Introduction to SHRP 2
Naturalistic Driving Study and
Roadway Information Databases

CUTC Summer Meeting
May 2014
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
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 ..
• **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

### 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

### 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

<table>
<thead>
<tr>
<th>Site</th>
<th>Total miles collected</th>
<th>% Rural/Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>FL</td>
<td>4,366</td>
<td>Rural: 45% Urban: 55%</td>
</tr>
<tr>
<td>IN</td>
<td>4,635</td>
<td>Rural: 64% Urban: 36%</td>
</tr>
<tr>
<td>NC</td>
<td>4,558</td>
<td>Rural: 59% Urban: 41%</td>
</tr>
<tr>
<td>NY</td>
<td>3,570</td>
<td>Rural: 68% Urban: 32%</td>
</tr>
<tr>
<td>PA</td>
<td>3,670</td>
<td>Rural: 83% Urban: 17%</td>
</tr>
<tr>
<td>WA</td>
<td>4,277</td>
<td>Rural: 31% Urban: 69%</td>
</tr>
<tr>
<td>Total</td>
<td>25,076</td>
<td></td>
</tr>
</tbody>
</table>

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