



SwRI Connected Vehicle Affiliated Test Bed

Mike Brown, SwRI

2014 TexITE Spring Meeting - Austin, TX

Affiliated
CONNECTED VEHICLE TEST BED






Presentation Overview

- ◆ **USDOT Connected Vehicle (CV) Affiliated Test Beds**
- ◆ **SwRI CV Affiliated Test Bed**
- ◆ **SwRI CV Development Activities**
- ◆ **TxDOT / SwRI CV Projects**
- ◆ **Conclusions / Questions**





USDOT Affiliated Test Beds

**RITA** U.S. Department of Transportation
Research and Innovative Technology Administration

*Intelligent Transportation Systems
Joint Program Office*

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Research

- ▶ Safety
- ▶ Mobility
- ▶ Environment
- ▶ Road Weather
- ▶ Policy
- ▶ Connected Vehicle Technology
 - Standards
 - Human Factors Research
 - Certification
 - Test Beds
- ▶ Short-Term, Intermodal Research
- ▶ Exploratory Research
- ▶ ITS Cross-Cutting Support
- ▶ Success Stories

Connected Vehicles

Connected Vehicle Test Beds





Affiliated Test Beds


The Intelligent Transportation Systems Joint Program Office (ITS JPO) has organized an affiliation of 5.9GHz DSRC infrastructure device makers, operators of vehicle to infrastructure (V-I) installations, and developers of applications that use V-I communications.

Coordination

To learn more about this research contact:


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Private Enterprise Collaborator Types



Collaborator Type	Count
Trade Associations	2
Application Centers	4
Automation Tier 1-2	2
Device Makers	6
Engineering Services	7
Security Services	2
Testing Services	2

Collaborators by Region



Region	Count
North America	28
Asia Pacific	3
Europe/Middle East	1

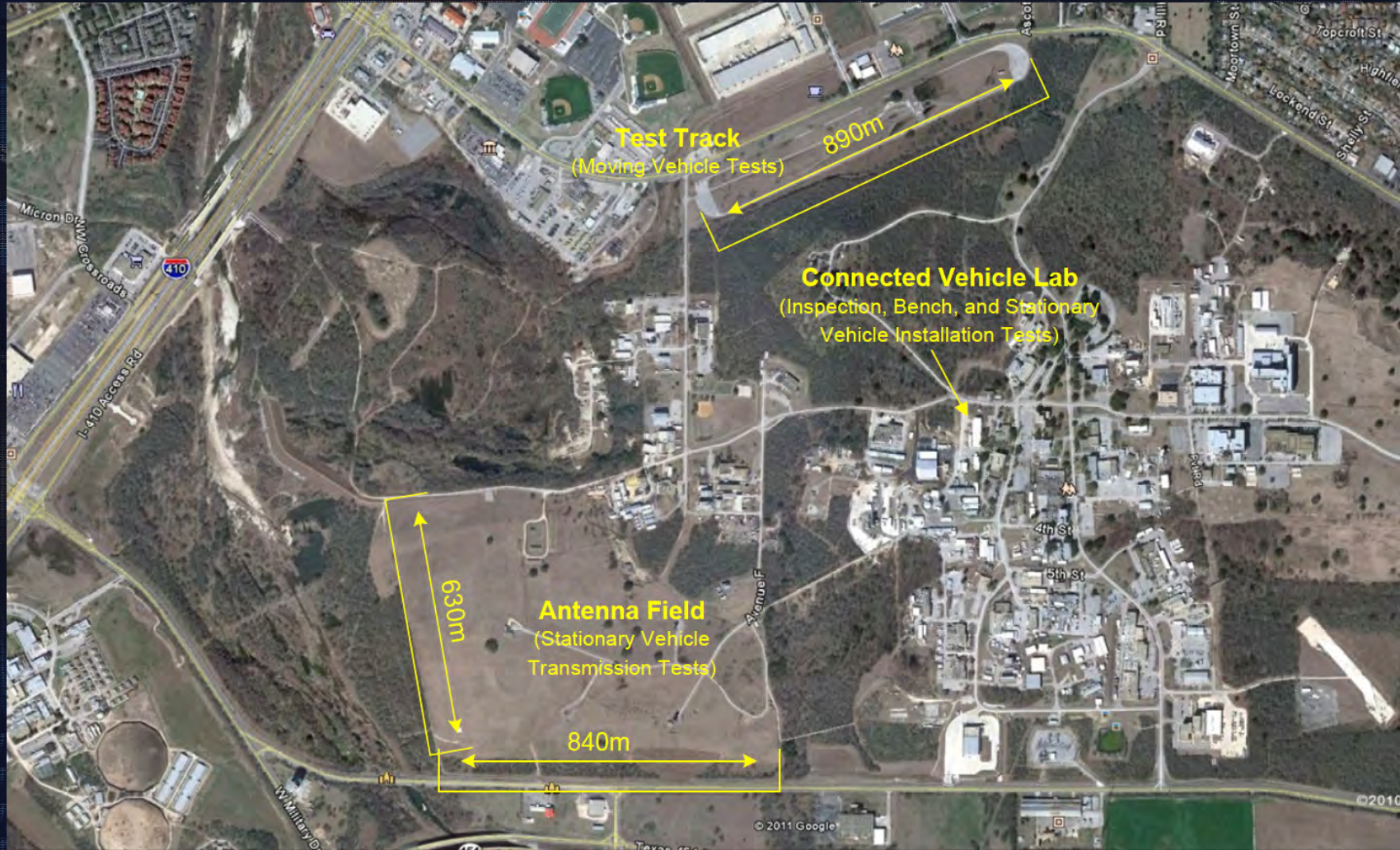


Membership & Benefits

- ◆ **Currently 32 public, private, and academic organizations**
- ◆ **To become an Affiliated Testbed:**
 - Sign Memorandum of Agreement
 - Participate in monthly calls
- ◆ **Benefits:**
 - Exchanging information
 - Sharing of deployment lessons learned
 - Developing a common technical platform
 - Expanding test bed options for users

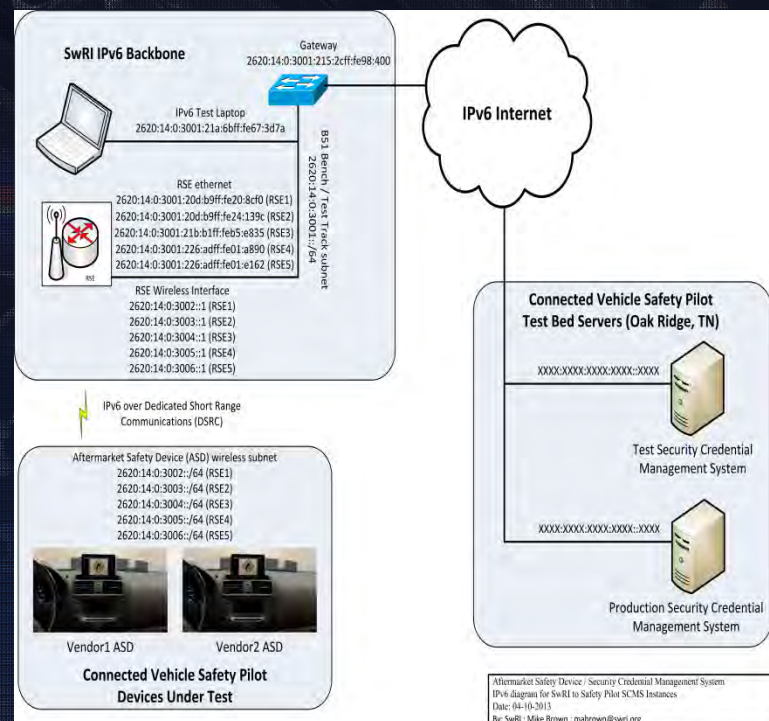


SwRI Connected Vehicle Affiliated Testbed





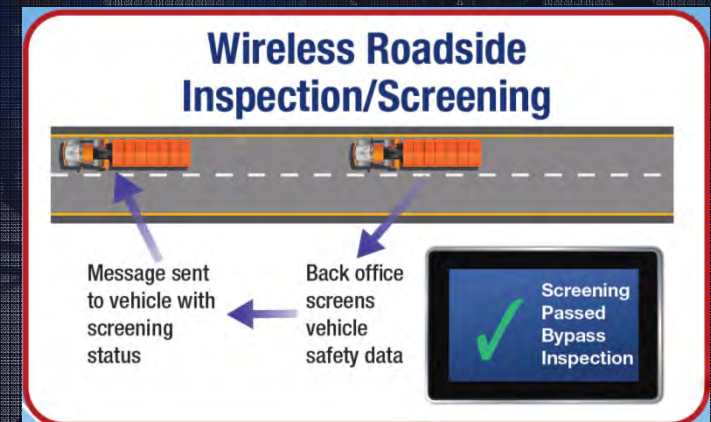
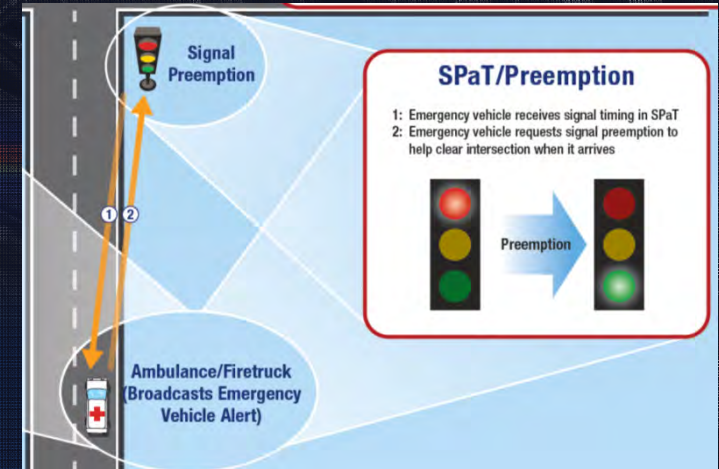
Testing Equipment and Infrastructure





SwRI CV Application Development Activities

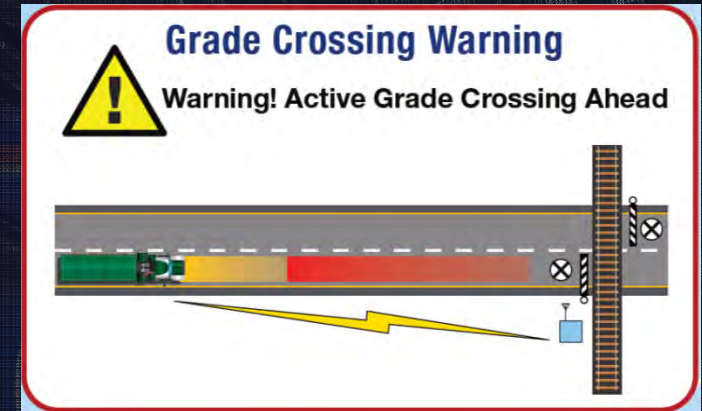
- ◆ Vehicle Probe Data
- ◆ Signal Phase & Timing / MAP
- ◆ Signal Prioritization
- ◆ Signal Preemption
- ◆ Green Speed
- ◆ Wireless Roadside Inspection
- ◆ Unsafe-to-pass / Unsafe-to-merge
- ◆ Blind Spot Warning





SwRI CV Application Development Activities

- ◆ Roadside Alerts
- ◆ Railroad Grade Crossing
- ◆ Traveler Information
 - curve speed warning
 - dynamic/variable text
 - static signage (MUTCD based)
- ◆ Emergency Vehicle Alert
- ◆ Overheight Detection/Alert
- ◆ Wrong Way Driver Detection/Alert





SwRI CV Application Development Activities

- ◆ Cooperative ACC
- ◆ Emergency Electronic Brake Lights
- ◆ Forward Collision Warning
- ◆ Mayday Message / Relay

Forward Collision Warning



A: Slow moving or stopped vehicle

B: Determines potential for collision based on path of travel and closing speed

Emergency Electronic Brake Lights



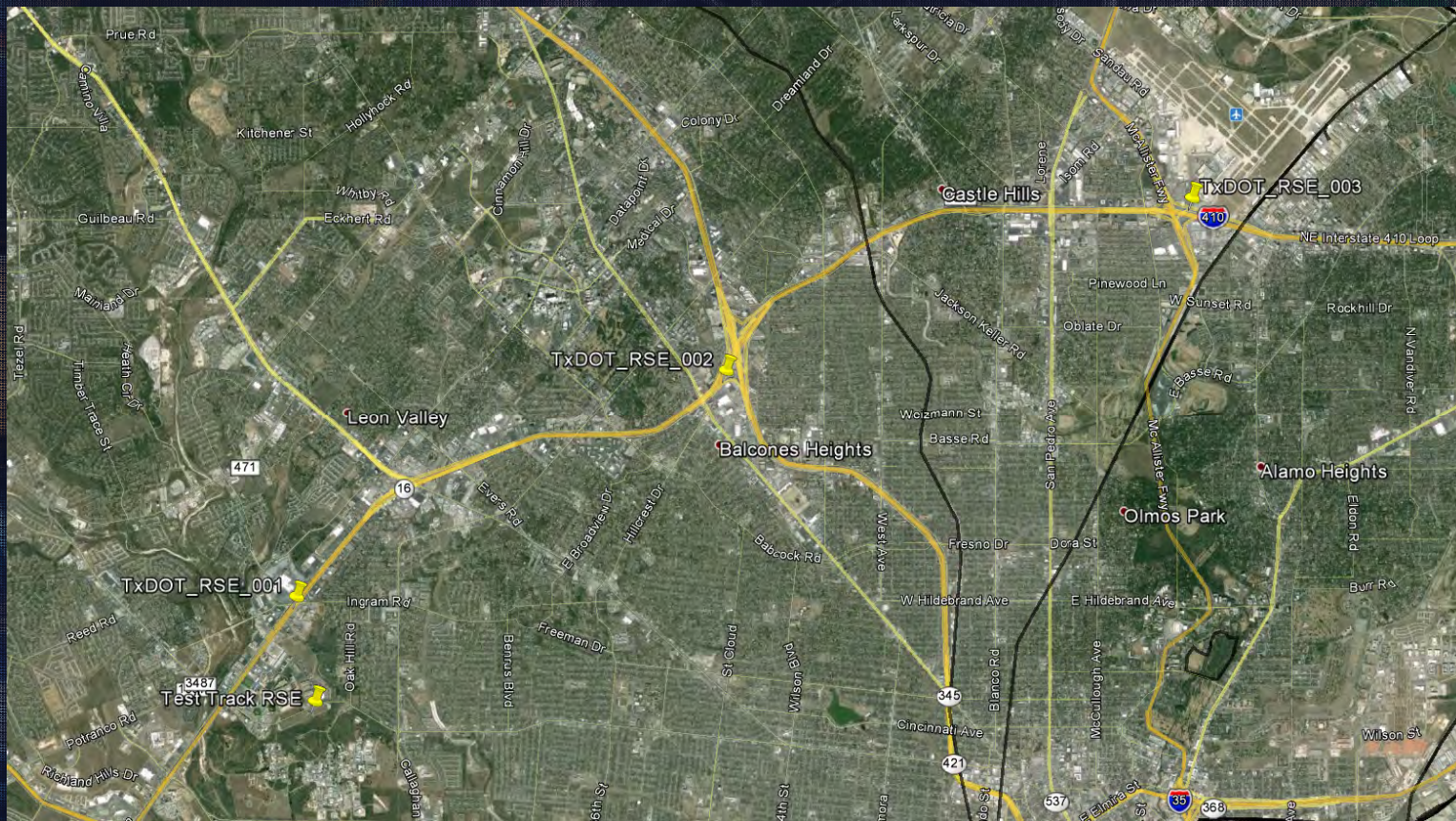
A: Broadcasts hard-braking 'event' when decelerating over the defined threshold

B: Vehicle potentially obstructing the view of Driver C and D
C and D: Receives hard-braking event from A and displays a warning if the vehicle is in the forward path



TxDOT San Antonio CV Pilot Deployment

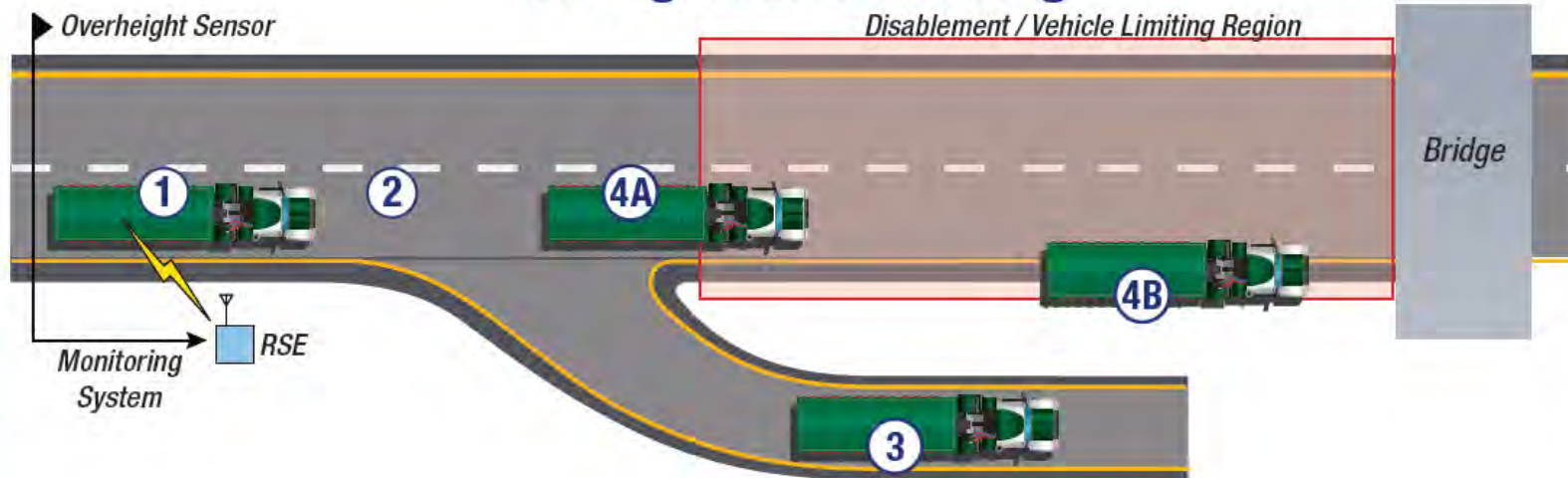
- ◆ Loop 410 from Airport to Ingram Road
- ◆ Collect BSM data / Transmit Electronic Signage





TxDOT Overheight Vehicle Detection & Warning

Bridge Hit Warning



- 1: Infrastructure OH sensor detects OH vehicle
- 2: RSE identifies specific vehicle and warning is displayed to the driver
- 3: Vehicle exits and uses bypass –Warning is removed from driver display
- 4A: Vehicle does not exit – Additional warnings presented. Vehicle automatically slows if available.
- 4B: Vehicle is disabled or speed limited prior to hitting the bridge, if available. Emergency responders automatically notified.

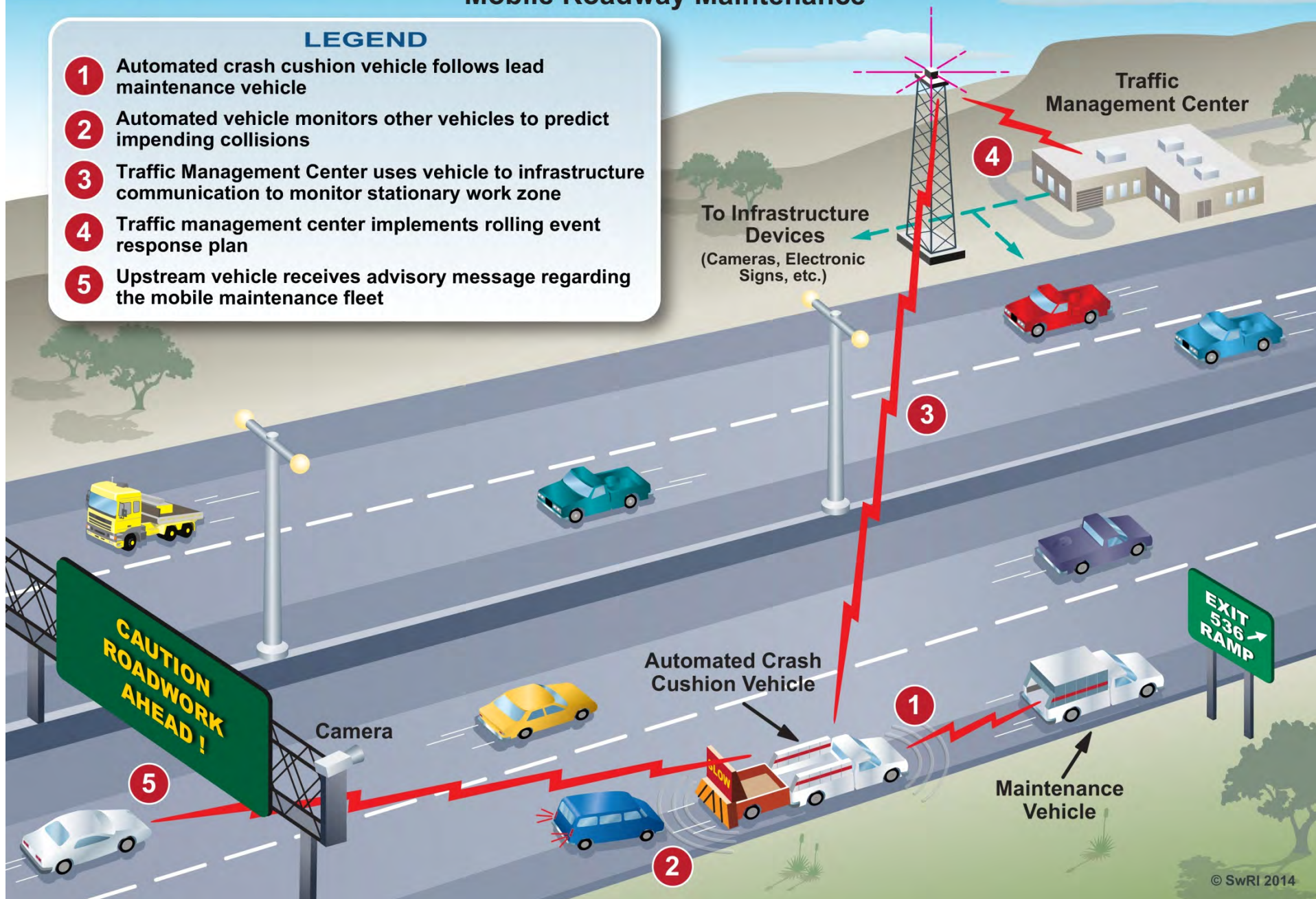
Enhancing Work Zone Safety

Mobile Roadway Maintenance



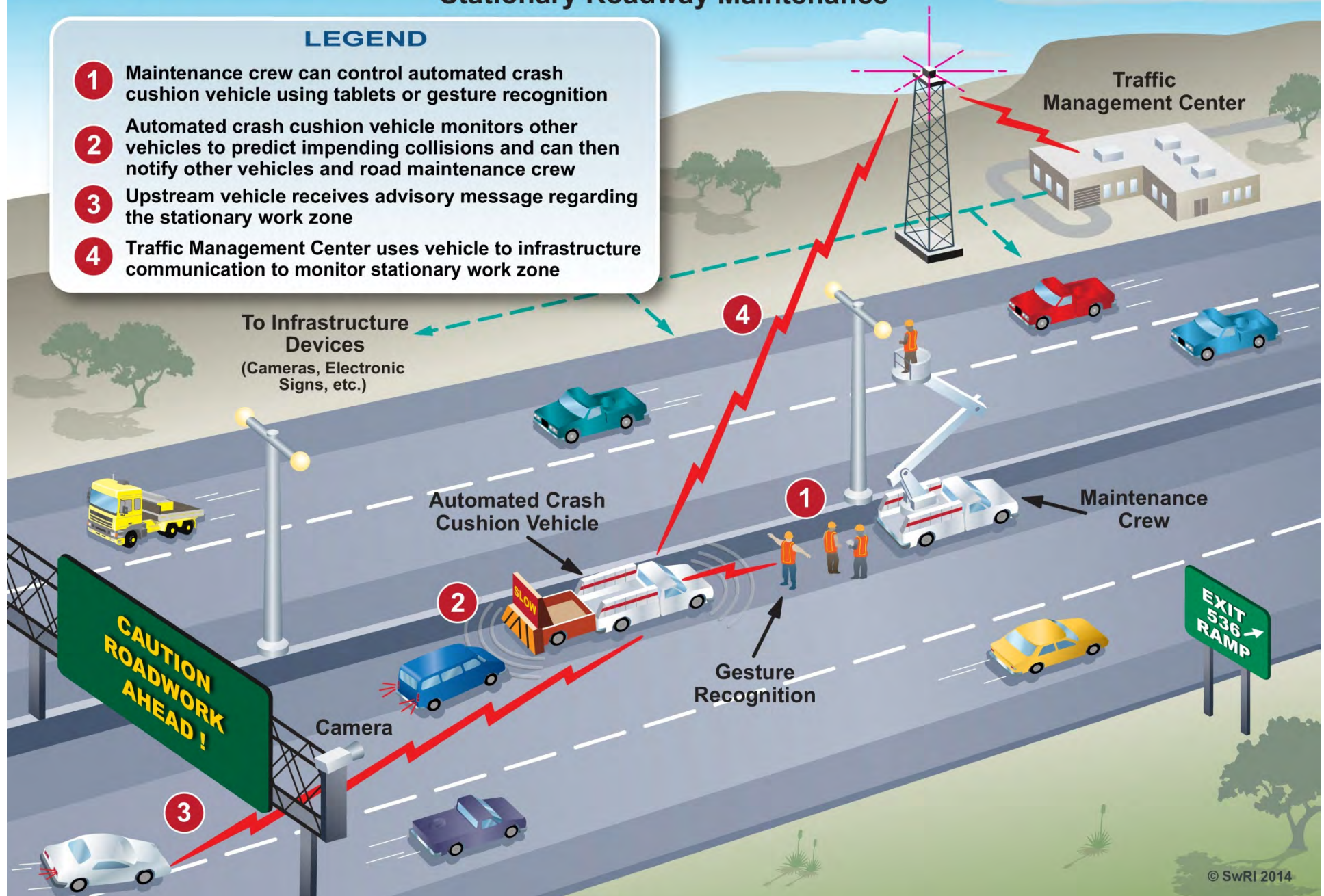
LEGEND

- 1 Automated crash cushion vehicle follows lead maintenance vehicle
- 2 Automated vehicle monitors other vehicles to predict impending collisions
- 3 Traffic Management Center uses vehicle to infrastructure communication to monitor stationary work zone
- 4 Traffic management center implements rolling event response plan
- 5 Upstream vehicle receives advisory message regarding the mobile maintenance fleet



LEGEND

- 1 Maintenance crew can control automated crash cushion vehicle using tablets or gesture recognition
- 2 Automated crash cushion vehicle monitors other vehicles to predict impending collisions and can then notify other vehicles and road maintenance crew
- 3 Upstream vehicle receives advisory message regarding the stationary work zone
- 4 Traffic Management Center uses vehicle to infrastructure communication to monitor stationary work zone





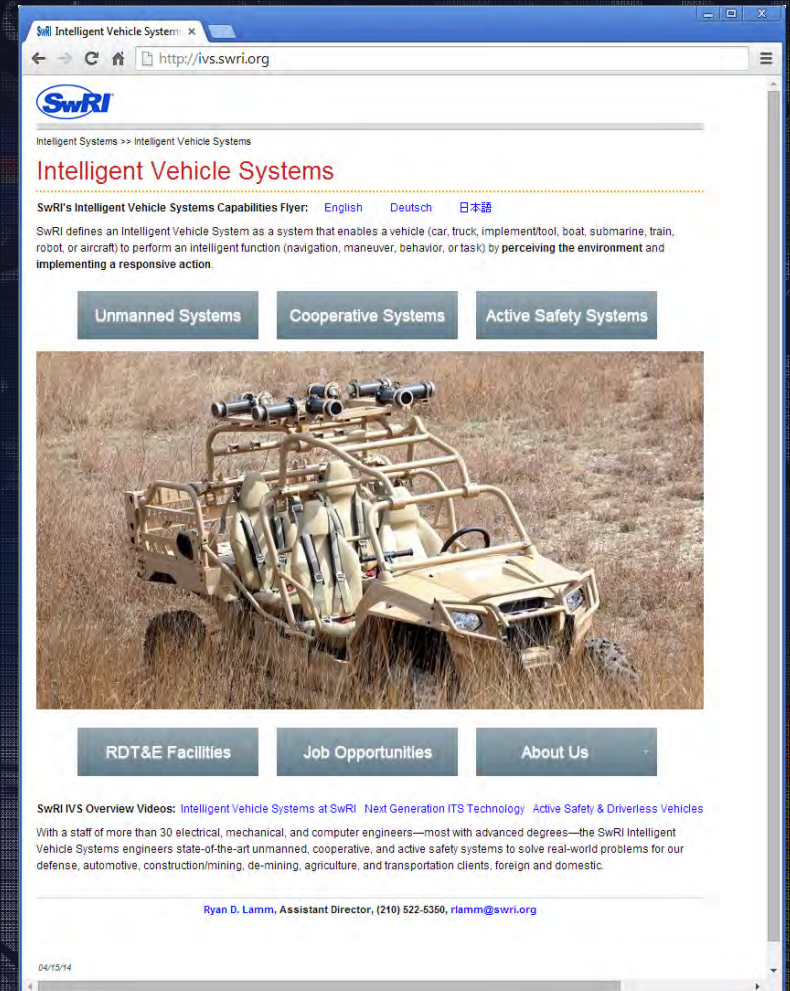
Conclusion

◆ USDOT CV Affiliated Test Beds

◆ SwRI CV Affiliated Test Bed

◆ SwRI CV Activities

◆ TxDOT / SwRI CV Projects



Questions?

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