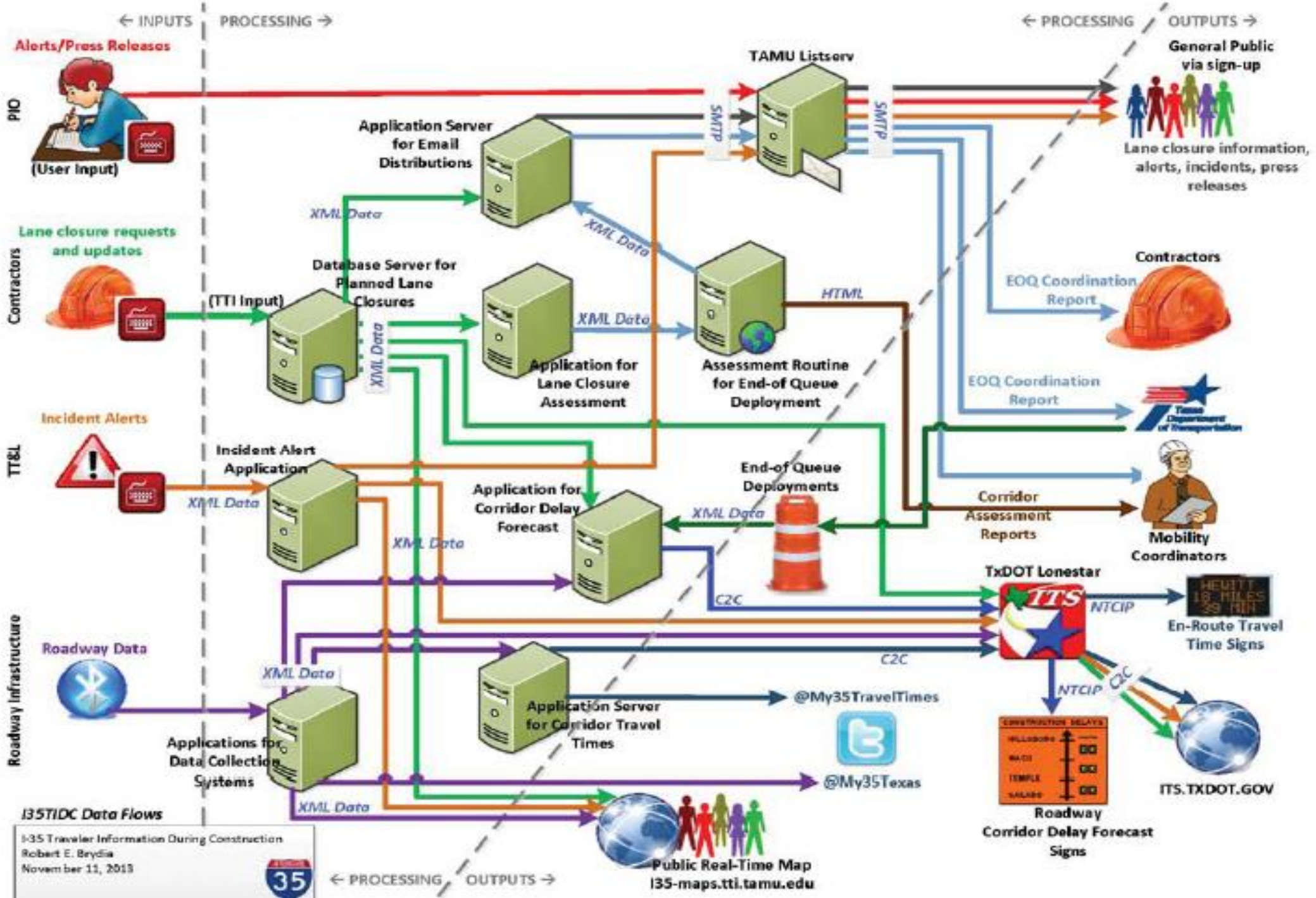
- Lane closure information submitted daily
- Basis for email distributions (Daily, 7-Day, High Impact)

Automated - Closures / Wavetronix

- Trip delay predictions
- End of queue recommendations

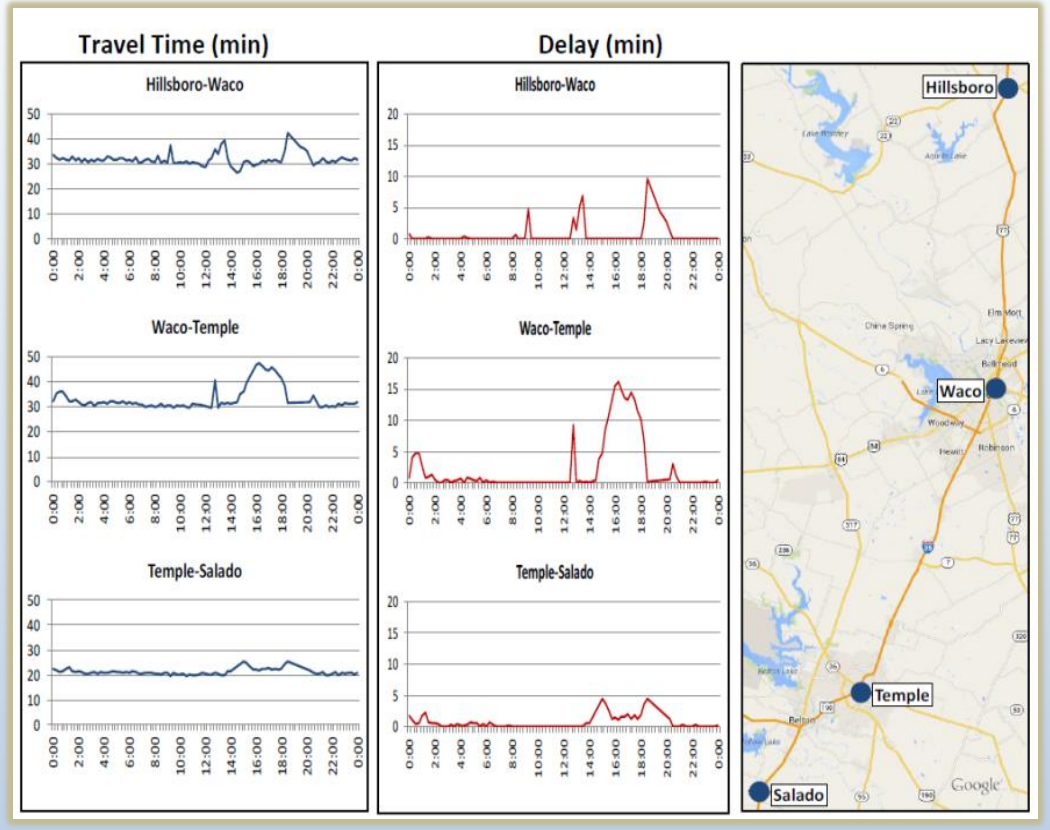


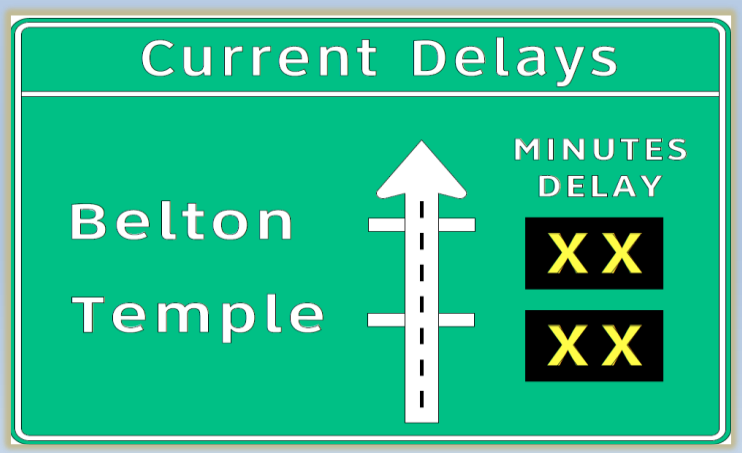
Automated

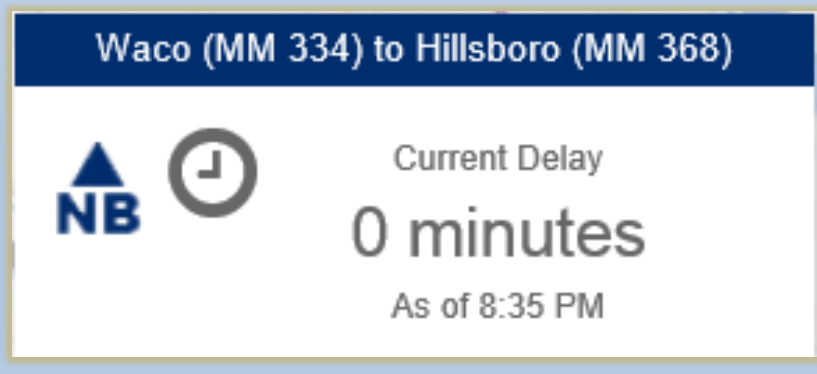

← INPUTS
PROCESSING →
← PROCESSING
OUTPUTS →
PIO
Alerts/Press Releases
(User Input)
TAMU Listserv
General Public via sign-up
Lane closure information, alerts, incidents, press releases
SMTP
SMTP
Application Server for Email Distributions
XML Data
XML Data
Contractors
Lane closure requests and updates
(TTI Input)
Database Server for Planned Lane Closures
XML Data
XML Data
Application for Lane Closure Assessment
Assessment Routine for End-of Queue Deployment
HTML
Contractors
EOQ Coordination Report
EOQ Coordination Report
TT&L
Incident Alerts
Incident Alert Application
XML Data
XML Data
Application for Corridor Delay Forecast
XML Data
End-of Queue Deployments
Corridor Assessment Reports
Mobility Coordinators
C2C
TxDOT Lonestar
NTCIP
En-Route Travel Time Signs
Roadway Infrastructure
Roadway Data
XML Data
Applications for Data Collection Systems
Application Server for Corridor Travel Times
C2C
@My35TravelTimes
@My35Texas
NTCIP
C2C
ITS.TXDOT.GOV
Roadway Corridor Delay Forecast Signs
XML Data
Public Real-Time Map
I35-maps.tti.tamu.edu
I35TIDC Data Flows
I-35 Traveler Information During Construction
Robert E. Brydia
November 11, 2013
35
← PROCESSING
OUTPUTS →

Automated - Bluetooth

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





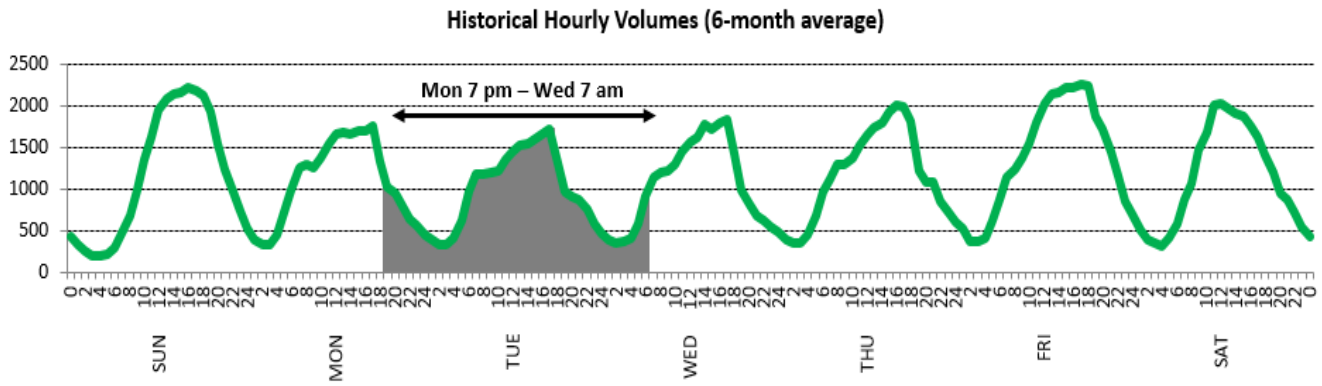


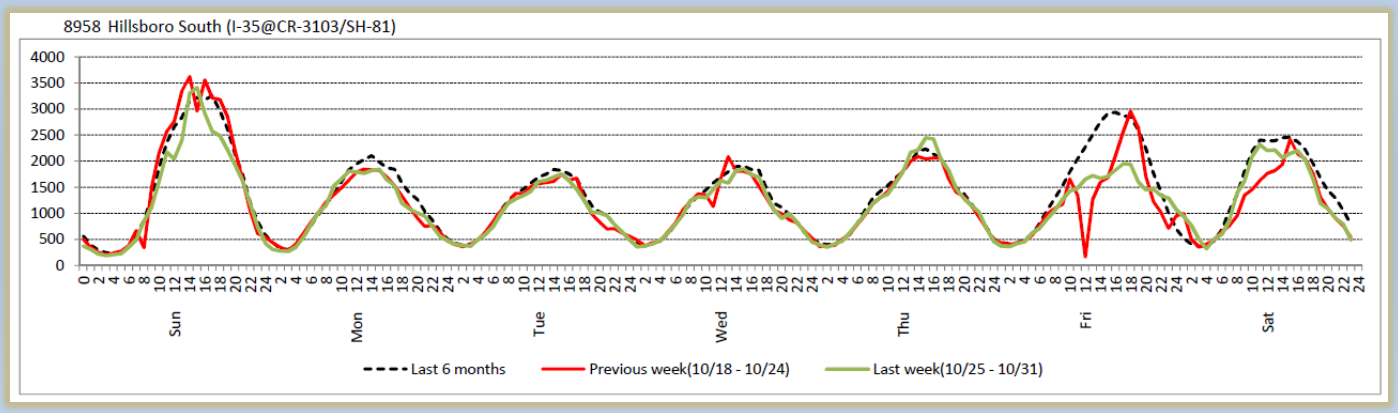
Automated - Wavetronix

- 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

	SUN	MON	TUE	WED	THU	FRI	SAT
Best start time	22:00	19:00	19:00	0:00	0:00	22:00	0:00
36-hr volume	34649	31983	32855	35389	38946	33320	34282





Reliable

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

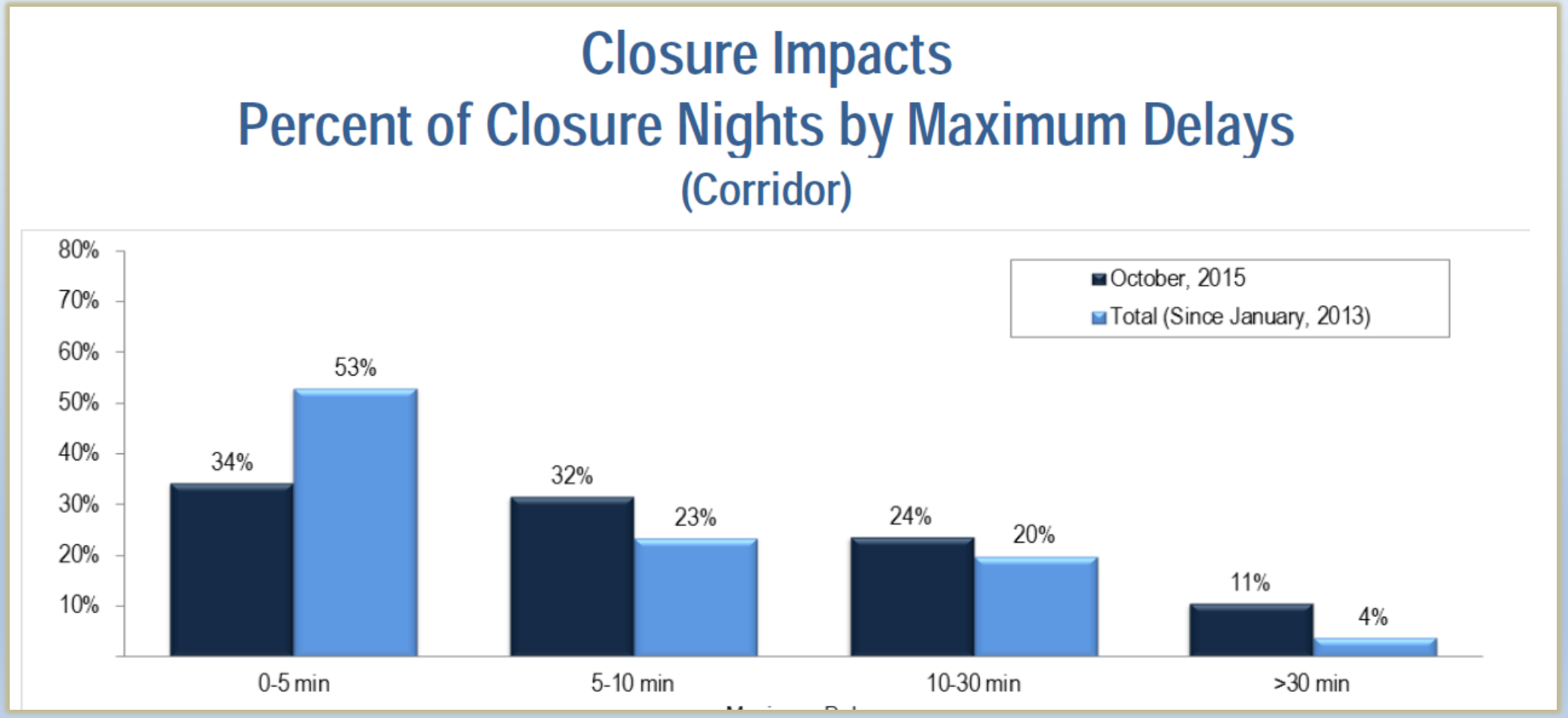
	A	B	C	D	E	F	G	H
1	Started on: 11/7/2015 12:03:46 AM							
2	PCMS-ID	% Online Count	Online Count	Error Cou	Offline Co	Total Count	Location	Destination
3	WAC.TT.PCMS.NB-1	100.00%	288	0	0	288	IH-35	BELTON
4	WAC.TT.PCMS.NB-2	100.00%	288	0	0	288	IH-35	TEMPLE
5	WAC.TT.PCMS.NB-3	98.26%	283	5	0	288	IH-35	TROY
6	WAC.TT.PCMS.NB-4	99.65%	287	1	0	288	IH-35	LORENA
7	WAC.TT.PCMS.NB-4B	100.00%	288	0	0	288	IH-35	HEWITT
8	WAC.TT.PCMS.NB-5	93.06%	268	20	0	288	IH-35	WACO
9	WAC.TT.PCMS.NB-6	100.00%	288	0	0	288	IH-35	WACO
10	WAC.TT.PCMS.NB-7	100.00%	288	0	0	288	IH-35	ELM MOTT
11	WAC.TT.PCMS.SB-10	99.65%	287	1	0	288	IH-35	SALADO
12	WAC.TT.PCMS.SB-4	97.92%	282	6	0	288	IH-35	HEWITT
13	WAC.TT.PCMS.SB-6	95.83%	276	12	0	288	IH-35	TROY
14	WAC.TT.PCMS.SB-7	91.32%	263	25	0	288	IH-35	TEMPLE
15	WAC.TT.PCMS.SB-7B	100.00%	288	0	0	288	IH-35	TEMPLE
16	WAC.TT.PCMS.SB-8	100.00%	288	0	0	288	IH-35	BELTON
17	WAC.TT.PCMS.SB-9	99.65%	287	1	0	288	IH-35	SALADO
18	Closed on: 11/8/2015 12:03:55 AM							
19								

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

PCMSId: WAC.TT.PCMS.SB-9
msgId: WAC.TT.PCMS.SB-9:dms:dms:FTW2+2015-11-08T22:33:522597
Priority: 20
Message: [jl3][pt30o0]SALADO[nl]12 MILES[nl]12 MIN
newmsgId:
Status: Device Error
DisplayError: 1

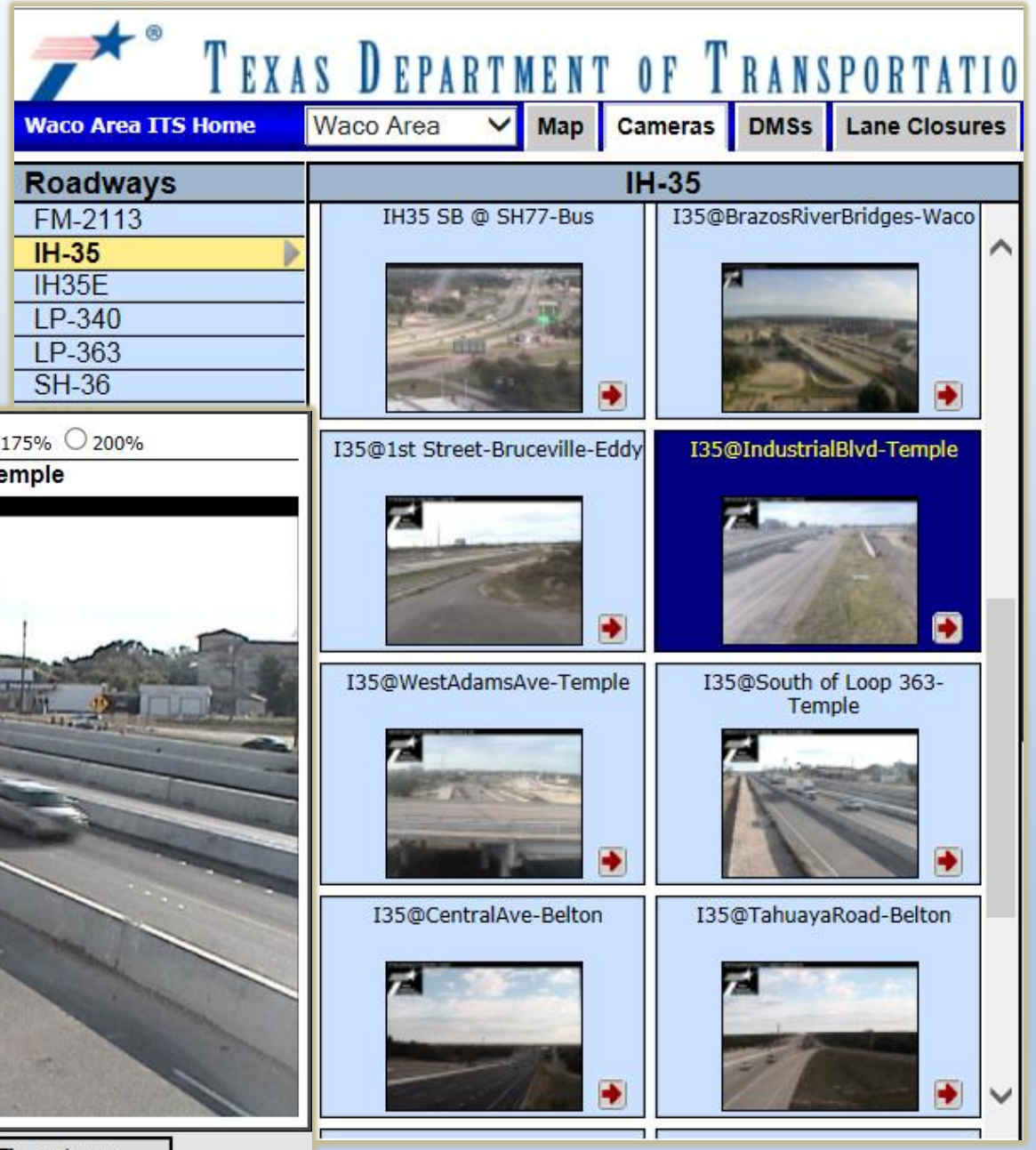
Reliable - Closures / Bluetooth

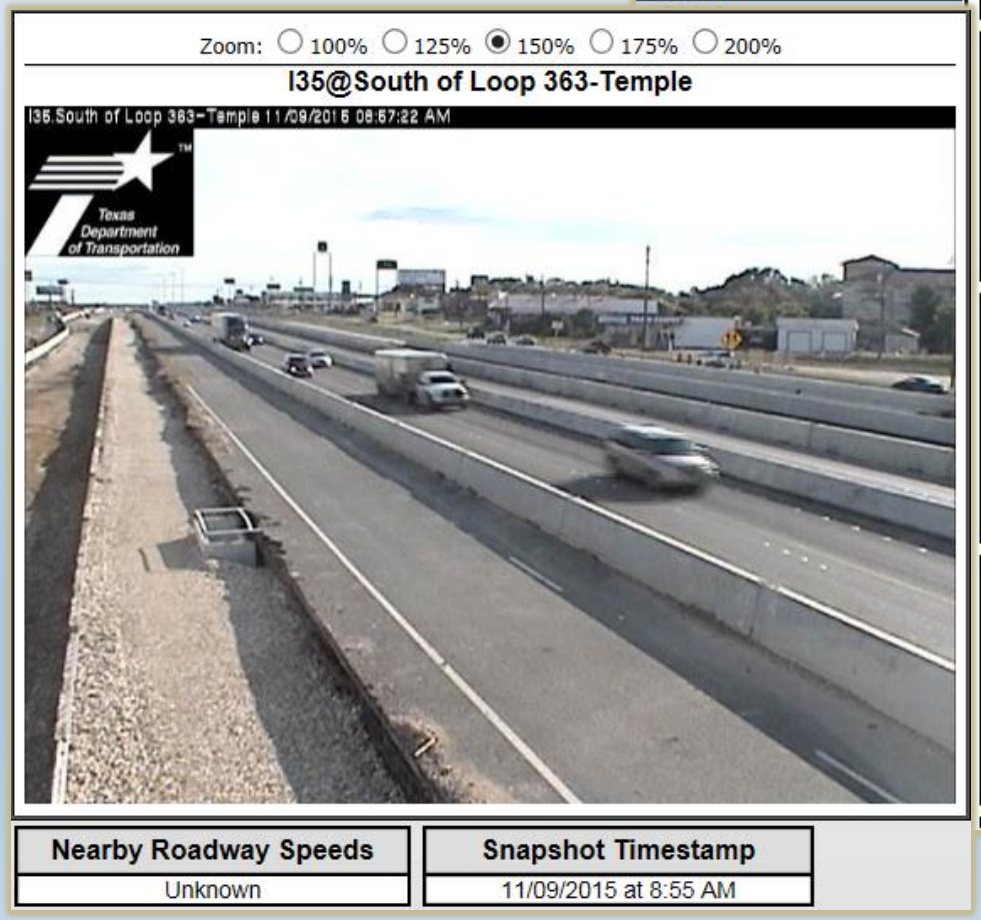
- Monthly performance measures report



Reliable - CCTV

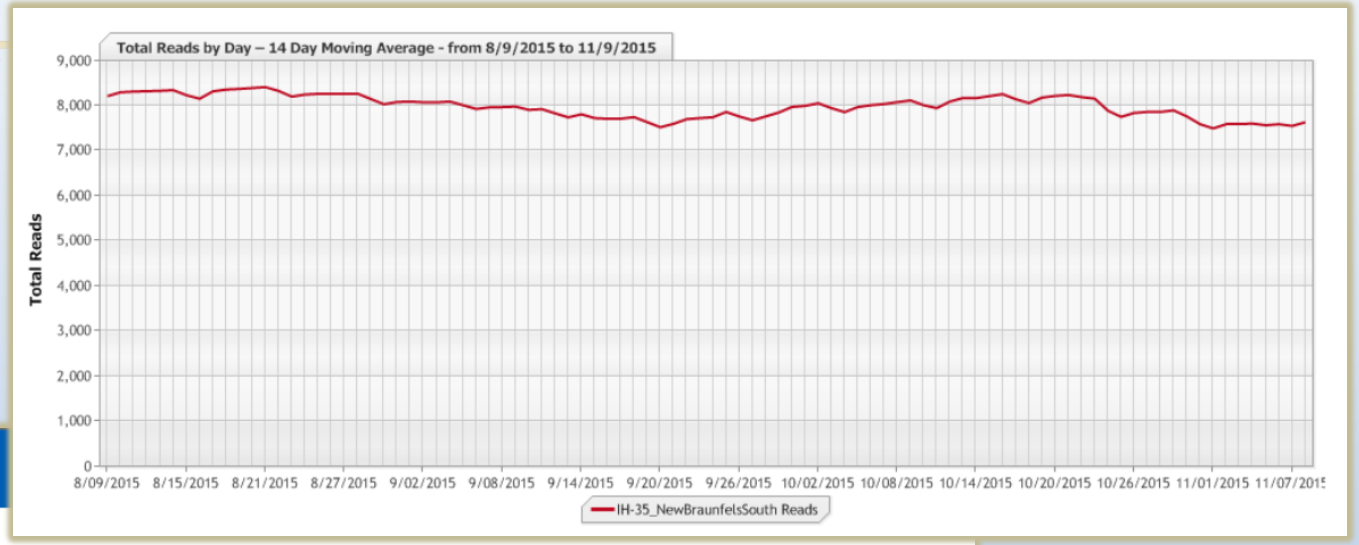
- Support traveler information
- Support incident management
- No archive
- O&M database





Reliable - (O & M)

- All site issues recorded
- Short- / Long-term trends analysis



ITS Device Maintenance and Operations Log

Add Issue | Recent Issues

Search Issues

Equipment Type: All / Bluetooth / Wavetronix / PCMS / CCTV

Location: All Locations

From: To: Only Show Open Issues: ☑ Search Issues

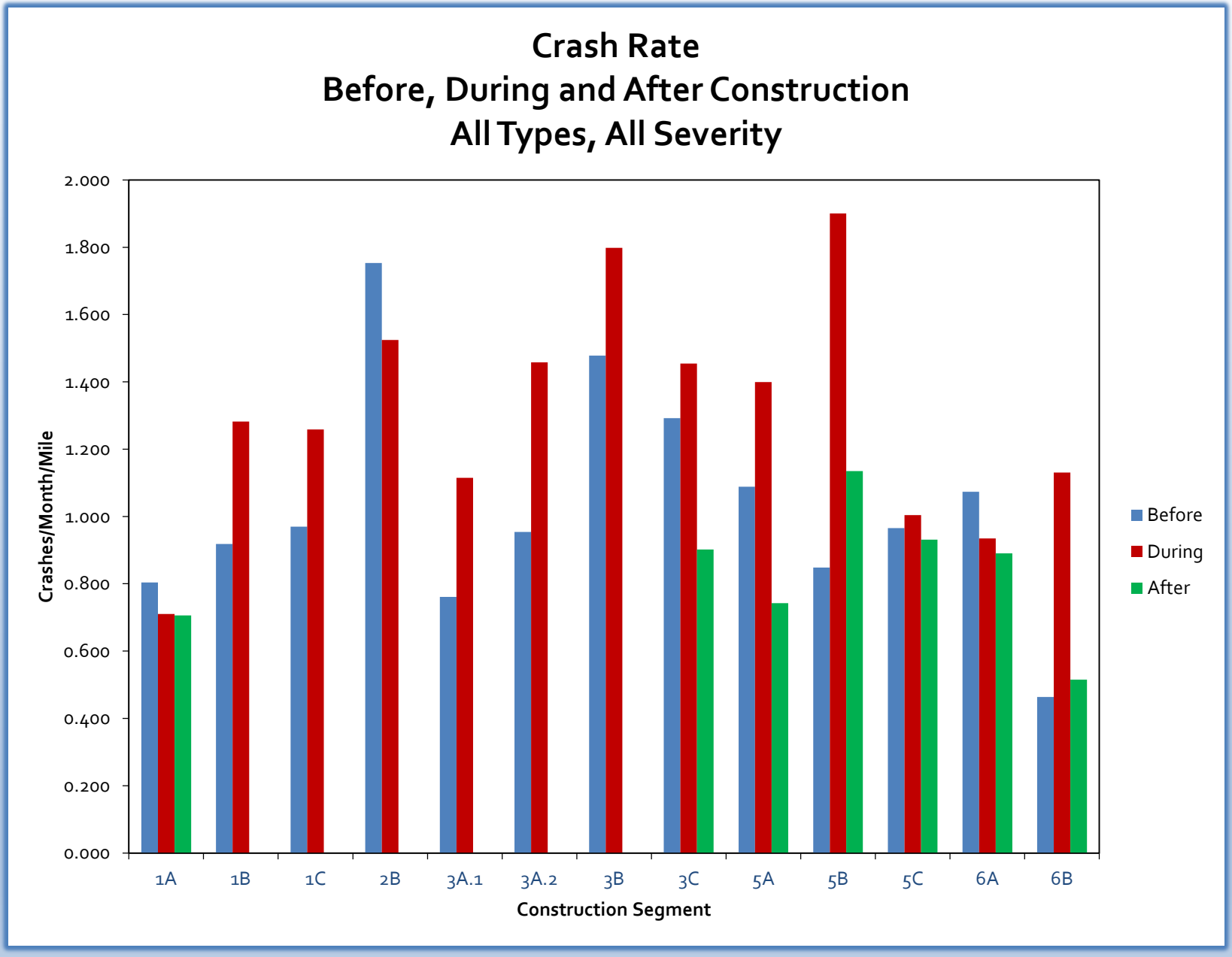
Sort Issues

◉ Last Edit Timestamp ○ Issue Opened Timestamp ○ Issue Closed Timestamp ○ Location ○ Equipment Type ○ Issue ○ Status

Action	Location	Equipment Type	Issue	Status	Last Edit Timestamp	Issue Opened Timestamp	Issue Closed Timestamp
Edit | Delete	IH-35_CookseyLn	Bluetooth	Device Not Operational	Open	11/6/2015 10:21 AM	11/5/2015 6:00 PM	-
Edit | Delete	IH-35W_FM-2959	Bluetooth	Device Not Operational	Open	11/6/2015 10:20 AM	10/22/2015 7:30 PM	-

Incidents

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



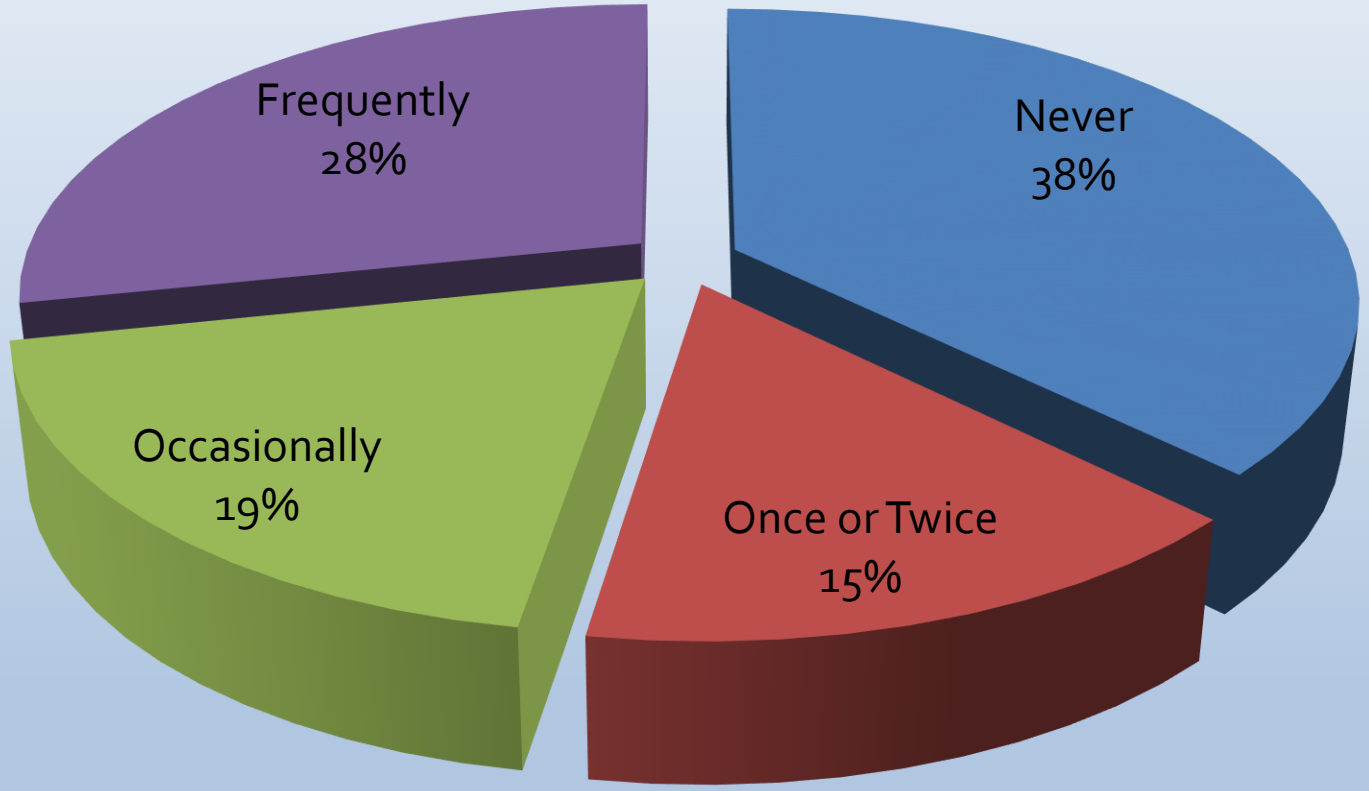
Traveler Information Surveys

- Initial survey to determine traveler's needs

- Follow-up surveys to determine traveler satisfaction

Have You Changed Plans Based on the Information?

62%

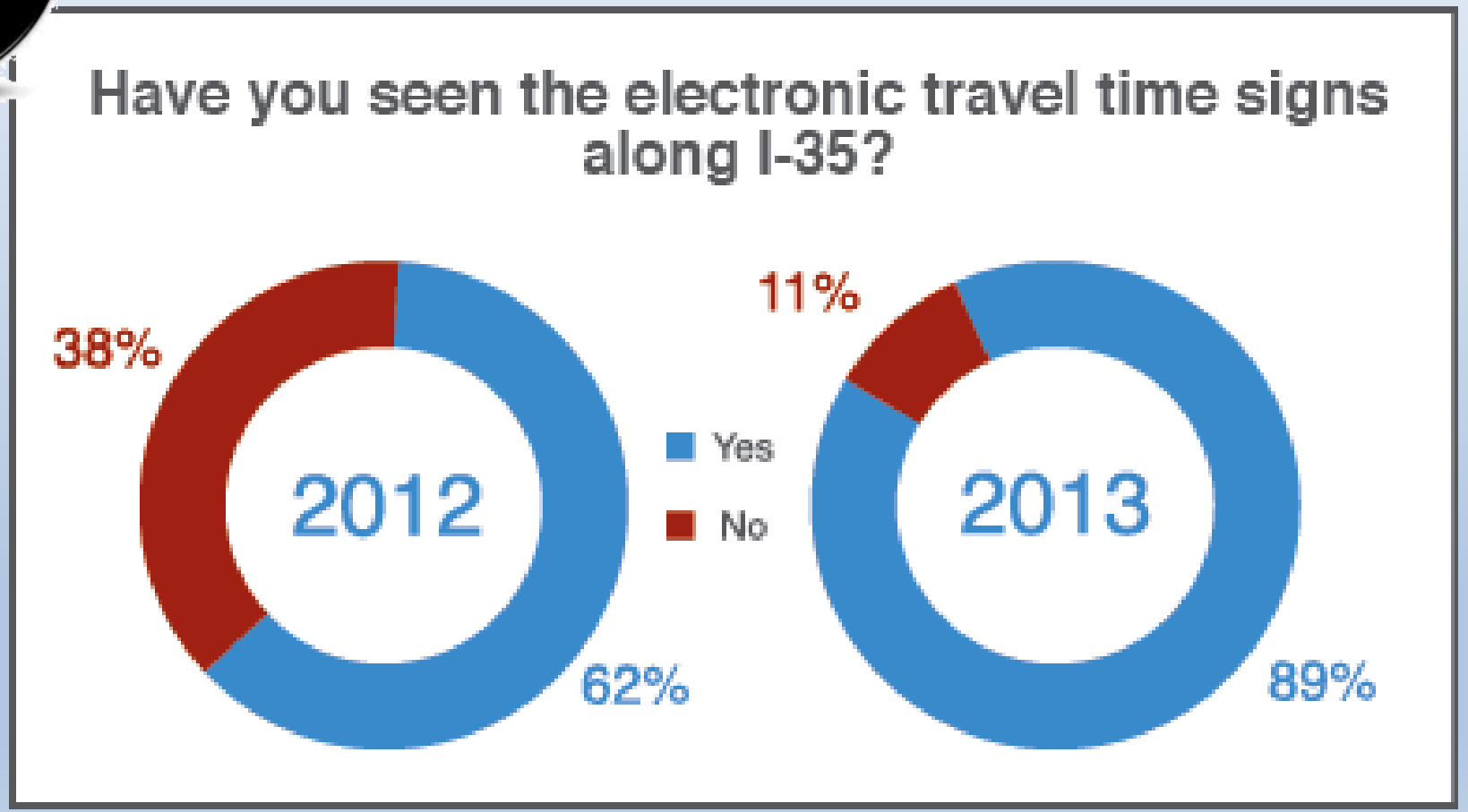


Traveler Information Outreach

- 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

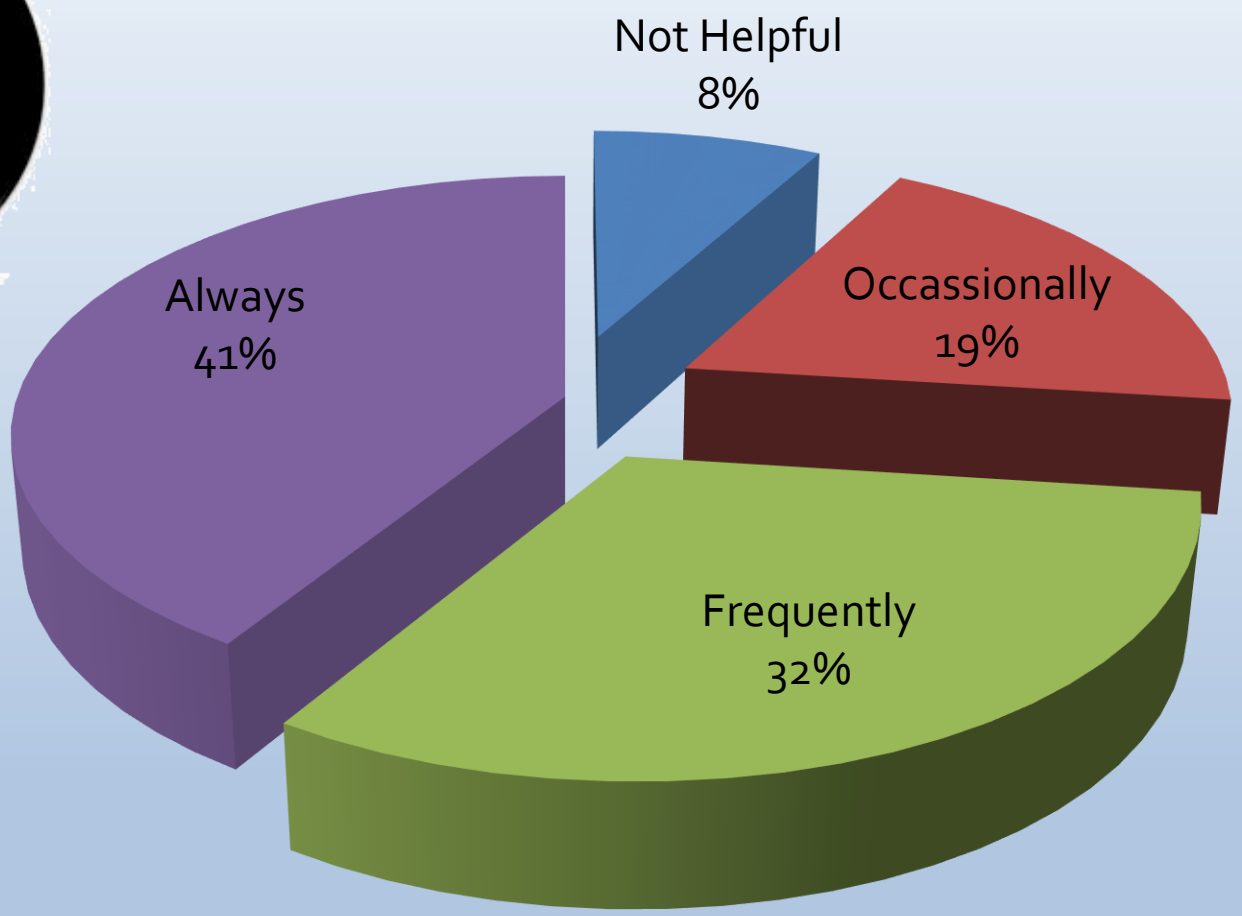
Approval rating of signs from those that have seen them



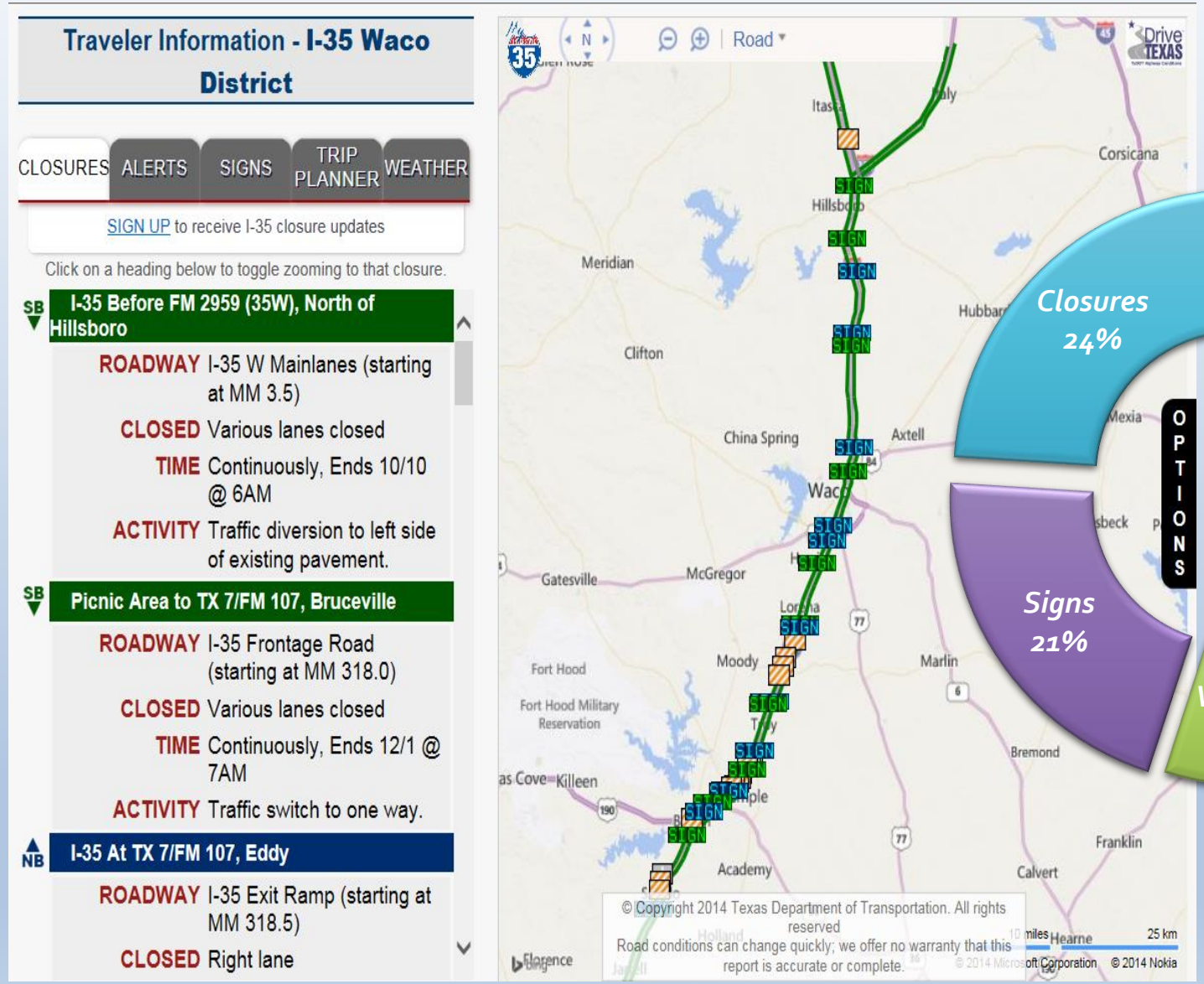
Comments on Travel Time Signs

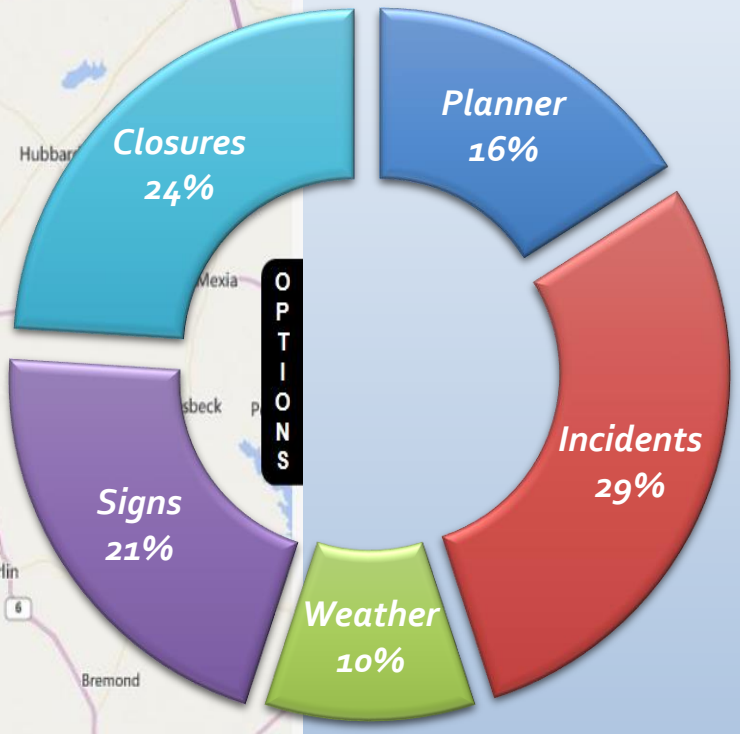
- *"LOVE LOVE LOVE these signs. Wish they were permanent."*
- *"I know the "normal" times and this info lets me know how slow it's going to be."*
- *"They should state the reason for the delay and advise of alternate routes."*
- *"These are extremely helpful during my daily drive."*
- *"VERY HELPFUL. I can decide whether or not to use the feeder/access road."*
- *"Love it! Helps me on time crunch."*

My35 Helpfulness

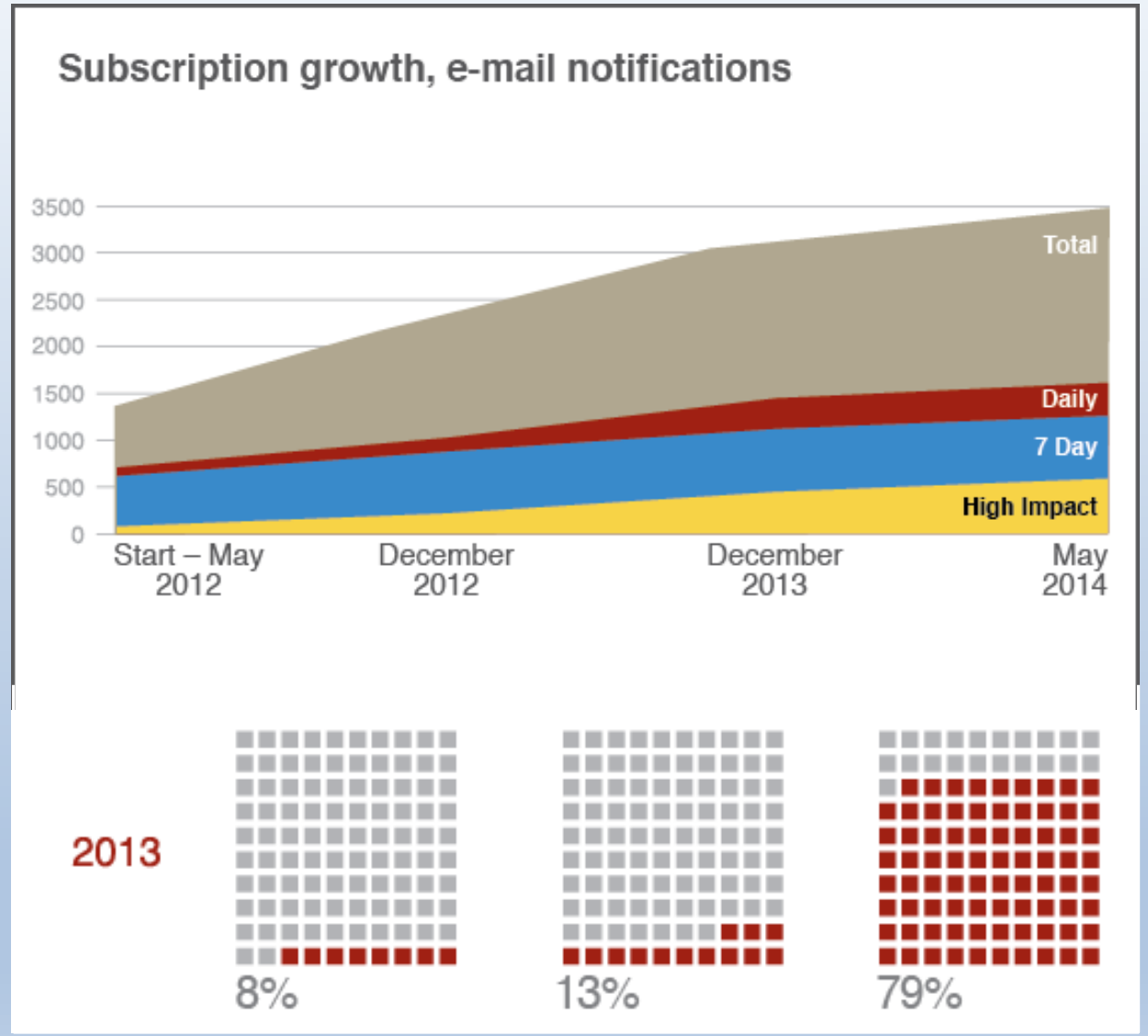


I-35 Real-Time Map Topic Selection





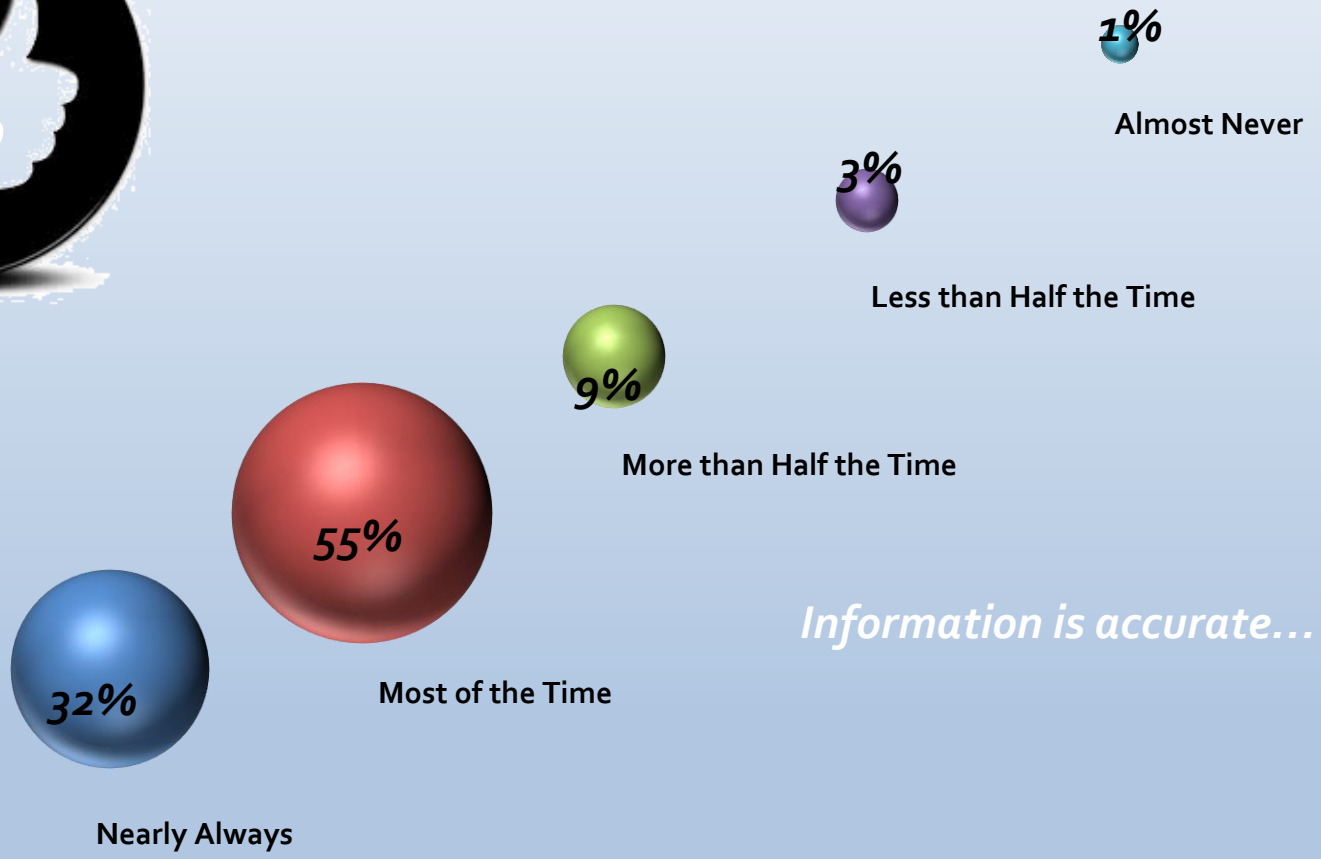
Lane Closure E-Mail Subscriptions



Emails

- *"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."*

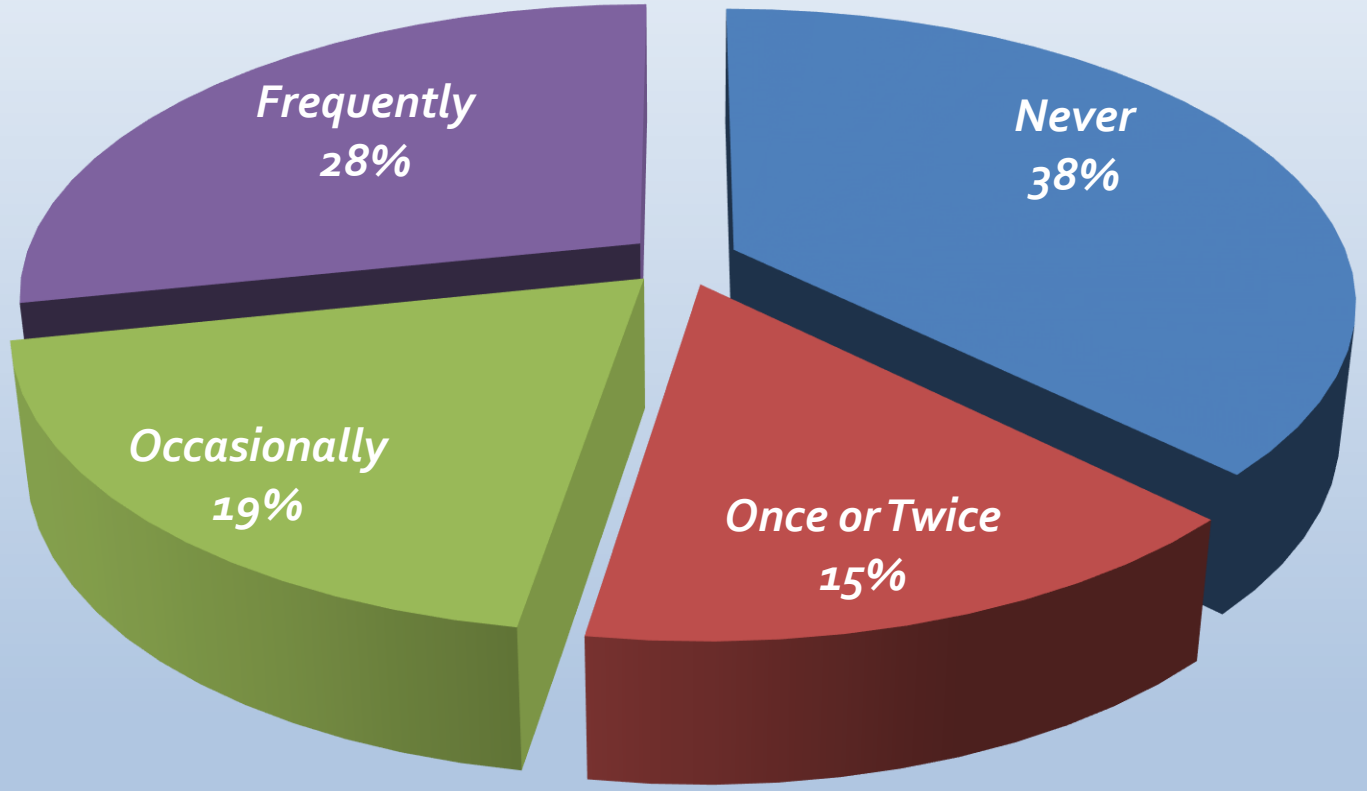
Public Perception of Information Accuracy



Information is accurate…

Have You Changed Plans Based on the Information?

62%

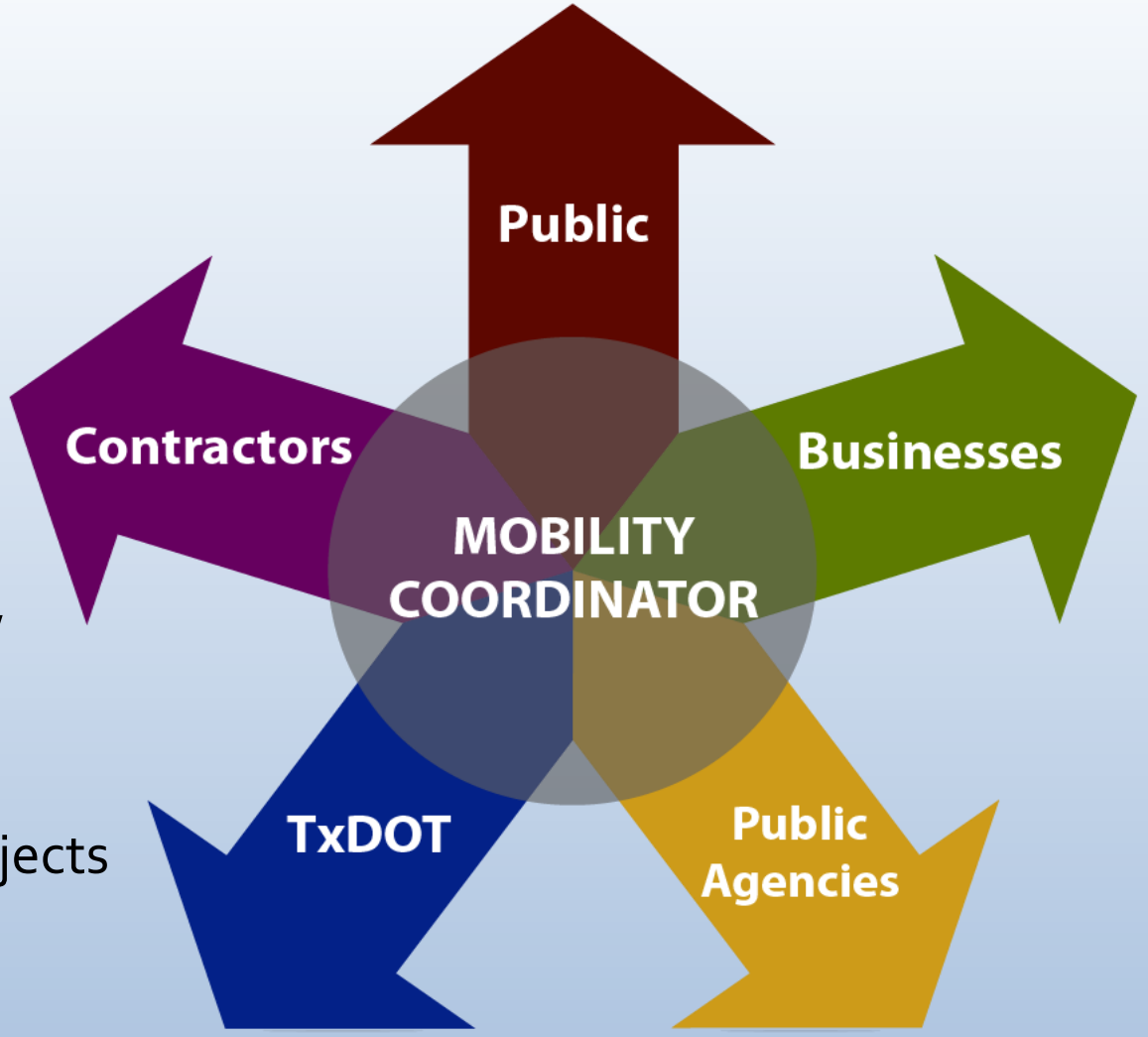


Some of the Innovations…

- 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

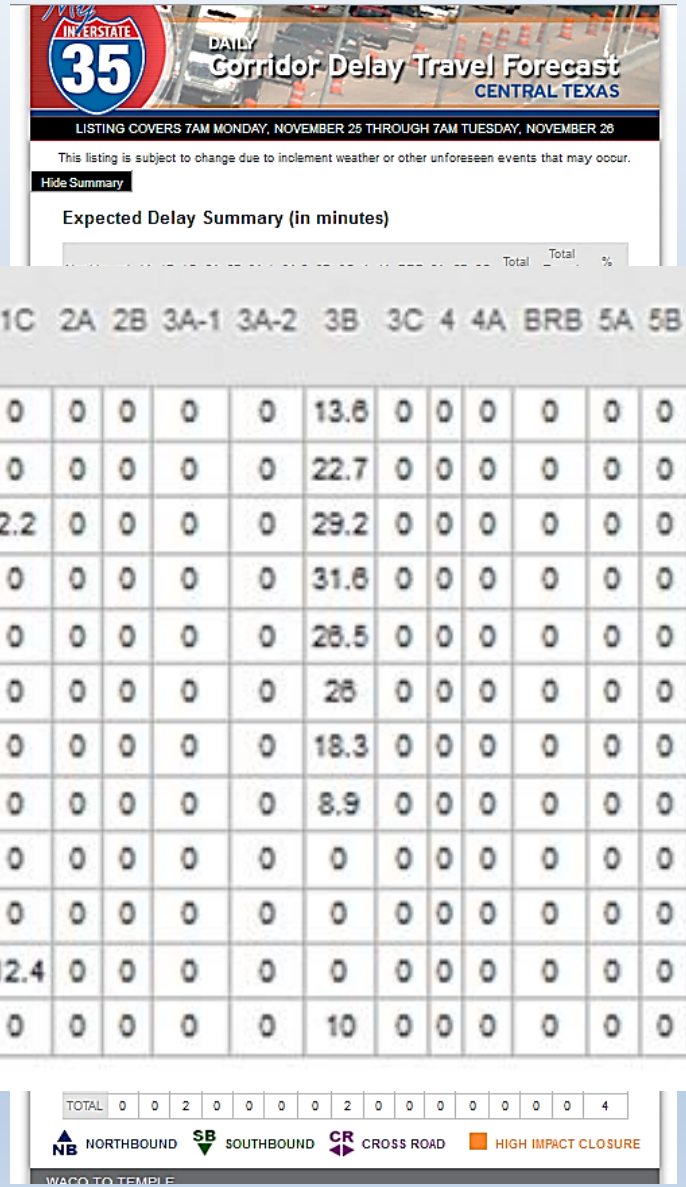
- **Role**
  - Project Ombudsman
  - Engage and assist those impacted
  - Technical advisor
  - Keep internal / external stakeholders informed
  - Facilitate flow of information (e.g., lane closures, maintenance work, traffic control changes, etc.)
  - Assist Public Information Officer
  - Examine mobility 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

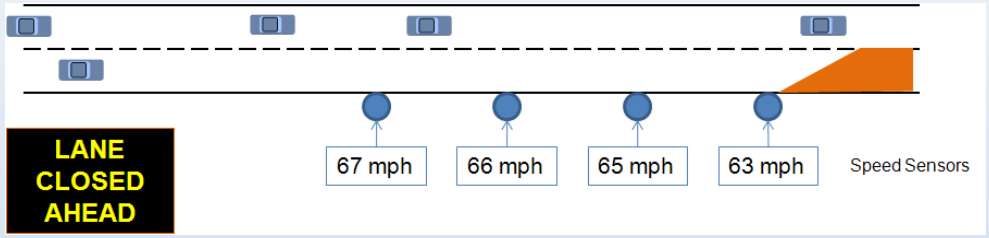
I-35 Mobility Coordination

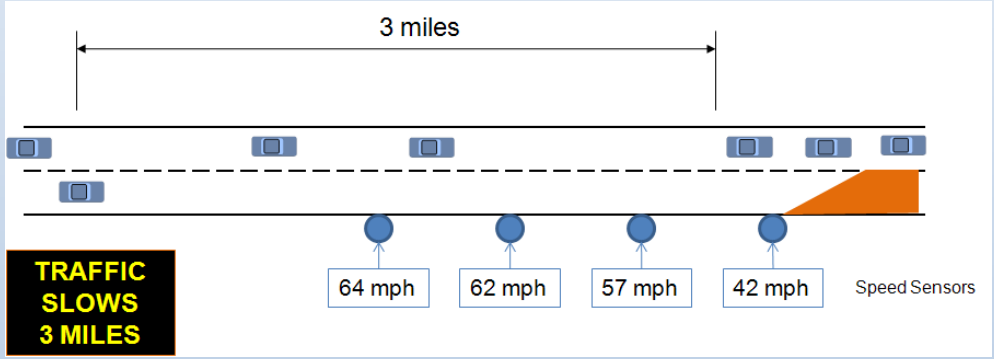


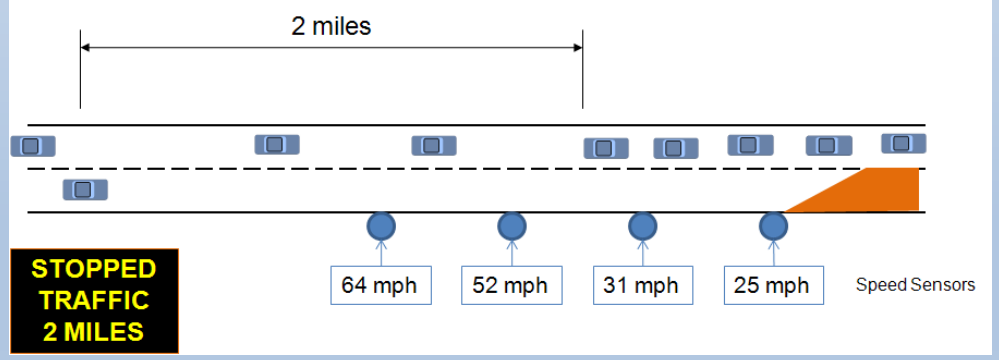
Southbound	1A	1B	1C	2A	2B	3A-1	3A-2	3B	3C	4	4A	BRB	5A	5B	5C	Total Delay	Total Travel Time	% Delay
7 PM	0	0	0	0	0	0	0	13.6	0	0	0	0	0	0	0	13.6	113.6	13.6
8 PM	0	0	0	0	0	0	0	22.7	0	0	0	0	0	0	0	22.7	122.7	22.7
9 PM	0	0	2.2	0	0	0	0	29.2	0	0	0	0	0	0	0	31.4	131.4	31.4
10 PM	0	0	0	0	0	0	0	31.6	0	0	0	0	0	0	0	31.6	131.6	31.6
11 PM	0	0	0	0	0	0	0	28.5	0	0	0	0	0	0	0	28.5	128.5	28.5
12 AM	0	0	0	0	0	0	0	28	0	0	0	0	0	0	0	28	128	28
1 AM	0	0	0	0	0	0	0	18.3	0	0	0	0	0	0	0	18.3	118.3	18.3
2 AM	0	0	0	0	0	0	0	8.9	0	0	0	0	0	0	0	8.9	108.9	8.9
3 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0
4 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0
5 AM	0	0	12.4	0	0	0	0	0	0	0	0	0	0	0	0	12.5	112.5	12.5
6 AM	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	10.1	110.1	10.1

I-35 Smart Work Zones

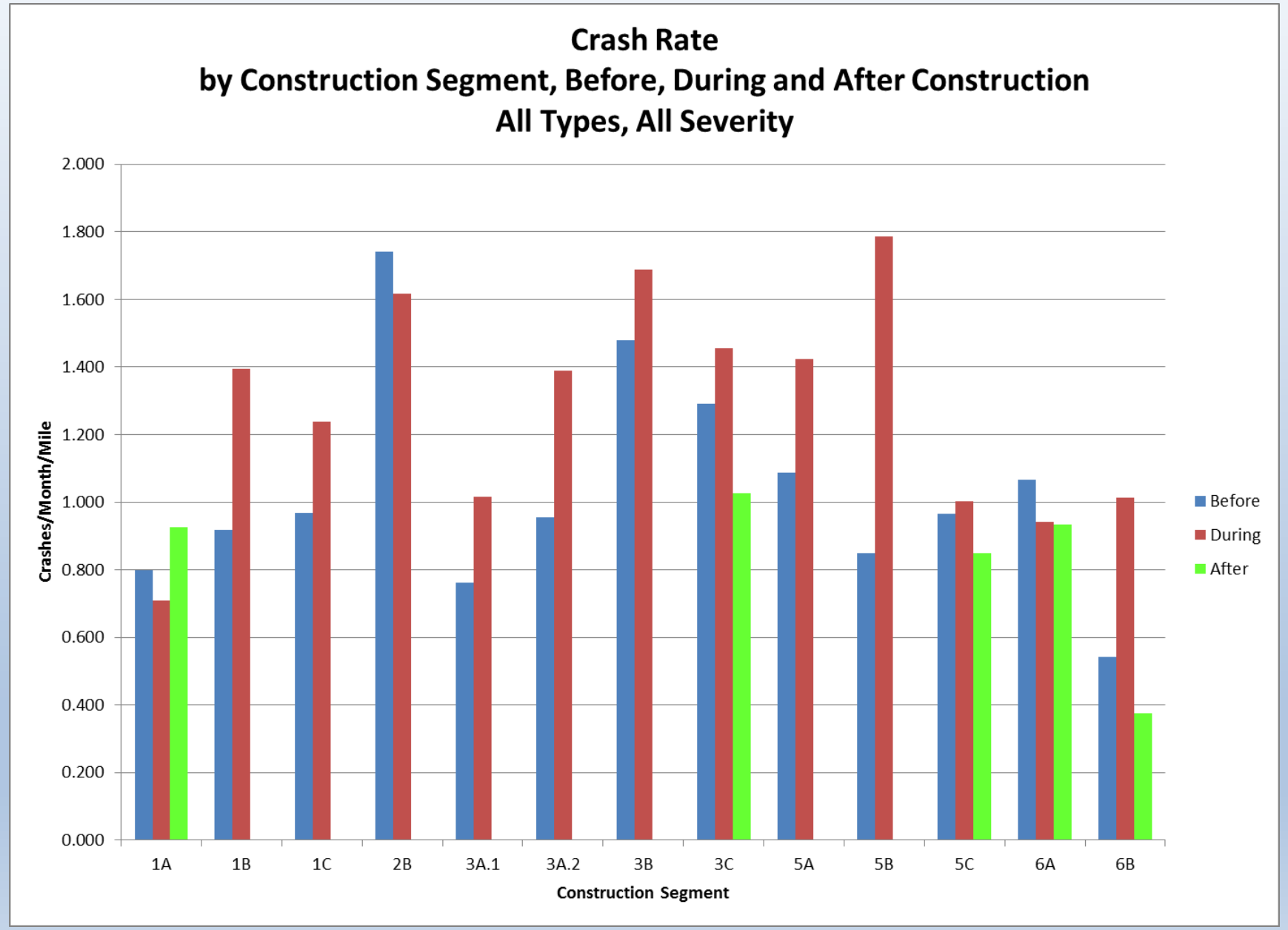
- Automated monitoring near a work zone
- Warning of slow speeds
- Warning of end of 'stop and go' traffic



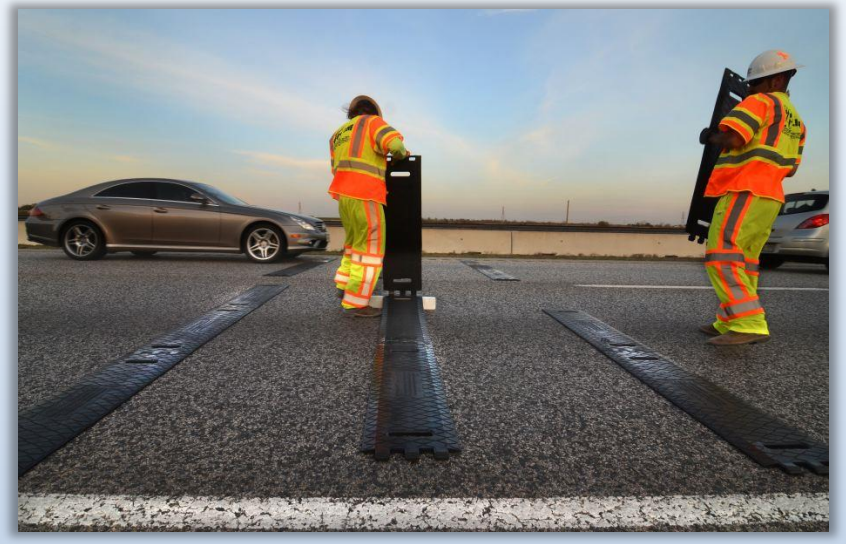




Crash Data Analysis

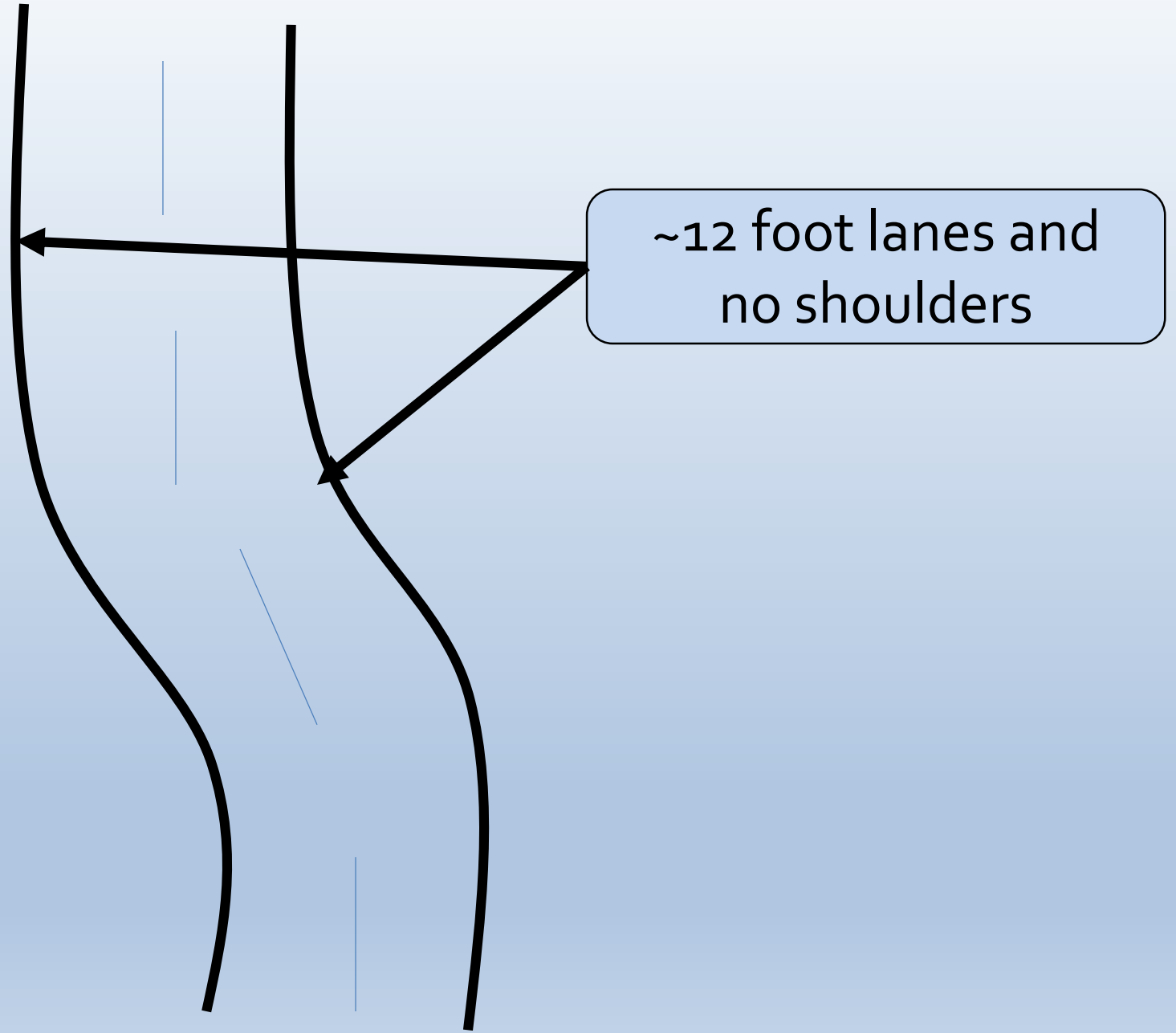


Traffic Engineering Solutions



Traffic Engineering Countermeasures

Typical Traffic Shift

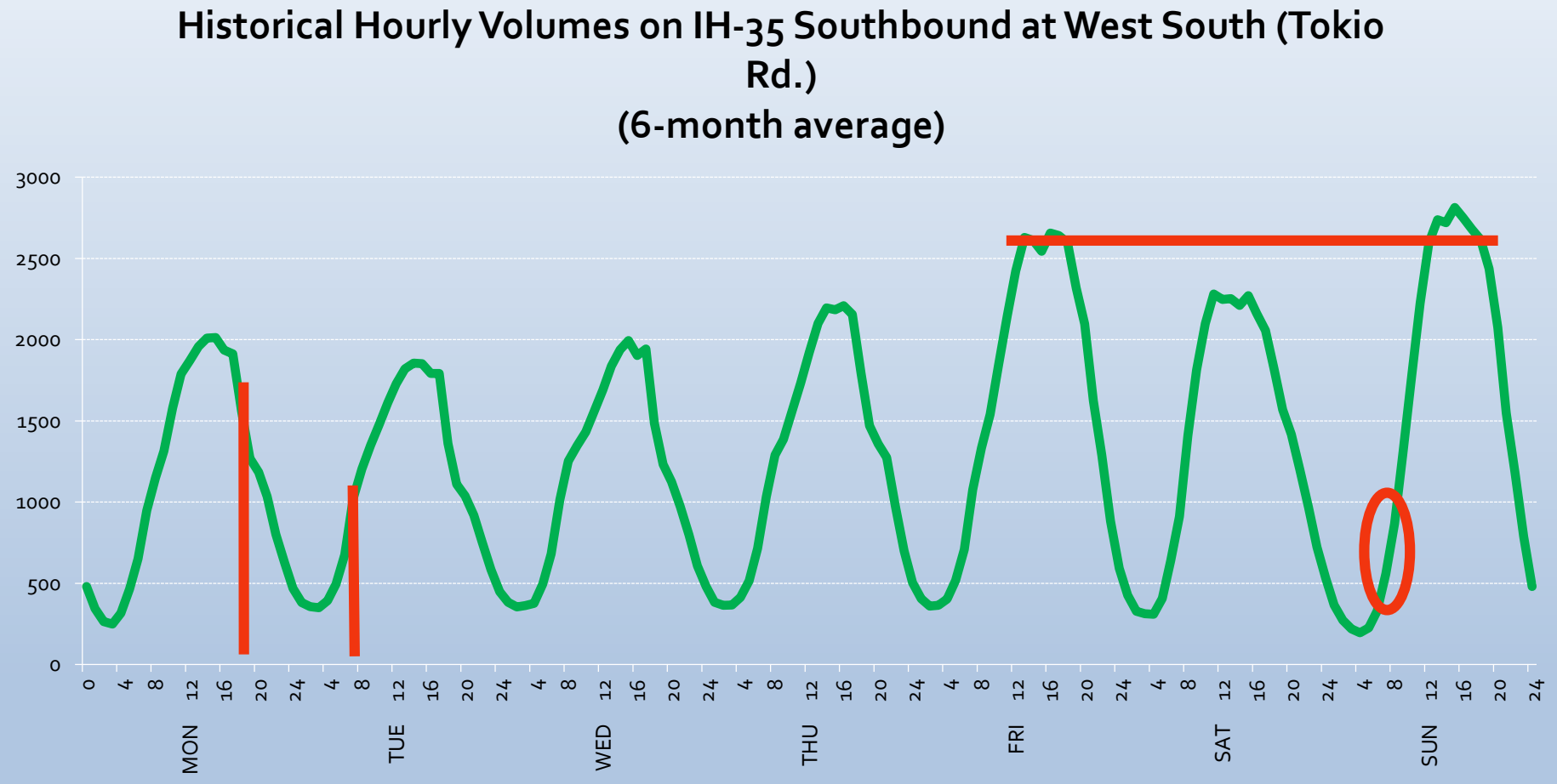


Texas Department of Transportation

Waco District I-35 Incident Management Plan

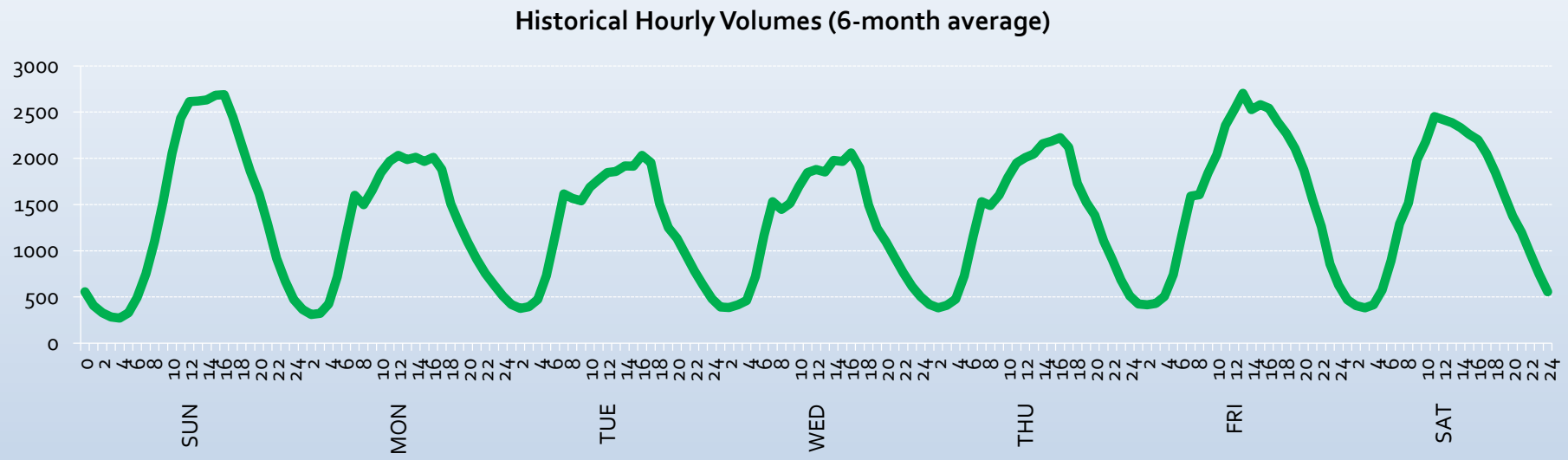
Standard Operating Guidelines

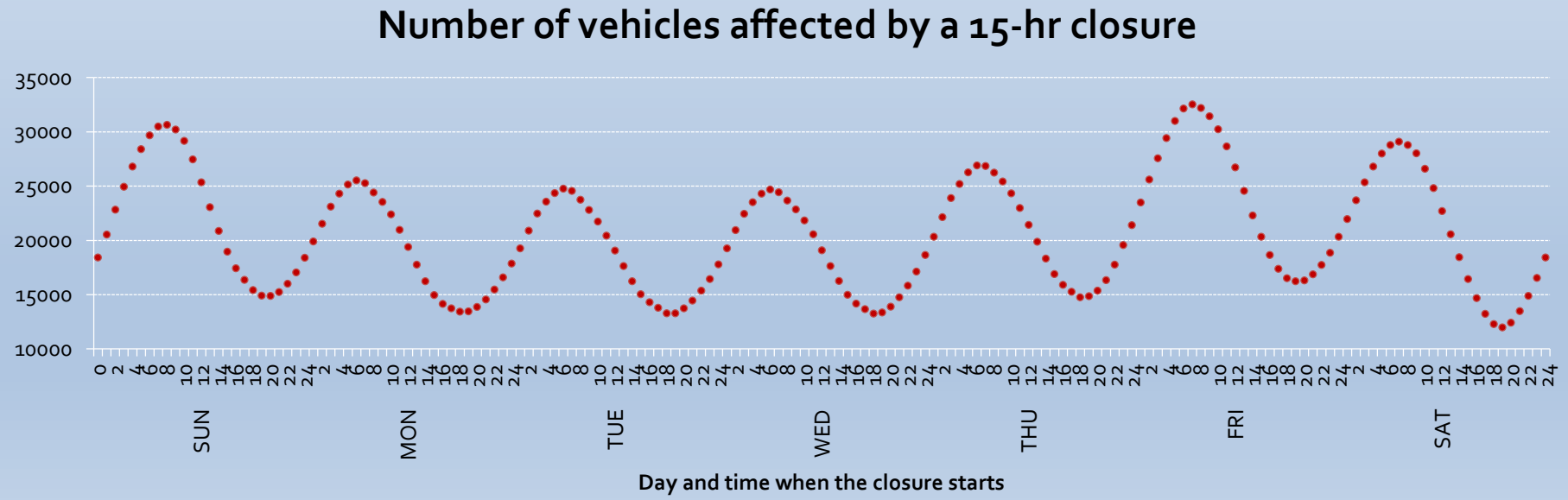
Examples of Support: Lane Closures



9202: Temple North (North of I-35@Industrial Blvd)

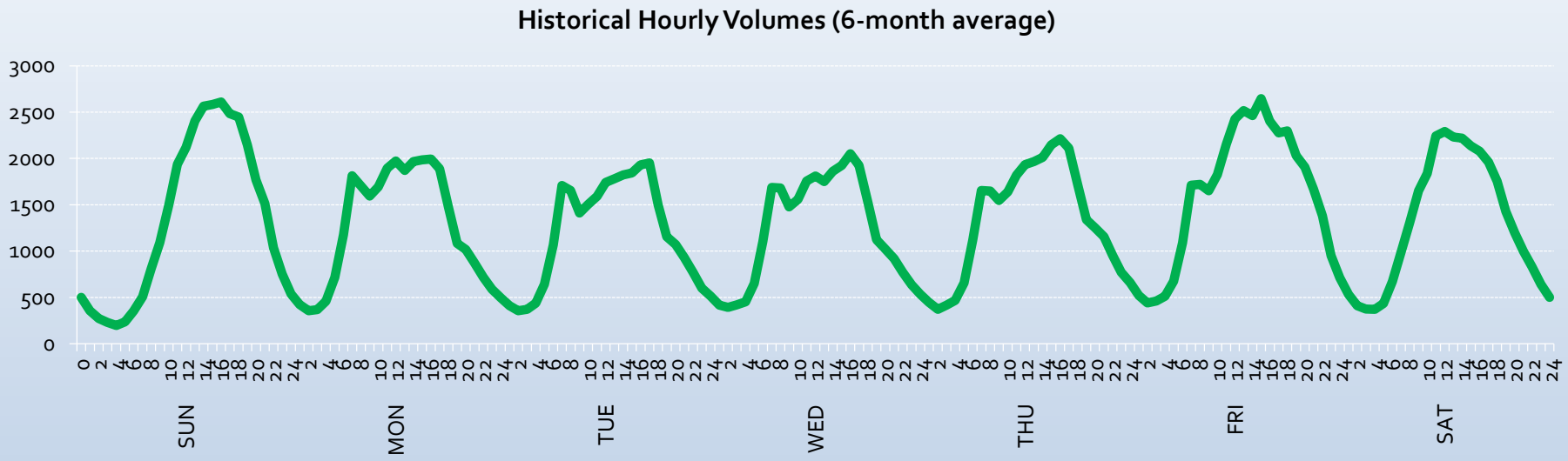
Northbound

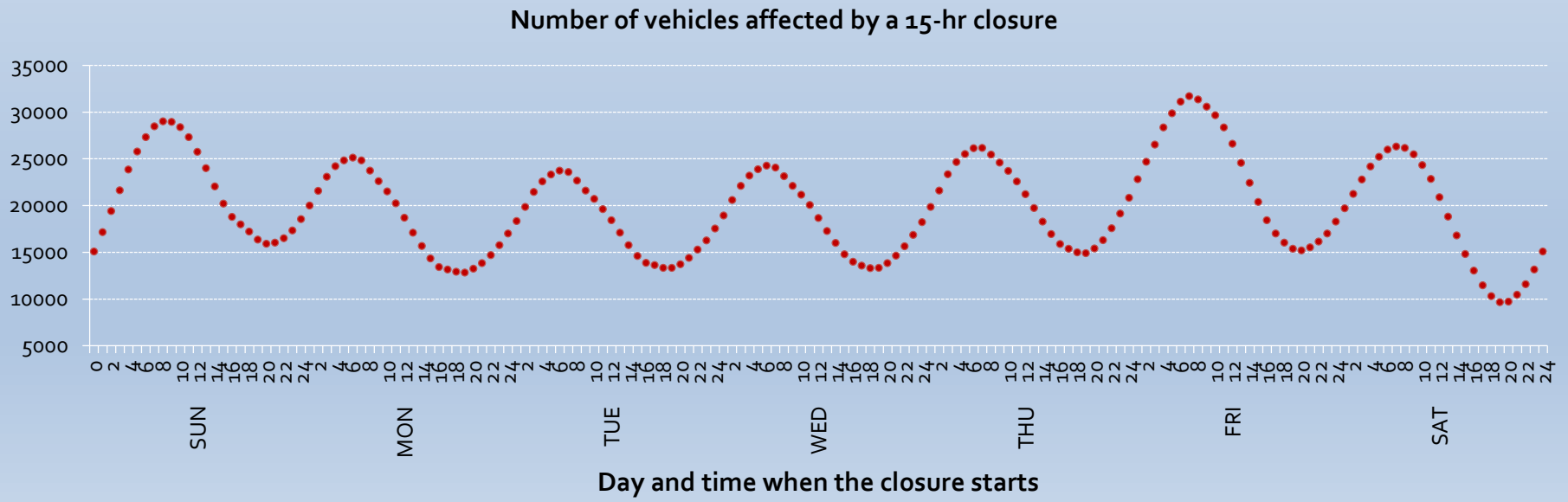




9202: Temple North (North of I-35@Industrial Blvd)

Southbound



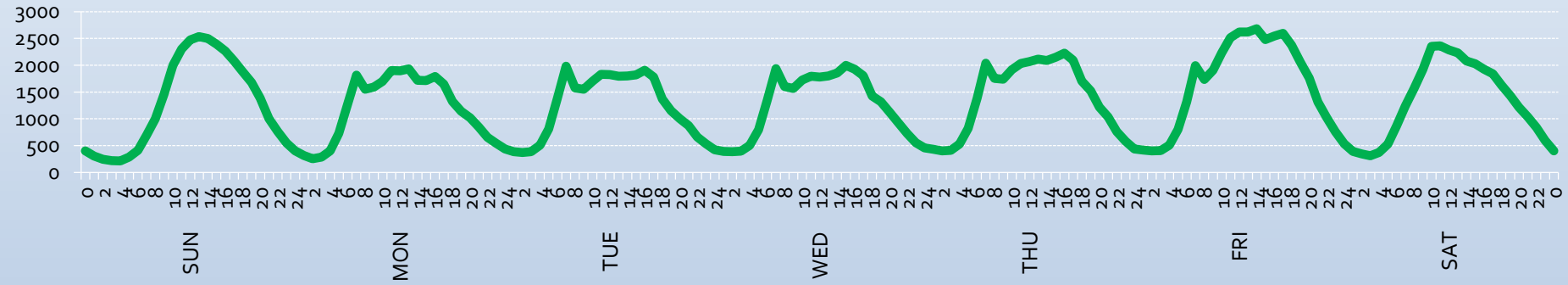


Best Time for 12-hour NB Closure in Temple

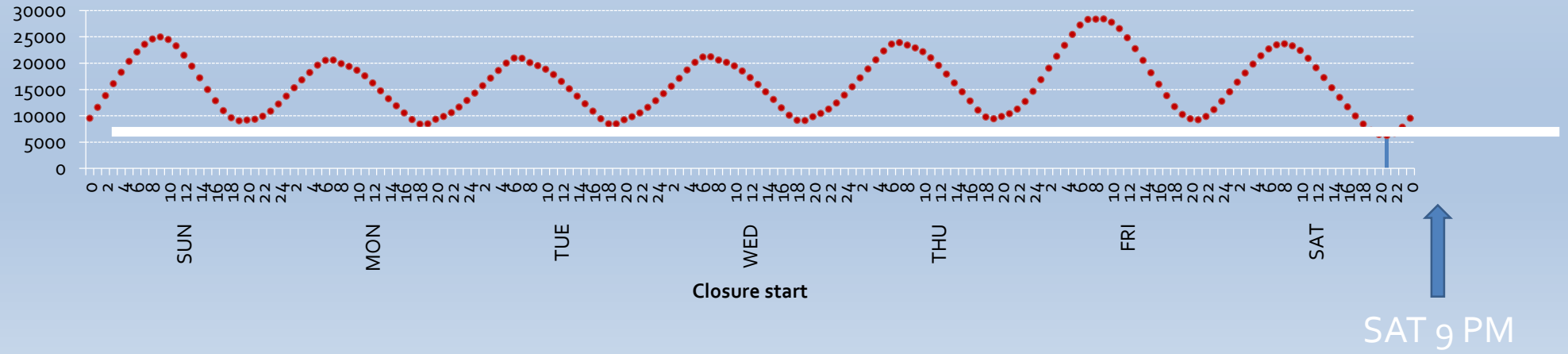
Wavetronix: Temple (South of I-35@Central Ave)

	SUN	MON	TUE	WED	THU	FRI	SAT
Closure Start Time	19:00	18:00	19:00	19:00	19:00	20:00	21:00
Affected Traffic Volume	9034	8428	8456	9094	9409	9243	6241

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



Number of vehicles affected by closure



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*

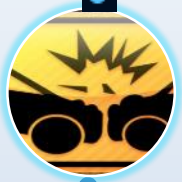
...to be continued

Safety - Work Zone Warning

Notifies a driver to use caution when traveling through a work zone.

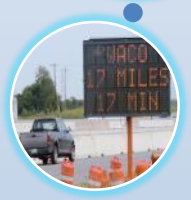
Questions?

Social Media Analytics



Incidents

CCTV



PCMS

Wavetronix

Bluetooth

Lane Closures

Surveys