Beyond ATC and ITS Standards

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Signal Control is only the beginning

Connected Vehicles
Automated Vehicles
Fully Connected Vehicles

**Vehicle Data:**
- Latitude, Longitude, Speed, Brake Status, Turn Signal Status, Vehicle Length, Vehicle Width, Bumper Height

**Infrastructure Data:**
- Signal Phase and Timing, Drive 35 mph, 50 Parking Spaces Available
Connected Vehicle Communications Technology

- 5.9 GHz Dedicated Short-range Communications (DSRC)
- 4G and older 3G cellular networks provide high-bandwidth data communications
- Other wireless technologies such as Wi-Fi, satellite, and HD radio may have roles to play
V2I Communications Will Improve Safety

Curve Speed Warning

Smart Roadside

Red Light Violation Warning

Stop Sign Gap Assist

NOTE:
Option 1 – This option includes sending an alert when the crosswalk signal has been activated.
Option 2 – This option includes the use of a pedestrian detection system to detect the presence of a pedestrian in the crosswalk.
Dynamic Mobility Application Bundles

**MMITSS** = *Multimodal Intelligent Traffic Signal System*

**INFLO** = *Intelligent Network Flow Optimization*

**RESCUME** = *Response, Emergency Staging and Communication, Uniform Management, and Evacuation*

**Enable ATIS** = *Enable Advanced Traveler Information Systems*

**IDTO** = *Intelligent Dynamic Transit Operations*

**FRATIS** = *Freight Advanced Traveler Information Systems*
ITS Standards – Signal Timing and Intersection data

Application Areas

- Transit Signal Priority
- Freight Signal Priority
- Emergency Vehicle Preemption
- Eco Signal Operations
- Eco Integrated Corridor
Other Enabling Standards

- Traffic Signal System
- IEEE 802.11P
- IEEE 1609
- Time Reference (GPS/Network)

DSRC Radio
Affiliated Interoperability Test Beds

The vision is to have multiple interoperable locations as part of one connected system moving toward nation-wide deployment.

• Common architecture
• Common standards
• Independent operations
• Shared resources
International Harmonization

Vehicle to Vehicle and Vehicle to Infrastructure Communication is being deployed worldwide to improve safety

- Signal operations data
- Geometric descriptions
- Commercial vehicle operations
Connected/Automated Vehicles

An automated vehicle communicates with other vehicles and the infrastructure to self-drive.

VS.

An *autonomous vehicle* is self-contained and does not interface with other vehicles or infrastructure.

Connected vehicle technology is an important input to realizing the full potential benefits and broad-scale implementation of the highest level of automation.
Exploratory Research—Vehicle Automation

Enhanced by connectivity to other vehicles and infrastructure

- For example, vehicle platooning

Benefits of Connectivity

- Increases availability, speed, and reliability of information
- Enables coordination of automated traffic streams

The full potential benefits of road vehicle automation can only be achieved through a connected environment
Probable Common Standards

IEEE 802.11p - Radio frequency Standard (5.85-5.925 GHz)

NTCIP 1202 – Intersection signal information

Signal Control Priority (NTCIP 1211 or TCIP v4)

SAE J2735 – Vehicle to Vehicle and Vehicle to Infrastructure information

IEEE 1609 – Security and privacy standards
Levels of Automation

**Level 0**: No automation

**Level 1**: Function-specific Automation
- Automation of specific control functions, e.g., cruise control

**Level 2**: Combined Function Automation
- Automation of multiple and integrated control functions, e.g., adaptive cruise control with lane centering

**Level 3**: Limited Self-Driving Automation
- Drivers can cede safety-critical functions

**Level 4**: Full Self-Driving Automation
- Vehicles perform all driving functions
New Standards

Geospatial Information Security and Privacy Protection

- Secure exchange of trusted data between users and applications without pre-existing relationship or entering into a permanent relationship

- Assurance of privacy between users and from third parties

- A user cannot be tracked along his journey or identified without appropriate authorization.
Path to Deployment

- Defined V2V Apps
- Defined Safety (V2I), Mobility (V2V & V2I), AERIS and Weather Apps
- Application Development
- Pilots/Early Deployments

2011: 
- FHWA Deployment Guidelines
  - NHTSA Decision to Move Forward with V2V communication for light vehicles
  - NHTSA Decision for Heavy Vehicles

2012: Safety Pilot in 2013

2013

2014

2015

2016
Recap

We are entering a period of rapid changes in how we operate the ground transportation system.

Standards could reduce the effort to track and keep pace with these changes.