



## Concept to Countermeasure – Research to Deployment Using the SHRP2 Safety Data

### Frequently Asked Questions

The Federal Highway Administration and AASHTO are soliciting applications from state transportation agencies through the Implementation Assistance Program for the *Concept to Countermeasure* research and implementation using the SHRP2 Safety Data. These frequently asked questions (FAQs) address key questions applicants may have.

#### What is SHRP2?

The second Strategic Highway Research Program (SHRP2) has undertaken more than 100 research projects designed to address critical state and local challenges such as aging infrastructure, congestion, and safety. The research results are now being made available in a series of effective solutions that will improve the way transportation professionals plan, operate, maintain, and ensure safety on America's roadways.

Authorized in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), SHRP2 builds on the success of the first SHRP, which produced, among other innovations, Superpave – a process for creating more durable roads – and new technology for addressing snow and ice. The Moving Ahead for Progress in the 21st Century Act (MAP-21) has authorized additional funding to support implementation activities.

SHRP2 will continue to launch proven innovations through 2015 as research and pilot projects are completed. By implementing SHRP2 Solutions, the transportation community will more efficiently strengthen the Nation's highway system to serve us through the 21st century. For more information, view the [SHRP2 outreach toolkit](#).

#### What are the SHRP2 Safety Data?

The SHRP2 Safety Data consist of two large databases: a Naturalistic Driving Study (NDS) database and a Roadway Information Database (RID). The NDS data, exceeding 2 petabytes in size - about the size of two million 1-gigabyte USB flash drives - provide a wealth of information regarding driving behavior, lane departures, and intersection activities that will be of interest to transportation safety researchers and others. The RID is a smaller database of the roadway elements and conditions. These two databases can be linked to associate driver behavior with the roadway characteristics. They are explained further below.

#### What are “naturalistic” driving study data?

A naturalistic driving study records ordinary driving under real-world conditions in order to make data

available to transportation agencies and researchers studying highway safety issues. In the SHRP2 study, 3147 volunteer drivers agreed to have their cars fitted with cameras, radar, and other sensors to capture data as they went about their usual driving tasks. Experience with earlier naturalistic driving studies demonstrates that drivers quickly forget the presence of cameras and sensors, which are as inconspicuous as possible. This allows researchers to study driving behavior that is as close to “natural” as possible: hence, a “naturalistic driving study.” This kind of study is needed because driver behavior contributes to more than 90 percent of crashes, and is the primary factor in more than 60 percent of crashes. Without naturalistic data, crash causation analyses must be based on interviews with drivers or investigators’ recreation of crashes. The NDS provides objective information on what preceded crash and near-crash events, and identifies what drivers actually are doing during routine driving conditions.

## What was the study’s objective?

The central goal of SHRP2 Safety research was to collect data that can be used to address the role of driver performance and behavior in highway safety. This includes developing an understanding of how the driver interacts with and adapts to the vehicle, traffic environment, roadway characteristics, traffic control devices, and the environment. It also includes assessing the changes in collision risk associated with each of these factors and interactions. This information will support the:

- Development and deployment of new safety countermeasures;
- Updating current design guides and associated practices;
- Driver training programs;
- Vehicle design;
- Infrastructure improvements; and,
- Public policy and enforcement.

## Who was included in the study?

The drivers in the study were men and women of all ages, from different socioeconomic strata, and from six geographic areas across the United States, driving different types of light vehicles. Volunteer drivers were recruited in a variety of ways, including through a national call center and local outreach efforts to attract drivers in each category. Volunteers were assessed for their visual perception, driving knowledge, reaction time, lower limb strength, and other factors so that these factors can be studied in relation to actual driving behavior under normal driving conditions.

## What is included in the Naturalistic Driving Study database?

The Naturalistic Driving Study database (NDS) includes video images of the view out the front and rear windshields and of the driver’s face and hands. Additionally, rates of acceleration, lateral and vertical motion, the presence of alcohol within the cabin, position information, turn signal actuation and other variables such as steering wheel angle, speed, seat belt use, and air bag deployment were recorded through various sensors. Radar was used to identify objects in the front of the cars, their range, and the rates at which the range changes. An incident push button allowed participants to report critical events and emergencies.



## What is included in the Roadway Information Database?

The Roadway Information Database (RID) is a geo-database that contains two broad types of data. New roadway data were collected and quality assured by SHRP2 on 12,500 centerline miles across the six NDS sites (these data types are listed below). Existing roadway and other relevant information were obtained from government, public, and private sources. These data further characterize the driving environment on approximately 200,000 centerline miles within the six study sites. Descriptions of the RID data are available: <http://www.trb.org/StrategicHighwayResearchProgram2SHRP2/SafetyWebinars.aspx>

All the RID data are referenced to a national base map that provides a consistent centerline across the six NDS sites. This design allows the users, through the process of dynamic segmentation, to produce road segments with any variable of interest from the various datasets contained in the RID. This capability of the RID makes it a very useful tool for NDS users interested in roadway characteristics and features by allowing them to focus on only those NDS trips that traversed road segments containing the items of interest.

The NDS and RID data sets will be linked by Dec. 31, 2014, to provide researchers with a uniquely powerful data source. Both data sets are geo-referenced, allowing for driver behavior to be indexed to aspects of the physical environment such as signs, other roadside hardware, and road design details, as well as to transient elements of the driving environment such as work zones and weather.

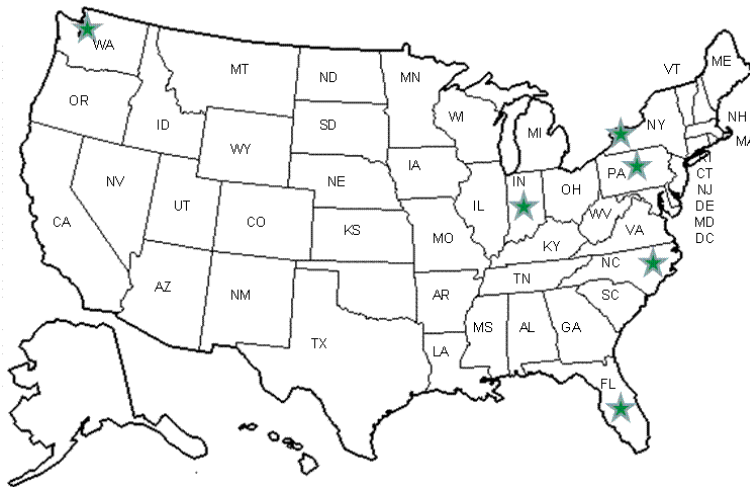
New roadway data collected consistently across the six NDS sites include:

1. Horizontal curvature:
  - a. Radius

- b. Length
  - c. Point of Curvature
  - d. Point of Tangent
  - e. Direction of curve (left- or right-based on driving direction)
2. Grade
3. Cross-slope/super-elevation
4. Lanes in terms of the number, width, and type (e.g., turn, passing, acceleration, car pool)
5. Shoulder type/curb (and paved width if it exists)
6. All MUTCD signs
7. Guardrail/barriers
8. Intersection location
9. Intersections: number of approaches, and control (uncontrolled, all-way stop, two-way stop, yield, signalized, roundabout). Ramp termini are considered intersections.
10. Median presence, type (depressed, raised, flush, barrier)
11. Rumble Strip presence, location (centerline, edgeline, shoulder)
12. Lighting presence
13. High definition video log

## Where were the data collected?

Six sites were selected for the roadway and NDS data collection through a process that required



contractors to present their qualifications and demonstrate the suitability of the site they wished to manage. The sites that were ultimately chosen from the 19 contractors who responded to the requests for qualifications were in Tampa, Florida; central Indiana; Durham, North Carolina; Erie County, New York; central Pennsylvania; and Seattle, Washington. Ultimately, the 3,147 drivers travelled almost 50 million miles.

## What are the privacy restrictions?

It is important to note that all privacy protections promised to participants and their data will continue indefinitely. Future research that seeks to use personally-identifying (PII) data collected in the NDS requires institutional review board (IRB) approval. In addition, researchers must establish a data-sharing agreement that guarantees privacy. The [SHRP 2 Data Access Guide](#) includes excerpts from the Consent Form for Primary Drivers and a Sample Data Sharing Agreement. State transportation agencies that want to pursue Implementation Assistance Program funding, and do not have Institutional Review Board privacy processes in place may want to consider teaming with a research entity that has an approved IRB process.

IRBs are independent ethics committees formally designated under the Office for Human Research Protections (OHRP) of the Department of Health and Human Services to approve, monitor, and review research that involves human subjects. An IRB performs oversight by approving, requiring modifications to planned research prior to approval, or rejecting proposed research. Before the NDS began, it was approved by several IRBs, including the Virginia Tech IRB, the IRB for the National Academy of Sciences, and four other IRBs.

Researchers who are not familiar with rules regarding human subjects' research, and the data gathered in such research should begin by visiting the National Institutes of Health (NIH) website <http://grants.nih.gov/grants/policy/hs/index.htm> and reviewing the NIH data-sharing policies and data-sharing workbook. They are also directed to the OHRP website that addresses human subjects research at <http://www.hhs.gov/ohrp/>.

### Does a researcher and their organization need to have their own IRB, institutional review board, and have a certified process in order to do research within this SHRP2 safety topic?

Not necessarily, but it may make the logistics somewhat easier to manage. The alternative for organizations that do not have an institutional review board (IRB) is to hire one. This means there will be a cost involved, and a bit of a learning curve as to how the for-hire IRB approaches the application process. As far as the execution of a data sharing agreement is concerned, however, approval/exemption from an institution's own IRB is no different to that from a for-hire IRB.

### Or, does the researcher need to apply for researcher status?

The website <https://insight.shrp2nds.us/home>, which is governed by the VTTI RIB process, is the location to register for researcher status. Qualified-researcher status is obtained once proof of institutional review board (IRB) training is received. IRB training (which is independent of IRB approval/exemption for a particular research project) can be received from one's own IRB, or from another IRB that provides that service. NIH provides training modules that can be used free of charge, as does the Virginia Tech IRB (and many others). This is independent of IRB approval for the research project, which would need to be received from one's own IRB or from a for-hire IRB (as mentioned in the previous answer).

### What is the Implementation Assistance Program?

The Federal Highway Administration Implementation Assistance Program is designed to help State departments of transportation (DOTs), metropolitan planning organizations (MPOs), and other interested organizations deploy SHRP2 Solutions. A range of opportunities for technical and financial assistance is available to raise awareness of SHRP2 Solutions and to encourage early adoption of these products. Application periods are offered approximately twice per year.

### What do AASHTO and FHWA hope to achieve through this Implementation Assistance?

AASHTO and FHWA are very interested in promoting and demonstrating the use of the SHRP2 Safety Data. They and the Transportation Research Board believe that important new countermeasures to re-

duce highway crashes can be discovered by researching driver behavior through the SHRP2 safety data. AASHTO has formed a SHRP2 Safety Task Force that identified the following objectives:

1. Identify for AASHTO and FHWA the most promising strategies for capitalizing on the Naturalistic Driving Study (NDS) data analysis to further the multiple efforts of various AASHTO committees to continuously reduce highway crashes.
2. Review and comment upon research proposals and research findings.
3. Lead from concept to countermeasure the coordination and cooperation among AASHTO committees for supporting research, analyzing findings, and developing promising countermeasures and strategies.
4. Select, guide, and promote early studies that demonstrate to AASHTO members and the highway safety community in general the potential of the NDS.
5. Identify strategies to accelerate the conversion of research findings into actionable strategies and countermeasures.

### Why is it called Concept to Countermeasure?

A countermeasure is an action or strategies to prevent, offset, or alleviate the impacts of a crash. Highway safety countermeasures could be identified in the categories of engineering, education, enforcement, or emergency services.

FHWA and AASHTO want to promote SHRP2 Safety Data research that identifies promising new countermeasures. IAP recipients must agree not only to research a topic using the SHRP2 Safety Data, but also to actively pilot and promote any countermeasures that are identified by their research. A primary – but not the only – goal is national adoption of new countermeasures. Adoption could include wide national understanding and use of the measure or its incorporation as an approved countermeasure or strategy in national manuals, guides, or policies.

### What assistance is available to agencies interested in piloting the SHRP2 Safety Data?

Financial and technical assistance up to \$100,000 will be made available for the first of three possible phases of research and countermeasure implementation. Applications will be available beginning May 30, 2014, on the SHRP2 Implementation Assistance Program website at <http://www.fhwa.dot.gov/goshrp2/ImplementationAssistance>. Applications are due by June 27, 2014.

### What is expected of the applicants?

To simplify the application process and to reduce the risk and uncertainty to applicants, a three-phased process will be used. In Phase I, applicants can apply for up to \$100,000 to acquire a small pilot data set of Naturalistic Driving Study (NDS) and Roadway Information Database (RID) data, and to demonstrate within nine months the proof of concept of their research proposal. The pilot data set will contain all the variables needed for the full analysis but only a small number of trips or trip segments. The pilot data set will require less time and expense to acquire and analyze than would a dataset containing all the trips or trip segments of interest. Applicants will use the pilot data set to demonstrate that a full analysis with a larger data set can answer the research question posed by the agency and its research partners. The SHRP2 database is a massive, 2-petabyte database that includes complex video and other data that

few researchers have used. The pilot data set will allow applicants to gain experience with the NDS and RID data and to refine their data request for Phase II.

Applicants must acquire on their own a pilot dataset from the Virginia Tech Transportation Institute (VTTI), which is the organization that is currently hosting the NDS data. Within the nine months and with the maximum \$100,000 Phase I budget, the applicant must acquire a pilot data set, analyze it, and produce promising preliminary findings that prove the validity of its research concept.

At the end of Phase I, the applicants must produce a brief report and meet with FHWA and the AASHTO SHRP2 Safety Task Force. The applicant must report on its findings and provide a work plan and budget for a Phase II and a possible Phase III.

There is no guarantee that Phase I IAP recipients will advance to Phase II. If Phase I is not promising, the Task Force and FHWA could decide at their sole discretion not to provide additional support to the applicant or the applicant's research question.

If the Task Force and FHWA find the Phase I results promising, they could approve additional IAP financial or technical support for a Phase II. In Phase II, applicants will acquire a larger dataset and use it to explore the research question more fully. A separate work plan, budget, and schedule will be negotiated for Phase II.

If Phase II produces meaningful results that are likely to lead to an implementable countermeasure or a new behavioral strategy, the Task Force and FHWA could provide additional financial or technical support for a Phase III, which would address implementation of the countermeasure. Implementation would not include additional research. Instead, implementation in Phase III could include engineering or other support to update national manuals, policies, or strategies to incorporate the countermeasure and endorse it for national adoption. Phase III might also include pilot testing a developed safety countermeasure in the field.

## Can some NDS data be accessed directly?

Yes. Naturalistic Driving Study (NDS) data are readily available on the TRB InSight website. The website contains two types of data without any personally identifying information: categorical data on all trips in the NDS database, and 30-second segments of continuous data, including the forward video, on all crashes and near-crashes as well as some random baseline driving segments. As of April 2014, the website contained data on 1,143,033 trips and 113 crashes and near-crashes. The remaining data will be added in quarterly updates throughout 2014. The InSight website is available at <https://insight.shrp2nds.us/>.

Applicants may apply for IAP assistance to conduct research using data from the InSight website. These data could support a variety of research questions, but none would involve data that could identify study participants or involve detailed roadway information. They could support research into questions such as:

- a) How often do drivers use cell phones? How does cell phone use vary by driver age and gender? How do hand-held cell phone laws affect cell phone use? (Two study states have hand-held

bans.) (Cell phone use is coded as the percentage of time the driver was using the phone during the trip.)

- b) What driver, vehicle, environmental, roadway, and trip characteristics are over-represented in crashes and near-crashes?
- c) For crashes and near-crashes involving lane or roadway departure, how often was the departure due to an emergency maneuver to avoid a vehicle, animal, or object in the travel lane?

### Who can apply for implementation assistance?

Applicants must be state transportation agencies; however, they are strongly encouraged to partner with public- or private-sector researchers given the requirements for IRB approval and related privacy requirements.

### What are the financial arrangements?

The successful state transportation agencies will be responsible for managing the Federal-aid funding with its accompanying requirements. The AASHTO SHRP2 Safety Task Force will maintain an oversight role through the life of the project, and successful proposers should anticipate communicating with the task force periodically. The recipient will receive an increase in Federal-aid appropriation equal to the Implementation Assistance. No state match is required.

### Have priority research areas been identified?

Yes. AASHTO is particularly interested in proposals addressing one of these five broad topics:

1. Driver Speed: What driver speed reactions, considerations, or adjustments occur under various roadway and/or environmental changes? Specific factors examined could be traffic control devices, work zones, school zones, transitional speed zones, weather elements, adjacent vegetation, or other factors.
2. Roadway Features and Driver Performance: How do certain roadway features influence driver performance or behavior? Specific factors examined could be roadway lighting, signage, pavement markings, rumble strips, stop bars, super-elevation, clear zones, or other features.
3. Preceding Contributory Events: What and how do driver characteristics, behavior, or performance tend to precede crashes and near-crash events? What commensurate actions tend to prevent near-crashes from resulting in crashes?
4. Vulnerable Road Users: How do drivers interact with vulnerable road users, for example, pedestrians, bicyclists, or motorcyclists?
5. Intersections: How is negotiation performance at either rural or urban intersections influenced by roadway elements, driver characteristics or driver behaviors? Specific factors examined could be at-grade intersections on rural expressways, lighting conditions, turn lanes, medians, signs, or pavement markings, signalized versus unsignalized intersections, by the presence of pedestrians, by driver age or other driver characteristics.

The AASHTO Task Force also strongly encourages well-reasoned proposals in other safety topic areas and is willing to consider any well-formulated project proposals of interest to states, including but not necessarily limited to the five areas of interest previously listed.



## Are there examples of research using the SHRP2 Safety Data?

Yes. The Transportation Research Board authorized a series of studies to explore potential usage of the data and to conduct four pilot research projects. Information about these preliminary efforts can be found at <http://www.trb.org/StrategicHighwayResearchProgram2SHRP2/naturalisticdrivingstudy.aspx>. Proposers are strongly encouraged to review the results of the SHRP2 research report *S02-RW-1 Integration of Analysis Methods and Development of Analysis Plan*, [http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2\\_S2-S02-RW-1.pdf](http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2_S2-S02-RW-1.pdf), in selecting research topics. The report addresses many research topics that could be pursued with the SHRP2 Safety Data.

Additional information about the four pilot studies conducted by TRB to date can be found at <http://www.trb.org/Main/Blurbs/168727.aspx>. The four selected contractors and their research areas were:

- Iowa State University Center for Transportation Research and Education (CTRE): Lane departures on rural two-lane curves;
- MRI Global: Offset left-turn lanes;
- University of Minnesota Center for Transportation Studies (CTS): Rear-end crashes on congested freeways; and,
- SAFER Vehicle and Traffic Safety Centre at Chalmers University, Sweden: Driver inattention and crash risk.

The four TRB-sponsored contracts began in February 2012. In Phase 1, which concluded in December 2012, each contractor obtained an initial set of data, tested and refined its research plan, and developed a detailed plan for its full analysis. The three projects selected for Phase 2 each obtained and analyzed a much larger data set. They will submit their final reports by July 31, 2014.

In addition to these safety questions and many more that will be raised in the future, there may be still broader applications for the data, in areas such as highway operations and planning, environmental impact of vehicles, and psychological study of drivers. The SHRP2 study is not specifically designed for these uses but the database may well be able to support more than highway safety research.

## What additional information is available?

Two webinars have been held and a workshop is scheduled to discuss the *Concept to Countermeasure* implementation assistance solicitation. Recordings of the webinars can be accessed at [http://www.fhwa.dot.gov/goshrp2/Solutions/Safety/NDS/Concept\\_to\\_Countermeasure\\_Research\\_to\\_Deployment\\_Using\\_the\\_SHRP2\\_Safety\\_Data](http://www.fhwa.dot.gov/goshrp2/Solutions/Safety/NDS/Concept_to_Countermeasure_Research_to_Deployment_Using_the_SHRP2_Safety_Data).

In addition, an online workshop on May 23<sup>rd</sup> will go into additional depth on the Safety Data and how it can be used. The May 23<sup>rd</sup> workshop will feature presentations by two researchers who conducted pilot studies and who have acquired practical experience in using the Safety Data. Registration for that workshop is at <https://attendee.gotowebinar.com/register/8230145058557228290>.

Additional websites with information include:

- The FHWA SHRP2 Solutions safety website at

[http://www.fhwa.dot.gov/goshrp2/Solutions/Safety/NDS/Concept to Countermeasure Research to Deployment Using the SHRP2 Safety Data](http://www.fhwa.dot.gov/goshrp2/Solutions/Safety/NDS/Concept_to_Countermeasure_Research_to_Deployment_Using_the_SHRP2_Safety_Data), which includes a summary of the Safety Data.

- The FHWA GOSHRP2 website includes general information about the SHRP2 Solutions and the implementation assistance program. <http://www.fhwa.dot.gov/goshrp2/>
- The TRB SHRP2 Naturalistic Driving Study page includes the preliminary research conducted to date.  
<http://www.trb.org/StrategicHighwayResearchProgram2SHRP2/naturalisticdrivingstudy.aspx>
- The TRB SHRP2 safety page  
[http://www.trb.org/StrategicHighwayResearchProgram2SHRP2/Pages/Safety\\_153.aspx](http://www.trb.org/StrategicHighwayResearchProgram2SHRP2/Pages/Safety_153.aspx) includes extensive background on the safety program.
- One-hour recorded webinars on the Naturalistic Driving Study (NDS) and Roadway Information (RID) databases may be found at  
<http://www.trb.org/StrategicHighwayResearchProgram2SHRP2/SafetyWebinars.aspx>