Connected Vehicles and Smart Cities

2017 ACPN Knowledge Exchange Conference

April 24, 2017

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ITS Strategic Plan Key Issues

• Automated/Connected Vehicles
• Connected Vehicles Pilot
• Smart Cities
Strategic Plan: Program Categories

- Accelerating Deployment
  - Connected Vehicles
  - Automation
  - Emerging Capabilities
- Interoperability
- Enterprise Data
VISION
Transform the Way Society Moves

CONNECTED SOCIETY

Conduct research, development, and education activities to facilitate the adoption of information and communication technology to enable society to move more safely and efficiently.
AUTONOMOUS VEHICLES

- Autonomous & Driverless Car
  - Array of sensors to detect other vehicles and obstacles
  - Requires Detailed map
  - Use machine learning to make software smarter
  - Doesn’t rely on communication with other vehicles

Automated vehicle
Connected Vehicles (CV) are vehicles that can communicate with each other, roadside devices (traffic signals), or non-motorized users (smart phones and other advanced devices)

- Vehicle to Vehicle (V2V)
- Vehicle to Infrastructure (V2I)
- Vehicle to Anything (V2X)
Imagine a Transportation System in which
VEHICLES CAN SENSE & COMMUNICATE
Things That You Can’t.
CONNECTED AUTOMATION - GREATEST BENEFITS

**Autonomous Vehicle**
Operates in isolation from other vehicles using internal sensors

**Connected Automated Vehicle**
Leverages autonomous and connected vehicle capabilities

**Connected Vehicle**
Communicates with nearby vehicles and infrastructure
CONNECTED AUTOMATION - GREATEST BENEFITS

- Improving safety
  - Reduce and mitigate crashes

- Increasing mobility and accessibility
  - Expand capacity of roadway infrastructure
  - Enhance traffic flow dynamics
  - More personal mobility options for disabled and aging population

- Reducing energy use and emissions
  - Aerodynamic “drafting”
  - Improve traffic flow dynamics

...connectivity is critical to achieving the greatest benefits
Objective:
- Reduce the number and severity of adverse weather-related incidents (including secondary incidents) in the I-80 Corridor to improve safety and reduce incident-related delays.
  - Focused on the needs of the commercial vehicle operator in the State of Wyoming

Approach:
- Equip fleet vehicles (combination of snow plows, maintenance fleet vehicles, emergency vehicles, and private trucks) that frequently travel the I-80 corridor to transmit basic safety messages (BSMs), collect vehicle and road condition data and provide it remotely to the WYDOT TMCs
- Deploy DSRC roadside equipment (RSE) to supplement existing assets and initiatives
- Provide shared road weather data with freight carriers who will then transmit this data to their trucks using existing in-vehicle systems

Deployment Team:
- Prime Consultant: ICF International; Partner State: Wyoming DOT
- Sub Consultants: Trihydro Corporation, National Center for Atmospheric Research, University of Wyoming, Catt Laboratory and McFarland Management
ICF/WYOMING PILOT DEPLOYMENT SITE: HIGH PRIORITY CORRIDOR

Wyoming I-80 Corridor - Connected Vehicle Map

Legend

- High Profile Wind Warning Area
- AVL/Tablet Snow Plows
- STIP Areas 2015-2018

WyoLink - Signal Strength
- Good
- Spotty
- Unreliable

- I-80, Wyoming
- Possible Locations Roadsides DSRC
- Locations within 500 ft of I-80
- YSL Devices (122 on I-80)
- Truck Parking (55 on I-80)

Source: Wyoming CV Pilot Deployment Team
Objective:
- The primary objective of this deployment is to alleviate congestion and improve safety during morning commuting hours.
- Deploy a variety of vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) safety, mobility, and agency data applications to create reinforcing benefits for motorists, pedestrians, and transit operation.

Approach:
- Deploy a variety of connected vehicle technologies on and in the vicinity of reversible express lanes and three major arterials in downtown Tampa to solve the following transportation challenges:
  - Morning peak hour queues, wrong-way entries, pedestrian safety, bus rapid transit (BRT) signal priority optimization, trip time and safety, streetcar trolley conflicts, and enhanced signal coordination and traffic progression.

Deployment Team:
- Prime Consultant: Tampa Hillsborough Expressway Authority (THEA)
- Sub Consultants: HNTB Corporation, Siemens Industry, Inc., Booz Allen Hamilton, Center for Urban Transportation Research at University of South Florida and Global-5 Communications
TAMPA (THEA) PILOT DEPLOYMENT SITE
AN OVERVIEW OF DOWNTOWN TAMPA

- Pedestrian Conflict and Pedestrian Safety
- Morning Backups/Traffic Progression
- Trolley/Auto Conflicts
- Wrong Way Entries/Morning Backups/Traffic Progression
- BRT Optimization Trip Times/Safety
- Trolley/Auto/Bike/Pedestrian Conflicts

Study Area
CONNECTED VEHICLE APPLICATION
V2I SAFETY
- Curve Speed Warning
- Pedestrian in Signalized Crosswalk
- Mobile Accessible Pedestrian Signal (PED-SIG)

V2V SAFETY
- Emergency Electronic Brake Light
- Forward Collision Warning (FCW)
- Intersection Movement Assist (IMA)
- Vehicle Turning in Front of Bus

MOBILITY
- Intelligent Traffic Signal System (I-SIG)
- Signal Priority (Transit)

AGENCY DATA
- Probe-enabled Traffic Monitoring
Objective:
- Improve safety and mobility of travelers in New York City through connected vehicle technologies
- Aligned with the NYC’s Vision Zero initiative, which seeks to reduce crashes and pedestrian fatalities, and increase safety of travelers in all modes of transportation

Approach:
- Equip up to 8,000 vehicles (taxis, buses, commercial fleet delivery trucks, and City-owned vehicles) that frequently travel in Midtown Manhattan and Central Brooklyn to transmit and receive connected vehicle data
- Install V2I technology at high-accident rate arterials:
  - Upgrade 239 traffic signals along 1st, 2nd, 5th, and 6th Avenues in Manhattan and Flatbush Avenue in Central Brooklyn (emergency evacuation route)
  - Deploy Roadside equipment (RSE) along FDR Drive

Deployment Team:
- Prime Consultant: NYC DOT
- Sub Consultants: J HK Engineering, Battelle, Cambridge Systematics, KLD Engineering, Security Innovation and Region 2 University Transportation Research Center
**Manhattan Grid**
- Closely spaced intersections (600’ x 250’)
- Day vs. Night conditions
- Residential/commercial mix
- High accident rate (red dot) (2012-2014)
  - 20 fatalities
  - 5,007 injuries
- 204 intersections

**Central Brooklyn - Flatbush Ave**
- Over-Height restrictions
  - Tillary St.; Brooklyn Bridge
- High accident rate (red dots) (2012-14)
  - 1,128 injuries
  - 8 fatalities
- Average AM speed 15 mph
- 35 intersections

**Manhattan - FDR Drive**
- Limited access highway
- Excludes trucks/buses
- Short radius of curvature
- Over-Height restrictions
- $1,958,497 in Over-Height incident delay costs (2014)
  - 24% of City-wide total

Source: NYC DOT
The Smart City Challenge

- Encourage cities to put forward their best and most creative ideas for innovatively addressing the challenges they are facing.

- Demonstrate how advanced data and intelligent transportation systems (ITS) technologies and applications can be used to reduce congestion, keep travelers safe, protect the environment, respond to climate change, connect underserved communities, and support economic vitality.
Integrated Data Exchange (IDE)

Non-Transportation Data Sources

Data from Smart COLUMBUS Program

Transportation Data Sources

Integrated Data Exchange (IDE)

Private App Developers

Public Sector

Private Sector

Independent Evaluators

Source: The City of Columbus
Enhanced Human Services (EHS)
SMARTCOLUMBUSUS Districts

Source: The City of Columbus
SMARTCOLUMBUS Solutions

- Leverage the new COTA CMAX Bus Rapid Transit (BRT) Line
- Equip intersections with Dedicated Short Range Communications (DSRC) technologies
- Provide new mobility and safety applications
- Create neighborhood hubs providing transportation options
- Deploy Smart Lighting and free public Wi-Fi to improve safety, make the neighborhood more walkable, and provide access to information

Proposed Applications

- Dynamic Transit Operations
- Connection Protection
- Dynamic Ridesharing
- Integrated Multi-Modal Electronic Payment
- Transit Signal Priority
- Transit Stop Pedestrian Warnings
- Pedestrian in Signalized Crosswalk Warnings
- Vehicle Turning Right in Front of Bus Warnings
- Forward Collision Warning
- Emergency Brake Light Warning
- Eco-Approach and Departure
**SMARTCOLUMBUS Solutions**

**Autonomous Vehicles**
Three fixed routes supporting first mile / last mile (FMLM) equipped with inductive charging stations

**Enhanced Human Service**
Available via both a smartphone application and deployed kiosks

**CCTN Build Out**
Signal Phase and Timing (SPaT), Emergency Vehicle Preemption, and Transit Signal Priority

*Source: The City of Columbus*
Event Parking Management
- Partnership with Experience Columbus and associated agencies that collectively manage more than 42,000 parking spaces
- Multilingual, multi-modal trip planning application allowing travelers to “reserve and book” parking

Loading Zone Parking Management
- Video equipment capable of monitoring loading zones
- Install and operate a real-time parking availability service for freight delivery

Permit-Only Parking
- Radio frequency identification (RFID) stickers to collect information on the permitted vehicles in zones

Transit Benefit Program
SMARTCOLUMBUS Solutions

- Intelligent truck warning and routing application to minimize incidents due to low bridges or narrow roads
- Regional Truck Parking Information and Management System

Source: The City of Columbus
Early Deployer Technical Assistance: Accelerate testing and deployment of interoperable connected ITS technologies during the early stages of deployment when development of standards, best practices, and support systems and processes are also ongoing and collaboratively build upon the state of the practice.
Thank You

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