Connected and Automated Vehicles: Challenges and Opportunities of New Vehicle Technologies on our Transportation Infrastructure

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The Path Forward: Revolutionary or Evolutionary?

Connected Vehicle
Development
Testing
USDOT, through State and Local Agencies

Automated Vehicle
Development
Testing
OEMs and Auto Industry Suppliers
Technology Companies

“Connected Automation”
Traffic Operations Challenges: Preservation of Roadway Infrastructure
Traffic Operations Challenges: Traffic Signal Maintenance
Traffic Operations Challenges: Confusing/Inconsistent Applications
Traffic Operations Challenges: Guarantee of Operations in All Conditions
Traffic Operations Challenges: Advanced Intersection Concepts

Divergent Diamond

Continuous Flow Intersection
Traffic Operations Challenges: Fixed vs Flexible Roadway Use
Traffic Operations Challenges: Active Traffic Management
Connectivity to Infrastructure

• Anything you can do unconnected (autonomously) you can do better connected
• Providing better information about vehicle movements to infrastructure operators (V2I)
• Providing better information and guidance about traffic, road and weather conditions to drivers and vehicle systems (I2V)
• Providing better information about vehicle movements to other vehicles and drivers (V2V)
Traffic Management Challenges

• Management objectives: safety vs. efficiency
• Traffic management complexity
• Architecture: vehicle-based vs. central vs. hybrid
• Roles and responsibilities of agencies
• Technology compatibility
  – Vehicles
  – Traffic management systems
• Methodology & innovation
• Transition & market penetration
Infrastructure Implications - CV

- Funding for implementation, operation, maintenance
- Communications
  - Fiber backhaul?
  - Wireless: DSRC or other?
- Data safeguards
- Technical skill sets
- Scale of implementation unknown
- Timeframe: market penetration of equipped vehicles?
New Infrastructure Requirements: Signal Phase and Timing (SPaT)

- Part of the Connected Vehicle/Automated driving environment
- Part of SAE DSRC Message set
- Provides status and time remaining in signal indications
- Applications
  - Red light running/collision avoidance
  - Dilemma zone protection
  - Ecodriving
  - Dynamic mobility
- Developed and tested prototype for FHWA
New Components: Integrated I2V Prototype

- Single platform for multiple I2V applications onto a single platform
  - DSRC/LTE Communications
  - Message Generation
  - SPaT/MAP Information
  - Positioning Correction

- Include processing power to field level decision making
New Equipment Functionality: Traffic Signal Controller Logic Enhancements to Support V2I Safety
New Testbeds: Smart Intersection Initiative

- Concept: create controlled environment (RELLIS) and real-world environment (West campus) to develop, test, and implement advanced connected vehicle traffic signal strategies.
  - Research signal operation, technologies, and pedestrian, bicycle, and transit interactions
  - Partners: Texas A&M University, TTI, and Private Sector
New Collaborations: AERIS Eco-Signal Operation

- Part of FHWA initiative for Applications for the Environment: Real-Time Information Synthesis (AERIS)
- Evolutionary approach
- Exploring implications of sharing Eco-signal relevant transportation data
- Sharing of data between public agency infrastructure and privately owned vehicles
- Sponsor: CAMP under a cooperative agreement with FHWA
New Approaches for Testing Connected Highway and Vehicle Systems
New Deployment Approaches
What’s next? – New Challenges and Opportunities

• Research – technological, socioeconomic, behavioral, institutional and policy
• Local proof-of-concept deployments solving local problems
• New public-private collaborations
Questions