OEDC-ITF-FMCSA Roundtable

Commercial Vehicle On-Board Safety Systems

Roundtable Paper #4 – Christopher Poe, Ph.D., P.E.

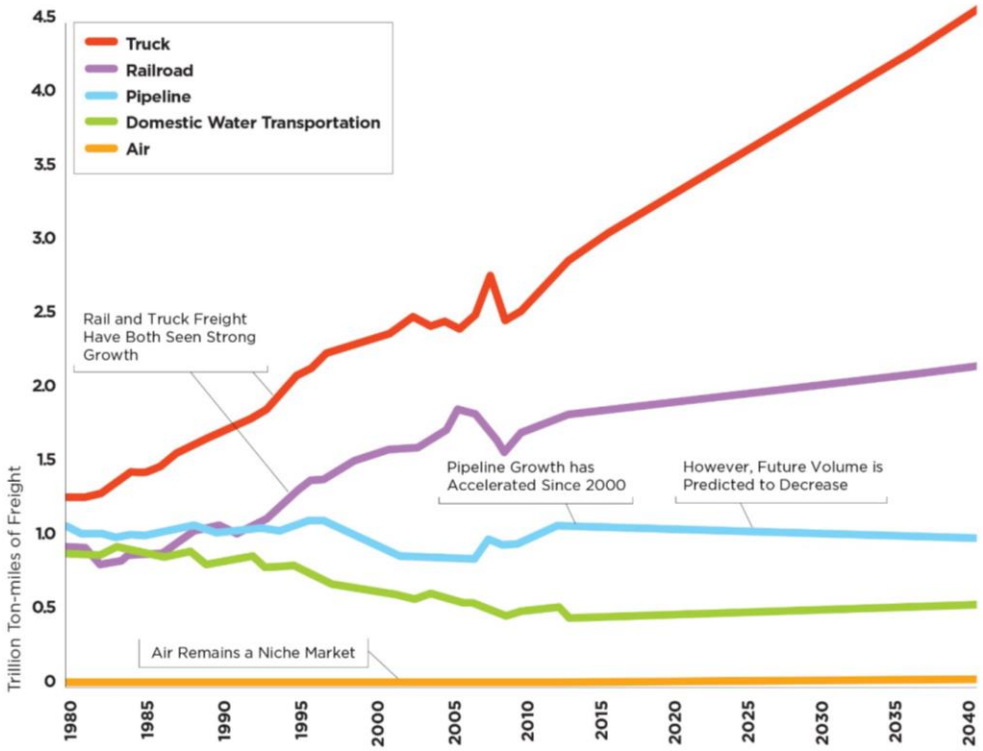
INFRASTRUCTURE FOR COMMERCIAL VEHICLE SAFETY

Presentation Outline

- Background
- Intelligent Transportation Systems
- Connected Vehicle Technologies
- Infrastructure Support to CMV Safety and Mobility
- Automation
- New Opportunities

Background

- Freight movement is growing
- Truck/ground transport is majority of freight movement
- Congestion increasing



Source: National Freight Strategic Plan (USDOT, 2015)

Transportation Technology

Investment in transportation technology is important to the Nation!

Ensures **safety** is **priority #1**

Protects **infrastructure** investments

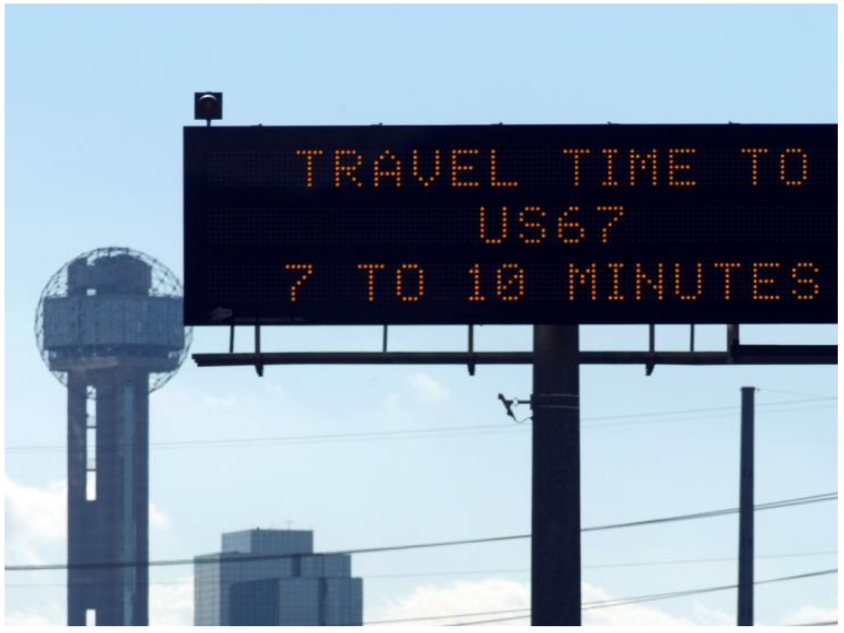
Enhances **mobility**

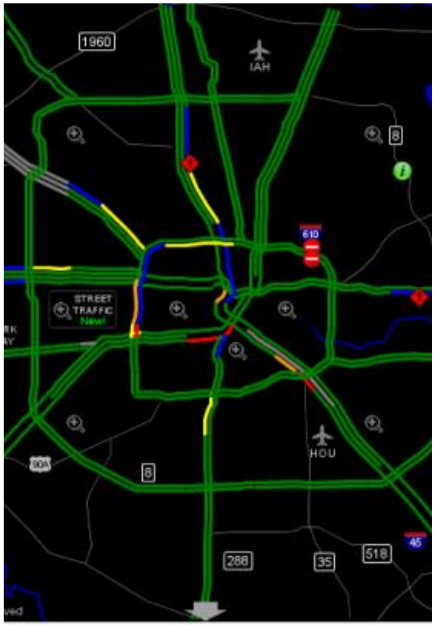
Supports **economic development**

Intelligent Transportation Systems

- Surveillance
- Detection
- Control Devices
  - Passive – dynamic message signs
  - Active – traffic signals, ramp meters
- Telecommunications
- Management Software
- Transportation Management Centers

ITS / Traffic Management



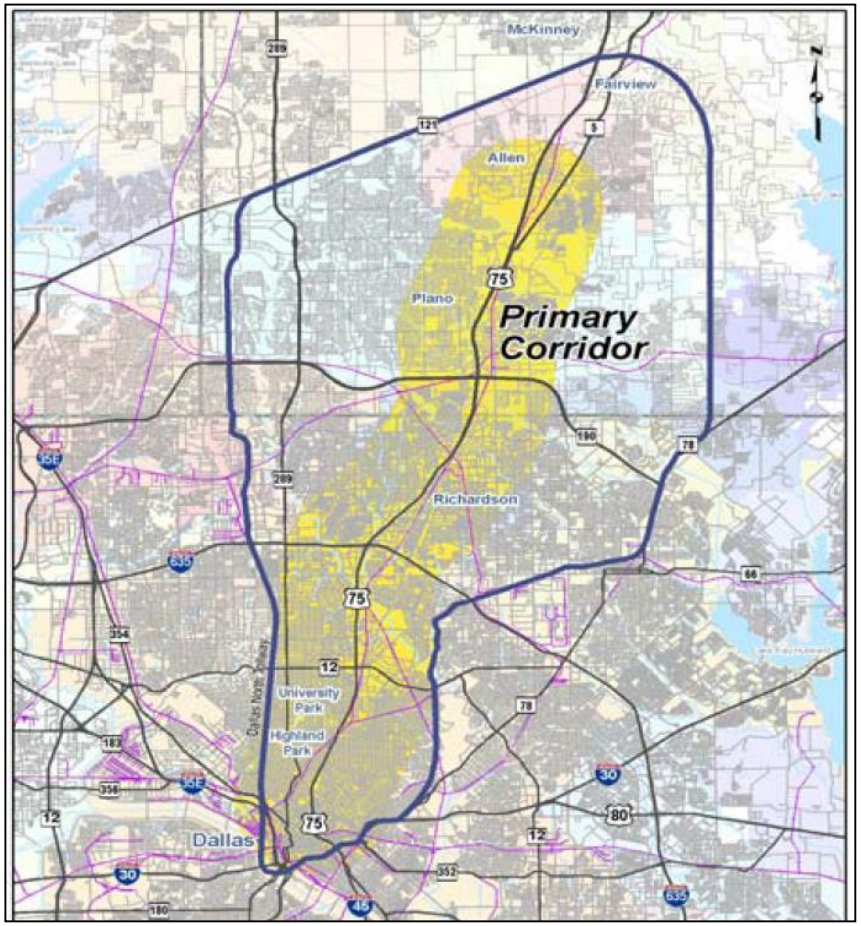


Real-time Traffic Information

- Significant public and private data
- Pre-trip and en-route
  - Internet, dynamic signs, 511, mobile apps
- USDOT FRATIS projects optimizing drayage and corridor operation
- CMV needs more corridor info

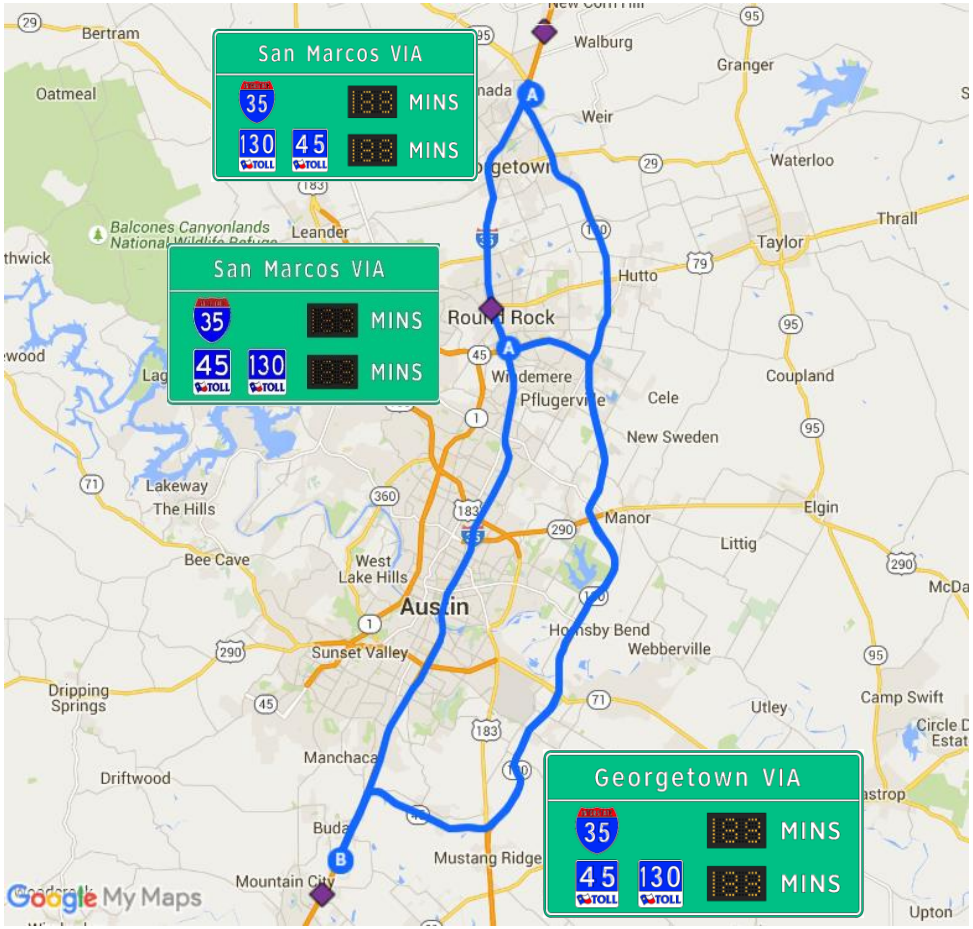
Integrated Corridor Management

- National demos in Dallas and San Diego
- Optimize corridor across jurisdictions, modes, and routes
- Predict future travel conditions
- DSS to assess strategies
- Disseminate travel info



ICM (Cont.)

- ICM-lite
- Optimizing routes
- Longer corridor for CMVs
- Drivers make the decision
  - Additional operating cost and toll



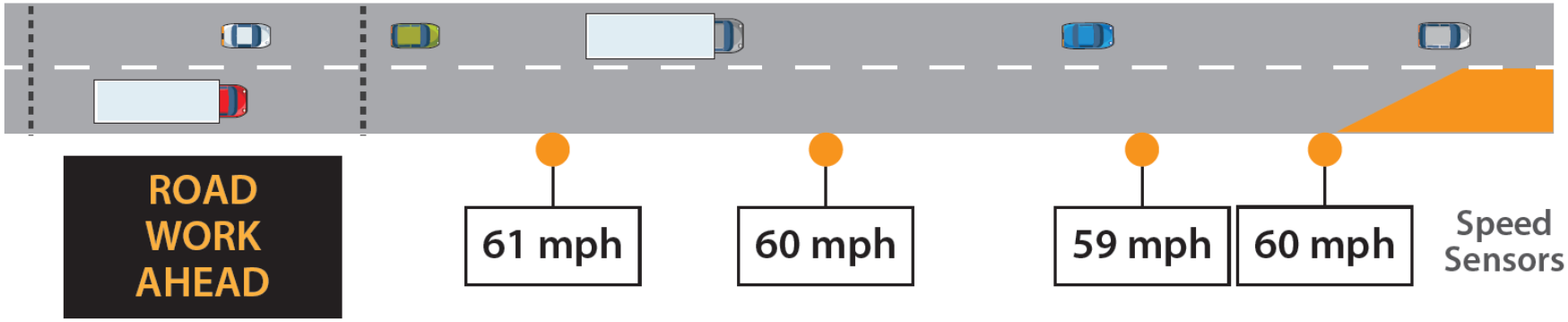
CMV Safety Applications Today

- Truck Signal Priority
- Curve Speed Warning
- Road Weather Management
- Smart Work Zones

Source: Iowa State University

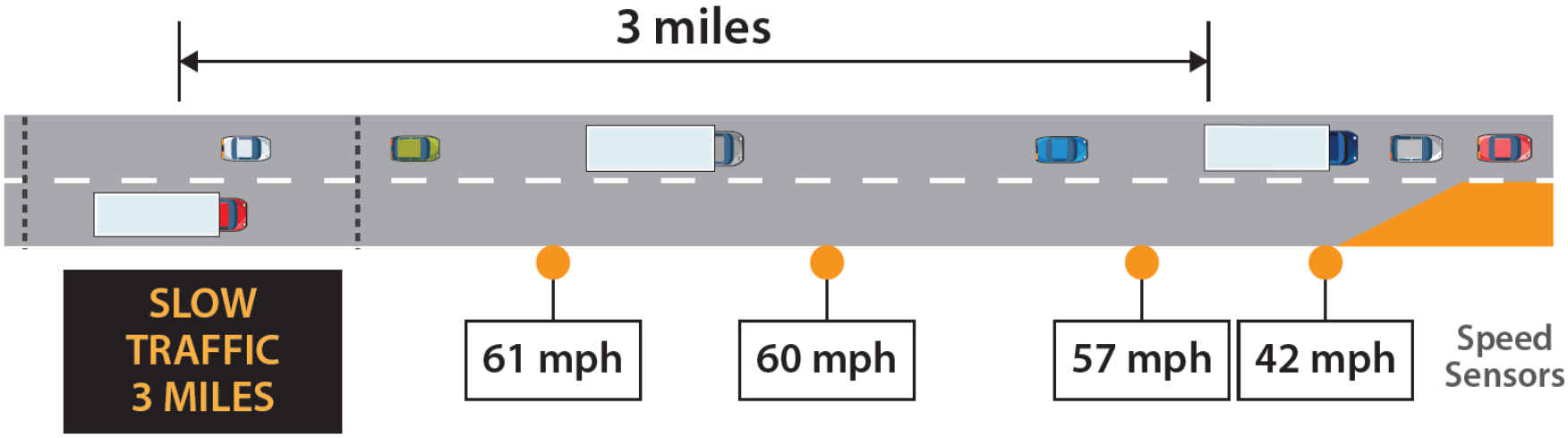
End of Queue Warning System

Drivers are alerted that they are entering a lane-closure work zone by warning signs, the presence of law-enforcement officers, and by portable rumble strips causing a slight bump and attention-getting noise. They then see a sign indicating road conditions in the work zone, e.g., "Road Work Ahead," when there is no traffic backup detected.



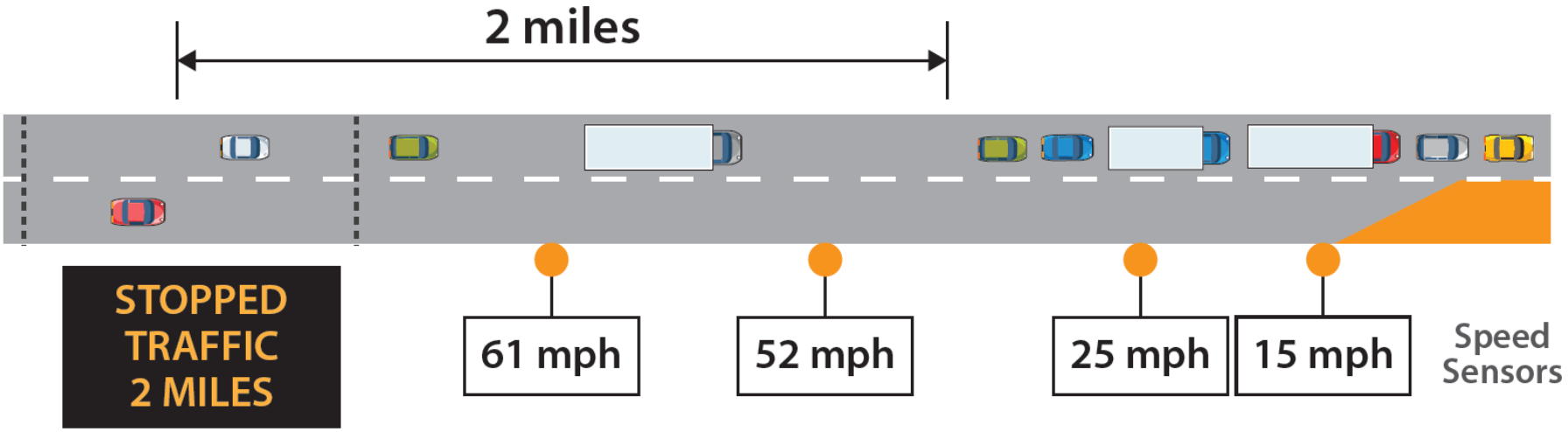
End-of-Queue (Cont.)

Drivers are alerted to slow traffic ahead by the sign message changing to "Slow Traffic," with an indication of how far ahead the problem will be encountered. The sign may say 3 miles, 2 miles, or 1 mile ahead, determined by the system's readings.

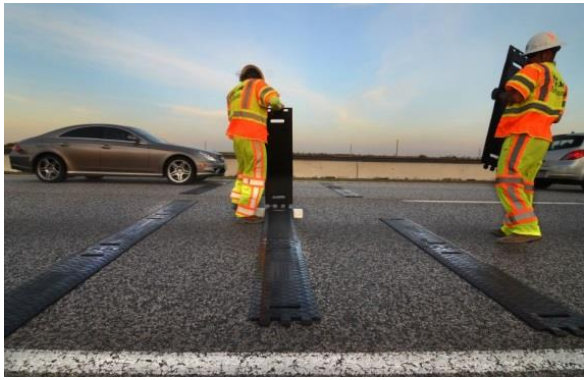


End-of-Queue (Cont.)

Drivers are alerted to very slow or stopped traffic by a new message, "Stopped Traffic," and the number of miles ahead the traffic queue is stopped. A distance of 3 miles, 2 miles, or 1 mile may be reported.



I-35 End-of-Queue



ITS State of the Practice

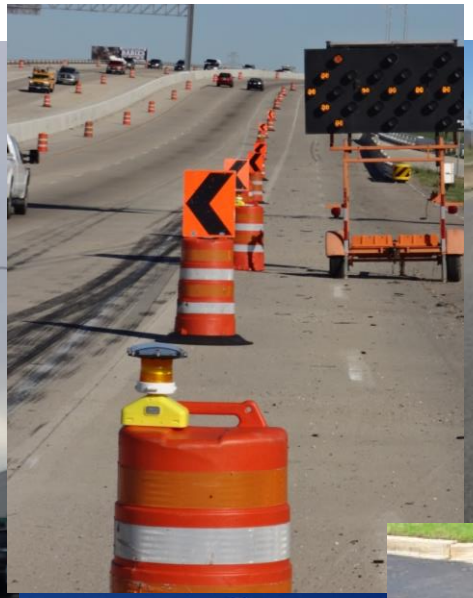
- Considerable data on traffic conditions, roadway design, weather conditions, incidents, and work zones

- Need more effective sharing with CMVs
- Heavily rely on dynamic signs
- More proactive management & operation

Connected-Automation

- Automated vehicles
- Connected vehicles

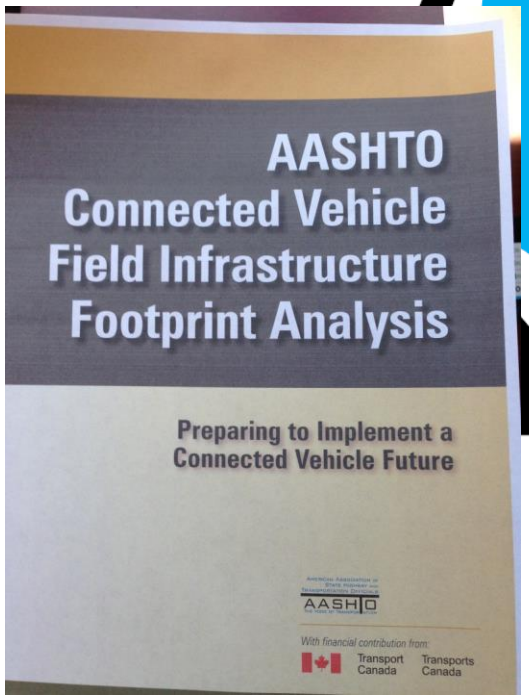
What are the challenges?



Connected Vehicles

- Cellular
- 4G/5G LTE
- 5.9 GHz DSRC
- Applications
  - V2V
  - V2I

AASHTO CV Infrastructure Footprint Analysis



Vision for Connected Vehicle Infrastructure Footprint - 2040

- 80% of traffic signals are V2I connected with DSRC
- 25,000 other local safety V2I connected devices
- Accurate real-time localized information on 90+% of roadway miles*
- Next-generation, multimodal, information-driven active traffic management deployed system-wide*

*enabled by both cellular and DSRC communications

Infrastructure for CMV Safety/Mobility

- Curve Speed Warning
- In-Vehicle Signage
- Oversize Vehicle Warning
- Pedestrian in Signalized Crosswalk Warning
- Railroad Crossing Violation Warning
- Red Light Violation Warning
- Reduced Speed Zone Warning / Lane Closure
- Restricted Lane Warnings
- Spot Weather Impact Warning
- Stop Sign Gap Assist
- Stop Sign Violation Warning
- Warnings about Hazards in a Work Zone
- Warnings about Upcoming Work Zone

Infrastructure (cont.)

- Roadway Geometrics
  - Horizontal alignment
  - Vertical alignment
    - Vertical clearance to bridges / overpasses
  - Cross Section
    - Narrow lanes
    - Narrow or no shoulders
  - Interchanges, ramps, and weaving

Connected Work Zone

- Scope: USDOT grant to expand work zone lane closure, delay, and queue information to freight logistics and trucks using CV architecture.
- Sponsor: TxDOT
- Deliverable: Working demonstration in central Texas on I-35.
- Phase 1 – CMVs using cellular
- Phase 2 – Expand to light-duty vehicles with DSRC

I-35 Field Deployments

- Bluetooth travel time detection
  - 40 segments, 2-5 miles in length
  - ~20 additional segments AUS, SAN, DAL, FTW
- 19 Wavetronix radar detector sites
- 42 CCTV cameras sites
- 21 portable changeable message signs (PCMS)
  - ~10 per direction at approximate10 mile spacing

Disseminating Travel Times

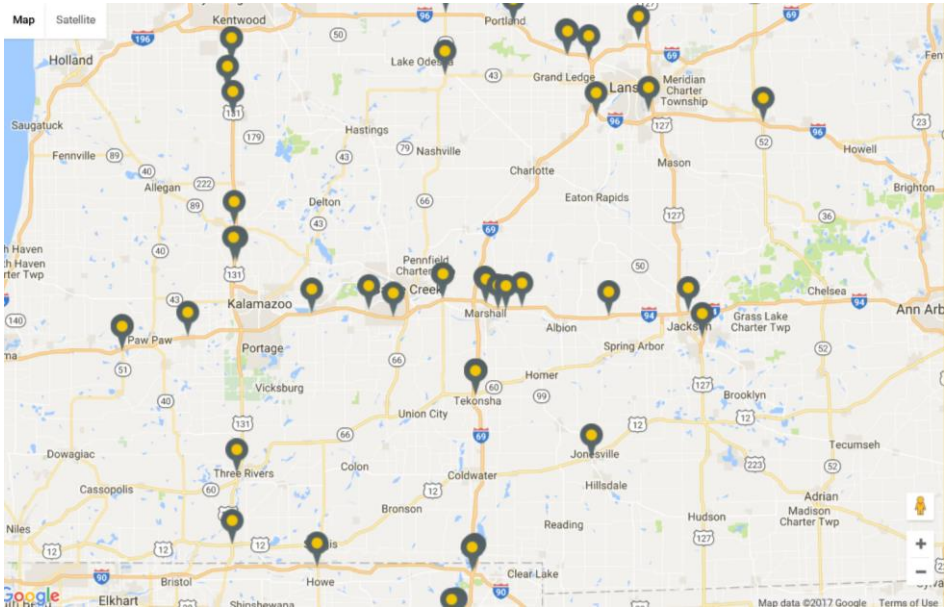
- 30 second data cycles
- 5-minute message updates
- 21 signs
- Signs procured via projects and rental
- Driven through TxDOT Lonestar® software

New Opportunities

- Truck Platooning
  - Infrastructure communicates:
    - Changes in geometry
    - Roundabouts
    - Bridges
    - Access ramps
    - Work Zones

New Opportunities

- Truck Parking



Source: Michigan Department of Transportation

New Opportunities

- Last Mile Delivery