PHASE 1 OF SHRP 2 DATA IMPLEMENTATION & OVERSIGHT

Accessing the SHRP 2 Safety Data: User Responsibilities and Access Procedures

July 27, 2015
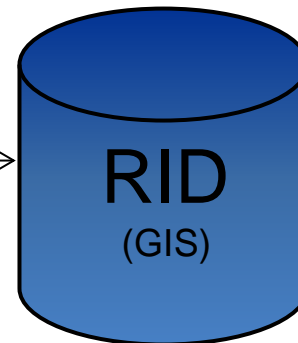
Safety: Strategic Rationale
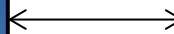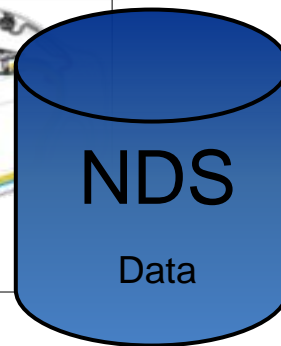
Driver behavior is key:

- Primary factor in two-thirds of crashes
- Contributing factor in more than 90% of crashes
- Hardest to study; the thing we know the least about

Opportunity - Naturalistic Driving Study (NDS):

- Miniaturized sensor technologies and increased computing capacity: can observe real-world driving
- Crash, pre-crash, near-crash, and "normal" driving data

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

SAFETY: Naturalistic Driving Study & Roadway Information Databases

NDS Data ←→ **RID** (GIS)
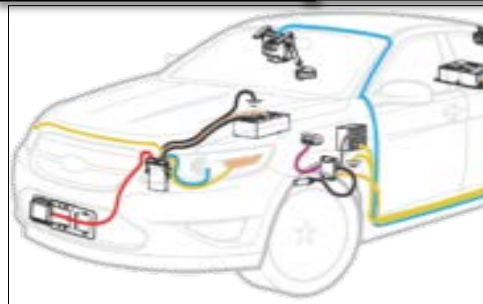
Data from **3,542 volunteer drivers and their vehicles** in six sites using passenger cars, vans, SUVs, pickups

New data collected 12,500 centerline miles consistent across six sites. **Acquired data** (DOTs, others) on 200,000 centerline miles with varying conditions: roadway, weather, traffic…

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

NDS Design

Largest naturalistic driving study ever undertaken

- 3,542 drivers, all age/gender groups.
- 4,368 data years; 5.5 M trip files; 32.5 M vehicle miles
- 1,600 crashes and 2,900 near-crashes
- 3 years of data collection
  - Most participants 1 to 2 years
- Vehicle types: All light vehicles
  - Passenger cars
  - Minivans
  - SUVs
  - Pickup trucks
- Six data collection sites
- Second by second data on what happens in vehicle

Seattle, WA
Buffalo, NY
State College, PA
Bloomington, IN
Durham, NC
Tampa, FL

The National Academies of
SCIENCES · ENGINEERING · MEDICINE
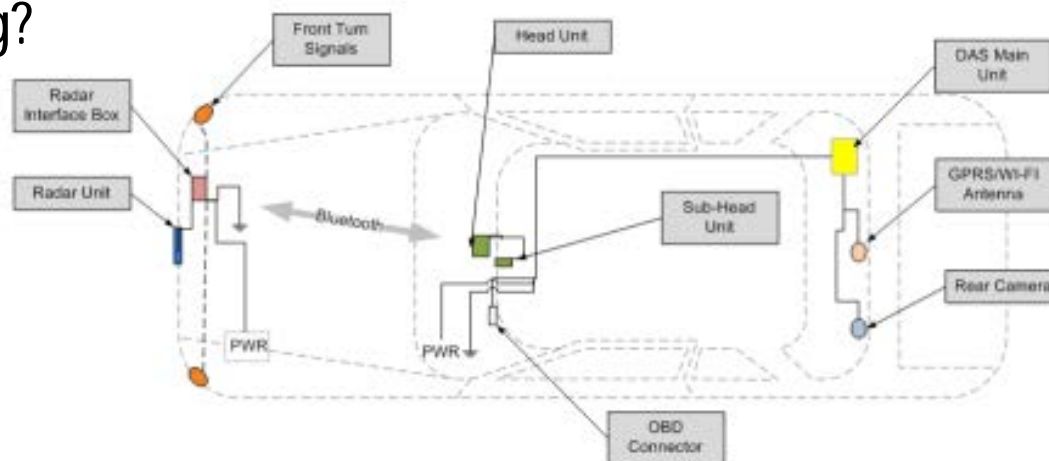
TRB
TRANSPORTATION RESEARCH BOARD

Naturalistic Driving Study Questions

Instruments volunteer drivers' vehicles and collects data continuously during their normal driving

- What do drivers really do?

- What were they doing just before they crashed?

- How did they avoid a crash?

- How do the roadway, vehicle, and environment impact driving?

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

NDS Camera Image Samples

Forward View - color

•15 Hz continuous video

Driver Face – Rotated for max pixel efficiency

Periodic still cabin image, permanently blurred for passenger anonymity

Center stack – Pedal Interactions

Right-Rear View

What is in the NDS Data Set?

Participant Assessments

- Demographic Questionnaire
- Driving History
- Driving Knowledge
- Medical Conditions and Meds
- ADHD Screening
- Risk Perception
- Frequency of Risky Behavior
- Sensation Seeking Behavior
- Sleep Habits
- Visual, Physical, and Cognitive Test Results
- Exit Interview

Vehicle Information

- Make, Model, Year, Body Style
- Vehicle Condition
- Safety and Entertainment Systems

Continuous Data

- Face, Forward, Rear, and Instrument Panel Video
- Vehicle Network Data
- Accelerometers/Gyros, Forward RADAR, GPS
- Additional Sensor Data

Trip Summary Data

- Characterization of Trip Content
- Start Time and Duration of Trip
- Min, Max, Mean Sensor Data
- Time and Distance Driven at Various Speeds, Headways
- Vehicle Systems Usage

Event Data

- Crashes, Near Crashes, Baselines
- 30s Events With Classifications
- Post-Crash Interviews
- Other Crash Data

Cell Phone Records

- Subset of participant drivers
- Call time and duration
- Call type (text, call, pic, etc.)

Roadway Data

- Matching trip GPS to roadway database
- Roadway classifications
- Other roadway data

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

RID Data Overview

Roadway Information Database (RID)

- Four data sources
    - ESRI GIS information
    - State roadway inventory data
    - Mobile van data
    - Supplemental data
- Will provide state departments of transportation, researchers, and others with powerful data sets
    - Will allow for driver behavior to be associated with physical environment on 12,000 centerline miles

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

RID Data Overview

Mobile Van Data

- New data SHRP 2 collected
- Quality assured to meet project specs
- 25,000 driven/ 12,500 centerline miles across the six NDS sites

Site	Total miles collected	% Rural/ Urban Routing purposes only
FL	4,366	Rural: 45% Urban: 55%
IN	4,635	Rural: 64% Urban: 36%
NC	4,558	Rural: 59% Urban: 41%
NY	3,570	Rural: 68% Urban: 32%
PA	3,670	Rural: 83% Urban: 17%
WA	4,277	Rural: 31% Urban: 69%
Total	25, 076	

Types of Mobile Van Data

- **Horizontal Curvature**: Radius, Length, PC, PT, Direction
- **Grade**
- **Cross Slope**
- **Lane** in terms of the number, width, and type (turn, passing, acceleration, car pool, etc…)
- **Shoulder** type/curb; paved width if exists
- **Intersection** location, number of approaches, and control (uncontrolled, all-way stop, two-way stop, yield, signalized, roundabout). Ramp termini are considered intersections
- **All MUTCD signs**
- **Barriers**
- **Median** presence (Y/N), type (depressed, raised, flush, barrier)
- **Rumble Strip** presence (Y/N) location (centerline, edgeline, shoulder)
- **Lighting** presence(Y/N)

All data (mobile van data and acquired data) are referenced to a common basemap that covers the continental US

Acquired Roadway Data

Existing roadway inventory data acquired from agencies such as the six State DOTs
(Data items not consistent)

- ~ 200, 000 centerline miles
- Includes HPMS files for the six states plus:
- Functional Classification
- Signals
- Intersections
- Access Control
- Pavement Condition
- Bridge Location
- Vertical Alignment
- Interchanges
- Rest Areas
- Terrain
- Tunnels
- FRA grade crossings

Acquired Supplemental Data

Existing data and information from State DOTs, Public Agencies, and Private Sources:

- ~ 200, 000 centerline miles
- Crash history data
- Traffic information – AADT
- Traffic Data - continuous counts (ATR)
- Traffic Data -short duration counts
- Aerial imagery
- Speed limit data
- Speed limit laws
- Cell phone and text messaging laws
- Automated enforcement laws
- Alcohol-impaired and drugged drivers laws
- Graduated driver licensing (GDL) laws
- State motor cycle helmet use laws
- Seat belt use laws
- Local climatological data (LCD) NOAA
- Cooperative weather observer/other sources
- Winter road conditions (DOT)
- Work zone
- 511 information
- Changes to existing infrastructure condition
- Roadway capacity improvements

PHASE 1 OF SHRP 2 DATA IMPLEMENTATION & OVERSIGHT

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

Phase I Implementation Program

- Phase I operates under a 5-year Cooperative Agreement between FHWA and TRB.

  – There is enough funding to operate through about March of 2019

- It is an experimental, proof of concept phase to work out data access procedures, value of the data, and to determine a long-term operations and data access plan.

- All of the procedures described in this webinar pertain to Phase I

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

Phase 1 Objectives

- Provide oversight and technical guidance for SHRP 2 Safety data implementation.

- Gather information from stakeholders and develop an involved user community

- Promote conditions under which SHRP 2 Safety Data will be widely available to qualified users while protecting the personally-identifying information of NDS participants

- Gain experience and monitor performance and data to support decisions about implementation and oversight of the SHRP 2 data after Phase 1.

- Support a transition to Phase 2, as appropriate.

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

Phase I Oversight and Governance

- TRB Role
  - Safety Data Oversight Committee (SDOC) – Establishes policies for use of the Safety Data. Policies apply to all users, sponsors, and partners
  - Expert Task Group (ETG) on Data Access – Addresses availability and technical issues
  - Expert Task Group (ETG) on User Community Development– Addresses communication and the needs of the user community
  - Manage contracts
- National Academies of Sciences, Engineering, and Medicine role
  - Institutional Review Board - Oversight of human subjects protection procedures
  - Legal Counsel – Ensures compliance with human subjects research laws

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

Phase I Contractor Roles

- Virginia Tech Transportation Institute
  - Operates under a contract to TRB. Reports to TRB and the SDOC.
  - Houses and manages the data base
  - VTTI IRB approves the data acquisition process and Data Use License templates. Staff manage the process and track usage.
  - Executes contracts with data users
  - Manages InSight web site
  - Prepares InDepth data sets for users; Removes PII; Manages a secure data enclave for viewing of PII
  - Tracks usage
- INTRANS at Iowa State University
  - Operates under a contract to TRB
  - Maintains the RID data base
  - Makes the RID data base available to users
  - Tracks usage

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

Phase I Partner Roles

- ## FHWA
  - Establish the Safety Training and Analysis Center (STAC)
    - Train and assist State DOT users
    - Pilot site for establishing a second fully operational secure remote data enclave (includes conducting on-site research and issuing contracts or agreements to utilize SHRP2 safety data through the STAC)
    - Facilitates Expanded Remote Data Access to other organizations
  - Works with TRB through the cooperative agreement to implement access to the safety data
  - Liaison member to the Safety Data Oversight Committee (SDOC), the Expert Task Group (ETG) on Data Access, and the Expert Task Group (ETG) on User Community Development
  - Provides grants to States for SHRP2 safety studies under the Implementation Assistance Program (SHRP2 IAP)

- ## AASHTO
  - Liaison member to the SDOC (4 State DOTs are members of the SDOC), the Data Access ETG, and the User Community Development ETG
  - Provides feedback to the SDOC, TRB and FHWA on State DOT and other user access and interaction with the safety data
  - Monitors the progress and results of the SHRP2 IAP studies

User Responsibilities

- *All* research with human participants at institutions that receive federal research funds is subject to the Federal Policy for the Protection of Human Subjects, known as the Common Rule (45 *CFR* 46)

- Each institution is required to have an Institutional Review Board (IRB) to review every research project that proposes to use human participants for compliance with the Common Rule's provisions regarding informed consent and minimization of risks to participants

- For proposals to use data that are already collected, the chief concern is protecting confidentiality and privacy according to the terms to which respondents consented

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

Data Constraints

- SHRP 2 Naturalistic Driving Study Dataset has access constraints based on three things:

  - Data were collected using volunteer human participants recruited and enrolled under the guidance of several Institutional Review Boards (IRBs) per federal regulations
  - Some of the data are personally identifiable information (PII) and must be protected in accordance with federal regulations, to honor promises made to participants, and to abide by the approval granted by the IRBs
  - Some of the data are original data and must be deleted in either 30 or 40 years

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

Personally Identifiable Information (PII)

- SHRP 2 NDS data include items that could be used to identify the participants, such as:
  - Driver face video
  - Full trip GPS traces (includes home, work, and school locations)
  - Unaltered forward video of a crash
  - Other less commonly used yet potentially identifying data elements (in combination with other non-identifying elements)
- PII data elements can only be accessed in a secure data enclave to respect participant privacy and minimize risk of a breach of confidentiality

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

Original Data

- The IRBs placed constraints on the retention of the original study data (collected directly from the participants at enrollment, about the vehicle at installation, from each trip during normal daily driving, and about crashes via post-crash interviews)
  - 30 years for most items
  - 40 years for de-identified sensor data
- Original study data must be tracked for eventual deletion
- De-identified summary data may be retained indefinitely

Access to Original Data

- Data Use Licenses (DULs) are required for each proposal—they stipulate type of access and are used by VTTI staff to track distribution and use of original study data to allow eventual deletion

- Requires approval from researcher's IRB

- InSight provides a way to view and query original study data but can never be used to download original study data

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

SHRP 2 NDS Data Services

- InSight Data Access
  - Self-service website portal (free registration)
  - Only aggregated, summarized, and non-personally identifying data
  - Governed by Terms of Use

- InDepth Data Access
  - Full-service data access through SHRP 2 and the Virginia Tech Transportation Institute (VTTI)
  - Requires contract, data preparation funds, IRB approval
  - Direct access to potentially any NDS data through secure data enclaves, prepared datasets, reduced data, etc.
  - Controlled through Data Use License

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

InSight Data Access

- Public facing SHRP 2 data viewing/querying website
  - First stop for those interested in NDS and available data with easy access, minimal requirements
  - Self-guided investigation of non-personally identifying data
  - Data dictionary information describing over different 1,000 variables
  - Thousands of participant questionnaires, vehicle descriptions, trip summary records, and crash/near crash event data
- Convenient way to assess the quantity and variety of data available within the entire SHRP 2 NDS dataset

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

https://insight.shrp2nds.us

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

Data Viewing Page

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

Functionality Available Now

- Background information
  - Project overview
  - Data dictionaries
  - Validation data download (not human subjects data)
  - Sample data download (not human subjects data)
- View individual datasets with filtering
- View data dictionary content for 1,000+ variables by dataset
- Event viewer (currently disabled)
  - Forward video (crashes and near crashes only)
  - Synchronized data traces for selected variables
  - Event reduction and classification
- Query capability
  - Select variables from any dataset and set filter criteria
  - View results in cross tabulations, graphs, tables of records
  - View events from trips, vehicles, drivers matching query criteria

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

Growing User Base

- About one thousand users have registered to use the InSight web portal to date.

- The great majority of registered InSight users—about 80 percent as of May 2015—are from United States Internet domains.

- However, there is also a considerable international contingent of InSight users.
  - Around 10 percent of all users are from European countries.
  - The remaining 10 percent of users are from the rest of the world, with the lion's share coming from China, Canada, Japan, and Australia.

- Over half of the current InSight users come from academia—university faculty, staff, and graduate and undergraduate students.

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

Terms of Service for Registered Users
Excerpts from SHRP 2 Website: insight.shrp2nds.us

By registering for access to the SHRP 2 Naturalistic Driving Study Safety Data Access Website ("Website"), you are deemed a "**registered user**" ("User")... there are **obligations and expectations accompanying access** to this site as a registered User:

– Access to publicly available aggregated and summarized data containing no personally identifying information

– Access to SHRP2 NDS project background information

– Access to SHRP2 NDS data access forum

– Usage statistics such as number of logins, page hits, etc. are tracked to the individual ID

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

Terms of Service for Registered Users
Excerpts from SHRP 2 Website: insight.shrp2nds.us

A registered User who presents valid Institutional Review Board (IRB) training documentation may also be deemed a "**qualified researcher**" ("researcher"). To that extent, there are **obligations and expectations accompanying access** to this site as a qualified researcher:

– User registration and upload of valid IRB training certificate required. To complete the application, the User must provide proof of training in the protection of human subjects (IRB training certificate, research ethics board training certificate, or equivalent). Researcher qualifications should include familiarity with use of confidential or proprietary data using human research participants.

– Researcher status allows broader access to individual datasets and dataset records but not to personally identifying information.

Terms of Service for Registered Users
Excerpts from SHRP 2 Website: insight.shrp2nds.us

In addition, by accepting these Terms of Service, the User agrees to the following obligations and expectations:

– The User should check with their IRB, Research Ethics Board (REB), or ethics board to see if approval is required before beginning analysis. The data are de-identified, but were collected from human subjects. Some IRBs require that these research protocols undergo IRB review, while others do not.

– The sharing of account credentials is prohibited.

– The User agrees not to attempt to learn the identity of research participants represented in these datasets by any means.

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

Terms of Service for Registered Users
Excerpts from SHRP 2 Website: insight.shrp2nds.us

- If the User discovers identifying information or data in a dataset that was intended to be non-identifying, he/she agrees to inform VTTI that the identifying information is on the website so it can be removed or de-identified.

- The User agrees not to use data for purposes other than research[1].

- The User agrees to not abuse data download privileges by repeatedly requesting data or by downloading all datasets without specific research purpose.

- The User agrees to not distribute the data to other entities or to post it in a public forum.

[1] The only exception to this term of service is that persons holding a properly executed data sharing agreement are allowed to demonstrate the InSight website, including the Event Viewer, at scientific and technical conferences, meetings, and symposia.

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

Terms of Service for Registered Users
Excerpts from SHRP 2 Website: insight.shrp2nds.us

- The User agrees to properly acknowledge the source of the data in any reports or articles resulting from the use of the database and describe how the data were helpful in the research[2].

- Please do not make any statements that suggest that the researchers or the conclusions were approved by the VTTI, SHRP 2, the Transportation Research Board, or the National Academies[3].

[2] Use the following citation: 'Transportation Research Board of the National Academies of Science. (2013). *The 2nd Strategic Highway Research Program Naturalistic Driving Study Dataset.* Available from the SHRP 2 NDS InSight Data Dissemination web site: https://insight.shrp2nds.us.'

[3] …the following disclaimer should be included at the conclusion of any publication: 'The findings and conclusions of this paper are those of the author(s) and do not necessarily represent the views of the VTTI, SHRP 2, the Transportation Research Board, or the National Academies.'

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

What Can I Do With the Website?

- Learn about how the NDS was conducted
- Explore the data dictionaries for datasets and variables of interest
- Assess data inventory with query functions
- Develop a coherent Data Use License
- Conduct initial research analyses
  - Contingency tables and cross tabulation
  - Dataset filters to produce record counts
  - Link results from queries across individual datasets

What Can't I Do With the Website?

- Obtain custom datasets or customized query results

- Access any personally identifying information

- Access continuous time series data

Remember that you can potentially gain access to the above items using the InDepth process, a Data Use License, IRB approval, and direct interaction with the SHRP 2 data management team.

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

New in Spring 2015 Release

- All available data added
  - 5.41M trip summaries
  - 4,250 crash/near crash events
  - 32,500 baseline events
- Trip summary variable extensions
  - Radar summary variables
    - 46 new variables including a variety of minimum TTCs, durations of trip with short headways, etc.
  - Roadway database linking variables
    - 19 new variables indicating duration or mileage spent on road types and where type of data exist
  - Alcohol sensor classification
    - New indicator variable based on alcohol sensor processing and video analysis

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

InDepth Data Access

- Full-service data access through Virginia Tech Transportation Institute (VTTI)
  - Crashes, near crashes, baseline trips
  - De-identified datasets **(no PII)**
  - Direct access to potentially any NDS data through secure data enclaves, prepared datasets, reduced data, etc.
- Requires contract, data preparation funds, IRB approval
- Controlled through Data Use License

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

Current InDepth Research Topics Include:

- Driver behavior and safety on curves
- Offset left turn lanes
- Lane departure warning systems
- Driver distraction/inattention
- Rural intersections
- Vehicle safety defects
- Speeding
- Animal/vehicle collisions
- "Road rage"
- Driver fatigue
- Crash risk by gender and age
- Seatbelt use
- Crash risk and driver health conditions

- Markings at pedestrian crossings
- Driver impairment risk and personality
- Autonomous vehicle safety systems
- Speed limits, roadway geometry, and driver behavior
- Closely-spaced freeway interchange ramps
- Roadway departure
- Work zones
- Inclement weather, driver behavior and traffic safety
- Fuel economy and vehicle operating costs

PHASE 1 OF SHRP 2 DATA IMPLEMENTATION & OVERSIGHT

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

InDepth Access Procedure

1. Use InSight for an initial investigation of your topic
2. Conduct conversations with VTTI (re: scope and cost for preparing and de-identifying your data)
3. Obtain your IRB approval (or proof of exemption)
4. Develop Statement of Work and execute a contract or PO with VTTI
5. In parallel with contracting, execute a Data Use License (DUL) in conjunction with VTTI
6. Work with VTTI to receive non-PII data or to arrange visit to secure data enclave for PII data

To get started contact: datasharing@vtti.vt.edu

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD

Where to Find More Information

- AASHTO SHRP2 web site Safety page: http://shrp2.transportation.org/Pages/Safety.aspx
- FHWA: www.fhwa.dot.gov/goSHRP2
- About the NDS:
  - InSight website https://insight.shrp2nds.us/
  - Recorded NDS webinar http://www.trb.org/StrategicHighwayResearchProgram2SHRP2/SafetyWebinars.aspx
- About the RID:
  - Website http://www.ctre.iastate.edu/shrp2-rid
  - Recorded RID webinar http://www.trb.org/StrategicHighwayResearchProgram2SHRP2/SafetyWebinars.aspx

The National Academies of
SCIENCES · ENGINEERING · MEDICINE

TRB
TRANSPORTATION RESEARCH BOARD