TRB SPECIAL REPORT

The Federal Investment in Highway Research 2006–2009

Strengths and Weaknesses

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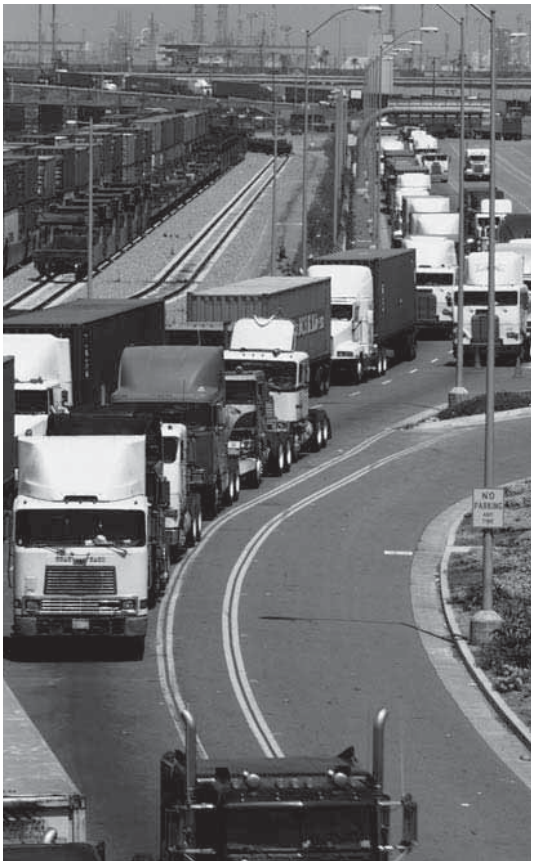
The nation has 8.4 million lane miles of roads that connect metropolitan areas, towns, and counties to serve more than 300 million residents and 7 million business establishments. Publicly funded highway research programs have developed innovations that have produced longer-lived assets at lower costs, reduced environmental impacts, saved lives, and improved economic efficiency. Additional innovation will be needed to improve safety, reduce congestion, address environmental and energy concerns, and provide the quality highway system that the nation's citizens expect.



Highways are vital to the nation's economy—trucks carry 75 percent of the value of all freight shipped in the United States; yet significant gaps remain in understanding the nature and extent of commercial trucking.

To foster this innovation, research funding should be awarded through a process of competition and merit review; advanced research activities should be pursued; past research cuts should be restored and additional funding made available; stakeholder-supported programs should be continued; a robust program for dissemination of research results should be undertaken; and a process should be established to engage the entire highway community in setting highway research priorities.

Systemic Stresses

Highway transportation is the principal circulatory system for the national economy. It has contributed to national economic growth in recent decades but is under severe stress because of heavy demand, the aging of capital stock, environmental impacts, and shortages of funding to address these problems.

The American lifestyle depends on highway transportation. Americans use personal vehicles for 87 percent of daily trips and 90 percent of long-distance trips. Moreover, highways are the backbone of the decentralized U.S. economy, which could not function without the access that highways provide for motor carriers. Truck ton-miles constitute approximately 30 percent of the total U.S. ton-miles of freight, but that tonnage accounts for nearly 75 percent of the value of all freight shipped.

Innovation's Role

Public-sector highway research has been the primary source of innovation and insight in meeting the national need for highway transportation. Continued innovations to make highways safer, perform better, last longer, and cost less are essential in sustaining the contributions of highways to national prosperity.

Successfully addressing the highway system's challenges will require new and more efficient ways of doing things—new materials, better and faster construction techniques, safer designs, better infor-

mation for drivers, new financing mechanisms, options for pricing the use of the system, and more. Research, development, deployment, and training must fill this role.

Since 1992, the Research and Technology Coordinating Committee (RTCC) of the Transportation Research Board (TRB) has served as an independent adviser on national and federal highway research; the members are appointed by the National Research Council of the National Academies (see box, page 31). The Federal Highway Administration (FHWA) has supported the committee's work over the past 15 years. The newly released Special Report 295, *The Federal Investment in Highway Research 2006–2009: Strengths and Weaknesses*, presents the findings and recommendations of the RTCC after assessing the highway research programs funded under the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU).

For the assessment, the committee applied the principles for research articulated by Congress in the preamble to SAFETEA-LU Title V: Research, as well as additional principles that the committee considers important in sustaining a vital highway research program (see box, below).

The use of prefabricated components in highway construction and reconstruction has expanded. The Central Artery–Tunnel Project (or "Big Dig") in Boston relied extensively on prefabricated applications. For the Ted Williams Tunnel, twelve 35-foot-long steel tunnel sections were constructed in Baltimore, shipped to Boston, floated into place, and then submerged.

Main Findings

Despite increases under SAFETEA-LU, highway research programs remain significantly underfunded in comparison with the levels of investment in industry. Public and private highway research receives approximately one-quarter of the amount that industry spends on research, development, and technology (RD&T) in the United States—highway RD&T represents only 0.9 percent of revenues provided to highway agencies; in contrast, industrial investment in RD&T is equivalent to 3.3 percent of revenues from sales.

Extensive legislative earmarking violates the SAFETEA-LU principle of awarding research funds through competition and merit review. For example, earmarks affect 62 percent of the Title V University Transportation Centers (UTC) program, and additional earmarks scattered across FHWA programs amount to at least 18 percent of the agency's funding.

The programs funded under SAFETEA-LU do not

Principles for Research Based on SAFETEA-LU Title V

1. The federal portfolio should cover the full innovation cycle, including the following:
   a. Agenda setting,
   b. Conduct of research,
   c. Support of research and technology transfer by the states,
   d. Sharing of results, and
   e. Deployment (including education and training).
2. Justification for federal investment requires that
   a. Activities be of national significance,
   b. There be public benefit and suboptimal private investment,
   c. Efficient use of federal funds by states and local governments be encouraged, or
   d. The activity be the best means to support federal objectives.
3. The content of the federal research, development, and technology (RD&T) program includes the following:
   a. Fundamental, long-term research;
   b. The filling of significant gaps; and
   c. Policy or planning.
4. Stakeholder input is addressed.
5. Awards are almost always made on the basis of competition and merit review.
6. Programs include performance review and evaluation.

Note: This list represents a distillation of eight principles included in Title V: Research; two principles that overlap are combined and one principle not relevant to this report is eliminated.

Application of Superpave on I-94 in Illinois. Developed under the first Strategic Highway Research Program, Superpave is used in all 50 states and the District of Columbia; a study projects that net savings over 20 years nationwide should approach $1.8 billion annually.

include all the content areas Congress requested. Because of funding constraints in Title V, FHWA was forced to cut important research in safety, operations, planning and environment, and policy. Funding was eliminated for research and data collection to support policy decisions, and funding for planning was greatly reduced. Although funding is provided in other areas—such as deployment and technology transfer—the levels are inadequate.

A 50-50 matching requirement biases the UTC program toward highly applied research and away from advanced research, which is one of the main rationales for a university research program. In addition, because of funding constraints, FHWA has not been able to follow through on commitments in its Corporate Master Plan for Research and Deployment of Technology and Innovation to engage stakeholders more broadly in agenda setting, merit review, and program evaluation.

The Strategic Highway Research Program 2 (SHRP 2) adheres to all the research principles of Title V, but the program has received funding at only 36 percent of the intended level—and for two years less than stakeholders requested. The downscaled program will not be able to meet all of the originally envisioned goals.

Recommendations

Principles for Research

To the maximum extent practicable, research funding should be awarded through competition and merit review. Sole-source funding should be allowable in the relatively rare circumstances in which it is appropriate—for example, when only a single agency has the capability required.

All UTC funds should be awarded to universities competitively. The 50-50 matching requirement for UTC research should be reduced to a 20 percent university match to allow universities to conduct more advanced research. Competition should be open to all universities and should not be limited by previous levels of transportation research activity.

Funding

FHWA should be provided with the resources it needs to fulfill the commitments in its Corporate Master Plan to involve stakeholders more substantively in its RD&T program, specifically in agenda setting, merit review, and peer review.

FHWA should receive additional funding for mission-related activities, such as program support for regulations and oversight, technical assistance, information sharing, technical exchange, and other deployment activities. Funding should be restored for program areas that were cut back significantly in SAFETEA-LU—including operations, safety, and environmental research. Funding for policy research also should be restored and expanded to meet pressing national needs.

FHWA should be given the resources for technical assistance and deployment activities for stakeholders in the planning and environmental area.

These resources previously were supplied under the Transportation Equity Act for the 21st Century.

Specific programs supported by stakeholders require additional attention. The RTCC recommends that

- Congress consider extending the SHRP 2 program for two years in the next authorization, with funding under Title I: Federal-Aid Highways, as states have requested;[1]
- The Long-Term Pavement Performance Program be funded to complete the data collection, support the analysis to realize the benefit of the investment, and preserve the massive database on pavement performance;
- The Long-Term Bridge Performance Program and other programs with broad-based stakeholder support established under SAFETEA-LU be reauthorized;
- The surface transportation environmental research program, supported by stakeholders, be authorized as a cooperative research program, as recommended in TRB's 2002 report, *Surface Transportation Environmental Research: A Long-Term Strategy* (2); and
- Funding for research programs to improve travel forecasting models and practice be authorized, as recommended in TRB's 2007 report, *Metropolitan Travel Forecasting: Current Practice and Future Direction* (3).

Data Collection

Greater emphasis on data collection is necessary. The ability to answer many of the most important policy questions in highway transportation requires much better data. Research and better data are needed in the planning area also to develop advanced modeling tools to meet federal and local planning and environmental mandates.

Agenda Setting

Establishment of communitywide consensus on national highway research priorities would help focus all highway research programs on the most important areas. FHWA should be given the resources to establish an ongoing process for the highway community to set priorities.

[1] The RTCC endorsed the funding of SHRP 2 in its 2001 report, *The Federal Role in Highway Research and Technology* (*1*). The program subsequently was authorized in SAFETEA-LU, and TRB was asked to manage the program. The committee believes that the program meets all the principles of research laid out in SAFETEA-LU. The program received much less funding and time than were requested and therefore is a candidate for continued funding. Even so, the committee does not wish to be perceived as recommending future work for TRB to manage. The committee's recommendation therefore urges Congress to consider the program's merits and to fund an extension.

Research Dividends

Even within current constraints, the federal investment in highway research is sound. Publicly funded highway research programs have developed innovations that have produced more durable assets at lower costs, have reduced environmental impacts, have saved lives, and have improved economic efficiency.

Adoption of the recommendations in the RTCC report would provide the nation with an improved program that would yield even greater dividends. These additional payoffs from research are urgently needed to meet the demands on the highway system today and in the future.

References

1. *Special Report 261: The Federal Role in Highway Research and Technology*. Transportation Research Board, National Research Council, Washington, D.C., 2001.
2. *Special Report 268: Surface Transportation Environmental Research: A Long-Term Strategy.* Transportation Research Board of the National Academies, Washington, D.C., 2002.
3. *Special Report 288: Metropolitan Travel Forecasting: Current Practice and Future Direction*. Transportation Research Board of the National Academies, Washington, D.C. 2007.

TRB Special Report 295, *The Federal Investment in Highway Research 2006–2009: Strengths and Weaknesses*, is available from the TRB online bookstore, www.trb.org/bookstore; to view the book online, go to http://onlinepubs.trb.org/onlinepubs/sr/sr295.pdf.