



# TRANSPORTATION RESEARCH BOARD

OF THE NATIONAL ACADEMIES

December 29, 2005

Mr. Richard Capka  
Acting Administrator  
Federal Highway Administration  
Room 4218  
400 7th Street, SW  
Washington, D.C. 20590

Dear Mr. Capka:

The Research and Technology Coordinating Committee (FHWA) met on November 1–2, 2005, at the Keck Center of the National Academies in Washington, D.C. The enclosed meeting roster indicates the members, liaisons, guests, and TRB staff in attendance. On behalf of the committee, I wish to thank FHWA for its continuing interest in and support for the work of the RTCC. I also thank you for your participation in the meeting, as well as that of members of the FHWA staff. The committee appreciates the presentations made by Dennis Judycki, Debra Elston, and FHWA consultant Glen Hiemstra, as well as the contributions of other FHWA staff who attended the meeting.

The meeting ended in closed session at which the committee met to deliberate its findings and recommendations and begin the preparation of this report, which was completed through correspondence among the members. This report summarizes the committee's key discussions and provides several recommendations for your consideration. It is an intentionally brief summary of the meeting; information about the committee's future activities and meetings is also provided. The report is organized into two main sections. The first summarizes meeting discussions on FHWA's expanded advanced highway research program and presents several recommendations. The second section summarizes discussions of other meeting topics.

## **FHWA's Advanced Research Program**

In light of previous RTCC recommendations that FHWA's research and technology (R&T) program focus more on advanced research, the committee is pleased that Congress substantially increased funding for an "exploratory advanced research program" in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). By authorizing \$14 million annually for 4 years for this program, Congress signaled its support for an expanded advanced highway research agenda aimed at breakthroughs and innovations that can fundamentally change the

highway transportation enterprise. Congress specified the following six broad research areas in the legislation:

- Characterization of materials used in highway infrastructure, including analytical techniques, microstructure modeling, and the deterioration process
- Assessment of the effects of transportation decisions on human health
- Development of surrogate measures of safety
- Environmental research
- Data acquisition techniques for system condition and performance monitoring
- Performance data and information processing needed to assess the day-to-day operational performance of the transportation system in support of hour-to-hour operational decision making

Advanced research is part of the continuum from basic research to the implementation and direct use of research results. While such research has the potential to yield high payoffs, the direct benefits of the investment are uncertain, and the research typically is longer term than applied research. Advanced research at the federal level is needed because the owners of other highway R&T programs—state departments of transportation, trade and professional associations, and private companies—find advanced research too risky or a poor fit for their specific missions. Thus, absent a federal program of advanced highway research, little or no such research will be undertaken, and potential opportunities will be missed.<sup>1</sup>

The meeting featured a discussion of the key characteristics of several successful federal basic and advanced research programs, moderated by former RTCC member Irwin Feller of Pennsylvania State University. Your participation and that of members of FHWA's R&T Leadership Team contributed significantly to the discussion. The following key characteristics of successful programs—including those of the Defense Advanced Research Projects Agency (DARPA) and the National Science Foundation (NSF)—were identified in a review prepared for the committee as important guidelines for the development of an expanded FHWA advanced research program:

- Such programs look beyond today's known needs to seek new technologies, processes, and methods that can help achieve the agency's mission.
- Leadership is provided by an appropriately qualified program manager capable of ensuring the performance of robust scientific research and program credibility.
- The program is independent but has strong ties to other agency programs.
- Program priorities are determined with the assistance of external technical experts on the basis of relevance to the agency's mission and scientific merit.
- Open competition and merit reviews by panels of external experts are used to select research projects.
- Partnering and collaborative efforts are employed to leverage program resources.

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<sup>1</sup> Advanced research also exploits the strengths of a federal agency—a national perspective, significant financial resources, and direct connections to all highway and other federal agency R&T programs.

- Dedicated program funding is protected from other day-to-day agency operating and research needs.
- Periodic external reviews assess program direction, performance, and accomplishments.

The committee believes the above characteristics, which are based on the experience of well-established programs, translate into specific suggestions for ensuring that FHWA's advanced research program meets the rigorous criteria for success of such programs. Further review of these and other programs could perhaps provide additional guidance for the agency.

It is important to recognize that advanced research is quite different from the agency's predominant applied research. Advanced research aims at discovery and innovation tied to broad national needs and federal responsibilities, rather than at problem solving through incremental change based on short-term applied research. Congress has authorized much more funding for advanced research than ever before and specified the research areas to be pursued. The committee offers the following recommendations that it believes will help FHWA meet the challenges of carrying out this agenda

**1. FHWA should create a separate unit to manage its advanced research program.**

One challenge of advanced research for a mission agency such as FHWA is to ensure that the program stays focused on advanced research to achieve breakthroughs in the understanding of transportation-related phenomena. Programs that lack independence can easily be diverted by the day-to-day demands of operating programs and offices that are driven by stakeholder needs. Successful advanced research programs such as DARPA are characterized by their independence from operating or service units. DARPA was created to look beyond current needs and requirements and seek new technological options for the Department of Defense; today it continues to pursue major changes for the entire department while individual service units carry out their own applied programs.

In short, because an advanced research program is expected to explore opportunities for major change and must avoid focusing on current needs, the committee believes such a program is most effective when operated as an independent unit. In addition, independence helps to ensure the integrity of program priority setting and to maintain the standards necessary for successful advanced research.<sup>2</sup>

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<sup>2</sup> Protecting a program's resources is also essential in light of the reviews required by the Government Performance and Results Act, the Office of Management and Budget's Program Assessment Rating Tool, and other assessment and audit provisions.

**2. FHWA’s advanced highway research program should be based on open solicitations aimed at attracting well-qualified researchers with new ideas and concepts to pursue.**

The committee believes an open solicitation process seeking investigator-initiated ideas in the research areas delineated by Congress represents the best research investment for achieving significant payoffs. This approach has proven successful for the research programs of DARPA, NSF, and other federal agencies in attracting innovative proposals and well-qualified teams of researchers capable of developing breakthrough innovations.<sup>3</sup> The committee believes such solicitations would enable FHWA to select the best ideas across the full range of its areas of interest. The committee suggests further that because FHWA has experience in partnering and collaboration in advanced research projects, the solicitation process should encourage researchers to leverage this experience and the staff capabilities and resources of Turner-Fairbank Highway Research Center to the extent possible. Finally, as noted previously by the RTCC, such solicitations for advanced research will require evaluation by teams of external technical experts on the basis of a combination of relevance to the agency mission and scientific merit.<sup>4</sup> Independent expert assessments will enable FHWA to keep the program focused on new concepts and ideas while avoiding projects of questionable value.

**3. The manager of FHWA’s advanced research program should have experience in managing an advanced research program.**

An advanced research program requires an appropriately qualified research manager to help ensure the conduct of robust scientific research, maintain the credibility of the program with the science community and technical experts outside the agency, and sustain the program’s direction. Because the funding for FHWA’s advanced research program is more substantial than in the past, and the range of topics encompasses nearly all the agency’s areas of interest, the role of program manager will be quite demanding. To help identify the appropriate qualifications for the program manager, FHWA should seek the assistance of experienced research managers at programs such as those of DARPA and NSF. It is expected that the program manager will be supported by a qualified technical staff empowered to focus solely on the advanced research program.

**4. To ensure that program outcomes and results add value to FHWA’s work, the program must establish and maintain strong technical and professional linkages with other offices within the agency.**

Even though the advanced research program should operate as an independent entity within FHWA, it should not operate in isolation from other agency programs and staff with which it share’s the agency’s mission, strategic goals, and overall agency R&T

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<sup>3</sup> FHWA’s contract research program relies heavily on detailed, staff-prepared statements of work that potential contractors address in detail; the proposals are evaluated by agency staff on the basis of technical and cost criteria detailed in the agency request for proposals.

<sup>4</sup> TRB Special Report 261: *The Federal Role in Highway Research and Technology*. 2001.

enterprise. The success of the program will depend heavily on support from agency leadership, as well as staff understanding of its importance to the agency's mission.

**5. The program should follow Congress' direction and encompass highway and intermodal transportation system topics.**

The six broad research areas set forth in SAFETEA-LU legislation provide FHWA with considerable direction for the advanced research program. The committee agrees with Congress that breakthroughs, or profound changes in the field, should be sought in traditional infrastructure areas as well as in institutional, management, and policy areas of importance to the nation's transportation system.

**Other Related Highway R&T Topics**

**A Review of SAFETEA-LU.** Dennis Judycki reported on the recent passage of SAFETEA-LU and provided a preliminary assessment of how it affects FHWA's R&T program. Congress expressed support for highway R&T by increasing spending for research; instituting the new advanced research program; and authorizing several programs previously endorsed by the RTCC, including the Future Strategic Highway Research Program, the Surface Transportation Environment and Planning Cooperative Research Program, and the National Cooperative Freight Research Program. On the other hand, Congress essentially eliminated FHWA's funding flexibility by earmarking and designating more R&T funds for the program than it authorized. FHWA indicated that it is exploring ways to support several research and R&T-related activities that are critical to its mission but were left unsupported. The committee concurs with the need for these activities and supports FHWA in its efforts to continue them. It also reiterates its concern with regard to how designations and earmarking of R&T funding limit FHWA's ability to sustain its R&T program.

**FHWA Forums on Future Highway Research.** Debra Elston, director of the Office of Corporate Research and Technology, reported on three forums organized by FHWA to elicit suggestions for the direction of the advanced research program from a wide range of participants representing academia, the public sector, and the highway industry. Glen Hiemstra of Futures.com, an FHWA contractor who moderated each of the forums, summarized their highlights. While the forums were organized prior to the passage of SAFETEA-LU—which, as discussed above, includes specific direction from Congress on key research areas to be addressed—they yielded valuable information on what the participants considered to be important areas for future research. Forum discussions focused on the following areas, or domains: human performance and safety, physical performance and infrastructure, technical performance and mobility, energy and environmental sustainability, and institutional performance. The forums also yielded information on the way several key technologies—information technology, telecommunications, alternative fuels, nanotechnology, advanced materials, and security technologies—are evolving and may impact the future surface transportation system. Such information will be valuable to FHWA as it develops its advanced research program and embarks on solicitations aimed at attracting qualified researchers. Forum participants

expressed support for an expanded FHWA advanced highway research program, underscoring their belief in its importance to the agency's mission. The RTCC commends FHWA for these timely forums and looks forward to the forthcoming agency report on their outcomes.

**The New Strategic Highway Research Program (SHRP II).** Neil Hawks, interim director of the new Strategic Highway Research Program (SHRP II), and Ann Brach, deputy director for the program, presented information on SHRP II which the committee has supported in the past. Because Congress authorized a smaller program than was included in the legislative proposals, TRB is working with FHWA and the American Association of State Highway and Transportation Officials and other stakeholders to adjust the program to the authorized funding level. This adjustment is being carried out on an accelerated schedule so the program can get under way as soon as possible.

**Laboratory Assessment Plans.** Assessments of the Aerodynamics Laboratory, the Coatings and Corrosion Laboratory, and the Crash Analysis Laboratory at Turner-Fairbank Highway Research Center are scheduled for 2006. FHWA provided the committee with lists of assessment team candidates—based on suggestions from staff and stakeholders—for review and comment. While FHWA wishes to have the assessment teams include experienced researchers, laboratory managers, and research program managers representing government, academia, and the private sector, the committee continues to believe that the most qualified people should be included regardless of their current affiliations. Individual committee members indicated they would review the assessment teams and provide their comments through TRB staff.

### **Future Meeting Plans**

The committee's next meeting is being scheduled for early March, 2006 in Washington, DC. At that time, we plan to examine in more detail the effects of the reauthorization on all aspects of highway R&T, including the State Planning and Research program, the University Transportation Centers program, and other related programs.

### **Final Remarks**

In closing, the committee again expresses its appreciation for the participation of you and your staff and the informative presentations of FHWA staff at the meeting. The committee stands ready to support FHWA as it responds to the reauthorization. I invite you to participate in future committee meetings as time permits.

Sincerely,



E. Dean Carlson  
Chair  
Research and Technology Coordinating Committee (FHWA)

Meeting Attendance: Committee, Liaisons, Guests, and Staff

**November 22-23, 2004**

**Committee**

E. Dean Carlson (NAE), Chair  
John Conrad  
Steve Heminger  
Cash Misel  
Sandra Rosenbloom  
Al Teich  
Kevin Womack

Art Dinitz  
Karen Miller  
Tim Neuman  
Joseph Sussman  
Paul Wells

**Liaisons and Guests**

Tommy Beattie, FHWA  
Rick Capka, FHWA  
Irwin Feller, AAAS  
Mike Halladay, FHWA  
Glenn Hiemstra, Futures, Inc.  
Dennis Judycki, FHWA  
Tom Krylowski, FHWA  
Stephanie Manning, USHR  
Jeff Paniati, FHWA

Susan Binder, FHWA  
Debra Elston, FHWA  
Jesus de la Garza, NSF  
Gary Henderson, FHWA  
Jill Hochman, FHWA  
Marci Kenney, FHWA  
Richard Livingston, FHWA  
Thomas E. Marchessault, RITA  
Eric Van Schyndle, USHR

**TRB Staff**

Ann Brach  
Stephen Godwin  
Amelia Mathis  
Robert Reilly

Walter Diewald  
Neil Hawks  
Mark Norman  
Robert Skinner

**Abbreviations**

AAAS	American Association for the Advancement of Science
FHWA	Federal Highway Administration
NSF	National Science Foundation
RITA	Research and Innovative Technology Administration
TRB	Transportation Research Board
USHR	U.S. House of Representatives