



# 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



# CONNECTED VEHICLE PILOT DEPLOYMENT PROGRAM

PROGRAM GOALS



## PILOT SITES



ICF/Wyoming DOT



NYCDOT



Tampa (THEA)

STAY CONNECTED

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

Feb 2016	Mar 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016
◆◆	◆		◆◆◆			◆◆◆

Concept of Operations Webinars

Performance Measurement Webinars

Comprehensive Deployment Plan Webinars

- Visit Program Website for Updates: <http://www.its.dot.gov/pilots>
- Contact: Kate Hartman, Program Manager, [Kate.hartman@dot.gov](mailto:Kate.hartman@dot.gov)



# Sites Selected – 2015 Awards



- 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.



- 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.



- 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.

# Data Sharing Provisions of the Connected Vehicle Pilot BAA



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>
- CV Reference Implementation Architecture
  - <http://www.iteris.com/cvria/>
- CV Open Source Application Development Portal
  - <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)





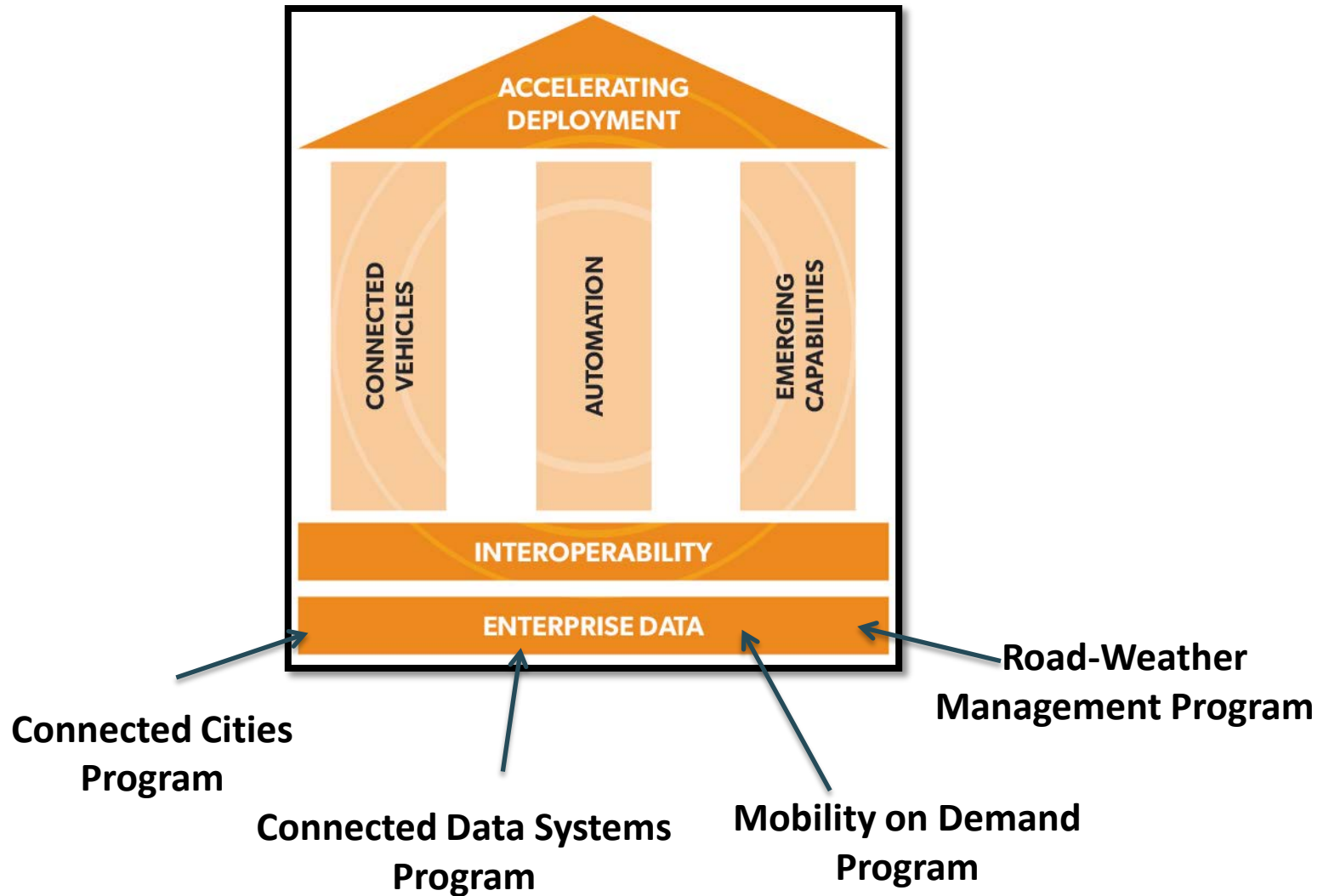
# Sharing Connected Vehicle Data on the Research Data Exchange (RDE)

Jon Obenberger, PhD, P.E.

Senior Transportation Research Engineer, FHWA



# USDOT ITS Strategic Plan & Sharing Connected Vehicle Data



# Connected Data Systems (CDS) 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



U.S. Department of Transportation  
Federal Highway Administration

Username	Password	Login
<input type="text"/>	<input type="password"/>	
<a href="#">Create New Account</a>	<a href="#">Forgot Credentials</a>	



Home Data ▾ About ▾



The data sent from the Integrated Mobile Observation (IMO) project provided by MnDOT is saved as archive files. The registered users can download the RDE API client application and receive the [real-time data](#).

[www.its-rde.net](http://www.its-rde.net)

## Promotes:

- Sharing  
Collecting & providing access to
- Archived & real-time connected vehicle & traveler data

## 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.





# 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

The screenshot shows the contact form on the RDE website. The header includes the U.S. Department of Transportation Federal Highway Administration logo and the Research Data Exchange logo. The navigation menu includes Home, Data, About, and a user profile for (0) cburnier. The contact form is titled "Contact Us" and includes fields for Name (Gene McHale), Email (gene.mchale@dot.gov), Subject, and Description. There is also a file upload section for "Attach file (2 MB max)" with a "Browse..." button and a "Send" button. A pull-down menu is open under the "About" link, showing options for Feedback, Contact Us, External Links, and FAQ.

# Process for Posting Data

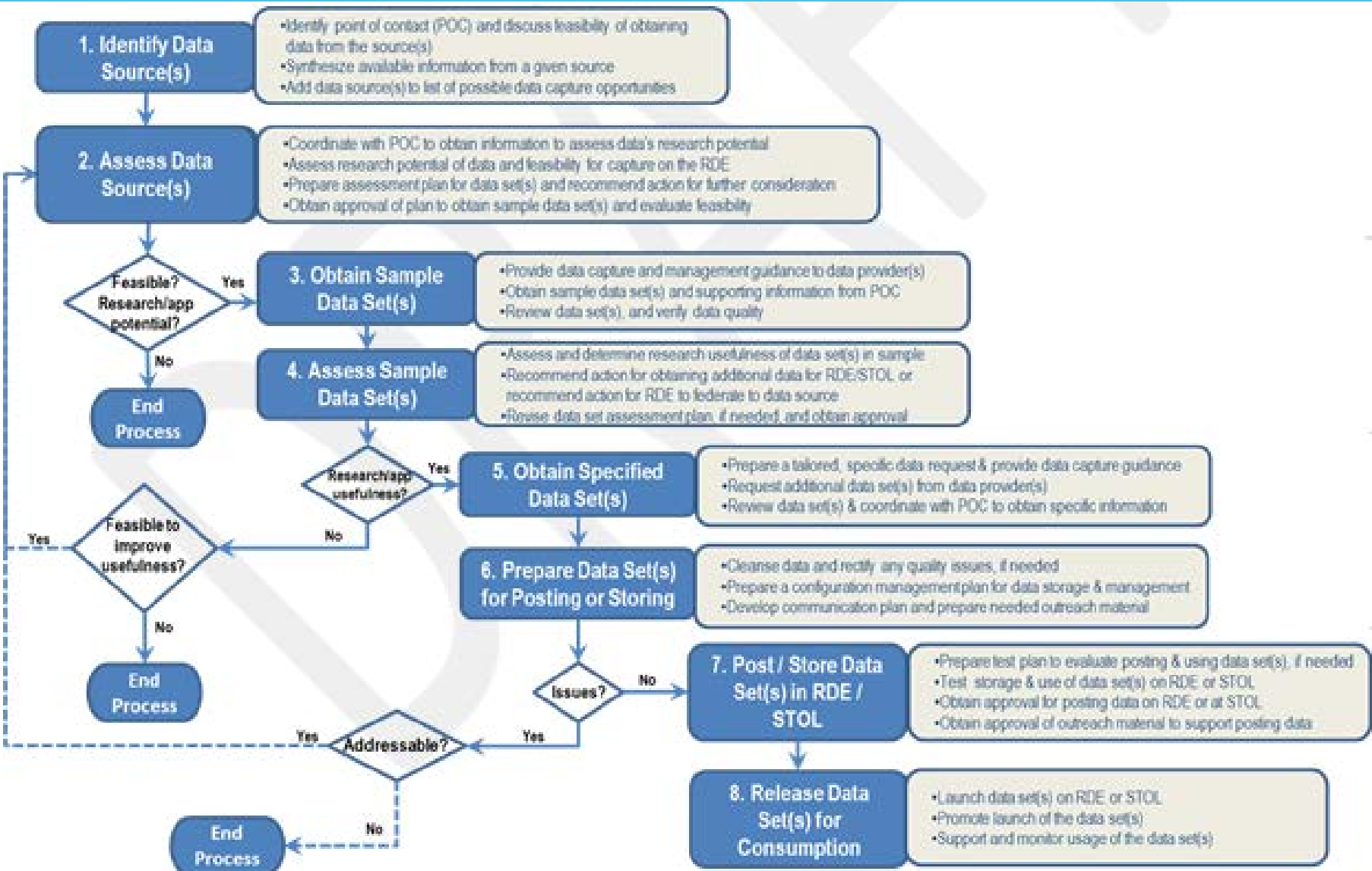


- Data is not posted directly to the RDE
- USDOTs review of data ensures quality, completeness & documentation before posting on RDE
- Sensitive information that cannot be removed from data sets are stored in Saxton Transportation Lab & use limited based on constraints established
- Requirements for data made available in the Saxton Lab are the same as for data submitted for the RDE





# Process for Submitting Data





# 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



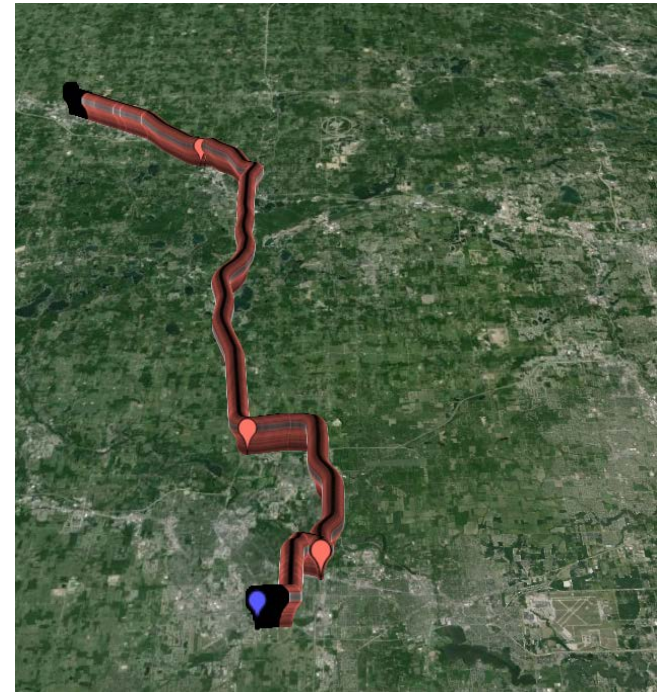
- The government must have written rights to distribute or allow others to use the data on RDE
- The data must not contain sensitive information (e.g., personally Identifiable Information (PII))
- The data must be documented
- The data is in a common non-proprietary format
- The data has been quality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



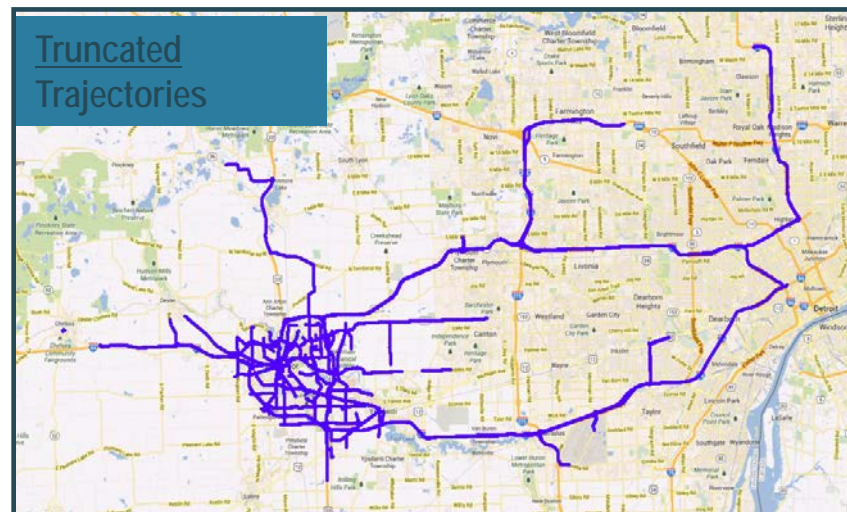
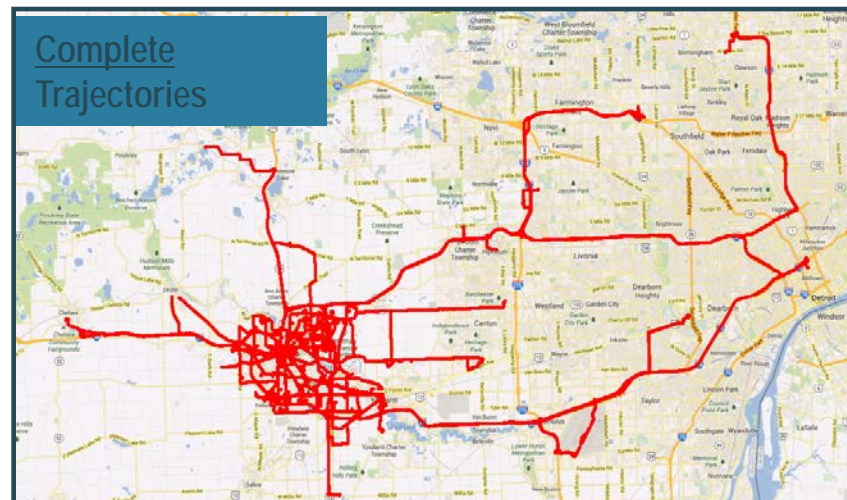


# Safety Pilot Model Deployment Data



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



# Open Source Application Development Portal (OSADP)



U.S. Department of Transportation  
Federal Highway Administration

OSADP

HOME

INFORMATION

COMMUNITY

CONTACT

LOGIN

Search ...



## Download and be CREATIVE

Registered users can download released open source applications!

## Welcome to Open Source Application Development Portal!

A channel for distributing and collaborating on transportation related open source applications

### LATEST APPLICATION RELEASES

- **SPaT 1.2**  
Signal Phase and Timing
- **VEDM-CAV 1.0**  
VISSIM External Driver Model for Connected and Automated Vehicles
- **BSM-Data-Emulator 1.0**  
Basic Safety Message Data Emulator
- **P-ODE 1.0**  
Prototype Operational Data Environment
- **CACC-VISSIM 1.0**  
Cooperative Adaptive Cruise Control VISSIMS

te on the Development of Anonymous Wireless Address Matching Application... [Signal Phase and Timing](#)



Exp



Upcoming Releases



Resources & Tools



Discussion Forum

[www.itsforge.net](http://www.itsforge.net)



### STATISTICS

Application Releases: 36

Application Downloads: 1000

### APPLICATION CATEGORIES



Arterial Management



Freeway Management



Collision Avoidance



Collision Notification



Commercial Vehicle Operations



Crash Prevention & Safety



Driver Assistance



Electronic Payment & Pricing



Information Management



Intermodal Freight



Roadway Operations & Maintenance



Road Weather Management



Transit Management



Traffic Incident Management



Emergency Management



Traveler Information



# 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](http://www.itsforge.net)

Jon Obenberger, PhD, P.E.

Senior Transportation Research Engineer, FHWA

[Jon.Obenberger@dot.gov](mailto: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



# Metadata Example



Leesburg Metadata documentation [Read-Only] [Compatibility Mode] - Microsoft Word

File Home Insert Page Layout References Mailings Review View Acrobat

Cambria 14 A A Aa Font Paragraph Styles

Book Title Caption DocSub... h3 Heading 2 Heading 4

Find Replace Select Editing

## 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.

Page: 1 of 22 Words: 7,411 130%

# 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 Demonstration and Tour



U.S. Department of Transportation  
Federal Highway Administration

Username  Password

[Create New Account](#) [Forgot Credentials](#)

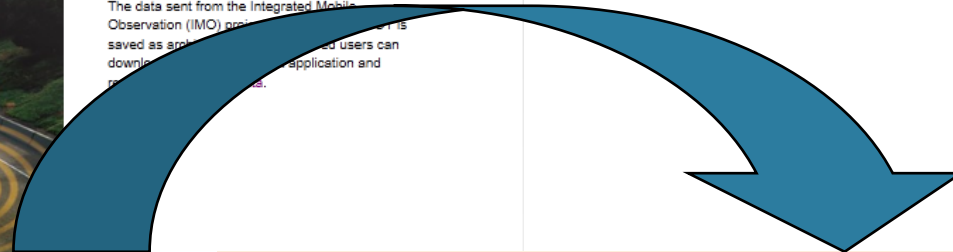
- Registered users may download data files



[Home](#) [Data](#) [About](#)



The data sent from the Integrated Mobile Observation (IMO) probe is saved as application files. Registered users can download application and



Data Environments					
9 items found, displaying all items.					
Title	Start Date	End Date	Description	Data Sets	Total Size
<a href="#">FDOT Orlando ITS World Congress</a>	2010-09-01	2010-10-22	The Florida Department of Transportation (FDOT) data environment contains data recorded by Vehicle Awareness Devices (VADs) on Lynx transit buses in Orlando FL. The VADs started operation in September 2011 and continued operation during the ITS World Congress in October 2011. The contents of the recorded data include the required components of the J2735 Basic Safety Message (BSM).	2	974.0 MB
<a href="#">Leesburg VA Vehicle Awareness Device</a>	2012-10-18	2012-12-19	The files in this data environment were produced by the Vehicle Awareness Device (VAD) installed on one test vehicle over a two month period. Activities included numerous repetitive trips in and around Leesburg VA and one long road trip from Ann Arbor, MI to Leesburg, VA by way of eastern Indiana. The VAD installed in the test car is identical to the VADs installed in over 2800 vehicles participating in the Safety Pilot Model Demonstration in Ann Arbor, MI.	3	534.0 MB
<a href="#">NCAR 2009</a>	2009-04-06	2009-04-22	See the Vehicle Infrastructure Initiative Proof of Concept data environment for a description of the Michigan Test Bed and the data collected there in 2008. In April 2009 a second set of trials was conducted at the Michigan Test Bed, directed by the National Center for Atmospheric Research (NCAR). These trials used a smaller set of vehicles, and concentrated on collecting data during periods of rainy or snowy weather. RSE data for the the NCAR 2009 tests were available for nine days in April 2009. The data in this data environment consists of RSE and OBE data for the six days with the most good data.	8	825.8 MB
<a href="#">NCAR 2010</a>	2010-01-28	2010-03-29	See the Vehicle Infrastructure Initiative Proof of Concept data environment for a description of the Michigan Test Bed and the data collected there in 2008. In late January through early April 2010 a third set of trials was conducted at the Michigan Test Bed, again directed by the National Center for Atmospheric Research (NCAR). These trials used a small set of vehicles, similar to the trials in 2009, and concentrated on comparing atmospheric data from vehicle-mounted sensors to data from a nearby fixed weather observing station. The 2010 data selected for inclusion in this data environment consists of RSE and OBE data for the six days with the most good data.	8	465.8 MB
<a href="#">Pasadena</a>	2011-09-01	2011-10-31	The Pasadena data environment covers the diverse roadway network in and around the City of Pasadena, California. The data was collected in 2011 during the months of September and October. The data environment includes a variety of data sets including network data (highway network file), demand data (trip tables), network performance data (link volumes, turn volumes, speeds and capacity), work zone data, weather data, Closed Circuit Television (CCTV) camera data, and Changeable Message Sign (CMS) data. Data from simulations are included where there are no sensors, and to provide forecasts.	37	347.9 GB

## WELCOME TO THE RESEARCH DATA EXCHANGE

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

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 mobility applications being pursued under the U (DMA) Program and other connected vehicle research activities. Data accessible through the Research Data Exchange will be the public. The vision of the DCM Program is to enhance current operational practices and transform future transportation acquisition and systematic provision of integrated data from infrastructure, vehicles, and travelers. This data is available to others.

[www.its-rde.net/](http://www.its-rde.net/)



# Stay Connected



## Contact for CV Pilots Program:

Kate Hartman, Program Manager

[Kate.hartman@dot.gov](mailto: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](https://twitter.com/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.

