CONNECTED VEHICLE PILOT
Deployment Program

Data Sharing with the
Research Data Exchange

Jon Obenberger, FHWA, Walter During, FHWA, Richard Glassco, Noblis

ITS Joint Program Office
Agenda

- Purpose of this Technical Assistance Webinar Series
  - To assist early deployers of connected vehicle technologies to conduct Concept Development activities

- Webinar Content
  - Topics related to Sharing Data with USDOT and the Public
  - Stakeholder Q&A
  - How to Stay Connected

- Webinar Protocol
  - Please mute your phone during the entire webinar
  - You are welcome to ask questions via chatbox at the Q&A Section
  - The webinar will be recorded except the Q&A Section
  - The webinar recording and the presentation material will be posted on the CV Pilots website within a week
Webinar Objectives

- Highlight the range of issues to consider with collecting, preparing, and submitting data from USDOT-Supported connected vehicle deployments for posting on the Research Data Exchange or storage in a USDOT controlled archive

  - Data desired from Connected Vehicle Pilot Projects (Walter During)

  - Description of the Research Data Exchange and data delivery procedures (Jon Obenberger)

  - Issues for consideration for posting data (Richard Glassco)
Data Sharing for CV Pilot Deployment Program

Walter During, P.E.
Transportation Specialist, FHWA
PROGRAM GOALS

- Participate in Concept Development Phase Webinars for the three Pilot Sites (see website for exact dates and times)

- Visit Program Website for Updates: [http://www.its.dot.gov/pilots](http://www.its.dot.gov/pilots)
- Contact: Kate Hartman, Program Manager, Kate.hartman@dot.gov
Sites Selected – 2015 Awards

ICF/Wyoming

- Reduce the number and severity of adverse weather-related incidents in the I-80 Corridor in order to improve safety and reduce incident-related delays.
- Focused on the needs of commercial vehicle operators in the State of Wyoming.

New York City

- Improve safety and mobility of travelers in New York City through connected vehicle technologies.
- Vehicle to vehicle (V2V) technology installed in up to 10,000 vehicles in Midtown Manhattan, and vehicle to infrastructure (V2I) technology installed along high-accident rate arterials in Manhattan and Central Brooklyn.

Tampa (THEA)

- Alleviate congestion and improve safety during morning commuting hours.
- 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 transportation challenges.
Appropriately prepared system control, performance and evaluation data are expected to be shared with the USDOT and posted in timely fashion on resources such as the Research Data Exchange.

Data sharing. Connected vehicle, mobile device, and infrastructure sensor data captured during the operational phase of the effort is expected to be broadly shared with the community to inform other deployers and prospective deployers of connected vehicle applications.

The Performance Measurement Plan shall include a Data Sharing Framework, a description of performance measurement data to be generated and transmitted to COR, including the frequency of these updates…
Role of Evaluation Data

- The three key goals of CV Pilot deployment are:
  - Spur CV Deployment
  - Measure impacts and benefits
  - Resolve deployment Issues

- To meet the second goal, we need to measure the benefits and attribute these benefits to CV applications and technologies.

- There are two ways of measuring these impacts & benefits; namely:
  - The site will measure the performance of their system
  - In parallel, there will be an independent evaluation
  - Thus, evaluation is not a side activity. It is central to the CV Pilots
Data Submitted to USDOT

- Type of Data Collected by CV Pilot or Independent Evaluators
  - Performance Data – Collected by pilot teams
  - Evaluation Data – Collected by pilot teams or independent evaluators
  - Contextual Data – provided by pilot teams

- Sharing Data
  - All need to be transmitted to USDOT
    - May be posted on RDE for public distribution if
      - No PII or other sensitive info
      - Agreed by pilot team
    - Otherwise, stored on Saxton Lab for restricted use only

- Review and Remove Sensitive Data Prior to Posting on RDE
Documentation of Data Attributes

- Performance Measurements and Evaluation Data will be worked out between the teams and the USDOT.

- Attributes for these data will include:
  - Frequency
  - Precision
  - Units
  - Level of aggregation

- These attributes will be documented in:
  - Data Sharing portion of the Performance Measurement Plan
  - Data Sharing portion of the System Requirements Specification
References and Contact Info

- **References**
  - CV Pilot Deployment Program Website
    - [http://www.its.dot.gov/pilots](http://www.its.dot.gov/pilots)
  - CV Reference Implementation Architecture
  - CV Open Source Application Development Portal
    - [http://www.itsforge.net/about](http://www.itsforge.net/about)
  - CV Pilot Technical Assistance Webinars
    - [http://its.dot.gov/pilots/technical_assistance_events.htm](http://its.dot.gov/pilots/technical_assistance_events.htm)

- **Speaker Contact Info**
  Walter During, P.E.
  Transportation Specialist, FHWA
  [Walter.During@dot.gov](mailto:Walter.During@dot.gov)
Sharing Connected Vehicle Data on the Research Data Exchange (RDE)

Jon Obenberger, PhD, P.E.

Senior Transportation Research Engineer, FHWA
USDOT ITS Strategic Plan & Sharing Connected Vehicle Data

- Connected Cities Program
- Connected Data Systems Program
- Mobility on Demand Program
- Road-Weather Management Program
**Vision** – Showing how emerging data can transform surface transportation systems management

**Mission** – The CDS Program seeks to develop scalable data management and delivery methods,

- Exploiting the potential of high-volume multi-source data from connected and automated vehicles, connected travelers with mobile devices & other sources,
- To enhance current operational practices & transform surface transportation system management
Program Initiatives:

1. Leveraging Emerging Data Sources
2. Optimizing Data Generation and Transmission
3. Harnessing Next Generation Analytics
4. Developing Advanced Transportation Data Management Capabilities
5. Enhancing Legacy Transportation Management Systems
6. Enabling Stakeholders' Research and Use of Connected Vehicle Data
What is the Research Data Exchange

Welcome to the Research Data Exchange

The Research Data Exchange (RDE) is developed as a transportation data sharing system that promotes sharing of both archived and real-time data from multiple sources (including vehicle probes) and multiple modes. This new data sharing capability will better support the needs of ITS researchers and developers while reducing costs and encouraging innovation.

The primary purpose of the DCM (Data Capture and Management) Research Data Exchange is to provide a variety of data-related services that support the development, testing, and demonstration of multi-modal transportation mobility applications being pursued under the USDOT ITS Dynamic Mobility Applications (DMA) Program and other connected vehicle research activities. Data accessible through the Research Data Exchange will be well-documented and freely available to the public. The vision of the DCM Program is to enhance current operational practices and transform future transportation systems management through the active acquisition and systematic provision of integrated data from infrastructure, vehicles, and travelers. This data is available to researchers, application developers, and others.

Promotes:

• Sharing
  Collecting & providing access to

• Archived & real-time connected vehicle & traveler data

www.its-rde.net
Data Environments in the RDE

- **14 Current Data Environments:**
  - CV data from Leesburg, Ann Arbor, Orlando, and Detroit
  - Road Weather warnings from Detroit demo
  - Multi-modal traffic and signal data from Pasadena, Seattle, Portland, and San Diego
  - Probe data from Southeast Michigan testbed

- **8 Data Environments Coming Soon - Dynamic Mobility Applications**
  - Multi-Modal Intelligent Signal Systems (MMITSS)
  - Intelligent Network Flow Optimization (INFLO)
  - Integrated Dynamic Transit Operation (IDTO)

- **25+ New Data Sets to Be Added to RDE in 2016**
Identifying and Adding Data to the RDE

New data sets are added to the RDE as they become available:

- From other USDOT projects
- From outside submissions

Data Submission Process

- Researchers invited to submit data to add to RDE
  - Use “Contact Us” link under the “About” pull-down menu.
- USDOT reviews & assesses potential data:
  - Value
  - Quality
- Data added to RDE when it passes this review & criteria
Process for Posting Data

- Data is not posted directly to the RDE

- USDOTs review of data ensures quality, completeness & documentation before posting on RDE

- Sensitive information that cannot be removed from data sets are stored in Saxton Transportation Lab & use limited based on constraints established

- Requirements for data made available in the Saxton Lab are the same as for data submitted for the RDE
Process for Submitting Data

1. Identify Data Source(s)
   - Identify point of contact (POC) and discuss feasibility of obtaining data from the source(s)
   - Synthesize available information from a given source
   - Add data source(s) to list of possible data capture opportunities

2. Assess Data Source(s)
   - Coordinate with POC to obtain information to assess data’s research potential
   - Assess research potential of data and feasibility for capture on the RDE
   - Prepare assessment plan for data set(s) and recommend action for further consideration
   - Obtain approval of plan to obtain sample data set(s) and evaluate feasibility

3. Obtain Sample Data Set(s)
   - Provide data capture and management guidance to data provider(s)
   - Obtain sample data set(s) and supporting information from POC
   - Review data set(s), and verify data quality

4. Assess Sample Data Set(s)
   - Assess and determine research usefulness of data set(s) in sample
   - Recommend action for obtaining additional data for RDE/STOL or recommend action for RDE to federate to data source
   - Revise data set assessment plan, if needed, and obtain approval

5. Obtain Specified Data Set(s)
   - Prepare a tailored, specific data request & provide data capture guidance
   - Request additional data set(s) from data provider(s)
   - Review data set(s) & coordinate with POC to obtain specific information

6. Prepare Data Set(s) for Posting or Storing
   - Cleanse data and rectify any quality issues, if needed
   - Prepare a configuration management plan for data storage & management
   - Develop communication plan and prepare needed outreach material

7. Post / Store Data Set(s) in RDE / STOL
   - Prepare test plan to evaluate posting & using data set(s), if needed
   - Test storage & use of data set(s) on RDE or STOL
   - Obtain approval for posting data on RDE or at STOL
   - Obtain approval of outreach material to support posting data

8. Release Data Set(s) for Consumption
   - Launch data set(s) on RDE or STOL
   - Promote launch of the data set(s)
   - Support and monitor usage of the data set(s)
Key Aspects of Each Phase

- **Engage** data providers to **identify** data sources and **assess** the data source’s content. **Decide** if data source(s) have research/application potential.

- **Explore** the data by **obtaining a sample**, and **assess** the sample for its research value. **Decide** if data sample will be of sufficient value to continue capture effort.

- **Obtain complete data sets. Decide on structure** for data. **Prepare the data** for public posting or secure storage.

- **Post** the data and **release** for public access.
Data Sharing Challenges

- **Ease of Use for the Data**
  - Structure the data files for easy use – no mammoth files
  - Comprehensive documentation

- **Real-Time vs. Archived Data**
  - Determine most useful method of providing data for access and use

- **Data Quality**
  - Check data quality before, during, and after data collection.
  - Verify quality before transmitting for evaluation and sharing to the public

- **Timeliness**
  - Get data quality checked, documented & available as soon as possible
Key Issues Considered to Post Data

- The government must have written rights to distribute or allow others to use the data on RDE
- The data must not contain sensitive information (e.g., personally Identifiable Information (PII))
- The data must be documented
- The data is in a common non-proprietary format
- The data has been quality checked
Safety Pilot Model Deployment Data

- Data from vehicles with vehicle awareness devices, aftermarket safety devices, retrofit safety devices, and integrated safety devices
- Messages sent and received by Roadside Equipment (RSEs)
- Basic Safety Messages (BSM) SAE J2735 standard & BSM files include:
  - Position (latitude, longitude, elevation)
  - Transmission status
  - Speed and heading
  - Lateral, longitudinal, and vertical acceleration
  - Brake system status, ABS status, traction control status
Ann Arbor, MI:

- RDE hosts 2 samples of SPMD data
  - 1-day
  - 60-day

- Different strategies used to identify & remove sensitive data (e.g., PII) from data sets

- Algorithms shortened trips lengths based on origins and destinations, and mid-trip stops

Source: Booz Allen Analysis
What is Required of a CV Pilots for Providing Data for the RDE

- Determine in partnership with each CV Pilot Site what data may or may not be appropriate to post on RDE

- Data sources to consider will include:
  - Performance data – Collected by pilot teams
  - Evaluation data – Collected by pilot teams or independent evaluators
  - Contextual or other sources of data – provided by pilot teams

- CDS Program Will Coordinate With FHWA Points of Contract for CV Pilot Sites after decisions made on what data may be provided or collected for evaluations at each pilot site
Reference and Contact Info

- Research Data Exchange (RDE) website
  https://www.its-rde.net/

- Open Source Application Development Portal (OSADP):
  www.itsforge.net

Jon Obenberger, PhD, P.E.
Senior Transportation Research Engineer, FHWA
Jon.Obenberger@dot.gov
Key Issues for Posting Data on RDE

Richard Glassco
Principal, Transportation Analytics, Noblis
What Data Should be Added?

- RDE posts data from:
  - Traditional and non-traditional sources
  - Probe data integrated with traditional data sources
  - Connected vehicle application testing

- Potential Data sources include:
  - connected vehicles (e.g., automobiles, buses, trucks, fleets)
  - mobile devices (e.g., cell phones, nomadic data loggers)
  - infrastructure-based sensors (e.g., loop detector, weather stations, traffic cameras)
Expectations of Data Posted on RDE

- Data should be of sufficient:
  - Quantity (e.g., data types to support analysis)
  - Value
  - Quality

- Data made available should be:
  - Easy to find (logical data organization and naming conventions)
  - Well-documented (Provision of metadata and other documents)
  - Reliable (elimination of quality or privacy issues)
Desirable Data Properties

- Standard non-proprietary format (e.g. text or common database format)
- Compliant to ITS standards
- Structured in files of manageable size
- Contains timestamps enabling correlation of data from different sources
- As disaggregated as possible
- Collected from multiple sources and multiple modes
- Well-documented (the RDE provides guidelines for meta data document)
Structure of Data in the RDE

- **Data environment**: logical collection or grouping of data sets
e.g., the Safety Pilot One-Day Sample Data Environment

- **Data set**: collection of data files containing a certain type of data, such as highway detector data, traffic signal timing data or message data
e.g., the Basic Safety Messages Data Set in the Safety Pilot One-Day Sample Data Environment

- **Data file**:
  - Single archived collection of data
  - Registered users can download files (e.g., ext, zip, binary, or other type)
e.g., Data File BsmP1_04_11_13-02-20-14 01 in the Basic Safety Messages Data Set in the Safety Pilot One-Day Sample Data Environment
Metadata Documents

- Guidance for Metadata Documentation based on ASTM 2468-05 Standard

- Required Fields:
  - Description of data collection procedures
  - Time and location of collected data
  - Contact information
  - For each data element:
    - Type (e.g., integer, float, character)
    - Units
    - Field length
    - Max and min values, if applicable
    - Definitions of codes, if applicable
Vehicle Awareness Device Data from Leesburg, Virginia

Identification Information

Citation

Citation Information
Originator: USDOT Research and Innovative Technology Administration (RITA)
Publication Date: 20130131
Title: Leesburg Vehicle Awareness Device Data
Edition: Version 1
Geospatial Data Presentation Form: Latitude and longitude
Publication Information
Publication Place: Washington, D.C.
Publisher: U.S. Department of Transportation’s (USDOT) Intelligent Transportation Systems (ITS) Joint Program Office (JPO)
Online Linkage: https://www.its-rde.net/

Description

Abstract: The files in this data environment were produced using the Vehicle Awareness Device (VAD) installed on one test vehicle over a two month period. The VAD installed in the test car is identical to the VADs installed in over 2800 vehicles participating in the Safety Pilot Model Demonstration conducted from August 2012 through August 2013 by the National Highway Traffic Safety Administration (NHTSA) in Ann Arbor, Michigan.

Activities included numerous repetitive trips by one individual in and around Leesburg, Virginia and one long road trip from Ann Arbor, Michigan to Leesburg, Virginia by way of eastern Indiana. No Personally Identifiable Information (PII) is included in the files. Data records for trip beginnings and endings were deleted to prevent possible determination of PII by analysis of these data files.
Other Metadata documents

- Concepts of Operation
- Test plans
- Simulation results
- Links to software on OSADP
Methods for Transmitting Data

- Evaluation data sent to USDOT at same time as sent to independent evaluator

- If independent evaluator collects own data, we will follow procedure directly with that contractor

- If archived, periodic transmission by hard drive or drop box is easiest

- If real-time data feed to be provided, arrange with RDE contractor to set up live feed, as is currently done with road data from Minnesota
Stakeholder Q&A

- Please keep your phone muted
- Please use chatbox to ask questions
- Questions will be answered in the order in which they were received
- This Q&A section will neither be recorded nor posted to the website
RDE Content: Features

- Advanced Search Capabilities
- Multiple File Download Capability
- FAQs
- External Links
- Contact Information
- Standard Metadata documentation
- Map of Data Location
- Registered Research Projects
- Sample Data Files
Registered users may download data files

WELCOME TO THE RESEARCH DATA EXCHANGE

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The primary purpose of the DCM (Data Capture and Management) Research Data Exchange is to provide a variety of development, testing, and demonstration of multi-modal transportation models. Applications being pursued under the DCM Program and other connected vehicle research activities. Data accessible through the Research Data Exchange will be freely available to the public. The vision of the DCM Program is to enhance current operational practices and transform future transportation decision making and systematic provision of integrated data from infrastructure, vehicles, and travelers. This data is available to others.

www.its-rde.net/
Contact for CV Pilots Program:
Kate Hartman, Program Manager
Kate.hartman@dot.gov

Join us for the Getting Ready for Deployment Series

- Discover more about the 2015 CV Pilot Sites
- Learn the Essential Steps to CV Deployment
- Engage in Technical Discussion

Website: http://www.its.dot.gov/pilots
Twitter: @ITSJPODirector
Facebook: https://www.facebook.com/DOTRITA

March 2016 Webinars

Technical Assistance Webinars

- **3/2/2016, 11:00 am – 12:30 pm EST**
  Preparing Data for the Research Data Exchange for Connected Vehicle Deployments

- **3/23/2016, 10:00 am – 11:30 am EST**
  DSRC Deployment Planning/Licensing for Connected Vehicle Deployments

- **TBD**
  Preparing an Outreach Plan for Connected Vehicle Deployments

Please visit the CV pilots website for the recording and the briefing material of the previous webinars.