Connected and Autonomous Vehicles on Maintenance

Paul Pisano
Federal Highway Administration
paul.pisano@dot.gov; 202-366-1301
Overview

• Provide a national perspective on Connected and Autonomous Vehicles
• Discuss the opportunities between Connected and Autonomous Vehicles and the Maintenance Community
National Perspective on Connected & Autonomous Vehicles

• Conduct applied research
• Address policy items
• Issue Rulemakings
• Promote Deployment
  - 2015 FHWA Vehicle to Infrastructure Deployment Guidance and Products (Draft)
  - Vehicle-to-Infrastructure Coalition
Connected and Autonomous Vehicles and the Maintenance Community

- A little perspective
- What are the opportunities?
  - Management strategies (aka applications)
  - Data needs and sources to support the strategies
- What’s been done to date? What’s coming?
Flashback
What Are the Opportunities?
Management Strategies

- **Road Weather Management**
  - Maintenance (e.g., winter maintenance)
  - Operations (e.g., motorists advisories and warnings)
  - Traffic Safety
  - Road Weather Performance Management

- **Traffic Management**
  - Work Zone Management
  - Congestion & Incident Management

- **Pavement Management**
  - Maintenance
  - Design

- **Asset Management**
## What Are the Opportunities?

### Data Needs and Sources

- Date
- Time
- Location (lat/long)
- Speed
- Altitude
- Air Temperature
- Barometric Pressure
- Humidity
- Dew Point
- Road Temperature
- Wiper Status
- Spread Rate

### Sources (current and emerging)

- Public sector (esp. State DOT) fleets
- Personal vehicles
- Private sector fleets
Michigan DOT’s Approach

Ingest

Manage

Consume
What’s Been Done to Date?
What’s coming?

• Integrating Mobile Observations for Road Weather Management
  - Michigan, Minnesota and Nevada DOTs
  - Instrumented vehicles to collect road weather data
  - Disseminating the data via several communication paths
  - Feed the data into several applications

• Weather Data Environment (wxde.fhwa.dot.gov)

• Vehicle Data Translator (aka Pikalert) posted on the Open Source Application Development Portal (www.itsforge.net)

• EDC-4 - Weather Savvy Roads
Texas Connected
Transportation Initiatives

John A. Barton, P.E.
Assistant Vice Chancellor
Human Factors

Automated Vehicles

Connected Vehicles

Cross-Cutting / Collaborative Research

Connected Vehicles

- Signal Phase and Timing (SPAT) and Related Messaging for Connected Vehicle Applications
- Integrated V2I Prototype Development
- Traffic Signal Controller Logic Enhancements
- Eco-Signal Operation
Connected Vehicles

- Speed Harmonization and Queue Warning Prototype Development and Demo
- Wrong-Way Driving Detection and Mitigation
- Sensing Highway Infrastructure
  - Safety and Operations
  - Bridge
  - Pavements
Peloton Technology

- Level 1 Automation Demonstration led by major LTL freight carrier
- Examine how infrastructure data (V2I) can enhance truck platooning operation
- Examine impacts to traffic and safety

Source: Peloton
Automated Vehicles

- Truck Automation
- Commercial Truck Platooning
AV/CV Policy Research

- ITS Program Legislative Research and Analysis
- Data Privacy and Liability
- Road Use Fees
- Travel Behavior Impacts
- Deploying AV/CV: Scenarios and Roadmap
- Policy Implications of Disruptive Technology and the Internet of Things
- Implications of Automated Vehicle Crashes
TAMUS RELLIS Campus

- 2,000 Acre Proving Ground
TAMUS RELLIS Campus

- Connected Vehicle Development
Test Bed to Improve Transit, Bike, and Pedestrian Safety

- Demonstrate and evaluate AV/CV technology hardware and applications in transit or paratransit vehicles to improve transit passenger, bicyclist, and pedestrian safety.
AV/CV Test Bed Development in Texas

- I-30 West Test Bed
- Circuit of the Americas (Austin)
- SH 130 (Austin)
- TxDOT DSRC Testing (San Antonio)
- Texas CV Pilot (Proposed)
- USDOT FRATIS/WZ (Waco)
- TTI Riverside Test Bed (CS)
- TxDOT Truck Platooning (CS)
- Transit/Ped/Bike Test Bed (CS)
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
- 7 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
Connected Work Zone

- USDOT grant to expand work zone lane closure, delay, and queue information to freight logistics and trucks using CV architecture.
- Working demonstration in central Texas on I-35.
- PI: Bob Brydia /Christopher Poe
Future Proof
For More Information

John A. Barton, P.E.
Assistant Vice Chancellor

jbarton@tamus.edu
(979) 458-6422
Changing the Way We Travel
Mobility and Accessibility, the Autonomous/Connected Way

2016 AASHTO Subcommittee on Maintenance (SCOM)
July 18, 2016

Tracy Larkin Thomason, PE
Deputy Director, Southern Nevada

...and a “recovering” Maintenance Engineer
Nevada is a State of **FIRSTS**

- **First** to create AV regulations for testing and consumer deployment
- **First** to create an AV testing program
- **First** to license a company for AV testing (Google)
- **First** to license a commercial vehicle for testing
- **One of the first** 6 states identified for UAV testing
How Nevada got here...

2011
Senate Bill 511
Authorized AV testing & operation. Required DMV to create regulations
1. Define insurance requirements
2. Establish minimum safety standards
3. Provide for vehicle testing
4. Restrict to specific areas

2013
Senate Bill 313
Further defined “Autonomous technology” to not need human active control/monitoring
Established $5 million liability requirement
Established aftermarket AV conversion liability

2015
First AV licensed in Nevada to Daimler/Freightliner (May 5th)

2016
Governor established the Center for Advanced Mobility (CAM).
AASHTO and AAMVA Workshops

• Raise awareness of policy issues for various national, state, and local organizations and agencies.
• Gain perspectives of Insurers, Data firms, Law Enforcement & OEMs on policy and regulatory issues
• Discuss balance in policy and regulatory framework

NHTSA
• Establishing Guidelines – Part 1 of 4 will be out in July 2016
Integrated Mobile Observation Project – Connected Snowplows

• Improve safety and reduce incidents
• Outfit snowplows with GPS, LiDAR, FLIR, and DSRC/5G radios
• Lane beacons
• Integrate sensors with NDOT’s RWIS
• Broadcast locations (AV HUDs, NDOT website, and travel apps)

• Provide enhanced information on snowplow HUD
• Integrate with AV/CV collision avoidance
Vehicle to Infrastructure (V2I)

Daimler relied partially on pavement markings and striping for their media event.
Vehicle to Infrastructure (V2I)
Integration
It’s all About the Data!!!

• DOT’s experience and understanding of the data
• Who is responsible for the data?
• Who owns the data? (Public vs. Private)
• There are varying standards for collecting and sharing data. How do you share across multiple platforms?
• Increased need for more refined data (i.e. construction zones, lane closures)
Autonomous People Movers

• Partnership with Local Motors announced June 16, 2016

• Provide “first-mile/last-mile” autonomous transit
Mobility for Disabled Residents

• Collaborate with OEMs and aftermarket AV technology companies
• Outfit passenger vehicles with aftermarket AV technologies
• Integrate with corridor ITS, DSRC/5G/WiFi, other ICT, and data centers
• Statewide multimodal testing of AVs
Connected car adoption

More autonomous cars

Smart City integration

V2I and V2V connections

Reliance on real-time data
Top Policy Issues

• Need for National Standards – challenge of 50 different sets of standards
• Data governance
• Cybersecurity issues (AV and traffic management systems)
• Liability clarification
• Infrastructure clarification
• Process for approving AV for public use
Changing the Way We Travel
Mobility and Accessibility, the Autonomous/Connected Way

Tracy Larkin Thomason, PE
Deputy Director, Southern Nevada
702.730.3300
tlarkin@dot.state.nv.us

AASHTO Subcommittee on Maintenance

No driver needed!

As seen in:
INTRODUCING THE NEXT GENERATION OF SAFETY

A SELF-DRIVING (AUTONOMOUS) TMA

THE ATMA
NO DRIVER NEEDED!

GPS WAYPOINT
NAVIGATION
REMOTE CONTROL
DRIVING
LEADER/FOLLOWER
HOW DOES IT WORK? [THE VEHICLE KIT]

1. THE VEHICLE CONTROL MODULE
   ✔ Converts manned vehicle into unmanned system

2. THE STEERING RING
   ✔ Short installation times

3. THE ACTUATORS
   ✔ Modular design
MARKET INTRODUCTION

Vehicle Control Module

Steering Ring

Actuators

- Demonstrated a Working Prototype to Florida DOT Officials
- June 2015 - Made a Presentation about this Revolutionary Product to Federal DOT Officials at the AASHTO Intermodal Conference in Cheyenne, Wyoming
- April 2016 – Demonstrated First ATMA Demo to International Company Out of Europe
WHY IS AUTONOMOUS OUR INDUSTRY’S FUTURE?

- TMA PURCHASE & RENTAL DEMAND IS RAPIDLY GROWING IN THE US

- THE NATIONAL MOTOR VEHICLE FATALITY COUNT IS NOT ZERO, IT’S OVER 30,000/yr

- THE CONVERSATION IS growing – WHY PUT A SITTING DUCK IN A CRASH TRUCK?

- AUTOMATED VEHICLE TECHNOLOGIES HOLD UNPRECEDENTED OPPORTUNITIES IN HELPING IMPROVE WORK ZONE SAFETY

* 2015 map of TMA purchases/rentals
THE INTEREST IS REAL

Officials have indicated strong interest in using the autonomous TMA truck as an “intermediate” application for testing autonomous technology on our national highway system.

NO DRIVER NEEDED!
“WE BELIEVE THE ANSWER IS REMOVING WORKERS FROM THE LINE OF FIRE WHERE EVER AND WHENEVER POSSIBLE. THE AUTONOMOUS TMA TRUCK ACHIEVES THAT LIKE NO OTHER TECHNOLOGY IN THE FIELD TODAY.”

ROBERT ROY, PRESIDENT, ROYAL TRUCK & EQUIPMENT
FUTURE DEVELOPMENT

1. COLLISION AVOIDANCE SENSORS

2. AUTOMATIC BREAKING SYSTEM WHEN IMPACTED

NO DRIVER NEEDED!
THE TECHNOLOGY PACKAGE

BACKUP CAMERA
- Did you know? 48% of accidents from backing up

INTERCOM SYSTEM
- We provide the necessary training videos!

“BLACK BOX” RECORDING SYSTEM
- Liability protection

CAMERA/DVR SYSTEM

MOBILE RADAR / MESSAGE & ALERT CENTER
- Provides real-time information
- Customizable messages
THE BRUTAL FACTS

ROYAL HAS MADE A PUSH FOR THESE INNOVATIONS AS A RESULT OF A NUMBER OF BRUTAL NATIONAL STATISTICS

32,675 - # OF MOTOR VEHICLE FATALITIES FROM 2015 *FARS Annual Report File

87,696 - # OF CRASHES IN WORK ZONES IN 2012 *US DOT FHA Facts & Statistics

41% - OF CRASHES WERE REAR-END COLLISIONS IN WORK ZONES * “Identification of Work Zone Crash Characteristics”

90% - OF TRAFFIC CRASHES IN FLORIDA ARE DUE TO HUMAN ERROR *2015 FL Dept. of Transportation
THANK YOU!

ANDREW ROBERTS | STRATEGIC ACCOUNTS MANAGER, ROYAL TRUCK & EQUIPMENT, INC.
andrew@royaltruckequipment.com
6910 N. Route 309 | Coopersburg, PA 18036
Main: 855-202-7129 | www.royaltruckandequipment.com/atma
V2I Deployment Coalition

V2I DC

Overview and Early Findings

Dean Deeter
Athey Creek Consultants
Topics

• Introduce the V2I Deployment Coalition
• Describe the Initial 18 Month Focus
• Share Early Findings
• Invite Your Participation
What is the V2I Deployment Coalition?

• V2I DC Concept
  ▪ A single point of reference for stakeholders to meet and discuss V2I deployment related issues

• V2I DC Approach
  ▪ USDOT asked AASHTO, ITS America and ITE to collaborate on organizing and managing the coalition
Connected Vehicle Executive Leadership Team

V2I Deployment Coalition Structure

V2I Deployment Coalition

- TWG 1: Deployment Initiatives
- TWG 2: Deployment Research
- TWG 3: Infrastructure, Operator, OEM, and Supplier Partnerships
- TWG 4: Deployment Guidance
- TWG 5: Deployment Standards

V2IDC Executive Committee

USDOT - ITS JPO - FHWA - FTA - NHTSA
## TWG Chairs & Co-Chairs

<table>
<thead>
<tr>
<th>TWG</th>
<th>Chair</th>
<th>Co-Chair</th>
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<tbody>
<tr>
<td>TWG 1: Initiatives</td>
<td>Bill Legg, WSDOT</td>
<td>Joe Averkamp, Xerox</td>
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<td>TWG 2: Research</td>
<td>Greg Larson, Caltrans</td>
<td>Rob Bertini, Cal Poly</td>
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<td>TWG 3: Partners</td>
<td>Matt Smith, MDOT</td>
<td>Roger Berg, Denso</td>
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<td>TWG 4: Guidance</td>
<td>Faisal Saleem, MCDOT</td>
<td>Navin Katta, Savari</td>
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<td>TWG 5: Standards</td>
<td>Ed Seymour, Texas A&amp;M</td>
<td>Gary Duncan, Econolite</td>
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## 16 Deployment Issues Identified

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<tr>
<th>Issue</th>
<th>TWG 1 Initiatives</th>
<th>TWG 2 Research</th>
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<th>TWG 4 Guidance</th>
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<td>Issue 1: V2X Applications</td>
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<td>Issue 9: Understanding V2I Liability Assignment</td>
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<td>Issue 10: V2I Synergies with Other Emerging Technologies</td>
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<td>Issue 12: V2I Multimodal Applications</td>
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<td>Issue 13: Infrastructure Processes as V2I Obstacles</td>
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<td>Issue 14: Federal V2I Policy Statement</td>
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<td>Issue 15: Maintaining V2I Infrastructure</td>
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<td>Issue 16: Operator and OEM Goals for V2I</td>
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V2I DC Overview

Initial Goals of the V2I DC:

To help accelerate V2I deployments related to:

1. Intersections (signalized & non-signalized)
2. End of queue warnings
3. Work zone management
4. Curve warning systems
V2I DC Efforts

TWGs approach to the 4 Focus Areas:

- Addressing the key issues impacting V2I deployment
- Each TWG has a Work Plan of activities
- ‘Fishbone Diagrams’ helped coordinate activities of TWGs
- Monthly TWG webinars
- Coalition wide meetings/calls

Four Focus Areas
1. Intersections
2. Queue Warnings
3. Work Zone Management
4. Curve Warnings
CV Institutional Framework

CV Entity

AASHTO CV Executive Leadership Team (CV ELT)

Vehicle to Infrastructure Deployment Coalition Executive Committee (V2I DC EC)

V2I DC Technical Working Groups (TWGs)

Role

Recommend Policies & Deployment Approaches

Guidance to V2I DC on Technical & Institutional Issues

Collaborate on technical work (Input level actions)
Early Findings / Results

- V2I Standards Context Drawing
- V2I Deployment Guidance Feedback / Input
- Definition of Research Activities for 4 Issues
- Increased Interaction with Automobile Manufacturers re: Data Exchanges – Planned Upcoming Meetings
- Survey of Planned & Most Beneficial V2I Deployments
To Become Involved

Gummada Murthy, AASHTO gmurthy@aashto.org

Siva Narla, ITE - Snarla@ite.org

Adrian Guan, ITS America – aguan@itsa.org

Dean Deeter, Athey Creek – deeter@acconsultants.org