



## Safety Research in SHRP 2

SHRP 2 Safety research addresses the role of driving behavior in traffic safety. Despite the fact that driving behavior is widely believed to be responsible for most collisions, the relationship of driver performance to roadway design and traffic conditions as they affect the risk of collisions and casualties is largely an unknown area. SHRP 2 safety research will take advantage of unprecedented opportunities to improve highway safety through advanced technologies. The goals include understanding how drivers interact with and adapt to various factors—the vehicle, traffic environment, roadway characteristics, traffic control devices, and the environment—and assessing the changes in collision risk associated with each of these factors and interactions.

### Research Questions

Most highway safety research has focused on crashes and how changes in vehicles and roads could improve safety. SHRP 2 safety research will focus on collecting data on driving behavior in pre-crash and non-crash circumstances. The research will quantify the interactions of drivers, roads, vehicles, and environmental conditions and develop objective measures of crash risk. An ambitious effort will use on-board recorders to capture data on 2,000 to 3,000 volunteer drivers, their vehicles, the environment, and the roadways. Analysis of the data will have implications for effective countermeasures to reduce the number and severity of crashes. While the study can involve many crash types and situations, attention will be given to crashes involving lane departures and crashes at intersections. Candidate factors include:

- Driver factors: age and gender, speed, driver errors, inattention, distraction, fatigue, impairment, and perhaps driving characteristics such as aggressive or non-aggressive driving styles that might be characterized from measured driving performance such as speed on curves, deceleration levels on intersection approach, or gap acceptance.
- Roadway factors: edge-marking, rumble strips, lane width, shoulder type and width, curvature, grade, signing and sight distance.
- Intersection factors: signal versus signed, intersection configuration, signal timing, traffic volumes, and sight distance.
- Environmental factors: light condition, weather, and pavement quality condition.
- Vehicle factors: vehicle type (e.g., car, SUV, van), braking characteristics, handling characteristics, available crash prevention technologies (e.g., cruise

control, stability control), and visibility characteristics (e.g., blind zones, headlamp performance).

Specific research questions will address the possible relationship of these factors, either independently or in combination, with the risk of road departure or intersection collisions.

### *Collision Surrogates*

A central issue for the planned analysis is the evaluation of collision surrogates. A collision surrogate is an event close to a collision, such as a near-collision or a traffic conflict. If risk is based only on actual collisions, large amounts of travel must be combined across many drivers to get a stable risk estimate. The use of surrogates for collisions, such as near-collisions, critical incidents, or traffic conflicts, can greatly increase the power of field studies since the surrogates occur much more frequently than crashes, and without harm. The concept of traffic conflicts was first introduced in 1968 and continues to develop. The new SHRP 2 data collection technologies will continuously measure crash margin factors such as the time-to-lane departure, or the time-to-collision. These are examples of measures that can be used to form surrogate risk estimates for specific traffic maneuvers.

### **Research Methods**

The same advanced technology that enables intelligent vehicle safety also enables the near-continuous collection of a vast array of data, including driver inputs and vehicle motion and position relative to the roadway and other vehicles. This new capability allows study of the entire driving process, including pre-collision and collision events, with an accuracy that could previously only be achieved under laboratory conditions.

The SHRP 2 safety research plan applies these technologies in two research tracks: the first track is a large field study of driving behavior using volunteer drivers and a sophisticated instrumentation package installed in the volunteers' vehicles. In the second track, a video system records the movements of all vehicles at specific road sites, such as an intersection. Table 1 lays out the main projects and provides a general idea of the flow of work. The exact number, content, and timing of contracts may change.

### **Current Projects**

Work is underway for two Safety projects. Project S01: *Development of Analysis Methods Using Recent Data* includes five separate contracts to develop or identify approaches to analyzing driving behavior and crash risk data and to demonstrate the methods on recently collected data sets from in-vehicle studies. Total funds for the 24 month, \$1.5M project were divided among the University of Michigan, the University of Minnesota, the University of North Carolina, Iowa State University, and the Pennsylvania State University.

The University of Michigan will conduct research for the \$1M, 21-month Project S09: *Site-Based Video System Design and Development*, which requires developing a site-based video system that captures surrogate measures of collision risk and demonstrates in a field study the correlation of the surrogate measures to actual crash frequencies. These projects will initiate the design of the major safety studies to follow.

A third project, Project S05: *Design of the In-Vehicle Driving Behavior and Crash Risk Study*, will develop and demonstrate the in-vehicle data collection system as well as design a management plan for the full-scale study of in-vehicle driving behavior and crash risk. At this writing, a contract is being negotiated for this project.

Requests for proposals for two more projects are scheduled for release in July 2007. Project S02: *Integrate Methods and Develop Analysis Plan*, will review the products of the first project (S01) and develop an analysis plan for the in-vehicle driving study. Project S03: *Specification and Acquisition of Roadway Measurement Van* is to acquire a van tailored to collect the roadway characteristics needed throughout the data collection period of the in-vehicle driving behavior field study.

**Table 1 SHRP 2 Safety Research Plan**

	2007	2008	2009	2010	2011
<b>In-Vehicle Study</b>					
Study Design & Field Data Collection	S05: Design of the In-Vehicle Driving Behavior and Crash Risk Study		S06: Technical Coordination and Independent Quality Assurance for Field Study		
			S07: In-Vehicle Driving Behavior Field Study (multiple awards)		
Roadway Data		S03 & S04 Combined: Acquisition of Roadway Information			
Analysis	S01: Development of Analysis Methods Using Recent Data (multiple awards, two phases)		S08: Analysis of In-Vehicle Field Study Data and Countermeasure Implications (multiple awards, different letting schedules)		
		S02: Integrate Methods and Develop Analysis Plan			
<b>Site-Based Study</b>					
Study Design & Field Data Collection	S09: Site-Based Video System Design and Development		S10: Design and Conduct of the Site-Based Field Study (pending additional resources)		
				S11: Analysis of Site-Based Field Study Data and Countermeasure Implications (pending additional resources)	

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