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A Synthesis of Highway Practice

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Research Sponsored by the American Association of State Highway and Transportation Officials
in Cooperation with the Federal Highway Administration

TRANSPORTATION RESEARCH BOARD
WASHINGTON, D.C.
2003
www.TRB.org
Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

In recognition of these needs, the highway administrators of the American Association of State Highway and Transportation Officials initiated in 1962 an objective national highway research program employing modern scientific techniques. This program is supported on a continuing basis by funds from participating member states of the Association and it receives the full cooperation and support of the Federal Highway Administration, United States Department of Transportation.

The Transportation Research Board of the National Research Council was requested by the Association to administer the research program because of the Board’s recognized objectivity and understanding of modern research practices. The Board is uniquely suited for this purpose as it maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; it possesses avenues of communication and cooperation with federal, state, and local governmental agencies, universities, and industry; its relationship to the National Research Council is an insurance of objectivity; it maintains a full-time research correlation staff of specialists in highway transportation matters to bring the findings of research directly to those who are in a position to use them.

The program is developed on the basis of research needs identified by chief administrators of the highway and transportation departments and by committees of AASHTO. Each year, specific areas of research needs to be included in the program are proposed to the National Research Council and the Board by the American Association of State Highway and Transportation Officials. Research projects to fulfill these needs are defined by the Board, and qualified research agencies are selected from those that have submitted proposals. Administration and surveillance of research contracts are the responsibilities of the National Research Council and the Transportation Research Board.

The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

NOTE: The Transportation Research Board of the National Academies, the National Research Council, the Federal Highway Administration, the American Association of State Highway and Transportation Officials, and the individual states participating in the National Cooperative Highway Research Program do not endorse products or manufacturers. Trade or manufacturers’ names appear herein solely because they are considered essential to the object of this report.
The National Academy of Sciences is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. On the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Bruce M. Alberts is president of the National Academy of Sciences.

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The Transportation Research Board is a division of the National Research Council, which serves the National Academy of Sciences and the National Academy of Engineering. The Board’s mission is to promote innovation and progress in transportation by stimulating and conducting research, facilitating the dissemination of information, and encouraging the implementation of research results. The Board’s varied activities annually engage more than 4,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest. The program is supported by state transportation departments, federal agencies including the component administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation. www.TRB.org

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FOREWORD

By Staff

Transportation Research Board

Highway administrators, engineers, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and unevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

There is information on nearly every subject of concern to highway administrators and engineers. Much of it derives from research or from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and to make it available to the entire highway community, the American Association of State Highway and Transportation Officials—through the mechanism of the National Cooperative Highway Research Program—authorized the Transportation Research Board to undertake a continuing study. This study, NCHRP Project 20-5, “Synthesis of Information Related to Highway Problems,” searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics. Reports from this endeavor constitute an NCHRP report series, *Synthesis of Highway Practice*.

The synthesis series reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report in the series provides a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems.

PREFACE

This report of the Transportation Research Board will be of interest to public- and private-sector managers and others who oversee research programs in the transportation community. The report examines partnerships, both internal and external, currently being used in transportation research, and presents methods and approaches that produce synergies beneficial to the research and to the participant organizations as a whole. It discusses the types of state and provincial transportation research partnerships, the functions of participants in research partnerships, motivations for and the benefits of research partnerships, the structure and elements of research partnerships, factors affecting the success of research partnerships, and provides information and examples to assist in the creation and management of research partnerships.

Information was derived from three primary sources: (1) 41 responses from a survey questionnaire sent to American Association of State Highway and Transportation Officials members departments’ and Canadian provincial transportation ministries’ research units, review of research unit management materials, and interviews with managers; (2) government publications, research and technology sources, and business management literature; and (3) state department of transportation unit peer exchange meeting reports.

A panel of experts in the subject area guided the work of organizing and evaluating the collected data and reviewed the final synthesis report. A consultant was engaged to collect and synthesize the information and to write this report. Both the consultant and the members of the oversight panel are acknowledged on the title page. This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As progress in research and practice continues, new knowledge will be added to that now at hand.
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ACKNOWLEDGMENTS

Barbara T. Harder, President, B.T. Harder, Inc., was responsible for collection of the data and preparation of the report.

Valuable assistance in the preparation of this synthesis was provided by the Topic Panel, consisting of William P. Carr, Washington, D.C.; Kenneth M. DiCrescenzo, Federal Relations Representative, California Department of Transportation; Geoffrey Frohnsdorff, Chief, Building Materials Division, National Institute of Standards and Technology; Gene Griffin, Director, Upper Great Plains Transportation Institute, North Dakota State University; Michael L. Halladay, Director, Office of Safety Integration and Delivery, Federal Highway Administration; David M. Johnson, Research Services Engineer, Minnesota Department of Transportation; Mark Norman, Director, Technical Activities, Transportation Research Board; Dale Peabody, Transportation Research Engineer, Maine Department of Transportation; Robert E. Spicher, Laurel, Maryland; Richard Woo, Director, Policy and Research, Maryland State Highway Administration; and Felicia B. Young, Team Leader, Community Programs, Office of Human Environment, Federal Highway Administration.

This study was managed by Stephen Maher and Jon Williams, Managers, Synthesis Studies, who worked with the consultant, the Topic Panel, and the Project 20-5 Committee in the development and review of the report. Assistance in project scope development was provided by Donna Vlasak, Senior Program Officer, Don Tippman was responsible for editing and production. Cheryl Keith assisted in meeting logistics and distribution of the questionnaire and draft reports.

Crawford F. Jencks, Manager, National Cooperative Highway Research Program, assisted the NCHRP 20-5 Committee and the Synthesis staff.

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SUMMARY

In today’s transportation research community, no single research unit possesses every required resource in sufficient measure to operate independently or meet all of its strategic goals. Research programs are becoming more efficient and productive, yet problems of increasingly diversity continue to need solutions. Partnerships can contribute significantly to providing answers. Partnerships can provide broader resource availability, increased flexibility in research performance, and greater opportunities to maximize the value of the research function for the parent organization.

State and provincial transportation agency research units throughout the United States and Canada are making smart choices about research: they are leveraging funding and sharing vital resources through research partnerships. These research partnerships are occurring in unprecedented numbers in every agency research program. What is intriguing about this dynamic trend in transportation research is the unique nature of the partnerships. There are a multitude of partners, a seemingly infinite variety of needs, and a vast number of structures used to enable beneficial research collaboration. However, with all this variation, research partnerships still produce mission-critical results for their member organizations.

The purpose of the synthesis is to examine partnerships currently in use within transportation research, to identify key factors that facilitate these partnerships, and to present methods and approaches that produce synergies beneficial to the research program and to the participant organizations as a whole. Material in the synthesis is presented to assist state and provincial research units to form, manage, and sustain research partnerships more effectively.

The partnership arrangements discussed range from informal collaborative working relationships to formal contractual vehicles that detail alliances among diverse and disparate organizations. The primary focus of the synthesis is partnerships with state or provincial agency research units.

Material supporting findings in the synthesis came from three primary sources: (1) 41 research unit managers—by means of a mail survey to American Association of State Highway and Transportation Officials member departments’ and Canadian provincial transportation ministries’ research units, review of research unit management materials, and interviews with various managers; (2) government publications, research and technology sources, and business management literature; and (3) state department of transportation research unit peer exchange meeting reports.

At the time of the survey, research units were, on average, participating in 17 partnerships. They are categorized into two principal types of partnership relationships: those internal to the agency of which the research unit is a part, and those external to the agency—with
other organizations. Of the partnerships currently in operation, 47% are internal to the agency and 53% are with external partner organizations.

On average, research units had the highest level of effort in participation with other units within their own agency. The degree of participation with academic institutions and federal agencies was nearly as great. In general, all research units have a collaborative relationship or some form of alliance with at least one academic institution, and often many. Often these efforts are major commitments by the research unit and take the form of university consortia or institutes. Research units also participate to a high degree with federal agencies, many of which provide funding and other vital resources.

Partner functions most often relate to the types of resources contributed to the partnership. State and provincial research units as well as other state agencies and the federal government most frequently function as the funding provider, the supplier of various in-kind resources, and the source of project managers and administrators. Universities and the private sector function as technical experts and supply research facilities and equipment and materials as well as funding. Local government partners have a variety of functions, such as supplying pilot sites, funding, and technology transfer and implementation opportunities.

Thanks to U.S. federal-aid programs such as the State Planning and Research program, as well as state funds available for research, state research units provide substantial funding for many of the partnerships in which they are involved. On average state research units commit 53% of their federal-aid research funds and 38% of their state research funds to partnership activities.

Memorandums of understanding and contracts were the most frequently used methods for formalizing a research partnership. When more and diverse partners are involved, and particularly those from the public sector, memorandums of understanding are favored. With multiple partners, including private-sector companies, contracts were the preferred arrangement. Informal collaborations, with no written agreement, were often found when research units formed partnerships within their own agencies.

Responses to the synthesis survey show that 60% of the partnerships described by the research managers have two or three partners. Additionally, although a number of research units have long-standing partnerships, especially with universities, most partnerships have been formed since 1985. Furthermore, the states and provincial research units reported the partnerships that were considered beneficial (working well and producing benefits to the partners) have an average term of 3 years. Of the beneficial partnerships, 52% had defined goals, and these goals were achieved 88% of the time. On average, these beneficial partnerships implemented eight research results during the past 5 years.

For the overall health and success of research partnerships, the most important elements in forming a research partnership are common goals and expectations, mutual interest, and resource availability, particularly for funding. The most important elements in sustaining a research partnership are generating positive results or showing progress and successes, and the presence of stable resources, including maintaining technical expertise and funding.

Key findings of the synthesis are as follows:

- Internal partnerships produce more implementable results—Although external and internal partnerships all almost equal in number, approximately 65% report that internal partnerships produce more implementable results.
• Partnership or alliance managers are essential—Alliance managers are considered an essential element of private-sector partnerships. These individuals are responsible for the progress of the alliance or partnership for their respective partner organizations. They reflect their organizations’ culture and values and identify with and understand the partner’s motivations and needs. Little mention was made by the state and provincial research units of partnership or alliance managers except when asked about items that would facilitate successful partnerships. Only then were personnel committed to managing the partnership noted as a most important factor.

• The high level of commitment to transportation research partnerships will be stable for the next 3 to 5 years—Some additional funds may be committed to the same number of partnerships, although a substantial increase in the activity is not anticipated. This stable level is due in part to the level of anticipated research funding, as well as to of research unit staffing. Because there is little opportunity in most agencies for increased research staffing, there may be a lack of staff to properly manage added numbers of partnerships.

• There are few models or guidelines—Partnerships have myriad variables, unique circumstances, individual objectives, and a seemingly infinite source of participants, each with an agenda and expectations. Collaborative arrangements, for most research units, require a substantial start from the ground up each time a new partnership is created.

• Partnerships are usually formed on an ad hoc basis—Like most U.S. companies, most state and provincial research units form their research partnerships on an ad hoc basis. Only 3 of the 41 responding research units had research partnership policies, and 5 research units had partnership tools or guidelines.

• Sharing resources is basic—Of all the variability that accompanies partnerships, this is one area of agreement that stands out.

• Leveraged funds—On average, research units reported that they leveraged funds by 2.3 to 1 in their partnerships.

• Commitment to a project is advisable—A well-defined project having clear goals subscribed to by all partners is a important for success. Commitment to the research project results encourages innovative means to overcome problems and difficulties. In contrast, creating the structure of the partnership first, with projects to be defined later, tends to be more difficult.

• Top benefits are the gained technical expertise and leveraged funding—State and provincial transportation research units report that the primary two benefits of research partnerships are enhanced technical expertise and cost savings.

• Project benefits are the only benefits currently being measured—The benefits of research partnerships are generally measured by evaluating the research project results. There is no definitive methodology to determine the benefits of the partnership as compared with traditional ways of accomplishing research.

• Successful partnerships require trust—The literature identifies trust as one of the most important elements of the partnership relationship. Opportunities must be provided to foster trust in the partnership relationships.

• Bridging differences in organizational cultures requires extra effort—To enable a partnership to work well, much attention must be paid to mitigating the negative influences of any cultural differences. State and provincial research units commit substantial effort to bridging the differences among partners, although cultural differences still exist between the state and local research units and their academic partners.

Suggestions for implementation and future research are as follows:

• Identifying and training personnel to be alliance managers should greatly enhance the productivity and value of research partnerships.
• In-depth case studies of common partnership structures and operating procedures would be helpful for research units as they continue forming partnerships.
• Identification and development of generic policies and procedures guidelines for partnerships should help in forming productive partnerships.
• Research units could use their own successful partnerships as models for future partnership activities, although guidance in the form of workshops or seminars for preparing example partnerships might be necessary.
• The literature described two tools for enhancing the value of partnerships: (1) capturing best practices and sharing these practices within the organization and (2) institutionalizing skills required for participating in, forming, and sustaining partnerships.
• Research is needed to develop a better understanding of the differences in organizational cultures, and to document the strategies that break down barriers to success and that facilitate expertise and resources.
• Research to determine and quantify the benefits of research partnerships could encourage more effective use of partnerships and might improve the stewardship of research funds.
CHAPTER ONE

INTRODUCTION

Partnerships and alliances are hot topics in every major sector of business today (1). Without exception, private, public, academic, and nonprofit organizations are embracing the strategic mandate of collaboration. Partnerships are found extensively, both domestically and internationally, and on a local or national scale. No matter in how business or government is viewed—by type of industry or service, by technical discipline, or by market segment, partnerships often used to achieve a host of organizational objectives.

Research is no exception to this business phenomenon. Many research partnerships are creating value for their stakeholders through enhanced competitive advantage, gained knowledge and expertise, and more effective leveraging of resources (2). Furthermore, public funding of transportation research is clearly not new. However, as with the private sector, the increased use of partnerships to accomplish strategic and operational goals has risen substantially over the last two decades (3, 4).

The popularity of this business phenomenon is not necessarily a sufficient reason to “jump on the bandwagon.” However, many partnerships in transportation research do contribute to strong, enduring, and vigorous programs that produce mission-critical results (5). Accordingly, this synthesis provides insight into facilitating partnerships for transportation research, with the goal of enhancing the value of the research investment and, in turn, increasing and improving mobility to the traveling public.

PURPOSE AND SCOPE

The purpose of the synthesis is to examine partnerships currently in use within transportation research, to identify key factors that facilitate these partnerships, and to present methods and approaches that produce synergies beneficial to the research program and to the participant organizations as a whole. Material in the synthesis is presented to assist state and provincial research units to more effectively form, manage, and sustain research partnerships.

The synthesis discusses the motivations for partnerships and the benefits that can be derived. Motivations originate from the basic tenet that partnerships create mutual advantage for their participants, and certainly partnerships should be a win–win for all involved. Each partner furthers its individual organizational goals while also accomplishing the goals of the research. These types of benefits of partnerships are some of the most compelling reasons why agencies seek collaborators. This synthesis identifies enabling strategies to create more of these win–win opportunities or to improve existing relationships.

The partnership arrangements discussed range from informal collaborative working relationships to formal contractual vehicles that detail alliances among diverse and disparate organizations. The primary focus of the synthesis is partnerships with state or provincial agency research units, and the study discusses relationships from that perspective. Two principal types of relationships are considered: those that are internal to the agency of which the research unit is a part, and those that are external; that is, with other organizations. Private, academic, and public-sector partnerships are examined, emphasizing the public-sector transportation agency.

Most research units considered in this study have experience with at least one substantially beneficial partnership: the U.S. State Planning and Research Program (SP&R) federal-aid partnership with the FHWA, the AASHTO National Cooperative Highway Research Program, or the Strategic Highway Research Programs in the United States and Canada. Many states, however, form alliances and cooperative associations with a host of partners in addition to such productive national relationships. A great deal of information is available within the transportation research community about these various partnerships in the context of research program descriptions and documentation of project results.

This synthesis is not a compendium of partnership programs or alliances. Nor does it attempt to detail the specific members, missions, or goals of the many research or technology partnerships in transportation. Rather, the synthesis is concerned with the motivations, benefits, key elements, and factors affecting the success of partnerships in transportation research.

CURRENT CONTEXT

Partnerships per se are not new; however, partnership activity on the widescale in which it now occurs in the United States is a relatively new phenomenon, having emerged over the past 15 to 20 years. There are a number of reasons for the dramatic growth in partnerships and alliances. During the period noted, business and government
grew larger, more multidisciplinary, increasingly more global, and more complex. Furthermore, downsizing and reengineering created leaner organizations focusing on core competencies and lacking in the broad technical capabilities outside that focus. During the late 1980s and into the 1990s, competitive advantage became one of the forces behind the collaboration of industry with its suppliers and within distribution channels. As Michael Dell was quoted in reference to the computer company he created, “[such] integration means you basically stitch together a business with partners that are treated as if they’re inside the company” (6). Interests also centered on decreasing the time for research and technology (R&T) development as a means to speed products to the marketplace.

At this time global competition began to pose a significant economic threat, particularly for science and technology applications. U.S. anti-trust laws were seen as too restrictive for meeting these broad economic challenges. Starting in 1980, federal laws were enacted, beginning with the Stevenson–Wydler Technology Innovation Act, which “required Federal laboratories to facilitate the transfer of Federally owned and originated technology to state and local governments and to the private sector” (7). Other legislation, such as the National Cooperative Research Act (1984), the Federal Technology Transfer Act (1986), which created Cooperative Research and Development Agreements (CRADAs), and the National Cooperative Research and Production Act (1993), enhanced the opportunities for partnerships, joint ventures, and other collaborative R&T transfer activities between the public and private sectors. Today, research units are using some of the vehicles established by these acts to enhance their research efforts and further their organization’s goals. (See Appendix A for a descriptive list of related laws fostering cooperative relationships for research.)

This series of laws narrowed the separation of public- and private-sector science and technology collaborations. The laws enabled private, academic, and government organizations to increase their partnership activities in all areas of science and technology. Due in part to these laws on partnerships and cooperative research, U.S. corporations continue to experience growth in partnership formation, with partnerships having increased at a rate of 25% each year since 1987 (8). Also, approximately one-fifth of revenues is tied to partnerships and, in 5 years, more than one-third of corporate revenues will be generated from partnerships (9). Whether the prolific activity in U.S. partnerships is spurring international activity or resulting from it, equal if not greater growth in partnerships is occurring internationally. For example, public–private partnerships are experiencing “explosive growth” in national and international research and development (R&D) alliances in Organisation for Economic Cooperation and Development (OECD) countries. These R&D activities are being facilitated and stimulated by the public sector (10).

This dynamic, global economy, spurred by government interest in science and technology, is the broad context in which U.S. transportation research partnerships exist. A number of these partnerships between federal or state transportation research units and academia have existed for many years. For example, AASHTO National Cooperative Highway Research Program was created in 1962, and the Virginia Transportation Research Council and the Joint Transportation Research Program in Indiana both have been in existence for more than 50 years. However, parallel to and in association with the rise of private-sector partnerships, most public-sector transportation research partnerships have emerged only during the past 15 to 20 years.

Currently, research partnerships abound and are common in the transportation sector, with activity directly influenced in the United States by the cooperative technology laws passed in the 1980s. These laws spurred the public sector, including transportation agencies, to be the initiator of collaborative relationships. The specific language identifying partnerships or collaborative research fully emerged in U.S. public-sector transportation with the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). The subsequent Transportation Equity Act for the 21st Century (TEA-21) (June 9, 1998) expanded the areas for application of collaboration and partnerships for transportation research, further encouraging their use. State departments of transportation (DOTs) research units took action. The results of a 1999 survey of the AASHTO Research Advisory Committee (RAC) of the Standing Committee on Research showed that state DOT research units experienced a 65% increase in partnership activities from 1996 through 1998. Additionally, RAC members anticipated another 29% increase in the 3 years following—2000 through 2002 (11).

DEFINITIONS

Research partnerships can be defined as: “cooperative arrangements engaging companies, universities, and government agencies and laboratories in varying combinations to pool resources in pursuit of a shared R&D objective” (12). For the purposes of this study research partnerships are defined broadly based on this definition. In particular, research partnerships can encompass any research activity in which two or more organizations participate by providing a part of the resources for a research effort and share in the resulting benefits of the research. The label “partnership” is used interchangeably with a variety of other names such as coalition, consortium, collaboration or collaborative relationship, alliance, compact, or affiliation. Partnerships may be constructed formally (legally, by contractual agreement) or informally (verbally). Partnerships are not contractual arrangements for strictly fee-paid services by one organization (such as a research laboratory or university)
for another organization (such as a state or provincial transportation research unit).

At times the term partnership is used incorrectly when referring to a strictly fee-paid arrangement between two entities. For example, arrangements that are called partnerships often occur between a state research unit and a university. If there is no sharing of investment and risks, and responsibilities and rewards, then there is no true partnership and it continues to be a contractual agreement. In such an arrangement, the contracting agency, the state, is provided a research result that it pays for.

Participation in a genuine research partnership occurs when an agency unit or organization in some tangible manner contributes to the conduct of the research effort through resource sharing. Resources include technical, facilities, equipment, financial, legal, marketing, or a variety of other relevant services.

Because state and provincial transportation research programs incorporate a wide range of activities, research is defined in its broadest context. Thus, related activities such as development, testing and evaluation, technology transfer (including training and education), deployment, and implementation are included. These activities embrace policy, planning, financial, and administrative research as well as traditional technical areas.

This synthesis uses the term beneficial partnership to define partnerships that are expected to make a positive contribution to the research unit or its parent agency—partnerships that work well and produce benefits. Less than successful partnerships are those partnerships that have not proven to be tenable and therefore have not met expectations. Such partnerships may be ongoing, but they are not producing sufficiently.

DATA SOURCES

There were three major sources of data used to develop this synthesis. The primary source was a survey distributed to AASHTO member departments and research units at Canadian provincial transportation ministries. To augment data from the surveys, interviews were conducted with a number of research managers, and a variety of research unit program management material was reviewed. Data from 41 research units were received. A list of those contributing to this synthesis is contained in Appendix B. Data from the survey is generally expressed as the number of occurrences, percentage of total responses, or average value of responses for the particular survey element.

The survey of state and provincial research units included three sections. The first asked respondents to provide information about the types of partnerships in which the unit was engaged and other general aspects about their partnerships. The second and third sections asked the respondents to provide information on beneficial partnerships and less than successful partnerships, respectively. Respondents provided information on 55 beneficial partnerships and 14 less than successful partnerships. (Appendix C contains the synthesis survey.)

Government publications and business management literature provided substantial background information on the growth and occurrence of partnerships in the United States and throughout the world. A large amount of information is directly available on the World Wide Web. References and the bibliography note such availability. The Transportation Research Information Services database and the TRB Library were particularly fruitful sources of information about transportation research partnership activity both on the federal and state level. In addition, material was used from the author’s attendance at the 80th Annual Meeting of the Transportation Research Board, session, “Meeting the Needs of All Partners.”

Other sources of information were the state DOT research unit peer exchange meetings and a report based on the exchanges of 51 research units (50 states and the District of Columbia). The report, Peer Exchange: A Value Added Program Management Tool (13) is a synthesis of the myriad concepts, methods, and recommendations from research peers having participated in research, development, and technology peer exchanges throughout the United States. Materials for this synthesis were taken from the findings and conclusions documented in the peer exchange reports and from interviews with state DOT research unit managers. Partnerships were among the various topics considered by the peer exchanges.

REPORT ORGANIZATION

Chapter one of the synthesis provides the introduction to the topic, describes the purpose and scope of the project, sets the context in which transportation research partnerships exist today, and recaps the primary sources of information used for this report. Chapters two through seven examine the various aspects of partnerships as follows:

- Chapter two discusses the types of research partnerships found in public, private, and academic settings, and highlights the partnership mechanisms most frequently used by state and provincial DOT research units.
- Chapter three describes the characteristics of the participants in research partnerships and discusses the requisite functions performed by the participants.
- Chapter four presents the motivations for forming and the benefits of research partnerships.
• Chapter five describes the organizational configurations, management strategies, administrative guidelines, legal and regulatory issues, and funding mechanisms present in successful partnerships.
• Chapter six examines factors that encourage and promote research partnerships, as well as barriers to effective partnerships.
• Chapter seven discusses current practice by a selection of research units for forming and operating research partnerships. The chapter provides a list of concepts generated by the state research unit peer exchanges and includes points to consider before entering into a partnership.
• Chapter eight summarizes the findings and conclusions from the study, and provides suggestions for implementation and future research.
CHAPTER TWO

TYPES OF STATE AND PROVINCIAL TRANSPORTATION RESEARCH PARTNERSHIPS

State and provincial DOT research units house a microcosm of the universe of partnership variations. The public and private sector alike take advantage of the flexibility inherent in partnership use. Coalition, consortium, collaboration or collaborative relationship, alliance, compact, or affiliation are terms that apply to partnerships use in today’s business, government, and academic environment. For this reason, the definition of partnerships for the synthesis is purposefully broad and refers to a multitude of structures and types. All of the traditionally used terms to describe “combining resources to achieve a research objective that provides mutual advantage for all parties” apply to this study, and the various terms are used interchangeably in the synthesis. The survey responses supporting this synthesis confirm the conventional wisdom that there is no “off-the-shelf” model for partnerships. Instead, each collaborative effort has its unique considerations, participants, motivations, needs, and objectives (4).

TYPES OF PARTNERSHIPS AND FREQUENCY OF OCCURRENCE

Although an open-ended management strategy of partnership use seems to be so extensive that little organization can be applied, some broad categories of partnership types can be defined. The description of these types however relies on the perspective from which the partnership is viewed. Partnerships discussed resulting from the survey will take the perspective that the partnership consists of that research unit in partnership with others. For example, an academic partnership would be the research unit’s collaborative arrangement, working in partnership with an academic institution. The partnerships discussed from the literature will simply describe a partnership according to the type of organization involved, such as a public-private partnership.

A further means of clarifying the type of partnerships is examining whether the partners are internal to the agency to which the research unit belongs or external to the agency. For the purposes of this synthesis, an internal partnership is one in which the research unit works in partnership with other divisions or bureaus within its agency. The synthesis considers all partners outside the research unit’s agency as external partners.

On average, research units had a high degree of participation with other units within their own agency (see Figure 1). The most frequently cited divisions or bureaus within the agency were materials, maintenance, traffic engineering and operations, structures, design, and planning. Most

![Figure 1](image-url)

FIGURE 1 Number of research units that have partnerships with other organizations (total responses, 34).
of the descriptions of these internal partners were central office functional areas; only in a few cases were partnerships with district or regional offices mentioned. Several respondents to the survey reported that there are no official internal partnerships, but that the research unit works with all units within the agency. Experiences from the peer exchange meetings conducted in each of the state DOTs during the past 4 years show that many of the research unit managers consider all others in the agency their customers or partners for research activities (13). Note that Figure 1 represents with whom the research units have partnerships, not the total number of partnerships with each respective organization.

Partnerships with external organizations are extensive. Major categories of organizations participating in partnerships with the research units are:

- Academic institutions (universities);
- Federal agencies;
- Other state agencies;
- Other agencies within the state;
- Local government;
- Private-sector organizations; and
- Nonprofit institutes, foundations, or associations.

Academic institutions with which research units created some form of alliance or partnership were most often universities within the state or province, many having a strong civil engineering program. In general, all research units responding to the survey reported that there was at least one collaborative relationship with a university institute or university consortium. Many research units reported multiple collaborative relationships, some focusing on a specific research effort and others more broadly allied with technical disciplines or the institute or consortium overall. Academic institutions have the second highest average participation rate for partnerships with state or provincial research units.

All respondents to the survey question about types of partnerships reported that they participate in partnerships with federal agencies. Every state DOT research unit participates in the SP&R federal-aid matching funding partnership (14). Most state research units also have experiences with federal-aid SP&R pooled-fund studies and the Local Technical Assistance Program, which also may bring local government into the federal–state partnership. Approximately one-half of the respondents that detailed their external partnerships also participated in FHWA experimental, demonstration, and test and evaluation projects. Approximately 15% of the research units considered their relationships with the Federal Transit Administration and the National Highway Traffic Safety Administration as partnerships, and from 5% to 10% indicated there were partnerships in existence with other U.S. modal administrations.

The state and provincial transportation research units are involved with a variety of partners and in a multitude of combinations of the public–private–academic types. For example, whereas all research units reported they have one or more partnerships with a federal agency, they may have many partnerships with internal agency divisions.

Fewer research units form partnerships with other state or provincial agencies than within their agencies or with federal or academic partners. Partners most often cited are a state or provincial agency dealing with the environment or natural resources, or some aspect of highway safety, such as the highway patrol. An additional element in state or provincial agency partnerships is the land grant or public universities that are considered state agencies. Although the vast majority of respondents defined these partnerships as academic, a few included the institutions as “other state or provincial agencies” in their partnership assessments.

Such current practice for research units further occurs in two additional areas: (1) other agencies in the state or province and local governments and (2) private-sector and nonprofit institutes and associations. There is no specific indication of why preference for partners seems to occur in this order. Partnerships are formed because of, among other reasons, a common goal. The order of preference may simply indicate that there are fewer reasons or common goals at this time to form partnerships with these organizations. Alternatively, there may be unidentified administrative or financial barriers that prevent more research units from participating in such collaborations.

Note that research units formed partnerships with other types of organizations. A few respondents mentioned that such partnerships existed but did not specify the type of partnership organization.

Some of the partnerships mentioned by the survey respondents are listed, with their website addresses, in Appendix D. The websites provide substantial information about the various partnerships.

Research units not only have a wide variety of the types of participants for their partnerships, but they also are participating in a substantial number of partnerships. On average, research units were involved with 17 different partnerships at the time of the survey. California reported the highest number of partnerships with 125. The next highest number of partnerships in a research unit was Kansas with 40, followed by Florida with 35, and Louisiana, Mississippi, and South Carolina each with 30. When the data were analyzed without California’s significantly larger number, the average number of partnerships decreased only by 4, to 13. One basic correlation to the success of partnerships is the experience of the organizations in forming
and sustaining partnerships, as well as their experience of being a good partner.

Notwithstanding the greater variety of external partnerships versus internal partnerships, external partnerships (53%) do not substantially outnumber internal partnerships (47%) (see Figure 2).

Although external and internal partnerships occur almost equally, on average, 65% of the research units report that internal partnerships produce more implementable results (Figure 3). This statistic does not imply that a substantial number of partnerships are less than productive. It may indicate, however, that when research and implementation are controlled within one organization, there is greater potential for the application to be practiced. The factors for success at implementation are complex. Important is the ability to have product results that are useful and applicable; a relationship wherein all groups work as a unit, with open, clear, and frequent communications; and a vision to apply the results of the effort, supported by the means to do so. The survey results indicate that internal relationships and communications and a common mission produce more success at implementation. For the remaining 35%, the research units reported that external partnerships produce more implementable results.

**OTHER GENERAL CHARACTERISTICS**

**Funding**

Partnerships in state and provincial research units include options for funding partnerships. For research units in state DOTs, federal-aid funds provide a substantial contribution to research funding for all research that is performed by the states. Not less than 25% of the SP&R funds are to be spent for research. SP&R funding is based on 80% federal-aid funds with a 20% state match. FHWA pooled-fund projects are eligible for 100% federal-aid funding. Transport
Canada, the federal Canadian organization that corresponds to the U.S.DOT, funds some research that is managed or conducted by the transportation research units of provincial ministries, but there is no legislated program reserving a percentage of funds. A number of the provincial ministries of transport fund highway research (C. Hedges, Transportation Research Board, personal communication, 2001). In the survey conducted for this synthesis, only one Canadian research unit reported using federal or provincial funds for transportation research partnerships. In general, other Canadian respondents indicated that there is little or no applicability in their context. Therefore, the funding averages in this document reflect the responses of U.S. (state) research units.

- State research units on average commit 53% of their federal-aid research funds to partnership activities. (The remaining federal-aid funds are used for research projects that are accomplished through in-house staff or by contract.)
- State research units on average commit 38% of their state research funds to partnership activities. (Likewise, the remaining state funds are used for research by in-house staff or through contracts.)

**Commitment to Research Partnerships**

In 1999, the AASHTO RAC members completed a comprehensive survey about their research programs. As mentioned in the synthesis introduction, RAC members reported that during the 3 years before the survey, they had seen funds committed to research partnerships increase by 65%. RAC members also expected to see a 29% increase in funds committed to research activities partnerships within the 3 years after the survey was conducted. Average data received from many of the same research unit managers for this synthesis project predicted little change in commitment to research partnerships for the next 3 to 5 years.

Figure 4 shows the distribution of responses for the percentage in change in commitment to research partnerships.

Most research units expect no change in commitment to the number of research partnerships in the next 3 to 5 years. “We are at an optimum level,” and “We have a stable partnership at this time,” were cited as reasons for no change. Several research units project significantly sharp decreases in their commitment to partnerships because of a lack of funding for research or completion of major partnership efforts that will not recur (i.e., major projects have solved problems, making partnerships no longer necessary). Nevertheless, a few research units will be increasing their partnership activity. Comments from respondents anticipating increased partnership activity focused on addressing topics outside of traditional pavement and materials disciplines and more on research with private-sector companies and universities.

Data from the AASHTO survey and the survey undertaken for the synthesis indicate that research partnership activity in the form of numbers of partnerships may be near its peak at this (Table 1). Statistics show that research units intend to maintain the current high level of research partnerships during the next 3 to 5 years. The no-growth average does not imply a static situation. States may increase the funding for existing partnerships while keeping the administrative responsibilities at a constant level. However, states will be able to increase funding for partnerships only to the extent that they have the staff to manage the partnership agreements. Partnership arrangements are labor intensive and require considerable staff attention. Most likely there will be new partnerships formed as older partnerships run their course, having been successful and delivering anticipated products.

Another factor affecting the trend in commitment to partnerships may originate with past successes. It is possible that future research partnerships will carry more risk.
### TABLE 1
TREND IN COMMITMENT TO RESEARCH PARTNERSHIPS

<table>
<thead>
<tr>
<th>Years</th>
<th>Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996–1998¹</td>
<td>+65.0</td>
</tr>
<tr>
<td>2000–2002¹</td>
<td>+29.0</td>
</tr>
<tr>
<td>2002–2006²</td>
<td>+01.6</td>
</tr>
</tbody>
</table>

Notes: Both surveys addressed the same population, used similar methodologies, and were conducted by the same researcher.

¹Source: AASHTO RAC survey of state research units 1999.
²Source: Synthesis survey.

Some partnerships will become more visible to agency executives and carry a higher degree of expectation for implementable results. Research managers are acutely aware of the need for such implementation and are emphasizing quality and performance to increase the potential for practical application of research results. Having some successes, research units will rely on past experiences and may enter into new partnerships with greater discretion—thus generating fewer new relationships. Needed now and in the near future are mechanisms to continue to improve the quality of existing and new partnerships, to keep pace with rising expectations. This synthesis is one small step in the effort to encourage quality enhancement for research units’ partnership activities, by making available information about current accomplishments.

### TYPE OF ARRANGEMENT

All research partnerships have some type of arrangement that commits the partners to the partnership. However, “partnerships are more than simply a contract research mechanism for subsidizing . . . R&D. Partnerships can be formal or informal arrangements governing general or specific objectives . . . [however] informal arrangements [will] take on a more structured context when costs and benefits are directly accountable” (10). Whether the partnership is a formal or informal arrangement, some understanding passes between the primary representatives of the various partnership organizations. Transportation research partnerships use a variety of arrangements to form their partnerships. Synthesis survey respondents were asked to provide information about aspects of partnerships in which their research unit was or had been involved. Both beneficial and less than successful partnerships were considered. Of the total partnerships, formal contracts and memorandums of understanding (MOUs) were the preferred partnership arrangement (Figure 5). The order of preference for research unit partnerships with universities follows the same pattern—a preference for contracts and then for MOUs. Generally, when state or provincial research units form partnerships with other state or provincial transportation units or agencies, the MOU is used. Additionally, when more diverse partners are involved, particularly those from the public sector, the MOU is also favored. When there were multiple partners, including private-sector companies, contracts are the preferred arrangement type. Examples of MOUs are given in chapter seven. As may be anticipated, informal collaborations, with no written agreement, appeared more frequently when research units formed partnerships within their own agencies. Nevertheless, these internal partnerships had clear definitions of goals and expectations of the partnerships. The contractual vehicle itself used showed no particular correlation with success.

![FIGURE 5 Type of arrangement for partnerships (total of 61 partnerships examined, both beneficial and less than beneficial).](image-url)
TERM OF PARTNERSHIPS

As with the many types of partnerships and varieties of partners, the term of the agreement governing the partnership varies with each situation. It depends directly on the goals of the collaboration. The relationship can be formed for one project that has a finite lifetime. When the project is completed, the partnership is dissolved. Conversely, there are partnerships that have lasted for decades, a result of the long-term goals of the partnership and the strong, continuing commitment of its partners. Examples of these long-term partnerships are the Indiana DOT–Purdue University Joint Transportation Research Center and the Virginia Transportation Research Council.

From the survey information it was determined that nearly all partnerships have been created since 1985. For all of the beneficial partnerships with a defined term of the partnership, the average length of the association was 3 years. For less than successful partnerships, the average term was a little over 2 years, possibly reflecting the understanding that after 2 years the state or province, for a variety of reasons, was not willing to pursue the relationship. For approximately 25% of all partnerships reported (beneficial and less than successful), the term was indefinite or not specified in the agreement. These partnerships are ongoing until the termination of the relationship between or among the partners. This situation implies that these partnerships are successful and will continue until there is no further advantage of the collaboration for any or all partners. The implication also is that longer-term partnerships are successful, or they would have been discontinued. In nearly every situation reported, these ongoing relationships were academic partnerships with individual universities, university institutes, or other university consortia.

In general, state or provincial research units provided information about beneficial or less than successful partnerships with external organizations. Although not providing as much level of detail about internal partnerships, research units have long-standing partnerships within their agencies (see Figure 1).

TYPES OF PARTNERSHIPS INITIATED BY PRIVATE-SECTOR ORGANIZATIONS

There are no definitive sources discussing the preferences or split of research partnerships in which private-sector organizations are engaged with government, industry, and academia. Business literature discusses all three major types: industry–industry, industry–government, industry–academia, and in particular industry–government–academia. For the private sector, the face of R&D generally changed in the last half of the 20th century. Formerly, a company would perform research and develop a product using its own staff. Now companies are more likely to either acquire another company for its technology or create a partnership to develop a marketable product (15).

Because of the consolidation of industry through mergers and acquisitions, more private-sector R&D is also done with subsidiary organizations. However, these subsidiaries may be billion-dollar enterprises, and the relationships tend to be treated as external partnerships.

The size and scope of the partnership in the private sector also determine the type of partnership formed. Partnerships may include 50 partners and have multimillion-dollar budgets. For such large endeavors, unique entities are often formed, resulting in joint-venture organizations, industrial consortia, research centers, and other corporations. From a general review of the literature, it can be determined that private-sector research efforts tend to form such new formalized entities more frequently than do state and provincial research units. For the private sector, creating a physical identity is often a sign of partnership strength and used as a marketing tool to attract expertise as well as customers (16). That trend may reflect the length of term of the agreement, the commitment of the partners to foster the partnership’s continuity and growth, and the budget for the effort.

As with public-sector partnerships as seen in state and provincial research units, the types of partnerships in the private sector are governed by the goals and expected outcome of the alliance. Private-sector partnerships are much more frequently viewed as for strategic advantage (17). Whereas research partnerships in state and provincial transportation departments or ministries are often less connected to the strategic direction of the agency (5), they are more of a contribution to the overall goals on a project-specific basis. Motivations for the partnership and the benefits sought from the partnership effort are discussed in the next chapter.

Agreements for research partnerships in the private sector exhibit the same variations as seen in the public-sector context of state and provincial research units. The best arrangements go beyond the type of agreement and extend to the care and nurture of the relationship. Such elements of partnerships are discussed in chapter five.
CHAPTER THREE

FUNCTIONS OF PARTICIPANTS IN RESEARCH PARTNERSHIPS

RESOURCES ARE THE COMMON DENOMINATOR

The literature on partnerships and alliances has much to say about creating and sustaining collaboration; however, as discussed earlier, no one type of arrangement is best. There is no guideline on the optimal number of partners, nor are there findings that govern the function of partnership participants. However, of all the variability that accompanies the partnership relationship, there is one area of agreement that stands out—sharing of resources as a basic function of any participant in a collaborative arrangement. Partnerships are a particularly effective means to leverage whatever resources an organization has to share (2, 4, 7, 18).

Collaboration allows individual partners to leverage their resources, reducing costs and risks and enabling research ventures that might not have been undertaken otherwise . . . more can be accomplished at lower cost when resources are pooled, especially if organizations complement each other in terms of expertise and/or research facilities (7).

State and provincial research units follow this thinking. Members of partnerships in which the state and provincial research units participate each bring a variety of resources. Resources that partners contributed to state and provincial research partnerships are listed here.

- Technical expertise—researchers and technicians,
- Project management and administration,
- Equipment and materials (including data),
- Research facilities,
- Funding,
- Research site or pilot site,
- Technology transfer or implementation expertise, and
- Training and education.

Each member organization in the partnerships described by the state and provincial research units tends to provide unique resources. There is a matching of complementary resources, with each partner bringing a necessary element to the relationship. Generally, funding is the only major exception to this tendency. Funding can be a resource brought to the partnership, along with other particular skills or property. In partnerships of multiple DOT research units, funding may be a resource contributed by all partners, forming the basis for a cooperatively funded effort such as the AASHTO NCHRP or the U.S. federal-aid FHWA-sponsored Pooled Fund Program. Contribution of expertise from multiple partners can occur in partnerships that involve, for example, the transportation research unit, consultants, academia, and local government. Nevertheless, according to the survey respondents, generally one organization provided the lead on supplying expertise.

The types of resources and the tendency of certain partners to provide certain types of resources did not vary between beneficial partnerships and less than beneficial partnerships. This trend shows that success does not depend on the resources supplied to the partnership or influenced by the type of resources any one partner provides. Other factors are more dominant determinants of success, as will be discussed in chapter five. The following are application examples:

- The Ontario Ministry of Transportation Concrete Patching Materials Project for Engineering Standards was formed to evaluate field performance of proprietary patching systems for rehabilitation of concrete highway structures. There were seven members to the partnership. The ministry provided technical expertise, project management, equipment, research facilities, funding, pilot sites, technology transfer, and training. The National Research Council of Canada, Institute for Research in Construction provided technical expertise, project management, equipment, and research facilities. Five private-sector organizations provided materials.

- The South Carolina DOT formed a partnership with its agency’s bridge design unit. The research unit provided technical expertise and researchers as well as project management and administration, and supplied funds for project administration. The bridge design unit funded the research for two projects. This example shows a match between those with the expertise and those with funds to accomplish the project. Only two partners were needed for such a project. This project is somewhat unusual because most research units provide the funding.

- A more typical arrangement for partners and the resources they provide are two examples from Florida DOT and Michigan DOT. In Florida, the research unit formed a partnership with the University of Florida. The research unit provided funding and project administration, and the university contributed training, education, and technical expertise. In Michigan, the DOT provided funding, and four universities in the state provided technical expertise and facilities.
The state and provincial research units supplied some amount of funding in nearly every situation reported from the survey. Other members in the partnership may also have provided funding. Most types of partners within the various partnerships contributed some level of funding at some point. Although state and provincial research units contribute substantial funds to the research partnerships, other funding is extremely important. On average, research units reported that they leveraged funds by 2.3 to 1 in the partnerships that were reported in the survey. The research units also provided various in-kind resources as well as project management and administration resources. University partners and private-sector organizations were most frequently called on to supply technical expertise. Universities also contributed research facilities, project administration, training and education, and funding, whereas the private-sector partners tended to supply equipment and materials, various in-kind services, and funding. In-kind resources are a popular vehicle for external organizations to contribute when there are no mechanisms in effect at the public-sector agency to accept funds from other entities. Table 2 summarizes the resources provided by the major partners, as identified by state and provincial research units.

The partnership with the FHWA is a given for many states. This resource at times is not highlighted because of its continued existence. During the peer exchange meetings conducted by the states, one exchange team member commented: “The relationship with the Federal Highway Administration . . . provides remarkable support and expertise to assist in building or rebuilding the research program. Use these resources to provide credibility for the RD&T program.”

Most frequently, tangible resources are the focus of partner contributions, but the literature adds an important intangible resource to the traditional items. Of all the resources that partners can contribute, the ability to be a good partner is certainly a valuable addition. Good partners have a well-developed capacity to create and sustain fruitful collaborations that provide significant advantage to their organizations as well as to other partners (17).

NUMBERS OF PARTICIPANTS

There are no right numbers of participants for a partnership (16). The resources needed govern whether an organization should be brought into the collaborative relationship. For the partnerships reported in the survey, the number of participants is given in Figure 6.

There is no definitive indication that certain types of partnerships must have a fixed number of partners. However, 60% of the partnerships described by survey respondents had two or three partners. The predominance of those numbers indicates that fewer numbers of partners correlates well with success for the types of partnerships conducted by transportation research agencies. Many of these partnerships are between the state or provincial research unit and academic institutions. Frequently these partnerships show broad mission statements and they experience relatively long-term relationships. At the other end of the spectrum, partnerships with many members are frequently based on specific projects with given term lengths in which local government, consultant engineers, materials vendors, and others are involved.

PARTNER ROLES

Partners tend to have roles defined by the resources they provide. Not unexpectedly, the public-sector members are

<table>
<thead>
<tr>
<th>Partner</th>
<th>Primary Resource Provided</th>
<th>Secondary Resource Provided</th>
<th>Tertiary Resource Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOT or provincial research unit</td>
<td>Funding—provided for nearly all partnerships reported by survey respondents</td>
<td>Various in-kind resources</td>
<td>Project management and administration</td>
</tr>
<tr>
<td>University</td>
<td>Technical expertise, researchers, and technicians</td>
<td>Research facilities</td>
<td>No clear third preference</td>
</tr>
<tr>
<td>Private sector</td>
<td>Technical expertise, researchers, and technicians</td>
<td>Various in-kind resources</td>
<td>No clear third preference</td>
</tr>
<tr>
<td>Local government</td>
<td>No clear preferences: pilot sites, funding, technology transfer and implementation, in-kind resources, and technical expertise</td>
<td>Various in-kind resources</td>
<td>No clear third preference</td>
</tr>
<tr>
<td>Other state or provincial government agency</td>
<td>Funding</td>
<td>Project management and administration (distant second)</td>
<td>No clear third preference</td>
</tr>
<tr>
<td>Federal government</td>
<td>Funding</td>
<td>Various in-kind resources</td>
<td>No clear third preference</td>
</tr>
</tbody>
</table>
the primary contributors of funding for the partnerships reported in the synthesis survey. Academia tends to be the primary supplier of technical expertise, project management, and training and education. Private-sector partners tend to supply technical expertise, technical equipment and materials, or other in-kind resources. Taken together, these various roles of the partners (and the resources they provide) form the total research effort.

Such roles are relatively familiar and not substantially different on the surface from the roles each type of organization plays in a traditional contract for products or services. In the traditional contract-for-fee service, the state research unit hires a researcher to produce a research result. Once the result is delivered to the client (the state), the researcher has no further obligation. The fees paid for the service contribute to the profit or expenses of the research organization, and that organization goes on to other projects for other clients.

With partnerships, however, the whole relationship of the entities involved is different, and the manner in which the partners approach the collaboration is markedly different. With the increasing receptiveness to partnerships by public-sector entities, the role that government must now play, versus its traditional role, changes. Partnerships tend to cross traditional boundaries, requiring substantial infrastructure to operate; they may be multidisciplinary. Also, academic partners must find a means to balance the agenda for research with that for education. Although performing many of the same functions, state and provincial research units (as well as federal level units) are exhibiting a change in attitude—one that brings opportunity for results beyond the level of results from traditional research efforts (19).
CHAPTER FOUR

MOTIVATIONS FOR FORMING AND BENEFITS OF RESEARCH PARTNERSHIPS

There are perhaps as many reasons for forming a partnership as there are partnerships. Each collaboration has its unique mission and either a formal or informal vision. Yet, there is a set of underlying principles that must be addressed even prior to determining the operational purpose for which the collaboration exists. Literature on partnerships in both the public and private sector has much to say about why partnerships are and should be formed. The bases of forming partnerships deal with complex issues such as core competencies of the organization, timing of product development, acquiring new knowledge, and strategic advantage for the organization with its customers. Adding to the complexity of the issues is each partner has its own motivations for entering into partnership with others, and these motivations must be sufficiently complementary with all others’ motivations in order for the alliance to proceed.

MOTIVATIONS FOR FORMING RESEARCH PARTNERSHIPS

“Companies have come to realize that they cannot be good at everything” (20). The fast pace of the economy and the availability of expertise globally are major forces affecting the formation of private-sector partnerships (8). This first-to-market, just-in-time, manner of operating, or at ever-increasing speeds of delivery manner of operating is affecting the research community in substantial ways. As with those in the private sector, public-sector transportation researchers are being asked to deliver answers to problems in compressed time frames and in areas having greater technical complexity, and to provide information for policy decision making, as can be seen from a review of state DOT Research Units’ Peer Exchange meetings for the District of Columbia, Indiana, Maine, Michigan, Minnesota, Ohio, Pennsylvania, and Virginia.

The time needed to produce results is a particular issue. For private-sector researchers, “The [motivation for] most alliances today is that markets [don’t have] the patience to wait for internal growth” (21). For public-sector researchers, the customers are similarly demanding, whether they are senior management, legislators, or the public. However, for research to be a strategic asset to the organization, timely responses to customers are essential.

Researchers are also finding that innovation often occurs at the boundaries between technical disciplines, and multidisciplinary efforts are required to tackle tough and challenging problems (19). A broader scope of expertise in technical disciplines in addition to civil engineering is required. Economics, finance, policy, and management topics are also becoming a focus of research problem-solving activities. In past years, the primary answer to these research dilemmas was to fill the gaps through “contracting it out.” Today, partnerships present highly attractive alternatives. It is easier to initiate a partnership in today’s economy. Partnerships are more readily accepted as a viable research framework, and often partnerships prove to be more efficient and productive than arm’s-length contract agreements (2, 4, 21, 22).

The primary basis for forming partnerships in the private sector is to gain advantage in the marketplace for products and services, all relating to profit. However, the private sector cannot pursue this motive without restriction. The goals of satisfied customers, stewardship of stockholder funds, and product safety are integral elements to the overall corporate objective. Although public-sector organizations do not have the profit incentive, they do have similar incentives of satisfied customers, stewardship of public funds, and fostering public safety. Interestingly, although there are differences in the underlying bases for forming partnerships, there are far fewer differences than may be expected, and sufficient areas of intersection that allow public–private partnerships to prosper.

In general, academic institutions have a significantly different set of motivations than do both the public and private sectors. Their primary mission is to educate students and develop new knowledge. However, the public- or private-sector setting of research projects allows academics to apply the development of new knowledge to real-world problems—enhancing the knowledge development and often funding the other aspects of the academic mission. Such experience and funding are substantial enticements for academia to form partnerships with government and industry. However, significant barriers are created when partners show a lack of tolerance or an inability to recognize the desire of other partners to adhere to their basic motivations. Rather, understanding the motivations and acknowledging the partnership eliminates one of the major causes for failure.
The New Mexico Transportation Research Partnership’s vision and organizational statements provided here cite a clear acknowledgment of the motivations of the state transportation department and the university.

Application Example

Vision Statement: The New Mexico Transportation Research Partnership is committed to the identification, implementation, and dissemination of high quality transportation research that is collaborative, proactive, and forward-looking. The outcome of these research activities will be practical and extendible models and products that demonstrate accountability and a measurable return on research investment. Our partnership is built on the tenets of integrity and quality with a focus on assembling exceptional teams of researchers for a given project while developing and mentoring our next generation of transportation professionals.

Organizational Statement: The institutions of higher education in the State of New Mexico have each, through years of hard work and commitment, developed transportation expertise unique to their particular establishment and the cultural heritage in which New Mexico prides itself. These same institutions have determined that the value provided by a particular expertise is substantially enhanced when offered in tandem with complementary proficiencies, and results in a collaborative body more adept at addressing the transportation research challenges of the state and the nation. Product development from investments in transportation research must be timely and of value to the people of the State of New Mexico. These products are developed in cooperation with the state and federal government and the private sector. Our partnership is built on the tenets of integrity and quality with a focus on assembling exceptional teams of researchers for a given project while developing and mentoring our next generation of transportation professionals.

As such, the following New Mexico institutions have, on this date, entered into a collaborative process that shall be called the New Mexico Transportation Research Partnership. Through this document, the signatories commit their effort to developing this partnership between the parties and reaching out to those who would further the goals of transportation in New Mexico. (Signatories at present: New Mexico State Highway and Transportation Department, FHWA, University of New Mexico, and New Mexico State University.)

A summary of the general motivations for research partnerships is given in Table 3.

<table>
<thead>
<tr>
<th>Type of Partner</th>
<th>General Motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public sector</td>
<td>Spur innovations that enhance public well-being and economy, satisfy customers</td>
</tr>
<tr>
<td></td>
<td>Leverage resources to maintain programs and fulfill agency mandates</td>
</tr>
<tr>
<td></td>
<td>Exercise stewardship of public money</td>
</tr>
<tr>
<td></td>
<td>Political considerations</td>
</tr>
<tr>
<td>Private sector and nonprofit organizations</td>
<td>Develop knowledge that results in cost savings or new products and services</td>
</tr>
<tr>
<td></td>
<td>Develop new technologies that contribute to stockholder value</td>
</tr>
<tr>
<td></td>
<td>Hire best and brightest students</td>
</tr>
<tr>
<td>Academic institutions</td>
<td>Develop new knowledge and convey that information to the next generation</td>
</tr>
<tr>
<td></td>
<td>Seek real-world context for new knowledge development</td>
</tr>
</tbody>
</table>

[Sources: (4, 19)].

Motivations their research unit had for forming partnerships. Respondents were encouraged to indicate any or all of the nine reasons provided (or others that could be added). On average, for all types of partnerships, the top reasons for forming partnerships are to gain technical expertise and to leverage funding. Reducing duplication of research efforts is the next most important reason (see Figure 7 for additional responses).

Respondents to the synthesis survey were also asked to provide the top three reasons for forming the specific partnerships about which they included detailed information. Respondents provided reasons for partnerships that they considered beneficial as well as for partnerships that were less than successful. Figures 8 and 9 show the results of this ranking as a weighted average of priority and the number of responses.

Reasons for forming the partnership have little bearing on whether it is ultimately a beneficial or less than successful partnership. The top two reasons are consistent in Figures 7 through 9.

Off-Center Motivations

“Although cost-sharing is generally considered a main motivation for partnering in R&D, evidence from partnerships... suggests that knowledge goals rank highest among participating firms” (10). Most of the literature about partnerships and the reasons for their formation deal with the positive aspects and benefits of partnerships. However,
where there is substantial discussion about motivations that are not as conducive to benefits as others, several stand out.

Funding is one of the most common resources provided by research partners. Because of the influence that funding has on research, it may assume a role of disproportionate importance. In a study of successful partnerships, Rosabeth Moss Kanter noted that

North American companies, more than others in the world, take a narrow, opportunistic view of [partnership] relationships, evaluating them strictly in financial terms or seeing them as barely tolerable alternatives to outright acquisition. Preoccupied with the economies of the deal, North American companies, more than others in the world, take a narrow, opportunistic view of [partnership] relationships, evaluating them strictly in financial terms or seeing them as barely tolerable alternatives to outright acquisition. Preoccupied with the economies of the deal, North American companies, more than others in the world, take a narrow, opportunistic view of [partnership] relationships, evaluating them strictly in financial terms or seeing them as barely tolerable alternatives to outright acquisition. Preoccupied with the economies of the deal, North American companies, more than others in the world, take a narrow, opportunistic view of [partnership] relationships, evaluating them strictly in financial terms or seeing them as barely tolerable alternatives to outright acquisition. Preoccupied with the economies of the deal, North American companies, more than others in the world, take a narrow, opportunistic view of [partnership] relationships, evaluating them strictly in financial terms or seeing them as barely tolerable alternatives to outright acquisition. Preoccupied with the economies of the deal, North American companies, more than others in the world, take a narrow, opportunistic view of [partnership] relationships, evaluating them strictly in financial terms or seeing them as barely tolerable alternatives to outright acquisition. Preoccupied with the economies of the deal, North American companies, more than others in the world, take a narrow, opportunistic view of [partnership] relationships, evaluating them strictly in financial terms or seeing them as barely tolerable alternatives to outright acquisition. Preoccupied with the economies of the deal, North American companies, more than others in the world, take a narrow, opportunistic view of [partnership] relationships, evaluating them strictly in financial terms or seeing them as barely tolerable alternatives to outright acquisition. Preoccupied with the economies of the deal, North American
companies neglect the political, cultural, organizational, and human aspects of partnerships (17).

Her observation is further confirmed by the state and provincial research unit managers; one of whom says, “if funding is the primary reason for partnership formation, don’t form the partnership.” Leveraging funding may be an important reason for entering into a partnership as well as a valuable benefit. Nevertheless, the focus on funding to the exclusion of other critical factors can be counterproductive. Partnerships are complex, and focusing on any one reason to the exclusion of others can foster significant problems during the operation of the relationship.

Benjamin Gomes-Casseres presents a second point in a discussion of the dramatic proliferation of alliances and partnerships.

The creation of the big alliance came to be seen as an end in itself rather than a means toward a broader strategic goal. The failure of [such] deals teaches one clear lesson: It’s the strategy behind the deal that matters, not the deal itself (23).

The motivations for forming partnerships are critical and organizing these reasons into a coherent strategy is necessary. Without such strategy, Gomes-Casseres says, alliances will fail (23).

A third point pertains to creating a relationship that “builds on each other’s qualities rather than trying to fill gaps” (24). The most successful partnerships do not focus on plugging holes, but create results based on the partner capabilities. These partnerships are combinations of complementary strengths. Throughout the time frame of the partnership, each partner remains a strong contributor to the common objectives of the relationship.

**BENEFITS OF RESEARCH PARTNERSHIPS**

The rewards of participating in a well-functioning partnership can be great. Benefits can accrue that would not normally be received through a traditional contracted relationship. A study on alliances conducted in 1997 showed that U.S. private-sector partnerships produced 50% more than the average return on investment for the top 2,000 companies. The 25 companies most active in partnerships achieved a 40% greater average return on equity than did those listed on the Fortune 500. Moreover, the greater the experience an organization has with partnerships, the greater will be its returns (22). The private sector also touts benefits that are less tangible than financial returns. Benefits resulting from partnerships with stakeholders, for example, yield increased productivity, development of distinctive competencies arising from partnerships with local communities or government agencies, reduced adverse litigation, reduced levels of negative publicity, and more favorable regulatory policies (25). Not only do partnerships show greater returns and productivity, but through collaboration, partners create new value together rather than just getting something back in the same measure as what they put in (17).
primary partnership benefits sought by public-sector agencies, the other benefits of productivity, cost savings, competency enhancement, and better customer service are valuable results of the partnership efforts. In the literature search for this synthesis, no studies were found that quantify partnership benefits within private-sector organizations and compares the benefits with those experienced by public-sector agencies. However, it is a relatively easy leap to conclude that benefits to public-sector agencies from similar research partnerships are also sizable. Several examples show these benefits.

- In an industry–government–academic partnership [National Science Foundation, Engineering Research Centers (18)] participants reported that they
  - Gained access to new ideas, know-how, or technologies (84%);
  - Received direct technical assistance (63%);
  - Reported a change in their R&D agendas (54%); and
  - Increased interaction with other participating organizations (50%).
- In an article examining general research collaborations, some of the benefits at the researcher level are identified (26).
  - Sharing of knowledge, skills, and techniques, yielding a more effective use of talent;
  - Transfer of skills or new knowledge, especially tacit knowledge;
  - Cross-fertilization of ideas that may be a source of stimulation and creativity (synergism—the new value created as mentioned—a result greater than the sum of its parts);
  - Connecting the researcher with a wider network of contacts; and
  - Enhanced potential for increasing the visibility of the work.
- In a presentation made at the 80th Annual Meeting of the Transportation Research Board, Session 253, “Research: Meeting the Needs of All Partners,” Les Hoel (University of Virginia) listed the following benefits that resulted from the partnership of the University and the Virginia Transportation Research Council (Virginia DOT). (Note that in other partnership arrangements, a number of the benefits may accrue to either partner):
  - Benefits to state DOT include
    - Access to expertise,
    - Availability of students to collect data,
    - Use of faculty for professional education,
    - Attractive cost structure,
    - Technical assistance, and
    - Continuity for the program.
  - Benefits to the academic program include
    - Access to modern materials labs and a comprehensive research library,
    - Relevant projects for senior theses,
    - Adjunct faculty (DOT employees) to provide practical examples,
    - Support of graduate students,
    - Office space and travel support, and
    - Publication and editorial services.
- An NCHRP study on facilitating the implementation of research results credits stakeholder partnerships as an effective booster for applying research results to practice (27).

When state and transportation research units were queried about their beneficial partnerships, they identified multiple benefits received from these activities. Figure 10 shows the number of research units indicating the benefits they received. The most frequently cited benefit is enhanced technical expertise, with the second being cost savings. Recall also that gaining technical expertise is the primary reason for forming partnerships, and leveraging funding is the second. When matched, these two sets of rankings shows that research partnerships are meeting important expectations for many of the research units. Two other benefits also rank high in frequency of occurrence. As the literature indicates, benefits accrue not only to the research units and researchers, but to the agency as well. Additionally, research units reported that benefits from partnerships were greater than what could have been generated by their units acting separately. The synergy created by partnerships leverages resources—more benefits are received than are contributed.

Application Example

A compelling benefit from the collaborative relationship between the Washington State Department of Transportation and its university research program is “Once a solid relationship has been built . . . opportunities arise that never would have presented themselves in the absence of that relationship” (28). This is an attractive benefit for research efforts. Capitalizing on such opportunities enhances research effectiveness. Clearly, the partners are creating greater value for their respective organizations through their collaboration than what they could have accomplished alone.

Other benefits reported were increased productivity for the program and in relationships with other organizations; production of new methods, designs, or products; and management and administration. Interestingly, only 20% of the research units that answered specific questions about beneficial partnerships reported that the partnership would be used as a model for other partnerships. Furthermore, only 10% of the beneficial partnerships were viewed as enabling organizational learning about partnerships. Research units detailed “other benefits,” as seen in Figure 10, as follows:
Enabled organizational learning about partnerships
Enhanced administrative expertise
Produced new design/spec.
Produced innovative product
Model for other partnerships
Enhanced safety
Other benefits
Enhanced tech expertise
Cost savings
Fulfilled agency goals
Greater results than generated on one’s own
Increased productivity
Produced new method/process
Solidified relationship with important org.

FIGURE 10 Benefits resulting from partnership activities (total responses, 46). (Note: Respondents reported multiple benefits arising from partnerships.)

- Increased knowledge and training for each organization’s staff,
- Improved product,
- Increased technology transfer,
- Reestablished importance of transportation research for universities and the community at large, and
- Enabled organizational learning on technical topic of interest.

MEASURING BENEFITS

Measuring the benefits of partnerships is a difficult task. Aside from the bottom-line financial measures used in the private sector, when comparing corporate performance of partnership organizations with that of non-partnership organizations, there is little written on systematic measurement of partnership benefits. The general absence of research on this topic particularly extends to public-sector research units and agencies. Most of the state and provincial agencies measure the benefits of the research partnership by the degree of implementation of the research project results or by some performance measure based on the research results. Several states, including Kansas and New York reported that they perform a cost–benefit analysis on the completed research projects. A number of research units reported having had no formal measures, and still others had yet to develop some measurement system. One research unit survey respondent declared, “This area needs a lot of work.” It does need a lot of work. There is no definitive methodology to determine the benefits of the partnership as compared with traditional ways of accomplishing research.

Survey respondents indicated that there were few performance measures oriented toward the partnership arrangement. California measured benefits by whether there were more partners added to the partnership and by increased invitations to partner. The state also determined that it had a more comprehensive solution to the research problem than through traditional research arrangements. Rhode Island reported on the New England Transportation Consortium. Benefits are not measured directly, but are realized through, among other ways, the level of interaction of state members of the participating DOTs.

Several other revealing facts about partnerships are available from the survey. Outcome goals for the research performed were defined in more than half of the partnerships about which research units provided detailed information whether they experienced beneficial or less than successful partnerships. Approximately 15% more of the less than successful partnerships had goals defined. It is not known whether these projects had more stringent performance standards and therefore had more challenge to become beneficial; however, such factors are most likely not the case. As discussed in chapter five, other elements tend to support the success or failure of the partnership. Beneficial partnerships have a substantially higher percentage of achieved goals (88%) than do those partnerships considered less than successful (50%). Within the past 5 years, these beneficial partnerships produced on average 9 or 10 implementable results, of which 8 were put into practice. in contrast, less than successful partnerships on average produced less than one implementable result. (see Table 4).
TABLE 4
GOALS DEFINITION AND IMPLEMENTABLE RESULTS—BENEFICIAL PARTNERSHIPS COMPARED TO LESS THAN SUCCESSFUL PARTNERSHIPS

<table>
<thead>
<tr>
<th>Type of Partnership Item</th>
<th>Beneficial Partnership</th>
<th>Less Than Successful Partnership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals defined for the research activity</td>
<td>52%</td>
<td>67%</td>
</tr>
<tr>
<td>Extent to which goals were achieved</td>
<td>88%</td>
<td>50%</td>
</tr>
<tr>
<td>In past 5 years, the number of implementable results produced</td>
<td>9.5</td>
<td>0.7</td>
</tr>
<tr>
<td>In past 5 years, the number of results implemented in agency</td>
<td>8</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Application Example

One southern state reported that it entered into a research partnership with its state department of environmental quality, a county public works department, and three private-sector organizations to evaluate the performance of a crumb rubber-modified hot mix asphalt overlay on a low-volume two-lane road. The research was undertaken by the state to gain technical expertise, to add project management experience, and to leverage funding. The partnership term was for 2 years. A number of important factors supporting successful partnerships were present in this project. There was a mutually agreed upon need to dispose of waste tires in an appropriate manner. Funding was available, and the state had had success in another project using crumb rubber modifiers. The project was considered less than successful because the supplier could not produce the product. There were no implementable results, nor were there any means of restructuring the partnership to overcome this hurdle. For this example, the lack of implementable results was equated with a lack of success.

This does not mean that lessons were not learned about the supplier, the modifier, or partnerships, but it does confirm the importance of resource availability and, most importantly, implementable results.

Application Example

For the Arizona DOT, the ultimate measurement of success in its partnership for evaluating the performance of a four-phase single-point urban interchange is the number of implementable products and the level of their implementation. The partnership with the Arizona Transportation Research Center, the department’s traffic operations unit, its Phoenix District Office, two city governments, and an association of governments organization expects benefits of the partnership to be enhanced safety, cost savings, increased productivity, enhanced technical expertise, and enhanced relationships with important organizations, among others. The project is not complete; however, three project deliverables are anticipated.
STRUCTURE AND ELEMENTS OF RESEARCH PARTNERSHIPS

PARTNERSHIP STRUCTURE

Partnerships or alliances have structures that are substantially different from the other contractual or internal research approaches familiar to research units. Research contracts define the roles and relationships within the project, and internal research efforts deal with known cultures, resources, and funding mechanisms. Creating a partnership involves defining the structural elements usually specified by the partnership agreement or by the internally written work plan. Partner roles and relationships as well as all project resources must be customized for the unique situation of each collaborative venture. “There is no single, simplified checklist by which any research and technology partnership can be structured ... There are too many variables, individual circumstances, and nuances among the major issues and facts” (4).

In general, organizations develop their partnership approach and capability over time. Today, particularly in the United States, most companies take an ad hoc approach to forming or structuring partnerships. There is little knowledge passed on from the experience of establishing one partnership to the next, and few best practices are captured; individuals operate independently of past lessons. To initiate a partnership, they tend to rely on their own experiences and understanding (22). State and provincial research units also are inclined to emulate the ad hoc approach. Most state and provincial research units do not have formalized policies for partnership structuring or formation. Of the 41 synthesis survey responses received, only Arizona, Minnesota, and Ontario reported any such policies. In its guidelines for management of its SP&R program, Arizona includes a detailed description of partnership participation in pooled-fund projects. Minnesota’s information, summarized in chapter seven, includes legislation and policy for forming partnerships. Ontario provides a guide for its project managers on the approval process for research projects, including cooperatively funded research, also described in chapter seven. Furthermore, only these three research units, along with those of Louisiana and Quebec, reported having any general tools or aids to guide an individual through the formation, operation, or closing of research partnerships. Some of this material is limited to a standard agreement for cooperative research.

STRATEGY AND METHODOLOGY

The questions in the synthesis survey concerning policy and guidelines were directed toward two important levels of detail regarding partnership structures. Organizations that have robust partnership capability address both levels. First, these organizations have a partnership strategy or strategic policy regarding partnerships. This contains four elements: (1) an underlying strategy that shapes the logic and design of individual partnerships, (2) a dynamic perspective that guides the management and evolution of each partnership, (3) a portfolio approach that allows coordination and flexibility, and (4) an internal infrastructure that supports and strives to maximize the collaborations (23). These elements form a framework from which an organization can approach partnerships. In public-sector agencies, this framework is expressed in the policy documentation of the agency’s approach to partnerships. As indicated by the survey responses, few such policies exist, although state and provincial transportation agencies have stated an interest in increasing the contribution of partnerships to the agency mission and objectives by developing appropriate partnership policies.

During the peer exchanges conducted by each state research unit, one exchange team member stated that

A trend for which research functions within agencies must prepare is the requirement for public/private partnerships to become more like those now seen in the private sector. Such partnerships must foster a commercial value for the private-sector partner; must deal with intellectual property rights, must incorporate means to handle hard money (not just soft money), and other similar items. A strategic investment for an agency is to begin to develop policies and processes to facilitate these new partnerships.

Another exchange team member gives the following example of what some of the policies and procedures might be:

Develop a standard language and processes for issuing Request for Proposals for Partnerships so the [that the] department is prepared to use it when the opportunity arises for partnership projects.

The second level pertaining to partnership structure is the individual partnership. Having a methodology for how the organization will create, operate, and close a partnership is considered an important strength for enduring productive partnerships. This methodology is not a rigid process, but instead a flexible guideline to accommodate the challenges and required freedoms inherent in each collaborative effort. For many organizations, this methodology uses a series of tools, such as the capture and sharing of best practices training in partnership formation and
Research units accomplished this through the development of tools to guide the management and operations of individual partnerships. As with the creation of policies for partnerships, synthesis survey results indicate that state and provincial research units reporting having made some concerted effort to match the skills and strengths of the various partners. For example, in the details about individual partnerships, 55% of the research units reporting having made some concerted effort to match the skills and strengths of the various partners. Research units accomplished this through:

- Discussion with partners and potential partners;
- Recognition of one another’s skills at technical levels;
- Teleconferencing with partners;
- Prior knowledge of partner skills. Such knowledge helps avoid redundancies and omissions;
- The placing of an experienced manager in charge of the effort; and
- Close involvement from the project champion who also knows each partner’s capabilities.

Furthermore, many states and provincial research units did not have formalized policies or processes in their approach to partnerships, there were indications that informal mechanisms lend strength to their practices. For example, in the details about individual partnerships, 55% of the research units reporting having made some concerted effort to match the skills and strengths of the various partners.

Although most state and provincial research units did not have formalized policies or processes in their approach to partnerships, there were indications that informal mechanisms lend strength to their practices. For example, information sharing may be occurring among the different groups conducting partnership-related activities; however, such sharing has not yet been acknowledged.

In addition, each partnership about which detailed information was supplied had a unique goal or vision statement. A number of the MOUs or agreements cited specific statements of expectations for the partnerships. Several samples of these vision statements or partnership expectations are listed here.

- Missouri—A partnership to enhance the mutually recognized importance of shared transportation research and education opportunities, as it will affect the quality of the transportation system serving the motorists of Missouri and beyond.
- New England states—That the New England states, “Join together to pool their professional, academic, and financial resources for transportation research.”
- Georgia—to promote transportation research in the state of Georgia.
- California—Development and rapid application of improved design methods and technologies for reducing earthquake vulnerabilities.
- Western state—to provide this western state a center for cooperative, jointly funded transportation research.
- Hawaii—to provide local highway agencies in Hawaii access to the latest technology and training.
- Maine—to take advantage of the U.S. Geological Survey financial resources and expertise to solve mutual transportation-related problems.

**PARTNERSHIPS ARE RELATIONSHIPS**

The actual relationship among the partners is one of the most frequently mentioned elements of partnerships. In particular, a solid relationship is the constant that enables the partnership to survive all manners of difficulties. The ultimate product(s) of the partnership will reflect the character of the relationship. The impact will be seen even with the shortest-term partnerships, which may exist for only one project. For longer-term partnerships, relationships become especially important. However, organizations often spend too much effort on screening potential partners on the basis of financial or other matters rather than managing the eventual partnership on human terms. There is more concern about controlling the relationship rather than nurturing it. Furthermore, although formal systems are important for the structure of the partnership, policies and procedures in themselves have little real impact on the quality of the relationships. What is required in partnerships is a dense web of interpersonal connections and internal infrastructures that unite the partnership organizations. For the most part, the interpersonal connections come from members that transcend boundaries—those working closely together in the continuing development of the partnership (17 29). One expert in the field who has studied hundreds of partnerships or alliances states that, “they are almost always [secured] at the level of individuals” and “they permeate the fabric of the [organizations]” (I).
are once again strong. Care and attention must be given to sustaining the relationships, especially when staffing changes occur.

One research manager expressed the following thoughts about relationships with academic partnerships this way during a peer exchange meeting:

Put substantial effort into planning and building an academic partnership relationship so that the university faculty will know how to be responsive to the agency’s needs and so the agency will know what it can reasonably expect from the university. In particular, work closely with university research partners to help them more effectively understand the department’s strategic directions, so research problems are more directly aligned to agency goals.

Another participant from Massachusetts stated that

DOT district/region offices can derive more benefit from research through developing relationships with researchers at universities located near the respective offices. Building such relationships will provide a greater capability in the academic community in the state and foster more practical solutions to DOT problems.

Trust

In one of the most important discussions of partnership relations in the literature, it was determined that the three predominant dimensions of partnering relationships are trust, compatibility, and commitment (29). Of the three, trust is the most essential element. “Profitable partnering relationships ... are cemented by building trust, not by contract” (30). It can be built by knowing and understanding the perspectives of the partners. Unfortunately for most partnerships, there are substantial organizational cultural differences among the partners. For collaborative efforts within the organization, individual cultural differences can arise between the researcher and the practitioner, although the shared organizational culture can often overcome unfavorable effects. More often it is the external alliances or partnerships that fall prey to the failure to deal with organizational cultural differences. Frequently minimized and therefore essentially ignored, cultural gaps can exist among government, industry, and academic partners. Understanding the perspective of the various partners comes in part from understanding and accepting each partner’s motivations and expectations for the partnership (see Table 3). Among the partners there are often competing agendas that must be clearly acknowledged and accommodated. The result should be mutual acceptance. An essential element of the partnership is the ability to address and deal with these types of issues; to reach a level where the “people involved in the relationship have the communication skills and cultural awareness to bridge their differences” (17).

Minnesota knew that organizational culture was a particular issue in its partnerships with academic institutions. The research unit sponsored a workshop with a psychologist to assist members of the Minnesota DOT with their understanding of the cultural differences. The process was successful and saved the Minnesota DOT frustration, energy, and time in forming good relationships with their academic partners’ staffs.

State and provincial research units are aware of the differences inherent in their partnerships. Often these differences are difficult to overcome and a general wariness can accompany the relationships throughout their lifetimes. However, among partnerships considered beneficial, research units reported that they can “bridge their differences.” Some examples of how states and provinces have been able to bridge their differences are provided here.

- California uses consensus-based project decisions and involves individuals who are open, flexible, and creative in the state's partnerships.
- Kansas uses a three-tier committee structure in its cooperative research with universities, involving top management at Kansas DOT and the universities, middle management, and stakeholders for selecting and managing projects. It also provides equal funding for each of the two university partners.
- Louisiana works out a mutually advantageous arrangement with its academic partners involving the teaching commitments and research of the educators.
- Maine’s basic agreement formalizes the partnership. However, the Maine DOT and the university maintain flexibility to foster success, which allows them to move forward and work together well.
- Michigan accommodates the academic calendar for its research effort. They are using a longer planning horizon (up to 5 years) to attract more strategically critical projects.
- Minnesota has employed a psychologist to discuss cultural differences and other potential difficulties that the department may encounter in a complex partnership.
- Mississippi has had to convince all competing partners that no favoritism would be exhibited toward any one partner.
- Missouri establishes communications equally among all partners and focuses on discussion and mutually acceptable solutions.
- New Jersey saw partners that are committed to completing their responsibilities. Partners, in turn, witness project benefits, as well as the opportunity to expand their knowledge base and experience. They also employ student interns and participate in positive media coverage.
New York conducts facilitated brainstorming sessions among partners and therefore benefits from strong, capable leadership.

Utah partnership participants debate pressing issues.

Wyoming notes that the state and its partners consistently work on the communication of results, failures, and successes.

West Virginia reports that having DOT and academia working on the same problem provides a double approach to finding the solution to the stated need.

Alberta conducts negotiations with various partners on a one-to-one basis; its agency is more than willing to be flexible (but with a firm desire to create a bold new collaboration), to listen to the ideas generated from a day-long brainstorming session among all partners, and to use the best parts of all the partner contributions. The province uses its neutral status to bring the various partners together.

Labrador/New Foundland saw complementary resources as the unifying factor. They had the dollars and project management skills, and the partner had the technician, equipment, and laboratory.

New Brunswick focuses on mutual agreement by all parties.

Ontario focuses on objectives and achieved consensus by identifying the needs and vision of the organizations involved.

Clearly, part of the internal infrastructure important in relationships is the ability to communicate effectively. Good communications within partnerships are usually an outgrowth of the general operations of the partnership organizations. “[Organizations] with strong communications across functions and widely shared information tend to have more productive external relationships” (17). Similar thinking was noted at peer exchange meetings.

Increase the communication among neighboring states regarding their experiences and research outcomes. Develop the network by scheduling regular interchange with the RD&T [research, development, and technology] managers—telephone discussions, conference calls, meetings, whatever mechanism that works for the managers. Fostering such relationships may be the initial steps of cooperatively funded research.

Research units support this approach, as described in literature. Time and again, communications appears as a principle mechanism for reducing the problems of culture, agenda, or schedule and for increasing the capacity to form a trusting relationship. Phrases such as “consistently worked on communications,” “plenty of negotiations,” “mutual agreement,” and “consensus” show the practical application of the practice.

The research units also provided information about their types of communicating and frequency of communicating with partners. Figures 11 and 12 show the preferences among the respondents. From Figure 11, the preferred methods of communicating (e-mail, telephone, and in person) suggest an informal, personal, and perhaps relationship-supportive method of nurturing the partnership. Additionally, whereas the most often cited frequency in communicating is cited as being on a monthly basis (Figure 12), it is important also to note that respondents confirmed the flexibility in managing partnerships, by indicating that the frequency of the communications depends on the partnership and its unique needs.

Compatibility and Commitment

Two other key elements of partnership relationships are compatibility and commitment. Partner compatibility implies that the strategic goals of the partner organizations are agreeable and correspond well to the overall goals of the partnership. However, compatibility does more than simply match resources or resolve conflict. It also extends to the policies, values, and integrity of the partners. Where there is similarity in these characteristics, the partnership can thrive.
A number of the states and provincial research units expressed that commitment is exhibited on several levels, initially with an organizational commitment to the concept of partnerships. Generally, this level of commitment must reside with senior management and research management and be exhibited through their involvement in the partnership. The business literature focuses on an aspect of partnerships not usually described in the experiences of state and provincial research units; that is, that senior management in private-sector organizations is often the catalyst for forming partnerships. Partnerships in the private sector are often formed through personal contacts between executives. However, in the public-sector research community, partnerships are more often built on the needs and resources of the respective partners rather than on personal interactions. The commitment of executives in the public sector may be more difficult to foster if there is no personal involvement in the individual partnerships. However, with both public- and private-sector partnerships, the positive attitudes of the top management are beneficial influences on the success of the partnership activity (13).

A second level of commitment resides with those directly involved in the partnership. These individuals can dedicate their activities to the shared goals of the partnership and its outcomes (29). Earlier comments from of New Jersey exemplify this level of commitment—recognizing the potential outcomes of the relationship, understanding the value of synergy in the outcomes, and behaving in an honorable, responsible manner toward defined goals.

ALLIANCE OR PARTNERSHIP MANAGER

The following is one way to define the role of the partnership manager:

The alliance manager is the person responsible for the progress of the alliance on behalf of the parent [organization] . . . He or she is a diplomat, socially adept and flexible, but also persistent, determined, and results-oriented . . . The alliance manager must embody the [organization’s] culture and values, yet understand the partner’s culture, needs and motivations.... Competent alliance managers are needed for weak alliances (29).

These individuals fulfill critical roles in operations of partnerships and are not necessarily the manager of the overall partnership activities. The literature frequently discusses the need for careful selection of these important individuals in the partnership (17, 20, 23, 29). Also mentioned is the need for organizational learning and training that enables development of these alliance managers.

Although the business literature frequently discusses alliance or partnership managers and encourages the development of expertise in this area, there is significantly less emphasis on such people or roles in public-sector partnerships. In the survey responses, the closest reference to an alliance manager was in terms of personal leadership, such as a “well-organized and motivated manager to get things done” and “someone in charge.” These descriptors were given as factors that influence forming or sustaining partnerships. Additionally, when asked to rank issues that facilitate partnerships, “personnel committed to managing the partnership” was considered most important (see Figure 13). Apart from this reference, the unique personalities and qualities of the people needed to foster the success of the partnership were not discussed. Partnership managers tended to be chosen most often according to a technical skill related to the research effort, not for the ability to make the partnership work in the most effective manner.

Given the results of the beneficial partnerships described in the synthesis survey, many state and provincial research partnerships exhibit quality management. However, the discussions of forming, sustaining, and dealing with challenges often omit the role of an alliance or partnership manager. This may indicate that current partner
ships do include individuals who are fulfilling this alliance manager role, or that such individuals may be added to the partnership activity to enhance the productivity of existing partnerships. In either situation, having such a manager is a winning strategy. Indications at present are that state and provincial research units have chosen individuals who are effective leaders for the partnership, and almost unknowingly they have chosen people who have through trial and error been able to develop the qualities of an alliance or partnership manager.

Regardless of how the partnership or alliance manager is appointed or developed, the role is not considered a best practice with research units. This could be construed as a lack of attention to best practice capture or sharing, as well as to training in all aspects of partnerships, including partnership management. However, the role, important to private-sector partnerships, is a topic worthy of consideration for state and provincial transportation research partnerships.

**IMPORTANT ELEMENTS IN FORMING RESEARCH PARTNERSHIPS**

Survey respondents from the state and provincial research units were asked to cite the three most important elements in forming research partnerships. Those reported to be the most effective are listed here in the order of the frequency that they were given.

- **Most Important**
  - Common goals, expectations, and mutual interest;
  - Resources, including expertise and funding;
  - Management support; and
  - Identification of potential partners.

- **Second Most Important**
  - Resources, particularly funding,
  - Common goals and mutual interest, and
  - Mutual benefits.

- **Third Most Important**
  - Resources, particularly technical expertise and funding;
  - Flexibility in development of agreements;
  - Mutual interest; and
  - Support from top management.

From this list, common goals and mutual benefits are widely seen as an important element in forming research partnerships; so is the availability of resources. These factors are correlated with success.

**INTELLECTUAL PROPERTY: A CHALLENGE TO FORMING RESEARCH PARTNERSHIPS**

One of the primary concerns of research organizations is the ownership of intellectual property. This is seen as a challenge to forming partnerships. Because dealing with this element of partnerships tends to require extra attention, state and provincial research units were queried specifically about intellectual property issues. The research units acknowledged that each of the points posed to them needed
FIGURE 14 Property issues needing resolution; beneficial partnerships (total responses, 24). (Note: multiple issues reported.)

Application Example

The Maryland State Highway Administration entered into partnership with a private institution in Maryland. The objective of the partnership is to pursue innovative technical solutions to transportation related problems. The State Highway Administration contributed more than 90% of the funding for the project, and the private institution contributed the remaining funds and technical expertise. The factors most influential in enabling formation of the partnership were mutual desire to develop technology, use of specialized expertise at the institution’s laboratory, and support from top levels of the administration. Patent rights and state procurement laws were the most detrimental factors to forming the collaboration. The Maryland research unit reports that there are no easy answers to these types of issues. Through extensive negotiations and continued communications, partners reached consensus on patent rights issues. Because the State Highway Administration partnership was with a private institution for higher learning, the procurement and contracting processes were also lengthier than those required for research conducted by public universities. The partnership would not have succeeded without organizational commitment, good personal relationships, and perseverance by the partners’ key individuals. This demonstrates the critical nature of personal relationships and trust in a partnership. These qualities often supersede all others when barriers or obstacles to the partnership occur.

In the past, for some research unit–academic partnerships, intellectual property issues have been contentious. However, many partnerships were shown to be successful using currently agreed upon policies. Research units may want to consider using the currently accepted agreements as models for future intellectual property negotiations.

Most important is the ability to negotiate a reasonable compromise among partners. Successful partnerships have the personal commitment of and have built trust among those involved with the partnership. Therefore, hurdles such as intellectual property rights can be worked out amicably. Indeed, the strength of the relationships is often the factor determining whether these types of barriers can be overcome.

IMPORTANT ELEMENTS IN SUSTAINING RESEARCH PARTNERSHIPS

State and provincial research units provided information on the elements that were the most important to sustaining research partnerships, with respondents asked to list the three most important elements. The elements cited here are listed in the order of the frequency given. As seen, communications, effective relationships, and good working relationships are equated with success.

- Most Important
  - Positive results or progress and successes,
  - Communications,
  - Resources,
  - Effective relationships, and
  - Mutual interest and common goals.
- Second Most Important
  - Resources, including maintaining technical expertise and sustained funding;

FIGURE 14 Property issues needing resolution; beneficial partnerships (total responses, 24). (Note: multiple issues reported.)
– Positive results or progress, documenting successes;
– Communications;
– Good working relationships; and
– Sound management of the project.

• Third Most Important
  – Sustaining funding resources,
  – Performance and implementation of results,
  – Commitment and accountability,
  – Communications.
CHAPTER SIX

FACTORS AFFECTING SUCCESS OF RESEARCH PARTNERSHIPS

BACKGROUND

Almost all literature on partnerships provides some prescription for ensuring success. Although there is no single correct set of guidelines, there are several significant discussions of success factors in the literature. Many factors have been cited in previous chapters of the synthesis. This chapter takes a closer look at the factors for success.

In the article, “Dance With Your Collaborators,” Smith and Ahmed (31) suggest that the following items are essential elements in successful partnerships:

- Knowing how to lead and how to follow,
- Excellent communications skills,
- Capability to select the right partners,
- Trust,
- Solid commitment,
- Capability to share risks and benefits,
- Top negotiating skills for dealing with a partner from another culture,
- Understanding of how to collaborate for sustainability,
- Organizational learning,
- Conflict resolution skills, and
- Ability to focus on developing these skills before entering into a partnership relationship.

In a presentation at the 80th Annual Meeting of the Transportation Research Board, Session 253, “Research: Meeting the Needs of All Partners,” Les Hoel detailed the following as being factors of success in long-standing DOT–university partnerships:

- Continuity of staff and faculty,
- Peer relationships,
- Stable funding,
- Close proximity,
- Problems resolved at the working level, and
- Support of administration.

Rosabeth Moss Kanter, in an article focusing on the relationship aspects of collaboration, provides a set of criteria that are indicators of best partnerships (17). She begins with some general comments:

Intracompany relationships . . . seem to work best when they are more family-like and less rational. Obligations are more diffuse, the scope for collaboration is more open, understanding grows between specific individuals, communication is frequent and intense, and the interpersonal context is rich . . . The best relationships are frequently messy and emotional, involving feelings like chemistry and trust. And they should not be entered into lightly (17).

Kanter goes on to provide “8 I’s That Create Successful We’s”:

- Individual excellence—Both partners are strong, have something of value to contribute, and possess positive motives for collaborating.
- Importance—The relationship fits major strategic objectives of the partners, therefore they want to make it work.
- Interdependence—The partners need each other. They have complementary assets and skills. Neither can accomplish alone what both can together.
- Investment—The partners show tangible signs of commitment by devoting financial and other resources to the relationship.
- Information—The partners share information to make the partnership work.
- Integration—The partners develop linkages and shared ways of operating so that they can work together.
- Institutionalization—The relationship is given a formal status with clear responsibilities and decision processes. It extends beyond the particular people who formed it.
- Integrity—The partners behave toward each other in honorable ways that justify and enhance mutual trust.

When research units were asked what factors facilitate successful partnerships, they responded that people were the most important. Personnel committed to managing the partnership and top management involvement in partnership formation were cited as the primary factors for successful partnerships. Next in importance was the availability of standard contracts or agreements. Three factors, team-building capability, legislated (secure) funding, and training are seen as somewhat important. Cited as having relatively little importance are written guidelines, facilities for the partnership, top management involvement in partnership operations, and legislated formation of partnerships (see Figure 13). There are, however, other factors that survey respondents identified with success. The following lists summarize the strong and weak factors correlating to success.

STRONG CORRELATIONS WITH SUCCESS

The following factors were seen as strongly correlated with success:
• Defined goals and expectations.
• Excellent communications and effective or good working relationships among partners.
• Implementable results and internal partnerships that provide for more implementable results.
• Length of time in existence: the greater the time in existence, the more opportunity to build mutual trust and to be providing value. However, the opposite is not necessarily true; a short-term partnership can be very successful.
• Experience in forming and sustaining partnerships.
• Experience in being a partner within a successful partnership and learning the qualities of being a good partner.
• Organizational commitment to the project.
• Key player’s individual commitment to the project.
• Number of partners: fewer seen as better.
• The need for technical expertise and leverage of funding by public research units.
• Sufficient resources to accomplish the project.
• Alliance manager assigned to the partnership.
• Trust among partners at all levels.
• Strong personal relationships among partners at all levels.

• Commitment to accommodating differences in organizational culture.
• Best practices sharing for effective partnerships.

WEAK CORRELATIONS WITH SUCCESS

The factors that follow are useful and practical, but show no particular relevance to success. They were present in beneficial partnerships as well as less than successful partnerships.

• Type of agreement, formal agreements or MOU, or informal agreement.
• Structure of partnership.
• Internal or external partnership.
• Types and sources of resources, as well as which partner contributes what resource.
• Motivations for entering into the partnership: each partnership started with good reasons and expectations, how clearly they were stated or how reasonable they were may be a factor that leads to success or failure.
CHAPTER SEVEN

INFORMATION TO ASSIST IN CREATING RESEARCH PARTNERSHIPS

This chapter provides a first-hand look at some of the items research units currently use to form and operate successful partnerships. It also contains a listing of concepts about partnerships suggested at the state peer exchange meetings, and then concludes with points to consider before entering into a partnership. Materials were chosen to illustrate unique features that were identified as being important to partnerships.

- California—Terms of MOU with other state and federal governments and the private sector; terms are quite detailed and instructive.
- Kansas—Funding process for the Midwest States Pooled Fund Accelerated Testing Program; other administrative items.
- Maine—Excerpts from its joint funding agreement with the U.S. Geological Survey.
- Minnesota—Language from legislation creating the capability for research partnerships and unique aspects of implementing the partnership legislation.
- Mississippi—Division of responsibilities in a partnership with the private sector.
- Missouri—Intellectual property clauses from the CRADA.
- Western State—Language from the western state’s partnership agreement; purpose and objectives statements.
- New Mexico—Selected text from its MOU with RSPA, Road LIFE, a 20–25-year partnership.
- Rhode Island (and others)—Summary of the MOU for the New England Transportation Consortium.
- Ontario—Aspects of partnership guidelines.
- Peer Exchange Meetings—Recommendations regarding partnerships.

CALIFORNIA: TERMS OF A MEMORANDUM OF UNDERSTANDING WITH OTHER STATE AND FEDERAL GOVERNMENTS AND THE PRIVATE SECTOR

Presented here is a synopsis of an MOU for the partnership between the California DOT (Caltrans), industry, a federal agency, a state commission, and a research institution. The partnership also uses a CRADA as the structure to incorporate the federal agency, the U.S. Geological Survey (USGS), and an academic institution to perform administrative functions (University of California at Berkeley). This partnership provides an effective example of the variety of partner organizations that can be used, the research expertise drawn into the partnership, and the means to provide for administrative support.

The material included in this synthesis shows the thinking behind creating the partnership, which is expressed in a resolution format [e.g., “Whereas conditions” 1, 2, 3, and so on, and “Therefore” action (summarized for this document)]. The MOU continues by describing the scope and operations of the partnership and the role and responsibilities of its individual members. For this synthesis, an outline with content summary is given to provide general direction for others considering what should be included in a partnership agreement. Note in the previous section that the MOU states specifically that it does not commit any resources; it is not an enforceable contract, but a formalized means to coordinate the partnership.

This MOU shows a good example of the operational expectations of the partnership. Many MOUs do not elaborate on the role and responsibilities of the partners and thus suffer for not having clearly defined these aspects before beginning the formal working relationship. Although providing such details is not required for success, mutually determining the roles and responsibilities is necessary whether they are expressed in writing or not.

In the response to the synthesis survey, Caltrans made the following comments:

- The partnership was formed to
  - Leverage funding,
  - Gain technical expertise,
  - Add administrative and project management expertise, and
  - Reduce duplication of research efforts.

- The factors most influential in enabling this partnership were
  - Common goals,
  - Respect of one another’s organizations and project managers, and
  - Scientific integrity.

- The factors most detrimental to forming and sustaining the partnership were
  - Organizational barriers,
  - New funding needs requested to the Governor’s budget, and
  - Time to make things happen.
Perseverance and initiative were the main characteristics that overcame the detrimental factors. The processes of consensus-based project decisions, as well as open, flexible, and creative personnel were the most critical items that facilitated agreements among the partners.

This partnership brought a host of benefits to Caltrans including:

- Cost savings,
- Increased productivity,
- Fulfillment in part of agency goals,
- A model for subsequent partnerships,
- Enhanced technical expertise,
- A higher level of results than could have been generated by Caltrans on its own,
- An innovative product,
- A new design or specification,
- A new method, and
- Solidified the relationship with important organizations.

Caltrans considers the addition of more organizations to the partnership, increased invitations to partner in conferences and earthquake reconnaissance field trips, and a more comprehensive attack on the stated problem as measures of the benefits of this partnership. Furthermore, the partnership would be easy to replicate in its administrative framework; however, unless there were the high integrity and open and flexible personalities and mutual respect among partners, the partnership would be difficult to replicate.

**General Points of the Memorandum of Understanding**

Partners—Caltrans, Pacific Gas & Electric Company (PG&E), California Energy Commission (CEC), Pacific Earthquake Engineering Research Center (PEER), and the USGS, for Cooperation on Common-Interest Seismic Research under the Program of Earthquake Applied Research for Lifelines (PEARL)

Declarations—“Whereas” statements included for each of the following summary areas:

- Provides the problem definition and a statement that research is needed,
- Establishes that the topic is a mutual problem for all provider partners,
- Describes benefits of collaboration,
- Reinforces past successful collaboration, and
- Establishes expertise of research partners.

Resolution—Formalizes partnership and identifies the name of the partnership.

**Outline and Content Summary of the Memorandum of Understanding**

**Section I: General Terms**

(A) PEARL Research Scope
- Defines scope.

(B) PEARL Membership
- Names member organizations.

(C) Adding New Member Organizations
- New members are allowed subject to the approval of all current member organizations.

(D) Program Direction
- Direction provided by two related Joint Management Committees (JMCs)—one for work executed through PEER and another for work executed through the USGS.
- Definition of JMC responsibilities
  - Identify research topics and guide development of requests for qualifications, and requests for proposals,
  - Review qualifications and select project principal investigators,
  - Negotiate scope and budgets for task orders, and
  - Review research results and approve project deliverables.

(E) JMC Membership
- Defines membership and voting privileges.

(F) JMC Decisions and Actions
- Establishes consensus basis; provides veto authority for partner organizations.
- Establishes that any partner may undertake research on project rejected by the partnership.

(G) Program Funding
- Variety of mechanisms to be used.

(H) Task Orders
- A separate task order is written for each project, and
- Task orders may be written to principal investigators from a wide variety of organizations, not restricted to partnership members.

(I) Program Administration
- The two research organization members to will provide program administration.

(J) Review of Data and Interim Findings
- All member organizations to receive data and interim findings at least quarterly.

(K) Public Domain Research
- All products of the partnership to be nonproprietary.

**Section II: Caltrans-Specific Terms**

(A) Caltrans Funding
- Caltrans funding through the PEER Center is provided through a Master Interagency Agreement, with the University of California at Berkeley serving as the administrative center for PEER.
Caltrans may not provide direct funding to the USGS, but may provide funds to PEER to match research activities performed by the USGS that are funded by other partners.

(B) Caltrans Match Proportion
- Provides match funding limitations and percentages.
- Eligibility for Caltrans Match Projects must be of interest to Caltrans, and the funding source to which Caltrans will provide match is neither Caltrans nor the state of California Highway Account funds.

Section III: PG&E-Specific Terms

(A) PG&E Funding
- Funding is provided through a master research agreement with the University of California at Berkeley.
- PG&E funding of activities at the USGS is provided through a CRADA.

(B) Direction of PG&E-Funded PEARL Research at the USGS
- Provides full authority for other partnership members to participate equally in PG&E-funded research.

(C) PG&E Management of CEC—Funding
- PG&E provides a contract for a no-cost pass-through of CEC funds.

Section IV: CEC-Specific Terms

(A) CEC Funding
- Funding managed through a separated agreement with PG&E.

(B) Delegation of JMC Functions to PG&E.

Section V: PEER-Specific Terms

(A) Administrative Center and Costs
- Agree to serve as one of two administrative centers.
- Annual negotiation to determine direct and indirect costs.

(B) National Science Foundation Match
- Funding received from PEARL may be considered National Science Foundation matching funds.

(C) Business and Industry Partnership
- PEARL to be considered part of that partnership, a previously established program.

Section VI: USGS-Specific Terms

(A) Administrative Center and Fee
- USGS agrees to be one of two administrative centers.
- Program administration assessed at USGS-applicable overhead rate; no fee.

(B) No Contractual Interference
- The MOU must have no impact on existing or future contracts between the USGS and PG&E.

Section VII: Amendments

(A) General
- The MOU may be amended at any time upon consensus agreement of current partnership members.

(B) New Member Organizations
- New members may be added upon consensus approval of current partnership members.

Section VIII: Approval

The MOU will become effective on the last date affixed by the signatories and will remain effective until terminated by any one of the partners. The MOU is not an enforceable contract but is a means of coordinating the partnership process. No funding or resource allocations are committed in the MOU.

Signature Page

All partners sign the MOU.

KANSAS: THE PLACE OF PARTNERSHIPS IN THE STRATEGY OF RESEARCH PERFORMANCE AND A MEMORANDUM OF UNDERSTANDING AMONG STATE RESEARCH UNITS, A UNIVERSITY, AND THE FEDERAL GOVERNMENT

The Kansas Transportation Research and New-Developments (K-TRAN) Research Program is an ongoing cooperative and comprehensive research program addressing the transportation needs of the state of Kansas, using academic and research resources from the Kansas DOT (KDOT), Kansas State University, and the University of Kansas. Transportation professionals of KDOT and the universities jointly develop the projects included in the research program. Other partners in addition to the universities are the Kansas Turnpike Authority, Wilson and Company (consultant), and the FHWA.

Through the K-TRAN program, Kansas has established a formal process that recognizes partnership activity as an integral part of its annual research effort. The vision of KDOT’s research engineer is “The research unit strives to utilize all available resources by pooling academic and
private partners’ resources . . . welcoming the input, involvement, and support.”

The K-TRAN partnership is governed by a contract agreement between KDOT and the academic partners, which was originally executed in 1990. The current agreement is for 5 years beginning in 2000. At present, the minimum funding level by KDOT is $700,000 ($350,000 per university). For fiscal year 2000, the K-TRAN research expenditures of $805,550 represented approximately one-quarter of the total KDOT research program funding. The current annual value contributed to the partnership by all participants is $1 million. A total of $9 million was committed by all participants over the life of the program, with two-thirds coming from KDOT.

The following K-TRAN program benefits for partners are excerpted for the Research Annual Report, Fiscal Year 2000 (33):

- Development of a flow of high-quality transportation research targeted to Kansas transportation needs;
- Financial support to engineering students contributing to the pool of transportation professionals in Kansas;
- Continuing education opportunities for KDOT personnel;
- Enhanced quality of faculty, staff, and graduates in the transportation area;
- Attracted federal research resources for use in Kansas; and
- A much expanded but efficiently organized transportation resource in Kansas.

In response to the survey, KDOT made these comments.

KDOT determines the success of this partnership by quantitative and qualitative measures. The K-TRAN program produces a benefit cost ratio of 13.6:1. Moreover, results are being implemented—two products have been or are in the process of being implemented, four times as many requests are submitted for research than can be funded, and the Program Council management group is satisfied with the program’s results.

The three primary reasons why the partnership was formed were to

1. Gain technical expertise,
2. Provide enhanced competitive advantage, and
3. Add administrative and project management expertise.

The three factors most influential in enabling this partnership were

1. Top management support at KDOT and the universities,
2. A decision to allow KDOT to be lead administrative agency, and
3. A broad base of research topics and involvement of many KDOT bureaus and staff.

The factors most detrimental to forming and sustaining the partnership were

- Some universities wanted administrative control, but decentralized project administration causes conflicts and places an extra burden on overworked staff.
- Some faculty members have not performed to the expectations of KDOT staff, and some KDOT project monitors have not been viewed as fair or sufficiently involved.

The situation that helped to overcome the detrimental factors included

- Universities wanting the program more than they wanted administrative control;
- KDOT encouraging more staff to be assigned to spread the workload; and
- Partners giving positive encouragement to the extent possible, with the focus on the program partnership, not just the project results.

KDOT believes that this partnership could be easily replicated by another agency. The KDOT research manager reports, “With top management support, the committee structure and department-wide focus could easily be implemented. The agency would have to have an open communications policy as KDOT does and also be able to cut through red tape for approvals to be efficient.” KDOT notes that having more major universities in the partnership might make committee sizes too large, as well as lessen funds available for each institution. Moreover, additional university contractual requirements could add inefficiencies. Keeping the partnership manageable and knowing how much can be appropriately managed is a key to the success of this program.

IOWA, KANSAS, MISSOURI, AND NEBRASKA: A MEMORANDUM OF UNDERSTANDING AMONG STATE RESEARCH UNITS, KANSAS STATE UNIVERSITY, AND THE FEDERAL HIGHWAY ADMINISTRATION—A REGIONAL POOLED-FUND STUDY

Midwest States Pooled Fund Accelerated Testing Program Memorandum of Understanding

Elements of this MOU are summarized here.
**Introduction/Background**

- Discusses the advantages of full-scale accelerated testing of pavements and other structural highway components in a controlled environment;
- Summarizes the type of accelerated testing being done at various facilities;
- Describes the Kansas State University Accelerated Testing Facility, its equipment, and capabilities; and
- Establishes a basis for the regional effort; not all testing of mix design parameters and pavements can be included in the national pooled-fund program projects currently under way.

**Name and Purpose of the Study**

- Identifies the name “Midwest States Pooled Fund Accelerated Testing Program”;
- Gives succinct purpose of study, “To share information and save costs by coordinating accelerated testing of mutual interest among participating states”; and
- Gives the purpose of the MOU
  - To formally describe administrative, financial, and organizational procedures to implement the study and
  - To establish roles and responsibilities for the contracting parties in carrying out the contract requirements.

**Lead Agency**

The MOU identifies the lead agency and describes its responsibilities, which include

- Administration of the contract study;
- Solicitation of study proposals from participating states;
- Review and submit quarterly vouchers to the states and/or the FHWA for payment, and transmit a copy to the chair of the technical committee;
- Initiate the overall contract and scope of services with Kansas State University; and
- Initiate contracts with each individual state for each specific contract.

**Participating States**

- The participating states are listed and
- Other states may request to join the pooled-fund study by contacting the technical committee. With concurrence of the technical committee, state(s) will become member(s) upon signing the MOU.

**Technical Committee**

The MOU describes the technical committee membership and its duties.

- Membership
  - At least one person from each member state with appropriate expertise, one person elected chair by members to serve for 1 year, and each state limited to one vote. The committee chair interacts through KDOT to obtain approvals and ensure coordination with the FHWA for contract-related matters.
  - Representatives from FHWA regional offices (as existed at the time of the execution of the MOU) and division offices, and Kansas State University, as ex officio members.
- Duties
  - Describes committee responsibilities at various stages of the project, including developing criteria for test feature priority, determining the priority list of projects, determining the project budget and contribution for each state, approval of work statements, reviewing final reports and their distribution, and making recommendations for results implementation.

**Project Manager**

The project manager’s role is defined as that of a first-line contact for technical issues, as the coordinator for committee decision making, and as the lead in information exchange with interested parties.

**Funding of Study**

- The technical committee prepares an annual budget for the study. Each participating state signs a participation statement (see example following this MOU description). Sources of funds may include federal-aid moneys, state matching funds, and other sources. Each state participates on an annual basis, sharing costs as agreed to by all participants.
- Where federal-aid funds are used, states and the FHWA follow the standard procedures in place for pooled-fund studies. Each state must develop the necessary documentation and approvals in its SP&R Part II Work Program. Where other funds are used, the study should be referenced in the state’s SP&R Part II Work Program.
- Appropriate contracts are executed between the lead agency and Kansas State University for the accounting of financial activities under the MOU. Contracts are executed between the lead agency and each participating state for each specific project.
Procedure to Withdraw

If a participant wishes to terminate its involvement, a 30-day notification is given to the technical committee chair. The participant requesting withdrawal retains responsibility for all existing agreements.

Audits

The performing organization (Kansas State University) must comply with all federal audit requirements.

Signatories

- State highway agency for each participating state,
- FHWA division office, and
- FHWA regional office (as existed at the time of the MOU).

MOU Participation Statement

To the FHWA Division Administrator:

The [state name] will participate with other states in the conduct of the research project identified as the Midwest States Pooled Fund Accelerated Testing Study.

The [state name] promises to contribute $[numerical value] for Fiscal Year [year], towards the cost of the research study under FHWA project number [number].

Type of Funds for the Study:

The funding proposed is as follows:

Federal fund type [name type] Amount [how many dollars]
Other fund type [name type] Amount [how many dollars]

If SP&R funds, are you requesting 100% federal (no state match)? yes or no.

Technical Committee Representative:

We have designated [person’s name] as our representative on the technical committee for the study. Our alternative will be [person’s name].

The participation statement is signed by the CEO of the participating state.

MAINE: A JOINT FUNDING AGREEMENT BETWEEN THE FEDERAL GOVERNMENT (U.S. GEOLOGICAL SURVEY) AND A STATE DEPARTMENT OF TRANSPORTATION

The USGS, U.S. Department of the Interior, and Maine DOT (for Water Resources Investigations) are the parties listed in this example, as is the date of agreement. The agreement is a standard, one-page joint funding agreement from the USGS.

Conditions of the Joint Agreement:

1. Identifies the effort as a cooperative project and states the project name.
2. States the amounts to be contributed to the project by each party (amounts are equal) and the dates during which the funding will be available. Additional or reduced amounts of funding may be negotiated for the period identified or for succeeding periods, but changes must be by mutual agreement.
3. Costs are to be paid by either party according to laws and regulations governing them.
4. Field and analytical work is to be done under the direction of or with periodic review by the USGS.
5. Areas to be included in the effort are to be agreed upon by both parties. Methods employed are to be according to USGS standards. Modifications are possible by mutual agreement.
6. All field and analytical work of either party is open to the other party. If the work is not being conducted in a satisfactory manner, either party may terminate the agreement upon 60 days written notice.
7. Records will be maintained by the party generating them and are to be available to the other party.
8. Information resulting from the work is to be made available to the public as soon as possible. Documents will be published by the USGS, although the Maine DOT has the right to publish as well. Each publication must state the cooperative relationship between the two organizations.
9. Payments will be made quarterly to the USGS.

Signatories:
USGS District Chief
Maine DOT, Director, Bureau Planning

Comments

The document is straightforward and regulatory or legal requirements are kept to a minimum. The Maine DOT reports that executing such an instrument would be relatively easy for a state DOT. However, such ease of accomplishment is not due only to a less cumbersome agreement. The reduced complexity of legal arrangements originates from a good match between the partners and clear objectives for the effort. Not all research partnerships have such a forthright early relationship that would prompt this type of MOU. Indeed, most partnerships require considerable effort by the organizations to define project goals and understand one another’s motivations and capabilities, often...
leading to substantially more guarantees and administrative requirements. Over all the ability to recognize a good match and pursue it is important. The research manager in Maine did so; he called this a “natural partnership,” because the USGS has the data and expertise to analyze them, and the Maine DOT needed the information to improve the efficiency of the state’s waterways and structures.

This assessment of the partner member fit has proven to be accurate. The synthesis survey revealed that the Maine DOT technical panel members and USGS principal investigators have developed professional relationships that lead to successful projects and generate high-priority research results. Research results are being implemented and new projects are being selected by Maine’s Research Advisory Council. The Maine DOT acknowledges that developing the professional relationships is the most difficult element of the partnership to replicate. However, these relationships will be created as the partners work together and will be solidified through contact and trust building. With each success, the partnership relationships become stronger—An experience that leads to further success. A good match of partners and a well-defined project of value to all is just the beginning. Over time, partnerships then develop in quality.

**MINNESOTA: PARTNERSHIP LEGISLATION CREATING THE CAPABILITY FOR RESEARCH PARTNERSHIPS FOR A STATE DEPARTMENT OF TRANSPORTATION, FORMAT FOR INITIATING A PARTNERSHIP PROPOSAL, APPROVAL PROCESS FOR PROPOSAL ACCEPTANCE, AND A SAMPLE AGREEMENT**

**Minnesota Partnership Legislation**

The partnership legislation provides the Minnesota DOT (Mn/DOT) with unique opportunities to more effectively manage transportation issues and technology in the future, through partnerships. District engineers and office directors are accountable for the development of proposals for agreements using the statute. Proposals must meet Mn/DOT’s mission, vision, and strategic plan, and be in the best interest of Minnesota citizens. All agreements using the legislation must be in writing. Expenditures are made from a special revenue account established for such purposes. Agreements must be approved by authorized Mn/DOT officials, the attorney general, and the Departments of Finance and Administration. The sample agreement outlined in this section is less than two pages.

The process is clear and easy to implement. The material for this summary is taken from brief implementation documentation that includes people to contact for guidance, the offices requiring approval, and a flowchart of the process, all of which facilitate entering into the partnership.

**Minnesota Statutes, 1992, Section 174.02, Subdivision 6**

Subdivision 6: AGREEMENTS. To facilitate the implementation of intergovernmental efficiencies, effectiveness, and cooperation and to promote and encourage economic and technological development in transportation matters within and between governmental and non-governmental entities:

(a) The commissioner may enter into agreements with other governmental or nongovernmental entities for research and experimentation; for sharing facilities, equipment, staff, data, or other means of providing transportation-related services; or for other cooperative programs that promote efficiencies in providing governmental services or that further development of innovation in transportation for the benefit of the citizens of Minnesota.

(b) In addition to funds otherwise appropriated by the legislature, the commissioner may accept and spend funds received under any agreement authorized in paragraph (a) for the purposes set forth in that paragraph, subject to a report of receipts to the Commissioner of Finance at the end of each fiscal year and, if receipts from the agreements exceed $100,000 in a fiscal year, the commissioner shall also notify the governor and the Committee on Finance of the Senate and the Committee on Ways and Means of the House of Representatives.

(c) Funds received under this subdivision must be deposited in the special revenue funds and are appropriated to the commissioner for the purposes set forth in this subdivision.

**Partnership Proposal Format**

1. Approximate cost participation or dollar value to Mn/DOT.
2. What parties are interested in this partnership?
   a. Mn/DOT contact person [provide name, address, phone, fax].
   b. Other party [entity name] contact person [provide name, address, phone, fax].
3. Describe the proposed responsibilities of each party.
   c. Mn/DOT would agree to: [provide description].
   d. Other party [entity name] would agree to: [provide description].
4. How will the partnership benefit each party?
   a. Benefits to Mn/DOT: [describe].
   b. Benefits to [entity name]: [describe].
   c. What other benefits including cost savings would result? [describe].
5. Approximate duration of proposed partnership: [from date, to date].
6. Identify any other justification for pursuing this partnership. What will happen if it does not materialize?

Signed by
District Engineer/Office Director
Assistant Commissioner
Director, Financial Management

Proposal Approval Process

- Partnership proposal is developed at the district or office level.
- The District Engineer or Office Director discusses the concept with the Division Director.
- Subject to Division Director approval, the written proposal is forwarded to the Director of the Office of Financial Management.
- If the concept is determined “sensitive,” the concept is forwarded to Deputy Staff for review.
- Subject to Deputy Staff agreement, a complete agreement package is prepared, and the package is processed through the normal budget and contract procedure.
- After the agreement is approved, encumbrances are processed.

Example Partnership Agreement

- Identifies the partners. An example is between the Mn/DOT and a Minnesota county government.
- Declarations (Whereas . . .) succinctly describe the needs or resources considered critical for the project. An example is where the Mn/DOT owns a communication tower and the county wants to use the tower for installing a remote receiver.
- Resolution (Be it resolved . . .) to enter into agreement. An example is
  - Mn/DOT permits county to install and maintain receiver, specifications detailed;
  - County agrees that work will be performed by qualified technical personnel;
  - Agreement requires Mn/DOT approval of all work on tower;
  - County agrees that work is being done at its own risk and cost and accepts full responsibility for liability;
  - Agreement establishes an effective date and length of agreement;
  - Agreement establishes a fee that the county will pay for power usage; and
  - Agreement provides 30-day written cancellation option for either party.

- Signatures
  - County
  - Minnesota Assistant Attorney General
  - Mn/DOT, Commissioners of Administration and Finance

Comments

Of all the organizations surveyed for this project, Minnesota was the only state that reported its specific legislated language that promoted research partnerships. The importance of the language is twofold. First, it encourages formation of research partnerships legitimizes them at the highest level of the state. Second, it provides a mechanism for the Mn/DOT to accept financial resources from a partnership organization, enabling the department to cooperatively fund projects with its partners. This mechanism substantially broadens the type of research partnership in which a state DOT would normally participate. Data from the survey and literature indicate that the state DOT is the primary funding body, and other partners bring technical expertise, facilities, in-kind services, and other resources to the relationship. With this legislation, Minnesota can attract partners with funding resources, thus potentially attracting private-sector organizations with funds for research. The legislation also provides the means to accept other states’ funds for pooled-fund research. Accepting such funds has been an administrative barrier for many state DOTs.

Enacting the legislation was the result of many small steps. Most important was that Mn/DOT research activities built substantial credibility through solid performance, focus on strategic goals of the organization, and implementation of results. These accomplishments occurred over time, by talented researchers and research managers, and with the guidance of supportive executives. Today, research activities are seen as an investment in transportation, and research is viewed as an essential stewardship of resources—whether the work is accomplished through the traditional federal-aid SP&R program, maintenance program research, local road research, intelligent transportation system research, or other initiatives. When such of conditions exist, legislation specifically promoting research partnerships is not as far out of reach as some state research units may suppose. The lesson from Minnesota is that performance yields trust and enables unprecedented opportunity.

MISSISSIPPI: EXAMPLE LANGUAGE OF THE DIVISION OF RESPONSIBILITIES IN A PARTNERSHIP BETWEEN A STATE RESEARCH UNIT AND A PRIVATE-SECTOR COMPANY

The objective of the partnership of Mississippi DOT’s research unit and its materials unit with that of a private-
sector testing organization was to determine why distress was appearing in polymer-modified test sections. This work is a cooperative venture that emerged from previous research efforts. The cooperative effort was easily put together because there was a specific need recognized by all partners. It exemplifies the foundation of a good partnership, an identified goal that all participants see as important. The common goal provides the opportunity to work toward the same result from all sides of this partnership. The Mississippi DOT research manager also observed that the organizations needed each other to meet the goal. Each partner was interested in the other’s welfare because it was clear to both that if either one failed, the goal would not be met. Another factor for success was Mississippi’s good relationship with the materials supplier. That relationship allowed the work to be performed well without unnecessary complexity.

This example also shows the benefits of well-defined roles, wherein each partner knows its responsibility and is well qualified to perform what is required. All partnerships, whether with many partners or just two, or whether with many tasks or just a few, must strive for unambiguous language describing the expectations of the partners’ involvement. Although this project is relatively small and has few partners, the explicit description is a good example for any size of partnership.

The following language is excerpted from the project agreement. The Mississippi DOT (research unit and materials unit) is providing SP&R funds and overseeing and conducting fieldwork. The private-sector company, Ergon, Inc., is conducting material testing and evaluation. The agreement has clear language, and it is concise and informative.

**Long-Term Evaluation of Polymer-Modified Asphalts**

Problem Statement and Partnerships: Recent observations have revealed modes of distress other than rutting, which present a need for further materials evaluation and continued field monitoring. This proposal is submitted in order to address those distresses as well as investigate the probability of distresses, which may not yet be visible. Both Mississippi Department of Transportation (MDOT) Research and Ergon, Inc., have recognized these problems and have approached each other concerning a joint venture to extend the previous two state studies by another three years. The intent is for MDOT to use SP&R funding for its source of revenue and Ergon to perform testing at no cost to the MDOT. MDOT will oversee and conduct all fieldwork including sand-patch testing, rut measurements, friction testing, pavement distress surveys, and coring. Ergon Technical Development will conduct material testing and evaluation while reporting its findings to the MDOT.

**MISSOURI: INTELLECTUAL PROPERTY CLAUSES FROM HONEYWELL INTERNATIONAL—COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENT**

The following articles are excerpted from a CRADA between Honeywell International, Inc., and the Missouri Highway and Transportation Commission. Honeywell is operating through its U.S. Department of Energy (DOE) contract. The articles included show the extent of the intellectual property stipulations for the project, “Develop an Automated System of Air Void Detection in Hardened Portland Cement Concrete.”

**Definitions**

Intellectual property means patents, trademarks, copyrights, mask works, protected CRADA information, and other forms of comparable property rights protected by federal law and foreign counterparts.

Background intellectual property means the intellectual property rights in the items identified in the agreement, which were in existence prior to or produced outside of the CRADA, including inventions that were applied to practice prior to the CRADA. Licensing of background intellectual property, if agreed to by the partners, requires a separate licensing agreement.

**Articles Dealing with Intellectual Property**

**Copyrights**

- Partners may assert copyright in any of their general information.
- Each partner has first option to retain ownership of copyrights in works created by its employees.
- Copyrights in jointly developed works are jointly owned.
- If one partner does not retain ownership of a work created by its employees, the copyright can be assigned to the other partner. DOE is assigned copyrights not retained by either party.
- The federal government has for itself and for others acting on its behalf, a royalty-free, nontransferable, nonexclusive, irrevocable worldwide copyright license to reproduce, prepare derivative works, distribute copies to the public, and perform publicly and display publicly, all copyrightable works produced by the CRADA.
- A copy of all copyrighted software source and executable code and documentation is provided to DOE.
- After 3 years under which information from the CRADA is protected and not to be disclosed at periodic intervals, DOE can request the copyrighted software for purposes of commercialization provided such request does not cause a termination of a licensee’s right to use the software.
- Copyright notices are to be placed on all media, including digital forms.
Inventions

- Partners are to disclose to each other and the DOE inventions, which may be protected under the patent act. Disclosures must contain sufficient technical detail for clear understanding of the nature of the invention.
- Each partner retains the rights to the inventions made by its employees.
- Title to jointly made inventions are jointly owned.
- If one partner does not retain title to an invention of its employees, the title can be retained by the other partner. DOE retains title to inventions not retained by either party. DOE may retain title to inventions for which a patent application is not filed.
- The federal government retains a nonexclusive, non-transferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States any invention made under the CRADA throughout the world.

Licenses

- During the CRADA and for 6 months thereafter the Missouri DOT can obtain an exclusive license to Honeywell’s inventions made under the CRADA.

Filing Patent Applications

- The inventing partner has first opportunity to file a U.S. and foreign patent application. The other partner may file after 1 year if the inventing partner does not. The inventing partner is to provide support.
- Partners agree between themselves which organization files patent applications on joint inventions.

Trademarks

- Partners may seek trademark/service mark protection on products or services generated by the CRADA in the United States and foreign countries.
- The federal government has the right to use such trademarks/service marks.

Cost of Intellectual Property Protection

- Each partner is responsible for payment of all costs relating to intellectual property protection.

According to the survey responses from Missouri, getting the CRADA established was not an easy task. Missouri rated it “difficult” when asked if such a partnership could be replicated in another agency. They also reported that there were difficulties getting the legal requirements of both partners incorporated into the CRADA. Each organization initially presented “unyielding points” until both organizations’ legal departments had the opportunity for discussion and negotiation. Patent rights and residual interests in the inventions made under the CRADA were items that needed specific attention. Despite these difficulties and the complexity of the agreement, as indicated in part by the detailed treatment of intellectual property, both partners overcame these obstacles by being persistent and ready to compromise.

The goals of the project for the partners were of sufficient value that they spurred the partners on to resolve problems. Honeywell desired to reduce its reliance on federal defense spending and to develop the air void detection system as a product for its own use. Missouri needed a system that would reduce its current labor-intensive method as well as the technical expertise to develop such a system. The project results became more important than their administrative or legal differences. Additionally, Missouri DOT had a good working relationship with its then FHWA regional office that initiated the contract. Trust and persistence enabled the partners to rise above the potential deal breakers and ultimately forge a beneficial partnership for both organizations.

WESTERN STATE: EXAMPLE PURPOSE AND OBJECTIVE STATEMENTS FROM A STATE RESEARCH PARTNERSHIP AGREEMENT WITH A UNIVERSITY

The following excerpt from a western state DOT and its state university system agreement is a good example, expressed in writing, of a state DOT’s awareness of the needs and unique capabilities of its state university system. In addition to the state’s goals of more cost-effective research, this partnership recognizes the broader outcomes of the relationship, those beyond producing a specific product. The partnership documentation readily embraces the basic motivations of the university system and capitalizes on the role it can provide for the citizens of the state.

A key to the relationship between this state DOT and the university system is its operating with the knowledge that the relationship is based on mutual advantage. If a state DOT operates with the assumptions that the funds it spends have, for example, no business increasing the expertise of the academic staff, nor for providing educational experiences for students, then there will be little mutual advantage. The relationship, therefore, will be difficult at best. Furthermore, if the cultures of both organizations are at odds, and little effort is made to find points of shared value, partnership is elusive. In the past, parochial attitudes and inflexibility in cultures created conflict between state
DOTs and academic institutions. However, the more each partner strives to operate by taking into consideration the basic motivations and cultures of the other partners, the more productive will be the relationship.

This western state had a good start with the setting described in the introduction, purpose, and objectives of its partnership. However, words in an agreement or MOU do not ensure a successful relationship. The real issue is how the agreement worked in day-to-day operations. In this situation, key people in forming the partnership retired. The state found that two of the most influential factors for forming the partnership, communication and compromise, were difficult to sustain considering the retirements. The state research manager specifically reported in the survey response that personnel had to make a concerted effort to put those two factors in place. Overall, the state considered this partnership a less than successful venture. The motivations of the partners and the differing cultures tended to be disabling. A clear agreement and the ability to operate as a well-stated agreement stipulates, is essential. However, this example shows that when there are staff changes, partnership relationships also change. Nurturing the personal relationships during change is as important or even more important than crafting an acceptable formal plan.

Introduction

Employing the highest ideals of cooperation and partnership, the state university and the western DOT propose to establish a partnership for transportation research. Initial funding for the partnership are federal-aid highway funds.

Through this partnership, the state DOT, the FHWA, the university system, and at a later time, the private sector, will provide a means to seek out and expedite solutions to transportation problems facing the DOT and, ultimately, the citizens of the state. It is further anticipated that the research partnership will strengthen the educational programs of both the university and the state university system.

Purpose

The main purpose of the research partnership is to provide the state with a center for cooperative, jointly funded transportation research. This center, once in operation, will allow the state to better use limited research resources, such as specialized expertise and research facilities.

Objectives

The overall goal of the research partnership is to provide an institutional setting within the state whereby the state DOT, the university, and other interested parties are given the opportunity to investigate a wide variety of transportation technologies. The goal will be accomplished through the following objectives:

- Establish an ongoing, funded mechanism, providing continuity to research projects and personnel;
- Expand research and educational opportunities for transportation students at both the undergraduate and graduate level;
- Expand on-campus employment opportunities for students of transportation and other disciplines;
- Upgrade the depth of the professional instructional staff;
- Establish a mechanism to ensure interaction with the Local Technical Assistance Program and its mission of technology transfer;
- Encourage the use of advanced technologies in transportation applications through feasibility studies and/or demonstration projects;
- Collect research problem statements and forward them to the state’s research unit for inclusion in its research prioritization process.

NEW MEXICO: MEMORANDUM OF UNDERSTANDING BETWEEN A STATE DEPARTMENT OF TRANSPORTATION AND THE RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION FOR A 20–25-YEAR RESEARCH INITIATIVE

The MOU discussed in this example has a unique term among the partnership examples received from the study survey: the relationship is planned for 20 to 25 years. The term for the partnership is based on the length of the project, which includes a 20-year warranty period for a highway’s performance. The partnership between New Mexico State Highway and Transportation Department (SHTD) and the U.S.DOT Research and Special Programs Administration (RSPA) is an example of how a long-term effort can set some precedents for partnership relationships. The literature confirms that partnerships mature through long-term relationships. The relationship can become more productive as the partner organizations’ staffs gain experience in working together. The New Mexico SHTD seeks to capitalize on such positive results in its long-term commitment for RSPA's evaluation of innovative design methods and performance warranties.

Most research partnerships are formed because there is a specific need for a research product and there are common goals among the partners, much like that of the Mississippi example provided earlier in this section. Partnerships then continue because products resulting from the relationship and goals were met. A number of partnerships endure for many years, encouraged by the continuing
mutual advantage produced by the relationship. This partnership has a unique length of relationship specified; however, the partnership itself is still based on a clear need associated with a defined project.

The specified term length may provide some motivation to keep the partnership together. However, the true test of whether the relationship will last comes from the ability of the partnership to produce the expected results, as well as the trust that the partners’ staffs build over time. Trust and the adeptness of the partners to sustain it when personnel changes occur will be essential to overcoming major problems that arise during the conduct of the work. At the writing of this synthesis, the partnership is less than 3 years old.

The partnership MOU is concise and direct. It was signed by the chief executive officers (CEOs) of both organizations. The following is the full agreement.

**MOU between the New Mexico SHTD and the U.S.DOT RSPA**

The New Mexico State Highway and Transportation Department (NMSHTD) has negotiated and signed a contract with a subdivision of Koch Industries of Wichita, Kansas, to design, manage, construct, and (at the option of the state), partially finance the expansion of a 121-mile section of NM Highway 44 that is to service four lanes of traffic no later than November 2001. For a one-time cost of $62 million, Koch will guarantee the overall performance of the highway pavement for twenty years from the date of completion, and also will warrant the bridges, drainage, and erosion control features of the highway for ten years. The NMSHTD anticipates that it will save $89 million in maintenance costs over the twenty-year period.

The Research and Special Programs Administration (RSPA) Volpe National Transportation Systems Center (Volpe Center) is a recognized national technical resource that has the necessary capability and expertise to assist the NMSHTD (in conjunction with the Federal Highway Administration) to establish an independent and objective economic analysis framework and conduct analyses to determine the efficacy of the NM44 approach to providing public roads using innovative design methods and performance warranties. Further, the RSPA Volpe Center has the institutional stability to provide the desired continuity of research and analysis over the life span of the twenty-year warranty period.

This Memorandum of Understanding (MOU) sets forth a mutual intent on the part of the NMSHTD and the U.S.DOT RSPA to work cooperatively in the New Mexico Road LIFE (Road Lifecycle Innovative Financing Evaluation Initiative). The MOU recognizes the importance of having a sustained R&D relationship between the RSPA Volpe Center and the NMSHTD throughout the Road LIFE initiative over the next 20 to 25 years. Further, the MOU also establishes the intent and basis for the RSPA Volpe Center to negotiate and accept specific tasks along with terms and conditions under annual reimbursable agreements with the NMSHTD for work to be performed on a best-effort basis in support of the Road LIFE initiative.

**THE NEW ENGLAND STATES AS REPORTED BY RHODE ISLAND: MEMORANDUM OF UNDERSTANDING AND POLICIES AND PROCEDURES FOR A MULTISTATE AND FEDERAL HIGHWAY ADMINISTRATION CONSORTIUM (NEW ENGLAND TRANSPORTATION CONSORTIUM)**

The New England Transportation Consortium (NETC) has existed since 1983 and operating by means of an MOU similar to the current one since 1988. The NETC is a multistate and FHWA consortium that is financed through the FHWA pooled-fund process. The MOU and the policies and procedures for the NETC are examples of a well-developed partnership agreement. The consortium has overcome typical barriers and problems experienced by partnerships, it has produced results that are beneficial to all members, and it continues to mature over time to be an increasingly more valuable research tool for its partners. Currently, the designated lead state is Connecticut, and the NETC administrative coordinating organization is the University of Connecticut.

The MOU establishes the collaborative activity and formally describes the organizational, financial, and administrative activities of the partnership. The NETC policies and procedures then describe the operational characteristics and activities established by the MOU.

This consortium could be used as an example for other states desiring to form a partnership. The partnership provides a structure that takes advantage of the FHWA’s Pooled Fund Program, having started as a regional pooled-fund project. The partnership gains technical expertise for the states, adds administrative and project management experience by having an administrative coordinator, and substantially leverages funding through the pooling of financial resources.

The MOU contains the following:

- **Purpose**—The transportation agencies of the six New England states join together to pool their professional, academic, and financial resources for transportation research. The cooperation will focus not only on research, but also on development and implementation of substantially improved methods for dealing with common problems. Such problems will be associated with the administration, planning, design, construction, rehabilitation, reconstruction, operation, and maintenance of the transportation system in the region.

- **List of Members**—Six New England states and the FHWA, ex officio.

- **Organization and Management Description**
  - Policy Committee (CEOs from the DOT members and the FHWA, ex officio) governs and defines
the overall research, development, and implementation needs of the consortium.

- Advisory Committee [representatives from each state, FHWA ex officio, and a representative from a university in each state selected by the respective state representative (universities have no voting rights)]. It oversees the selection and content of an annual work program and monitors the progress of research and the implementation of results.

- Technical Committee (one representative from each state and others as needed) oversees the technical aspects of each research project.

- Administrative Management (coordinator) is an organization selected by NETC members through a request—for proposals to provide administrative coordination services for the consortium.

- **Funding**—The consortium is funded through the FHWA pooled-fund process.

- **Program Development**—The Policy Committee annually approves a program. Requests for proposals are issued to the universities designated by NETC and others as needed.

- **Project Selection**—The Advisory Committee recommends projects to be funded to the Policy Committee. Administrative management is performed by the Coordinator.

- **Amendments**—The MOU may be amended at any time by the Policy Committee.

- **Signatories**—The CEOs of each member state.

The policy and procedures detail the process by which the consortium operates. The document describes the elements in the process; provides a suggested time frame for the annual program development; details the consortium’s organizational chart; describes the order of business for various meetings; and provides guidance on research proposals, reporting, and other deliverables of research, as well as intellectual property rights.

For more information on NETC, see the consortium’s website: [http://www.cti.uconn.edu/ti/Research/about.htm](http://www.cti.uconn.edu/ti/Research/about.htm).

**ONTARIO GUIDELINES FOR SELECTING RESEARCH PARTNERS**

In its guidelines, Ontario includes all types of researcher organizations as partners; only the section on collaborative arrangement is listed.

**Types of Research Assignments**

Pooled research funds—A number of road jurisdictions contribute funds to a pooled research fund managed by a nonprofit research institution or road association to which they belong.

Cost sharing research projects with others—Research partners contribute cost, staff time, testing services, or other equity and share in the rights to the products and risks. Participants may include road jurisdictions, research institutions, and private-sector partners.

**Process**

With regards to pooled research funds, approvals are required for contributions to general research funds for road organizations that the ministry belongs to, provided that

- Ministry obtains special membership rights to the research products,
- Ministry has a vote in selecting the projects, and
- The research is focused on the ministry’s core businesses.

For cost sharing research projects the process provides that

- The ministry project manager contacts potential partners with the requisite resources and interest;
- The project manager recommends short-listed partners and prepares a draft legal agreement, with internal approvals required;
- The project manager negotiates legal agreement, with internal approvals required;
- If the ministry has the lead, the delivery mechanism for the project follows the standard agency procedures; and
- If another research partner has the lead, it follows its own procurement guidelines.

**PEER EXCHANGE METHODS—CONCEPTS, METHODS, AND RECOMMENDATIONS REGARDING RESEARCH PARTNERSHIPS**

During the past 5 years, state DOTs have been conducting research peer exchanges. Each state DOT research unit has held a meeting in which five to eight peers have met to discuss the management of the host state program, as well as issues of importance to the participating state DOT research units. Partnerships were a topic of interest to many state DOTs during these meetings. This section is a collection of the concepts, methods, and recommendations on research partnerships, as detailed by participants at the peer exchanges. The material is taken from the findings and conclusions documented in the peer exchange reports and from interviews with state DOT research managers. These items are all based on lessons learned, expressed during the exchanges. They could be the beginning of a best practices
Partnership Activities

- States are successfully engaging the private sector (e.g., asphalt and concrete paving associations, Associated General Contractors, and mineral and aggregate associations) in their research needs identification process and in their research project review processes.
- Develop a “quick response team” at the partnership university or research organization to provide assistance to the DOT on problems that require an immediate solution.
- Expand the relationship with the university(ies) to include other disciplines outside of civil engineering.
- The relationship with the FHWA and the partner university(ies) provides remarkable support and expertise to assist in building or rebuilding the research program. Use these resources to provide credibility for the RD&T program.
- A strong, supportive relationship with the FHWA Division Office has been highly influential in establishing the research program. Take care in developing and maintaining this relationship.
- The R&T units sponsor a number of full-time faculty appointments at the major partnership university. A close working relationship with members of the RD&T unit and operational staff is established with the faculty members. Benefits accrue to the agency through the conduct of practical and applicable research. In such situations, it is possible to work with top graduate students who may be attracted to employment opportunities at the agency. Such arrangements are profitable for the agency and university alike, provided that the appointments are in force for at least two- to three-year periods.
- To maintain long-term quality, objectivity, and competitiveness of research performed by university partners, review by external industry and academic peers is advisable.
- Create an incentive program that, for example, takes a small percentage of the documented savings from implementation of research results and puts it in an “investment account” for the partnership university. The account can then be used for “unfettered” or blue-sky research by the university, with the only requirement being that it be directed at the strategic goals of the DOT. The university would be required to evaluate and document the cost savings to the department. Resources required to do this would be paid from the “investment account.”
- Create an incentive program that, for example, takes a small percentage of the documented savings from implementation of research results and puts it in an investment account at the DOT. The account could then be used for unsolicited proposals by the private sector, professional capacity building, such as technical seminars, implementation assignments, and more.

Facilitating Partnerships

- Develop a working group between the DOT and university transportation centers to shape future strategic and tactical plans for research.
- DOT district/region offices can derive more benefit from research through developing relationships with researchers at universities located near the respective offices. Building such relationships will provide a greater capability in the academic community in the state and foster more practical solutions to DOT problems.
- Increase the communication among neighboring states regarding their experiences and research outcomes. Develop the network by scheduling regular interchange with the RD&T managers—telephone discussions, conference calls, meetings, or whatever mechanism that works for the managers. Fostering such relationships may be the initial steps of cooperatively funded research.
- Commit more resources to regional pooled-fund efforts. Consider a university as a project administrator.
- Develop a memorandum of understanding with various organizations to expedite the agency’s ability to use these resources.

Setting Up Processes to Handle Partnerships

- Develop a standard language and processes for issuing request for proposals for partnerships so that the department is prepared to use it when the opportunity arises for partnership projects.
- A trend for which research functions within agencies must prepare is the requirement for public–private partnerships to become more like those now seen in the private sector. Such partnerships must foster a commercial value for the private-sector partner, must deal with intellectual property rights, must incorporate the means to handle hard money (not just soft money), and must handle other similar items. A strategic investment for an agency is to begin to develop policies and processes to facilitate these new partnerships.
- Put substantial effort into planning and building an academic partnership relationship so that the university faculty will know how to be responsive to the agency’s needs and so the agency will know what it can reasonably expect from the university. In particular, work closely with university research partners to help them more effectively understand the department’s strategic directions, so research problems are more directly aligned with agency goals.

Points to Consider Before Entering a Partnership

The following points are provided to assist with thinking through the process of forming a partnership. The items are not intended to be a checklist for successful partnerships.
• Do you have any examples of successful partnerships from which you could apply successful strategies for this partnership?
• Do you have a means to capture practices that work well, so others can use them in future partnership activities?
• Have you consulted any policies and procedures within your organization that provide guidance for forming partnerships?
• Is there a formal structure that will be used for the partnership, including some type of agreement or MOU?
• Understanding that partnerships internal to the agency on the average produce more implementable results, have considerations been given to using internal resources and partners as well as external partners? If external partners are being used, what extra effort is being planned to ensure implementable results?
• Will there be mutually defined goals for the partnership, written and agreed to by all parties? This is a basic element of the agreement, the MOU, or the work plan for the internal informal agreement.
• Is there common interest in the topic so that all partners will be particularly committed to the work of the partnership?
• Is there interest and support from management for this partnership?
• Is there sufficient mutual advantage to all partners to initiate and sustain the partnership?
• Does the partnership build on the partners’ qualities rather than trying to fill gaps?
• Most successful partnerships commit to a project that will bring mutual advantage to all parties. Does the partnership have such a project defined?
• Are all resources for the partnership able to be supplied by the partners? Is your organization committed to providing resources identified as its contribution?
• Knowledge outcomes of the partnership should be the primary goal of the partnership. If leveraging funds or financial concerns are the only reason, reconsider the necessity of forming the partnership.
• Is this partnership the start of a potential long-term relationship? Is there a defined project with anticipated implementable results to show the success of the partnership and to spur it on to more activity?
• Do you trust your potential partners, and as a priority, have you considered how trust will be built at all levels of the partnership relationship?
• Has consideration been given, as a priority activity, to building the relationship at all levels within the partnership organizations?
• Do the organizational cultures of the various partners support partnership activities? Has a concerted effort been made to accommodate and understand the differing cultures among the partners? This will take extra effort.
• Do you have an alliance manager for the partnership? This is an individual who will care for and nurture the partnership and be able to expedite the conduct of the work technically and administratively.
• Is the work being done by the partnership designed to produce tangible results periodically? Is the structure of the work such that progress can be shown regularly?
• Are successes (research results and implementation) well communicated, so that sponsors and all participants know the positive outcome of the partnership?
CHAPTER EIGHT

FINDINGS AND RECOMMENDATIONS

Partnerships are many faceted and the findings regarding them are equally as diverse. The following section summarizes the findings of this synthesis and presents recommendations for implementation and future research.

The findings of this synthesis show that transportation research partnerships are working well for many public-sector organizations. Research units can improve the opportunity for success in their current partnerships by using these findings as a benchmark against which existing activities can be compared. Additionally, these findings can provide some guidance about characteristics that could be incorporated into future partnerships.

- **Research Units Form Partnerships**
  - With other units within their own agency—On average, research units indicated a preference to form partnerships with other units within their own agency. The most frequently cited divisions or bureaus within the agency were materials, maintenance, traffic engineering and operations, structures, design, and planning. Most of the descriptions of these internal partners were central office functional areas.
  - With units outside the agency—Research units formed external partnerships most frequently with academic institutions. These academic partners were most often universities within the state or province, many having a strong civil engineering program. In general, all research units responding to the survey reported that their agency was involved with at least one collaborative relationship with a university institute or university consortium.
  - With federal agencies—Research units participate in partnerships with federal agencies almost as frequently as with academia. Every state department of transportation (DOT) research unit participates in the State Planning and Research Program (SP&R), a federal-aid matching funding partnership. Most state research units also have experiences with federal-aid pooled-fund studies and the Local Technical Assistance Program, which can bring local governments into the federal–state partnership.

**Key Finding**

- Internal partnerships produce more implementable results. Although external and internal partnerships occur almost equally, on average 65% of the research units report that internal partnerships produce more implementable results.

- **How Many Partnerships Do Research Units Manage?**
  - Many at one time—On average, research units were involved with 17 different partnerships at the time of the survey. California reported the highest number of partnerships, 125. The next highest number of partnerships in a research unit was 40. When the data were analyzed without California’s significantly larger number, the average number of partnerships was reduced only by 4, to 13.

**Key Finding**

- The high rate of commitment to transportation research partnerships will be stable for the next 3 to 5 years. Some additional funds may be committed to the same number of partnerships, although a substantial increase in the activity is not anticipated. This stable level is due in part to the level of anticipated research funding during the next 3 to 5 years, as well as to aspects of research unit staffing. Partnership management is a labor-intensive activity. Because there is little opportunity in most agencies for increased research staffing, there may not be sufficient staff to properly manage added partnerships.

- **How Many Partners?**
  - On average two to three. Sixty percent of state and provincial transportation research unit partnerships have two or three partners. The predominance of these numbers indicates that fewer partners correlates well with success for the types of partnerships conducted by transportation research agencies. Although the average supports a low number of partners, the major factor that drives the number of partners is the project itself and the resources required to accomplish it.

- **Primary Public-Sector Contribution in Partnerships**
  - Funding—Funding is the primary contribution of DOTs, provincial research units, and other government units (federal and local) to partnerships.

- **Agreement Preferences and Funding for Partnerships**
- Formal contracts and memorandums of understanding—These agreements define the goals and purpose of the partnership, describe the role each partner plays, and define respective resource contributions. The degree of specificity varies with each document.

- Approximately half of SP&R federal-aid research funds go to research partnerships—Research units on average commit 53% of their federal-aid research funds to partnership activities. The remaining federal-aid funds are used for research projects that are accomplished through in-house staff or by contract.

- Almost 40% of the state’s own funds go to research partnerships—State research units on average commit 38% of their state research funds to partnership activities. Likewise, the remaining state funds are used for research by in-house staff or through contracts.

- Few Tools or Guidelines Exist for Research Partnership Formation

  **Key Findings**

  - There are few models or guidelines. Partnerships have myriad variables, unique circumstances, individual objectives, and an infinite source of participants, each with an agenda and expectations. Because there are no precise models, standard guidelines, or simplified operating procedures makes these collaborative arrangements a tool that, for most research units, requires substantial “starting from the ground up” each time a new partnership is created.

  - Partnerships are usually formed on an ad hoc basis. In this respect, state and provincial research units emulate U.S. companies. Only 3 of the 41 responding research units had research partnership policies, and 5 research units had partnership tools or guidelines. Although formal policies and procedures were scarce, there were indications that research units rely on some accepted informal methods to approach the formation of partnerships.

Interestingly, approximately 20% of the research units that answered specific questions about beneficial partnerships reported that the partnership would be used as a model for other partnerships. Furthermore, only 10% of the beneficial partnerships were viewed as enabling organizational learning about partnerships.

- Motivations for Entering into a Partnership

  - To gain technical expertise and to leverage funding—The primary motivation of state and provincial transportation research units in forming partnerships is to gain technical expertise. In addition, leveraging funding may be an important reason for entering into a partnership as well as a valuable benefit. Nevertheless, the focus on funding to the exclusion of other critical factors is counterproductive.

  - Approximately one-half of the partnerships had established goals—Of the beneficial partnerships, 52% had defined goals. These goals were achieved 88% of the time.

  **Key Findings**

  - Sharing resources is basic. Of all the variability that accompanies partnerships, there is one area of agreement that stands out—sharing of resources. It is the most basic function of any participant in a collaborative arrangement.

  - Funds were leveraged. On average, research units reported that they leveraged funds by 2.3 to 1 in the partnerships that were reported in the survey.

- Length of Time for the Partnership

  - Long-term partnerships exist—A number of long-standing DOT and university partnerships exist, such as the Virginia Transportation Research Council partnership between the Virginia DOT and the University of Virginia, or the Indiana DOT’s and Purdue University’s Joint Transportation Research Program. Both partnerships are more than 50 years old.

  - Most started after 1985—However, many research partnerships have not been in existence for a great many years. Encouraged by the liberalized technology partnership laws enacted in the 1980s, the majority of transportation research partnerships were created after 1985.

  - Average length of time, 3 years—For all of the beneficial partnerships with a defined term of the partnership the average length of the association was 3 years. For less than successful partnerships the average term of the partnership was a little more than 2 years. A briefer term for these less than successful partnerships may reflect the understanding that after 2 years the state or province was not willing to pursue the relationship for a variety of reasons.

- Important Elements in Forming and Sustaining Partnerships

  - Mutuality and resources are important for forming partnerships—The state and provincial research units consider the most important elements in forming a research partnership to be common
goals and expectations, mutual interest, and resource availability, particularly funding.

- Research results and resources are important for sustaining partnerships—To sustain a research partnership it is important to generate positive research results or show progress and successes. The presence of stable resources, including maintaining technical expertise and funding, is vital as well.

**Key Finding**

- Commitment to a well-defined project having clear goals is advisable—Commitment to the research project results encourages innovative means to overcome problems and difficulties that could otherwise result in failure. Projects showing tangible results have been those that have had readily identifiable goals for all partners. In contrast, creating the structure of the partnership first, with projects to be defined later, tends to be more difficult.

**Benefits of Research Partnerships**

- Implementable research results—On average, the beneficial partnerships described by research units implemented eight research results in the past 5 years.

**Key Findings**

- Gained technical expertise and leveraged funding are the primary benefits. State and provincial transportation research units reported that the top two benefits of research partnerships are enhanced technical expertise and cost savings. These benefits correlate with the motivations for forming partnerships.

- Project benefits are the only benefits currently being measured. Measuring the benefits of research partnerships is generally accomplished by evaluating the research project results. There is no definitive methodology to determining the benefits of the partnership compared with traditional ways of accomplishing research.

**People Are a Critical Success Factor Partnership**

- Partnerships are relationships—Successful partnerships are grounded in excellent relationships among the people involved. Organizations often spend more time screening other partners or being concerned with finances and administrative duties, whereas managing the relationship is most critical. When well grounded at every required level, partnerships can withstand a great deal of turbulence and still be successful.

- Staff changes are a major hurdle—Research units found that changes in key staff were one of the most difficult hurdles to overcome in sustaining a partnership. Much care must be taken to select appropriate replacements, and considerable effort must be made to reestablish critical relationships with partners.

**Key Findings**

- Successful partnerships require trust. Trust is identified in the literature as one of the most important elements of the partnership relationship. It does not happen automatically; opportunities must be provided to foster trust in the partnership relationships.

- Bridging differences in organizational cultures requires extra effort. Cultural differences occur among partners. Methods of operations and organizational goals and objectives are dramatically different between the public sector and private sector and the public sector and academia. For a partnership to work well, significant attention must be made to mitigate the negative influences of these cultural differences. State and provincial research units commit substantial efforts to bridging the differences among partners. However, it was determined that many differences in organizational cultures still exist between the state and local research units and their academic partners.

- **Partnership or alliance managers are essential**—Considered an essential element of private-sector partnerships, these individuals are responsible for the progress of the alliance or partnership for their respective partner organizations. The individual should be especially talented in diplomacy and negotiation skills, socially adept and flexible, persistent, and results oriented. The alliance manager reflects his or her organization’s culture and values and is able to identify with and understand the motivations and needs of the partners. Little mention was made by the state and provincial research units of partnership or alliance managers except when their staff was asked about items that would facilitate successful partnerships. Personnel committed to managing the partnership were then ranked as one of the most important items. In general, research units did not seem to fully understand the importance of this position beyond the manager’s commitment to the project.

The following are suggestions for implementation and future research.
• Identifying and training personnel to be alliance managers could greatly enhance the productivity and value of research partnerships. As with private-sector companies, research units could find the addition of these competent managers to be a factor influencing the success of the partnership. Research to identify the role and responsibilities of alliance managers is a productive avenue for future inquiry. Once these roles and responsibilities are identified, developing training for alliance or partnership managers will be essential.

• For agencies that already have alliance or partnership managers, mentoring opportunities should be developed to train others in the skills of alliance management.

• A series of in-depth case studies of common partnership structures and operating procedures might be helpful for research units as they continue forming partnerships. Detailed examples could assist in eliminating some of the duplication currently made when establishing partnerships (that is, starting from the ground up for a new partnership).

• Identification and development of generic policies and procedures for partnerships could be a particular help in forming productive partnerships. The challenge is to develop items that would allow the necessary flexibility and foster the informal inner workings that are so critical to partnerships.

• Research units can use their own successful partnerships as models for future partnership activities. Guidance in preparing example partnerships might be necessary. A workshop or seminar on developing such models could fulfill this need.

• Two tools mentioned in the literature for enhancing the value of partnerships are (1) capturing best practices and sharing these practices within the organization and (2) institutionalizing skills required for participating in, forming, and sustaining partnerships.

• The list of practices relating to partnerships from the peer exchange meeting, as given in chapter seven, could help initiate a best practices analysis. Development of measures to evaluate practices is necessary. Additionally, research to compile a comprehensive list of those requirements and skills essential to forming and sustaining partnerships is needed. This list could be the starting point of a guide to show research units what must become part of their standard approach to creating and conducting research partnerships. Efforts to foster development of such tools for the research units could be quite beneficial.

• Research is needed to develop a better understanding of differences in organizational cultures, and to document the strategies that break down barriers to success and that encourage better use of existing expertise and resources. Such research might enable research units to overcome significant difficulties that currently impede successful partnerships.

• Currently, although anecdotal information supports the role and value of partnerships for research, there is no definitive methodology for determining the benefits of conducting research through partnerships compared with other traditional means of conducting research. With benefits quantified through study, there could be an even more effective use of research partnerships. The stewardship of research funds might be improved as well.

• Research is needed for identifying and developing appropriate training tools for building interpersonal partnership skills for research unit and other agency staff involved in partnerships. This training would involve
  – Building relationships,
  – Building trust at all levels in partner organizations,
  – Bridging the gap of cultural differences, and
  – Increasing the awareness of the importance of partnership/alliance manager responsibilities.
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State Departments of Transportation Research Units’ Peer Exchange Meetings: District of Columbia, Indiana, Ohio, Pennsylvania, Maine, Michigan, Minnesota, and Virginia.


U.S. Department of Transportation Strategic Plan for Fiscal Years 1997–2002, U.S. Department of Transportation,
APPENDIX A
Principal Federal Legislation Related to Cooperative Technology Programs

Since 1980, a series of laws have been enacted to promote federal/civilian partnerships and to facilitate the transfer of technology between sectors. Among the most notable pieces of legislation have been the following:

Stevenson–Wydler Technology Innovation Act (1980)—Required federal laboratories to facilitate the transfer of federally owned and originated technology to state and local governments and to the private sector.

Bayh–Dole University and Small Business Patent Act (1980)—Permitted government grantees and contractors to retain title to federally funded inventions and encouraged universities to license inventions to industry. The Act is designed to foster interactions between academia and the business community.

Small Business Innovation Development Act (1982)—Established the Small Business Innovation Research Program within the major federal research and development agencies to increase government funding of research with commercialization potential within small, high technology companies.

National Cooperative Research Act (1984)—Encouraged U.S. firms to collaborate on generic, precompetitive research by establishing a rule of reason for evaluating the antitrust implications of research joint ventures. The Act was amended in 1993 by the National Cooperative Research and Production Act, which let companies collaborate on production as well as research activities.

Federal Technology Transfer Act (1986)—Amended the Stevenson–Wydler Technology Innovation Act to authorize Cooperative Research and Development Agreements between federal laboratories and other entities, including state agencies.

Omnibus Trade and Competitiveness Act (1988)—Established the Competitiveness Policy Council to develop recommendations for national strategies and specific policies to enhance industrial competitiveness. The Act created the Advanced Technology Program and the Manufacturing Technology Centers within National Institute of Standards and Technology to help U.S. companies become more competitive.

National Competitiveness Technology Transfer Act (1989)—Amended the Stevenson–Wydler Act to allow government-owned, contractor-operated laboratories to enter into cooperative research and development agreements.

National Cooperative Research and Production Act (1993)—Relaxed restrictions on cooperative production activities, enabling research joint venture participants to work together in the application of technologies they jointly acquire.

## APPENDIX B

List of Survey Respondents and States That Provided Input to the Synthesis

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<th>AASHTO MEMBER DEPARTMENT</th>
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Because many mutually beneficial working relationships have developed in transportation research, there is now an excellent opportunity to enhance overall research efforts by examining the processes through which partnerships are formed and implemented and by highlighting tools that can be used by others to replicate partnership successes.

This questionnaire is being conducted to gather information on the diverse types of partnerships used at the state/provincial level. These partnerships may be with organizations internal to the agency or with a vast selection of external partners including other government organizations on the national, regional state, and local levels, academic, and other not-for-profit institutions, as well as private sector organizations. The data provided by respondents will enable development of key factors that contribute to successful partnerships and provide useful tools to aid formation of partnerships in existing research programs. The information collected though this questionnaire will be synthesized in a report of current practices which addresses “facilitating partnerships in transportation research.”

Please return your completed questionnaire, along with supporting material, by August 31, 2000 to:

Barbara T. Harder  
B. T. Harder, Inc.  
1740 Addison Street  
Philadelphia, PA 19146

Telephone and e-mail contacts are encouraged: 215-735-2482 and bharder@sprintmail.com

Please provide the name of the person completing this questionnaire or someone else who may be contacted to obtain any needed follow-up information:

Name: ____________________________________________
Title/Division: ______________________________________
Agency: ___________________________________________
Street Address: ______________________________________
City/State/Zip: _______________________________________
Telephone & Fax: _____________________________________
E-mail: _____________________________________________
If not the same as above, your name: _______________________

Summary of what to do:
- Complete general information (white sheets) about research activities partnerships.
- Complete TWO yellow forms—Beneficial Research Activities Partnerships—Internal (within agency) or external beneficial partnerships can be documented.
- Complete ONE blue form—Less Than Successful Research Activities Partnerships.
- Please send documentation about the partnership along with your completed questionnaire.
DEFINITIONS

For the purpose of this questionnaire, we define:

RESEARCH PARTNERSHIPS—A research activity in which one or more organizations, in addition to your own research unit, participates by providing a part of the resources for a research effort and shares in the resulting benefits of the research.

PARTICIPATION—An agency unit or organization that in some tangible manner contributes to the conduct of the research effort through resource contribution (technical, facilities, equipment, financial, legal, marketing, or any variety of relevant services).

RESEARCH ACTIVITIES—Because state and provincial transportation agency research programs are involved in a wide spectrum of activities, we are defining research in its broadest context, thus including in addition to research, other related activities such as development, testing and evaluation, technology transfer—including training and education, deployment, and implementation. PLEASE NOTE THESE ACTIVITIES EMBRACE POLICY, PLANNING, FINANCIAL, AND ADMINISTRATIVE RESEARCH AS WELL AS TRADITIONAL TECHNICAL AREAS.

Partnerships are not contractual arrangements for strictly fee-paid services by an organization for your agency. Partnerships may be formally (legal/contractual agreement) or informally (verbal) constructed. Partnerships have a variety of names, such as coalitions, consortia, collaborative relationships, alliances, compacts, or affiliations.

INFORMATION ABOUT RESEARCH ACTIVITIES PARTNERSHIPS

We have some general questions about research activities partnerships. Two checklists ask about the involvement in partnerships. We then follow with general questions and then narrow our questioning to individual partnerships. These questions will give us a snapshot of some of your research activities partnerships. We have included two types of forms to gather information about the various partnership arrangements in which your program and/or agency has participated. We have included two forms for documenting beneficial partnerships and one form for documenting less than successful partnerships. Describe one partnership relationship per form. PLEASE COPY THE FORM TO DOCUMENT ADDITIONAL PARTNERSHIPS. WE WELCOME WHAT YOU WILL SHARE.

Beneficial Partnership Descriptions

Document the partnerships that have been or are expected to be beneficial to your organization. Document two of the most beneficial partnerships; please make only one internal, if possible. On the form we will be asking why this partnership worked and the benefits it produced. Please fill out the information as completely as possible.

Less Than Successful Partnership Descriptions

Document one partnership that has not proven to be workable or was considered to be less than successful.

IN VolvEME NT IN RESEARCH-RELATED PARTNERSHIPS, ALLIANCES, AND COALITIONS

We would like to know about the activities in which your agency’s research program participates. We have listed a variety of items that are research partnerships, coalitions, or programs that perform or sponsor research and research related-activities.

Two tables to complete follow:
TABLE 1—STATE/PROVINCIAL AND LOCAL
TABLE 2—FEDERAL AND REGIONAL PUBLIC, ACADEMIC, AND PRIVATE SECTORS
TABLE 1— STATE/PROVINCIAL AND LOCAL
Please specify a partnership name or partner organization as requested.

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<th>AGENCY PARTNERSHIPS/COALITIONS (such as with Maintenance Division Research Program)</th>
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TABLE 2—FEDERAL AND REGIONAL PUBLIC, ACADEMIC, AND PRIVATE SECTORS

Check all that apply and please specify a partnership name or partner organization as requested.

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<td>___ Field Testing of FHWA developed products</td>
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<td>___ Other, please specify</td>
<td>__ U.S. Army Corps of Engineers</td>
</tr>
<tr>
<td></td>
<td>__ International research consortium, please specify</td>
</tr>
<tr>
<td></td>
<td>__ Intersational research consortium, please specify</td>
</tr>
<tr>
<td></td>
<td>__ Private Sector research partnerships/consortium</td>
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<tr>
<td></td>
<td>__ Private sector research partnerships/consortium</td>
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<td></td>
<td>__ Other, please specify</td>
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<td>__ Other, please specify</td>
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<td>__ Other, please specify</td>
</tr>
<tr>
<td><strong>SHRP Activities</strong></td>
<td><strong>AASHTO</strong></td>
</tr>
<tr>
<td>___ SHRP Implementation (including Superpave7)</td>
<td>___ National Cooperative Highway Research Program</td>
</tr>
<tr>
<td>___ Long-Term Pavement Performance Program</td>
<td>___ National Transportation Product Evaluation Program</td>
</tr>
<tr>
<td>___ Other, please specify</td>
<td>___ Snow and Ice Cooperation Program</td>
</tr>
<tr>
<td></td>
<td>___ Research activities by regional organizations</td>
</tr>
<tr>
<td></td>
<td>___ Committee research activities, please specify</td>
</tr>
<tr>
<td></td>
<td>___ Other, please specify</td>
</tr>
<tr>
<td></td>
<td><strong>Transportation Research Board</strong></td>
</tr>
<tr>
<td>___ Other, please specify</td>
<td>___ ITS America research projects</td>
</tr>
<tr>
<td></td>
<td>___ Automated Highway Systems</td>
</tr>
<tr>
<td></td>
<td>___ ITS corridor coalitions research efforts, please specify</td>
</tr>
<tr>
<td></td>
<td>___ Other ITS research, please specify</td>
</tr>
</tbody>
</table>
GENERAL RESEARCH ACTIVITIES PARTNERSHIP INFORMATION

1. In how many research partnerships does your research unit participate? ________ (approximate number)

2. Looking at all partnerships, please rate your research unit’s participation with them. (Rate these according to their degree of participation: 1—highest participation, 2—second highest participation, 3—third highest participation, and so on.)
   ___ internal agency partners
   ___ other agency within your state
   ___ other state agency partners
   ___ federal agency partners
   ___ university/academic partners
   ___ local government partners
   ___ private sector partners
   ___ non-profit institutes or association partners
   ___ other partners, please specify type
   ___ other USDOT research, please specify
   ___ Other USDOT research, please specify

3. Of all the federal-aid funds your program manages, what percentage is committed to research activities partnerships? (Do not include the funding provider as a partner or all of the funds would be partnership related.) ____________ percent (For example of SP&R Part II funds, Safety funds, and others.)

4. If your research unit receives state funds, do you form partnerships with these? What percentage is committed to research activities partnerships? ____________ percent

5. For your agency’s research program, in the next 3–5 years, will there be change in the level of commitment to research activities partnerships? ____________ percent change (use – percent, + percent, or no change) Why will these changes occur? _____________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________

6. Of the research activities partnerships in which your research unit participates what percent are with Internal agency partners _______ percent   External to the agency partners _______ percent

7. Which partnerships produce more implementable results? (check one) Internal _______ External _______

8. What are the three most important factors in forming a research activities partnership?
   1. _____________________________________________________________
   2. _____________________________________________________________
   3. _____________________________________________________________

**Other U.S.DOT and Federal Modal Administration**

___ Federal Motor Carrier Safety Administration research
___ Federal Transit Administration research
___ Maritime Administration research
___ Research and Special Programs Administration research
___ National Highway Traffic Safety Administration research
___ Federal Railroad Administration research
___ Federal Aviation Administration research
___ Other USDOT research, please specify
 ___ Other USDOT research, please specify

**Academic**

___ University transportation centers research
___ University institute, please specify
___ University institute, please specify
___ Other university consortium/alliance, please specify
___ Other university consortium/alliance, please specify
___ Other university consortium/alliance, please specify
9. What are the three most important factors in **sustaining** a research activities partnership?
   1. 
   2. 
   3. 

10. What are the three top items that make **forming a research partnership difficult**? Please rank the difficulty using 5 as most difficult and 1 as least difficult.

<table>
<thead>
<tr>
<th>Items that make forming a research partnership difficult</th>
<th>Rating (5-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

11. What are the three top items that make **sustaining a research partnership difficult**? Please rank the difficulty using 5 as most difficult and 1 as least difficult.

<table>
<thead>
<tr>
<th>Items that make sustaining a research partnership difficult</th>
<th>Rating (5-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12. Does your organization have any policies regarding forming partnerships? Yes _______ No _______

   If yes, PLEASE ENCLOSE A COPY OF THE POLICIES WITH YOUR COMPLETED QUESTIONNAIRE.

13. Does your organization have any checklists, general tools, or other documentation that guides a person through the formation, operation, and closing of a research activity partnership? Yes _______ No _______

   If yes, PLEASE ENCLOSE A COPY OF THIS DOCUMENTATION WITH YOUR COMPLETED QUESTIONNAIRE.

14. What is the most often used manner of communicating within vital and successful partnerships in which your agency participates?
   ____ in person     ____ fax     ____ telephone     ____ e-mail     ____ written reports     ____ other

15. How often is it necessary to communicate with partners to keep the partnership vital and on course?  ____ monthly
   ____ daily     ____ quarterly     ____ weekly     ____ annually     ____ bi-monthly     ____ other

16. Please rate the following items according to their importance in facilitating research activities partnerships.

   (3—very important, 2—moderately important, 1—somewhat important, 0—not important)
   ____ standard contracts or agreements
   ____ legislated formation of partnerships
   ____ legislated funding
   ____ written guidelines for forming and managing partnerships
   ____ personnel specifically committed to managing partnerships
   ____ facilities reserved for research activities partnerships
____ top management involvement in partnership formation
____ top management involvement in partnership operations
____ cross-functional team-building capability within agency
____ training personnel to participate effectively within partnerships
____ other, please specify _____________________________________________________________________

17. In general, why does your agency form partnerships? Check as many as apply.
____ to gain technical expertise ___________ to advance commercialization
____ to add administrative/project management expertise ___________ to provide enhanced competitive advantage
____ to leverage funding ___________ to reduce duplication of research efforts
____ to fulfill a regulatory requirement ___________ to accomplish more basic research
____ to satisfy a political need ___________ other, please specify ____________________________

<table>
<thead>
<tr>
<th>BENEFICIAL RESEARCH ACTIVITIES PARTNERSHIP DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partnership Name ____________________________</td>
</tr>
<tr>
<td>Partnership Goal, Objective, or Vision __________</td>
</tr>
<tr>
<td>___________________________________________________________________________________</td>
</tr>
<tr>
<td>Partnership Participants</td>
</tr>
<tr>
<td>Please list the participants, what they contribute to the partnership and whether the contribution was in-kind (no funds were exchanged). Use the following codes for the type of partnership. Non-profit organizations may be transportation associations or trade groups or other similar bodies.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TYPE—PLEASE USE CODE</th>
<th>CONTRIBUTION—PLEASE USE ONE OF THESE OR YOUR OWN DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. academic</td>
<td>6. state/provincial government -technical expertise/researchers</td>
</tr>
<tr>
<td>2. private sector company</td>
<td>7. state/provincial non-profit -technicians</td>
</tr>
<tr>
<td>3. local public sector</td>
<td>8. federal government -project management and administration</td>
</tr>
<tr>
<td>4. regional government</td>
<td>9. national non-profit -equipment</td>
</tr>
<tr>
<td>5. regional non-profit</td>
<td>10. international -research facilities</td>
</tr>
<tr>
<td>11. internal to agency</td>
<td>-funding</td>
</tr>
<tr>
<td></td>
<td>-research or pilot site</td>
</tr>
<tr>
<td></td>
<td>-tech transfer/implementation</td>
</tr>
<tr>
<td></td>
<td>-training and education</td>
</tr>
</tbody>
</table>
1. **Type of Arrangement** (Check one)

   ___ informal, no written agreement
   ___ interagency agreement
   ___ memorandum of understanding
   ___ contract
   ___ other, please specify __________________________

   **PLEASE SEND A COPY OF THE AGREEMENT WITH YOUR COMPLETED QUESTIONNAIRE**

2. **Why was the partnership formed?** (Rate top three reasons, 1—top reason, 2—second reason, 3—third reason)

   ___ to gain technical expertise
   ___ to add administrative/project management expertise
   ___ to leverage funding
   ___ to fulfill a regulatory requirement (please send copy of regulation)
   ___ to satisfy a political need
   ___ to advance commercialization
   ___ to provide enhanced competitive advantage
   ___ to reduce duplication of research efforts
   ___ to accomplish more basic research
   ___ other, please specify __________________________
   ___ other, please specify __________________________

3. When did the partnership **first start**? ____________ (mm/yy) What is **current term** of the partnership? ____________ (months or years)

4. Was a **specific organization created** for this partnership? Yes _____ No _____

   If yes, are the project team members **co-located in a defined facility or area**? Yes _____ No _____
If no, how are team communications handled among the various partnership organizations?

5. **Resources** (please provide estimates if you do not know the definitive values.)

<table>
<thead>
<tr>
<th>Annual Value of Resources Your Organization Will Contribute</th>
<th>Total Value of Resources Your Organization Will Contribute</th>
<th>Annual Value of All Resources Contributed by All Participants</th>
<th>Total Value of All Resources Contributed by All Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
</tr>
</tbody>
</table>

6. What factors were the **most influential in enabling** this partnership to be formed?
1. 
2. 
3. 

7. What factors were the **most detrimental to forming and sustaining** the partnership?
1. 
2. 
3. 

8. What occurred to **overcome these detrimental factors**? Who or what changed?

9. How were the **cultures, schedules and potentially competing agendas agreed upon** for this partnership? Please summarize the three most critical items that facilitated agreement.
1. 
2. 
3. 

10. Were efforts made to **match skills and strengths** of the various partnership organizations?
Yes ______ No _______ If yes, how was this done?

11. What research **property issues** resulting from the partnership effort had to be addressed within this project? *(Please send documentation with your completed questionnaire.)*

- [ ] patent rights
- [ ] trademark protection
- [ ] copyright
- [ ] residual interests
- [ ] intellectual property rights ownership
- [ ] license arrangements
- [ ] other, please specify _______________________
12. What benefits were received from the activity resulting from this partnership? (check all that apply)
   ____ enhanced safety
   ____ cost savings
   ____ increased productivity
   ____ fulfilled (in part) agency goals
   ____ model for subsequent partnerships
   ____ enhanced technical expertise
   ____ enhanced administrative expertise
   ____ because of partnership, enabled
   ____ greater/higher level of results than
   ____ could have generated on own
   ____ produced innovative product
   ____ produced new design or specification
   ____ produced new method or process
   ____ enabled organizational learning about partnerships
   ____ solidified relationship with important organization
   ____ fulfilled (in part) agency goals
   ____ produced new design or specification
   ____ produced new method or process
   ____ enabled organizational learning about partnerships
   ____ solidified relationship with important organization
   ____ other, please specify

13. How were (are) benefits of the partnership measured?

   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

14. Were benefits or outcome goals of the research activity defined for your agency?
   Yes _____ No ______
   If yes, to what extent were they achieved? _________ (use 25%, 50%, 75%, 100%, greater than 100%)

15. Within the past five years, how many implementable results has the partnership produced?
   ___________ (number)

16. How many of these results produced in the last five years has your agency implemented (or is in the process of implementing)? ____________ (number)

17. How did you measure whether the partnership was successful?
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

18. How easy would this partnership arrangement be to replicate in another agency? (use rating 5—most difficult, 4—difficult, 3—neither difficult or easy, 2—easy, 1—very easy.) __________ rating

19. What elements would be easiest to replicate in another agency?
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

20. What elements would be most difficult to replicate in another agency?
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

Please send any documentation that would help describe the partnership, including agreements and any tools or instruments that assisted in making the partnership possible.

(End of this form, fill in one more please)
LESS THAN SUCCESSFUL RESEARCH ACTIVITIES PARTNERSHIP DESCRIPTION

Partnership Goal, Objective, or Vision

Partnership Participants

Please list the participants, what they contribute to the partnership, and whether the contribution was in-kind (no funds were exchanged). Use the following codes for the type of partnership. Non-profit organizations may be transportation associations or trade groups or other similar bodies.

<table>
<thead>
<tr>
<th>TYPE—PLEASE USE CODE</th>
<th>CONTRIBUTION—PLEASE USE ONE OF THESE OR YOUR OWN DESCRIPTION</th>
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<tbody>
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<td>7. state/provincial non-profit-technicians</td>
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<tr>
<td>4. regional government</td>
<td>9. national non-profit-equipment</td>
</tr>
<tr>
<td>5. regional non-profit</td>
<td>10. international-research facilities</td>
</tr>
<tr>
<td>11. internal to agency</td>
<td>11. internal to agency-funding</td>
</tr>
</tbody>
</table>

Please continue on a separate sheet, if necessary.

1. Type of Arrangement (Check one)

   ____ informal, no written agreement
   ____ interagency agreement
   ____ memorandum of understanding
   ____ contract
   ____ other, please specify______________________________

PLEASE SEND A COPY OF THE AGREEMENT WITH YOUR COMPLETED QUESTIONNAIRE
2. **Why was the partnership formed?** (Rate top three reasons, 1—top reason, 2—second reason, 3—third reason)
   - ____ to gain technical expertise
   - ____ to add administrative/project management expertise
   - ____ to leverage funding
   - ____ to fulfill a regulatory requirement **(please send copy of regulation)**
   - ____ to satisfy a political need
   - ____ to advance commercialization
   - ____ to provide enhanced competitive advantage
   - ____ to reduce duplication of research efforts
   - ____ to accomplish more basic research
   - ____ other, please specify ______________________________________________________________
   - ____ other, please specify ______________________________________________________________

3. When did the partnership **first start?** ___________ (mm/yy) What is **current term** of the partnership? ___________ (months or years)

4. **Resources** (Please provide estimates if you do not know the definitive values.)
   - If yes, are the project team members **co-located in a defined facility or area**? Yes _____ No _____

<table>
<thead>
<tr>
<th>Annual Value of Resources Your Organization Will Contribute</th>
<th>Total Value of Resources Your Organization Will Contribute</th>
<th>Annual Value of All Resources Contributed by All Participants</th>
<th>Total Value of All Resources Contributed by All Participants</th>
</tr>
</thead>
<tbody>
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<td>$</td>
<td>$</td>
</tr>
</tbody>
</table>

5. What factors were the **most influential in enabling** this partnership to be formed?
   - 1.
   - 2.
   - 3.

6. What factors were the **most detrimental to forming and sustaining** the partnership?
   - 1.
   - 2.
   - 3.

7. How did this experience contribute to **you or your agency’s learning** about research activities?
   - ____________________________________________
   - ____________________________________________
   - ____________________________________________

8. Did the **initial agreement provide for amicable settlement** of the differences of this partnership? Yes_____ No_____

9. Were benefit or outcome **goals** of the research activity defined for your agency? Yes ____ No __
   - If yes, to what extent were they achieved? _______ (use 25%, 50%, 75%, 100%, greater than 100%)
10. Within the past five years, **how many implementable** results has the partnership produced? 
   ________ (number)

11. How many of these results produced in the last five years has your agency implemented (or is in the process of implementing)? ________ (number)

12. How did you **measure whether the partnership was successful or less than successful**?

   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

13. What could you share with other research activities partnerships to help them avoid the problems this effort encountered?

   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

Please send any documentation that would help describe the partnership, including agreements and any tools or instruments that were part of the partnership experience.

END

THANK YOU VERY MUCH FOR YOUR ANSWERS, COMMENTS, AND WISDOM!
APPENDIX D

External Research Partnerships in Which State and Provincial Research Units Participate

There are a host of partnerships in which state and provincial research units participate. Although it is impossible to list all partnerships mentioned in the survey responses, research unit managers consistently mentioned a number of important partnerships. The following listing provides the web addresses of these partnerships, where more information about the partnership organization and activities can be obtained.

<table>
<thead>
<tr>
<th>WEBSITE ADDRESSES OF A VARIETY OF RESEARCH PARTNERSHIPS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FHWA-sponsored partnerships</strong></td>
</tr>
<tr>
<td>Research and Technology Partnerships such as:</td>
</tr>
<tr>
<td>SP&amp;R, Pooled Fund Projects,</td>
</tr>
<tr>
<td>Experimental, Demonstration, and Test Evaluation Projects</td>
</tr>
<tr>
<td>Local Technical Assistance Program (LTAP)</td>
</tr>
<tr>
<td><strong>FHWA Turner–Fairbank Highway Research Center</strong></td>
</tr>
<tr>
<td><a href="http://www.tfhrc.gov/">http://www.tfhrc.gov/</a></td>
</tr>
<tr>
<td><strong>FHWA sponsorship, LTAP</strong></td>
</tr>
<tr>
<td><a href="http://www.ltapt2.org/">http://www.ltapt2.org/</a></td>
</tr>
<tr>
<td><strong>Strategic Highway Research Program (SHRP) Activities</strong></td>
</tr>
<tr>
<td><strong>FHWA sponsorship</strong></td>
</tr>
<tr>
<td>SHRP Implementation</td>
</tr>
<tr>
<td>TRB SHRP Implementation website</td>
</tr>
<tr>
<td><a href="http://www4.trb.org/trb/divc.nsf/web/shrp_implemen">http://www4.trb.org/trb/divc.nsf/web/shrp_implemen</a></td>
</tr>
<tr>
<td>tation?OpenDocument</td>
</tr>
<tr>
<td>AASHTO Innovative Technologies website</td>
</tr>
<tr>
<td><a href="http://leadstates.tamu.edu/">http://leadstates.tamu.edu/</a></td>
</tr>
<tr>
<td><strong>Long-Term Pavement Performance Program</strong></td>
</tr>
<tr>
<td>FHWA sponsorship</td>
</tr>
<tr>
<td><a href="http://www.tfhrc.gov/pavement/ltpp/ltpp.htm">http://www.tfhrc.gov/pavement/ltpp/ltpp.htm</a></td>
</tr>
<tr>
<td><strong>Other SHRP cooperative research, including C-SHRP</strong></td>
</tr>
<tr>
<td>Canadian SHRP</td>
</tr>
<tr>
<td><a href="http://www.cshrp.org/">http://www.cshrp.org/</a></td>
</tr>
<tr>
<td><strong>AASHTO Research and Technology Partnerships</strong></td>
</tr>
<tr>
<td>National Cooperative Highway Research Program (NCHRP)</td>
</tr>
<tr>
<td>National Transportation Product Evaluation Program (NTPEP)</td>
</tr>
<tr>
<td>Snow and Ice Cooperative Program (SICOP)</td>
</tr>
<tr>
<td><strong>NCHRP, cooperative program managed by TRB</strong></td>
</tr>
<tr>
<td><a href="http://www4.nas.edu/trb/crp.nsf/">http://www4.nas.edu/trb/crp.nsf/</a></td>
</tr>
<tr>
<td>AASHTO sponsored</td>
</tr>
<tr>
<td><a href="http://www.transportation.org/programs/ntpep/site.nsf/a">http://www.transportation.org/programs/ntpep/site.nsf/a</a></td>
</tr>
<tr>
<td>allpages/overview?opendocument</td>
</tr>
<tr>
<td>Sponsored by AASHTO, American Public Works Association,</td>
</tr>
<tr>
<td>and National Association of County Engineers</td>
</tr>
<tr>
<td><a href="http://www.sicop.net/">http://www.sicop.net/</a></td>
</tr>
<tr>
<td><strong>Other Alliances and Research Consortia</strong></td>
</tr>
<tr>
<td>Civil Engineering Research Foundation</td>
</tr>
<tr>
<td>National R&amp;T Partnership Forum</td>
</tr>
<tr>
<td>Highway Innovative Technology Evaluation Center</td>
</tr>
<tr>
<td><a href="http://www.cerf.org/hitec/">http://www.cerf.org/hitec/</a></td>
</tr>
<tr>
<td>TRB information website</td>
</tr>
<tr>
<td><a href="http://www4.nas.edu/trb/homepage/website/framework?Ope">http://www4.nas.edu/trb/homepage/website/framework?Ope</a></td>
</tr>
<tr>
<td>nDocument</td>
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<tr>
<td>TRB Special Report 261 available from TRB and download</td>
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<td>able from TRB website</td>
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<tr>
<td><a href="http://nationalacademies.org/trb/">http://nationalacademies.org/trb/</a></td>
</tr>
<tr>
<td>Research Partnership</td>
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<tr>
<td>--------------------------------------------</td>
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<tr>
<td>National Science Foundation (NSF)</td>
</tr>
<tr>
<td>Transit Cooperative Research Program (TCRP)</td>
</tr>
<tr>
<td>University Transportation Centers (UTC)</td>
</tr>
</tbody>
</table>
APPENDIX E

Synopsis of the Treatment of Intellectual Property in Selected Research Partnership Agreements and Memorandums of Understanding

This table shows examples of how intellectual property is handled in state DOTs and provincial ministries of transportation. The selected items are specific examples and may not be the only means by which these agencies treat intellectual property.

<table>
<thead>
<tr>
<th>State or Province</th>
<th>Synopsis of the Treatment of Intellectual Property in Selected Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>All intellectual property belongs to the state unless the partner gives the state highway agencies and the U.S. government irrevocable, nonexclusive, nontransferable, royalty-free license to practice each invention in manufacturing, use, and disposition.</td>
</tr>
<tr>
<td>California</td>
<td>From Memorandum of Understanding regarding seismic research; all intellectual property has public ownership.</td>
</tr>
<tr>
<td>Kansas</td>
<td>Department of Transportation (DOT) can publish data; university keeps intellectual property including patents and copyrights. DOT has the royalty-free, nonexclusive, irrevocable license to use any patent or copyright if university does not patent or copyright, then DOT is free to do so.</td>
</tr>
<tr>
<td>Louisiana</td>
<td>Similar to Alabama.</td>
</tr>
<tr>
<td>Maine</td>
<td>Similar to Alabama.</td>
</tr>
<tr>
<td>Missouri</td>
<td>Example is a Cooperative Research and Development Agreement (see chapter seven for the specific language).</td>
</tr>
<tr>
<td>Montana</td>
<td>Copyright must include the other party than the requesting party; the other party has the right to include a disclaimer or acceptance.</td>
</tr>
<tr>
<td>Nebraska</td>
<td>Patentable discoveries belong to the public.</td>
</tr>
<tr>
<td>North Carolina</td>
<td>The state has the free license to use patented devices or procedures, no royalties to be paid, freely licensed to use, distribute, and make derivative works of copyrighted materials and may extend right to others.</td>
</tr>
<tr>
<td>Rhode Island and other New England States</td>
<td>New England Transportation Consortium (NETC)—Title of all products of research resides with the university that prepared the report. The university will grant NETC member departments, the U.S. government, and the general public nonexclusive, irrevocable, royalty-free, worldwide license for copyright data to use, reproduce, and prepare derivative works.</td>
</tr>
<tr>
<td>West Virginia</td>
<td>All rights from discoveries are sole property of the contractor. All state DOTs and the U.S. government are granted an irrevocable, nonexclusive, nontransferable, and royalty-free license to practice such invention in the manufacture, use, and disposition.</td>
</tr>
<tr>
<td>State or Province</td>
<td>Synopsis of the Treatment of Intellectual Property in Selected Cases</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td>Ontario</td>
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Abbreviations used without definition in TRB Publications:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>AASHO</td>
<td>American Association of State Highway Officials</td>
</tr>
<tr>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
</tr>
<tr>
<td>ASCE</td>
<td>American Society of Civil Engineers</td>
</tr>
<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
</tr>
<tr>
<td>FAA</td>
<td>Federal Aviation Administration</td>
</tr>
<tr>
<td>FHWA</td>
<td>Federal Highway Administration</td>
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<tr>
<td>FRA</td>
<td>Federal Railroad Administration</td>
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<tr>
<td>FTA</td>
<td>Federal Transit Administration</td>
</tr>
<tr>
<td>IEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
</tr>
<tr>
<td>ITE</td>
<td>Institute of Transportation Engineers</td>
</tr>
<tr>
<td>NCHRP</td>
<td>National Cooperative Highway Research Program</td>
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<tr>
<td>NCTRP</td>
<td>National Cooperative Transit Research and Development Program</td>
</tr>
<tr>
<td>NHTSA</td>
<td>National Highway Traffic Safety Administration</td>
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<tr>
<td>SAE</td>
<td>Society of Automotive Engineers</td>
</tr>
<tr>
<td>TCRP</td>
<td>Transit Cooperative Research Program</td>
</tr>
<tr>
<td>TRB</td>
<td>Transportation Research Board</td>
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<tr>
<td>U.S.DOT</td>
<td>United States Department of Transportation</td>
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