Getting There From Here: Traffic Modeling, Data Streams, and Prediction for Connected Vehicle Systems Planning and Operations

Accelerating the Deployment of Vehicle-to-Infrastructure Cooperative Systems: U.S. Perspectives in an Era of Increasing Automation

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NEW ADMINISTRATION | NEW INITIATIVES

Strategic priorities
- Safety
- Infrastructure
- Technology and Innovation
- Reducing Regulatory Burden

Signature Actions
- $1B Infrastructure Investment
- Federal Aviation Administration Privatization
- Fixing America’s Surface Transportation (FAST) Act provides $305 billion in funding 2016-2020
Vision for Connected Automated Future

Drivers and Operators

Safety 80% of Unimpaired Crash Scenarios

Vehicles and Fleets

Wireless Devices

Rail

Maritime

Infrastructure
Solutions for 80% of Crashes

- Rear End Warning 28%
- Lane Departure 23%
- Intersection 25%
- Lane Change 9%
- Opposite Direction 2%
- Backover 2%

SAE J2735 Basic Safety Message

<table>
<thead>
<tr>
<th>Basic Safety Message</th>
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</thead>
<tbody>
<tr>
<td>Temporary ID</td>
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<tr>
<td>Time</td>
</tr>
<tr>
<td>Latitude</td>
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<td>Longitude</td>
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<tr>
<td>Acceleration</td>
</tr>
<tr>
<td>Brake System Status</td>
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<tr>
<td>Vehicle Size</td>
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</table>
Safety Pilot – 2836 Vehicles

V2V
Forward Collision Warning
Emergency Electronic Brake Light
Intersection Movement Assist
Blind Spot Warning/Lane Change Warning
Do Not Pass Warning
Left Turn Across Path/Opposite Direction
Right Turn in Front

V2I
Signal Phase and Timing
Curve Speed Warning
Railroad Crossing Warning
Pedestrian Detection

Informed NHTSA Decision February 2014
1955 Signals

805 ITS Equipment + 22 Weigh Stations

500 ft diameter buffers
SPIS Sites (95-100) Within Range (n=4,530)
Enterprise Data Driven Improvement
- Probe-based Pavement Maintenance
- Probe-enabled Traffic Monitoring
- CV-enabled Performance Measures
- Work Zone Traveler Information

Fee Payment
- Road User Charging
- Tolling/HOT Lanes/Congestion Pricing

Enhanced Operations and Responsiveness
- Motorist Advisories & Warnings (MAW)
- Enhanced Maintenance Decision Support
- Incident Guidance Emergency Response (RESP-STG)
- Incident Scene Work Zone Alerts (INC-ZONE)
- Emergency Communications/Evacuation (EVAC)

Enabled Corridors and Segments
- Advanced Traveler Information System (EnableATIS)
- ICM Decision Support System
- Dynamic Speed Harmonization (SPD-HARM)
- Queue Warning (Q-WARN)
- Next Generation Ramp Metering (RAMP)
- Freight Dynamic Travel Planning & Performance

Equipped Roadside Nodes
- Signal Phase & Timing (SPAT)
- Curve Speed Warning
- Spot Weather Impact Warning
- Railroad Crossing Warning
- Disabled/Oversized Vehicle Warning
- AFV Charging/Fueling Information
- Wireless Inspection
- Smart Truck Parking
## Near Term Focus for Oregon DOT

<table>
<thead>
<tr>
<th>No</th>
<th>Connected Vehicle Application</th>
<th>Impact</th>
<th>Effort</th>
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<td>Freight Dynamic Travel Planning &amp; Response</td>
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<td>Signal Phase and Timing (SPAT)</td>
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<td>Curve Speed Warning</td>
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<td>Probe-enabled Traffic Monitoring</td>
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<td>Motorist Advisories &amp; Warnings (MAW)</td>
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CV Roadmap

- DSRC and Backhaul Communications
- Education and Outreach
- Policy and Communications/Collaboration
- Benefits/Business Case
- Data Management and Strategies
- Applications
- Try Things
- Research Questions/Challenges
- Planning and Equity
- Multimodal
- Design and Construction
- Operations and Maintenance

94 Actions
12 Categories
2017 Ford Fusion

Starting MSRP $22,110
EPA Rating 22 City/34 Highway
Rear View Camera
Reverse Sensing System
Tire Pressure Monitoring
Adaptive Cruise Control w/ Forward Collision Warning
Blind Spot Information System w/ Cross-Traffic Alert
Lane-Keeping System
Active Park Assist
911 Assist (SYNC feature)
Traffic Sign Recognition
Driver Alert
Pedestrian Alert Kit and Active City Stop

Intelligent Vehicle in 2017
6% of plans consider the potential effect of driverless technology.

3% of plans take into account private transportation network companies (TNCS) such as Uber or Lyft, despite the fact that they operate in 60 of the 68 markets.
DOT Smart City Challenge

1,400 local officials, companies, academics and non-profits joined our webinars

800 people participated in our Smart City Forum

300 companies have expressed interest in partnering

78 applications received for the Smart City Challenge

5 Smart City Challenge Finalists to be announced in March at SXSW

1 Smart City Challenge Winner announced in June

#DOTSmartCity www.transportation.gov/smarteCity
V2I Deployment Coalition

- A single point of reference for stakeholders to meet and discuss V2I deployment related issues
- USDOT asked AASHTO, ITS America and ITE to collaborate on organizing and managing the coalition
- To help accelerate V2I deployments related to:
  - Intersections (signalized & non-signalized)
  - End of queue warnings
  - Work zone management
  - Curve warning systems
- Provide strategic guidance,
- Recommend policies and national deployment approaches,
- Provide critical program reviews,
- Assess the risks associated with deployment,
- Commit the resources of their organizations,
- Educate their organizations and supporting institutions
The SPAT Challenge

- To challenge state and local public sector transportation Infrastructure Owners & Operators (IO&Os) to cooperate together to achieve deployment of DSRC infrastructure with SPaT broadcasts in at least one corridor or network (approximately 20 signalized intersections) in each state by January 2020.
- Additional V2I Applications that build on SPaT are also encouraged!

20 Intersections in 50 states by 2020!
Motivating Questions

- What do we mean by “smart?”
  - Performance measures and accountability
  - Mobility
  - Accessibility (e.g. to food, health care, education, recreation, jobs, transportation options...)
  - Safety
  - Efficiency
  - Equity
  - Sustainability/CO₂

- What do we mean by “city?”
  - Different geographical units
  - Neighborhood → city → region → beyond
Motivating Questions

- **Shift from “Things” to “People”**
  - Who are the key players/stakeholders?
  - Policy/IT/Engineering/Public Affairs/Elected/Citizens
  - Get them working together now
  - New collaborations
  - What can we do without new funding?
  - How can new funding leverage new partnerships?
  - Public/Private/Academic

- **How to Avoid Paralysis**
  - Waiting for standards, funding, mandates, regulations
  - Need to demonstrate and quantify benefits before investment
  - How to leave the door open when making current investments.
Motivating Questions

- Dealing With Issues that Others are Also Facing
  - Privacy
  - Cybersecurity
  - Data Integration
  - Data Ownership and Archiving
  - Standards
  - Institutional Issues
  - Social Issues
- Education/Workforce Development (Focus on People)
  - Clearinghouse for benefits/costs
  - Successes, lessons learned and what doesn’t work
  - Role for training, education, academic institutions
  - Mechanism for collaboration/cooperation/incentives
Don’t Forget

- Design places where people want to be
- Let’s not be victims of technology
- Try things! Start now!
Many thanks to the Oregon Department of Transportation, Haizhong Wang, Tony Knudson, and Kevin Carstens