USDOT Transit Connected Vehicle Research Program

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Connected Vehicle Research

- Connected Vehicle is a suite of technologies and applications that use wireless communications to provide **connectivity**:
  - Among vehicles of all types
  - Between vehicles and roadway infrastructure
  - Among vehicles, infrastructure and wireless consumer devices

**All Roads, All Modes, All The Time!**
Connected Environment
## Connected Vehicle Program Structure

### Applications

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<tr>
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### Technology
- Harmonization of International Standards & Architecture
- Human Factors
- Systems Engineering
- Certification
- Test Environments

### Policy
- Deployment Scenarios
- Financing & Investment Models
- Operations & Governance
- Institutional Issues
# Transit Connected Vehicle for Safety

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High Priority Transit Safety Scenarios

1. Right-Turn-In-Front Crash (V2V)
2. Pedestrian vs. Turning Bus Crash (V2I)
3. Bus Angle Crash At Intersection
4. Left-Turn Head-On Crash
5. Rear-End Crash At Stop/Intersection
6. Left-Turn Crash At Light Rail Grade Crossing
Vehicle Turning Right in Front of Bus Scenario

Provides bus driver a warning when a vehicle turns right in front of a bus as the bus pulls away from a bus stop

Source: [YouTube Video](http://www.youtube.com/watch?v=9gK2EgFw99_0)
Vehicle Turning Right in Front of Bus Warning - Concept Illustration
Pedestrian vs. Turning Bus Scenario

Provide bus driver a warning when a pedestrian is crossing the street as the bus is making a turn

- Application relies on infrastructure for pedestrian detection
- Pedestrians are not equipped with Safety Awareness Devices
Pedestrian vs. Turning Bus Warning – Concept Illustration
Transit Safety Retrofit Package (TRP)

Five Safety Applications:
- Pedestrian in Signalized Crosswalk Warning - V2I
- Vehicle Turning Right in Front of Bus Warning - V2V
- Forward Collision Warning (FCW) - V2V
- Emergency Electronic Brake Lights (EEBL) - V2V
- Curve Speed Warning (CSW) - V2I

Phased Deployment:
- Phase 1: FCW and EEBL, August 2012
- Phase 2: Integrated Data Acquisition System (DAS), October 2012
- Phase 3: Remaining three applications and bus driver training, December 2012
Concurrent Safety Application Research

- **Stop Sign Violation Warning**
- **Railroad Crossing Violation Warning**
- **Spot Weather Information Warning**
- **Oversize Vehicle Warning**
- **Reduced Speed Zone Warning**
- **Red Light Violation Warning**
- **Stop Sign Gap Violation Warning**
- **Curve Speed Warning**
Transit Safety Research Next Steps

- Evaluate the outcome of the two safety applications through Safety Pilot Model Deployment
- Conduct more detailed analysis of transit crashes, including other transit vehicle types
- Continue engaging transit stakeholders
- Prioritize transit crash scenarios for future safety research
- Collaborate with other CV activities, such as test beds and pilots, to promote transit adaptation
Transit Connected Vehicle for Mobility

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Intermodal Connectivity

Integrated data environment further supports intermodal mobility management capability
Mobility Application Area Definition

Real-time Data Capture and Management (DCM)

- Vehicle Status Data
- Weather Data
- Truck Data
- Transit Data

Dynamic Mobility Applications (DMA)

- Data Environment
- Reduce Speed 35 MPH
- Weather Application
- Real-Time Travel Info
- Fleet Management/Dynamic Route Guidance
- Signal Phase & Timing Adjusts Real-Time Conditions
- Safety Alerts and Warnings

U.S. Department of Transportation
Data Environments and Application “Bundles”

90+ ideas → 30 applications → 7 bundles

Legend:
- Green: DMA PROGRAM FUNDED
- Yellow: DMA SUPPORTED (NOT FUNDED), OPEN TO OTHER PROGRAMS AND RESEARCHERS

U.S. Department of Transportation
Integrated Dynamic Transit Operations (IDTO) Bundle

- One of the seven mobility application "bundles"
- Led by Federal Transit Administration (FTA)
- Integrated transit operations that provide dynamic scheduling, dispatching, and routing of transit vehicles, and facilitate passenger connection protection and dynamic ridesharing:
  - Dynamic Transit Operations (T-DISP)
  - Connection Protection (T-CONNECT)
  - Dynamic Ridesharing (D-RIDE)
Multi-Modal Intelligent Traffic Signal System (M-ISIG) Bundle
Transit Mobility Research Next Steps

- Complete bundle functional and performance requirements
- Conduct IDTO prototype development and testing
  - “Phased” development
  - Full-and-Open competition
- Evaluate IDTO effectiveness and impacts
- Revise IDTO ConOps and requirements as needed
- Broaden field impacts thought knowledge transfer and stakeholder outreach
# Transit Connected Vehicle for Environment

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- Road Weather Applications

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AERIS Transformative Concepts
Examples of Transit Roles in AERIS Transformative Concepts

- Eco-Signal Operations
  - Eco-transit signal priority
- Dynamic Eco-Lanes
  - Transit dedicated lane and vehicle platooning
- Dynamic Low Emissions Zones
  - Incentivized choice transit travelers
- Support for Alternative Fuel Vehicles
  - AFV transit vehicles
- Eco-Traveler Information
  - Integrated intermodal traveler information supporting eco-traveling
- Eco-Integrated Corridor Management
  - Corridor load balancing and dynamic modal shift
AERIS Next Steps

- Complete an Initial Benefit Cost Analysis (BCA) to better understand to potential environmental benefits that may be achieved from implementing AERIS applications

- Develop Concepts of Operations (ConOps) for each AERIS Transformative Concept

- Model AERIS Transformative Concepts and Applications to further assess their benefits

Cleaner Air Through Smarter Transportation
For More Information.....

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