



# **Space-Based Position Navigation and Timing National Advisory Board**

## **Intelligent Transportation System (ITS) Evolution GPS/GNSS Role in Emerging Vehicle Fleets and Highway Infrastructure**

Brian P. Cronin, P.E.  
ITS Joint Program Office  
U.S. Department of Transportation (USDOT)  
December, 2014

# Today's Transportation Challenges

LIMIT  
35

## Safety

- 32,367 highway deaths in 2011
- 5.3 million crashes in 2011
- Leading cause of death (for ages 4, 11-27)



## Mobility

- 5.5 billion hours of travel delay
- \$121 billion cost of urban congestion



## Environment

- 2.9 billion gallons of wasted fuel
- 56 billion lbs of additional CO<sub>2</sub>



Data Sources:  
Traffic Safety Facts: 2010 Data, National Highway Traffic Safety Administration (June 2012)  
2011 Annual Urban Mobility Report, Texas Transportation Institute (Feb 2013)

# ITS JPO Key Programs

- Connected Vehicle Research
  - Safety
    - Vehicle to Vehicle (V2V)
    - Vehicle to Infrastructure (V2I)
    - V2X (pedestrians, motorcycles, cell phones etc.)
  - Mobility
    - Dynamic Mobility Applications
    - Real-Time Data Capture
  - Environment
    - Eco-Lanes / Eco Traffic Signals
- ITS Training
- Automated Vehicle / Cybersecurity Research
- ITS Standards and Architecture
- ICM, Road Weather, MSAA, MCOM, ATTR, and more Research



# Connected Vehicle Program



Image Source: USDOT

**Why It Matters** - Up to **80%** of non-impaired crash types may be impacted by connected vehicle technology



# CONNECTED VEHICLE APPLICATIONS

## V2I Safety

Red Light Violation Warning  
 Curve Speed Warning  
 Stop Sign Gap Assist  
 Spot Weather Impact Warning  
 Reduced Speed/Work Zone Warning  
 Pedestrian in Signalized Crosswalk  
 Warning (Transit)

## V2V Safety

Emergency Electronic Brake Lights  
 (EEBL)  
 Forward Collision Warning (FCW)  
 Intersection Movement Assist (IMA)  
 Left Turn Assist (LTA)  
 Blind Spot/Lane Change Warning  
 (BSW/LCW)  
 Do Not Pass Warning (DNPW)  
 Vehicle Turning Right in Front of Bus  
 Warning (Transit)

## Agency Data

Probe-based Pavement Maintenance  
 Probe-enabled Traffic Monitoring  
 Vehicle Classification-based Traffic  
 Studies  
 CV-enabled Turning Movement &  
 Intersection Analysis  
 CV-enabled Origin-Destination Studies  
 Work Zone Traveler Information

## Environment

Eco-Approach and Departure at  
 Signalized Intersections  
 Eco-Traffic Signal Timing  
 Eco-Traffic Signal Priority  
 Connected Eco-Driving  
 Wireless Inductive/Resonance  
 Charging  
 Eco-Lanes Management  
 Eco-Speed Harmonization  
 Eco-Cooperative Adaptive Cruise  
 Control  
 Eco-Traveler Information  
 Eco-Ramp Metering  
 Low Emissions Zone Management  
 AFV Charging / Fueling  
 Information  
 Eco-Smart Parking  
 Dynamic Eco-Routing (light  
 vehicle, transit, freight)  
 Eco-ICM Decision Support System

## Road Weather

Motorist Advisories and Warnings  
 (MAW)  
 Enhanced MDSS  
 Vehicle Data Translator (VDT)  
 Weather Response Traffic  
 Information (WxTINFO)

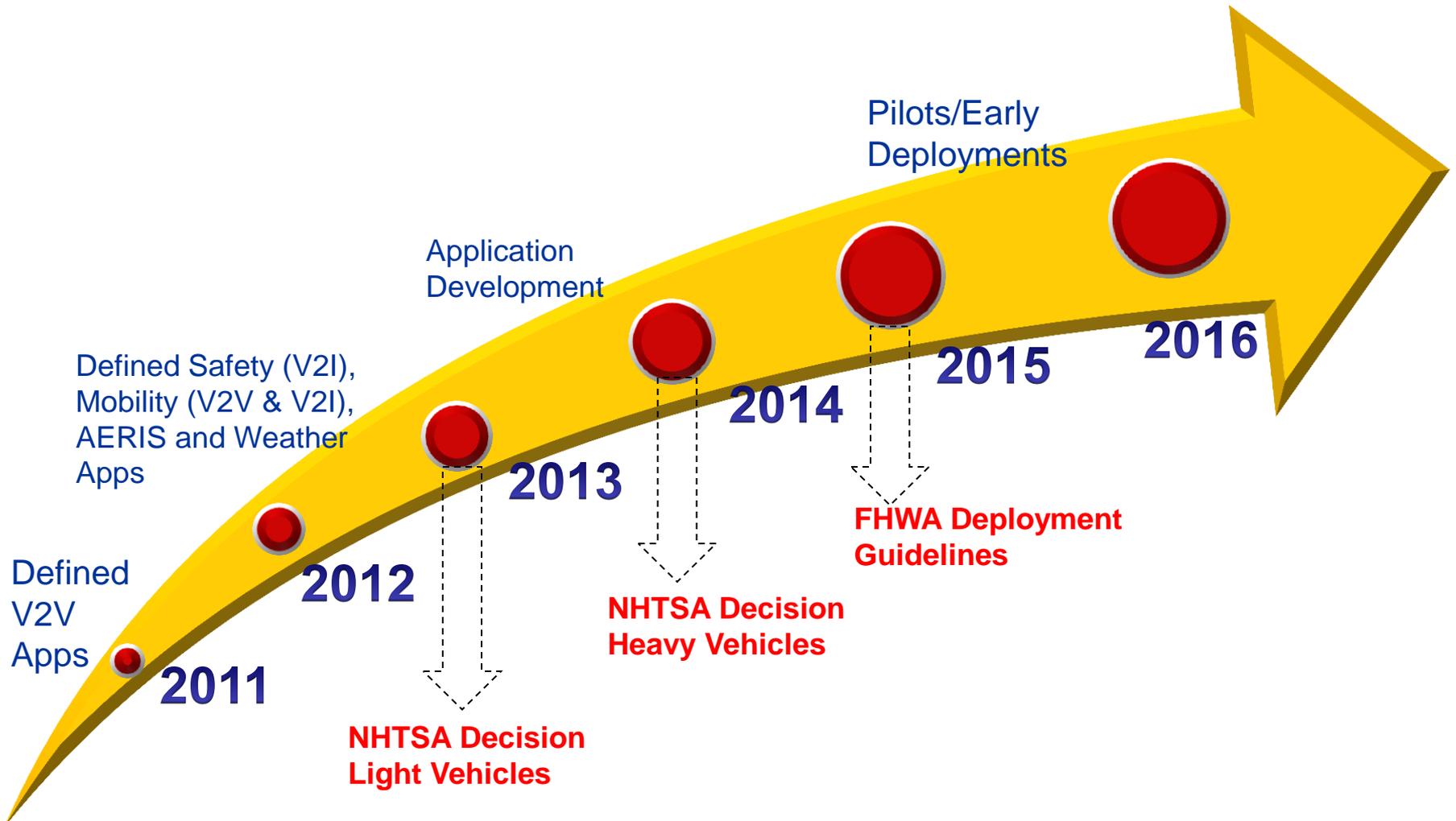
## Mobility

Advanced Traveler Information System  
 Intelligent Traffic Signal System  
 (I-SIG)  
 Signal Priority (transit, freight)  
 Mobile Accessible Pedestrian Signal  
 System (PED-SIG)  
 Emergency Vehicle Preemption (PREEMPT)  
 Dynamic Speed Harmonization (SPD-  
 HARM)  
 Queue Warning (Q-WARN)  
 Cooperative Adaptive Cruise Control  
 (CACC)  
 Incident Scene Pre-Arrival Staging  
 Guidance for Emergency Responders  
 (RESP-STG)  
 Incident Scene Work Zone Alerts for Drivers  
 and Workers (INC-ZONE)  
 Emergency Communications and  
 Evacuation (EVAC)  
 Connection Protection (T-CONNECT)  
 Dynamic Transit Operations (T-DISP)  
 Dynamic Ridesharing (D-RIDE)  
 Freight-Specific Dynamic Travel Planning  
 and Performance  
 Drayage Optimization

## Smart Roadside

Wireless Inspection  
 Smart Truck Parking

# The Path Toward Connected Vehicle Deployment



# NHTSA Decision on V2V for Light Vehicles

---

- Announced on February 3, 2014, for light vehicles
  - Primary purpose is to enable collision warnings to drivers prior to a crash
  - Based on several years of research including the Safety Pilot – a road test of nearly 2,800 equipped vehicles in Ann Arbor, Michigan
  - Security and privacy protections built into contemplated system
    - No exchange or recording of personal information
    - No tracking of vehicle movements
  - NHTSA beginning work on a regulatory proposal to require V2V devices in new light vehicles in a future year
  - Decision on heavy vehicles planned at end of 2014 / early 2015
- Automobile industry recently announced plans for Connected Vehicle equipage in 2017
- **Location Requirement is 1.5 meter absolute location. Applications use relative positioning.**



# Connected Vehicles Protect Privacy

---

- The USDOT is committed to ensuring that V2V technologies preserve personal privacy and that the system protects against unauthorized access. We recognize that we have to get this right for the public to have confidence in the technology.
- V2V technology does not involve exchanging or recording personal information or tracking vehicle movements. The information sent between vehicles does not identify those vehicles, but merely contains basic safety data.
- A vehicle or group of vehicles would be identifiable only if there is a need to fix a safety problem.



# Connected Vehicles Are Secure

---

- The connected vehicle system will contain several layers of security and privacy protection to ensure that vehicles can rely on messages sent from other vehicles.
- The USDOT is working on new ways to safeguard privacy and security within the V2V system. The agency is actively engaged with industry and security experts to ensure that privacy and security protections will be as comprehensive as possible when the system is deployed.
- During the Safety Pilot Model Deployment, NHTSA and its partners developed and tested a detailed prototype of a V2V communications security system, and more testing is planned.
- NHTSA working to establish an industry-based information sharing mechanism about vehicle cybersecurity threats.



# NHTSA V2V Decision for Heavy Vehicles

---

- NHTSA's decision is currently on track for the end of 2014 or early 2015.
- It includes all vehicles greater than 10,000 lb. GVWR such as medium- and heavy-duty trucks, buses, and single-unit trucks.
- This would also include transit vehicles that fit into those classes of vehicles.



# 2015 FHWA Guidance Will Help Communities Prepare for Connected Vehicles

---

- The FHWA is developing policy positions, guidance, guidelines, whitepapers, and practitioner tools to promote the smooth deployment of V2I technology by transportation system owners/operators.
- The guidance does not impose any new requirements on local governments.
- The FHWA will issue initial guidance in late 2015. This initial guidance is intended to assist in planning for future investments and deployment of V2I systems.
- This work will be harmonized with related efforts by other USDOT modal agencies.



# What the FHWA Guidance Is and Is Not

---

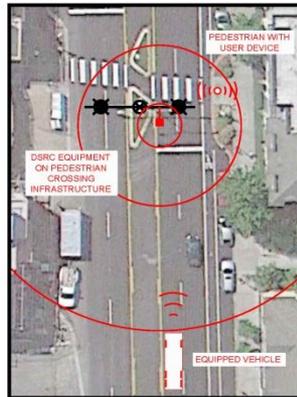
- *It is not a requirement* to implement infrastructure.
- It is a tool kit for local communities that suggests how to implement infrastructure and supporting systems for connected vehicles.
- It is a listing of high-priority applications that local communities should consider installing, including:
  - V2I safety applications (crash warnings at traffic signals, etc.)
  - Dynamic mobility applications
  - Road-weather applications
  - Environmental applications
- It is based on DOT research and AASHTO analysis of infrastructure needs and deployment approaches.



# Urban Intersection Example



1 INTERSECTION



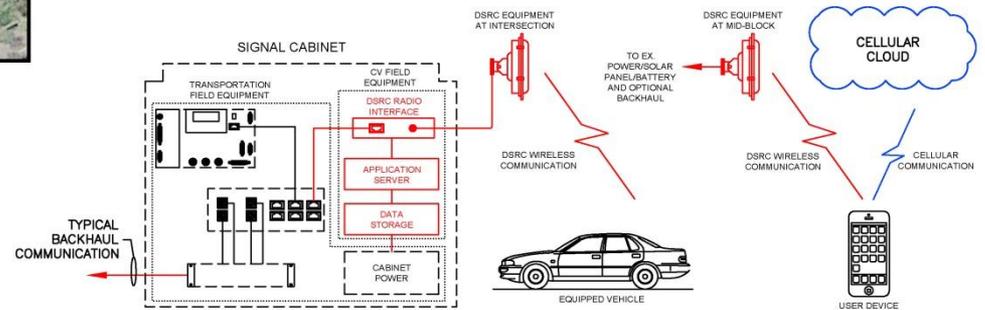
2 MID-BLOCK (OPTIONAL)



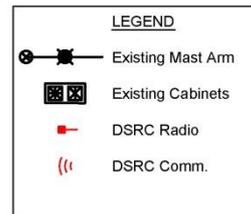
1 INTERSECTION INSTALLATION



2 OPTIONAL MID-BLOCK PEDESTRIAN CROSSING



3 COMMUNICATION AND POWER SCHEMATIC



**TYPICAL SETTING FEATURES**

urban intersections are junctions of two or more roads within a city setting which typically includes curbing, designated lane markings, and pedestrian crossings.

**CONCEPT EXAMPLE**

DSRC antennas communicate towards all approaches of the intersection and at a mid-block location to communicate with vehicles on the roadway.

- OTHER EXAMPLE APPLICATIONS**
- Red Light Violation Warning and Stop Sign Violation
  - Driver Gap Assist at Signalized Intersections and Stop Signs
  - Multimodal Intelligent Traffic Signal Systems
  - Advanced Arterial Management and Operations
  - Advanced Signal Operations



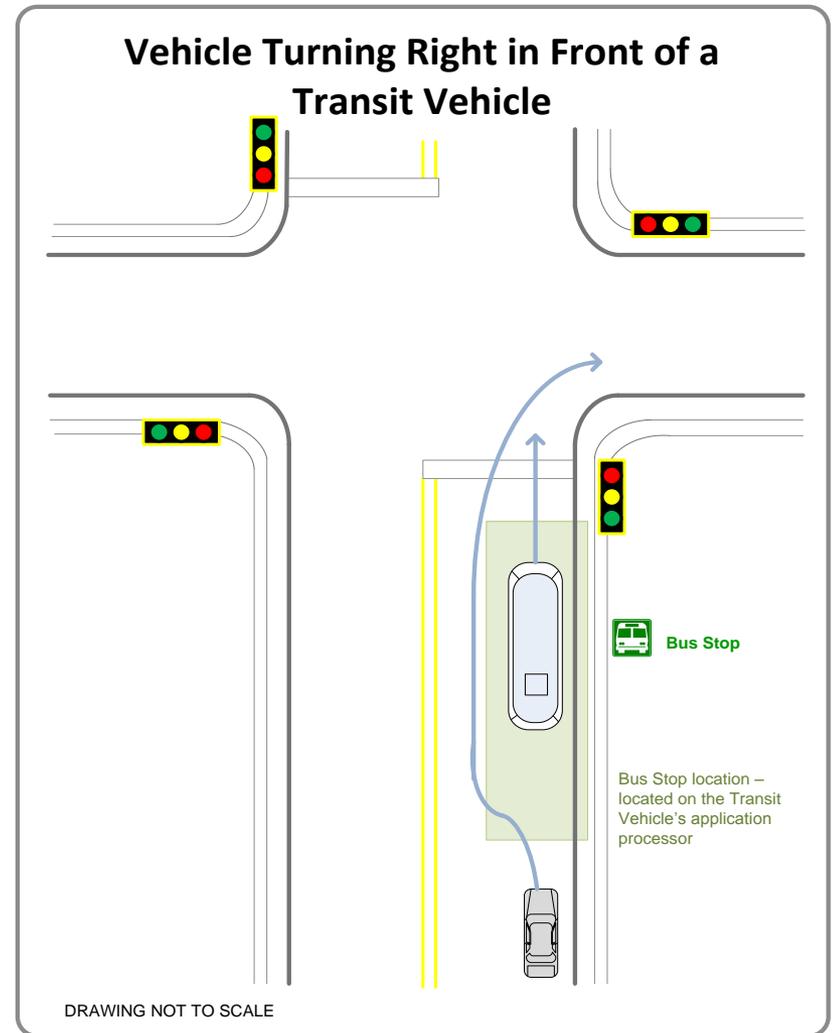
## Urban Intersection Deployment Concept

**NOT FOR CONSTRUCTION**



# Safety Applications

- Blind Spot Warning and Lane Change Warning (BSW/LCW)
- Do Not Pass Warning (DNPW)
- Emergency Electronic Brake Light (EEBL)
- Forward Collision Warning (FCW)
- Intersection Movement Assist (IMA)
- Left Turn Across Path (LTA)
- Transit Application: Pedestrian in Signalized Crosswalk Warning
- Transit Apps: Vehicle Turning Right in Front of Bus Warning



# The Safety Pilot Was a Big Success for Vehicle Safety

- Data collection exceeded our expectations
- Regular drivers experienced proven technology
- Connectivity was achieved across various types and modes

## Types of Data Collected:

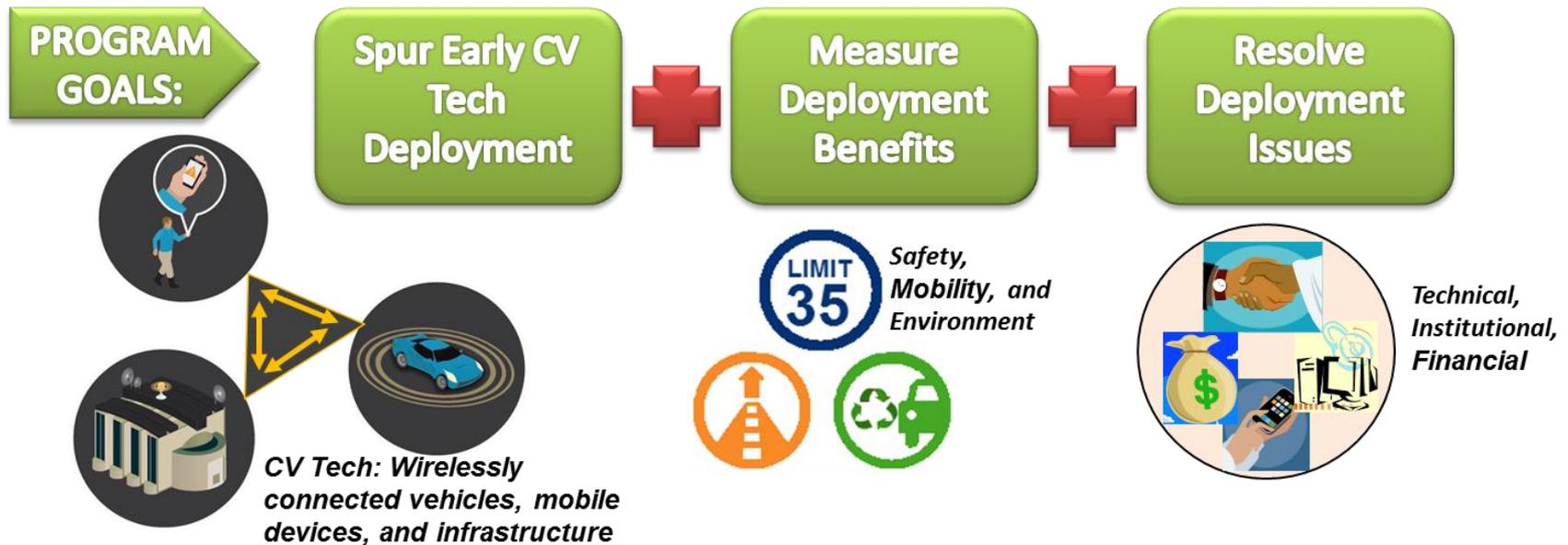
- Numerical data in-vehicle
- Wireless/GPS
- External sensors

## Volume of Data Collected:

- 2.3B database records
- 63,000 hours of video



# Connected Vehicle Pilots Go Beyond Safety Applications



## Proposed Program Schedule

- Summer-Fall 2014 - Regional Pre-Deployment Workshops/Webinars
- Early 2015 - Solicitation for Wave 1 Pilot Deployment Concepts
- Early 2017 - Solicitation for Wave 2 Pilot Deployment Concepts
- September 2020 - Pilot Deployments Complete

## Resources

- ITS JPO Website: <http://www.its.dot.gov/>
- CV Pilot Deployment Program Website: <http://www.its.dot.gov/pilots>



# SAMPLE DEPLOYMENT CONCEPT – DOWNTOWN SUNNYSIDE

## ~ Improving Congestion in an Urban Arterial Network ~

### Improve Transit Reliability

- Connection Protection
- Transit Signal Priority

### Improve Pedestrian Safety

- Signal System
- Pedestrian in Signalized Crosswalk Warning
- Intersection Movement Assist

### Improve Air Quality

- Eco-Approach and Departure at Signalized Intersections
- Eco-Traffic Signal Timing



***Synergies among applications increase benefits and reduce costs***



# Summary of US DOT ITS Program

---

- US DOT successfully developing diverse ITS transportation solutions across vehicles and infrastructure
- ITS research is delivering real capability and value to states, industry and the public
- ITS JPO is addressing strategic issues in transportation in:
  - Connected Vehicles
  - Automated Vehicles
  - Enterprise Data
  - Interoperability
  - Technical Assistance and Deployment
  - Emerging Capabilities



# 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.



Source: Carnegie Mellon University



Source: Carnegie Mellon University

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



# Contact Information

- Brian Cronin
- [Brian.cronin@dot.gov](mailto:Brian.cronin@dot.gov) <http://www.its.dot.gov>

**Intelligent Transportation Systems Joint Program Office**

Updated January 27, 2014 12:01

Print page

### Intelligent Transportation Systems (ITS) ePrimer

Build your knowledge and expertise in ITS with a new, easy-to-use, FREE Web resource.

The ITS ePrimer provides transportation professionals, educators, students, and others with a series of up-to-date, Web-based modules describing key ITS topics, with a multimodal perspective.

U.S. Department of Transportation

1 2 3 4 5 6 7 8 >

#### Help Develop the Federal Highway Administration (FHWA) 2015 Guidance for Connected Vehicles

Read more...

**Spotlight**

- Letter to Stakeholders from ITS JPO Director Ken Leonard 1/27/14
- Kevin Dopart Joins the Intelligent Transportation Systems Joint Program Office (ITS JPO) Team 1/22/14
- Second Public Meeting on the Connected Vehicle Reference Implementation Architecture 1/16/14

More News>>

#### Our Current Research

Applications Mode-Specific Cross-Cutting

- ▶ Vehicle-to-Vehicle Safety
- ▶ Vehicle-to-Infrastructure Safety
- ▶ Real-Time Data Capture
- ▶ Dynamic Mobility Applications
- ▶ Environment
- ▶ Road Weather
- ▶ Connected Vehicle Policy

More >>

#### CONNECTED VEHICLE TECHNOLOGY

#### Connected Vehicle Test Beds

#### Procurement Opportunities

#### Stay Connected

Facebook Twitter Email RSS

Share