

Implementing the Results of the Second Strategic Highway Research Program

Saving Lives, Reducing Congestion, Improving Quality of Life

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The highway system has a pervasive presence in U.S. society. Whether driving, biking, or riding the bus, most people use the nation's roads every day in tending to personal, professional, family, and social responsibilities. These facilities have been in constant use for decades, often exceeding their original design life and traffic volumes, leaving a deteriorating and increasingly congested system. Moreover, deaths and injuries from highway crashes constitute a major public health concern.

Congress authorized the second Strategic Highway Research Program (SHRP 2) to address some of the most pressing concerns about highway transportation. As part of the SHRP 2 authorization, Congress requested a report by early 2009 about promising results from the research and how these results could be implemented most effectively. The Transportation Research Board's Special Report 296, *Implementing the Results of the Second Strategic Highway Research Program: Saving Lives, Reducing Congestion, Improving Quality of Life*, outlines what is needed to implement the program results and to reap the promised benefits.

The committee that authored the report (see box, page 38) was appointed by the National Research Council of the National Academies under the auspices of the Transportation Research Board (TRB).

The committee believes that widespread implementation of products developed by SHRP 2 is necessary to address the nation's roadway safety, renewal, reliability, and capacity issues.

To accomplish this, an implementation program should be established; the Federal Highway Administration (FHWA) should serve as the principal implementation agent, in partnership with others; stable and predictable funding of \$400 million over 6 years should be provided for the implementation activities; a stakeholder advisory structure should be established; and detailed implementation plans should be developed as soon as feasible.

The Challenges

The 4-million-mile highway system is the backbone of the U.S. economy, carrying 65 percent of the nation's \$15 trillion in freight traffic (1) and 88 percent of the noncommercial person miles traveled (2). The system and its functioning are taken for granted. Today, however, the system faces major challenges, as facilities have aged, often exceeding their original design life and traffic volumes.

The National Highway System is totally resurfaced every 7 to 8 years (3) and totally reconstructed on a 50-year replacement cycle, although roadways typically are designed only for a 20-year life span. The average age of bridges in the national inventory is 40 years; 27.5 percent of this inventory is structurally deficient or functionally obsolete (4).

In 2005, congestion cost travelers in 437 urban areas 4.2 billion hours and \$78 billion, wasting 2.9 billion gallons of fuel (5). Some 43,000 deaths and millions of injuries occur on the nation's roads every year. Motor vehicle crashes remain the leading cause of death for those between the ages of 5 and 34, and highway crashes are estimated to cost the nation \$230 billion annually (6).

These infrastructure renewal, congestion, and safety problems will intensify with the growth predicted in the next two decades: the U.S. population is expected to grow by 24 percent by 2030; despite a

Utah Department of Transportation workers use self-propelled modular transporters—computer-controlled, multi-axle, platform vehicles—to speed bridge installation.



Photo: Utah DOT

recent downturn, the number of vehicle miles traveled (VMT) is projected to increase by 60 percent by 2030, with truck VMT increasing by 75 percent (7); and the number of truckloads is predicted to increase by 80 percent, to nearly 23 billion tons, by 2035 (8).

This expected growth calls for better system operation and more rapid renewal of in-place infrastructure to optimize capacity and improve travel time reliability. Additional highway capacity will be needed in selected locations to move motorists and freight.

One estimate indicates that an additional 173,000 lane miles of Interstate highway will be needed by 2035 to maintain the current level of highway performance (9). This implies the addition of more than 5,700 lane miles of Interstate highway annually for the next 30 years—nearly comparable with the rate of expansion during the Interstate construction years. Capacity enhancements will have to integrate environmental, economic, and community requirements.

SHRP 2

Research and innovation have an important role to play in addressing the issues and concerns associated with the building, maintenance, operation, and use of the highway system. In 2005, because of the success of the first SHRP, which was conducted in the late 1980s and early 1990s, Congress authorized a highly focused SHRP 2 in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users.

The program focuses on goals that are meaningful to highway users—such as increasing safety, reducing congestion, minimizing disruption to users when roads are being rehabilitated, and providing new capacity that enhances neighborhoods and avoids environmental harm. The 7-year, \$170 million program addresses four research focus areas:

◆ **Safety:** Significantly improve highway safety by achieving an understanding of driving behavior through a study of unprecedented scale.

◆ **Renewal:** Develop design and construction methods that cause minimal disruption and produce long-lasting facilities to renew the aging highway infrastructure.

◆ **Reliability:** Reduce congestion and improve travel time reliability through incident management, response, and mitigation.

◆ **Capacity:** Integrate mobility, economic, environmental, and community needs into the planning and design of new transportation capacity.

Promising Results

Research projects in SHRP 2 have been under way for less than 2 years of the program's projected 7-year duration. Preliminary results, however, indicate that SHRP 2 research products will contribute substantially to addressing some of the most salient challenges for highway transportation.

Safety

SHRP 2 will conduct a naturalistic driving study of unprecedented scale—sensors will be installed on the vehicles of 4,000 volunteer drivers for 2 years in several sites across the United States. The sensors will collect data on driver and vehicle performance as the volunteers go about their ordinary driving routines. These data, linked with roadway data, will be used by safety researchers and practitioners to improve highway safety for years, if not decades, into the future.

Additional products include initial findings from the study that can be used to modify or improve safety treatments; analysis tools and research protocols that safety researchers can build on to develop new countermeasures; and a site-based video system for studying vehicle behavior on particular roadway segments, such as intersections.



Renewal

SHRP 2 will develop tools to support the consistent and systematic rapid renewal of highways—completing highway projects quickly, with minimal disruption to the community, and producing facilities that are long-lasting. This new way of doing business relies on more collaborative relationships and decision making; better integration of management, planning, design, construction, and maintenance; and more synergistic use of technologies and methods, so that



Potential Beneficiaries of SHRP 2 Research Products

- ◆ Taxpayers
- ◆ Motorists
- ◆ Commercial drivers
- ◆ Bus riders
- ◆ Shipping and logistics professionals
- ◆ Environmental agencies
- ◆ Communities, businesses, and owners of event venues served by the highway system
- ◆ Railroads
- ◆ Utilities
- ◆ Automobile manufacturers and suppliers
- ◆ Metropolitan planning organizations
- ◆ Law enforcement
- ◆ Firefighters
- ◆ Emergency medical services
- ◆ Highway designers, contractors, and suppliers
- ◆ State and local transportation agencies

optimal benefits can be realized from complementary sets of innovations.

Among the products of this research are bridge and pavement materials and systems, equipment, and innovative designs; and new ways to address construction and asset management, quality control, risk management, and institutional arrangements between transportation agencies and their many partners.

Reliability

SHRP 2 will develop tools to improve travel time reliability by addressing congestion problems that arise from nonrecurring events, such as crashes, vehicle breakdowns, inclement weather, special events, and work zones.



Products of the research include data and methods to support decision making; guidance on the institutional changes needed to support agencies' increased focus on operations; and analyses of the effectiveness of highway designs and operational countermeasures to support incorporation of reliability into planning, programming, and design manuals and procedures. The research also will define future needs and explore innovative ideas to address these needs.

Capacity

SHRP 2 will address the challenge of planning and designing new transportation capacity that integrates mobility, economic, environmental, and community needs.



The central product is the Collaborative Decision-Making Framework (CDMF), an integrated web-based tool focusing on key decision points in the planning and programming process.

The CDMF brings together the right people with the right information at the right time. The framework is supported by tools developed in three other research areas. In the area of ecology, products include an ecosystem-based credits system, a business model, and guidelines for strategies that rise above resource-by-resource mitigation. In the area of travel behavior, products include mathematical relationships between motorist behavior, pricing, and congestion and demonstrations of the effects of highway management strategies on highway throughput. In the area of economics, products include before-and-after case studies of economic development impacts, a practitioner's handbook to make the development impacts more transparent to noneconomists, and improved economic analysis tools.



PHOTO: AAA FOUNDATION FOR TRAFFIC SAFETY

The Second Strategic Highway Research Program's naturalistic driving study will collect data on driving behavior that, when combined with roadway data, will be used to improve highway safety.

Recommendations

In addition to identifying these promising results of SHRP 2 research, the committee's report, as requested by Congress, presents potential incentives for, impediments to, and methods of implementing SHRP 2 results; estimates the costs of implementation; and discusses the administrative structure and organization best suited to carry out an implementation program. Following is a summary of the committee's recommendations.

Recommendation 1: A SHRP 2 implementation program should be established.

A robust and comprehensive effort to implement the products of SHRP 2 should address all four focus

Potential Value of Widespread Implementation of SHRP 2 Results

Small Percentages Translate into Big Impacts

The committee that authored Special Report 296, *Implementing the Results of the Second Strategic Highway Research Program: Saving Lives, Reducing Congestion, Improving Quality of Life*, believes that implementation of results from SHRP 2 will provide significant benefits to roadway users and to society in general. For example, every 1 percent decrease in congestion from the implementation of SHRP 2 products will provide the following benefits annually:

- ◆ \$780 million saved,
- ◆ 42 million fewer hours spent in traffic delays, and
- ◆ 29 million fewer gallons of fuel consumed.

Similarly, every 1 percent improvement in highway safety from applying findings from the SHRP 2 safety program would provide the following annual benefits:

- ◆ 400 lives saved,
- ◆ More than 25,000 injuries avoided, and
- ◆ \$2.3 billion in reduced costs to society from roadway injuries and deaths.

The hub of the Maryland State Highway Administration's Coordinated Highways Action Response Team (CHART) program is the Statewide Operations Center in Hanover. According to a University of Maryland study, the CHART program in 2001 may have prevented as many as 766 secondary incidents through its prompt clearing of primary incidents and may have eliminated 25.80 million vehicle-hours of delay, saving 4.35 million gallons of fuel and keeping 4,027 tons of vehicular emissions out of the air.



PHOTO: MARYLAND SHA CHART PROGRAM

areas: safety, renewal, reliability, and capacity. The program should use demonstrated implementation strategies, as well as other innovative approaches that may be developed.

Recommendation 2: The Federal Highway Administration (FHWA) should serve as the principal implementation agent for SHRP 2, in partnership with the American Association of State Highway and Transportation Officials (AASHTO), the National Highway Traffic Safety Administration (NHTSA), and TRB. NHTSA should exercise a leadership role in the long-term stewardship of the safety database.

Promoting technology has been central to FHWA's mission since its earliest predecessor, the Office of Road Inquiry, was established in 1893. FHWA has

long-established relationships with state departments of transportation (DOTs), including field offices in each state with staff who work closely with DOT staff, in addition to expertise in Washington, D.C., and a multidisciplinary highway research center in Virginia. The agency's expertise encompasses most of the major disciplinary areas covered by SHRP 2: highway planning, design, and construction; environmental and safety concerns; and highway operations.

In addition to providing funds and technical assistance to state and local transportation agencies, FHWA can modify or waive regulations to facilitate testing and implementation of new technologies and methods. FHWA administered a successful implementation effort for the first SHRP and learned many practical lessons from that experience.

The committee believes that the agency is best positioned to administer SHRP 2 implementation, as long as it takes into consideration the specific differences between the first SHRP and SHRP 2, as well as the unique challenges facing SHRP 2 implementation. The agency will need to engage in reorganization to provide dedicated management and technical support for SHRP 2 implementation. It may need to recruit staff to provide additional technical expertise.

Although many stakeholders will be involved in the implementation program, several stand out as potential partners. Primary among these is AASHTO, because the state DOTs remain the principal user group. AASHTO also can play a role in setting standards to facilitate the adoption of innovations by state and local government transportation agencies.

TRB's involvement is a result of its role in administering the research program. TRB offers a network

Committee for the Strategic Highway Research Program 2: Implementation

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of technical committees, other communication and coordination mechanisms, and the ability to establish high-level advisory, oversight, and technical committees. The safety component of SHRP 2 calls for a strong role for NHTSA.

Recommendation 3: Stable and predictable funding should be provided over several years to support SHRP 2 implementation activities. Total funding for the first 6 years of the implementation program is estimated at \$400 million. The need for additional funding thereafter should be assessed at the appropriate time. Implementation planning and budgeting should take into account the need of several SHRP 2 products, especially the safety database, for support that extends beyond the initial 6-year period.

Effective implementation will require a plan for several years of effort with a predictable funding flow; ideally, funding should be authorized to be “available until expended.” The funding recommended for SHRP 2 implementation would be over and above the usual level of funding for ongoing research and technology activities at FHWA and NHTSA, to ensure that the implementation program does not have a negative impact on other much-needed activities at these agencies.

Recommendation 4: A formal stakeholder advisory structure should be established to provide strategic guidance on program goals, priorities, and budget allocations, as well as technical advice. At a minimum, this advisory structure should include an executive-level oversight committee for the entire SHRP 2 implementation program and a second oversight committee focused exclusively on administration of the safety database.

Members of the executive-level SHRP 2 implementation oversight committee should include the principal users of SHRP 2 products—state DOTs, local transportation agencies, metropolitan planning organizations, and appropriate private-sector and academic representatives—as well as experts on research implementation, information technology, and knowledge management.

Recommendation 5: Detailed implementation plans should be developed as soon as feasible to guide the implementation efforts.

As soon as implementation funding is made available, FHWA should develop detailed plans, with appropriate input from users and technical experts, in coordination with the ongoing SHRP 2 research program. The implementation plans should be living documents, updated periodically, and should be publicly available.

Focused on Improvement

The four focus areas of SHRP 2—safety, renewal, reliability, and capacity—were developed through almost 3 years of study and consultation with an array of stakeholders to ensure that the most critical highway user needs would be addressed. Increasing safety, reducing congestion, minimizing disruption to users when roads are being rehabilitated, and providing new capacity that enhances neighborhoods and avoids environmental harm are outcomes that are valuable to highway users.

In addition, SHRP 2 is focused on changing the way that highway agencies do business. Changing institutions and processes is risky, especially in the public sector. SHRP 2 will produce methods and guidance, as well as technologies, to help agencies make the changes necessary to improve service to their customers while managing the risk involved with institutional change. If widely implemented, the products of SHRP 2 research could enhance taxpayers’ investments in transportation and improve the daily experience of roadway users significantly.

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TRB Special Report 296, *Implementing the Results of the Second Strategic Highway Research Program: Saving Lives, Reducing Congestion, Improving Quality of Life*, is available from the TRB online bookstore, www.trb.org/bookstore; to view the book online, go to <http://onlinepubs.trb.org/onlinepubs/sr/sr296.pdf>.