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REPORT

IN BRIEF

## IMPLEMENTING THE RESULTS OF THE SECOND STRATEGIC HIGHWAY RESEARCH PROGRAM

### Saving Lives, Reducing Congestion, Improving Quality of Life

RESEARCH BOARD

The highway system has a pervasive presence in our society. Whether we drive, bike, or take the bus, many of us use the nation's roads every day in tending to our 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. The second Strategic Highway Research Program (SHRP 2) was authorized by Congress to address some of the most pressing concerns with regard to highway transportation. As part of the SHRP 2 authorization, Congress requested that a report be delivered in early 2009 concerning promising results from the research and how they could be implemented most effectively. In response to this request, the Transportation Research Board's report *Implementing the Results of the Second Strategic Highway Research Program: Saving Lives, Reducing Congestion, Improving Quality of Life* outlines what it will take to implement the results of the program and reap the benefits it promises.

The committee that developed this report 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, in partnership with others, should serve as the principal implementation agent; stable and predictable funding of \$400 million over 6 years should be provided for implementation activities; a formal stakeholder advisory structure should be established; and detailed implementation plans should be developed as soon as feasible to guide the implementation efforts.

### 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 and 88 percent of all noncommercial person miles traveled. The system's existence and functioning are generally taken for granted. Today, however, the system faces major challenges as highway facilities have aged, often exceeding their original design life and traffic volumes. It is estimated that the National Highway System is totally resurfaced every 7 to 8 years and totally reconstructed on a 50-year replacement cycle, although roadways are typically only designed for a 20-year life span. In addition, the average age of bridges in the national inventory is 40 years; 27.5 percent of this inventory is structurally deficient or functionally obsolete. In 2005, congestion cost travelers in 437 urban areas 4.2 billion hours and \$78 billion and resulted in 2.9 billion gallons of fuel wasted. 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.

The magnitude of the infrastructure renewal, congestion, and safety problems increases significantly in light of growth predictions for the next two decades: the U.S. population is predicted to grow by 24 percent by 2030; despite a recent downturn, the number of vehicle miles traveled

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(VMT) is projected to increase by 60 percent by 2030 with truck VMT projected to increase by 75 percent in the same period; and truck freight is predicted to increase by 80 percent, to nearly 23 billion tons, by 2035. This expected growth calls for better system operation and more rapid renewal of in-place infrastructure to optimize the use of existing capacity and improve travel time reliability. There will be a need for additional highway capacity 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 just to maintain the current level of highway performance. This estimate 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. On the basis of the success of the first Strategic Highway Research Program (SHRP), conducted in the late 1980s and early 1990s, Congress authorized a highly focused second Strategic Highway Research Program (SHRP 2) in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users of 2005. 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; however, preliminary results indicate that SHRP 2 research products will contribute substantially to addressing some of the most salient challenges facing 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 over 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

## 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

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 existing safety treatments, analysis tools and research protocols that safety researchers can use and build on to develop new safety 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 consistent and systematic “rapid renewal” of highways, which means completing highway projects quickly, with minimal disruption to the community, and producing facilities that are long-lasting. This is a new way of doing business built 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 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 the aspect of the congestion problem that results 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 institutional change 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 will also define future needs in this area and explore a number of 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 is based on having the right people with the right information involved at the right time. It is supported by tools 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.

## RECOMMENDATIONS

In addition to identifying these promising results of SHRP 2 research, the committee's report, as requested by Congress, discusses 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. A summary of the committee's recommendations is presented below.

### **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 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 the Transportation Research Board (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 agency, the Office of Road Inquiry, was established in 1893. It 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 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 being able to provide funding and technical assistance to state and local transportation agencies, FHWA can modify

## Potential Value of Widespread Implementation of SHRP 2 Results

### *Small Percentages Translate into Big Impacts*

The committee that authored this report believes that implementation of SHRP 2 results will provide significant benefits to roadway users and to society in general. As an illustration, every 1 percent decrease in congestion from 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 gallons less fuel consumed.

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

- 400 lives saved,
- More than 25,000 injuries avoided, and
- \$2.3 billion in reduced societal costs associated with roadway injuries and deaths.

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 to SHRP 2 implementation. It may need to recruit staff to provide additional technical expertise.

While 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 can also play a role in setting standards to facilitate adoption of innovations by state and local government transportation agencies. TRB's involvement is based on its current role in administering the research program and on its network of technical committees; its other communication and coordination mechanisms; and its 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 the ability to plan 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 is intended to 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 of 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.**

Membership 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 that should be coordinated with the ongoing SHRP 2 research program and based on appropriate input from users and technical experts. The implementation plans should be living documents that are periodically updated, and they should be made publicly available.

## CONCLUSIONS

SHRP 2’s four focus areas—safety, renewal, reliability, and capacity—were developed through almost 3 years of study and consultation with a broad 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 meaningful to highway users. In addition, SHRP 2 is focused on changing the way 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, designed to help agencies make the changes necessary to better serve their customers while managing the risk involved with institutional change. The products of SHRP 2 research, if widely implemented, could significantly enhance taxpayers’ investments in transportation and improve the daily experience of roadway users.

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**This report brief was prepared by the National Research Council on the basis of the committee’s report.** Permission granted to reproduce this brief in its entirety with no additions or alterations. *Implementing the Results of the Second Strategic Highway Research Program: Saving Lives, Reducing Congestion, Improving Quality of Life* is available from the Transportation Research Board, 500 Fifth Street, NW, Washington, DC 20001 (telephone 202-334-3213; fax 202-334-2519; or e-mail TRBsales@nas.edu).

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