Federal Highway Administration ■ **TURNER-FAIRBANK** HIGHWAY RESEARCH CENTER

Office of Safety R&D

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

Roadway Departure

Almost 60 percent of all U.S. roadway fatalities occur as a result of roadway departure crashes.[1]

Advanced Crash Analysis Program

Advanced finite element models and crash simulations are used to (1) study the effectiveness of roadside hardware such as guardrails, sign supports, and concrete barriers; (2) assess how differences in vehicle characteristics affect vehicle-to-hardware impacts; (3) investigate crash causes; (4) formulate improved guidelines for the selection and deployment of roadside hardware; and (5) develop concepts for new roadside treatments. These efforts provide transportation agencies with new ways to mitigate roadside safety problems. Researchers are developing guidelines for the design and placement of cable median barriers, analyzing roadside terrain effects on vehicle trajectories, and evaluating how commonly used roadside hardware will perform under proposed new national crashworthiness criteria. The models, data, and results of this program are freely shared and have been the basis for other safety research worldwide.

Managing Pavement Marking Retroreflectivity

FHWA is developing minimum standards for pavement marking retroreflectivity for inclusion in the *Manual on Uniform Traffic Control Devices*. Research supporting this effort focuses on identifying how to utilize these minimum standards in pavement marking management procedures so that States and municipalities can maintain pavement markings at a level that provides drivers with the information they need to make safe driving decisions.

Pavement Marking Demonstration Projects

During demonstration projects in Alaska and Tennessee, researchers will consider the cost effectiveness of different pavement marking systems, the safety effects of increasing pavement edgeline widths, the potential environmental impacts of the pavement marking systems included in the study, and the effects of state bidding and procurement processes on the quality of pavement marking materials used.

Intersections

Intersection-related crashes make up 21 percent of all fatal crashes.[1]

Intersection/Interchange Improvements

Researchers are developing and evaluating novel intersection designs to improve intersection safety while also increasing capacity, reducing congestion, and minimizing infrastructure costs. These designs include the Diverging Diamond Interchange (DDI), the New Jersey Jughandle Intersection, median U-turn intersection treatments, and the Continuous Flow Intersection (CFI). While some of these intersection designs are under construction, researchers are using the Highway Driving Simulator in the FHWA Human Centered Systems Laboratory to collect drivers' evaluations of interchange geometries and marking and signage alternatives. Also under development is the Cooperative Intersection Collision Avoidance System (CICAS), which warns drivers about to violate a red light and helps drivers correctly judge gaps in traffic when making left turns. Under field evaluation is the Detection-Control System (D-CS), which detects vehicles approaching isolated rural intersections at high speeds and alters traffic signal timing to reduce the likelihood of dangerous red light violations, while also minimizing delays to others waiting to use the intersections.

Surrogate Safety Assessment Model

The Surrogate Safety Assessment Model (SSAM) is a new software tool that uses trajectories generated from traffic simulation models to analyze indirect indicators of the likelihood of a collision, including time-to-collision, deceleration rates, and post-encroachment time.

Safety Assessment of Access Management Techniques

Researchers are developing algorithms to assess the safety impact of access management techniques such as driveway spacing, non-traversable medians, and dedicated turn lanes along a particular roadway. Those algorithms will be incorporated into an access management safety evaluation tool to help practitioners evaluate access management needs along a specific highway and develop alternative access management approaches.

Pedestrian

Eleven percent of roadway fatalities are pedestrians.[1]

Evaluation of Pedestrian/Bicycle Safety Measures

The objective of this project is to determine the effectiveness of new and innovative countermeasures, including the HAWK-beacon signal, rapid-flash beacon, and shared-lane markings, in reducing pedestrian fatalities and injuries and in minimizing conflicts between pedestrians and motor vehicles.

Measures of Pedestrian Exposure to Risk

Effectively assessing pedestrian safety requires information on pedestrian exposure to risk. This is typically defined as the ratio of crashes to total exposure. Vehicle exposure is represented by million vehicle miles traveled. However, currently no analogous pedestrian exposure metric exists. In this project, TFHRC human factors researchers are examining pedestrian crossing behaviors at seven different facility types that are used by both pedestrians and vehicles (e.g., intersections, midblock crossings, parking lots) to develop a new pedestrian exposure metric.

Speed Management

Speeding plays a role in 31 percent of roadway fatalities.[1]

Effect of Urban Street Environment on Operating Speeds

Research indicates that more than 75 percent of drivers claim to drive at speeds appropriate to the roadway regardless of posted speed limits. However, a driver-selected speed may not correspond with the speed the road was designed around. In this program, researchers developed methods for estimating operating speeds based on drivers' perceptions of design features, environmental factors, and operational conditions on low-speed urban roadways.

Typology of Speeding-Related Crashes

Speeding—exceeding the speed limit or going too fast for conditions—is a contributing factor in many severe crashes. In this project, researchers are analyzing crash data to learn what speed-related crashes are like and to identify where they occur most often, when they are most likely to happen, and who is most likely to be involved in these crashes. The results will help highway agencies identify ways to reduce the number and severity of speed-related crashes.

Demonstration and Evaluation of Speed Management on Main Roads in Rural Communities

In many rural communities, the main road that runs through town is a state or county highway with high speed limits outside of the city boundaries. Motorists often do not slow down when they enter the center of town. Because traffic calming measures such as enhanced signing, lane width reduction, pavement markings, and gateway structures are known to work in larger urban areas, in this program researchers evaluated the effectiveness of such traffic calming treatments for reducing speeds on main roads in rural communities.

Evaluation of Speed-Activated Displays on Curves

Speeding and curved roadways are a dangerous combination. Many run-off-the-road fatal crashes on horizontal curves are speed related. This project is a national field test of the effectiveness of low-cost, speed-activated Dynamic Curve Warning Systems (typically a speed-measuring device combined with a variable message sign) in reducing speeds and improving safety on horizontal curves in rural roadways.

Safety Management

Evaluation of Low-Cost Safety Improvements

FHWA is partnering with 26 States to evaluate low-cost safety improvement strategies taken from *NCHRP Report 500: Guidance for Implementation of the AASHTO Strategic Highway Safety Plan*. The effectiveness of many of these strategies has not been rigorously established previously. Before-and-after evaluations are being conducted at sites where these strategies have been previously implemented, and additional evaluations are planned for future sites. FHWA's Highway Driving Simulator is also being used to help determine the effectiveness of these safety strategies.

Highway Safety Information System

The Highway Safety Information System (HSIS) is a safety database in which accident, roadway inventory, and traffic volume data are combined to help users study current highway safety issues, direct research efforts, and make the best possible decisions about safety improvements. Presently, seven States and two urban centers are actively providing data to be entered into the system. Data from the HSIS have been used to study the safety effects of converting rural two-lane roadways to four-lane roadways, the relationship of median width to safety, the safety of lighting options on urban freeways, and many other safety topics.

Interactive Highway Safety Design Model

The Interactive Highway Safety Design Model (IHSDM) is a suite of software tools for evaluating the safety and operational effects of geometric design decisions on two-lane rural highways. IHSDM is available as a download. The Geometric Design Laboratory within the Office of Safety R&D provides technical support to IHSDM users. Ongoing research and development will enhance and expand the capabilities of IHSDM, in coordination with the Highway Safety Manual being developed by the Transportation Research Board.

SafetyAnalyst

SafetyAnalyst, a software package with state-of-the-art tools, is being developed to correspond to the six main steps in highway safety management: (1) network screening to identify sites and corridors that hold the most potential for reducing crashes, (2) diagnosis of safety problems at specific sites, (3) selection of appropriate countermeasures, (4) economic appraisal of candidate improvements, (5) priority rankings for candidate improvements, and (6) before-and-after evaluations of safety improvement projects.

Advanced Research

Real-Time Pedestrian Detection System

The research objective of this project is to develop an on-board, sensor-based system that detects and tracks pedestrians and other objects on or near roadways during day and night from a moving vehicle and then warns drivers of potential collisions.

Driver Visibility Requirements

The purpose of this human factors project is to examine the kind and amount of information that a driver needs to drive safely at night. The results will help guide road designers in their selection of roadway delineation and traffic control measures. Moreover, the results will be used to refine a control model for a robotic vehicle so that the vehicle will respond as much as possible like a human driver to the available pavement markings, signs, and other cues that human drivers use. The "final exam" for the control model will be the robotic vehicle and a human-controlled vehicle driving along the same section of a test track.

Digital Highway Measurement System

FHWA's Digital Highway Measurement System (DHMS) is an instrumented vehicle which uses multiple sensors to collect a range of data, including roadway and roadside geometries, roadside inventories, and pavement condition information, all located very precisely. Information is collected in one pass and at highway speeds. DHMS provides data for enhanced safety analysis capabilities to support a State's safety decisions, as well as to meet asset management needs including the data elements established by the Model Minimum Inventory of Roadway Elements (MMIRE).

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1 NHTSA FARS 2006 Annual Report.

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