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 wides scale 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

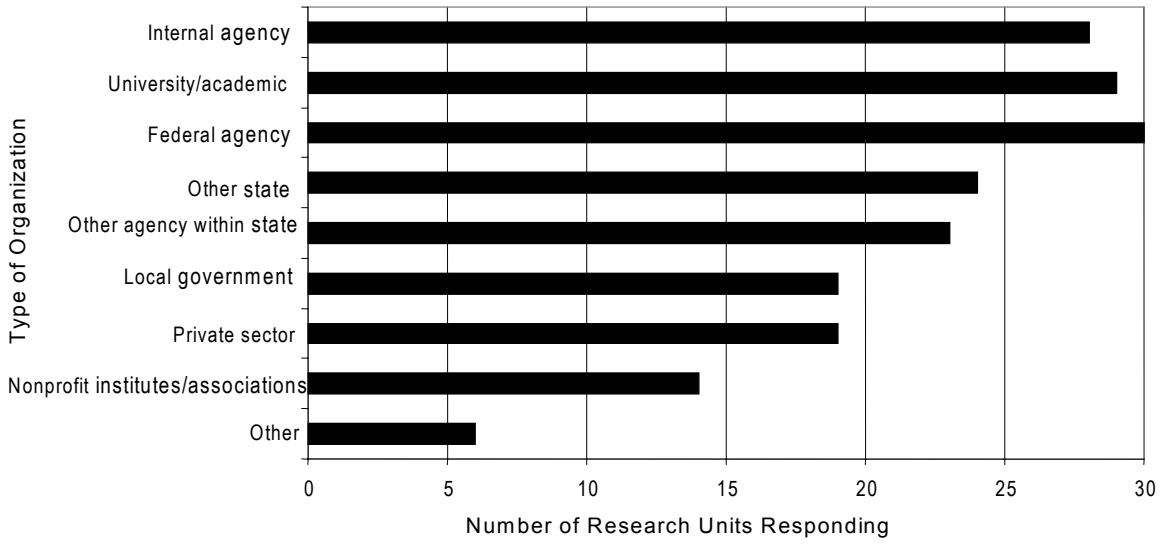

FIGURE 1 Number of research units that have partnerships with other organizations (total responses, 34).

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

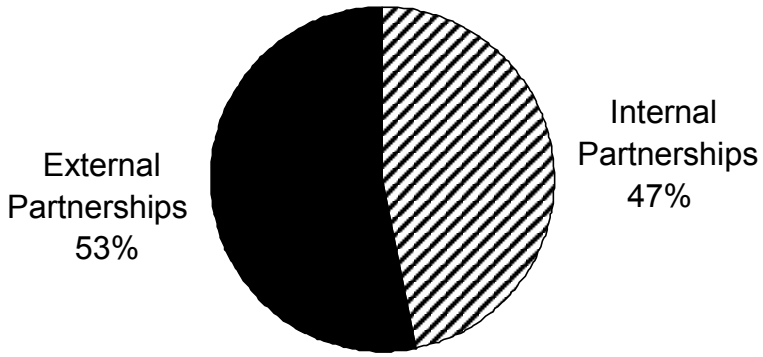

FIGURE 2 Percent of internal and external partnerships (total responses, 32).

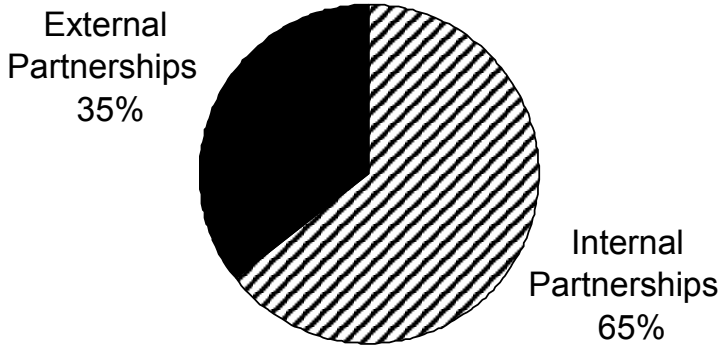

FIGURE 3 Production of more implementable results (total responses, 31).

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

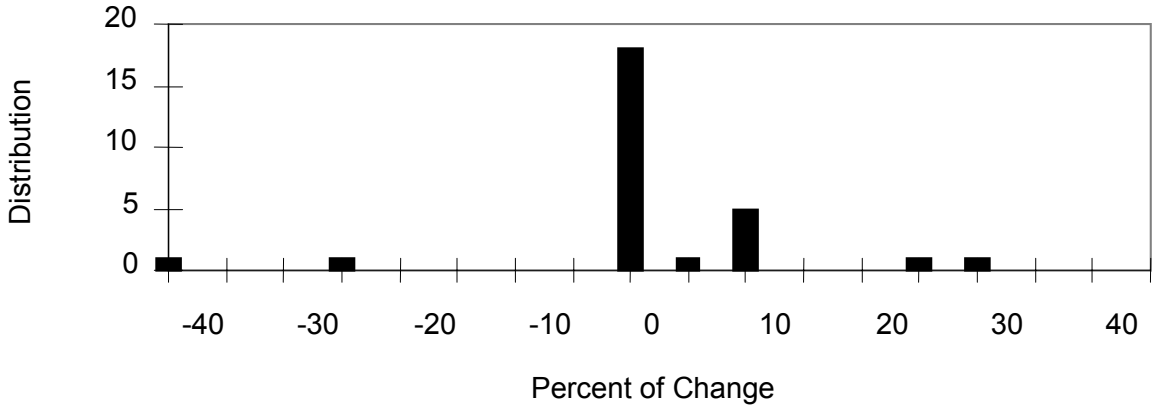

FIGURE 4 Distribution of responses: Percent of change in commitment to research partnerships (total responses, 28).

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

Years	Change (%)
1996–1998[1]	+65.0
2000–2002[1]	+29.0
2002–2006[2]	+01.6

Notes: Both surveys addressed the same population, used similar methodologies, and were conducted by the same researcher.
[1]*Source*: AASHTO RAC survey of state research units 1999.
[2]*Source*: 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.

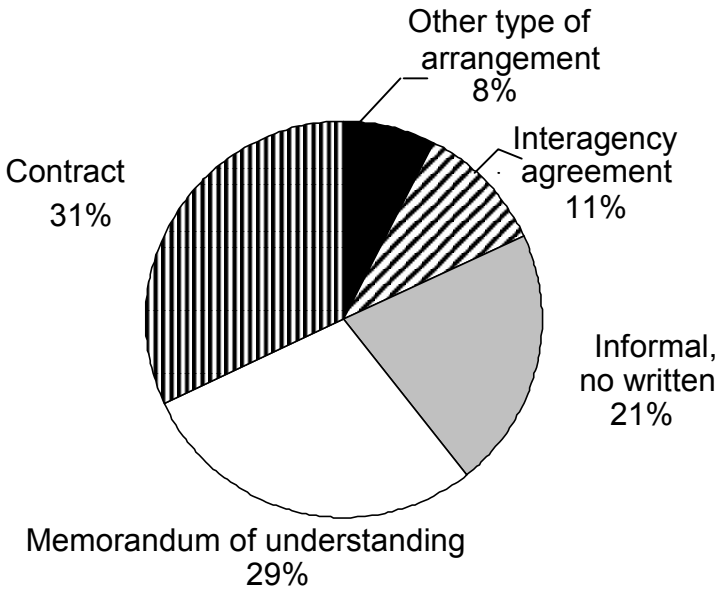

FIGURE 5 Type of arrangement for partnerships (total of 61 partnerships examined, both beneficial and less than beneficial).

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.