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

Investment in transportation technology is important to the Nation!
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
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.
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.
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 approximate 10 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