

TRANSPORTATION RESEARCH  
**CIRCULAR**

---

Number 448

October 1995

**Conduct of Research  
Workshop Proceedings**

26  
copy 2

## CONDUCT OF RESEARCH WORKSHOP PROCEEDINGS

### COMMITTEE ON THE CONDUCT OF RESEARCH

Denis E. Donnelly, Chair

Gary R. Allen  
Maria Ardila-Coulson  
Robert J. Benke  
Robert J. Betsold  
William F. Brown  
William P. Carr  
Steven A. Davis

Arlene L. Dietz  
David C. Esch  
Barbara Thomas Harder  
Eric E. Harm  
Kathryn Harrington-Hughes  
Christopher Hedges  
David L. Huft  
Lynne H. Irwin

Arnold H. Mohlman  
Robert J. Perry  
Morris J. Rothenberg  
Marvin Patrick Strong  
A. Haleem Tahir  
Katherine F. Turnbull  
John West

Robert E. Spicher, Transportation Research Board Staff

Subscriber category  
IA planning and administration

Transportation Research Board  
National Research Council  
2101 Constitution Avenue, N.W.  
Washington, D.C. 20418

---

The **Transportation Research Board** is a unit of the National Research Council, which serves as an independent advisor to the federal government on scientific and technical questions of national importance. The Research Council, jointly administered by the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine, brings the resources of the entire scientific and technical community to bear on national problems through its volunteer advisory committees.

## FOREWORD

---

The identification of the requirements of effective and coordinated transportation research programs was the objective of a three-day workshop held during the week of July 24, 1994, in Vail, Colorado. The overall goal was to evaluate the following topics and identify shortcomings in their application within transportation research programs. Approaches were identified for the development of proper procedures and methods for conducting transportation research, and potential mechanisms for presenting these approaches to research sponsors were discussed.

Topics and specific issues addressed in each of four breakouts follow:

- Program Development
  - What Makes People Support Research?
  - Strategic Planning
  - Public/Private Partnerships
  - Personnel Development and Training in Research
  - What Makes a Program Effective?
- Research Methodology
  - A Methodology for Both Basic and Applied Transportation Research Studies
- Dissemination of Information/Information Exchange
- Research, Development, and Technology Transfer Coordination
  - Assessment of Future Transportation Research and Avoidance of Research Duplication Among Agencies
  - Assessment of Transportation Databases and Needs
  - Strategies for Networking Transportation Research
  - Identification of Opportunities for International Transportation Research Coordination and Cooperation

This report should be of interest to agencies that sponsor research and can implement the workshop findings through the identified mechanisms (e.g., research study, synthesis, etc.).

# CONTENTS

---

## CONDUCT OF RESEARCH WORKSHOP

Background .....	7
Relationship of AASHTO Research Advisory and TRB Conduct of Research Committees .....	7
Workshop Topics .....	7
Breakout Sessions .....	8
Findings and Conclusions	
Program Development (Breakout A) .....	8
Research Methodology (Breakout B) .....	9
Dissemination of Information/Information Exchange (Breakout C) .....	9
Research, Development, and Technology Transfer Coordination (Breakout D) .....	10
Next Steps .....	11

APPENDIX A AGENDA AND ATTENDEES .....	12
---------------------------------------	----

## APPENDIX B BREAKOUT SUMMARIES

Program Development (Breakout A) .....	16
Research Methodology (Breakout B) .....	19
Dissemination of Information/Information Exchange (Breakout C) .....	21
Research, Development, and Technology Transfer Coordination (Breakout D) .....	22

## CONDUCT OF RESEARCH WORKSHOP

---

### BACKGROUND

The Transportation Research Board Committee on the Conduct of Research (A5001) serves the transportation research community by addressing issues related to the process of conducting research. In order to continue providing this service, the committee decided that a special forum was needed for the identification, discussion, and development of recommendations on the issues surrounding the research process. A mid-year meeting was held in July, 1994 for this purpose.

The Technology Transfer subcommittee of Committee A5001 also participated in the meeting. The 33 participants included representatives of state and federal transportation agencies, universities, private consultants, transportation institutes, and a Canadian transportation association.

The goal of the mid-year meeting of the committee was to identify topics related to the committee scope that need to be researched, marketed, and implemented by research agencies in the public and private sectors. This *Circular* presents the needs identified at the workshop for consideration by the TRB in the form of research problem statements or suggested research topics. This information is also provided for use by other transportation agencies including AASHTO, FHWA, FRA, FTA, and others.

### RELATIONSHIP OF AASHTO RESEARCH ADVISORY AND TRB CONDUCT OF RESEARCH COMMITTEES

The first annual meeting of the Research Advisory Committee (RAC) of the American Association of State Highway and Transportation Officials (AASHTO) was also held in Vail, Colorado, during the week of July 24, 1994. The RAC membership is composed of state transportation research officials, and its meetings are also attended by federal and other transportation agency officials. Although primarily devoted to the concerns of state research programs, the RAC meeting provided an excellent introduction to the somewhat broader focus of the TRB committee meeting.

The RAC provides input and advice to the AASHTO Standing Committee on Research and participates in coordinating research programs at the national, regional, and state levels. Peer review and self evaluations of research programs are major emphasis areas of the RAC.

The scope of the TRB Committee on the Conduct of Research is as follows:

To increase the quality and effectiveness of research through encouragement of better planning, management, and operational practices by organizations engaged in transportation research programs and to assist the Transportation Research Board in its role of stimulating research and serving as a national clearinghouse for research activities.

The scope of the TRB committee deals with the process associated with the conduct of transportation research; whereas, the scope of the AASHTO/RAC deals with the content and size of the research programs conducted by state transportation agencies. The related interests of the two committees prompted the scheduling of the committee meeting to follow the RAC meeting in order that RAC meeting attendees could also participate in the workshop.

### WORKSHOP TOPICS

At the January 1994 Annual Meeting of TRB Committee A5001, a list of topics for the mid-year meeting was proposed. This list provided the basis for a follow-up survey to the membership regarding interest in these and other candidate workshop topics. Many of these topics were felt to be appropriate for attention by TRB, AASHTO/RAC, FHWA and other transportation agencies. As a result of the survey, the following list of workshop topics was developed for use at the mid-year meeting:

- Establishing guidelines for marketing/selling the research, development and T<sup>2</sup> program. Identification of methods to obtain resources including personnel and funding.
- Guidelines on establishing a research management program.
- Establishing uniform technology on information exchange: Information highway as it pertains to transportation research. Applying new technologies and user-based strategies so that the products are available and used.
- Prepare a manual on developing a research experiment. Establish a mechanism for state-to-state consistency.

- Prepare a manual for standardization of research data bases (e.g. using the SHRP protocols).
- International exchange of research activities, findings and training programs.
- Coordination of current research activities. Establish a mechanism for information exchange at federal, state, local, public and private levels with focus on work in progress.

## BREAKOUT SESSIONS

The four topics covered in the breakouts were

- Program Development (Breakout A);
- Research Methodology (Breakout B);
- Dissemination of Information/Information Exchange (Breakout C); and
- Research, Development, and Technology Transfer (R, D, & T<sup>2</sup>) Coordination (Breakout D).

Appendix A of this report contains the agenda as well as descriptions of the four assigned topics. Appendix A also contains a listing of names, affiliation, and phone numbers of those attending the workshop.

Appendix B contains the summaries from each of the four breakouts. The overall goal of the breakouts was to discuss the assigned topic and prepare suggested actions to resolve a given issue. The actions could be in the form of a research problem statement, study proposal, suggestion for implementation, etc. The suggested actions would be appropriate for follow-up by a national agency (TRB, FHWA, AASHTO, etc.) or groups of agencies.

Approaches were identified as to how proper procedures and methods for conducting transportation research should be developed and presented to the user agencies. Such activities as synthesis studies, research, training, marketing, and application of state-of-the-practice were considered candidates.

## FINDINGS AND CONCLUSIONS

### Program Development (Breakout A)

Transportation research has been considered as the essential cornerstone of effective transportation systems. The development of research needs is a critical element for programs to be efficient and effective. In addition, the identification of key issues within the transportation agency can shift the direction of research from a reactive

role to a more proactive role with the involvement of all elements of the transportation agency work force.

Five identified topics that contribute to program development are

- What Makes People Support Research?
- Strategic Planning
- Public/Private Partnerships
- Personnel Development and Training in Research
- What Makes a Program Effective?

### *What Makes People Support Research?*

It is essential that a transportation research program be sustainable and dynamic in the eyes of the user. Therefore, the fundamental reasons for supporting research must be explicit to the decision-makers and the public. A process of "enlightenment" needs to be established to build intellectual conviction regarding research and a sense of the value of research when products are implemented.

Organizational and cultural factors conducive to supporting research need to be identified. A study could be conducted by NCHRP or FHWA to identify these factors for consideration by research agencies at all levels.

### *Strategic Planning*

The goals and mission of a transportation agency should be the basis for developing a short and long term strategic plan for the research program. This plan should be developed in concert with the agency management and users. It is important for the research program administrators and staff to recognize this plan when determining the direction and operation of their programs.

A strategic planning methodology is needed for use by public agencies at the federal, state, and local levels in developing transportation research programs. A method or guideline for establishing strategic plans would help ensure coordinated approaches in transportation research throughout the country and would assist in managing ongoing research programs.

A study should be conducted to develop a methodology for use by public transportation agencies interested in developing a strategic plan. The study would address the contributing factors identified in the workshop to provide an industry-wide uniform process. It is anticipated that the findings would be presented to FHWA and AASHTO for consideration.

### *Public/Private Partnerships*

With the current complexity of the government-sponsored research agenda, contributions from the private sector are becoming increasingly important. Public/private partnerships can play an important role in defining the research agenda resulting in a program that will address needs of the entire transportation community. Current cooperation between public and private agencies is becoming increasingly effective. Therefore, this project is timely.

It is suggested that strategies for facilitating public/private partnerships in research program development be identified. Agencies from states, universities, military, federal government, and private industry should be interested in contributing to the development and implementation of these strategies.

### *Personnel Development and Training in Research*

Personnel managing and operating within research programs must possess special qualifications, and it is important that these qualifications be recognized, developed, and rewarded. The goal of this activity would be to provide qualified transportation professionals for future research projects. This activity may include expanding existing programs, developing new training and education programs, and coordinating the activities with other transportation agencies.

Personnel qualification requirements, as well as development, training, and education needs, should be identified to support multi-modal transportation research programs. Once identified, these qualifications should be published for use by transportation agencies as well as educational institutions. A fact finding study could be conducted by NCHRP, FHWA, or CERF.

### *What Makes a Program Effective?*

Several research programs have been recognized as leaders in the industry. The basic characteristics of these programs need to be identified along with details of how best to develop them in other programs.

A synthesis of effective research organizational structures is needed for use throughout the transportation community. This synthesis could be developed by TRB with the cooperation of FHWA, AASHTO, and other engineering organizations. Application of the findings would be made by state and federal transportation agencies, as well as other public and private organizations providing research services.

### **Research Methodology (Breakout B)**

A systematic approach using valid methods of conducting research is essential. A goal should be identified and a plan developed to achieve it. Emphasis should also be given to determining and agreeing to a measurable objective or hypothesis with the appropriate experimental design or research approach. The following topic was identified for consideration.

#### *A Methodology for Both Basic and Applied Transportation Research Studies*

There exists a distinct difference between basic and applied research. As a result, different approaches are necessary in developing, sustaining, and implementing research studies or projects within these categories. A manual on transportation research practice needs to be assembled which would contain information concerning project planning and management. State-of-the-art procedures for all activities within a comprehensive research program would be included. The manual would address the differences between basic and applied research. Course instruction should also be developed in conjunction with this manual.

The development of the manual could be accomplished within TRB committees, NCHRP, and/or FHWA. It is anticipated that the manual would be of value to both basic and applied researchers and managers.

The format and topics to be covered in the proposed manual were prepared in the breakout and are outlined in Table 1 (page 20).

Note: The AASHTO Standing Committee on Research has since approved funding for this study under NCHRP Project 20-7.

### **Dissemination of Information/Information Exchange (Breakout C)**

The transportation community at all levels is dependent upon good resource information. Unfortunately, the value of good information is difficult to quantify in a way that would support the need for research to improve information resources. The lack of information and/or bad information are very costly to the users.

There needs to be an improved awareness of the cost and value of information and of accessing that information. The cost of the lack of information should also be included. A blue-ribbon committee should be

appointed for a TRB special project to address the value issue and to identify the best approach for developing a better understanding of and appreciation for good information. This activity covers a broad spectrum and should be of interest to the entire transportation community. Information resources in private industry need to be included. The report should be strategic in nature and cover issues from a global perspective.

### **Research, Development, and Technology Transfer Coordination (Breakout D)**

A major emphasis is needed on a coordinated effort to address administrative, technical, and funding requirements of R, D, and T<sup>2</sup>. The exchange of information is needed to avoid duplication of efforts, maintain efficiency of operation, and maintain the state-of-the-art. Coordination is needed to pool resources across jurisdictional boundaries including national/international, public/private, and transportation/non-transportation industry sectors.

The breakout participants felt that a multi-level approach was needed to address these issues given the diversity of the topics. Therefore, the following four topics were identified for future action:

- Assessment of Future Transportation Research and Avoidance of Research Duplication Among Agencies;
- Assessment of Transportation Databases and Needs;
- Strategies for Networking Transportation Research; and
- Identifying Opportunities for International Transportation Research Coordination and Cooperation.

#### *Assessment of Future Transportation Research and Avoidance of Research Duplication Among Agencies*

Throughout the transportation community there is a very large menu of research activities being proposed or in the planning stage. Many of the topics being considered are duplicated by other agencies. It is therefore important that these planned activities be coordinated in order to avoid duplication of efforts throughout all stages of the research. Since a coordinated effort does not currently exist for planned research and future research, it is recommended that a database be developed to address such a need.

It has also been pointed out that databases do exist for research-in-progress and completed research. The success of these efforts has been limited, suggesting

similar problems may be encountered in establishing a database for planned and future research. Therefore, the proposed effort must take into account existing barriers as well as identify alternative approaches to this information coordination. The system must also be flexible to respond to the dynamic and changing nature of research programs that often makes this information quickly out of date. However, the expected large payoff, along with the expected savings in time and funding, makes this effort a high priority.

A research study is suggested to examine potential mechanisms for establishing a database containing information on planned transportation research projects and issues being considered for future research efforts. This study should be conducted at the national level with direction and input from the user agencies. Users include transportation research agencies at all levels, public and private.

#### *Assessment of Transportation Databases and Needs*

There currently exists a wide variety of databases that provide information on research projects and reports. However, there is limited knowledge on how to access and utilize these databases along with the exact content of each. A better understanding of the nature, content, availability, and access technique is needed to ensure that they are used more effectively in transportation research programs.

A research study is recommended that would assess current transportation databases and future needs. The study would identify and examine current databases and define a future vision for using one-stop shopping. The identification of steps to accomplish this goal would also be made. This study should be conducted at the national level with direction and input from the user agencies. Users include transportation research agencies at all levels, public and private.

#### *Strategies for Networking Transportation Research*

Networking with other experts or peers is often the most effective means to obtain current information on the status and results of transportation research. In order to ensure that networking takes place, management of agencies and businesses must provide the needed support to their staff to participate in committees, conferences, etc.

TRB should explore ways to examine the issues and opportunities associated with expanding the networking capabilities in transportation research. This would benefit all groups interested in improving coordination



on research and development activities and technology transfer. TRB should involve other transportation agencies.

*Identification of Opportunities for International Transportation Research Coordination and Cooperation*

Transportation research conducted within North America is typically well known and publicized. Unfortunately, the transportation community is not aware of numerous projects underway throughout other parts of the world. This situation should be addressed to help ensure the timely sharing of information and to help coordinate transportation research on a worldwide basis.

A synthesis study should be conducted to examine current international research coordination and cooperation as well as to identify opportunities to expand and enhance these efforts. This information would be used to identify potential techniques and approaches to improve international coordination and cooperation efforts.

**NEXT STEPS**

The TRB Committee on the Conduct of Research will take the lead in advancing many of the recommended actions.

## APPENDIX A AGENDA AND ATTENDEES

---

### TRB COMMITTEE ON THE CONDUCT OF RESEARCH (A5001) MIDYEAR MEETING WORKSHOP

July 27-29, 1994  
Vail, Colorado

#### Agenda Outline

##### *Wednesday, July 27*

- 2:00 pm NEW MEMBERS ORIENTATION, NON-RAC (Private Dining Room)  
 Introductions Robert Spicher  
 Committee Scope Denis Donnelly
- 2:30 pm NON-RAC MEMBER UPDATE  
 Research Advisory Committee (RAC) Activities  
 Coordination Between RAC and A5001
- 3:30 pm GENERAL SESSION WITH RAC MEMBERS (Arizona Room)  
 Regional Reports  
 Resolutions  
 Future Actions
- 5:00 pm RECEPTION — Cash Bar (Cafe Colorado Veranda)  
 Committee A5001 and Guests

##### *Thursday, July 28*

- 8:00 am GENERAL SESSION (Tucson Room)  
 Call to Order and Meeting Objectives Denis Donnelly
- 8 - 10 am Spouse/Guest Hospitality (Altitude Club)
- 8:15 am Welcome Robert Spicher
- 8:30 am Relationship of Committee,  
 Subcommittee, and RAC Activities Denis Donnelly
- 9:00 am Breakout Assignments Bill Carr  
 Topics  
 Facilitators  
 Recorders  
 Attendees
- 9:30 pm BREAKOUT SESSIONS A (Tucson Room) AND C (Scottsdale Room)  
 Individual Workshops by Topic (Workshop Format)  
 Topic and Assignments Facilitator  
 Open Discussion All Attendees  
 Recommendations All Attendees  
 Action Items All Attendees

## Statement Development

Recorder

- Noon LUNCH BREAK (Cafe Colorado Veranda)
- 1:30 pm BREAKOUT SESSIONS B (Scottsdale Room) and D (Tucson Room)
- 4:00 pm CLOSING SESSION (Tucson Room)  
Workshop Summaries and Discussion Facilitators
- 5:00 pm ADJOURN COMMITTEE MEETING

Note: Coffee breaks will be held outside the Tucson Room.

*Friday, July 29*

- 8:00 am PRODUCT DEVELOPMENT (Tucson Room)  
(Meeting with committee officials, facilitators, and recorders to prepare outline for final product.)

**BREAKOUT SESSIONS (Guidelines for Participants)**

The overall goal of the breakouts is to discuss the assigned topic and prepare suggested actions to resolve a given issue. The actions may be in the form of a research problem statement, study proposal, suggestion for implementation, training needs, or other activities.

Following are the suggested topics for breakouts along with some examples of candidate discussion items:

**Breakout A: Program Development**

- Program development to meet agency needs
- Public/private partnerships
- Responding to customer/user needs
- Marketing the research program
- Program organization and administration
- Personnel development and training in research

**Breakout B: Research Methodology**

- Manual on developing a research experiment
- Standardization of research databases, etc.
- Data collection—SHRP protocols
- Quality control
- Education and training

**Breakout C: Dissemination of Information/Information Exchange**

- Technology transfer organization and operation
- International exchange of research findings
- Uniform technology on information exchange, etc.
- Marketing research results

**Breakout D: Research, Development, and Technology Transfer Coordination**

- At the state, national, and international levels
- Requirements (funding, personnel, etc.)
- Pooled-fund programs
- International information exchange
- Networking with other programs (AASHTO, TRB, industry)

**TRB COMMITTEE ON THE CONDUCT OF RESEARCH (A5001)  
MIDYEAR MEETING WORKSHOP**

**List of Attendees**

<b>NAME</b>	<b>ORGANIZATION</b>	<b>PHONE NUMBER</b>	<b>FAX NUMBER</b>
Ariniello, Alex	Colorado State Univ.	800/262-7623	303/491-8671
Benke, Robert J.	Minnesota DOT	612/282-2267	612/296-6599
Bentenson, Wade	Utah DOT	801/965-4303	801/965-4796
Betsold, Robert J.	FHWA	703/285-2054	703/285-2379
Brach, Ann	Maryland Hwy. Adm.	410/321-3577	410/321-2208
Brown, William F.	FHWA	703/285-2774	703/285-2791
Carr, William P.	Washington State DOT	206/705-7802	206/705-6823
Dietz, Arlene	U.S. Army Corps of Engrs.	703/355-2071	703/355-0047
Donnelly, Denis E.	Consultant	303/985-2245	303/985-2245
Edwards, Paul	Utah DOT	801/965-4115	801/965-4796
Evans, Bill	FHWA	703/285-3081	703/285-2379
Griffin, Rich	Colorado DOT	303/757-9506	303/757-9974
Griffith, Ray	FHWA	202/366-9210	202/366-7909
Harder, Barbara	B.T. Harder, Inc.	215/735-2482	215/735-9586
Harm, Eric	Illinois DOT	217/782-6732	217/782-2572
Harrington-Hughes, Kathryn	Harrington-Hughes Assoc.	202/347-1414	202/347-6938
Hedges, Christopher	Trans. Assn. of Canada	613/736-1350	613/736-1395
Huft, David	S. Dakota DOT	605/773-3358	605/773-3921
Irwin, Lynne	Cornell University	607/255-8033	607/255-4080
Marti, Mike	Braun Intertec Corp.	612/942-3044	612/942-3059
McGinnis, Laurie	Univ. of Minnesota	612/625-3019	612/625-6381
McReynolds, Richard	Kansas DOT	913/296-7410	913/296-2526
Metcalfe, John	Louisiana State Univ.	504/388-4911	504/388-4945
Moore, Beth	Colorado DOT	303/757-9220	303/757-9242
Perry, Robert	New York State DOT	518/457-5826	518/457-7535
Port, Roger	FHWA, Region 7	816/276-2740	816/363-3347
Reilly, Eugene	Consultant	908/549-5212	908/549-2262
Rothenberg, Morris	JHK & Associates	703/370-2411	703/823-8347
Schmiedlin, Robert	Wisconsin DOT	608/246-7950	608/246-4669
Shaffer, Douglas	TRB	202/334-2298	202/334-2003
Spicher, Robert E.	TRB	202/334-2935	202/334-2003
Strong, Pat	North Carolina DOT	919/733-9770	919/715-0137
Turnbull, Katherine	Texas Transportation Inst.	409/845-1535	409/845-6008

## APPENDIX B BREAKOUT SUMMARIES

---

### PROGRAM DEVELOPMENT (BREAKOUT A)

#### Opening Remarks

Transportation research along with the utilization and development of new technology is an essential cornerstone of effective transportation system management efforts. Many transportation agencies have a commitment toward research and development of new technology. A vital aspect of the transportation research and experimental process, as well as in the development of new technology, is in the identification of research needs. A needs identification process can be useful in development of top priority research projects for near-term start-up. Thus, needs identification is a key issue in the research development process.

The process can shift direction of research from a reactive role to a more proactive role with the involvement of all elements of the transportation work force. This process can identify the immediate practical research needs using minimal resources and staff. For the purpose of identifying transportation research needs, the process can be efficient and effective.

#### Topics Discussed

The originally assigned topics were

- Program Development to Meet Agency Needs;
- Public/Private Partnerships;
- Responding to Customer/User Needs;
- Marketing the Research Program;
- Program Organization and Administration; and
- Personnel Development and Training in Research.

After brainstorming, synthesis and prioritization by the workshop participants, five topics were identified as worthy of future attention. These were

- What Makes People Support Research?
- Strategic Planning
- Public/Private Partnerships
- Personnel Development and Training in Research
- What Makes a Program Effective?

### Recorder Notes

#### *What Makes People Support Research?*

The management and operation of a research program can easily be carried on without clear direction of user needs. This condition frequently results in findings being "put on the shelf" with little, if any, implementation. Consequently, those outside the research program do not provide the support to maintain a sustainable and dynamic program. The following issues are in need of consideration in order to obtain support for the research program:

- CAO/top management issues;
- Legislative issues;
- Public issues;
- Internal issues;
- Communications issues;
- Champions; and
- Look beyond traditional transportation agencies.

#### Action Needed

There is a need to identify organizational and cultural factors conducive to supporting research. The topic could be submitted to the AASHTO Standing Committee on Research for consideration as part of the Work Plan for Task 9 of the AASHTO Reauthorization Initiative. This activity consists of a review and update of the 1989 AASHTO report *Innovation: A Strategy for Research, Development, and Technology Transfer*.

#### Interested Agencies

NCHRP, FHWA, or AASHTO could lead the effort in providing overall program guidance and encouragement to the user agencies.

#### Discussion/Justification

- How to get CAO to encourage/support research.
- Outreach programs to CAO/top management.
- How do we get and keep good people in research?

There is a need for making the fundamental reasons for supporting research more explicit. Researchers may have taken for granted the importance of these activities, neglecting to remind decision-makers and the public of the relationship of research to products they value. A process of "enlightenment" needs to be established to build intellectual conviction regarding research and a sense of the value of research when products are implemented. Side issues such as marketing, good writing skills, development of clear and attractive presentations, and other communication techniques also need to be addressed. The thrust of this effort is to identify barriers and how to break the barriers down.

### *Strategic Planning*

A transportation agency's overall goal and mission should be the basis for developing a short and long term strategic plan for the research program. This plan should be developed in concert with the agency management and the principal program users. The research program administrators and staff should then use this strategic direction to address its future operation given the following factors:

- Mission of research organization;
- Integration within organizations;
- Resources and funding sources;
- User needs and involvement;
- Agency top management involvement;
- Integration with parent organization;
- Role of basic research;
- Changing technology;
- Problem identification and prioritization; and
- Technology transfer process and feedback.

### *Action Needed*

A study should be conducted to develop a strategic planning methodology for research programs at the federal, state, and local levels. This would address the items noted above. The study would provide a uniform process and help ensure that resources for research activities are maintained and conducted. The methodology could be developed with a research or synthesis study. It is suggested that the study request be initiated by the AASHTO Research Advisory Committee with support from state and other transportation research organizations.

### *Interested Agencies*

Any number of agencies could do this work. However, the main user would be AASHTO to provide uniform guidance to its member transportation agencies. Also, broad support of the project could result in funding from multiple sources. The final product should be submitted to the AASHTO RAC for their consideration and then included in the FHWA R & D Program Manual.

### *Discussion/Justification*

There is a need to develop a strategic planning methodology that could be used by all groups interested in developing and conducting transportation research. This would include state and local agencies, universities, private sector groups, and federal agencies and organizations. As such, the methodology will help ensure coordinated approaches in transportation research throughout the country and will assist in managing ongoing research programs.

### *Public/Private Partnerships*

A government-sponsored research agenda has developed into a complex process. One aspect of that process is the public/private partnerships that are developed to help define the research agenda. To define these partnerships, the following situations and factors should be considered and described:

- Identify partners;
- Identify opportunities;
- Identify barriers;
- Case studies;
- Enabling legislation; and
- Cultivate differences/similarities.

### *Action Needed*

Activities currently underway through the Intelligent Transportation System program should be considered as a resource to develop strategies for facilitating public/private partnerships in program development. In addition, current state-of-the-practice activities should be considered. This could be sponsored by the AASHTO SCOR with consideration for development of a Research Digest or "quick synthesis" document. A national pooled

fund DOT/FHWA staff supported project could also be considered.

### Interested Agencies

State DOTs should be encouraged to promote public/private partnerships within their agency seminars, conferences, and partnering activities. Legislators should also be invited to participate. AASHTO could work with national agencies such as the National Governors Association and political leaders on developing this concept.

### Discussion/Justification

The cooperative efforts between the public and private sector is the "wave of the future" in the transportation industry. Therefore, the project is timely. The early completion of such a project will produce more effective and productive partnerships.

Funding for such a project could come from a number of sources close to the customers. These include the states, universities, military, federal government, and private industry.

### *Personnel Development and Training in Research*

Personnel managing and operating within the research program should exhibit unique characteristics. These qualifications should be recognized and rewarded for their contribution to a successful research program. Items that should be considered in developing and training of personnel within the research program are

- Dual career path development;
- Skill needs assessment;
- Cross training;
- Training models (national training);
- Equitable compensation;
- Staff retention;
- Networking;
- Personnel qualifications and training requirements to support multi-model transportation research and development programs;
- Emerging technologies;
- University developmental curriculum;
- Organizational cultural factors conducive to research support;
- Communications with CAOs;

- Outreach programs to CAOs; and
- How to get and keep good people in research.

### Action Needed

Identify personnel qualification requirements, personnel development, training, and education needs to support multi-modal transportation research and development programs. Identify existing programs and efforts to incite these needs. Determine where expanding existing programs, implementing new programs, or coordinating efforts with other groups is needed. These requirements should be clearly identified and published for use by transportation agency research administrators.

It is suggested that this topic be submitted to AASHTO SCOR for overall consideration, and perhaps to the AASHTO Personnel Committee.

### Interested Agencies

All organizations who have research, management, operations, and construction responsibilities such as TRB, NCHRP, AASHTO, FHWA, local governments, universities, and others could be the main agencies with interest in this activity. The Civil Engineering Research Foundation (CERF) could also help address these qualifications.

It is also suggested that other TRB committees (i.e., Committee A1A02, Management and Productivity) or possibly the FHWA National Highway Institute program could undertake this topic as a task force activity. It is anticipated that the final product be included in the AASHTO RAC Manual and the FHWA R&D Guidelines.

### Discussion/Justification

Ensuring that a pool of qualified transportation professionals continues to be available will be critical to the future success of the transportation system. The dramatic changes in technology and policy directives, as well as the evolving needs of system users, mandates that professional training and development also change. This project will assess the current and future needs for professional training and development for all types of transportation officials and will outline the best approaches to meet these needs. This may include expanding existing programs, developing new training and education programs, and coordinating the activities of other transportation groups.



This project should be coordinated with the development of a model university curriculum for educating tomorrow's researchers.

#### *What Makes a Program Effective?*

Several research programs have long been recognized for their leadership in the industry and using state-of-the-art procedures. This recognition comes from within their agencies as well as from their peers. The following are items that should be considered by research program managers in order to help develop and maintain an effective program:

- Multi-modal;
- Customer involvement/satisfaction;
- Strategic plans;
- Multi-skilled staff; and
- Case studies.

#### Action Needed

A synthesis of effective research organizational structures is needed for use throughout the transportation sector. (Synthesis studies currently underway could be extended to include this topic). This document could provide guidance in developing a sustainable research program. Conditions for application would be for agencies developing or restructuring a research program or those agencies looking for guidance in making their research program more effective.

#### Interested Agencies

A synthesis could be developed by TRB with guidance or sponsorship from FHWA, AASHTO, and other engineering organizations. The primary user would become AASHTO, its membership, and those public and private organizations providing research services.

#### Discussion/Justification

A typical synthesis of state-of-the-practice could be developed which illustrates the basic requirements for an effective program. This could then be used as a starting point to identify the research requirements. However, it is anticipated at this stage that the synthesis would not get into details of how best to achieve the requirements.

## RESEARCH METHODOLOGY (BREAKOUT B)

### Opening Remarks

The chairman began the workshop discussion by indicating that a more up-front emphasis should be given to determining and agreeing on a measurable objective or hypothesis and an experimental design or research approach. If a goal is identified and a plan is developed to achieve it, generally the data issues become less of a problem. A message should be sent - do not collect data and then try to formulate the question. On the other hand, even with a well thought-out and planned project, the data issues are still significant.

Additional comments included:

- More emphasis on cost-effective data management resulting from ISTE management systems.
- Data systems must be configured to save managerial, technical and non-technical needs while still adhering to standardization protocols.
- Shortage of professional expertise to skillfully develop and manage data bases.
- Clear impact of new technologies on data base development.
- Need for specialized training in transportation data base development and management.

### Topics Discussed

This workshop developed one topic for future consideration:

- A Methodology for Both Basic and Applied Transportation Research Studies.

This topic was discussed and presented in a "report" format. Items to be covered in the "report" table of contents were identified.

### Recorder Notes

#### *A Methodology for Both Basic and Applied Transportation Research Studies*

A distinct difference has long been recognized between basic and applied research. These differences require unique approaches to developing, sustaining, and implementing research studies or projects within these categories.

**TABLE 1 MANUAL FOR SCIENTIFIC INQUIRY INTO TRANSPORTATION PROBLEMS: RESEARCH METHODOLOGIES**

Table of Contents	
Chapter 1	Introduction (Need for Professional and Ethical Research Practices)
Chapter 2	The Principles of Scientific Inquiry
Chapter 3	Objectives (Quality, Methods, Results, etc.)
Chapter 4	Definition of Terms
Chapter 5	Experimental Design Approaches
Chapter 6	Data Collection, Management, and Reporting (Concepts and Issues)
Chapter 7	Analysis and Interpretation
Chapter 8	Presentation of Results (Data Presentation Techniques)
Chapter 9	Summary
Appendix I	Recommended Training and Development Courses
Appendix II	Peer-Review Issues Concerning Research Objectives, Experimental Design, and Data Analysis and Management
Appendix III	Case Studies of Data Analysis and Management Practices
Appendix IV	Literature Search and Review Principles
Appendix V	Non-Data-Driven Results: Policy Studies and Project Evaluation Studies
Appendix VI	Checklist: Quality Research Design and Project Design Parameters
Appendix VII	Bibliography and Other Recommended Readings

#### Action Needed

There is a need to assemble existing information concerning research project planning and management into a manual of transportation research practice. The manual will be of value to both basic and applied research practitioners and managers. This developmental activity should be titled, Manual for Scientific Inquiry Into Transportation Problems: Research Methodologies. Course instruction should be developed in conjunction with the manual. (Note: On April 23, 1995, the AASHTO Standing Committee on Highways approved \$75,000 under NCHRP Project 20-7 for the proposed study.)

#### Interested Agencies

The Transportation Research Board, Task Force on Statistical Methods in Transportation (A3T51); National

Cooperative Highway Research Program; Federal Highway Administration, National Highway Institute Training Program; and, the AASHTO Standing Committee on Research and the Research Advisory Committee.

#### Discussion/Justification

Transportation research managers and practitioners need one comprehensive source of information for proven methods of research, project planning, and execution. The proposed manual should advance state-of-the-art techniques for project planning, experimental design, research, data collection, management, quality control, analysis, and interpretation. Instruction that accompanies this manual should meet the specific needs of both the research principal investigators and research program managers. This instruction should emphasize state-of-the-art procedures for data quality control and

data interpretation. Throughout this process, consideration for implementation of the final product should be maintained.

The format for this manual was recommended by the workshop participants and is presented in Table 1.

## **DISSEMINATION OF INFORMATION/ INFORMATION EXCHANGE (BREAKOUT C)**

### **Opening Remarks**

The chair pointed out that the transportation sector is dependent upon good resource information at all levels, including administration, operations, and research. However, because of limitations in staff and funding, good data are often not available.

The value of good information is difficult to quantify in a way that would support the need for research to improve information resources. The lack of information or bad information is very costly to transportation organizations because inefficiencies result. The added value of new information (research) needs to be identified.

A previous TRB study identified the lack of commitment to research by the transportation community. As a result, the public sector became more aware of the need for transportation research, and Congress funded additional research including the Strategic Highway Research Program (SHRP), and major institutions devoted resources to transportation issues. The information resources and needs in private industry need to be identified and publicized in a similar way.

### **Topics Discussed**

The top priority issue identified by this breakout is the need to market/recognize the value of information.

### **Recorder Notes**

There is a need to market/recognize the value of information. Incremental improvements in access to information could lead to big payoffs for transportation agencies and industry. How can we effectively and efficiently link information resources with needs? There is a need to document the use and value of information in solving problems.

### *Action Needed*

An NRC study is needed on the cost and value of information as a national resource. This study should be conducted by a blue-ribbon committee. The proposed report should be strategic in nature and cover issues from a global prospective.

Items to be studied include:

- Value to the nation's well-being (cost of information vs. cost of lack of information). Case studies should be included.
- Cultural issues — Public agency vs private organization's approach to information. Bottom-line orientation.
- Discussion of existing system of information exchange and suggestions for alternative models. Getting the right information in the right form to the right people at the right time.
- Dissemination via linking to information superhighway.
- Industry analysis of next steps/how to use the reported information.

It is anticipated that TRB Committee A5001, Conduct of Research, would seek ways to implement the study's findings.

### *Interested Agencies*

This activity covers a broad spectrum and should be of interest to the entire transportation community. This includes industry, state DOTs, local agencies, FHWA, LTAP centers, academia, associations, and others.

The proposed NRC study could be commissioned by AASHTO, FHWA, Bureau of Transportation Statistics, National Institute of Standards and Technology, etc.

### *Discussion/Justification*

Information is a valuable, but often untapped, national resource. The single largest problem faced by information-exchange agencies is the overriding lack of understanding of the value both of information and of access to that information. Research conducted and knowledge gained at laboratories and agencies around the country often go unrecognized by the transportation community as a whole, because of an unawareness of, and a lack of easy access to, the information. This lack of awareness and access is inefficient and costly, causing

agencies to unknowingly duplicate the work of others and fail to add others' experiences and findings to their knowledge base.

Even as the technology to aid in information exchange continues to improve (for example, the information superhighway, computer networks, CD-ROM interactive technology), budget constraints are prompting the closing of transportation libraries — the linchpin in the information retrieval and dissemination process — at both the state and federal levels. The result — problems getting new information into the system, accessing the information, encouraging local and global information exchange, and so forth.

The first step in overcoming the problem in the *process* of information exchange is overcoming the *perception* issue - there needs to be an improved awareness of the value of information - and especially the cost of the lack of information. Acquiring information can be costly, but it is often more costly in the long run to do without that information. A blue-ribbon committee, appointed by the National Research Council, should address this issue.

## RESEARCH, DEVELOPMENT, AND TECHNOLOGY TRANSFER COORDINATION (BREAKOUT D)

### Opening Remarks

A major emphasis needs to be placed on coordinated efforts to address the administrative, technical, and funding requirements of R, D, and T<sup>2</sup>. These items should be well-identified for consideration by national agencies for inclusion in their research programs. The exchange of information is needed to avoid duplication of these efforts and to enhance effectiveness and to maintain efficiency of operations. Information exchange also is required to relay the state-of-the-art related to what is working and what can be enhanced in the research, development, and technology transfer process. Coordination is needed to pool resources across jurisdiction boundaries. This is also the case at the national/international, public/private, and transportation/non-transportation industry levels.

### Topics Discussed

The four most important topics identified in this breakout were

- Assessment of Future Transportation Research and Avoidance of Research Duplication Among Agencies;
- Assessment of Transportation Databases and Needs;

- Strategies for Networking Transportation Research; and

- Identification of Opportunities for International Transportation Research Coordination and Cooperation.

In addition, a strategic plan for R, D, and T<sup>2</sup> transportation data coordination was discussed. Items identified for inclusion:

- What do we have?
- What do we need?
- Access.
- What new products and services are needed?
- One-stop shopping.
- Coordinating with existing studies and initiatives.

### Recorder Notes

#### *Assessment of Future Transportation Research and Avoidance of Research Duplication Among Agencies*

There is a great deal of transportation research being planned and conducted by a wide range of groups. These include federal agencies, national organizations, state departments of transportation, universities, transit agencies, MPOs, and private sector groups. Although databases, such as TRIS, provide a good source of information on completed reports and ongoing studies, there is not a good source of information on research being planned, and major issues being considered for future research studies. A database containing this information is needed to help facilitate greater coordination among research programs and to help ensure that duplication of efforts does not occur.

### Action Needed

Research Coordination Study: A research study would be conducted to examine potential mechanisms and methods for establishing a database containing information on planned transportation research projects and issues being considered for future research efforts. The study would examine the extent to which these topics are included in existing databases. Based on this review, alternative approaches would be identified and evaluated to improve existing databases or to establish a new database. The advantages, disadvantages, costs, and issues associated with each approach would be analyzed. Based on this assessment a recommended approach would be outlined. This would include a plan for developing the recommended system. It would include the steps necessary to implement the recommended approach, the costs and potential funding

sources, and procedures for updating and maintaining the database. The assessment would consider both public and private sector research activities.

One possibility would be to expand the TRIS data base to include information pertaining to all transportation agencies regardless of funding sources. This would include public/private partnership programs, private and other grants, and other sources such as NSF, ASCE, ASTM, CERF, and others. The expanded format would also include planned and future research issues.

#### Interested Agencies

A variety of agencies and groups across all modes of transportation would be interested in this research study. These include TRB, NCHRP, FHWA/NHI, FHWA/RTCC, NHTSA, FTA, ASCE/CERF, AASHTO, states, MPOs, local jurisdictions, universities, private sector groups, and others.

#### Discussion/Justification

It is difficult to maintain accurate, complete, and up-to-date databases on research which is underway or complete. The states, FHWA, and others are providing this information to TRB/TRIS, and the new SPR regulations should cause states to make greater use of the system, both on the input and output sides. However, the dynamic and changing nature of national, state, and local research programs makes this information quickly out of date.

Even more difficult, would be the inclusion of planned research and future issues in these systems. Nonetheless, the establishment of a database containing information on transportation research in-progress, planned research projects, and future issues would help enhance coordination of research activities and assist in ensuring that duplication of efforts does not occur.

This research study would be of benefit to all groups interested in enhancing coordination on research and development activities and technology transfer. At some point in time it might be appropriate for the principal agencies involved in the above, such as AASHTO, TRB, FHWA, etc., to address the issue of research program coordination by providing a strategic implementation plan.

#### *Assessment of Transportation Databases and Needs*

Currently, a wide range of databases provide information on transportation research projects and reports. Further, numerous databases are available containing additional information on transportation-related activities and information on other research fields. However, there appears to be limited knowledge about how to access and utilize these databases, along with the exact content of each. A better understanding of the nature, content, availability, and access techniques for these databases is needed to ensure that they are a useful part of the ongoing transportation research program. Further, enhancing the understanding and use of these databases will help facilitate communication and coordination of transportation research.

#### Action Needed

**Research Study:** A research study should be conducted to assess current transportation databases and future needs. This assessment would start with the identification and examination of all transportation databases, as well as those in related fields. This would include examining the content and focus, the methods for access—both entering information and obtaining information—quality control mechanisms, relevant issues, and potential areas for improvements and enhanced coordination. Further, the study would define the future vision for a one-stop shopping transportation database and identify the steps needed to accomplish this goal. A TRB Special Projects study, outlined by the Conduct of Research Committee, is recommended to accomplish this objective.

#### Interested Agencies

A variety of agencies and groups would be interested in this research study. These include TRB, FHWA/NHI, FHWA/RTCC, FTA, NHTSA, ASCE/CERF, AASHTO, states, MPOs, local jurisdictions, universities, private sector groups, and others.

#### Discussion/Justification

This research study would be of benefit to all groups interested in enhancing the use and quality of transportation databases. This would help ensure that all groups interested in transportation research and

improving the transportation system have access to the best available information on the results of past research projects and other efforts. This activity would help fulfill the objectives of the TRIS current efforts to enhance and further the use of TRIS in other transportation environments.

#### *Strategies for Networking Transportation Research*

Networking with other experts is often the best way to obtain current information on the status and results of transportation research. Information exchange is needed at the regional, multi-state, national and international levels. Waiting for research reports to be published, and to find their way into the appropriate databases, is often not an effective approach. In order to ensure that networking is a viable option, however, agencies and businesses must provide the needed support. This includes financial, as well as corporate, support from all levels. This support is not present in some agencies and organizations, and, thus, networking is not effective.

#### Action Needed

TRB should examine the issues and opportunities to be associated with expanding the networking capabilities in transportation research. The review should examine the value of networking, the cost associated with networking, the organizational and cultural factors needed to encourage and nurture networking, necessary policy and top administrative support, and the identification of specific strategies to support expanded networking capabilities. Opportunities to use new technologies to enhance networking would be identified and evaluated. Further, the potential to develop and maintain a listing of experts—both agency and individual—would be considered. A set of recommended strategies would be developed to enhance networking capabilities among all groups. The results of the review, perhaps conducted by the TRB Conduct of Research Committee, should be widely disseminated.

#### Interested Agencies

A variety of agencies and groups would be interested in this study. These include TRB, NCHRP, FHWA/NHI, FHWA/RTCC, NHTSA, FTA, ASCE/CERF, AASHTO, states, MPOs, local jurisdictions, universities, private sector groups, and others.

#### Discussion/Justification

This review would be of benefit to all groups interested in improving coordination on research and development activities and technology transfer. Enhancing networking opportunities would be of benefit to individuals and organizations responsible for conducting, sponsoring, and coordinating transportation research.

#### *Identification of Opportunities for International Transportation Research Coordination and Cooperation*

In addition to transportation research being conducted in North America, numerous projects are underway throughout the world. Current transportation research databases contain very little information about research activities outside of North America. This situation should be addressed to help ensure the timely sharing of information and to help coordinate transportation research on a worldwide basis.

#### Action Needed

**Synthesis Study:** A synthesis study should be conducted to examine current international transportation research coordination and cooperation as well as identify opportunities to expand and enhance these efforts. The study would document and review existing efforts—including those by FHWA, other U.S. DOT agencies, universities, and private sector groups. Participation in international activities sponsored by such organizations as the International Road Federation, the World Bank, and others would be assessed. Barriers to participating in these agency programs, meetings, and conferences would be identified along with recommendations to alleviate these barriers. This information would be used to identify potential techniques and approaches to improve international coordination and cooperation efforts. The costs and benefits associated with each method would be identified and analyzed. It would also assess methods to encourage greater participation and identify the steps and funding necessary to implement these techniques. This study will be recommended as a NCHRP Synthesis Study by TRB Conduct of Research Committee.

#### Interested Agencies

A variety of agencies and groups would be interested in this synthesis study. These include TRB, NCHRP,

FHWA/NHI, FHWA/RTCC, NHTSA, FTA, ASCE/CERF, AASHTO, states, MPOs, local jurisdictions, universities, private sector groups, World Bank, foreign countries, and others.

#### Discussion/Justification

This synthesis study would be of benefit to all groups interested in enhancing coordination on research and development activities and technology transfer, especially those interested in enhancing international coordination and cooperation. The synthesis would identify current methods of cooperation, techniques to improve this process, identify ways to expand participation, funding resource needs, and steps to undertake international cooperation. Chief administrative official (CAO) peer-to-peer contacts are suggested as one successful approach.