DMA Webinar Series

Research Data Exchange (RDE)
Open Source Application Development Portal (OSADP)

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TODAY'S OVERVIEW

- DMA Program Overview
- Research Data Exchange (RDE)
  - Overview and Demonstration
  - Connected Vehicle (CV) Data Sets
  - Adding Data to the RDE
- Open Source Application Development Portal (OSADP)
  - Overview and Demonstration
  - Submitting Software to the OSADP
- Stakeholder Q&A
  - We can only answer questions related to the ITS DMA program
  - We cannot answer any questions related to the ITS Connected Vehicle Pilot Program

DMA Program Overview

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DYNAMIC MOBILITY APPLICATIONS PROGRAM

Vision

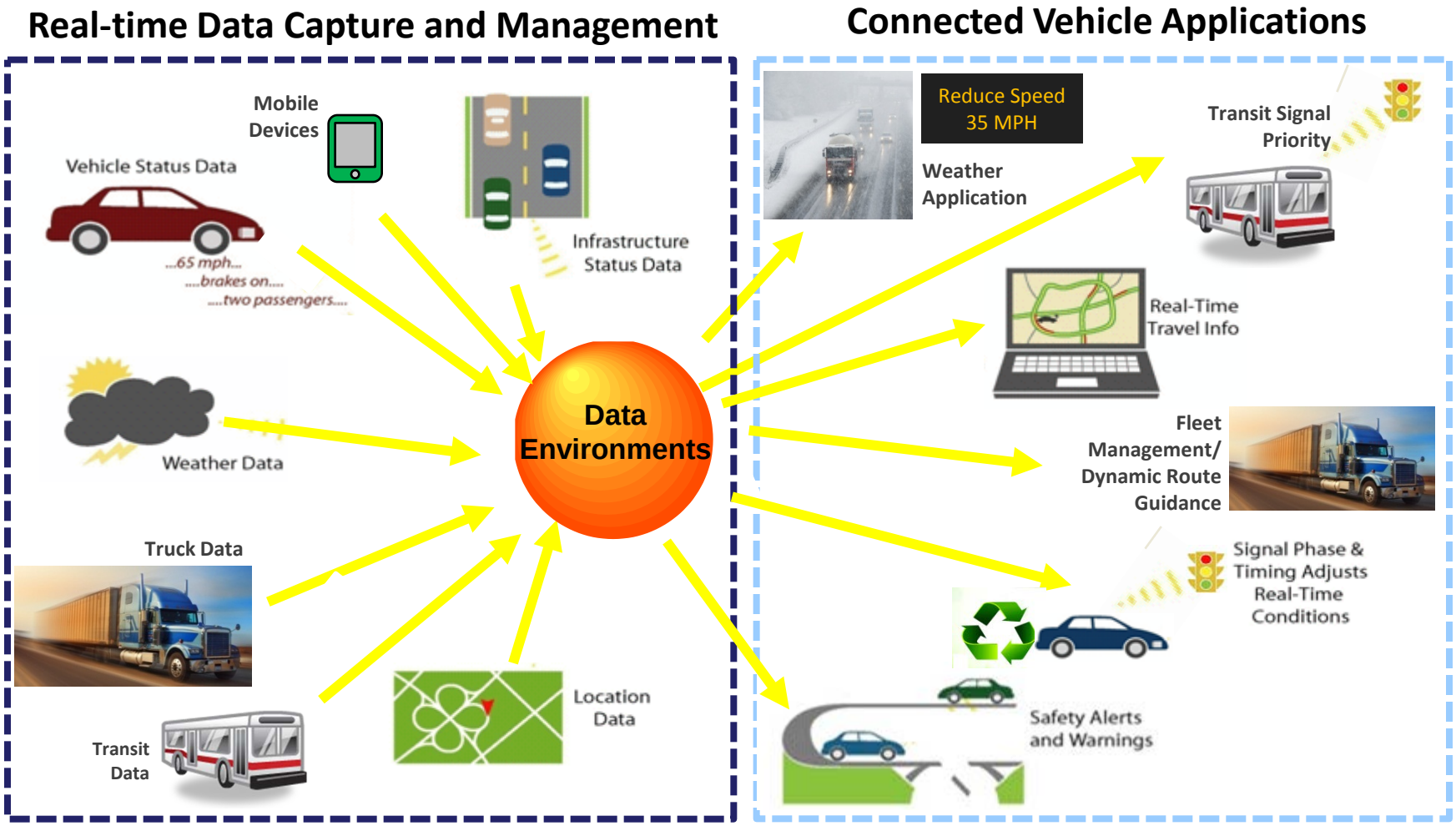
- Expedite development, testing, commercialization, and deployment of innovative mobility applications to:
  - maximize transportation system productivity
  - enhance mobility of individuals within the surface transportation system

Objectives

- Create applications using frequently collected and rapidly disseminated multi-source data from connected travelers, vehicles (automobiles, transit, freight) and the infrastructure
- Develop and assess applications showing potential to improve the nature, accuracy, precision and/or speed of dynamic decisions
- Demonstrate promising applications predicted to significantly improve capability of the transportation system
- Determine required infrastructure for transformative applications implementation, along with associated costs and benefits

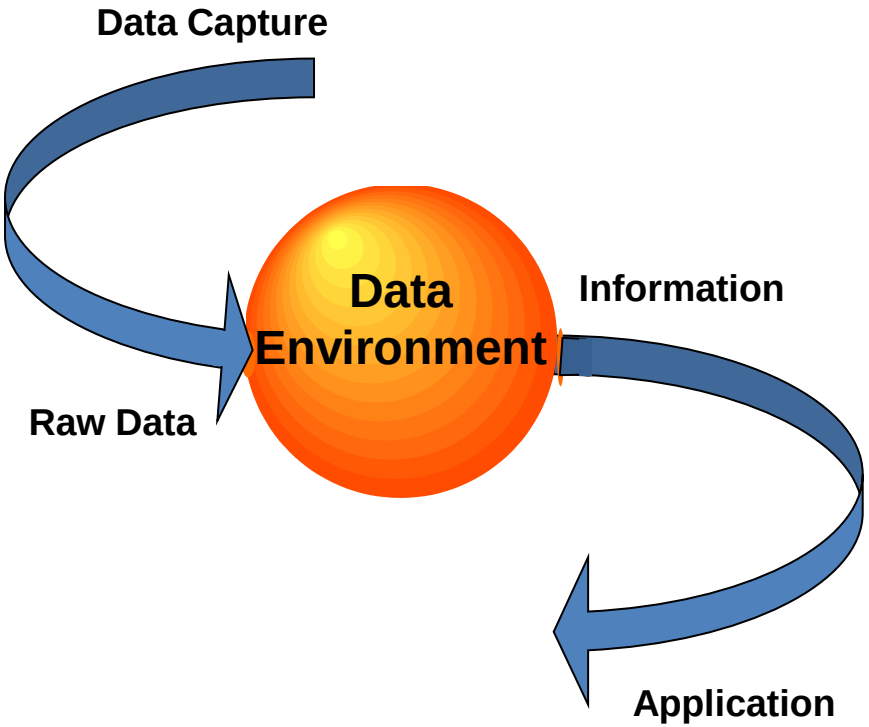
Research Data Exchange (RDE) Overview

Multi-source, multi-modal Data for CV Applications



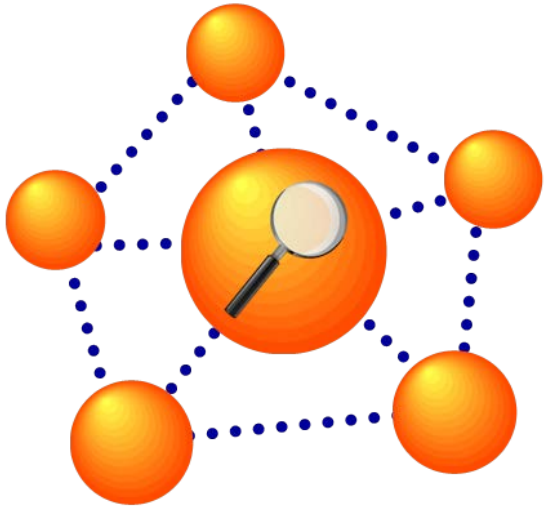
DATA ENVIRONMENTS

- Data Environment:
  - well-organized collection of data of specific type and quality
  - captured and stored at regular intervals from one or more sources
  - systematically shared in support of one or more applications



Purpose and Objectives of the RDE

- Purpose
  - To provide a variety of data-related services that support the development, testing, and demonstration of multi-modal transportation mobility, weather, and environmental applications.
- Objectives
  - Enables systematic data capture from connected vehicles, mobile devices, and infrastructure
  - Performs data quality checks and provides clean, well-documented data sets
  - Integrates data from multiple sources into data environments



Research Data Exchange (RDE)

DATA HIERARCHY IN THE RDE

- A data environment is a logical collection or grouping of data sets that were obtained under the same contract or agreement. e.g., the “Safety Pilot Model Deployment - One Day Sample” Data Environment

- A data set is collection of data files containing a certain type of data, such as highway detector data or traffic signal timing data or collected message data. e.g., the “Basic Safety Message” Data Set in the “Safety Pilot Model Deployment - One Day Sample” Data Environment

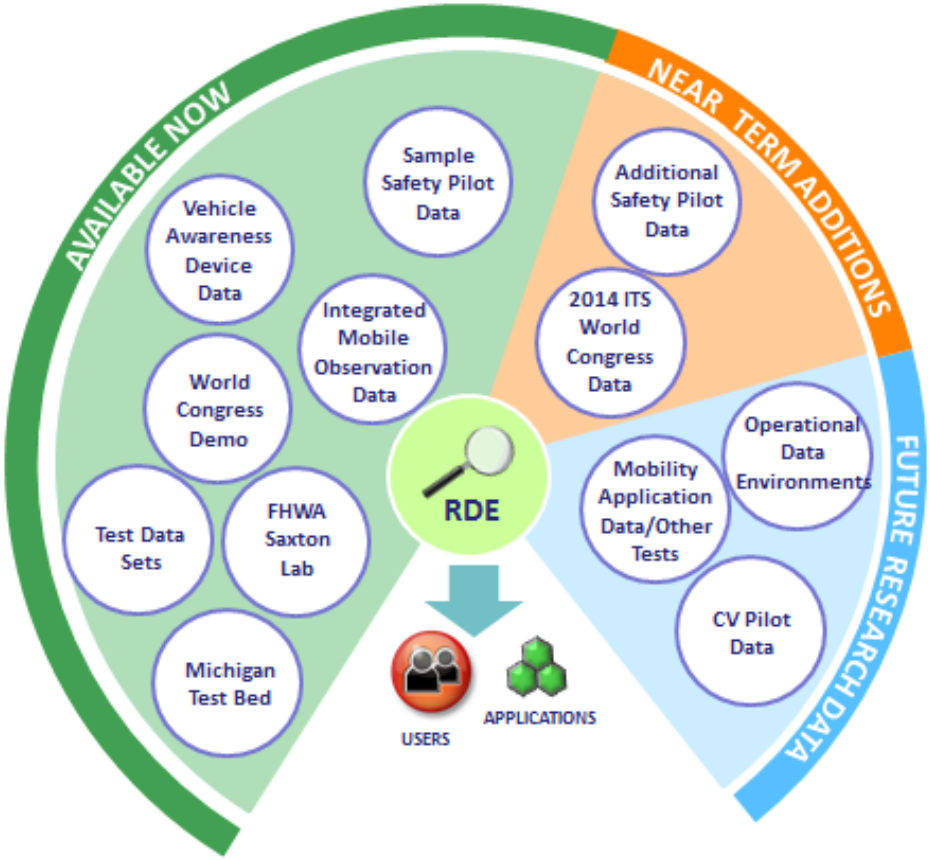
- A data file is an single archived collection of data. It can be text, zip, binary, or other file type. All data files can be downloaded by registered users. e.g., Data File “BsmP1 01” in the “Basic Safety Message” Data Set in the “Safety Pilot Model Deployment - One Day Sample” Data Environment

For Example …

- Data Environment: “Safety Pilot Model Deployment - One Day Sample”
- Data Sets in the “Safety Pilot Model Deployment - One Day Sample” Data Environment:
  - Basic Safety Message
  - Data Acquisition System 1
  - Data Acquisition System 2
  - Roadside Equipment
  - Weather
- Data Files in the “Basic Safety Message” Data Set:
  - BsmP1 01
  - BsmP1 02
  - BsmP1 03 …
- Plus metadata (documentation) files

Data Environments in the RDE

RDE Content: Data Environments



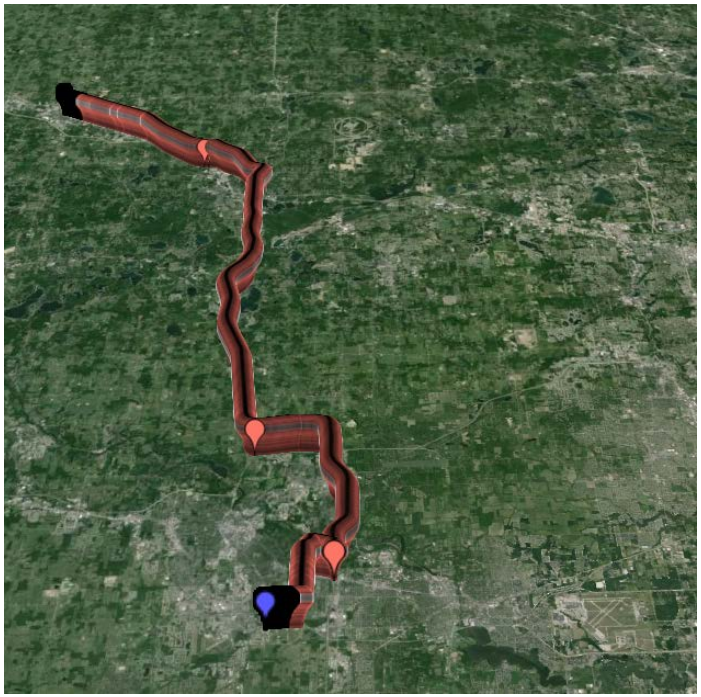
- What data is included in the RDE
  - Real-time and Archived Data
  - Probe Data from Field Tests
  - Data from Research Projects including simulations

AVAILABLE DATA IN RDE

- **Probe Message Data.** Actual and simulated vehicle trajectories and probe snapshot messages in SAE J2735 format from tests conducted at the Connected Vehicle Test Bed in Novi, MI in 2008, 2009, and 2010.
- **Vehicle and Roadside Device Data.** Integrated multimodal data from vehicles and roadside sensors from four sites (Seattle, Portland, Pasadena, and San Diego). Data includes light and transit vehicles, incidents, weather, freeway and arterial travel times, and traffic signal data.
- *** Connected Maintenance Vehicles.** Real-time and archived onboard (GPS/AVL) data from wirelessly-connected snowplows and maintenance trucks operated by Minnesota DOT.
- **Basic Safety Messages (BSM) - Orlando.** BSM data collected every 0.1 second from transit vehicles at the 2011 World Congress Demonstration in Orlando FL.
- **BSM Data - Leesburg.** BSM data collected every 0.1 second from a device in a vehicle in the vicinity of Leesburg, VA.
- *** Connected Vehicles and Roadside Device Data.** One day of connected vehicle, Roadside Equipment, and contextual weather data from the Safety Pilot Model Deployment in Ann Arbor, MI.

SAFETY PILOT MODEL DEPLOYMENT DATA

- **Connected Vehicle Data (One-Day Sample) from Ann Arbor, MI**
  - 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) defined in the SAE J2735 standard.
  - The primary contents of 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



Archived and Real-Time Maintenance Vehicle Data

- Minnesota DOT maintenance vehicles
- Location, road weather, and engine data via:
  - Archived downloadable files for specified time intervals.
  - Real-time feed from the RDE using a downloadable file that enables the user to receive the data records as they arrive.
- Example data elements:
  - Vehicle latitude and longitude
  - Vehicle direction and speed
  - External vehicle lights on or off
  - Windshield wipers on or off
  - Surface and air temperature
  - Precipitation status
  - Type of granular or liquid material being spread

FUTURE DATA ADDITIONS

- Additional Data from Safety Pilot Deployment
- * Data from 2014 ITS World Congress
  - Queue Length Data and CV Data
  - Weather Data Demonstration
- Additional Mobility Projects:
  - DMA Program Prototype deployments (e.g. IDTO, INFLO, FRATIS)
  - Prototype Operational Data Environment (ODE)
- Links to additional connected vehicle related data
  - e.g. Weather Data Environment (WxDE)

NEW DATA SCHEDULED FOR RELEASE 2.2

- **Connected Vehicle and Queuing Data from the ITS World Congress in Detroit in September 2014**
  - Nine connected vehicles circled the convention hall
  - Basic Safety Messages (BSMs) from the instrumented vehicles
  - Queue counts (including CVs) collected manually by lane at one approach to a signalized intersection
  - Signal Phase and Timing (SPaT) messages from 17 instrumented intersections around the convention center
  - Traveler Information Messages broadcast by Roadside Units

New Data Scheduled for Release 2.2

- **Road Weather Data from Belle Isle Demo at the 2014 ITS World Congress**
  - Slippery conditions created artificially on road surface
  - Road weather-related observation data from vehicles such as wiper status, temperature, and humidity
  - Anti-lock brake system (ABS) and Traction Control System (TCS) activations
  - Advisory warnings issued in vehicles

RDE's Data Files

- Registered users may download data files

Data Environments

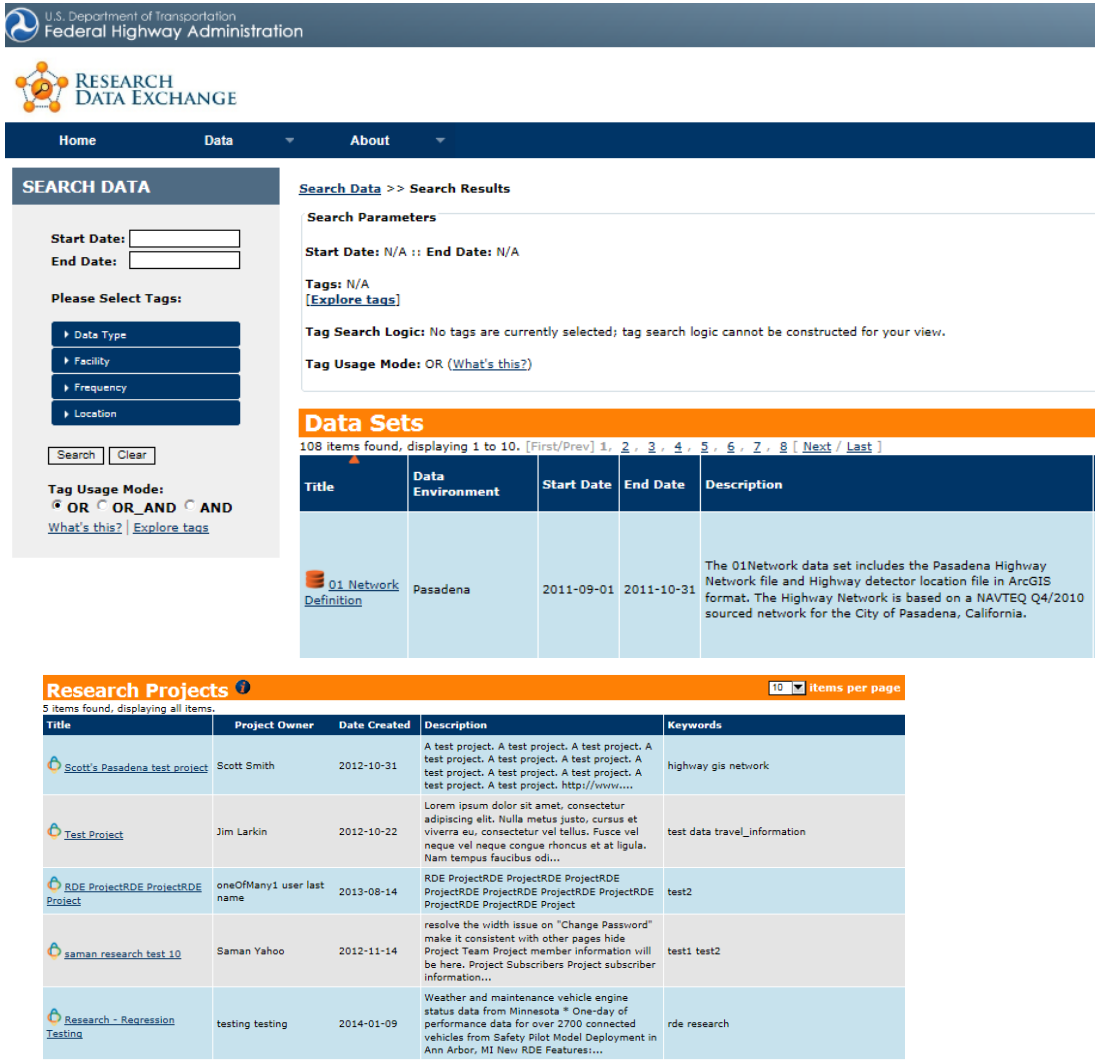
9 items found, displaying all items.

Title	Start Date	End Date	Description	Data Sets	Total Size
FDOT Orlando ITS World Congress	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
Leesburg VA Vehicle Awareness Device	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
NCAR 2009	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
NCAR 2010	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
Pasadena	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

www.its-rde.net/

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



POLICY AND GOVERNANCE

- Data Privacy
  - RDE data sets are free of any private or sensitive data
- Data Ownership
  - USDOT owns the distribution rights for the data:
    - Signed agreements from data providers
    - Public domain
- Evaluation
  - Established systematic evaluation of RDE
    - Data quality and conformance to policy
    - Usefulness

How to Use the Research Data Exchange

(A Demonstration)

RDE WEBSITE

www.its-rde.net/

- RDE is the connected system of data environments supporting application research and development for connected vehicle applications
- Currently all data is archived at USDOT within the RDE; in the future other data will be archived outside of USDOT and federated with the RDE
- RDE website has been built and hosted by IndraSoft

Adding Data to the RDE

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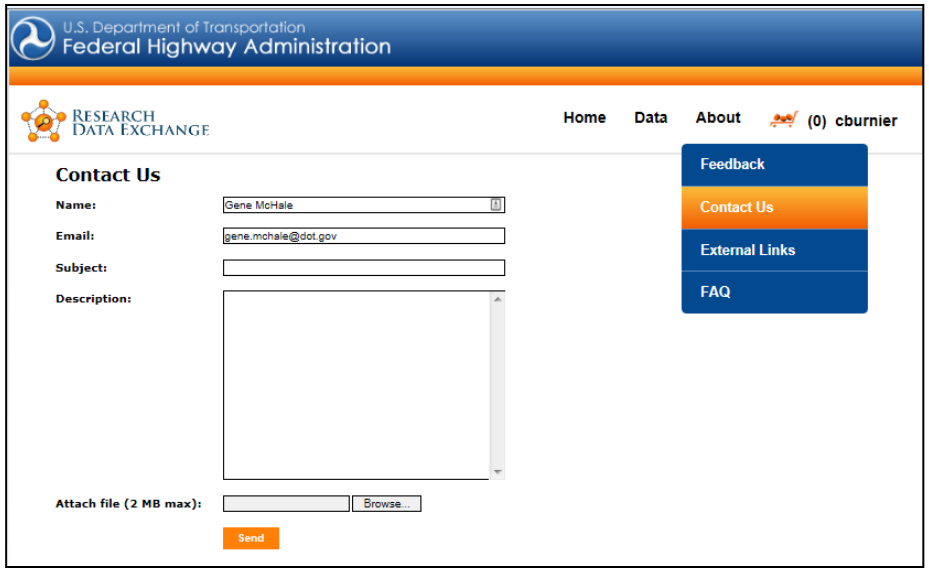
IDENTIFYING AND ADDING DATA TO THE RDE

- New data sets are added to the RDE as they become available:
  - From other USDOT projects
  - From outside submissions



- **Data Submission Process**
  - ITS researchers are invited to submit data sets to the RDE Data Administrator
    - using the “Contact Us” link under the “About” pull-down menu.
  - USDOT assesses potential data:
    - Value
    - Quality
  - When a data environment passes these criteria, RDE management adds the data to the RDE.

What Data Should be Added?

- The RDE program is exploring making data available from:
  - **Traditional** and **non-traditional** sources
  - **Probe data integrated with traditional data sources**
  - Connected vehicle application testing

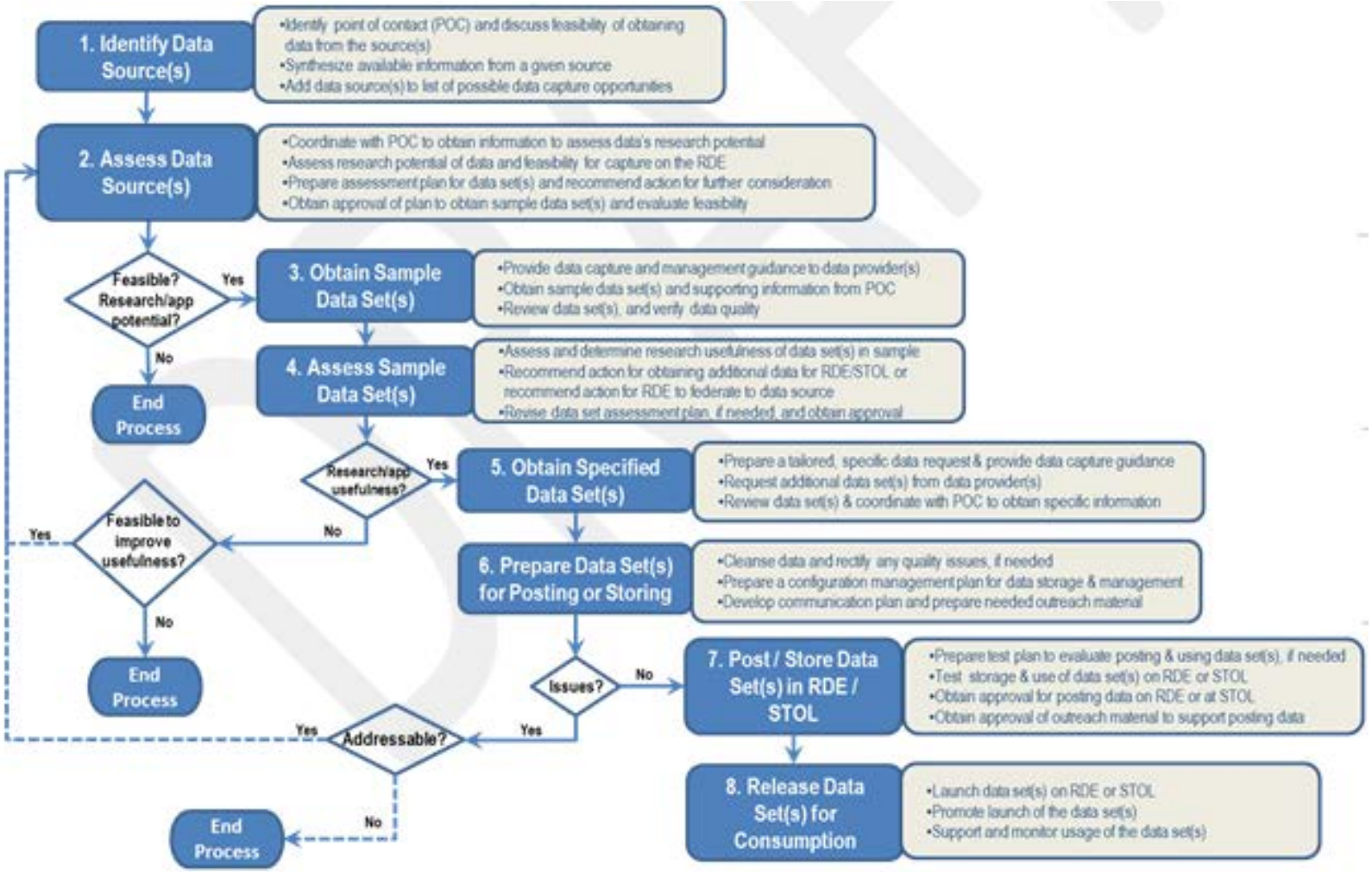
- Potential Data sources include:
  - **connected vehicles** (e.g., automobiles, buses, trucks, fleets)
  - **mobile devices** (e.g., cell phones, nomadic data loggers)
  - **infrastructure**-based sensors (e.g., loop detector, traffic cameras)

EXPECTATIONS WHEN DATA IS POSTED?

- 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)
  - Accessible
  - Well-documented (Provision of metadata and other documents)
  - Reliable (elimination of quality or privacy issues)

Process for Evaluating and Preparing New Data for Inclusion in the RDE



KEY ASPECTS OF EACH PHASE OF PROCESS

- **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 the data. **Prepare the data** for public posting or secure storage.

- **Post** the data and **release** for public access.

For More Information …

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Open Source Application Development Portal (OSADP) Overview

www.itsforge.net

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WHAT IS THE OSADP?

- **Purpose:** To develop, operate and maintain an open source portal the will enable stakeholders to collaborate on application development

- **Objectives:**
  - *Collaborative development* - cultivates and promotes a friendly and collaborative community
  - *Transparency* - mechanism to ensure that application development is transparent and broadly available
  - *Reusability* - promote the reusing of software wherever possible
  - *Provide complete application package*

OSADP Features

- Application download page
- Information on new applications
- Forums for community discussions
- Resources to use applications & OSADP
  - Developer uploader guide
  - FAQ's
- Platform to test (GitHub) applications before posting
- Application Submittal (e.g., upload, collaboration, proposal)

CURRENTLY AVAILABLE TOOLS & APPLICATIONS

- LA-FRATIS 1.0: LA-Gateway FRATIS project application
- DFW-FRATIS 1.0: Dallas-Fort Worth FRATIS project application
- Cross-Town Improvement Project Drayage Optimizing 1.0: Optimization algorithm to improve drayage operations
- Trajectory Converter Analysis (TCA) 2.3: Processes trajectory data from flat file or simulation (VISSIM, PARAMICS) to create Basic Safety Messages (BSM), Probe Data Messages (PDM), Japanese ITS-Spot Messages or European Cooperative Awareness Message (CAM) Messages
- Performance Measurement Application 1.0: Processes trip-based trajectory data into performance measures

APPLICATION EXAMPLE: THE TCA

- Trajectory Converter Analysis (TCA) 2.3:
  - User Guide (over 30 pages long)
  - Source code (Python) for the program
  - Readme.txt file (e.g., Description, System Requirements, Documents)
  - Release-notes.txt file – detailed description of each version of the TCA
  - License.txt – Apache License notification with description and website
  - Attribution.txt – List of all key contributors to the software
  - Sample Data Files:
    - TCAinput.xml – Sample input control file for program
    - Strategy.xml – Sample strategy file for the program
    - Regions.xml – Sample regions file
    - RSE_location.csv – Sample RSE placement file.

OSADP – Tools Terms of Use

- All OSADP applications are required to have an Open Source License
- Required terms of use for applications on OSADP are captured in Apache 2.0 Open Source License
- Other Open Source Licenses will be considered on a case-by case basis and will consider restrictions unique to each application and expected users
- All OSADP users must adhere to the terms and conditions in license specific to each application

OSADP – Tools Terms of Use

- Required open source terms and conditions captured within recommended Apache 2.0 Open Source License:

- Allows:
  - Download and use for free
  - Incorporate software in proprietary package you create
  - Make changes without having to resubmit as open source

- Limits:
  - May not redistribute without proper attribution
  - Must include License in any redistribution including software/tool
  - Must document which files were modified in any new distribution
  - Must not use any Trademarks or Logos stating or implying FHWA or any organization endorses software/tool

OSADP – Future Tools and Applications

- Currently Under Review:
  - CV Retrofit Safety Device (RSD) kits
  - Pikalert 4.0 – check and report road weather conditions
  - Response, Emergency Staging, Communications, Uniform Management and Evacuation (R.E.S.C.U.M.E.)
  - Integrated Dynamic Transit Operations (IDTO)
  - Intelligent Network Flow Operations (INFLO)
  - Signal Phase and Timing (SPaT)

- Future Additions:
  - DMA Applications:
    - Enable Advanced Traveler Information Systems (ATIS)
    - Multi-Modal Intelligent Traffic Signal Systems (MMITSS)
  - Mobile Devices

OSADP – Who Can Submit Tools?

- Anyone can submit software, tools or applications for consideration (e.g., testing, license, documentation)
- Priority on first posting software and tools developed on ITS Program sponsored projects
- Other software, tools or applications are encouraged to be submitted and will be evaluated on case-by-case basis

OSADP – Tool Submission Guidelines

- Required:
  - Source code
  - Web ready documentation (e.g, 508 compliant files)
  - README file (e.g., version number, description, install instructions)
  - License – open source license file
  - Notes files – features to release, description of data inputs & outputs
  - Documentation or links to (e.g., ConOps, architecture, configuration management plan, installation and users instructions)

- Optional:
  - Test or sample files to run with the software
  - Attribution file

OSADP Demo Walkthrough

- Registration and Login
- Downloading Applications
- Submitting Applications
- Resources and Tools
- Community Forums
- Getting Help

OSADP Demo

Stakeholder Q&A

DMA Program

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DMA Website

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