TODAY'S AGENDA

- Gene McHale
  Team Leader, FHWA Office of Operations R&D

  - □ Connected Vehicle Pilot Deployment Program Overview
  - □ Open Data

- Randy Butler
  Manager, FHWA Freight Operations and Technology

  - □ Open Source
  - □ Performance Measurement

- Stakeholder Q&A

Connected Vehicle Pilot Deployment Program Overview

PROGRAM GOALS

ORGANIZING PRINCIPLES AND REQUIREMENTS

- **Organizing Principles**
  - Problem-Driven
  - Multiple Pilot Sites
  - Large-Scale and Multi-Modal
  - Multiple Applications Deployed Together

Source: U.S DOT

- **Deployment Requirements**
  - Multiple Forms of Communication Technologies
  - Data Capture and Sharing
  - Quantifiable Performance Measures
  - Security and Credentialing Management System

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

CV PILOTS DEPLOYMENT SCHEDULE AND RESOURCES

- Proposed CV Pilots Deployment Schedule

Schedule Item	Date
Regional Pre-Deployment Workshop/Webinar Series	**Summer-Fall 2014**
Solicitation for Wave 1 Pilot Deployment Concepts	**Early 2015**
Wave 1 Pilot Deployments Award(s) Concept Development Phase (6-9 months) Design/Build/Test Phase (10-14 months) Operate and Maintain Phase (18 months)	**September 2015**
Solicitation for Wave 2 Pilot Deployment Concepts	**Early 2017**
Wave 2 Pilot Deployments Award(s) Concept Development Phase (6-9 months) Design/Build/Test Phase (10-14 months) Operate and Maintain Phase (18 months)	**September 2017**
Pilot Deployments Complete	**September 2020**

- Resources
  - ITS JPO Website: http://www.its.dot.gov/
  - CV Pilots Program Website: http://www.its.dot.gov/pilots

CV Pilots Website

http://www.its.dot.gov/pilots

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Research
- ▸ Safety
- ▸ Mobility
- ▸ Environment
- ▸ Road Weather
- ▸ Policy
- ▸ Connected Vehicle Technology
- ▾ CV Pilots Deployment Project
  - • Pilots Deployment Project
- ▸ Short-Term, Intermodal Research
- ▸ Exploratory Research
- ▸ ITS Cross-Cutting Support
- ▸ Success Stories

Connected Vehicles
CV Pilots Deployment Project

Latest News & Updates
- Sample Deployment concept audio recordings for District 13 Operations is now available (9/23/14)
- Sample Deployment concept audio recordings for Greypool County is now available (9/22/14)
- Deployment concept audio recordings for Downtown Sunnyside and H.W. Halleck Expressway are now available (9/18/14)
- CV Pilots FAQs (Updated September 16, 2014)
- Webinar Part 1 recording is now available - August 27, 2014 - Webinar Series Part 1: Concept, Phases, Waves, and Partnerships (9/4/14)
- The USDOT Connected Vehicles Pilot Deployment Program Webinar Series Part 2: Communications and Role of DSRC is open for registration
- The presentation material of the USDOT Connected Vehicles Pilot Deployment Program Webinar Series Part 1 is available now
- The Descriptions of the Connected Vehicle Applications are available now
- Summary of Responses to the Connected Vehicle Pilot Deployment Program's Request for Information (RFI)

More news »

About the CV Pilots Deployment Project

The U.S. DOT (DOT) connected vehicle research program is a multimodal initiative that aims to enable safe, interoperable networked wireless communications among vehicles, infrastructure, and personal communications devices. Connected vehicle research is sponsored by the DOT and others to leverage the potentially transformative capabilities of wireless technology to make surface transportation safer, smarter, and greener. Research has resulted in a considerable body of work supporting pilot deployments, including concepts of operations and prototyping for more than two dozen applications. Concurrent Federal research efforts developed critical cross-cutting technologies and other enabling capabilities required to integrate and deploy applications.

Based on the successful results of the connected vehicle research program, and the recent decision by NHTSA to pursue vehicle to vehicle communications safety technology for light vehicles, a robust connected vehicle pilots program is envisioned as a mechanism to spur the implementation of connected vehicle technology. These pilots will serve as initial implementations of connected vehicle

CV Pilots Portal

[?] **CV Pilots FAQs**

🌐 **CV Applications**

Deployment Concepts

🔗 **Featured Links**

- Active Transportation and Demand Management (ATDM
- Connected Vehicle Reference Implementation Architecture (CVRIA) and SET-IT
- Connected Vehicle Test Beds
- Open Source Application Development Portal (OSADP)
- Research Data Exchange (RDE)
- Safety Pilot
- Vehicle-to-Infrastructure (V2I) Prototype
- ITS Professional Capacity Building Program (PCB)

Research Contact

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Open Data

OPEN DATA OVERVIEW

- **Definition**
  - Open data is data that can be freely used, reused and redistributed by anyone - subject only, at most, to the requirement to attribute and sharealike. (http://opendatahandbook.org/)

- **Characteristics of Open Data**
  - Reusable by third parties with few or no restrictions
  - Available at little or no cost
  - Discoverable (easy to find)
  - Usable (documented, in standard formats)

- **Open Data Concerns**
  - Protecting privacy
  - Protecting data of individual entitles (e.g. Commercial carriers)

- **Commons License Open Data License**
  - Free to: Share, Create, and Adapt data
  - Long as you: Attribute, Share-Alike, Keep open
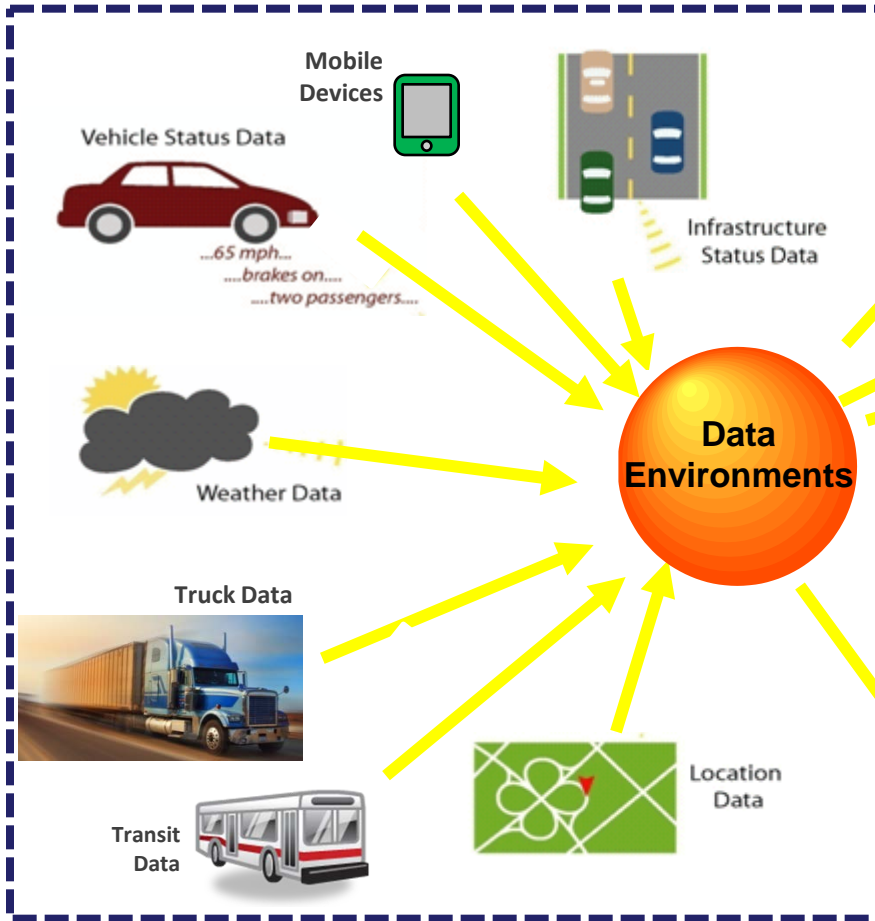
OPEN DATA IN PILOT DEPLOYMENT

- CV Pilot program intends to make all **data open. Why?**

    - Pilot Deployments are intended to INFORM and GUIDE broader mainstream deployment of Connected Vehicle technologies, through….

    - Data Preservation and Sharing
        - Collect, organize and archive pilot deployment data for research
        - Archive or make available as real-time feed in Research Data Exchange (RDE)
        - Share experience with all stakeholders considering their own future deployments

    - Supporting Concurrent or Follow-On Research Efforts, such as:
        - How can the expected *large volume* of data from CV applications be efficiently managed?
        - How can the *variety of data* and new data sources in a CV environment enable new applications and services?
        - How can data *quality control* be implemented in a real-time CV environment?

CV DATA ENABLES CV APPLICATIONS

Real-time Data Capture and Management

Mobile Devices

Vehicle Status Data

...65 mph...
....brakes on....
....two passengers....

Infrastructure Status Data

Weather Data

Truck Data

Transit Data

Location Data

Data Environments

Connected Vehicle Applications

Reduce Speed 35 MPH

Weather Application

Transit Signal Priority

Real-Time Travel Info

Fleet Management/ Dynamic Route Guidance

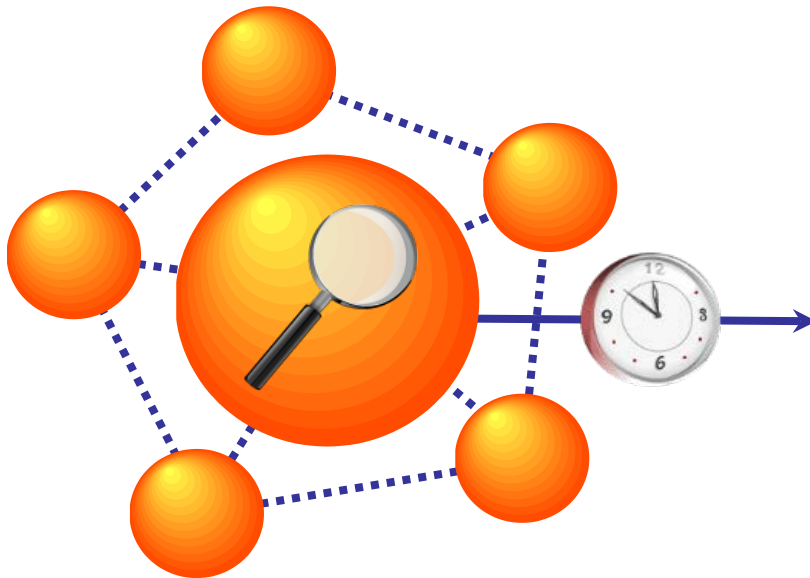Signal Phase & Timing Adjusts Real-Time Conditions

Safety Alerts and Warnings

RESEARCH DATA EXCHANGE (RDE)

www.its-rde.net

- Promotes sharing of archived and real-time connected vehicle data collected in USDOT-sponsored research efforts and field tests
- 2 TB of well-organized and documented data
- Drawn from a dozen geographic locations across the country
- Multi-source data (traditional sensor plus probe and connected vehicle data)
- Search and download functions
- **RDE Release 2.0 is now available**
- **Detailed data submission guidelines by Jan 2015**

Open Source

OPEN SOURCE OVERVIEW

- **Definition**
    - Software that gives users the right to run, copy, distribute, study, change, and improve it as they see it, without having to ask permission from or make fiscal payments to any external group or person. (http://opensource.org/osd)

- **Requirements** in the Pilot Deployment
    - New software developed using Federal funding must be open source.
    - Existing software brought to the project and not modified need not be made open source
    - Modify existing proprietary software or combined Federal / private funding of new software development will be a case by case basis
        - emphasis will be on making the changes or alterations open source, where possible
    - The USDOT encourages the use of "permissive" open source licenses, such as the Apache license

OPEN SOURCE APPLICATION DEVELOPMENT PORTAL
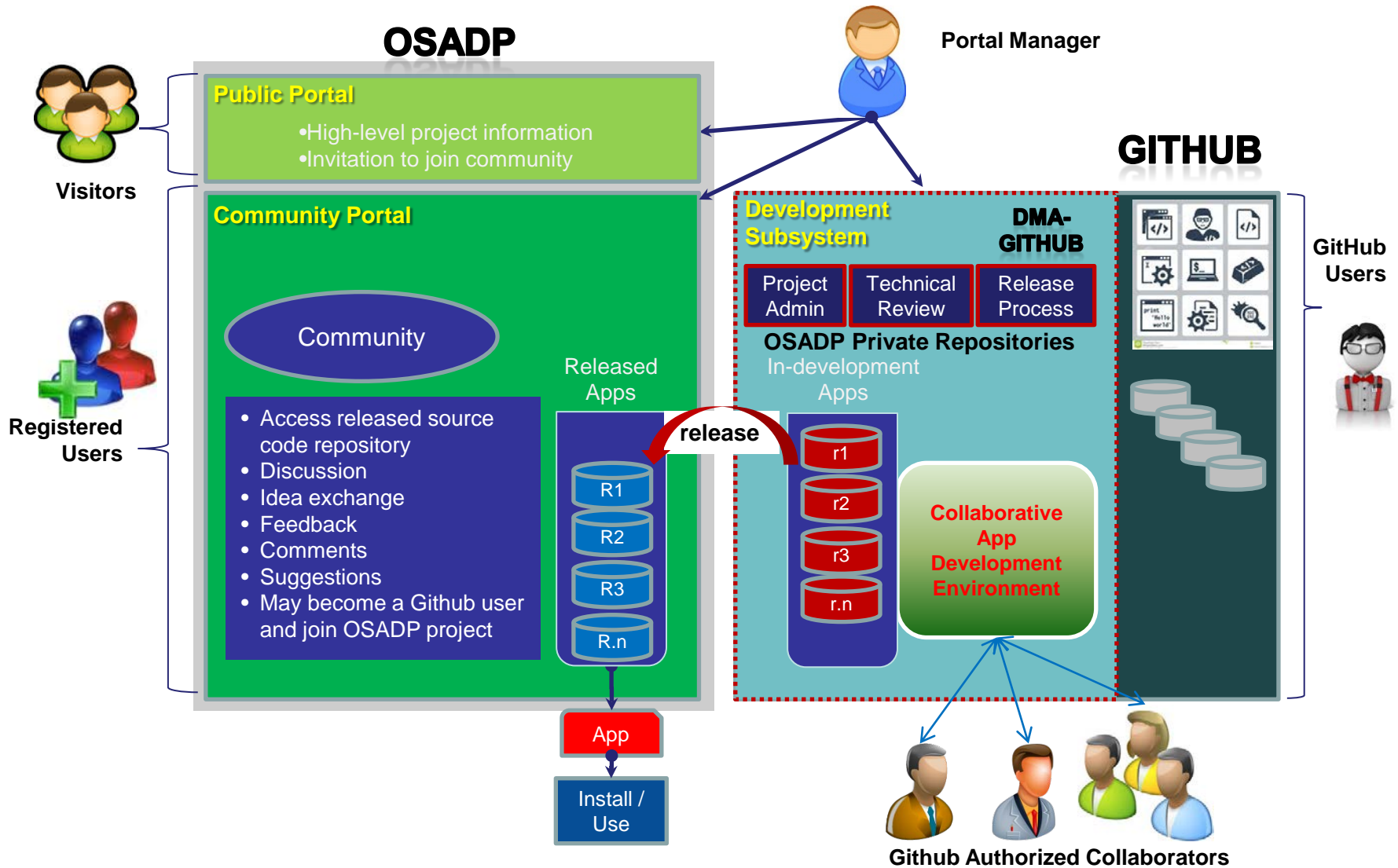
www.itsforge.net

- Portal for sharing documentation and source code from USDOT-sponsored application prototyping efforts
- By end of 2014, will be populated with materials describing 10+ connected vehicle applications
- Contributed code must meet documentation guidelines
- Search and download functions
- **Release 1 is now available to the public**

- **Purpose**: Develop, operate, and maintain an open source portal that will enable multiple stakeholders to collaborate on application development

- **Coordination**: Application bundles require concurrent, collaborative development
  - For example, in the MMITSS bundle, pedestrian signal phases in the PED-SIG application must be coordinated with applications providing priority or pre-emption services
  - This coordination extends to both DMA-funded application development and research conducted at UTCs and other organizations

- **Transparency**: the Open Source Portal provides the mechanism to ensure application development is transparent and broadly available

OPEN SOURCE IN THE OSADP

- Case 1: New Code, Acceptable Open Source License
- Case 2: New Code, Copyright Transferred to USDOT
- Case 3: New or Modified Code, Signed Contributor License Agreement
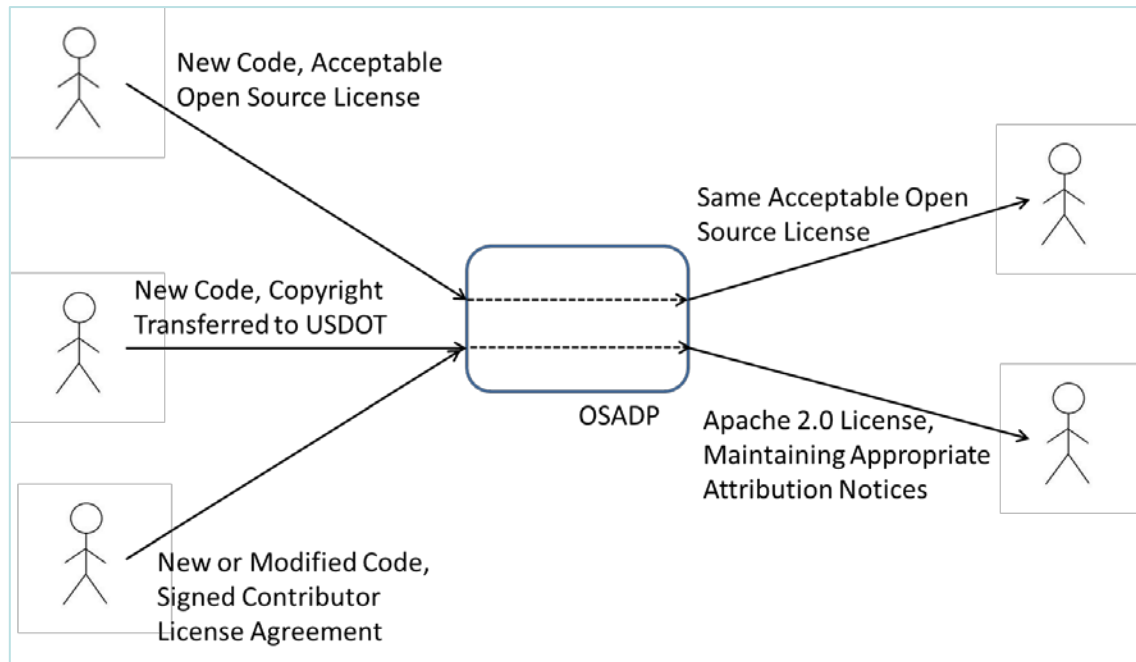
- Cases 2&3: The code, if accepted, will be released by USDOT under the Apache 2.0 License

APACHE 2.0 OPEN SOURCE LICENSE: OVERVIEW

Can	Cannot	Must
Download and use for free	Redistribute without proper attribution	Include License in any redistribution that includes the software
Incorporate software in proprietary package you create	Use any Trademarks or Logos that may State that the Organization Endorses your Distribution	Document which files where modified in any New Distribution
Make changes without having to resubmit as open source	Restrict use of the software	

Performance Measurement

PERFORMANCE MEASUREMENT REQUIREMENTS

- Pilot deployments must address a critical problem
  - A **problem-driven** deployment process
  - Must have measureable impacts

- Pilots deployment must have performance-driven capability for **self assessment**
  - Quantitative performance measures supporting continuous improvement
  - Support an independent evaluation effort

- Assessment **frequency** depending on the types of measurements
  - Hourly, daily, weekly, monthly
  - Over a long term and continuity

FOLLOWING THE PILOT DEPLOYMENT PROCESS

- **Pilot Deployment Concept Development Process**
  - Identify Local Needs
  - Set Performance Goals
  - Select CV Applications That Work Together Meet Those Goals

- **USDOT Sample Pilot Concepts from Hypothetical Locations**
  - Hypothetical, but realistic examples of localities applying the pilot deployment concept development process

- **Using I-876 Productivity Corridor as an example**
  - Problem-driven pilot deployment
  - Self-assessment capability "built-into" operational system

I-876 PRODUCTIVITY CORRIDOR
~ IDENTIFY KEY TRANSPORTATION CHALLENGES ~

- **Freight Productivity**
  - Heavy congested freeways interferes with timely and reliable freight movement and hinders economic development
  - Underutilized freight facilities, infrastructure, and mobile assets
  - Frequent empty moves within the corridor create non-optimal utilization of assets
  - Port, airport and inter-modal access subject to surge demand and long waits
- **Truck Safety**
  - Truck-vehicle conflicts in hilly merge/weave sections near interchanges
  - Truck-involved crashes caused by lane changing and blind spots

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I-876 PRODUCTIVITY CORRIDOR
~ STAKEHOLDERS SET THREE PERFORMANCE TARGETS ~

| Goal	Performance Measure	Performance Target
Improve Truck Travel Times	Freight travel times	Reduce freight vehicles travel times by 17%
Reduce Number of Wasted Trips	Number of wasted truck trips	Reduce the number of wasted trips by 15%
Improve truck safety	Number of truck related conflicts	Reduce truck-related conflicts by 30%

Applications Selected

- Improve Freight Productivity
  - Freight Advanced Traveler Information System (FRATIS)
  - Drayage Optimization (DRG-OPT)
  - Freight Signal Priority (FSP)
- Improve Truck Safety
  - Smart Truck Parking
  - Curve Speed Warning (CSW)
  - Do Not Pass Warning (DNPW) /Lane Change Warning (LCW)

I-876 PRODUCTIVITY CORRIDOR
~ SELF ASSESSMENT EXAMPLES ~
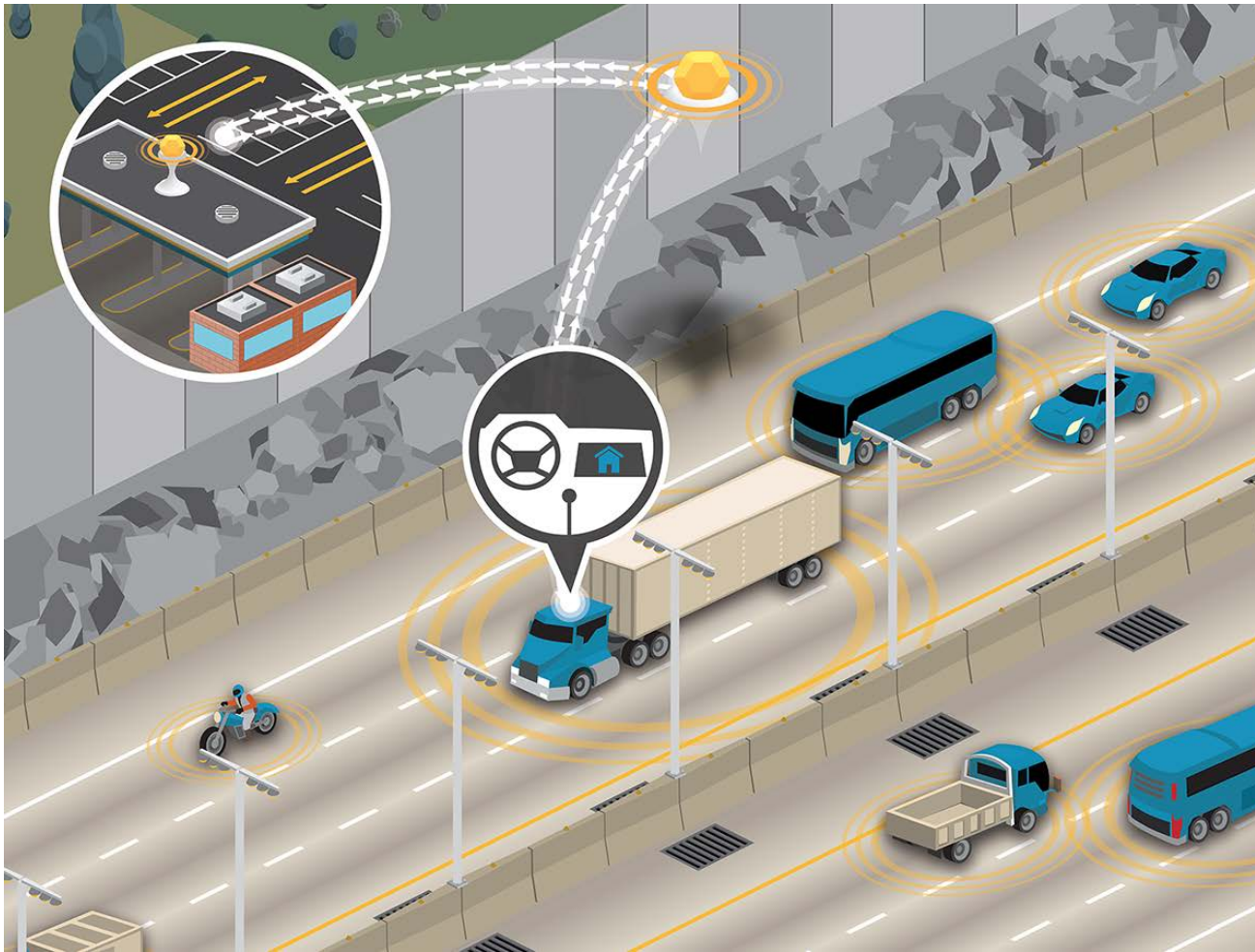
Truck Safety Apps
- Smart Truck Parking
- Curve Speed Warning
- Do Not Pass Warning /Lane Change Warning

Safety Related PMs
- Number of truck-vehicle conflicts
- Number of truck-involved crashes
- Number of unsafely parked trucks in rest areas/"hotspots"
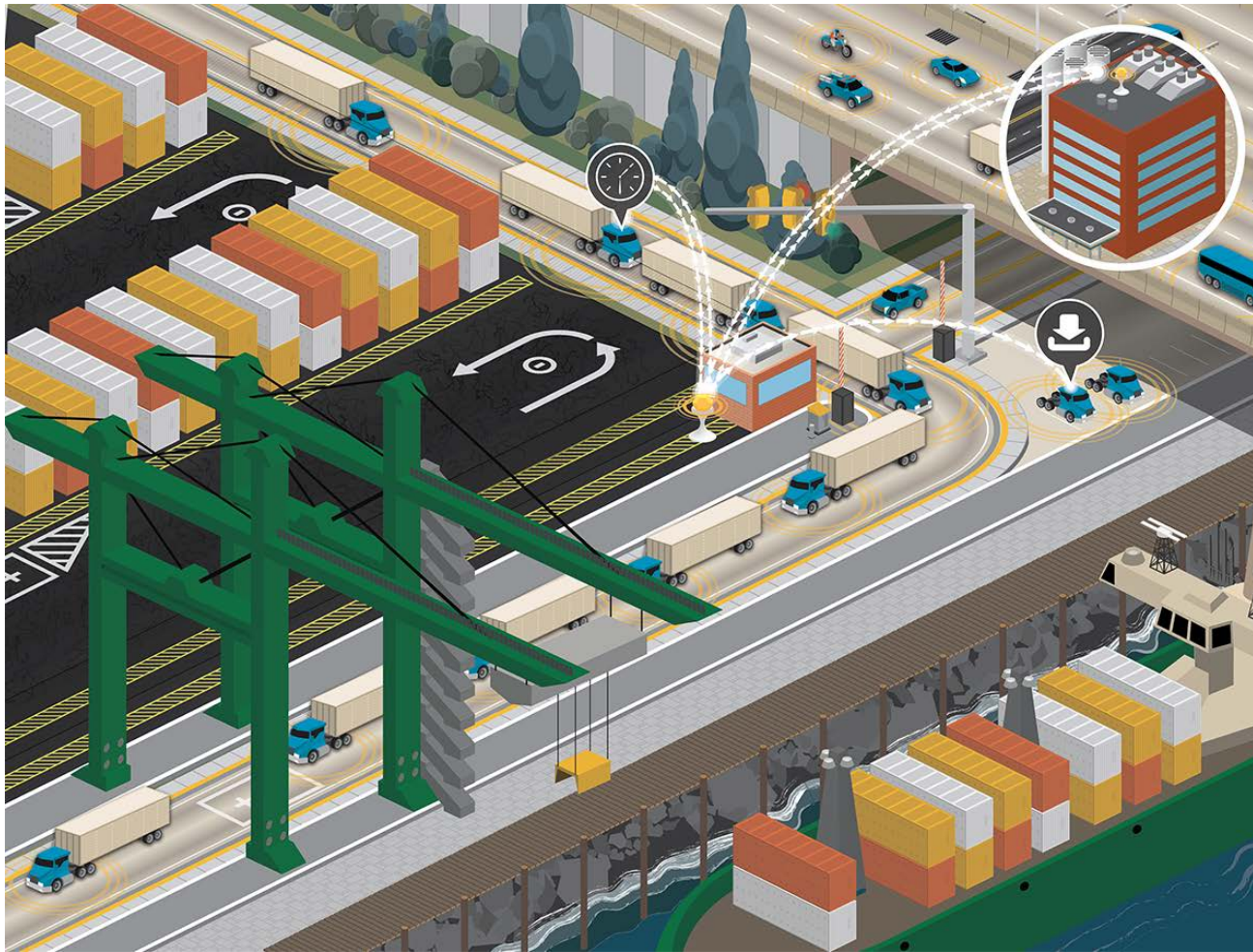
Possible Approaches
- Video detection in safety hotspot to count conflicts/crashes
- Count trucks unsafely parked in rest areas each night (hourly)

I-876 PRODUCTIVITY CORRIDOR
~ SELF ASSESSMENT EXAMPLES ~

Truck Mobility Apps
- Freight Advanced Traveler Information System
- Drayage Optimization
- Freight Signal Priority

Mobility Related PMs
- Number of empty/ wasted trips
- Freight travel times
- Truck wait times to intermodal facilities

Possible Approaches
- Partner with drayage companies to measure fleet travel time/ efficiency
- Install Bluetooth readers and roadside units on approaches to intermodal facilities

WRAP UP ON PERFORMANCE MEASUREMENTS

- Focus on a few key measures

- Performance-measurement should be "built in" to the pilot deployment

- Supports continuous improvement/dynamic management

- Measure actual improvements relative to deployment goals

Stakeholder Q&A