



*UNITED STATES*  
**DEPARTMENT OF TRANSPORTATION**

# Connected Vehicle Infrastructure to Support Safety, Mobility and Environmental Applications

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# Research Towards Implementation

## Drivers/Operators



Infrastructure

Vehicles and Fleets

## Wireless Devices

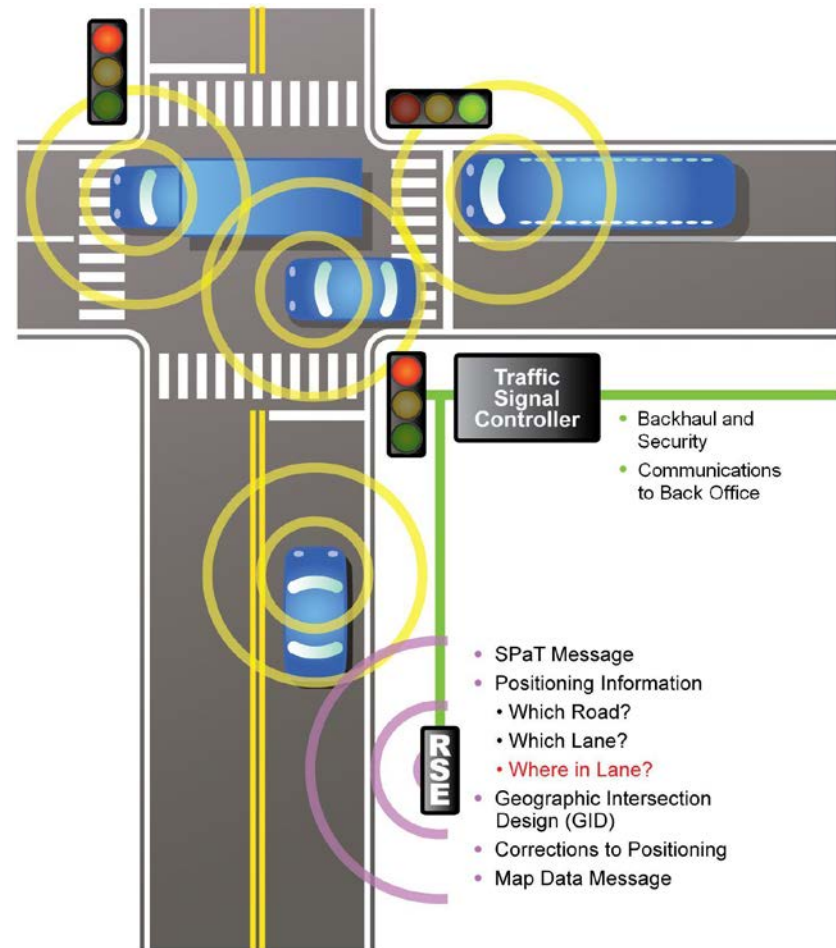


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# Vehicle to Infrastructure Applications

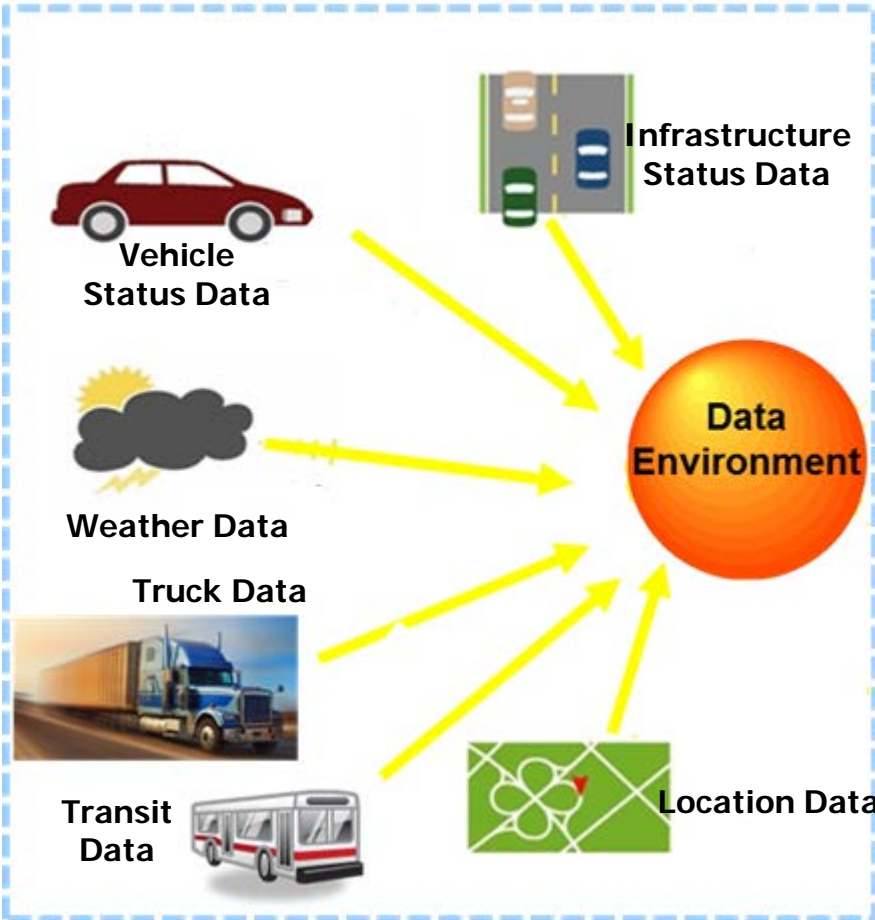
# V2I Safety Applications

- Accelerated Development
  - Red Light Violation Warning
  - Curve Speed Warning
  - Stop Sign Gap Assist
- Additional Applications Development
  - Stop Sign Violation
  - Railroad Crossing Violation Warning
  - Spot Weather Impact Warning
  - Oversize Vehicle Warning
  - Reduced Speed/Work Zone Warning

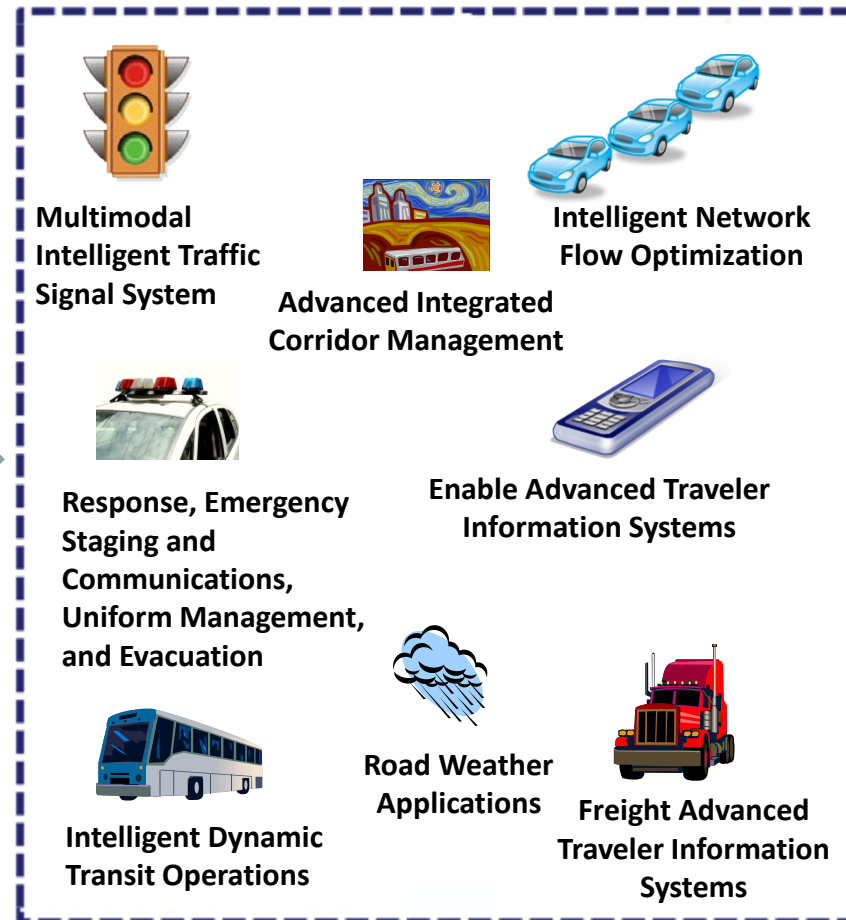


# V2I Mobility Applications

## Real-time Data Capture and Management



## Dynamic Mobility Applications



# V2I Environmental Applications

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## ▪ Eco-Signal Operations

- Eco-Approach and Departure at Signalized Intersections Eco-Traffic Signal Timing
- Eco-Traffic Signal Priority

## ▪ Eco-Traveler Information

- Dynamic Eco-Routing
- Eco-Smart Parking
- Multi-Modal Traveler Information



AERIS

## ▪ Dynamic Eco-Lanes

- Dynamic Eco-Lanes Management
- Eco-Speed Harmonization
- Eco-Cooperative Adaptive Cruise Control
- Eco-Ramp Metering

## ▪ Dynamic Low Emissions Zones

- Dynamic Emissions Pricing

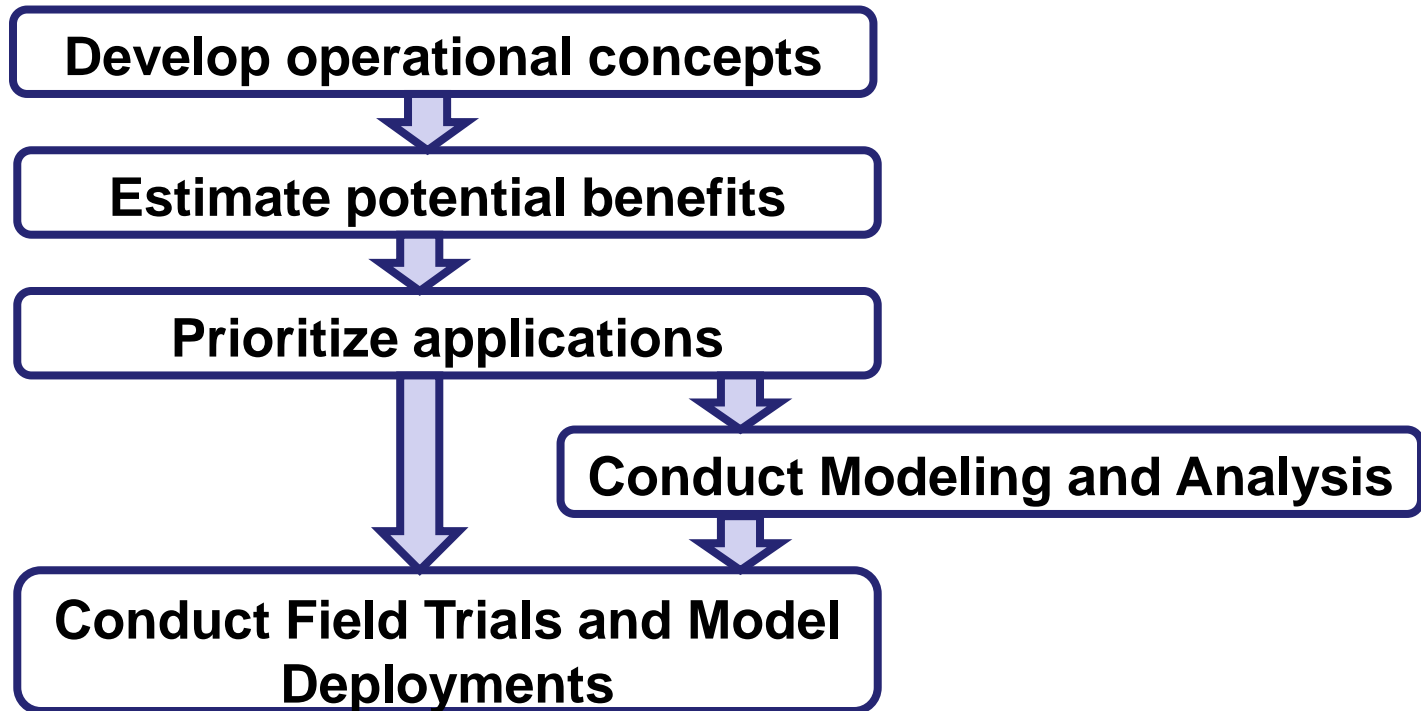
## ▪ Support for Alternative Fuel Vehicle Operations

- Alternative Fuel Vehicle (AFV) Charging / Fueling



# Applications Research Approach

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- Federally funded research will provide open data and open sourced software for mobility applications



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# The Path to Deployment



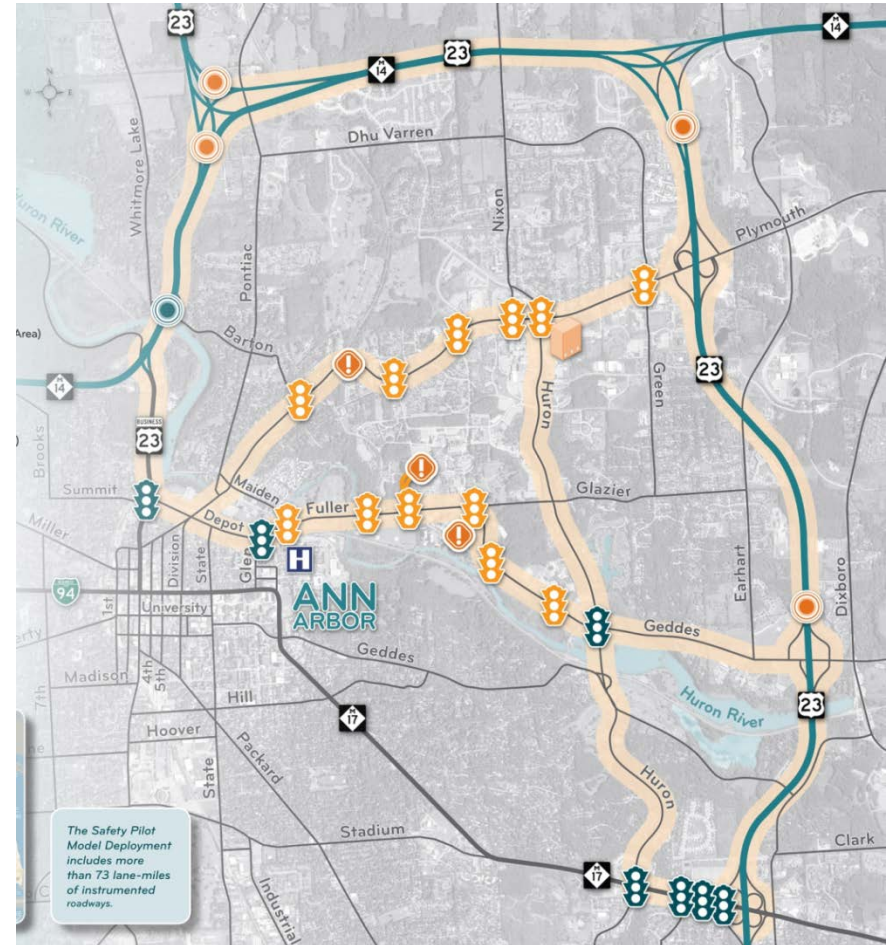
# NHTSA Agency Decision

- 2013 NHTSA agency decision on V2V and V2I safety communications systems. Options include:
  - Future regulatory action
  - Inclusion in the New Car Assessment Program (NCAP)
  - Further research and development
- Similar milestone in 2014 for a decision regarding V2V and V2I safety technology on heavy vehicles
- Information to support the decision will come from many sources, including the Safety Pilot Model Deployment



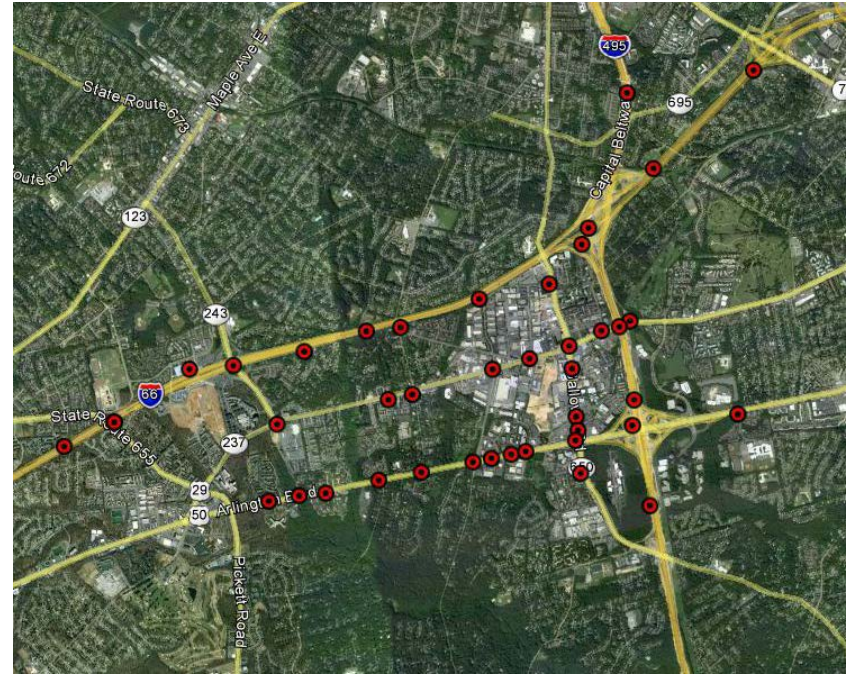
# Safety Pilot Model Deployment

- 3,000 vehicles (cars, buses, and trucks) equipped with V2V devices.
- Provide data for determining the technologies' effectiveness at reducing crashes.
- Includes vehicles with integrated safety applications and others that use aftermarket devices (i.e., not built into the vehicle)
- Applications to be tested include:
  - Blind Spot Warning/Lane Change Warning
  - Forward Collision Warning
  - Electronic Emergency Brake Lights
  - Intersection Movement Assist
  - Do Not Pass Warning
  - Control Loss Warning



# Connected Vehicle Pooled Fund Study

- Established in 2009
- Currently involves 10 States, Maricopa County, AZ, Transport Canada – Virginia is lead State
- Purpose is to aid transportation agencies in justifying and promoting the deployment of cooperative transportation systems through modeling, development, engineering, and planning activities
- [http://cts.virginia.edu/CTSPFS\\_1.html](http://cts.virginia.edu/CTSPFS_1.html)



# Infrastructure Deployment Planning

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- USDOT is working with state and local DOTs and private industry to plan for deployment
- Standardized interfaces
  - Between vehicles
  - Between vehicles, roadside, and handheld devices
  - Between roadside equipment
  - Between roadside equipment and management centers
- Certification processes for equipment and systems
- Nationwide Security Credential Management System (SCMS)
- National Cooperative Highway Research Program (2013 completion)
  - Benefit Cost Analysis for state and local DOTs, including funding options
  - DSRC deployment guidance for state DOTs
- National Connected Vehicle Field Infrastructure Footprint Analysis (AASHTO led, 2014 completion)



# National Connected Vehicle Field Infrastructure Footprint Analysis

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- Comprehensive and detailed study including a set of design concepts with high level of engineering detail illustrating the relationships between applications & infrastructure
- Will define set of deployment scenarios
- Will answer:
  - Why is a Connected Vehicle field infrastructure needed?
  - What form should the field infrastructure take?
  - Where is deployment of field infrastructure needed?
  - By when should field infrastructure be in place?
  - What are the cost, organizational, and institutional implications of deploying, operating, and managing field infrastructure?
  - What are the planning and funding strategies to put the infrastructure into place in a coordinated manner?



# National Connected Vehicle Field Infrastructure Footprint Analysis

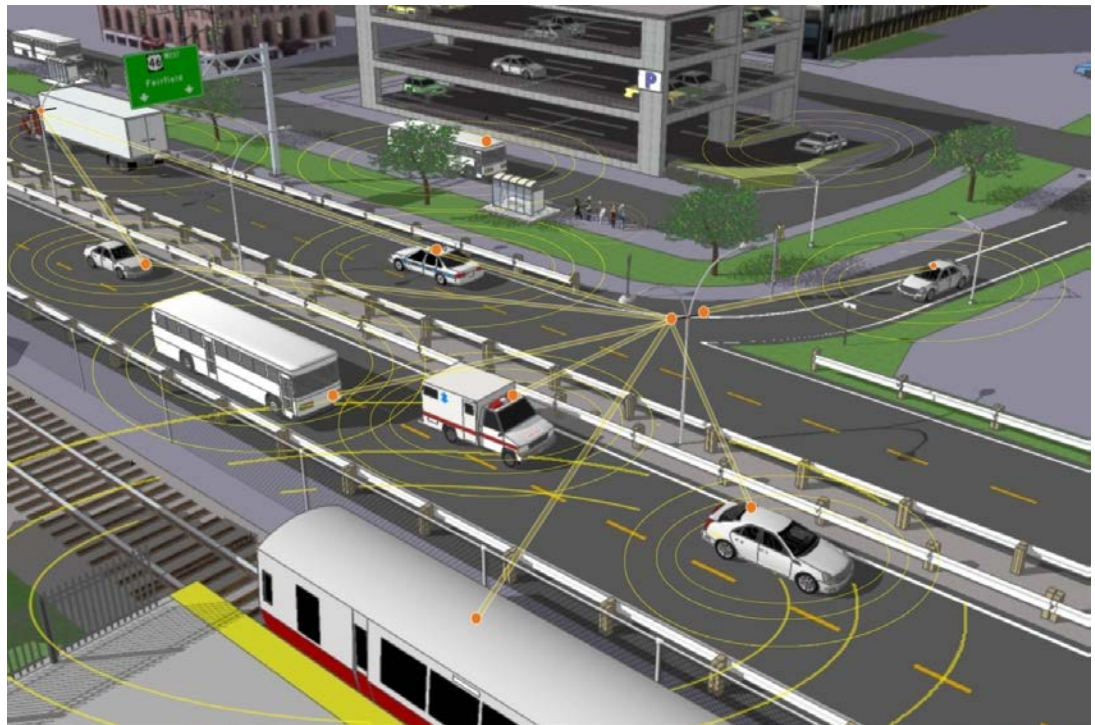
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- Will provide:
  - Preliminary national footprint of connected vehicle field infrastructure
  - Phased deployment plan, along with required actions and funding strategies
  - Cost estimates for deployment, operations, and maintenance.
  - Estimates of workforce and training requirements
  - Policy and guidance needs.
  - Identification of implementation challenges and required timeline for resolution



# Exploration of Policy Issues Underway

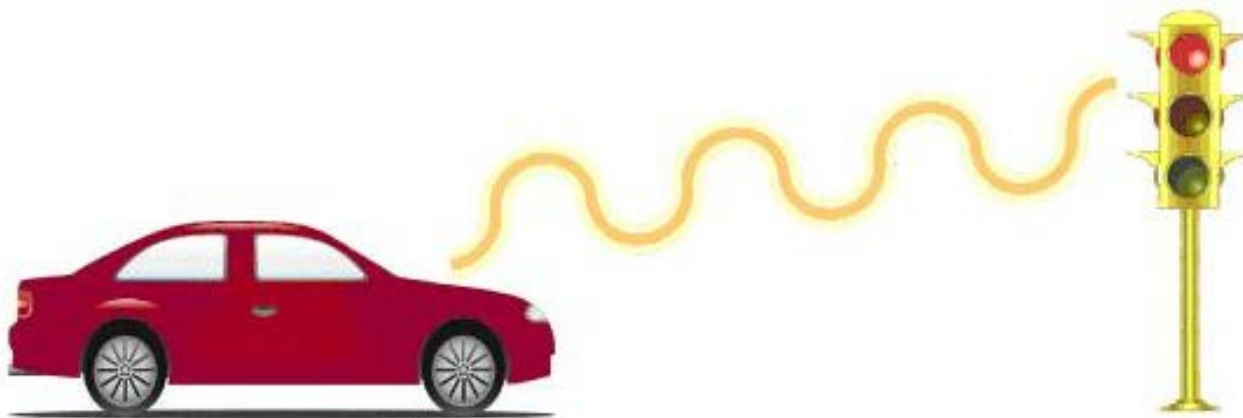
- System security
- Privacy
- Governance
- Business Models
- Legal Issues



# Summary

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- Infrastructure based safety, mobility and environmental applications are under development
- 2013 is a key decision milestone for vehicle equipage, which will significantly impact infrastructure deployment
- Key deployment decisions have yet to be made
- USDOT, state and local DOTs, and private industry are working together to make these decisions and move from research concepts to deployment







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Thank you!