Priority Connected Vehicle Applications for Bus and Paratransit

APTA Best Practices Workshop
USDOT's Connected Vehicle Program

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Topics

- FTA Program Overview
- Safety Pilot
- Real-Time Data Capture and Management Program
- Dynamic Mobility Applications Program
- Priority Applications for Transit
# Connected Vehicle Program Structure

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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
## Connected Vehicle Safety Program Areas

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<th>Initiative</th>
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| Vehicle-to-Vehicle                 | • Support NHTSA regulatory decision for 2013  
• Could cover NEW cars, trucks, and transit vehicles                                                                                           |
| Vehicle-to-Infrastructure          | • Enable active safety applications to assist vehicle operators (including cars, trucks, and transit vehicles) and pedestrians to avoid or mitigate crashes.                                                  |
| Safety Pilot                       | • Accelerate in-vehicle technology to ensure value to the first V2V deployed vehicles  
• Test data for benefits assessment in support of NTHSA 2013 decision for V2V for light vehicles.  
• Demonstration of V2V and V2I safety applications in a real world environment.                                                                   |
Transit Participation in Safety Pilot

• Conducted transit crash data analysis (Summer 2010)
• Solicited transit stakeholder input (face-to-face meetings and webinars, Fall/Winter 2010)
• Selected two safety scenarios for transit participation in Safety Pilot
  – Pedestrian vs. Turning Bus (V2I)
  – Right-Turn-In-Front (V2V)
• Will begin developing the transit retrofit package soon
Transit Safety Scenario #1 – Pedestrians vs. Turning Buses

• Approximately 35% of all pedestrian-bus crashes occur during turning maneuvers (and 49% of fatal bus-pedestrian crashes).

• Of these, 85% occur during left turns, and 15% during right turns.
Pedestrian vs. Turning Bus

Approximately 35% of all pedestrian crashes occur during turning maneuvers.

85% are left turns
15% are right turns
Pedestrian vs. Turning Bus

Pedestrian signal request queues notification in vehicles

Pedestrian is sensed in the crosswalk with notification to vehicles that will cross path

Notification is removed once pedestrian exits the cross walk
Transit Safety Scenario #2 – Right-Turn In Front Crashes

This scenario was discussed and recommended by transit stakeholders during transit stakeholder meetings.
Right Turn in Front of Bus

Cars passing a stopped bus do not realize the bus is pulling away from the stop.
Right Turn in Front of Bus

The bus notifies vehicles that it is pulling away from the stop

• Release of brakes
• Closing of front door

Drivers are given an alert that the bus will begin moving
Transit Driving Simulators

- Will begin conducting feasibility assessment of simulators
- Leveraging Vehicle Assist and Automation (VAA) effort
- Considering multiple functions, including driver clinics, human factor research and driver training
Transformative Concepts

- Integrated operational concepts use vehicle-to-vehicle (V2V) and/or vehicle-to-infrastructure (V2I) data and communications to reduce transportation-related emissions and fuel consumption.
- Transformative Concepts are intended to change the way transportation systems operate, with an emphasis on combining intermodal applications to provide significant environmental benefits. *Example: Eco-traveler information*
- Transformative Concepts also consider regulatory/policy and educational tools.

AERIS Transformative Concept
Illustration of a Transformative Concept

Operational Decisions are determined by a real-time data fusion and decision-support system focused on optimizing the corridor for the environment.

- Transit Signal Priority is granted based on real-time passenger and schedule data.
- V2V and V2I communications devices replace conventional ITS devices for collecting real-time traffic, emissions, and weather data.
- Ramp Metering utilizes data from in-vehicle devices to optimize traffic flow based on real-time emissions data.
- Real-time multi-modal traveler information is made available to in-vehicle systems through V2I communications.
- Variable Speed Limits are implemented on the freeway, optimizing for mobility and the environment. Speed limit information is made available to in-vehicle systems through V2I communications.
- Traffic signals are optimized based on data collected from conventional ITS devices (i.e., loop detectors) and vehicle systems. Traffic signal optimization is focused on reducing emissions.

Traveler information websites and phone applications are in place to provide real-time multi-modal traveler information, including eco-routing information.
USDOT Mobility Program Overview

Real-time Data Capture and Management

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

Dynamic Mobility Applications

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

Data Environment
Real-time Data Capture and Management

Data Environment

- Vehicle Status Data
- Infrastructure Status Data
- Weather Data
- Truck Data
- Transit Data
- Location Data

Dynamic Mobility Applications

- Reduce Speed 35 MPH
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Vision

- Active acquisition and systematic provision of integrated, multi-source data to enhance current operational practices and transform future surface transportation systems management

Objectives

- Enable systematic data capture from connected vehicles (transit, automobiles, trucks), mobile devices, and infrastructure

- Develop data environments that enable integration of data from multiple sources for use in transportation management and performance measurement

- Reduce costs of data management and eliminate technical and institutional barriers to the capture, management, and sharing of data
DCM Program Status

- Conducting a state of the practice and innovations assessment of current practices in data capture and management methods and technologies

- Developing a research data exchange concept of operations for the Mobility program

- Solicited test data sets from industry

- Developing a request for proposals for a data manager
Dynamic Mobility Applications

- Reduce Speed 35 MPH
- Transit Signal Priority
- Weather Application
- Real-Time Travel Info
- Fleet Management/Dynamic Route Guidance
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Real-time Data Capture and Management

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Data Environment
Dynamic Mobility Applications

Vision
- Expedite development, testing, commercialization, and deployment of innovative mobility applications:
  - maximize system productivity
  - enhance mobility of individuals within the system

Objectives
- Create applications using frequently collected and rapidly disseminated multi-source data from connected travelers, vehicles (automobiles, transit, freight) and infrastructure
- Develop and assess applications showing potential to improve nature, accuracy, precision and/or speed of dynamic decision making by system managers and system users
- Identify innovative forms of wireless connectivity supporting applications
- Demonstrate promising applications predicted to significantly improve capability of transportation system to provide safe, reliable, and secure movement of goods and people
DMA Program Status

- Selected high priority dynamic mobility applications for further research and development

- Conducting work to develop or purchase an Open Source Application Development Portal for development of the high priority applications

- Will begin developing concepts of operations and functional requirements for the high priority mobility application bundles
Integrated Dynamic Transit Operations (IDTO) Bundle

- Dynamic Transit Operations
- Connection Protection
- Dynamic Ridesharing
Dynamic Transit Operations

- Dynamic scheduling, dispatching and routing of a vehicle by matching compatible trips

- Traveler provides desired destination & departure time tagged with their current location through personal mobile device

- Considers various modal options, including demand responsive service, fixed-route service and private service, such as taxi

- Considers real-time traffic conditions and vehicle capacity

- May replace some late night or mid-day fixed-route service
Connection Protection

- Requires transit inter-modal and inter-agency coordination

- Uses real-time and historical data to examine the arrival status of a transit vehicle and transmits a “hold” message to another vehicle if the lateness falls within a pre-determined threshold

- Transfer requests may be initiated by transit riders

- Monitors the situation and provides connection protection status to travelers
Transit Connection Protection

2013 Bus & Paratransit Conference
Dynamic Ridesharing

- Uses dynamic ridesharing technology, personal mobile devices, and voice activated on-board equipment to match riders and drivers along their route.

- Allows trip-by-trip ridesharing (dynamic as opposed to preset carpooling).

- Can take into account individual ridesharing preferences and constraints.

- May include technology to verify the number of people in a vehicle for HOV enforcement and toll discounts.
Multimodal Intelligent Traffic Signal System Bundle

- Intelligent Traffic Signal System
- Transit Signal Priority
- Mobile Accessible Pedestrian
- Freight Signal Priority
- Emergency Vehicle Preemption with Proximity Warning
- Connected Eco Driving
Transit Signal Priority (TSP)

- Enables earlier, more accurate and continuous monitoring of transit vehicles as they approach and progress through the intersection, and potentially down an entire corridor.

- Selects the most appropriate priority strategy based on knowledge of up-to-the-second location and multiple conditionality criteria, such as:
  - Schedule/headway adherence
  - Passenger loads
  - Service type
  - Time of day
  - Peak direction

- Enables TSP on a network of arterials.
Enable Advanced Traveler Information System (ATIS) Bundle

- Multimodal ATIS
- *Smart Park-and-Ride System*
- *Universal Map Application*
- Real-Time Route Specific Weather Information for Motorized and Non-Motorized Modes
Smart Park and Ride System

- Monitors the occupancy of parking spaces in real time and provides the information to travelers via personal mobile devices and on-board equipment.

- Calculates the average travel distance and time to the parking facility.

- If the preferred parking facility is at capacity, the system would suggest an alternative location based on traveler’s direction of travel.

- May include a reservation system and be integrated with a payment system.
Universal Map Application

- Allows participating transportation agencies to place real-time information on a universal map, such as:
  - Street closures and detours
  - Traffic flow information
  - Transit vehicle locations
  - Transit service level information
  - Transit amenities

- Addresses issue of proprietary map applications
Response, Emergency Staging and Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E.) Bundle

- Incident Scene Workzone Alerts for Drivers and Workers
- Incident Scene Pre-Arrival Staging Guidance for Emergency Responders
- Mayday Relay
- Emergency Communication and Evacuation
Emergency Communication and Evacuation

- Uses Connected Vehicle capabilities to improve evacuation planning and delivery for the transportation disadvantaged and those with special needs

- Integrates databases of human services recipients and transportation service providers, and allows individuals to register themselves

- Provides emergency management offices and transportation providers updated user needs status/location during an evacuation

- Enables dynamic dispatching and routing of vehicles during an evacuation with real-time, up-to-date information
Transit Participation in Environment

- AERIS = Applications for the Environment: Real-time Information Synthesis
- Vision – Cleaner Air through Smarter Transportation
- Four goal areas –
  - Improve operations
  - Manage demand
  - Change driving behavior
  - Support use of alternative fuel vehicles
AERIS

- Research Program: **What it Means for Transit?**
- Nationally/ Internationally Sustainable Transportation Goals

Transit Vehicles Probe Operating Environment
Environmental Data Compiled/ Provided
More Real-Time Traveler Information Available
Increase Availability of Transit Service
More Alternative Fuel Transit Vehicles
Transit Expands Air Quality Mitigation Role

USDOT 2030 Projection: Decrease of 5-17% in Green House Gas Emissions
For More Information …

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