



U.S. Department of Transportation  
**Federal Highway Administration**

## **Office of Safety Research and Development**

### **STAC and SHRP2 Studies Update**

**USDOT TRCC**

**3/23/17**

**Carol H. Tan, PhD**

**Federal Highway Administration**

**Office of Safety R&D**

**Safety Data and Analysis Team**

# Overview

 SHRP2 Data Review

 Update on STAC

 FHWA and NHTSA SHRP2 Studies

# SHRP2 NDS and RID

- **One of a kind data set** collected for safety
- Value extends to other areas of surface transportation
- Real world data (fraction sec) on *How crashes occur*

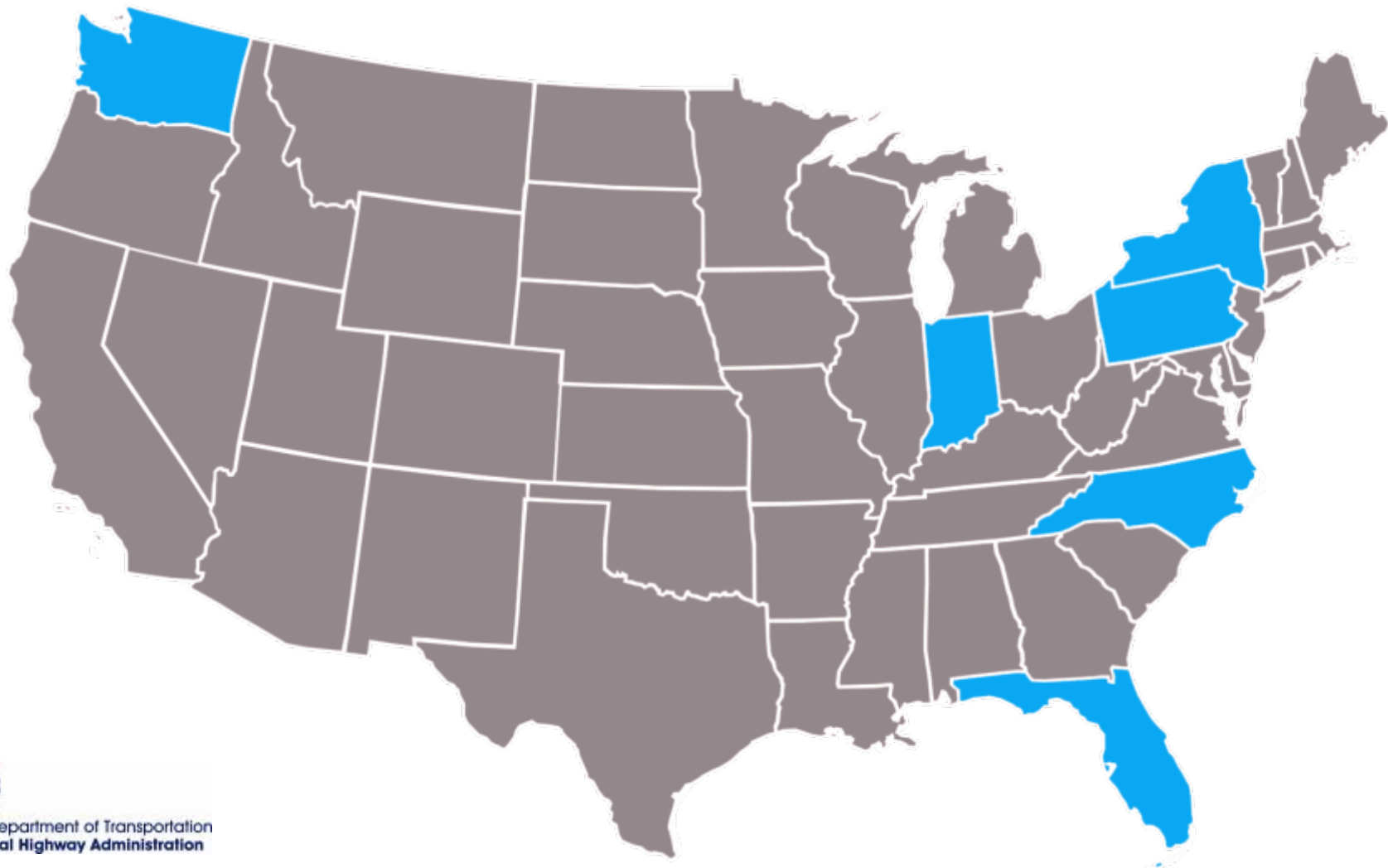


**Naturalistic Driving Database**

- *How crashes are avoided*
- *How people 'normally' drive*



**Roadway Information Database**



- **Multiple Videos**
- **Computer Vision**
  - Lane Tracker
- **Accelerometer** Data (3 axis)
- **Rate Sensors** (3 axis)
- **GPS**
- **Forward Radar**
  - X and Y positions
  - X and Y Velocities

#### **Driver/ Participant Data:**

- Age & Gender
- Visual perception
- Visual–cognitive ability
- Psychomotor ability
- Physical ability
- Health and medication status
- Psychological factors
- Driving knowledge
- Driving history

- **Illuminance sensor**
- **Infrared illumination**
- **Passive alcohol sensor**
- **Incident push button**
  - Audio (only on incident push button)
- **Vehicle network data**
  - Accelerator
  - Brake pedal activation
  - ABS
  - Gear position
  - Steering wheel angle
  - Speed
  - Horn
  - Seat Belt Information
  - Airbag deployment
  - Turn signals
  - Many more variables...

# NDS Data - 2 PB



3,500  
Participants



5.4 Million trips  
– 30+ million  
miles



Passenger car,  
Van, SUV,  
Pickup



1,600 crashes  
3000 near-  
crashes



**1 Million** hours continuously recorded video  
and other sensor data (exposure data)

# RID Data: New-collected data



12,500 centerline/25K driven miles  
Quality assured - specs/ consistent in 6 states



Lane and shoulder



Intersection and control type



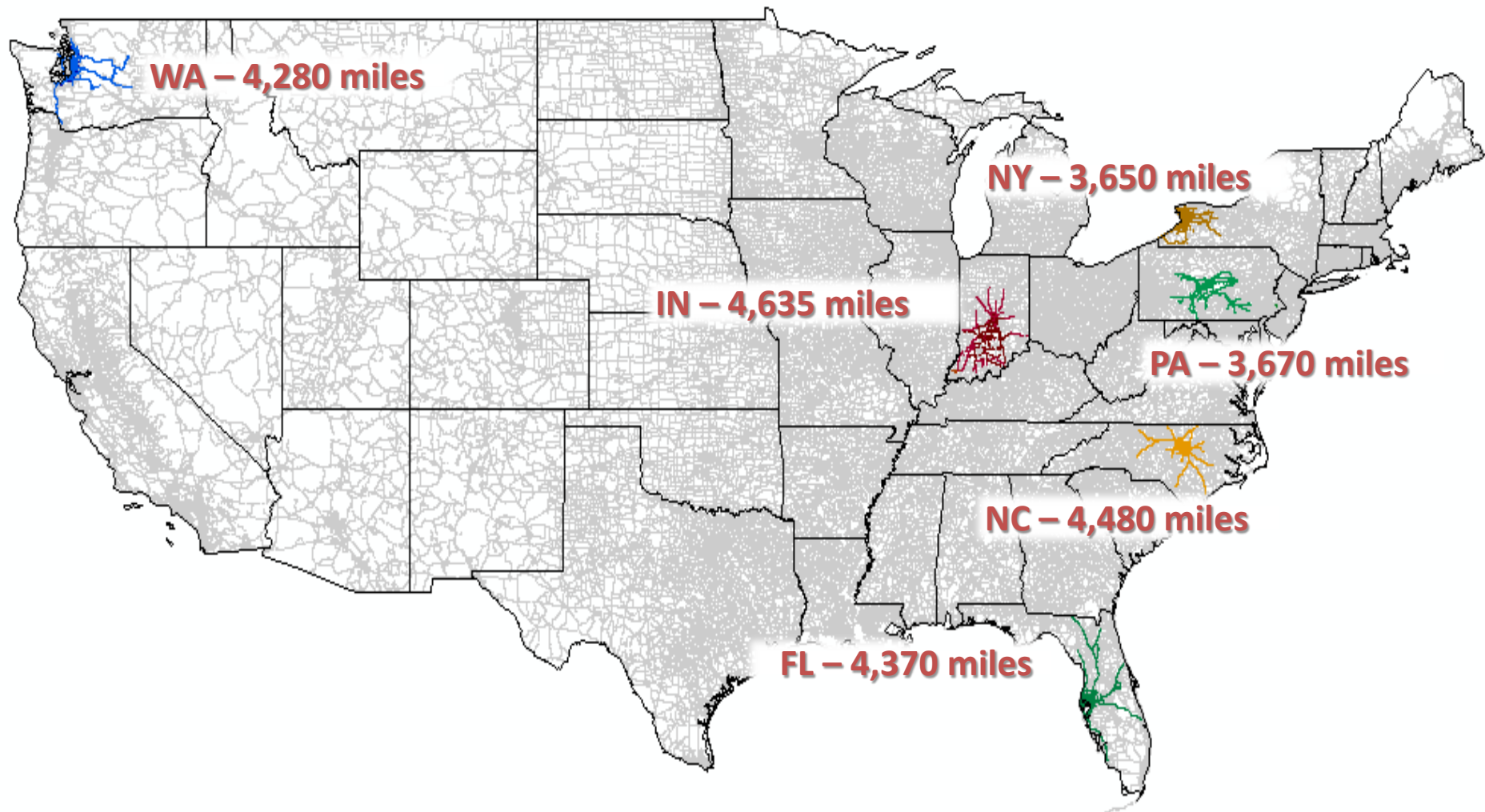
All MUTCD signs



Curvature; **grade (every 21')**



Medians, barriers, rumbles, lighting





WA – 4,280 miles



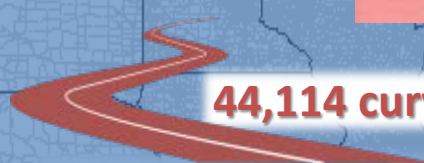
518,570 signs

33,013 miles of  
paved/unpaved  
shoulders

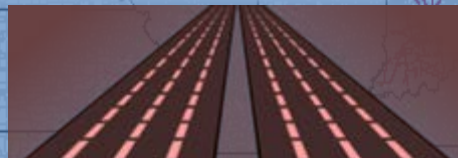


NC – 3,650 miles

44,114 curves

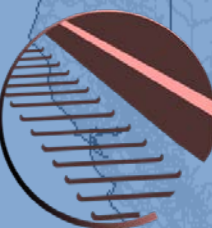


IN – 4,635 miles



10,756 miles of median

11,852 miles of rumble



7,376 miles lighting



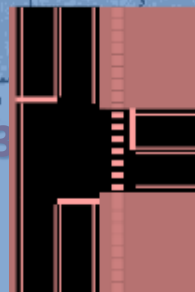
NC – 4,480 miles

6,129 miles of barriers



FL – 4,300 miles

43,195 intersections



# RID Data: Acquired-existing



200,000 Centerline miles



Weather



Traffic



7 years crash histories



Safety Laws



511, **incl work zones**; RRxing

*Captured system: driver-vehicle-roadway environment*



Naturalistic Driving Study

Roadway Information Database

# STAC

Technical Assistance, Training, and Tools for  
Researchers using the **SHRP2 NDS** and **RID** data



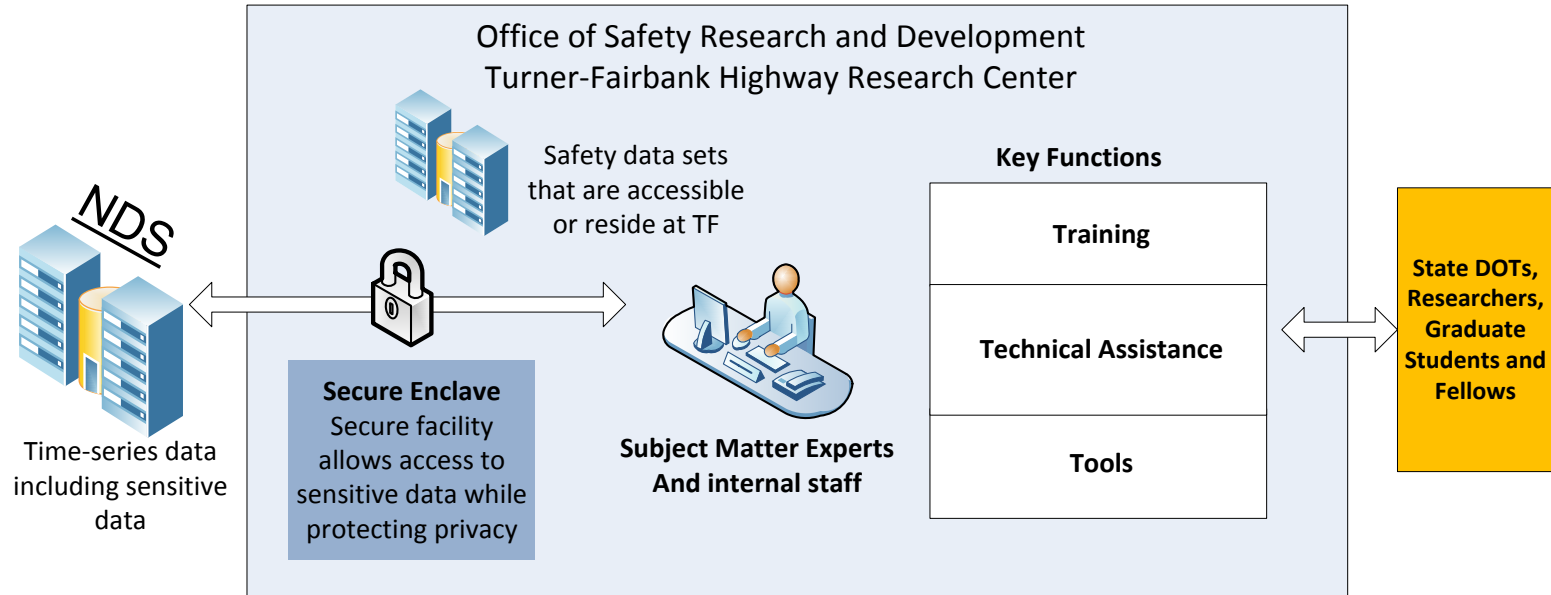
U.S. Department of Transportation  
Federal Highway Administration

**NDS  
Data**

**RID  
(GIS)**

# Safety Training and Analysis Center (STAC)

## Technical assistance with Naturalistic Driving Study (NDS) & Roadway Information Database (RID)



# STAC goals and activities

## Expand understanding of the SHRP 2 NDS and RID – develop training

- Webinar series, TRB workshop, developed & piloted detailed training for NHI

## Expand access to these data, incl. PII – remote data access

- **Est first secure remote data enclave permitted to access SHRP2 NDS data**

## Expand usability of these data – tool development

- Developed reduced data sets; enhancements to RID
- EAR video analytic tools

## Expand research opportunities

- **Technical support to state DOT and USDOT re: their own NDS/RID projects**
- **IAP, BAA**
- **Fellowships, Sabbaticals**
- **Cross-Cutting NDS Pooled Fund (TPF-5(361))**



# STAC Open for Business



# How the SHRP2 Safety Data Have Been Used

April 2015 to November 2016

- InSight website: 2,100 registered users and over 1,000 qualified users (req. human subject training- takes 30-45 min online - <https://phrp.nihtraining.com/users/login.php>)
- InDepth DULs: 196 data use licenses – data requests for time series data (costs \$\$)
  - Universities (often for DOTs) > 70 %
  - Private firms (non-OEM), OEMs, Public Health agencies
  - FHWA — 25 projects (active, pending) including IAPs and BAAs





# BAA, IAP total 17 projects



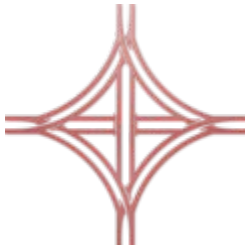
## **Adverse Weather Conditions**

- Investigating how weather conditions affect speed behavior and drivers



## **Horizontal and Vertical Curves**

- Evaluating the interaction of traffic on rural, two-lane roads



## **Interchange Ramps**

- Assessing driver behavior near closely spaced interchange ramps

**State DOTs**

**Wyoming**

**North Carolina**

**Utah**

# IAP and BAA total 17 projects

## State DOTs



### Roadway Departure

- Investigating the roles of the driver and roadway characteristics in crashes



### Roadway Lighting

- Identifying the role roadway lighting conditions play in crashes



### Speeding

- Assessing how speed limits on certain types of roadways affect driver behavior
- Examining episodic speeding

**Iowa**

**Washington**

**Michigan**  
**Missouri**  
**Washington**

# IAP and BAA total 17 projects

**State DOTs**

**Michigan  
Minnesota  
Missouri**

**Florida  
Maryland  
Nevada  
New York**

## **Work Zones**

- Determining the role played by speed and distractions in and around work zone crashes

## **Vulnerable Road Users**

- Understanding the interactions between pedestrians and drivers at signalized intersections
- Assessing the influence of different factors on pedestrian crashes at intersections
- Analyzing pedestrian safety and high-visibility markings

# IAP and BAA total 17 projects



## **Intersection**

- Driver and situational red-light running
- Dilemma zone at high speed signalized loc.
- Driver behavior and rural intersection safety



## **Enforcement**

- Driver behavior and high visibility enforcement



## **Analytics and crash hot spot evaluation**

- Crash model evaluation

## **State DOTs**

**AL/CA/IA/MI/MN/  
OH/WI/WS**

**New York**

**Virginia**

# IPAs – Phase II ending May

Focus Area	Project Title	Recipient/ Contractor
Pedestrian	Driver Interaction with Pedestrian Features at Signalized Intersections when Pedestrians are or are not Present	FL/U of South Florida
Road Departure	Role of Driver and Roadway Characteristics in Road Departure Crashes and Safety Critical Events	IA/CTRE Iowa State
Speeding and Speed-Related	The Interrelationships between Speed Limits' Geometry and Driver Behavior	MI/ Wayne State & Iowa State
Work Zones	Role of Speed and Distraction in Work Zone Crashes or Near Crashes	MN/ CTRE Iowa State
Horizontal/ Vertical Curves	Evaluation of the Interaction between Horizontal and Vertical Alignment on Rural Two Lane Roads	NC/U of North Carolina
Interchanges	Impact of Closely Spaced Interchange Ramps on Driver Behavior and Performance	UT/U of Utah
Lighting	Illumination Safety Research Using SHRP2 Naturalistic Safety Data (NSD) Collected in Washington State	WA/VTTI
Speeding and Speed-Related	Examination of Episodic Speeding on Washington State Roads	WA/Battelle

# BAA Projects – Phase I completed, reviewing proposals for Phase II

Focus Area	Project Title	Contractor
Intersections	An Examination of Driver and Situational Factors That Affect Driver Red Light Running and Go/No-Go Dilemma-Zone Decisions at High Speed Signalized Intersections	Battelle
Enforcement	The Development of New Insights into Driver Behavior To Improve High Visibility Highway Safety Enforcement Programs	CUBRC
Intersections	Evaluating the Relationship Between The Driver and The Roadway to Address Rural Intersections Safety	ISU
Work Zones	Multi-Disciplinary Approach to Investigate Work Zone Safety	Missouri
Speed	Development of Speed-Safety Relationships	MRI Global
Vulnerable Road Users	Toward a Better Understanding of Vulnerable Road User Safety Issues	TransAnalytics
Work Zones	Understand Normal and Abnormal Driving Behavior in Work Zones	UMTRI
Crash Surrogates	Applying the Crash Trifecta Model to an Analysis of Crash Hotspots	VTTI 22

# FHWA In-house Studies

Project	Program/Contract Mechanism
Driver Behaviors Study at Select High Crash Interchanges/Intersections in Washington State	NRC Fellow – Post Doc
Evaluation of Association between Observed Driving Speeds and the Occurrence of Crashes Using NDS data	IPA – U of Conn
Analyzing Naturalistic Driving Study (NDS) Data for Car-Following Behaviors/Moving FHWA Work Zone Driver Model Towards Practical Application	Eisenhower GRF – U of Wyoming
An In-Depth Investigation of the Efficacy of High Visibility Crosswalks (HVC) by Regional Difference, Location and Configuration Using SHRP2 NDS Data to Improve Pedestrian Safety	NRC Fellow – Post Doc
Differences in Young and Elderly Driver Behaviour and How They Interact with Roadway Infrastructure in Naturalistic Settings	Graduate Assistant – George Mason

# NHTSA Studies

 *Quantifying Drowsy Driving*  
(<https://rip.trb.org/view/2015/P/1427692>)

 *Characteristics and Predictors of Occasional Seat Belt Users* (<https://rip.trb.org/view/2014/P/1427693>)

 *Analysis of SHRP2 Speeding Data*  
(<https://rip.trb.org/view/2013/P/1427691>)

 *The Effects of Medical Conditions on Driving Performance*  
(<https://rip.trb.org/view/2011/P/1260411>)



# SHRP2 Naturalistic Driving Study Pooled Fund TPF-5(361): Advancing Implementable Solutions

Cross-cutting  
Safety-Operations-Planning



# SHRP 2 Naturalistic Driving Study Pooled Fund:

## Advancing Implementable Solutions

- Strategic-coordinated approach
- Minimize risk
- Maximize resources to address Safety, Operations, & Planning
  - Address high priority needs, leverage resources, and accelerate 'sound'-actionable results
  - Development and improvement of predictive models and design guides; development and improvement of countermeasures, policy recommendations, etc.
- FHWA will contribute \$1,000,000 over 5 years
- Requesting min State contribution of \$50k/year



## Safety Training and Analysis Center

Office of Safety Research & Development

Turner-Fairbank Highway Research Center

<https://www.fhwa.dot.gov/research/resources/stac/>

### Charles Fay

SHRP2 Research Manager

Phone: 202-493-3336

Email: [charles.fay@dot.gov](mailto:charles.fay@dot.gov)

Fax: 202-493-3374



### Yusuf Mohamedshah

SHRP2 Research Analyst

Phone: 202-493-3464

Email: [yusuf.mohamedshah@dot.gov](mailto:yusuf.mohamedshah@dot.gov)

Fax: 202-493-3374

