Introduction to SHRP 2 Naturalistic Driving Study and Roadway Information Databases

CUTC Summer Meeting

May 2014

SHRP2

STRATEGIC HIGHWAY RESEARCH PROGRAM

TRB TRANSPORTATION RESEARCH BOARD

Workshop Structure

- David Plazak, TRB
  - Overview of the SHRP 2 safety data
  - Planning for “Phase 1” of data availability

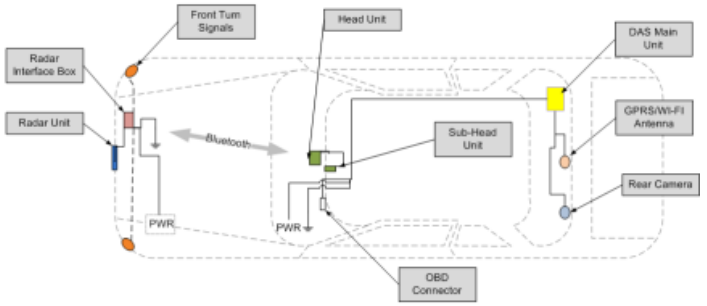
- Joel Kady, VTTI Virginia Tech University
  - What’s in the NDS Database?
  - Introduction to the InSight web portal

- Zach Hans, INTRANS Iowa State University
  - What’s in the Roadway Information Database?

- All
  - Questions, Answers, Discussion

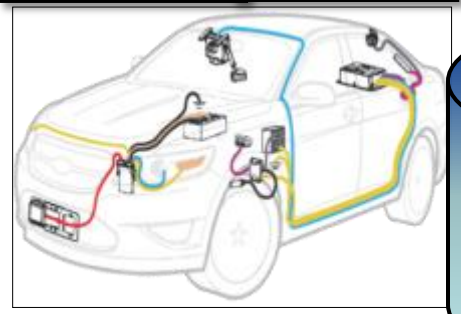
Naturalistic Driving Studies

- Instrument volunteer drivers' vehicles and collect data continuously during their normal driving



- Why?...
  - What do drivers really do? Speeding, tailgating, cell phone, alcohol…
  - What were they doing just before they crashed?
    - Usual crash studies can only guess
    - We can see fraction of second by second what happened
    - How did they avoid a crash?
  - How do the roadway, vehicle, and environment impact driving?
- Several previous smaller naturalistic driving studies
- SHRP2 Naturalistic Driving Study: 40 times larger, national scale
  - SHRP2 data could be used for 20 years or more

SHRP 2 Naturalistic Driving Study & Roadway Information Databases



NDS
Data

RID
(GIS)

Data from 3,147 volunteer drivers in six sites

Passenger cars, vans
SUVs, pickups

New data collected
12,500 centerline miles
consistent across six sites

Acquired data (DOTs, others)

- 200,000 centerline miles
- Roadway, weather, traffic ..

SHRP 2 NDS Study Design

- **Largest naturalistic driving study ever undertaken**
  - 3,147 drivers, all age/gender groups.
  - 3,958 data years; 5 M trip files; 49.7 M vehicle miles
  - 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

NDS Data Quick Overview

- Driver demographics, assessments
- Vehicle descriptors

TRIP DATA

- Multiple Videos
- Machine Vision
  - Eyes Forward Monitor
  - Lane Tracker
- Accelerometer Data (3 axis)
- Rate Sensors (3 axis)
- GPS
  - Latitude, Longitude, Elevation, Time, Velocity
- Forward Radar
  - X and Y positions
  - X and Y Velocities
- Cell Phone Records
  - Beginning and end of calls on major carriers
- Passive Alcohol Sensor
- Illuminance sensor
- Infrared illumination
- Incident push button
  - Audio (only on incident push button)
- Turn signals
- Vehicle network data
  - Accelerator
  - Brake pedal activation
  - ABS
  - Gear position
  - Steering wheel angle
  - Speed
  - Horn
  - Seat Belt Information
  - Airbag deployment
  - Many more variables…

NDS Example Data from InSight Website
(not an actual participant)

NDS Data Key Issues

- **Size: the file is huge**
  - 2 petabytes = 2 million 1 GB flash drives (1.2 PB video, 0.8 PB sensor)
  - “Give me the whole raw data file” isn’t possible or sensible
- **Complexity: different data types**
  - Categorical data constant over a trip: driver age, vehicle type
  - Sampled data: collected at original resolution (once a trip up to 640 Hz during a crash): speed, acceleration, GPS position, radar, vehicle network information
  - Video data from 4 cameras; must be coded
    - Automated reduction: lane tracker
    - Manual reduction: all other items for specific analyses
- **Privacy considerations: personally-identifying data (PII)**
  - Face video and other personal information access only with Institutional Review Board (IRB) approval for qualified researchers in a secure location

SHRP 2 Roadway Information Database (RID)

Geospatial database to manage and access disparate data sets

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)

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

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

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

NDS Tools for Data Users

- Trip summary files
- Crash, near-crash, and baseline event and epoch files
- InSight web portal
- Linked roadway information data (RID)

Planning for “Phase 1” Operations

- During 2014, data are still being assembled
- 2015-2018 or 2019 is known as “Phase 1” of operations
- Operations will emphasize making data widely available to qualified researchers
- Phase 1 will also allow for testing and evaluation of access technologies and for planning for the 15 or so years beyond that
- Necessary agreements such as MOUs and contracts and funding are now being put in place
- TRB will establish an Oversight Committee (to work out policy issues) and Expert Task Groups (to provide technical advice to the OC)
- Some data will be available in 2014

Where to Find More Information

- About the NDS:
  - On the InSight website https://insight.shrp2nds.us/
  - In the recorded NDS webinar http://www.trb.org/StrategicHighwayResearchProgram2SHRP2/SafetyWebinars.aspx
- About the RID:
  - In the recorded RID webinar http://www.trb.org/StrategicHighwayResearchProgram2SHRP2/SafetyWebinars.aspx
- About potential research topics and example work plans:
  - In the S02 report, Integration of Analysis Methods and Development of Analysis Plan http://www.trb.org/Publications/Blurbs/166051.aspx
- About the three current analysis projects:
  - In the S08 summary report, Initial Analyses from the SHRP 2 Naturalistic Driving Study http://www.trb.org/Publications/PubsSHRP2ResearchReportsSafety.aspx

Questions, Answers, Discussion