

Office of Safety R&D

The Federal Highway Administration (FHWA) Office of Safety Research and Development (R&D) helps reduce highway crashes and related fatalities and injuries by developing and implementing safety innovations through a program of nationally coordinated research and technology development. Selections from this broad research portfolio are highlighted below.

Safety Management

The Safety Management team's purpose is to support positive safety resource allocation decisions through consistent high-quality data collection and analysis, analytical tool development to transform data into actionable information, and formal evaluation of the effectiveness of potential safety improvements.

Highway Safety Information System

The Highway Safety Information System (HSIS) includes a safety database in which crash, roadway inventory, and traffic volume data are combined to help users study current highway safety issues, to direct research efforts, and to make the best decisions about safety improvements. Presently, seven States and one urban center actively provide data to the system. HSIS also provides analytical support for highway safety research.

Interactive Highway Safety Design Model

The Interactive Highway Safety Design Model (IHSDM) is a suite of software tools that support project-level geometric design decisions by providing quantitative information on the expected safety and operational performance of roadways. IHSDM helps project developers make design decisions that improve the expected safety performance of roadway designs. The crash prediction module of IHSDM is a software implementation of Part C of the American Association of State Highway and Transportation Officials *Highway Safety Manual* (HSM), which includes crash prediction methodologies for rural two-lane and multilane highways and urban/suburban arterials.⁽¹⁾

Evaluation of Low-Cost Safety Improvements Pooled Fund Study and Development of Crash Modification Factors

FHWA has partnered with 29 States to conduct the Evaluation of Low-Cost Safety Improvements Pooled Fund Study. This study, now in its seventh phase, evaluates unproven priority safety improvements. The Development of Crash Modification Factors (DCMF) study is a major long-term study that also evaluates

unproven low- to high-cost priority safety countermeasures to develop high-quality crash modification factors (CMF) that meet the criteria for inclusion in the HSM.⁽¹⁾ These evaluations are conducted using empirical Bayes or other appropriate methodologies to analyze crash, road geometry, and other related data collected before and after the countermeasure was installed in order to estimate the countermeasure's safety effectiveness. The products of these studies are CMFs and benefit-cost ratios for each countermeasure. The DCMF program will also examine methods used to develop and apply CMFs and assess their quality.

Motorcycles

Motorcycle rider fatalities comprise about 14 percent of motor vehicle fatalities. Increases in the number of motorcycle rider fatalities have prompted research into motorcycle safety. FHWA is currently conducting a motorcycle crash causation study to collect data regarding motorcycle crashes. These data will be used to study potential causes of motorcycle crashes and develop possible countermeasures to prevent these crashes or make them less severe.

Geographic Information System Safety Analysis Tools

State and local transportation departments are moving much of their crash, roadway, and traffic data to geographic information system (GIS) platforms. Currently, FHWA is conducting research to identify the resources needed to advance the use and capabilities of GIS as part of a safety program for State and local governments.

Human Factors

Human factors studies help researchers better understand transportation user needs and limitations. By taking into account driver capabilities when designing roadways, human errors will be minimized, and public safety will be enhanced by decreasing crashes and fatalities. Human factors research supports many of the research projects and programs undertaken within the other R&D focus areas.

Numerous studies have been carried out using the research tools in FHWA's Human Factors Laboratory (HFL). HFL's full-scale driving simulator is a 6 degree-of-freedom motion system that includes a seamless 240-degree field of view composed of high-fidelity, computer-generated roadway scenes and advanced eye-tracking capabilities. HFL also has a field research vehicle that is equipped to record the vehicle's position, speed, and acceleration and includes a state-of-the-art eye-tracking system. The field research vehicle can gather live driving data and allow researchers to examine driving behaviors.

HFL's Sign Laboratory consists of a 60-inch liquid crystal display high-definition TV connected to a computer control center. It enables researchers to determine the maximum distance at which a sign can be recognized and measure a participant's comprehension of signs and markings.

Pedestrian Safety

Pedestrians account for nearly 13 percent of traffic fatalities nationally. Accordingly, FHWA's Pedestrian Safety Program develops pedestrian safety-related products, research documents, and technologies to help improve conditions for pedestrians. From safer crosswalks and sidewalks to growing educational and safety initiatives, the program strives to cultivate safer roadways for some of the most vulnerable users of U.S. roadways.

Recent research considered the problem of pedestrians who choose to cross the road at midblock locations when there are long distances between intersections. Researchers developed and evaluated countermeasures, including the pedestrian hybrid beacon (PHB), rapid-flash beacon, and shared-lane markings, to improve the safety of pedestrian crossings. This research analyzed pedestrian and driver responses to PHBs and identified the operational tradeoffs associated with different locations of PHBs. Additional research is necessary to identify and compare the impacts of specific beacon/light-emitting diode characteristics, such as beacon size or flash pattern, now being used or considered for pedestrian crossing signs. Another research project will determine the effectiveness of raised crosswalks in protecting pedestrians.

Roadway

The Roadway Safety Research Program emphasizes two fundamental objectives: keeping vehicles on the roadway and minimizing the consequences of a vehicle leaving the roadway. Roadway safety studies are conducted in five focus areas: roadway departure, speed management, intersection safety and design, visibility, and intelligent transportation systems (ITS).

Roadway Departure

Roadway departure research considers ways to provide better information to drivers about their vehicle's position on the road surface and indicate to drivers when their vehicles are straying toward a potentially

dangerous situation. Measures such as rumble strips and rumble stripes provide drivers with a clear warning that their vehicles are approaching potentially unsafe conditions.

FHWA's roadside safety research uses state-of-the-art computer models and crash simulations to study a number of topics, including the effectiveness of roadside hardware such as guardrails, sign supports, and concrete barriers; vehicle-to-vehicle impact compatibility; and the causes of rollover crashes. Simulations are validated through full-scale crash tests at FHWA's Federal Outdoor Impact Laboratory (FOIL). These studies result in the design and deployment of new roadside safety features and the establishment of guidelines for the appropriate use of those features. FOIL is also used to develop perimeter security devices to prevent the unwanted intrusion of speeding motor vehicles into Government buildings and other critical facilities.

Speed Management

Speed management focuses on how to set and enforce speed limits. It is a complex issue involving both engineering and behavioral factors. Ultimately, motorists decide what speed to travel in a given circumstance. As a result, a significant aspect of speed management research is to investigate how motorists arrive at that decision.

Speed management researchers develop and test engineering measures and technologies to manage speed while seeking ways to encourage wider adoption of travel speeds appropriate for the class of road, roadway design, and travel conditions.

Intersection Safety and Design

More than 50 percent of the combined fatal and injury crashes occur at or near intersections. FHWA's intersection safety and design research facilitates the implementation of shorter-term safety improvements and defines and evaluates longer-term higher payoff strategies to improve intersection safety. Intersection safety and design

research has led to the development and successful deployment of innovative intersection and interchange designs, including the multi-lane roundabout, displaced left-turn and restricted crossing U-turn intersections, and the double crossover diamond interchange.

Visibility

The visibility program seeks to improve visibility on and along roadways and create traffic control devices to enhance the safety of road users. Visibility research conducted at FHWA's Arens Photometric and Visibility Laboratory supports human factors studies on roadway visibility issues, such as the impact of roadway lighting on driver performance and the effectiveness of innovative pavement markings.

ITS

ITS safety applications research involves developing the technologies and protocols necessary for vehicles and infrastructure to securely communicate information to each other to prevent crashes and roadway departures. ITS safety applications have the potential to improve safety across many of the R&D focus areas, such as at intersections, in dangerous curves, and in reduced speed zones and work zones.

A key aspect of the overall ITS program is vehicle-to-infrastructure (V2I) research and development. The goals of the V2I Communications research program are to develop the infrastructure components of a connected vehicle environment and to document the benefits, installation specifications, and the processes and tools that will result in the deployment of an interoperable system. The Office of Safety R&D is leading the V2I effort and coordinating with other stakeholders to accomplish these goals.

Reference

1. American Association of State Highway and Transportation Officials. (2010). *Highway Safety Manual*, First Edition, AASHTO, Washington, DC.

