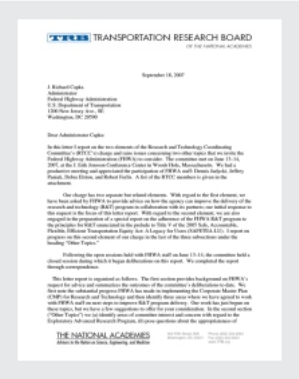

Research and Technology Coordinating Committee Letter Report: September 2007

DETAILS

0 pages | null | PAPERBACK

ISBN 978-0-309-43629-8 | DOI 10.17226/23152

AUTHORS

TRB TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

September 18, 2007

J. Richard Capka
Administrator
Federal Highway Administration
U.S. Department of Transportation
1200 New Jersey Ave., SE
Washington, DC 20590

Dear Administrator Capka:

In this letter I report on the two elements of the Research and Technology Coordinating Committee's (RTCC's) charge and raise issues concerning two other topics that we invite the Federal Highway Administration (FHWA) to consider. The committee met on June 13–14, 2007, at the J. Erik Jonsson Conference Center in Woods Hole, Massachusetts. We had a productive meeting and appreciated the participation of FHWA staff: Dennis Judycki, Jeffrey Paniati, Debra Elston, and Robert Ferlis. A list of the RTCC members is given in the attachment.

Our charge has two separate but related elements. With regard to the first element, we have been asked by FHWA to provide advice on how the agency can improve the delivery of the research and technology (R&T) program in collaboration with its partners; our initial response to this request is the focus of this letter report. With regard to the second element, we are also engaged in the preparation of a special report on the adherence of the FHWA R&T program to the principles for R&T enunciated in the prelude to Title V of the 2005 Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). I report on progress on this second element of our charge in the last of the three subsections under the heading "Other Topics."

Following the open sessions held with FHWA staff on June 13–14, the committee held a closed session during which it began deliberations on this report. We completed the report through correspondence.

This letter report is organized as follows. The first section provides background on FHWA's request for advice and summarizes the outcomes of the committee's deliberations to date. We first note the substantial progress FHWA has made in implementing the Corporate Master Plan (CMP) for Research and Technology and then identify three areas where we have agreed to work with FHWA staff on next steps to improve R&T program delivery. Our work has just begun on these topics, but we have a few suggestions to offer for your consideration. In the second section ("Other Topics") we (*a*) identify areas of committee interest and concern with regard to the Exploratory Advanced Research Program, (*b*) pose questions about the appropriateness of

THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

500 Fifth Street, NW
Washington, DC 20001

Phone (202) 334-2934
Fax (202) 334-2003
www.TRB.org

indefinite quantity contracts for research, and (*c*) summarize progress on the second element of our charge.

R&T Program Delivery in Collaboration with Partners

The main purpose of this letter report is to respond to the request by FHWA staff for advice on next steps for FHWA to implement to improve R&T program delivery in collaboration with its partners. As background for the committee before embarking on this assignment, FHWA staff gave the committee a briefing on its CMP during a conference call held on May 11, 2007. FHWA staff briefed the committee on progress in implementing the CMP throughout the agency during the June 13–14 meeting.

Corporate Master Plan

FHWA published the CMP in 2003. It represents a new approach to the development and deployment of innovation by stating seven principles to guide the agency in research, development, delivery, and evaluation. The guiding principles are as follows:

1. The FHWA R&T process, from research through implementation, is systematic and begins with the end in mind.
2. FHWA engages in advanced and applied research and innovation deployment activities where there is an appropriate federal role.
3. Stakeholders are engaged throughout the R&T process.
4. The R&T process is grounded in FHWA mission and goals and guided by multiyear plans.
5. The R&T budget allocation is based on and driven by multiyear plans and priorities.
6. FHWA measures the performance of R&T at the agency, program, and project levels.
7. FHWA effectively communicates its R&T program and projects.

Each principle is accompanied by a set of commitments that FHWA has made to realize it. The commitments are not repeated here but are referenced, where appropriate, below. The seven principles of the CMP apply to FHWA as a whole in the delivery of innovation—they are not just for the agency's research activities. The committee believes this is an important distinction that is consistent with FHWA's mission to "improve mobility on our nation's highways through national leadership, innovation and program delivery." Central to FHWA's mission are the development and delivery of innovations, which require the commitment and involvement of the entire agency for success. The committee is pleased to note that some of these principles follow directly from recommendations made in its 2001 report, *The Federal Role in Highway Research and Technology*.[1]

Since the 2001 report, the committee has observed substantial progress in articulating the guiding principles in the CMP and in infusing these principles throughout the innovation process

[1] Transportation Research Board. 2001. *Special Report 261: The Federal Role in Highway Research and Technology*. National Research Council, Washington, D.C.

as it is developed and deployed by FHWA. The committee has noted these improvements from presentations it has received over the past few meetings from various program managers and R&D team leaders, testimony by R&T program stakeholders, and the briefing provided at the June 13–14 meeting. The committee notes the following areas of progress:

- Development and application of FHWA's "innovation life cycle" to illustrate how activities are initiated with "the end in mind,"
- Incorporation of stakeholder involvement throughout the innovation life cycle,
- Implementation of the Exploratory Advanced Research Program, and
- Development of mission- and goal-driven research aligned with budget priorities.

We elaborate on the progress observed in the next few subsections.

Development and Application of the FHWA Innovation Life Cycle

The CMP and the agency's R&T activities are based on the innovation life cycle, which depicts the innovation process as an ongoing cycle of agenda setting, research, technology development, deployment, evaluation, and then a return to agenda setting. In this process, FHWA envisions stakeholder involvement as an element of each phase and recognizes it as necessary in ensuring success in deployment. This concept has become an organizing principle for FHWA's R&T program, and, as noted below, RTCC observes its application in key areas.

Stakeholder Involvement

Over the past few meetings RTCC has received briefings on FHWA's advanced research program; infrastructure R&T; operations R&T; the University Transportation Centers (UTC) program, which is administered by the Research and Innovative Technology Administration (RITA); and the Strategic Highway Research Program 2 (SHRP 2), which is administered by the Transportation Research Board (TRB). The following are examples of stakeholder involvement demonstrating FHWA commitment to CMP Guiding Principle 3 that the committee has observed:

- The advanced research program was authorized in SAFETEA-LU. In the months before SAFETEA-LU was enacted, FHWA sponsored three workshops around the country to gather suggestions of priority research areas from stakeholders.

The concrete pavement road map was developed with FHWA funding through the Center for Transportation Research and Education of Iowa State University by holding five brainstorming sessions involving experts from state and local departments of transportation, FHWA, industry, and academia, out of which emerged 250-plus problem statements. These research topics were organized into major themes for a 10-year R&D program, advisory structures were recommended for stakeholder involvement, and the results were published on FHWA's website.

- In FHWA's structures research, the Long-Term Bridge Performance Program was developed with substantial input from the American Association of State Highway and Transportation Officials (AASHTO) bridge committee, and the Innovative Bridge Research and Deployment Program research road map was developed with input from a wide range of stakeholders including state departments of transportation, industry, and

- FHWA's R&D activities in traffic operations are heavily influenced by stakeholder input from groups such as the National Traffic Operations Coalition, AASHTO's Subcommittee on Systems Operations and Management, TRB technical committees, and ITS America.
- SHRP 2 has extensive stakeholder input through the oversight committee of stakeholders that decides priorities and resource allocation, the technical committees that oversee projects, and the expert task groups that write requests for proposals and evaluate the proposals received.

Unfortunately, the ability of FHWA to follow through on many of the recommendations from these stakeholders is constrained by the high degree of congressional designations and earmarking of research in Title V of SAFETEA-LU.

Exploratory Advanced Research Program
RTCC has a special interest in this program because the FHWA endorsement of it as a guiding principle of the CMP and its authorization in SAFETEA-LU are partly attributable to the recommendations this committee has made over the years concerning the importance of FHWA investing in longer-term, higher-risk research. The program is slated to receive about $10 million annually during the life of SAFETEA-LU, a 10-fold increase above the previous authorization. RTCC has recommended that FHWA allocate up to one-quarter of its portfolio to advanced research.[2] This new program is an important step toward that goal. As pleased as we are that this program is under way, we have concerns about aspects of the program's implementation, particularly its slow pace in contracting for research, as indicated in the second section of this letter.

Mission- and Goal-Oriented R&T
CMP Guiding Principles 4 and 5 call for FHWA to conduct research driven by FHWA goals and to align its budget and priorities accordingly. Multiyear research road maps developed with stakeholder input are an important step in developing strategic, priority-driven R&T activities consistent with these principles. The concrete pavement research road map described above is one example. Another is the pavement technology road map, which was reviewed by the TRB Pavement Technology Review and Evaluation Committee earlier this year.[3] FHWA reports that research road maps are being relied upon throughout the agency's R&T activities. Posting these road maps prominently for stakeholder viewing and comment would be consistent with the agency's commitment to an "R&T process that is proactive, visible, and accessible to all stakeholders."

R&T activities and budgets are consistent with FHWA goals. However, they are constrained by the requirements of Title V of SAFETEA-LU and cannot always be consistent

[2] *Special Report 261: The Federal Role in Highway Research.*
[3] Letter Report of Carlos M. Braceras, Chair, TRB Pavement Technology Review and Evaluation Committee, to Administrator J. Richard Capka, February 2007.
http://onlinepubs.trb.org/onlinepubs/reports/PavTecComm_feb_2007.pdf.

with the priorities identified by program stakeholders, as mentioned above. SHRP 2 remains highly responsive to its stakeholders but is funded well below the levels recommended.

Summary
Compared with the situation 10 or so years ago, RTCC has seen marked improvement in FHWA's R&T activities. The agency is getting its R&T house in order, as indicated by FHWA's implementation of many changes, including recommendations made by this committee and others.[4] We note these improvements with a considerable sense of irony, because even as FHWA's R&T management processes have improved, its discretion over its R&T budget has declined considerably. Next we discuss some steps that could lead to increased discretion in FHWA's R&T budget.

Next Steps to Improve R&T Program Delivery

During discussion at the June 13–14 meeting, a number of topics emerged that FHWA and RTCC will continue to discuss as opportunities for improvement:

- Priority setting by the highway research community,
- New approaches to deployment and implementation, and
- Improved communications about R&T.

Priority Setting
Stakeholders now have a major role in shaping FHWA's R&T plans, but rallying the entire highway R&T community around priority areas is a concern. The community worked together during the prelude to SAFETEA-LU to create the 2002 document *Highway Research and Technology: The Need for Greater Investment*.[5] Although it was notable as an all-volunteer effort involving numerous constituencies, this document did not set priorities. Instead, it listed important areas of research grouped under FHWA goal areas, such as mobility, safety, system preservation, and environmental protection. The relative priorities of various research areas were not considered. The existence of a separate set of constituencies for R&D funding for each of FHWA's goal areas and the opinion of each constituency concerning the importance of the topic its research addresses are apparent. The engagement of these constituencies with FHWA in the agenda-setting process has helped rationalize this diversity of interests to some degree within goal areas, but FHWA itself is constrained in changing the allocation of resources across goal areas from what Congress authorized in SAFETEA-LU.

The need for the highway community to set priorities cooperatively for a coordinated national program was raised as an issue by FHWA staff. The report mentioned in the preceding

[4] FHWA's R&T program improvements are also responsive to the Government Accountability Office's *Report to Congressional Committees: Highway Research: Systematic Selection and Evaluation Processes Needed for Research Program* (GAO-02-573), published in 2002.
[5] This report is accessible on the TRB website: http://onlinepubs.trb.org/onlinepubs/rtforum/HwyRandT.pdf. It is not a TRB document.

paragraph was a beginning step, but it has not been sufficient. The UTC program illustrates the need for a more priority-driven agenda. Congress has authorized nearly $70 million annually for UTCs, a significant portion of which is for research and the remainder for education and training. Each of the 60-plus UTCs has considerable discretion in the development of its research initiatives. SAFETEA-LU requires that these activities be consistent with the 2002 report cited above, but, as noted, this document is an inventory of important research topics across the whole field of highway research and not a prioritized list. There is no mechanism in SAFETEA-LU to ensure that UTC research focuses on national priorities.[6]

One approach to the priority-setting process would be to consider, from a strategic perspective, the allocation of R&T resources in relation to the level of needs in FHWA's goal areas, such as mobility, safety, and environmental protection. This analysis would address whether the allocation of the highway R&T budget, which of course is substantially determined by SAFETEA-LU, lines up with the costs of congestion, crashes, and environmental damage. Another dimension is the consideration of whether proposed R&T investments can have a significant impact on the issues being addressed. RTCC proposes to continue to engage with FHWA on these questions at future meetings, since it may be helpful in identifying any misalignment of resources in advance of reauthorization.

Another approach would be to consider alternative processes for setting priorities. How could collective agreement on R&T priorities be reached by the highway R&T community given the diversity of its interests? RTCC is not in a position to answer this question; as a starting point, we suggest that we review with FHWA staff the history of efforts to set highway R&T priorities at our next meeting. We propose to review the models that exist today: FHWA's current stakeholder process, SHRP 2, the National Cooperative Highway Research Program, and earmarking. A historical review might include the period of time, before the Intermodal Surface Transportation Efficiency Act (ISTEA), when FHWA had much more authority to set R&T priorities through the then "nationally coordinated program." We might compare that with the post-ISTEA history and the efforts that led to the 2002 report cited above. Reviews of current models and history may help identify next steps.

New Approaches for Deployment

FHWA's commitment to be "innovators for a better future" requires the agency both to develop new approaches and to encourage their implementation by the states and local governments that own and operate almost all roads and highways. Because most states and local governments have their principal contact with FHWA through field offices, this deployment strategy depends on the skills and motivations of the field office staff, few of whom are trained in technology transfer.

The traditional model for deploying technologies to states and local governments is for FHWA to field-test and demonstrate new approaches; develop materials and market new approaches through publication of results; reach out to potentially interested constituencies with

[6] SAFETEA-LU does require UTCs funded in Title V to obtain matching funds to ensure that their work is relevant to stakeholders, but only a small amount of federal funds is available for this match, which weakens the ability of FHWA and other modal administration R&T programs to influence the direction of UTC research.

presentations, technical briefs, and brochures; develop guidebooks and manuals; offer training courses through the National Highway Institute; and market to local governments and tribes through the Local Technical Assistance Program centers.[7]

At the meeting Jeff Paniati presented an innovative strategy used to deploy the adaptive control software (ACS) "lite" technology.[8] In this example, FHWA is relying on vendors to spread a promising new technology. FHWA developed the technology, in this case software, demonstrated its effectiveness through field tests, and then provided interfaces for vendor products that local governments rely on. (FHWA is also forming an industry consortium to protect the software integrity in an open standard and reduce future development cost.) On the basis of the field tests, FHWA estimates the savings per system to be $800,000 in reduced congestion, delay, and wasted fuel compared with an implementation cost of $30,000 to $80,000 per 10 to 12 intersections. Vendors are incorporating this innovation at virtually no cost and presumably have strong incentives to market it to local governments that procure traffic control software because of the growing interest in better synchronizing traffic signals to reduce delay.

This model displays an innovative approach compared with relying on FHWA headquarters, resource centers, and field offices to get the word out. It is only one example of the different kinds of approaches that might work, but the committee believes that it has potential for diffusing other innovations. Clearly this model depends on innovations where there is a vendor–buyer relationship as opposed to innovations that are specified by public agencies in procurements or that become new standards. Furthermore, the federal government should not subsidize industry in adopting and marketing innovations when industry has adequate incentives to do so on its own. Given the low margins of vendors in this market, we doubt that an unwarranted subsidy exists in the ACS-lite case. This approach reflects new thinking about deployment, and we encourage the sharing of the approach with others at FHWA engaged in deploying technologies.

This new model for deployment raises an issue that RTCC addressed in its 1999 report, *Special Report 256: Managing Technology Transfer: A Strategy for the Federal Highway Administration.* After FHWA reorganized and abolished the former Office of Technology Applications (OTA) in 1998, RTCC became concerned that there was no central source of expertise in the agency focused on deployment of technologies. RTCC's recommendation in *Special Report 256* to create an office for technology transfer was not a proposal to reestablish OTA; instead, the idea was to have a small staff with proven technical expertise in the strategies that can be used to deploy new technology. As pointed out in *Special Report 256*, there is no one best way to transfer technology, but there is something of a science in matching the many different possible approaches with the particular situation at hand. In the committee's vision, this staff would create a strategic plan, serve as consultants to the program and R&T staff charged with deployment, and evaluate the effectiveness of various strategies. Now that responsibilities for deployment are spread across programs and many individuals, staff with only

[7] A 1999 report of this committee (*Special Report 256: Managing Technology Transfer: A Strategy for the Federal Highway Administration*, National Research Council, Washington, D.C.) describes FHWA and state technology practices and suggests new organizational approaches.

[8] FHWA developed the ACS but determined that implementation of the complete package was too expensive and complex for most users. ACS-lite is designed to provide most of the benefit for a fraction of the cost.

a part-time or occasional responsibility for deployment might not be using the most effective techniques. Such a group would be ideal for promoting innovative approaches such as that used with ACS-lite within FHWA and encouraging their use where appropriate.

FHWA's latest (2006) partner satisfaction survey of the state departments of transportation indicates that the agency should put less priority on simply getting the word out on new products. Instead, the respondents indicate greater need for "making it easy" to obtain and use new technologies and innovations. A technology transfer expert within FHWA could address strategies to do this. In many areas, of course, FHWA does go to considerable lengths to make it easy for states and local governments to learn about and apply innovations. FHWA's pavements website, for example, is replete with technical briefs, technical advisories, fact sheets, design guides, training opportunities, and information about whom to contact and where to go for technical resources across all phases, from design to rehabilitation. Given this considerable resource, a systematic analysis by a technology transfer expert with proven successes in championing new products could help identify the appropriate strategy to "make it easy" for state and local agencies to adopt innovations.

The committee applauds the development of the priority list of market-ready technologies, which follows through on a commitment made in the CMP. Also notable is how FHWA is setting specific goals and tracking the deployment of market-ready technologies. This effort demonstrates a welcome higher-level sophistication in the agency's deployment activities. At the next meeting we hope to spend more time on this effort than we were able to spend in June. We seek information about how the agency decides when success is adequate and that the time is right to begin promoting new market-ready technologies. Roundabouts and rumble strips, two innovations on FHWA's market-ready list, for example, appear to have passed the tipping point of becoming accepted practice.

Communications

Effective communication is Guiding Principle 7 of the CMP. During the meeting, the issue of how FHWA should communicate successes in both innovation and the management of innovation with its many constituencies was raised. Getting the right message to the right person at the right time, which is an agency commitment of the CMP, continues to be a challenge.

We encourage FHWA to consider conducting a communications audit with primary stakeholder groups to determine how to present the agency's efforts most effectively. The Virginia Department of Transportation conducted such an audit, which first determined how the department was perceived by key stakeholders. The audit enabled the department to design outreach to correct misperceptions. This kind of communication allows the crafting and delivery of information that key stakeholders need to receive.

We note that FHWA has met one of the commitments it made to communications by publishing an annual agencywide R&T performance report. Documenting accomplishments in this manner is important, but targeting information to specific customers requires something more. Before RTCC will be in a position to assist in getting the right message to the right person at the right time, the committee will need to understand better the nature of the mechanisms that

FHWA is using and where they are perceived to fall short. We invite FHWA presentations on this topic at the next meeting.

Summary
As indicated at the outset, the committee observes significant progress by FHWA in getting its R&T house in order. Notable achievements, of which the agency should be proud, have been cited above. The work is not complete, however, and we have agreed to assist FHWA in three areas: priority setting, deployment, and communications.

With regard to priority setting, we suggest working with FHWA to develop a strategic analysis of how the current highway R&T funding levels match up with the scale and significance of FHWA's major goal areas (safety, mobility, environmental protection). This may be helpful at the policy level of allocating R&T resources to goal areas. In terms of setting priorities for how funds should be invested, we suggest reviewing current models and the history of how highway R&D priorities have been set, along with the pros and cons associated with these processes, which may help us find new approaches for the future.

With regard to deployment, we are encouraged by the innovative strategy used to deploy the ACS-lite technology. We would like to discuss the pros and cons of the technology transfer office recommended in *Special Report 256* with FHWA. We invite presentations on FHWA's strategy for setting goals and tracking progress in deploying market-ready technologies at our next meeting.

In the area of communications, we suggest that FHWA conduct a communications audit to determine how key stakeholders perceive the agency's R&T efforts and to help correct any misperceptions. We invite a presentation at the next meeting concerning gaps in communicating with key stakeholders throughout the innovation life cycle.

OTHER TOPICS

Exploratory Advanced Research Program
RTCC appreciates the progress made in rolling out this new program. We are particularly pleased by the large number of respondents to the first Broad Agency Announcement (BAA). Like FHWA, we would have preferred a better balance across topic areas. For example, the planning and environment areas only received 5 percent of proposals and the policy area only 6 percent. With the success in getting out the first BAA and approaching decisions about the first set of awards, a reevaluation of certain features of the first BAA to determine whether they are optimal would be useful. The committee wishes to raise two areas for review:

- *The 50-50 match*: Is a 50-50 match appropriate for advanced research? An 80 percent federal share is more common in other federal departments such as the advanced research programs funded through the Department of Energy. Are some universities, small companies, and individuals able to compete on a 50-50 match basis for higher-risk research?

- *Uneven response to the BAA*: Was the low response in the policy and environmental areas due to a failure of solicitations to reach faculty in appropriate university programs? Is the lack of policy proposals simply due to a mismatch between the structure of this advanced research program and the nature of policy research?

Although we are pleased to see this program under way, as we noted in our prior report, we stress the importance of showing significant progress as the reauthorization process begins, which may be as early as next year. It does not appear as if there will be much completed research by the end of 2009, but a full portfolio of exciting research under way may build support for the program among authorizers. In the same vein, we urge FHWA to complete recruitment and hire an appropriate program manager as quickly as possible.

Indefinite Quantity Contracting

Over the past few meetings we have raised questions about the appropriateness of indefinite quantity contracts (IQCs) for research and the extent of FHWA reliance on them for R&T. At the June meeting, Dennis Judycki reported on the reliance on IQCs in the innovative pavement R&D program, where they represent about 24 percent of total funding. Judycki explained that FHWA's procurement office does not track its IQCs by subject area, so it is not easy to ascertain the percentage of IQCs across all R&T program areas, but he promised to provide a more complete picture at a future meeting.

The committee has been discussing whether relying on the individual task orders of IQCs is an appropriate model for research and for adhering to the SAFETEA-LU principle of competitive award of R&T funding. Clearly IQCs are awarded competitively, and the teams that have won IQCs compete for individual tasks. The competition in these vehicles is restricted, however. Universities have raised concerns about being unable to win IQCs (although we note that FHWA does have IQCs with universities). Winning proposals tend to assemble large teams with diverse expertise, and universities and small consulting firms are often included on these teams as subcontractors. There is concern, however, about subcontractors not receiving an appropriate share of the work won by the prime contractors. This model raises the question of whether the most competent research talent is being excluded by the process and whether IQCs are appropriate for research. Exceptions occur, of course, such as when speed in contracting is essential. In general, however, the question remains.

An appealing feature of task order IQCs is that individual tasks can be identified and contracts awarded in a matter of weeks, if not days. In comparison, a full and open competition can require up to 9 months to proceed through FHWA's contracting office. This raises the question of whether the length of time needed to execute successful open competitions is excessive.

We look forward to receiving statistics on the extent of reliance on IQCs for R&T. We encourage FHWA to examine whether it can execute open competitions more expeditiously.

Progress on Report

Over the past few meetings, FHWA and RITA staff have helped us review the UTC program, the Exploratory Advanced Research Program, infrastructure R&T, and traffic operations R&T. These programs, collectively, represent the bulk of the R&T funding authorized in Title V and managed by the U.S. Department of Transportation. At our next meeting we will review FHWA's highway safety and planning, environmental, and realty research. We appreciate the hard work of FHWA staff in developing the materials we have requested and in following up on our requests for additional information. We particularly thank Ian Friedland and Cheryl Richter for responding to follow-up questions. We thank Jeff Paniati for his excellent presentation on traffic operations research. In addition, the staff assembled meeting notebooks for the committee that were filled with useful reference material.

In closing, let me thank you for the work of your staff in support of the committee. I look forward to the next meeting, which will be held November 5–6, 2007, at the National Academies' Beckman Center in Irvine, California.

Sincerely,

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

Attachment
RTCC Members
(members in attendance in bold)

Chairman

E. Dean Carlson
Consultant
Topeka, KS

Members

Frances T. Banerjee
Banerjee and Associates
San Marino, CA

John Conrad
Washington State Department of Transportation
Olympia, Washington

Arthur M. Dinitz
Transpo-Industries, Inc.
New Rochelle, NY

Ysela Llort
Miami-Dade County
Miami, Florida

Daniel Murray
American Transportation Research Institute
St. Paul, MN

Timothy R. Neuman
CH2M Hill
Chicago, IL

Lawrence Orcutt
California Department of Transportation
Sacramento, CA

Leonard Sanderson
Parsons Brinckerhoff
Raleigh, NC

Constance S. Sorrell
Virginia Department of Transportation
Richmond, VA

Leslie Sterman
East-West Gateway Council of Governments
St. Louis, MO

Joseph M. Sussman
Massachusetts Institute of Technology
Cambridge, MA

Albert H. Teich
American Association for the Advancement of Science

Paul T. Wells
New York State DOT (retired)
Ballston Spa, NY

Kevin Womack
Utah State University
Logan, Utah

Guest
Stephen Lockwood
PB Consult
Washington, DC

FHWA Staff
Dennis C. Judycki
Jeffrey F. Paniati
Debra S. Elston
Robert A. Ferlis

TRB Staff
Robert E. Skinner, Jr.
Stephen R. Godwin
Thomas R. Menzies, Jr.