National Cooperative Highway Research Program

Synthesis of Highway Practice 231

Managing Contract Research Programs

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

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.

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The members of the technical committee selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and, while they have been accepted as appropriate by the technical committee, they are not necessarily those of the Transportation Research Board, the National Research Council, the American Association of State Highway and Transportation Officials, or the Federal Highway Administration of the U.S. Department of Transportation.

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The Transportation Research Board evolved in 1974 from the Highway Research Board, which was established in 1920. The TRB incorporates all former HRB activities and also performs additional functions under a broader scope involving all modes of transportation and the interactions of transportation with society.

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PREFACE

A vast storehouse of information exists on nearly every subject of concern to highway administrators and engineers. Much of this information has resulted from both research and the successful application of solutions to the problems faced by practitioners in their daily work. Because previously there has been no systematic means for compiling such useful information and making it available to the entire community, the American Association of State Highway and Transportation Officials has, through the mechanism of the National Cooperative Highway Research Program, authorized the Transportation Research Board to undertake a continuing project to search out and synthesize useful knowledge from all available sources and to prepare documented reports on current practices in the subject areas of concern.

This synthesis series reports on various practices, making specific recommendations where appropriate but without the detailed directions usually found in handbooks or design manuals. Nonetheless, these documents can serve similar purposes, for each is a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems. The extent to which these reports are useful will be tempered by the user's knowledge and experience in the particular problem area.

FOREWORD

By Staff
Transportation
Research Board

This synthesis will be of interest to state DOT research administrators and mid- to upper-level research managers; DOT research staff and staff from design, construction, and maintenance who provide input to the research process; and university and private industry researchers. The synthesis describes the state of the practice for managing contract research programs. Data presented were obtained from a review of the literature, a survey of state departments of transportation (DOTs), and interviews of selected state DOT, Federal Highway Administration, Transportation Research Board, and university professionals.

Administrators, engineers, and researchers are continually faced with highway problems on which much information exists, either in the form of reports or in terms of undocumented experience and practice. Unfortunately, this information often is scattered and unevaluated and, as a consequence, in seeking solutions, full information on what has been learned about a problem frequently is not assembled. Costly research findings may go unused, valuable experience may be overlooked, and full consideration may not be given to available practices for solving or alleviating the problem. In an effort to correct this situation, a continuing NCHRP project, carried out by the Transportation Research Board as the research agency, has the objective of reporting on common highway problems and synthesizing available information. The synthesis reports from this endeavor constitute an NCHRP publication series in which various forms of relevant information are assembled into single, concise documents pertaining to specific highway problems or sets of closely related problems.

This report of the Transportation Research Board describes all aspects of the research process, from defining the problem and selecting a program, through contract monitoring, to implementation. Successful practices are identified and case studies, representing programs of various sizes, are presented.

To develop this synthesis in a comprehensive manner and to ensure inclusion of significant knowledge, the Board analyzed available information assembled from numerous sources, including a large number of state highway and transportation departments. A topic panel of experts in the subject area was established to guide the research in organizing and evaluating the collected data, and to review the final synthesis report.

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 the processes of advancement continue, new knowledge can be expected to be added to that now at hand.

CONTENTS

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Valuable assistance in the preparation of this synthesis was provided by the Topic Panel, consisting of Gary R. Allen, Director of Research, Virginia Transportation Research Council; Denis E. Donnelly, Research Consultant, Lakewood, Colorado; Richard L. Hollinger, Manager, Bureau of Research, New Jersey Department of Transportation; Robert J. Kreklau, Director–Office of Research & Development Operations and Support, Federal Highway Administration; James W. March, Chief, Systems Analysis Branch, Federal Highway Administration; Robert E. Spicher, Director, Technical Activities, Transportation Research Board; Richard H. Sullivan, Director, Office of Minnesota Road Research, Minnesota Department of Transportation; Jon P. Underwood, Director, Research Technology Transfer Office, Texas Department of Transportation, RTT; and John West, Program Manager, New Technology & Research Program, California Department of Transportation.

The Principal Investigators responsible for the conduct of this synthesis were Sally D. Liff, Manager, Synthesis Studies, and Stephen F. Maher, Senior Program Officer. This synthesis was edited by Linda S. Mason.

Scott A. Sabol, Senior Program Officer, National Cooperative Highway Research Program, and Wesley Lum, Chief, Office of Research, California Department of Transportation assisted the NCHRP 20-05 staff and the Topic Panel.

Information on current practice was provided by many highway and transportation agencies. Their cooperation and assistance are appreciated.

MANAGING CONTRACT RESEARCH PROGRAMS

SUMMARY

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 mandated at least 25 percent of state planning and research funding for research, development, and technology transfer activities. The immediate effect of targeting these funds reversed the trend of previous decades and significantly increased many state research programs.

The new focus on research induced transportation agencies that had downsized staff during the 1980s to contract with outside agencies for much of their current research. This raises technical and administrative issues for state research managers who must now contend with contract documents and contract adherence. The technical expertise formerly provided by the research staff is now increasingly off-site and the monitoring and technical procedures employed by contractors may differ from those used within the state research infrastructure.

This synthesis was initiated to provide information to research managers on the contract procedures used in other states so that contract programs can be more effectively incorporated into state research. In addition, in-depth interviews with research managers and other members of management at five state transportation departments, two universities, the Federal Highway Administration, and a representative of the former Strategic Highway Research Program were conducted. Questionnaire results are synthesized with other literature and state case studies. Suggestions to improve all aspects of the contract research program are offered.

The synthesis provides tools to help with the initial steps of defining problems and selecting a program, through contract monitoring to program implementation. Each state's research and contracting processes are unique, the result of differences in organization, policy, or state legislation. Therefore, this synthesis offers a range of techniques for research managers to apply to their particular set of requirements.

All but one of the responding states conduct contract research, which is accomplished primarily with universities. In fact, 90 percent of the states responding to the survey reported moderate to large increases in the contract program over the past 5 years. The tendency for states to use contractors for such a large portion of their research is based on the number of research staff, their expertise, and the complexity of the work. For projects started in 1994, pavement research is the only area in which research by staff remains the rule rather than the exception.

Most states solicit university contractors only, using the Request For Proposal technique, and contract through a basic agreement process. As a result, issues relevant to universities are included in the synthesis.

When negotiating contracts, most states consider the scope and the deliverables the most important contract items. Cost-reimbursable and fixed-price contracts are the most frequently used contract forms. A discussion of innovative contracting arrangements and the difficulties involved with contract modifications is contained in the chapter on negotiating a contract.

Once the research begins, ongoing communication between state research managers and contractors is crucial to the success of the research. The most frequently used contract monitoring technique is a review of the contractor's progress report. Advisories of various forms are issued to a contractor for unacceptable contract compliance. A brief discussion of the contractor's involvement in the technology transfer effort and contract closeout procedures is also incorporated in the synthesis. When research units have small staffs, there is a larger proportion of programs under contract and a larger number of projects assigned to each staff member. Because of the strain on their resources, states in this situation report significantly less than full implementation of project results.

Both government and private industry experience similar impediments to the implementation of research. Principles and techniques for increasing the implementation potential are listed from the literature, and an existing state implementation process is provided. Whether the various research sources available to the state are useful is discussed, and findings and conclusions drawn from reported practice and from the literature are provided. Data from the questionnaire are used throughout the synthesis, states' responses to the questionnaire appear in tables within the text, while summary information appears in Appendix A.

CHAPTER ONE

INTRODUCTION

RESEARCH PROCESS

In the United States, formal government involvement in highway research began with the establishment of the Office of Road Inquiry in the Department of Agriculture in 1893 (*1*). The introduction of research units into state highway and transportation departments took several decades. By 1952, a total of 22 states had formalized these operations (*2*). Over the past 40 years the research function has continued to receive support in federal legislation.

The most recent boost to research came with the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). The Act stipulated that at least 25 percent of the State Planning and Research (SPR) funds apportioned to the states must be expended on research, development, and technology transfer (RDT) activities. In addition, the research procedures between the states and the Federal Highway Administration (FHWA) were modified by regulations (23 CFR, Part 420, State Planning and Research, Subpart B), requiring the states to have a documented interactive management process. In January 1995 an interim guide (*3*), which included sections on management that responded to the federal regulations, was distributed to all state research managers. Although many states currently have research manuals, some lack procedures for fulfilling various requirements. State research units are urged to follow guidelines that can lead to effective, implementable programs. The National Cooperative Highway Research Program (NCHRP) has a contract to develop a complete guide that will include agency and research goals and policies, the organization of the RDT program and project development, project operations, program and project reporting, technology transfer and implementation processes, program and project evaluation, and staff, resource, and administrative management issues.

PURPOSE AND SCOPE OF SYNTHESIS

Background

Two events in the late 1980s and early 1990s affected state transportation organizations significantly. State governments trimmed the size of transportation agency staffs while accelerating the move toward privatization, and ISTEA increased federal funding for most state transportation research organizations. Many research managers found themselves in the position of having larger budgets but reduced staffs. The drive by the states to address ever increasing problems has given rise to finding additional research resources. Of all the avenues the states use to perform research, the contract program is the most favored.

To discover what effect increased funding and reduced staff had on the contract research programs of the states, and to provide information that could improve research programs, surveys (through a questionnaire) and interviews of selected state research managers were conducted. The questionnaires were responded to by 41 states and the District of Columbia. Interviews focused on the contract research process at the FHWA, SHRP, and two universities. The questionnaire and tabulated summary of responses are in Appendices A and B. The FHWA and SHRP processes are in Appendices C and D. The contract issues relating to universities are discussed in Chapter 3.

The range of the state research programs is evident from Table 1, which reflects fiscal year 1994 data. Except for the relative changes in the size of contract and staff research programs, the results do not reflect absolute changes over time in staff, projects conducted, or funding.

Problem

The way most states solved the problem of maintaining an active research program with reduced staff was by increasing their contracting efforts. The survey showed that 90 percent of the respondents had increased their contract program over the past 5 years, many by a significant proportion, and 40 percent increased their staff program. More than 90 percent of the respondents expect these changes to remain the same or increase further over the next 5 years. (See responses to questions 1e and 1f in Appendix B.) Table 1 gives details of the contract and staff research changes on a state-by-state basis. Limited staff must handle diverse projects working with private consultants, universities, pooled-fund programs, and in a few cases, consortiums. This diversity complicates monitoring responsibilities and administrative requirements.

The increase in contracting and the reduction in staff is putting pressure on some states to find ways to effectively develop and monitor the contract program. Staff turnover is adding urgency for new members of the research units to learn both research and contracting procedures. Although this synthesis will not address research staff training, the NCHRP guide (*3*) should be a useful reference.

States use a basic agreement with universities to expedite the contracting process. Evidence of the effectiveness of the basic agreement is found in Table 1. In dealing with universities, transportation agencies typically have to modify their more pragmatic approach to research to accommodate the more theoretical approach of many educational institutions.

TABLE 1

BACKGROUND DATA FOR STATES (1994)

Questionnaire: Question 1.0—BACKGROUND INFORMATION																	
State	Staff				Projects		Funds*** (x$1000)			Total Projects by Category					Change in Program****		
															Contract		Staff	
	Res	Adm	Con	Tech	'94	Tot	SPR	S	Oth	Con	Unv	PF	S	Oth	5Yr	Fut	5Yr	Fut
AL	2	1	2		12	32	1375	1000	81		27	2	2	1	>>	>	=	>
AK		1*	*		6	36	330	82		1	31		4		>	=	<	>>
AR	12	2			4	48	307	170	700		13	4	30	1	>	>	=	<
CA	26*	6	3*		42	134	7000	4260		14	44	21	55		>>	>>	<	<
CO	8	3	1	2	25	69	2000	600		10	13	10	36		>	=	<	<
CT	22	3	1		14	54	2288	554	316	3	15	7	25	4	=		>	=
DC	1*		*		5	8	52				1	3	4		>	>	=	>
FL			4		26	130	2600	2400	100	2	96	30		2	>>	=	=	=
GA	5*	1	5*		21	53	1898	475	967	4	25	5	19		>>	=	<	=
ID		1			9	21	217	26	48	1	8	10	2		>	=	<	=
IL	15	2	1	14	11	34	1690	1434			12		22		>	>	>	>
IN	10	5	1	9	26	77	3120	1300	105	1	58	3	15		>	<	>	=
IA	6	1	1		17	47	1410	1850	1600	7	21		15	4	>	>	=	=
KY			1**		14	54	1710	1208	690		54				>	>		
LA	40	3	3		32		2626	1262							>	>	>	>
ME	11*	2*	1*		7	15	280	260			11	1	2	1	>	>	<	=
MD	6	2	2		4	16	1117	461			6	4	6		<	>	<	>
MI	56	4			41	139	2100	3800		1	36	7	95		>>	>	=	=
MN		3	9		53	123	1112	6009	1300	35	88				>>	>	>	>
MS	10*	2*	2*		6	17	968	242	650	1	3		13		>	>	>	>

TABLE 1 (Continued)

Questionnaire : Question 1.0—BACKGROUND INFORMATION																		
State	Staff				Projects		Funds*** (x$1000)			Total Projects by Category					Change in Program****			
															Contract		Staff	
	Res	Adm	Con	Tech	'94	Tot	SPR	S	Oth	Con	Unv	PF	S	Oth	5Yr	Fut	5Yr	Fut
MO	9	2	1	10	2	31	1750		67		7	2	22		>	>	>	>
NE			2		17	53	922	231			14	21	18		>	>	<	=
NV			1		5	9	296	80			7	2			>>	>	=	=
NH	2	1			7	12	410	60		1	3	2	4	2	>	=	>>	=
NJ	13	2	1		6	63	3238		710	9	6	8	40		>>	<	<	>
NY	30	10	1		22	60	3116	1047	661		14	17	28	1	>>	>>	>	>
NM	3	2	1		4	11	360	120	480	2	7		1	1	>	>	=	=
NC		2	4		20	24	1430	383	263		23	4	1	3	>	=	>>	=
ND	4				14	31	500	100		1		3	27		>	>	>>	>
OH	2	3	5	8	23	73	3128	622		11	39	20		3	>	>	=	=
OR	8*	1	*	2	26	76	1026	415	271	1	12	9	54	1	>>	>	>	=
PA		2	6		8	80	2900	750	275	20	11	14	35		<	=	=	=
RI	3	1*	1*		7	11	449	112			7		4		>	>	>	>
SC	2*	1*	1*		9	18	1036	155		1	11	4	2		>>	=	=	>>
SD	8*	1	*		17	48	640	450		8	5	2	33		>	>	>	>
TN			1**		25	31	1500	500			31				>>	>>		
TX		8*	8*		62	200	8000	9000	5000		200	2			>	<		
UT		2	10		12	18	659	472	800	4	14				>>	=	<	>
WA		5	3		38	101	2219	3126	608	2	83	16			>>	>	=	=
WV	2	2	1		10	25	598	150	484		25				>>	=		
WI	6		2		12	70	1200	240			28	15	27		>>	>	>	>
WY		3			6	24	560	124	270	3	5	6	10		=	>	=	>

Refer to Appendix A for the Questionnaire.

Abbreviations: (Under Staff in Table) Res-Researchers, Adm-Administrative, Con-Contract Adm, Tech-Technicians, etc. (Under Projects by Category) Con-Private Consultant, Unv-University, PF-Pooled Fund, S-In-House Staff, Oth-Other. (Under Changes in Program) 5Yr-Over Past 5 Years, Fut-Expected in the Future.

* Contract administration/monitoring is shared by staff

** KY's research program is conducted by the University of Kentucky
TN's research program is conducted primarily by the University of Tennessee

*** See Table 1d, in Appendix A,. for details on sources of other funding

**** - < (will decrease)
= (remains the same)
> (increase moderately)
>> (increase greatly)

Scope

The synthesis addresses all aspects of contract research programs. Successful practices are identified and case studies representing programs of various sizes are recorded. The areas covered include:

- Funding sources for the research program, the decision process that determines the size, content, and the research resource used to conduct the program;
- Methods used to elicit contractor interest;
- Contractor evaluation and selection criteria and barriers to contractor participation;
- Contract issues such as overhead rates and terms;
- Contract negotiations including type of contract and difficult issues;
- Monitoring methods, agency monitoring actions, contract modification issues, and contractor requirements such as report deliverables;
- Implementation techniques, contractor technology transfer involvement, and the process for implementation; and
- Contract closeout issues and requirements.

Synthesis Organization

A topic panel with state and federal representation helped develop the research steps used in the synthesis.

A questionnaire sent to state research managers covered background program information, techniques used in the contract process, contractor solicitation and selection procedures and contract terms, and performance monitoring methods. The main text of this synthesis is based on these data; some also appear in tabular form, by state response. The data are also summarized to reflect state tendencies. The questionnaire is Appendix A and the summarized responses to it are Appendix B.

A literature search provided related contract issues in private industry. Several sources covering research process issues and private industry findings were found using the Transportation Research Information System (TRIS) files. All referenced sources are listed at the end of the main text.

The report follows the research program format. Initially, research projects are selected (Chapter 2), then a resource is sought to address the projects (Chapter 3). Following this, contract negotiations are conducted (Chapter 4) and the contracts are monitored (Chapter 5). Chapter 6 discusses the implementation effort, because of its importance to state research managers. Case studies of state research agencies accentuated disparate and effective programs. Although limited to five case studies, they represent a range in the size of the states' programs and the scope of the use of contract/in-house research resources. Chapter 7 records the research process and other details for the states of California, Minnesota, New Jersey, North Carolina, and South Dakota.

Interviews with universities highlighted topics of paramount interest to them. The importance of discussing university issues has already been shown (note the size of the individual state university contract programs from Table 1). State agencies should have a full understanding of the nature and aims of universities to collaborate successfully with academics in the development and conduct of the agencies' research programs. The university issues are presented in Chapter 3.

Discussions with the FHWA and SHRP personnel yielded successful contracting procedures. FHWA has one of the longest-running contract programs in transportation and many problematic contracting issues have been addressed (Appendix C). Although each state has laws and policies that require unique procedures, there are aspects of the FHWA process that can be drawn on. SHRP represents one of the single most intensive road research programs ever conducted in the United States. Some of the techniques used to conduct and monitor the SHRP program (discussed in Appendix D) may be applied to state research programs. Several useful practices are referenced from the case studies in the text and details of some procedures are shown in Appendix E.

CHAPTER TWO

SELECTING CONTRACT PROGRAMS

ORGANIZATION CONSIDERATIONS

General

"Allocation of resources in the right areas and in the right amounts is one of the more prevalent and perplexing decisions facing management. The allocation of R&D resources (people, capital and facilities) is especially difficult because capital resources are current outlays with an uncertain payout whose benefit lies in the future and whose success and extent are difficult to predict" (*4*). To reduce the risk of large expenditures on internal resources, contract research is a viable option for organizations.

State Agency Environment

Complicating the decision to contract for research are factors such as fluctuations in financial resources and administrative changes brought about by elections. Often the choice of contract research in state agencies relates to the availability of staff, their expertise, and the complexity of the research. (See responses to question 2d in Appendix B.) In many states, the contract choices are made by the research staff, who then seek management approval. Table 2 lists, by state, the active participants in problem submission, program development, and selection of projects for contract. There is little similarity between the states in these combined activities.

State DOT research must be pragmatic and should conform to the needs of the agency, which are oriented to operations and to the capital program. The thrust of a state transportation agency to develop and maintain an applied research program is based on several factors:

- Planning, design, and construction functions of transportation agencies are oriented toward the production and advancement of capital projects. Top management and staff support for research on these activities is essential to assure the efficient use of agency staff and state-of-the-art technologies.
- The functional units of an agency expect usable research findings and procedures that are timely and applicable.
- Administration changes occur frequently in state government agencies. As a result, the research program must include a very strong short-term element that produces frequent milestones.

All but one of the states responding to the questionnaire have a contract program. Even California, which operates under a court-interpreted constitutional requirement to conduct work with department staff, has a contract program covering 50 percent of its work program projects. (Information on the other states can be obtained by reviewing Table 1 under "Total Projects by Category.") With the increase in the use of contracts in the past 5 years, the majority of states expect their programs either to continue at that increased level or get larger in the future. In 1987 the states reported that agency staff performed about 50 percent of the research (*5*). Today, staff take on about 30 percent of the research.

Research Unit Workload

In moving to a larger contract program, project control shifted from one of managing research staff to monitoring principal investigators through a legal agreement. A comparison of the states with a large contract program (more than 70 percent of their program under contract) and states with a small contract program (less than 30 percent under contract) shows the average number of projects per staff member in a large contract program is 5.8 projects per staff member and in a small contract program, 2.6 projects per staff member. The contrast in the number of projects per staff member is even greater with a comparison of large (>20) and small (<6) staffed states. The larger staffed states average 1.7 projects/staff and the smaller staffed states average 9.8 projects/staff. This latter difference appears to be a result of the large contract programs conducted by the states with fewer staff members.

More than one-third of the states have fewer than six staff members. Staff must solicit and review problems, develop projects, manage the contracts, conduct in-house research, administer or conduct a technology transfer effort (through the Local Technology Assistance Program) and play an active role in the implementation of the research results. Even the research units with more than 15 staff members usually have budgets that stretch the capacity of the staff. Larger-staffed states usually conduct a smaller portion of their program with contractors: in the 14 responding states with fewer than six staff, 82 percent are contracted; and in the 10 responding states with more than 15 staff, 61 percent are contracted.(figures do not include pooled-fund projects). There are two exceptions to the average for the states with more than 15 staff; both Ohio and Texas conduct all of their research through contract.

RESEARCH NEEDS

Development Practices

A study of companies in the United States, Europe, and Japan illustrated several "best practices" regarding research

TABLE 2

STATE CONTRACT PROGRAM DATA

Questionnaire : Question 2.0 - SELECTING A CONTRACT PROGRAM								
State	Problem Suggester*	Program Developer*	'94 Projects by Functional Area**		Contract Projects Seleced By*	Criteria for Selecting Resource***		State Law****
			Contract	Staff		Cotractn.	Staff	
AL	S, RC,O,U AD,CO,O	RC	4B,4 MAT, 1 PAV, 1 PL	2 Pav	RC AD	C	ST, EX, C	NO
AK	S,RC,O, CO,U	S	1B, 3EN,1G,2M, 1MAT,1P	1B	S AD	LS,LE,C	LS,LE,O, C,F	NO
AR	O,CO,U	S,RC,CO	2MAT,1O	1PL	RC	LE,C,F	LS,LE,C,	NO
CA	S,O	RC,O,AD	2B,1EC,2EN,5G, 1MAT,2PAV,6T,6 O	1B,2EC,1G, 9MAT,2PAV,4T	S,RC,AD	LS,LE	O	YES
CO	S,RC,O, CO,U	S,O,CO,U	3B,5EN,11G,2PL, 2T	2B,1C,5G,2M,4MA T,11PAV,5T,1I,3O	S	LS,LE,O, C,F		NO
CT	S,RC,O,AD CO,U,OT	S,RC,CO,U	3B,4EN,1G,1M,1 MAT, 1T,3O	3B,1C,6PAV,1T, 2I,12O	S,RC	LS,LE,C,	O,C,P,F	YES
DC	S	S	1C,1MAT,1T,2I		S,AD	LS,LE,C		NO
FL	S,O,AD,U	O	7B,2C,1EN,1G,4M AT, 2PAV,2PL,2T,5O	N/A	S,RC,AD	LS,P		YES
GA	S,RC,O,U	S,RC	1B,1C,1EC,1M,2M AT, 1PAV,2T,2O	2C,1M,2MAT	S,RC	LS,LE,C	LS,LE,C	NO
ID	S,RC,O,CO, U	S,RC,O,U	2B,1M,1PAV,1T	2PAV	S,RC	LS,C,F	LS,C,F	YES
IL	S,O,AD,CO	S,O,AD,CO	1B,1EN,4MAT,3P AV,1PL, 1T,1O	10B,3MAT,7PAV	RC,AD	LS,LE,O, C,F	LS,LE,O, C	YES
IN	S,RC,O,AD, CO,U	S,RC	4B,1EC,1EN,1G,1 M,4MAT,1PL,2T,1 I,4O	1M,3PAV,1T,1I	S	LE,O,CO	LS,LE,C O	YES
IA	S,RC,O,CO, U	S,RC,O,CO, U	5B,2C,1M,1PAV,1 T,1O	1B,1C,1O	S,RC,AD	LS,LE	LS,LE	YES
KY	S,O,U	U	6B,6C,2EC,2EN,6 G,2M, 6MAT,4PAV,2P,4 T,2I,2O	N/A	RC	P		YES
LA	S,O,AD,U	S.O	3B,4C,1EN,1M,4 MAT, 1PAV,4PL,1T,1I	2B,3C,1EN,6G,5M AT,2PAV,1PL	S,RC,AD	LS,LE,C		YES
ME	S,O,U	S,RC,AD	1EN,1MAT,1PL,1 O	1MAT	RC,AD	LS,LE,C	LS,LE,C	NO
MD	O,U	S,RC	3B,2MAT,1PAV,1 T	1B,1MAT,1PAV	RC	LS,LE,O, C,P	LS,LE,C, P	NO
MI	S,O,U	S,AD	3B,2C,3EN,1G,1M ,7PAV, 8T,3I	2B,1M,2MAT,3PA V	S,AD	LS,LE,C		NO
MN	S,RC,O,AD, CO,U	S,AD	4B,2EC,3EN,9MA T,4PAV, 2PL,5P,6T,2I,20O	30PAV	S	LS,LE,C, P,F	LS,C,P,F	YES

TABLE 2 (Contined)

Questionnaire : Question 2.0—SELECTING A CONTRACT PROGRAM							
State	Problem Suggester*	Program Developer*	'94 Projects by Functional Area**		Contract Projects Selected By*	Criteria for Selecting Resource***		State Law ***
			Contract	Staff		Contract	Staff	
MS	S,RC,O,AD	S,RC	1B,1PL,1T,1I	1C,2G,1M,3MAT, 5PAV,1I	S	LS,LE,C	LS,LE,O, C,P,F	YES
MO	S,RC,O,AD, CO,U	S,RC,O,AD,U	6B,1G,1M,2PAV, 3T	2G,2PAV,6PL,1I,9 O	S,RC,AD	LS,LE,C	LS,LE,C	NO
NE	O,AD,CO,U	S,RC,AD	6B,1PAV,1I,3O	1MAT	RC,AD	LE,O,C	LS,LE,C	NO
NV	O,U	RC,U	2MAT,2PAV		S,AD	LS,LE,O, C		NO
NH	S,O,U	S,RC,AD	2B,1C,1M,2PAV	1M,2MAT,1PAV	S,RC	LS,LE,C		NO
NJ	S,O,AD,U	S,U	1M,1T,1O	1B,1EN,1MAT	S,AD	LS,LE,C, P	LS,LE,C, P	NO
NY	S,O,AD,U, OT	S,RC,O	1C,1EC,1EN,1M, 1MAT, 1PL,1P,1O	2B,1MAT,1PAV,1 O	RC	LS,LE,O, C	LS,LE,O, C	NO
NM	S,CO,U,OT	S,CO,U,OT	1B,1G,1MAT,1P AV		S,RC	LS,LE,C, P,F		NO
NC	S,O,AD,U	S,U	2B,1C,1EN,1G,1 M,4MAT, 1PAV,3T,5O	1O	AD,O	LS,LE,C, P	LS,LE,O, C	NO
ND	S,RC,AD	S,RC,AD	1P	1C,1G,1M,1MAT, 1PAV,1PL	S,RC,A D	LS,LE	LE,O,C,F	NO
OH	S,O,CO,U	S,RC,O	5B,1G,1MAT,4P AV,2T,1O		RC	LS,LE,C		YES
OR	S,RC,O,AD	S,RC	3B	7B,1M,1MAT,2P AV,3T	S	LS,LE,O, C		YES
PA	O,CO,U	S,RC,AD	2B,1C,1EN,1MA T,1T,1I,1O		RC,AD	LS,LE,O, C,P,F		NO
RI	S,RC,O,U	S,RC,U	2B,3MAT,2PAV	2MAT	S,RC,A D	P,F	LS,P,F	NO
SC	S,O,AD U,OT	S,RC	1B,1C,3MAT,1O	1O	S,RC,O T	LS,LE,C	LS,LE,C	NO
SD	S,RC,O,AD, CO,U	S,RC	1EC,1G,1M,2MA T,2T	1B,2M,3MAT,2P AV	S,OT	LS,LE,F	LS,LE,F	NO
TN	O	S	3C,6EN,2G,1M,1 MAT,1PAV,2PL, 1I	N/A	S,RC	LS,LE		NO
TX	S,O,AD,U	S,O,AD,U	200+ Projects	N/A	RC	LS,LE,P		YES
UT	O,CO	S,RC	1B,1EC,1EN,1G, 2MAT,2PL,1P,1T		S,RC	LS,LE		YES
WA	S,RC,O,AD, CO,U,OT	S,RC,O,U	14B,1C,14EN,8G, 5M,2MAT,7PAV, 8PL,16T,7O	1EN,3G,1PAV,1O	S,AD,O T	LS,O,C,P		NO
WV	S,O,AD,CO, U	AD,CO,U	7B,3T		S,AD	LS,LE,O, P,F		YES
WI	O,U	RC,AD	1B,5C,1EN,1PAV, 2PL,1T	5C,2MAT,3PAV	S	LS,LE,O, C,F		NO
WY	S,O,CO,U	O,CO,U	1EN.2MAT	1C,1MAT,1PAV	RC,AD	LS,LE,O, C	LS,LE,O, C	NO

Refer to Appendix A for the Questionnaire

Notations: * Questions 2a and 2c, S-Research Staff, RC-Research Council, O-Operating Units, AD- Administration,.
** Question 2b, B-Bridge, C-Construction, EC-Economics, EN-Environment, CO-Priv/Ind/Univ, G-Geotechnical, U-University, M-Maintenance, OT-Other, MAT-Materials, PAV-Paving, Pt. -Planning, P-Policy, T-Traffic, I-Istea, O-Other.
***Question 2d , LS-Limited Staff, LE-Limited Expertise, O-Operating Unit Req't., C-Complexity of Research, P-Department Policy, F-Funding Req't. [medium and high criteria are noted]
****See Table 2c in Appendix A for details of legislation.

product quality and process effectiveness (*6*). Those practices affecting the development of research needs are (1) top management maintaining active commitment to technology, paying attention to long-term technical needs and (2) the technical team's awareness of corporate strategy and change. The research unit understanding the goals of the individual business units is also important. (*7*)

The state research agencies responding to the survey questionnaire reflect widespread adherence to these practices. In more than 60 percent of the responding states a research council, representing agency management, selects the contract projects and approves the developed work program. As reported in Chapter 7, North Carolina enhanced the role of the Division of Highways and its management in the research process and improvements in research implementation have resulted.

To advance the goals of the operating units, more than 90 percent of the states involve them in the determination of research needs. Chapter 5 shows that the monitoring effort also has a high level of involvement of the operating units. The position of the "best practice" suggests that the research unit should develop a deeper understanding of the function and purpose of each of the operating units and increase personal contact. The project administrative and technical panels could include a discussion of the operating unit's role at their meetings. But project meetings provide only limited exposure to the research unit as a whole. Another means is to include operating unit's issues in advisory committee meetings. More of the research staff, and usually all of the research management staff, are present at these meetings and both the research and the operating units can have more meaningful interaction.

A special effort must be made to assess long-term technical needs. Literature scanning, professional meeting attendance, and networking with industry and academia can help keep the state abreast of the advances and needs in the transportation field.

Program Selection

In 1987, less than 50 percent of the states' research was contracted (*5*). Seventy percent of the 1994 state research project starts were contracted. In Table 2, limitations of staff and expertise and the complexities of the research are the most frequently reported reasons for selecting contract over staff research. Even if the trend is reversed, there will always be the need to maintain a responsive contract research program. The research unit and its management have direct control over research progress conducted by in-house staff. Alternative means of monitoring have to be developed to ensure that all aspects of the research are progressing satisfactorily when research is conducted through a contract.

The research needs developed by a state do not address all functional areas of the agency every year. The responsiveness of a research unit should be measured by its willingness to develop projects in the functional areas that show need. In 1994, only nine states had started projects on policy issues and 11 states started projects in the economics category. At the other end of the scale, 36 states started new projects in the bridge category and 34 states had new project starts in pavements. Table 3 shows the distribution of project starts by the states in 1994. Table 2 reflects the individual categories by state and defines the categories in a footnote to the table. Kentucky, in the 65th percentile for SPR and state funds and with only one department staff member, was the only state to start projects in 12 of the 13 categories. The University of Kentucky Transportation Center performs all transportation research for the state and has staff who administer the program.

TABLE 3

NUMBER OF STATES WITH PROJECT STARTS IN VARIOUS CATEGORIES IN 1994

	Number of Categories					
	1-2	3-4	5-6	7-8	9-10	11-12
Number of States	2	11	7	10	7	4

Of the 13 categories in which research projects were started in 1994, only the pavement category had more than 50 percent of the projects conducted by agency research staff. From 64 to 94 percent of the research of all the other categories was done by contract. The environmental, traffic, and economics categories were contracted more than any others (question 2b in Appendix A). Research units wish to retain at least a limited expertise in the various areas, but can be severely hampered by the increase in contract research. Developing innovative approaches could alter the way the management process involves staff, the operating units of the agency, universities, and private consultants in the development and conduct of the program. The management process itself may have to involve each of these entities on a different contractual basis, making each of them equal partners.

LEGISLATIVE REQUIREMENTS

Legislative requirements on the transportation research program are generally not restrictive. Of the 33 percent of the responding states whose program is affected by legislation, half must contract in whole or part with universities. Only one reporting state is not currently contracting with a university, but 40 percent of the states are not contracting with private industry.

CHAPTER THREE

CONTRACTOR SOLICITATION AND SELECTION

The procedure for selecting a contractor involves: soliciting qualifications of firms, conducting an explanatory meeting, receiving proposals, selecting firms to interview, conducting interviews and negotiating a contract with the selected firm *(8)*. This procedure can be varied to fit the many situations that agencies use to solicit and select a contractor. For state transportation agencies, the procedure can be used for the RFP process, sole source selection, or a targeted solicitation, e.g., within the state university system. In the FHWA solicitation process, described in Appendix C, there are five potential routes; sole source, invitation for bid, request for proposal, broad agency announcement, or set aside. Although more information is given for each of these in the appendix, states wanting more detailed knowledge of an approach should contact the FHWA Office of Contracts and Procurement in Washington, D.C.

Considering the size and anticipated increase in the state agencies' contract research programs, some organized solicitation and selection procedure is essential. Although 40 percent of the states responding to the questionnaire have no contracts with private consultants, all but one do have contract programs with universities. A private company reports that its use of universities is intended to increase access to new technologies and create a window on science and technology. The company's association with the universities has given them insight on avoiding overdirection and assuring interaction *(9)*. Although the university association has been well established in many states, the desire to continuously improve the relationship should be maintained.

The states currently have many pooled fund arrangements and are becoming even more involved with private partnerships. Limitless expertise exists in the private realm. To take advantage of this expertise, a state will have to make an effort to endure the longer contracting procedures. The basic agreement arrangement between the states and universities does not seem to have an equivalent in contracts with the private sector. This results in extensive negotiations with private consultants on the administrative issues of the contract, particularly the cost. A scanning of Table 4 (under the Solicitation Process) and the summary of the response to question 1e in Appendix B, reflects the states substantial use of universities in preference to private consultants.

ADVERTISING PROCESS

Two-thirds of the responding states send RFPs only to universities in the state. (See response to question 3a in Appendix B and for a listing of the individual states, refer to Table 4.) In some of these cases the RFP is responded to by only one academic. In other cases, the RFP does not scope the work effort and proposals are requested within a strategic category. In all cases, the proposals are subject to review. Some variations to this procedure are shown in the state case studies in Chapter 7. There is no common procedure used by all states.

Minnesota DOT has a considerable contract program with both the University of Minnesota and private industry. They have developed a set of forms and instructions for the potential proposers from the university. Issuing these instructions to the academic staff of the University of Minnesota is beneficial to both the proposer and the state. A project at the solicitation stage is subject to extensive discussion between the proposer and the issuing agency. When this discussion can be held within the bounds of technical issues, without the need to dispute the form of presentation, both parties save time. Minnesota explains every detail of the proposals; sample forms are shown in Appendix E, under "Preparation of Application of Project Work Plan." Almost all of the proposals from South Dakota are advertised to both the universities and private industry. They also issue information to potential proposers in the form of a set of "Guidelines for Performing Research for the South Dakota Department of Transportation." The Guidelines cover program administration, development and scheduling, proposal preparation, and a sample agreement with the state. A copy of the section on "Proposal Preparation and Submissions" is included in Appendix E.

Transportation agencies use the state universities for a variety of reasons. Besides legislative or policy requirements, there is the ease of contracting through the mechanism of a basic agreement (almost 80 percent of the states have basic agreements), the anticipation of savings because of reduced overhead charges, absence of fee charges, and the expectation that a positive influence will be made with the future professionals in the field.

Twelve states reported that there was no competition in the solicitation and selection process. Most other states use a competitive process only occasionally. New Jersey uses a competitive process for about half the contracts that are let. The other half are primarily contracted on a selective basis with academics of the University Transportation Center of Region 2. New Jersey's competitive contract process started in 1991. The first step is a request for letters of interest; the request stipulates a budget cap for the research. (An example of an advertisement for letters of interest is shown in Appendix E.) After evaluating the letters, New Jersey then asks for proposals from a short list of consultants, reviews the proposals, and negotiates contract terms with the best technical proposer. Time limits are set for each step of the process to ensure a fast cycle. Several projects have experienced extensive delays in the negotiating process, usually involving budgetary matters.

To shorten the process, one technique being considered is a prequalification of contractors by category of expertise. This will preclude the need to advertise for expressions of interest, but the problems of contract negotiations still remain.

SOLE SOURCE AND TASK ORDERS

A handful of states, e.g., Colorado, Minnesota, and Wyoming, issue sole source awards in addition to using an RFP process. The sole source method has several advantages:

- This technique primarily saves time in the contracting process;
- Advantage can be taken of the beneficial experience that the contracting agency has had with the contractor in the past and the relationship can be enhanced over time;
- A search for additional contractors may not be warranted; and
- Emergency investigations cannot be handled any other way.

The task order of a basic agreement with a university is the most common contracting technique used by the states. A basic agreement is not a contract with the university, but rather an understanding between the state and the university of "boiler plate" terms. With the addition of a task order and any other documents that the parties want added, the combination constitutes a contract. Task orders to basic agreements are usually only a few pages in length. They could contain the scope of work or reference to an attached document, the budget for the research, the principal contacts at the agency, the principal investigator, and reference to the terms of the basic agreement.

TABLE 4

CONTRACTOR DATA

Questionnaire: Question 3.0—CONTRACTOR SOLICITATION AND SELECTION							
State	Solicitation Process*	Competition**	Contractor Selection Basis***	Technical Criteria****	Imp.**	Contractors** Barred	Univ. Basic Agreement*****
AL	RFP-UNIV	Y-10%	T/B	U,A,E,S,F,D	Y	N	Y-ALL
AK	RFP-UNIV	N	T/B	U,A,E,S,F	Y	N	Y-ALL
AR	RFP-UNIV	Y-20%	T/B	U,A,E	N	N	Y-ALL
CA	RFP	Y-5%	T/B	A,E,S,F	Y	N	Y-ALL
CO	RFP,SS	Y-5%	T	U,A,E,S,F,D	Y	Y	N
CT	RFP	Y-100%	T/B	U,A,E,S,D	Y	Y	Y-ALL
DC	RFP-UNIV	N	T/B	U,A,E,S,F,D	N	N	Y-ALL
FL	RFP-UNIV	N	T	U,A,E,S,F,D	Y	N	N
GA	RFP	Y-10%	T/B	U,A,E,S,D	Y	N	N
ID	RFP-UNIV	N	T/B	U,A,E,S,F	N	Y	Y-LIMITED
IL	RFP-UNIV	Y	T/B	U,A,E,S,F	N	Y	Y-ALL
IN	RFP-UNIV	N	T	E,S,F	N	N	Y-ALL
IA	RFP	Y-10%	T	U,E,S,F	N	Y	N
KY	RFP-UNIV	Y-60%	T/B	U,A	N	Y	Y-ALL
LA	RFP-UNIV	Y-85%	T,T/B	U,A,E,S,F,D	Y	N	Y-ALL
ME	RFP-UNIV	N	T/B	U,A,E,F,D	N	N	Y-ALL
MD	RFP-UNIV	Y-5%	T/B	U,A,E,F,D	Y	N	Y-SELECT
MI	RFP-UNIV	Y-25%	T/B	U,A,E,S,F,D	N	N	Y-SELECT
MN	RFP,SS	Y-5%	T,T/B	U,A,E,D	N	N	Y-ALL
MS	RFP	Y-100%	T/B	U,A,E,S,F,D	N	N	N
MO	RFP-UNIV	Y-100%	T/B	U,A,E,S,F,D	N	N	N
NE	RFP-UNIV	N	T	U,A,E,S,F	Y	N	Y-ALL
NV	RFP-UNIV	N	T/B	U,A,E,S,D	N	N	Y-ALL
NH	RFP	Y-25%	T	U,A,E,S	N	N	N
NJ	RFP	Y-50%	T/B	U,A,E,S,F,D	Y	Y	Y-ALL

TABLE 4 (Continued)

Questionnaire : Question 3.0 -CONTRACTOR SOLICITATION AND SELECTION							
State	Solicitation Process*	Competition**	Contractor Selection Basis***	Technical Criteria****	Imp**	Contractors** Barred	Univ. Basic Agreement*****
NY	RFP-UNIV	Y-94%	T/B	U,A,E,S,F,D	Y	N	Y-MILITARY
NM	RFP	Y-90%	T,B	U,A,E,S,F,D	N	Y	Y-BR. TESTS
NC	RFP-UNIV	N	T,B	U,A,D	N	N	Y-ALL
ND	SS	N/A	T,B	E,S,F	N	N	Y-LIMITED
OH	RFP	Y-25%	T/B	U,A,E,S,F,D	Y	N	N
OR	RFP	Y-10%	T/B	U,A,E,S,F,D	Y	N	Y-ALL
PA	RFP	Y-100%	T/B	U,A,E,S,F,D	Y	Y	Y-LIMITED
RI	RFP-UNIV	N	T/B	U,A,E,S,F,D	N	N	Y-ALL
SC	RFP	Y-33%	T	U,A,E,S,F,D	Y	N	Y-ALL
SD	RFP	Y-100%	T	U,A,E,S,F,D	N	N	N
TN	RFP-UNIV	Y-90%	T	E	N	N	Y-LIMITED
TX	RFP-UNIV	Y-80%	T,T/B	U,A,E,S,F,D	N	Y	Y-ALL
UT	RFP	Y-90%	T/B	U,A,E,S,F,D	N	N	Y-ALL
WA	RFP-UNIV	Y	T/B	U,A,E,F,D	N	N	Y-ALL
WV	RFP-UNIV	N	T,T/B	U,A,E,S,F,D	Y	N	Y-ALL
WI	RFP-UNIV	Y-50%	T/B	U,A,E,S	N	N	Y-ALL
WY	RFP,SS	Y	T	U,A	N	N	Y-LIMITED

Refer to Appendix A for the Questionnaire

* Question 3a of Questionnaire in Appendix A, RFP-request for proposals from all, SS-sole source, UNIV-in-state university.
** (see table 3c in Appendix A for details on impediments), Y-yes, N-no, %=%of competitive projects (Question 3b in Appendix A)
*** Question 3c of Questionnaire in Appendix A, T-technical, B-budget, T/B-technical and budget.
**** (see table 3d in Appendix A for details on weighting criteria), U-understanding of problem, A-approach to solution, E-staff expertise, S-staff availability, F-facility availability, D-statement on deliverables (including implementation effort).
*****Question 3g of Questionnaire in Appendix A, ALL-type of research, Limited-"

The basic agreement and task order are frequently used as a form of sole source solicitation. For reasons stated earlier the combination will probably be the preferred method of contracting for years to come.

REVIEW PROCESS FOR COMPETING PROPOSALS

The primary basis for reviewing competing contractor proposals is either a technical evaluation or a combined technical and budgetary evaluation, with several variations to the procedures used with either technique. The advantages to the technical evaluation include the following:

- the contractor has freedom to be innovative in the proposal;
- the most interested and best contractors have an excellent chance of being selected;
- with the appropriate evaluation factors included, the most qualified team can be selected.

The technical and budgetary evaluation technique is actually a technical evaluation with budget negotiations conducted with the selected contractor. Occasionally, the budget is an accepted part of the proposal and negotiations are not necessary. The proposal must then be evaluated with all other projects to come within the agency's budgetary allowances.

Most of the states use a combination of the following factors in evaluating proposals:

- contractor understanding of the problem,
- research approach to problem,
- expertise of staff to be used on project,
- the availability of staff for the time limits of the project,
- the availability of equipment or lab facilities, and
- a statement on the deliverables.

The FHWA uses basically the same factors (note Appendix C), but the exact wording of the factors and their weighted value will vary with each project. Only half the states apply a form of weighing to the factors. The understanding of the problem, research approach, and staff expertise are the most frequently weighted factors, but receive priority attention from less than one in six states. There are obviously times when consideration should be given to weighing the evaluation

factors used to judge proposals. For example, the availability of facilities is not always relevant, but there are times when it is central to the conduct of the research. Weighing can account for these differences. The expertise and availability of the research staff are invariably important to all research. Without the talent there may be no means of conducting the research in the first place. A sample of the form used by NJDOT to evaluate proposals is shown in Appendix E. Although not shown in the example, the total weighing used by NJDOT for the criteria is 100 percent. Each factor of the evaluation may be given a different weight for each project, depending on the nature of the research.

BARRIERS TO SOLICITATION AND SELECTION

Besides the states where universities are the only recipients of RFPs (which occurs in two-thirds of the states), contractors are generally not excluded from submitting proposals. (See response to question 3f in Appendix B.) The few reasons given where contractors are excluded from proposing are: poor performance (5 states), conflict of interest (2 states), and fraud (2 states). Although three-quarters of the states do not prevent private consultants from participating in the competitive process, two-thirds of the states send RFPs only to universities. It may be to the benefit of the agency if a more expansive solicitation process were followed, one in which any qualified researcher could respond to an advertisement for research and not just university academics. In the extreme, when only university contracting is permitted, some research may be deferred because a qualified academic is currently overextended or did not perform satisfactorily in the past. But qualified researchers can usually be found in any field of transportation.

If the agency is interested in performing research in a timely response to the accepted problems, using the basic agreement and task order approach with a university is currently the most expeditious manner of researcher solicitation and selection. Contracting outside of the basic agreement will almost assuredly lengthen the process. A lengthening of the research process can sometimes be tolerated to ensure that the most capable investigator is selected. Research is programmed for accomplishment; there may be several instances where a delay can be tolerated.

The last area where obstacles delay a final contract is in the terms of the contract itself. Eight states apply an upper limit to the overhead charges. (See response to question 3e in Appendix B.) This item is often negotiated with the contractor. The overhead limit set by the state is intended to lower the total cost of the research. The overhead rate of the research organization reflects the actual cost of maintaining the organization and providing the support services. A compromise by both the agency and the research organization is a prudent course to advance the research effort. States have a wide range of fringe and indirect rates used with the universities. In addition, there is considerable variation between states on the allowable charges, as reflected in Table 5.

Two states have occasional problems with excessive budgets. Some states set the limit on a budget with the advertisement (New Jersey), but the budget frequently is negotiated with the proposer. There are administrative support delays (audit, legal) within some states that are problematic. These are internal issues that must be continuously reviewed and improved by each state.

UNIVERSITY ISSUES

Most states have a large share of their contract research program with universities. No discussion of contract research would be complete without highlighting issues important to universities. Some of the states have contract problems with the universities. An understanding of the university's point of view and priorities may serve to make future contract negotiations easier for the states.

There is no attempt to prioritize the items listed below. The list was developed on the basis of discussions with Dr. Louis Pignataro, Distinguished Professor and Director of the Center for Transportation Studies and Research at the New Jersey Institute of Technology and Dr. Kumares Sinha, Professor and Head of Transportation and Urban Engineering at Purdue University. It is neither an exhaustive compilation of issues nor complete in its breadth of discussion of a particular item.

- The primary mission of a university is the education of the student body. But research is an integral part of the educational process. Besides keeping faculty abreast of the latest developments in their field, research can show the student a disciplined approach to problem solving while also giving the student a practical introduction to the specific field of study covered by the research.
- Students are involved in most research projects conducted by the university. They are aligned with projects on the basis of their particular field of interest. However, students have their own priorities, primarily related to the courses and the course requirements in their major field of study. In addition, the students have varied backgrounds. With these backgrounds, some students do not recognize the inter-relationship of work on a research project at a university with their education or the needs of the client. The faculty of the university "bridges the gaps" that the student does not recognize.
- The teaching mandate of a university makes technology transfer second nature to its operations. Conferences, seminars and workshops are within the realm of desirable and managed activities.
- Tenured faculty have reached their position through a rigorous process that includes research. They have developed an expertise in a field of study sought after by the practicing community. Their abilities and knowledge are invaluable in deciding a course of action for research in their field. Sometimes, though, tenured faculty may view the transportation agency's problems as too pragmatic to be considered as serious issues for study. The desire for a more basic research is a high priority with the faculty.

TABLE 5

SAMPLE OVERHEAD RATES IN STATE-UNIVERSITY CONTRACTS

State	Overhead Rates		
	Fringe*	Indirect	Comments
CA	<10%	49%	School A
	34%	10%	School B
MN	38%**	40%***	
		10%	Adm. w/State Projs.
NJ	32.5%	59%	Private School
	24%	50%	Public, Out of State
NC	37.5%		Combined
SD	Actual Audited Rates		
ME	Federal Agency Approved Rates		

Notations: * Base is total salaries, unless otherwise noted.
** Salary base is students only.
*** Federal agency approved rate.

- Untenured faculty have a developing expertise in their fields, as their dissertation demonstrates. They are very willing and able to advance study in the fields at the suggestion of the transportation community.
- Academic freedom is a protected right of faculty. This freedom includes the intellectual property rights of their work. Individual faculty negotiate their own publishing arrangements with clients.
- Contracts are entered with universities. If the principal investigator leaves the university, the university has the option to replace the principal investigator with another qualified and willing faculty member. If none is found, the project may go with the faculty member at the option of the client.
- The "grant" program may be the most ideal contractual arrangement that a university enters between the research team and client. The team details the scope of work in a proposal that may be peer reviewed before the client grants funding for the study. Since most of the grant projects are for more basic research than that performed for a state transportation agency, the conduct of the study is more liberal in the direction it takes over time.
- University "administrative overhead" is not a high-priced item. Therefore, many amenities that are found in private industry cannot be provided, such as glossy reports or multimedia displays for the monthly meetings. Clients can expect a professional presentation of the research results, but not a "glamorous" one.
- Universities have a more difficult time "staffing" a project than private consultants, for a couple of reasons. First, a semester is the smallest increment of time in the university research program. Second, the areas of expertise of staff and the academic year for the students may not make a perfect match. Furthermore, the loss of students and staff due to turnover cannot be easily replaced.
- The forms used by public agencies from which consultants are selected are not easily responded to by universities. The form is usually designed for the "bread and butter" company. The coherence of the university is found mainly in its educational mandate, not with the assembling of a contract team.
- University relationships are usually formal. Because the school is not organized for the profit motive and many of the individual faculty foster specific fields of interest, a relationship with a state agency should stress these points. There are existing long-term associations between universities and public agencies founded in legislation that have become relationships with the closest rapport.
- The nature of the university (formal, not for profit, low overhead, student involvement, academic freedom) and its mandate (education) suggest types of study distinctively different from the private consultant. Similar relationships and contractual arrangements would not be appropriate between the public agency and the university as with the public agency and a private consultant.
- Contract requirements of various clients are sometimes difficult for the university to comply with. The most common problems arise in the accounting and insurance categories. For example, an academic's accounting of time is on a percentage of time basis rather than hourly. In addition, contract modifications that require a fast turnaround may also prove problematic because of education precedence and student involvement.

A thread of academic freedom and the mandate to educate can be seen throughout this list of issues. A state research organization should draw on these academic strengths throughout the research process. In program development, the state can take advantage of the expertise that exists in the

university. This same expertise can be channeled to respond to the project needs of the agency, through contract research.

Not all universities and states relate with all items on this list. The research manager is advised to pursue an investigation of the salient points with the universities with whom they contract. Because obstacles are not easily overcome, the pertinent points should be discussed at the earliest possible time. Both the state agency and the university may find considerable room for accommodation in future contractual arrangements.

CHAPTER FOUR

NEGOTIATING A CONTRACT

The process by which contracts are approved can be protracted both in private industry and in state agencies (*10*). The process is eased, however, when the basic agreement approach is used between universities and the states. But as more contracts are issued with private industry, the states will be looking for innovative techniques to hasten that process. Some examples of innovative techniques are:

- New Mexico's Alliance For Transportation Research (ATR), a consortium of Department of Energy Laboratories (Los Alamos and Sandia), universities (New Mexico State and the University of New Mexico), and the New Mexico Highway and Transportation Department. Research challenges are matched with the Alliance's resources to find solutions.
- California complements the expertise at Caltrans with other state agencies, when appropriate and available.
- Open-ended contracts are currently used to purchase specialized services and can be a research resource outside the university system. The contract should only be awarded for specific expertise and the state must carefully define the terms and participants.

DEVELOPING SCOPE OF WORK

The scope of work for research is considered a project development function of the agency. However, two-thirds of the states negotiate the scope with the potential contractor, suggesting that contract negotiations are part of the development phase. The size of a state's contract program does not play a role in whether or not the scope is negotiated (Table 6). Scope development is an involved process and varies from state to state. Although more than 90 percent of the states solicit research needs from the operating units of the agency, many contracted projects are scoped with the principal investigators.

The goal of the research program is the implementation of the results. A rule of implementation is that the objectives of the research address the needs of the operating units. The scope of work must be designed to achieve those objectives. Therefore, it is advantageous for the operating units to be part of the negotiating team developing the scope of the work.

TABLE 6

DEVELOPING SCOPE OF WORK BY SIZE OF CONTRACT PROGRAM

	Number of States	
Scope	>50% of Program Contracted	<50% of Program Contracted
Negotiated With Contractor	15	11
Set by State	6	7

SELECTING TYPE OF CONTRACT

The type of contract used by the states varies slightly between universities and private consultants. States prefer using cost reimbursable contracts with a ceiling and fixed-price agreements with universities, in that order. The reverse order is true when working with private consultants. Cost reimbursable contracts are used in only a few cases. The FHWA uses several award arrangements (see Appendix C).

NEGOTIATING TERMS OF AGREEMENT

More than 70 percent of the states reported that contract terms in the negotiating process were not particularly difficult. Table 7 indicates that states that contract solely with universities are not experiencing the problems that states with an open contracting policy may have. Part of the explanation for this difference is the existence of a basic agreement between the state and the universities, which previously covered the administrative terms of the contract. The choice of the contractor should not be solely based on the ease and speed with which contracts are consummated, however tempting it may be to direct the contract program to a relatively problem-free contract atmosphere.

TABLE 7

DIFFICULTY WITH NEGOTIATING CONTRACTS BY CONTRACTING AGENCY

	Number of States Experiencing Difficult Negotiations	
Contracting Agency	Have Difficulty	No Difficulty
Universities only	1	24
Universities and Private Consultants	9	6

Whether the contract is with universities or private consultants, the scope of work and the deliverables are the most important items for the majority of states. (See response to question 4c in Appendix B.) Next in order of importance are the schedule, reporting, publication, and implementation terms.

Many states responded that it is more expeditious to contract with universities through the basic agreement than without it.

The project schedule is the single most negotiated item. The scope of work, budget, and deliverables are the next most often negotiated items. Most other contract terms are set by the states. Of particular interest is the fact that technology transfer is an aspect of contracts in all but two reporting states. Most states reported no problem with any of the contract terms. Of the few states that reported problems, the items mentioned at least twice were indemnification, insurance, publication schedule, data rights, and scope. These issues were mentioned by both universities and private consultants.

NEGOTIATING MODIFICATIONS

When it comes to negotiating modifications to the contract, the budget is considered the most difficult by both universities and private consultants. (See response to question 4e in Appendix B.) The reasons related to the funding limits of the states and the objectives of the scope modifications, which cause the budget renegotiations to be less definitive than in the original contract.

The first reason is not wholly within an agency's control, but the second is readily influenced by the parties of the contract. The principal investigator may have the best thoughts of anyone on the requirements for modifications to the research project. The value of good communications becomes apparent when a principal investigator proposes the need for extended research in a specific area to the technical panel. Open minds and an understanding of the outcome of the project can effectively resolve differences of opinion.

The renegotiation of the scope is troublesome for a few states with private consultants. Frequently, the interaction of the technical panel with the research team is the key to an untroubled progression to the research. The states may have developed a strong interaction with a core group of academics over the years, resulting in the understanding and acceptance between the technical panel and the researcher. The infrequent use of private consultants has not permitted this type of relationship to develop. As literature suggests, communication is the key to improved interaction.

There is no easy comparison between universities and private consultants in terms of experience and expertise. Assuming this comparison has been made for a project, the progress of the research and the modification requests proposed by the research team should receive the same technical panel scrutiny, whether the team is a university or a private consultant. The research team has been selected for good reasons, namely those listed under the "Review Process for Competing Proposals" in Chapter 3.

CHAPTER FIVE

MONITORING THE CONTRACT

A state research organization may set several priorities for itself. High among them is the tracking of research projects to implementation and the state must give preferential monitoring to those aspects of the project that directly affect the implementation. As noted earlier, the states view the scope and deliverables as the most important aspects of the contract. Tracking a project can be problematic when it is contracted to an independent research agency because aspects of project control are taken out of the states' direct control and put under a contractual arrangement. To maintain the most effective control of the research effort and assure that the contractor is performing at a satisfactory level, the contractor should meet the following performance requirements (*11*):

- high level of communication between state and contract agency,
- good technical quality of the work performed,
- timely adherence to contractual milestones, and
- a high level of originality in the work performed (when applicable.)

An Arizona state DOT survey in 1992 (*12*) indicates that only two reporting states achieve 100 percent implementation. The majority of states get less than 50 percent implementation of their research, with one state reporting no implementation. North Carolina DOT has reported increased success with implementation since the involvement of Division of Highways staff in the development and monitoring efforts. (See the case study in chapter 7). Forming a successful technical panel can be accomplished in many ways. One is to choose a panel that has the operational needs and the desire for improved conditions. The panel chairperson should ensure that the panel members maintain a high degree of motivation. For support, a research staff liaison who has championed the research can help focus the research team. Every effort should be made to have a research staff member on the technical panels. The Virginia Transportation Research Council uses Research Advisory Committees for specific research disciplines. The membership of the committees is restricted to staff whose work is relevant to the program. Meeting attendance is important, even if a member has to send an alternate. Virginia has assessed that the advisory committee activities have played a very important role in the reputation for quality that the Virginia Department of Transportation enjoys.

The states' responses to the questionnaire regarding monitoring methods and actions, and contractor requirements are given in Table 8. Summary information on these items is given in Appendix B responses to questions 5a through 5g.

SELECTING METHODS TO MONITOR

Almost 90 percent of the responding states involve the research staff in monitoring the contract work; only Florida, Maryland, Missouri, and Pennsylvania do not. Table 9 shows that the size of the research staff has no influence on the method of monitoring contracts. The fact that those states which use only research staff for the monitoring effort have the lowest average staff size, is contrary to what might be expected. There are other factors that states must be using to decide monitoring techniques. Seventy percent of the responding states use some combination of technical panel, operating staff, and research staff to monitor the contract. The technical panels have operating staff representation. The primary benefit of involving operating staff is to increase the potential for implementation.

A direct contact between research staff and the principal investigator of the contract research is beneficial in acheiving the following advantages:

- continuing promotion of the project by the research unit,
- ongoing improvements to the research process,
- enhanced staff expertise, and
- technically creative products through research staff involvement with the operations units.

The Arizona state DOT survey reported the number of projects managed by a research staff member is normally between one and four. Fewer than ten states reported having an engineer manage more than five projects (*12*). From the organization considerations section of chapter 2, it was shown that more projects are monitored per staff person in the larger contract programs.

A method of maintaining research staff as monitors while not overburdening their workload is to reduce their involvement in other activities. Some states use research staff as administrative contract monitors and the technical panel as product and work task reviewers (see Table 1).

TRACKING PROGRESS OF WORK TASKS

Despite the fact that overruns of time and budget are a part of research programs, the majority of projects have time overruns of less than one year and cost overruns of less than 20 percent of the budget (*12*). As important as adherence to these items are to a research program, overruns can be tolerated if the expected deliverables are beneficial to the agency. One means of closely scrutinizing time on a project is a method

used by West Virginia. The contractor is required to report progress in terms of percent of task completed. (sample Project Task Completion form in Appendix E). The contract monitors can easily evaluate project progress. West Virginia requires this form monthly in addition to the contractor's written report on accomplishments. Minnesota is regularly improving its Automated Research Tracking System (ARTS), which provides easy access to summary information on research projects for a variety of users, while maintaining background data on funding for the Office of Research Administration personnel. ARTS yields separate screen data on the project (purpose, category, status), funding (by source), contract (dates), encumbrances (balance by source), payments, project panel, keywords, and final report. Sample project funding contract information screens are shown in Appendix E.

A review of the deliverables is an ongoing activity for most states, but the review frequently comes in the form of a progress report. One-third of the states reported having meetings on a quarterly to annual basis, and half the states reported that meetings are held on an "as needed" basis. Within a project, the attainment of notable milestones or the occurrence of problems are the usual reasons to hold a meeting. Some meeting schedules are set on the basis of the size of the contract and/or the perceived importance of the research. Although there may be a liaison staff person from the agency keeping contact with the principal investigator, project monitoring is a team effort that should strive for usable results.

The contract items receiving the most attention from the project monitors are the project schedule, technical progress, and scope. Following those is the budget (See the response to

TABLE 8

CONTRACT MONITORING DATA

Questionnaire: Question 5.0---MONITORING CONTRACT PERFORMANCE							
State	Contract Monitoring Methods*	Contractor Requirements**			Contract Monitoring Actions***	Close-Out Req'ts.****	TT w/Cont.*****
		Report	Meeting	OP			
AL	T,O,R	Q,F	R	F	V,W- S,T,SC,B,ST,I	A,FR	NO
AK	T,R	SA,F	V	F	V,W- SC	FR,P	NO
AR	R	SA,F	V	A	V,W,P- S,T,SC,B,ST,I	FR	YES
CA	R	Q,F	V		V,W,P- T,SC,B,ST	FR,EQ	NO
CO	T,O,R	Q,F	V	V	V,W,P- T,SC,B	A,FR	YES
CT	O,R,OT	Q,F	Q	V	V,W- T,SC,B P- B	FR,D	NO
DC	R	F	V		V- SC W- S,T,B	FR	NO
FL	O	Q,F	V		V,W- S,T,SC,B,ST P- S,T,B D- S,T,B	FR,I	NO
GA	T,R	SA	V	V	V- S,T,SC,B,I	A,FR,C	NO
ID	T,R	Q	V		V,W- S,T,SC,B,ST	FR	NO
IL	T,O,R	Q	SA	V	V,W- S,T,SC,B,I	FR	YES
IN	T,R	Q	SA	F	R- S,T,SC,B,I	FR,IM	YES
IA	T,R	BA	V	BA	PR- S,T,SC,B	A,FR,I	YES
KY	T,O,R	SA	SA		V- T,B,I	FR	YES
LA	T,O,R	SA	SA	A	V- T,SC W- S,I P- B	A,FR,E	NO
ME	T,R	Q		V	V,W- S,T,SC,B	A,FR,I	NO
MD	T,O	Q	SA		V- S,I W- B P- T,SC	A,FR	YES
MI	T,R	M	Q	F	V,W- S,T,SC,B,ST,I P- T,SC,B	A,FR	NO
MN	T,R	Q	Q	F	V- S,ST,I W- T,SC,B P- DL	A,D,IM	NO
MS	O,R	Q			V- S,T,SC,B,ST,I W- S,T,SC,I	A,FR,D	YES
MO	T,O	Q	Q	F	V- S,T,SC,B,ST,I	FR	NO
NE	O,R	PR	V		V- S,T,B W- SC	A,FR	YES
NV	R	Q	V		W- T,SC,B,I P- B	A,FR,IM	YES

TABLE 8 (Continued)

Questionnaire: Question 5.0—MONITORING CONTRACT PERFORMANCE							
State	Contract Monitoring Methods*	Requirements**			Contract Monitoring Actions***	Close-Out Req'ts.****	TT w/Cont.*****
		Report	Meeting	OR			
NH	R	V	A		V- S,T,SC P- B	FR	NO
NJ	T,O,R	Q	V		V,W,P- S,B	FR,I	YES
NY	O,R	Q	V	V	V,W,P,R- S,T,SC,B,ST,I	A,FR	YES
NM	R	Q	V	F	V- S,T,SC,B,I	FR,C	YES
NC	O,R	SA	A	V	V,W- S,T,SC,B,ST,I	A	NO
ND	R	V			V- T,SC,B	A,FR	NO
OH	O,R	Q		A	V- S,T,SC,I P- B	A,FR,D,E	YES
OR	T,R	Q	SA		V,W,P- S,T,SC,B,ST,I	A,FR,I	NO
PA	T,R	M/Q	V	V	V,W- S,T,SC,B,ST,I,DL P,RE- DL	A,FR,DL,I,E	YES
RI	O,R	Q	V		V,W- S,T,SC,B,ST,I	A,FR	NO
SC	T,R	Q	V	F	V,W,P- S,T,SC,B	A,FR	YES
SD	T,R	Q	V	F	V,W- S,T,SC,B,ST,I P- T,SC	A,FR,I,E	YES
TN	R	Q	Q	F	V,W,P- T,SC,B,ST	FR	YES
TX	T,R	SA	BA	A	V- S,T,SC,B,ST	A,FR	YES
UT	T,O,R		Q		V- S,T,SC,B,ST,I	FR,IM	YES
WA	O,R	Q	V		V- S,T,SC W- B	A,FR,I	YES
WV	O,R	M	Q	Q	V,W- S,T,SC,B,ST,I P- B	C	YES
WI	R	Q	V	F	V- S W- T,SC P-B	FR	YES
WY	O,R	Q			W,RE- S,T,SC,B,ST,I	FR	NO

Refer to Appendix A for the Questionnaire

Notations:

* Question 5a of Questionnaire in Appendix A, T=technical/adm. panel, O-opening staff, R-research staff, OT-other.

** Question 5b of Questionnaire in Appendix A, M/Q-monthly/quarterly meetings, SA-semi-annual mtgs, A-annual mtgs, BA-biennial mtgs, F-final mtg, V- varies or as needed.

*** Question 5c of Questionnaire in Appendix A, V-verbal, S,-scope, W-written adv., T-technical prog., P-pay't. deferment, SC-schedule, D-dismissal, B-budget, R-review, ST-staff, RE-removal from list, I-implementation, PR-progress report, DL-deliverables.

**** Question 5d of Questionnaire in Appendix A, A-audit, FR-final report, D-deliverables, E-equipment disposal, C-certification, IM-implementation plan/mtg.

***** (see tables 5e and 5f in Appendix A for details on contractor involvement)

TABLE 9

MONITORING METHODS COMPARED TO SIZE OF RESEARCH STAFF

Monitoring Method	Number of States	Average Staff (Range)
Combination of Research and Technical or Operating Staff	29	14.6 (1-60)
Research Staff Only	9	8.1 (1-35)
No Research Staff Used	4	13.5 (4-22)

question 5c in Appendix B). When a contractor needs a reminder to adhere to the contract terms, verbal advisories are used. More serious actions, such as payment deferments, are taken if necessary to prevent budget and time overruns and to ensure technical progress. Only Florida indicated that dismissal of a contractor is an action that could be taken, and Pennsylvania and Wyoming would remove a contractor from the eligibility list.

In monitoring contracts, the contractor's maintaining appropriate staffing levels and the project's potential for implementation receive attention in less than half of the states. (See response to question 5c in Appendix B). As difficult as it may be, all the contract terms require close attention from state monitors. Replacement of a project's principal staff member could have a more devastating affect than a budget overrun. A few states view all terms of the contract as equally important and they are willing to remove a contractor from a future eligibility list for serious infractions of the terms. The evaluation of contractors should be commensurate with the level of risk of the research (*6*). It is not enough to monitor the work tasks of the contractor; the review team must also evaluate the technical work, judge the progress against the budget and provide feedback to the contractor.

TRACKING EFFORTS LEADING TO IMPLEMENTATION

Opinions and methods differ over the way the states involve contractors in the implementation effort. Forty percent of the responding states reported that contractors are not included in any aspect of the technology transfer effort. Conversely, 12 of the responding states want the contractor to assist with

training sessions and seminars on select projects. Four states ask the contractor for an implementation plan but fewer ask the contractor for a presentation of the findings to staff or for an audiovisual tape. The SHRP process, described in Appendix D, notes that a conscious effort was made to refrain from including any aspect of the implementation effort in the contract research. The implementation effort was undertaken subsequent to the study.

There are several reasons for limiting the contractor's involvement in the implementation process: lack of contractor knowledge of the internal processes of the agency; desire not to divert the contractor's focus from the objectives of the research; need for separate work plans for the research effort and the implementation effort (only four states ask the contractor for an implementation plan); and specialized disciplines required for the implementation effort may be different from those of the agency conducting the research.

Although the contractor does not have primary responsibility for implementation, states view implementation as a priority and it is generally accepted that the process should start with the development of the scope of work.

Technology transfer techniques and implementation methods are discussed in chapter 6. Each research project and the agency's internal organizational structure and interaction with other agencies should be considered when developing implementation procedures.

DEALING WITH SPECIAL ISSUES

The importance of effective communication between the state and the contractor during the contracting and contract monitoring processes cannot be overemphasized (*11,13*). Kreiger Henderson, a former director of the NCHRP, stated it pragmatically when he said that "Experience has demonstrated that once contracted, the practical fact of life is that the destiny of the research is pretty well committed no matter how extensive the staff surveillance or how many administrative procedures are available to accommodate changes" (*13*). A clear statement of the research issues and their resolution should be understood by all parties to the contract. Ambiguity in any of the work tasks can lead to protracted discussions of contract modifications during the actual research phase. Ambiguity can be reduced or eliminated through early, concentrated discussion of the issues.

Several comments and questions were raised by the managers of research units with the returned questionnaires (see response to question 5g in Appendix B). Not all of them relate to monitoring a contract, but their inclusion is relevant.

- "There is an imperative to identify competent contractors." Evaluation techniques that quantify the performance of contractors would be useful if maintained on a broad basis, regionally or nationally. The Research Advisory Committee (RAC) could be the focal point of these evaluations. However, care must be exercised to maintain fair and comprehensive evaluations.
- "Private contractors are not responsive." Several problems exist with any contractor, but the private contractor usually requires lengthy negotiations. The negotiations that occur with modifications to a contract reflect the strength of the communication bond between the state and the contractor. The maxim that the bond between the agency and a contractor is formed at the negotiating stage cannot be repeated too often.
- "Research units should seek funding beyond state planning and research funds." The responses to question 1d on program funding (Appendix b) indicate that the states concur.
- "Separate units conduct research within the DOT." The case study of Minnesota depicts how successfully this type of arrangement can work.
- "The technical advisory committee improved the focus of contract research." Benefits of such a committee are numerous. The primary players of an agency are brought together to act as a cohesive force for the agency.
- "The state is considering using an RFP process instead of going solely with the university." There is a range of experience with the RFP process. The expertise of potential proposers is broadened, but at the expense of less timely contract document closures.
- "There should be an alliance for transportation research between industry and government." The interaction of government and industry for transportation research has positive potential for both parties. Industry can be the party at the table that they deserve to be and government can develop its research strategy with all affected parties. The added benefit to government is the possibility of private funding for an expanded research program.
- "A means must be found to expedite past due research reports." The final report is one of the most important deliverables of a research contract. The contract between the state and researcher should give appropriate authority to the state allowing for the withholding of payment in these situations. Future contract awards can also be withheld from the unresponsive agency. With effective, continuing communication and monitoring techniques in place, this should occur rarely.
- "What happens to a study when the principal investigator leaves the university?" In chapter 3, this issue is addressed from the perspective of the university. Most, if not all, contracts fail to include this contingency. A solution is to have the contract follow the principal investigator, but the contracting research agency may be reluctant to make the required contractual arrangement.
- "Do university contracts reference OMB-21?" All university research contracts using federal funds reference OMB-21. A copy of the latest revisions to the circular on "Cost Principles for Educational Institutions" is available from the FHWA division office. This document should be the resource for contract terms and references.
- "Disposal of equipment." The contract terms note the ownership rights of equipment purchased for the research project. The funds used for purchase of the equipment dictate the process to follow. If federal funds are used for the contract, FHWA regulations dictate the procedure to follow.
- "There are excessive in-state audit requirements." Each state has its own regulations that must be followed but there are also federal regulations. Frequently, a university may not have an

accounting system that is responsive to small transportation research contracts. As noted in chapter 3, there are other time-reporting differences that have to be dealt with in university contracts.

- "The amount of retainage is problematic." Not all agencies have retainage clauses and the amount of retainage selected is usually a little less than the fee; it is not meant to be punitive, but serves as a small insurance policy for the client.

CONTRACT CLOSEOUT

The formal closing of a contract has practical advantages. All parties are made aware of the shift of responsibility from the research agency to the state at the end of the funding. The implementation effort can proceed on the basis of formally accepted findings approved by the technical panel.

The final report is the document required to close out a contract. More than half the states require an audit, however, the audit requirement for a university that is regularly used by a state may be waived and annual or biennial audits of all contracts closed out in that period may be more practical. Invoices and deliverables are a necessary part of the contract closeout procedure. A final payment for the products contracted should be formalized.

Although only two states indicated that a formal process was used to terminate a contract, the requirements mentioned would indicate that a process is used universally. As noted in Appendix C, the FHWA's contract closeout process includes a final report or product, the disposition of equipment or property, audit closeout, and a final payment.

CHAPTER SIX

IMPLEMENTATION OF CONTRACT RESULTS

Implementation is defined as ". . . that part of the technology transfer process concerned directly with the mechanisms of putting specific sets of research findings into practical use. The full implementation process includes the development of revisions of policy, plans, specifications, standards, and so on, that must occur before new knowledge can be incorporated into practice." *(2)* There is overwhelming support for the notion that research results should find their way into practice. The manner in which this is accomplished varies with each state.

South Dakota Process

South Dakota has a two-pronged approach to implementation. The bottom up approach involves staff tracking the research effort and fostering implementation in conjunction with the operations units.

The top down portion was instituted in 1992. A detailed explanation of the top down process is given here as an example of what can be done. The forms used throughout the process are found in Appendix E. The project technical panel evaluates the research findings relative to the research objectives and tasks that were issued with the RFP. Comments are made on each objective and task regarding the completeness and acceptability of the researchers' work. Finally, the contractors' recommendations are approved or rejected. The accepted recommendations are analyzed for the most appropriate way to put them into operation. The panel's comments are circulated throughout the department for region and division manager comment and approval. A final set of recommendations is presented to departmental upper management (Research Review Board) for comment and approval. The Secretary of the Department of Transportation gives the final sign-off for the recommendations. At this point, a responsible division of the department is appointed for each of the recommendations. The office of research tracks the progress on each recommendation.

INVOLVEMENT OF CONTRACTOR STAFF

A Colorado study of state research organizations found that 21 of the 34 respondents (62 percent) had a formal process to implement research findings *(14)*. The questionnaire used to supplement this study also showed that 60 percent of the respondents involved the contractor in the technology transfer effort.

The contractors are involved in the technology transfer effort in various ways. Most frequently, they give seminars or training sessions to agency staff. These can have good results because staff most directly involved with the implementation of the research results have the opportunity to interact with both the principal investigator and other operating units on the merits and methods of implementation.

Indiana, Minnesota, Nevada, and Utah ask for an implementation plan from the contractor. The most useful plans have input from the technical review panels. Principal investigators may not have sufficient knowledge of the work flow or the extent to which other agency units are affected to be able to design an effective implementation plan. The plans submitted by contractors along with their research results can serve as useful starting points for a large-scale implementation effort. As noted in chapter 5, there are reasons for limiting the contractor's involvement in the implementation effort.

The least-asked-for item from a contractor is an audiovisual product, which is sometimes submitted with a training session. While a tape can replace repeat visits by the principal investigator, and is useful in showing the conditions and effects of a process, the trainers showing the tape must be well-informed on the project results. The explanation of the process and the proposed changes are better handled by a speaker who can respond to questions.

TECHNOLOGY TRANSFER METHODS

Utility of Research

There is no recent information on how states perceive the usefulness of research. The 1987 state research manager survey by Reilly *(5)* placed research by universities and consultants lower in usefulness than work by state research staffs, USDOT, and NCHRP (Table 10). Since this survey, states have improved their implementation techniques as well as increased their contract work with universities. The implementation process with the universities is under continuous review and constant refinements are being made. This will undoubtedly increase the usefulness of university research for states.

Generalized Process

No research study should be conducted in ignorance of knowledge that has preceded it. The following outline of technology transfer techniques stresses the importance of this continuum of knowledge. Documentation from research studies

TABLE 10

STATES PERCEPTION OF UTILITY OF RESEARCH BY SOURCE (1987 Survey) *(5)*

Source of Research	Average Rating (On a scale of 1 to 5)	Number of States Rating Source Less Than 3
State	3.6	4
USDOT	3.3	4
NCHRP	3.3	5
University	2.9	12
Consultant	2.5	17

must find its way via an information system to users. This way, the research is assimilated, evaluated, and incorporated either into another research project or an implementation effort.

Documentation of a study typically takes the form of a written report, but many techniques are available: presentations, training workshops, hard copy distributions, and text entrees into computer files for subsequent retrieval. A tangible deliverable can also be produced, such as a process or material specification or prototype.

Documentation is provided through several international outlets *(15)*:

- Personal networking,
- Professional meetings,
- Professional publications,
- University, state, and federal training programs,
- Reports from research and operational professionals in the transportation field, and
- Retrieval systems such as TRIS and the National Technical Information Services.

Networking, attending professional meetings, and searching online data bases were considered to be the best means of finding sources of external technology.

The final part of the process, the assimilation, evaluation, and incorporation of the results, is the lengthiest and most difficult. It is here that the factors in a successful technology transfer—credibility, champions, and communication—apply more than anywhere else *(15)*. The credibility of the research is decided at this phase. To incorporate the results will require the strong support of management. Effective communication among all levels of the agency and outside organizations is essential to the process. Champions of the technology must exist, both within the research unit and the agency. The evaluation effort may involve experimental projects, as well as multidiscipline staff meetings within the agency.

Impediments to Implementation

Items put forth as impediments to the implementation of research by staff at the NCDOT, Division of Highways, included a lack of effective communication with the principal investigator, poor alignment of the research to operational needs, shortage of funds, and resistance to change. Cutler summarizes the literature on the subject and lists the following obstacles to transferring technology *(15)*:

- The not-invented-here syndrome, which he states can be nullified if new technology is aimed at addressing the agency strategy, and the research team understands the strategy;
- Technology cannot be pushed into an agency; it must be pulled. This supports the effort to involve the operational units of the agency in the development of the research program.
- Technology must take place the way the recipient wants it, not the way the provider thinks it should be done. The operational processes should not be completely overhauled to accommodate technology unless the cost and effort of the organizational changes are worth it.
- Other obstacles include physical and cultural distances, inappropriately trained staff, and solutions in search of a problem.

TRB *Special Report 202* stated the impediments more succinctly: "Research often fails to change practice because of limited understanding, organizational inertia, inflexible standards, preoccupation with first costs, mistrust of change or a desire to perpetuate jobs."*(16)*

Enhancing Technology Transfer Efforts

Recognizing the importance of implementation, NCHRP has undertaken a major research effort, Project 20-33, "Facilitating the Implementation of Research Findings." The objectives of the research are to (1) identify and evaluate the significant factors that influence the implementation of research findings, (2) determine ways to improve technology transfer and facilitate interagency and public-private cooperation in applying research results in surface transportation, and (3) recommend strategies to create an environment conducive to innovation and timely application of research findings in surface transportation. A published report is expected in 1996.

A study was conducted several years ago on techniques to enhance the utilization of research results. The results were published in Transportation Research Record 738 *(17)*. The authors concluded that following basic principles increased research implementation:

- The research results must be timely,
- Policy variables must be identified and the way each institutes change must be shown,
- The researcher and user must be partners in all stages of the work,
- The researcher must translate results into an understandable language,
- The research must be objective,
- A rapport should exist between the researcher and the implementing agency, clear communication between researcher and agency is essential, and
- Implementation must be planned from the outset of the research.

Implementing research results is a continuous and time-consuming process. A state's implementation methods must conform to the agency structure and the nature of the research project. Several methods have been described by Rutherford and Brooks to transfer technology in the Washington State DOT (*18*). These methods are:

Conferences: formal displays, presentations and networking are among the opportunities that exist at conferences, which can be either attended by or conducted by the research unit.

Meetings: depending on the size and number of issues covered, the meeting is a formal opportunity to thoroughly discuss research; networking is enhanced when associated with professional organizations.

Reports: although the least communicative of the methods, reports are frequently the first and only contact with a particular research study; further investigation requires pursuing any of the other methods.

Newsletters: quick and effective access to abstracted research; several states publish newsletters regularly.

Training: with multiple communication methods, an interactive experience and a focused subject, training is an effective technique to assist aency staff to adopt innovation.

Procedures: usually formalized in manual form, procedures describe the standards, specifications and practices of the agency; the implementation of improved procedures is obviously time-consuming.

Committees: internal agency committees provide the range in disciplines and the center for support for innovation.

Workshops: a hands-on training technique conducted by either the agency or the FHWA.

Agents: representatives of the research unit and/or operations serve in the capacity of a technology transfer agent, bringing conceptual innovation to the agency.

Demonstrations: a working installation frequently conducted with a workshop for the benefit of operations staff.

CHAPTER SEVEN

CASE STUDIES

California

1994 Background Information:

Program Funds—$7000k (SPR), $4260k (State)
Organizational Reporting—Transportation Management
Staff—35 (Division of New Tech. and Res.)
Contract Projects—44 (Univ.) 14 (Cons.)
Staff Projects—55

The California Department of Transportation (Caltrans) uses a blended research system that incorporates in-house research with contracted research at universities, other government agencies, and private organizations. This blended system supports four separately funded research programs: a) the facilities R&D program, which includes the state planning and research (SPR) program; b) a traffic operations research program that is wholly state funded; c) a state-funded seismic retrofit research program; and d) the Advanced Transportation Systems research program that combines state, federal, and private funding and partnered worksharing to research intelligent transportation systems (ITS) technologies and applications. The case study reflects the facilities R&D program. The others have similar restrictions and use similar methods.

History

The facilities R&D program dates to the mid 1950s. It has always been a blended system, but began with a much higher proportion of in-house research than is now pursued. As early as the 1960s successful research was being performed by the California universities. These successes led to a specific contract program in 1983 with the University of California's Institute for Traffic and Transportation Engineering (ITTE) at the Berkeley campus. The program is now called the Institute for Transportation Studies (ITS) and includes the Davis, UCLA, and Irvine campuses of the University of California. A master agreement is used to simplify individual approvals for subsequent research projects. Additional research was pursued through the California State Universities. In the late 1980s Caltrans began using universities outside the state for specific research.

In addition to universities, Caltrans has contracted with other government agencies. This approach has been especially efficient where the other agency has expertise complementary to Caltrans' transportation engineering expertise or would have more direct access to required data or data collection systems. Caltrans has also performed contract research with private organizations, when they possess expertise on specific subjects not available through the other mechanisms.

Several factors limit contract research in California. First, the state constitution requires all work that can be accomplished by civil servants be done that way, with few exceptions. Lack of staff has not been a valid reason for contracting, but lack of expertise may be. Because the language of this requirement is open to interpretation, several lawsuits have sought to clarify it. An interim decision in one lawsuit has further restricted the range of allowable reasons for using contracts. The required justification and reasons given for seeking outside expertise have become more stringent.

A second restriction to contracting is the limited application of sole source contracting. Because of apparent misuse, sole source contracting has been very difficult to pursue except where the work is done by a public entity, including public universities, which can be granted an exemption.

A third contracting limitation is directly related to the economic recession in California. It is very difficult for state agencies to get approval for out-of-state contracts while California has a high unemployment rate.

Finally, contract reviews of the requisite documents are very time consuming. An extensive legal review within Caltrans is followed by an oversight review by the Department of General Services. If the contract exceeds $1 million it must be approved by the Caltrans umbrella superagency, the Business, Transportation and Housing Agency, which takes 4 to 10 months.

In spite of these limitations, contract research has increased from $2.5 million per year in the mid 1950s to $8 million in the mid 1990s. Over this 40-year period Caltrans staff has decreased but the total number of projects has remained in the 120–150 range.

Program Development

Traditionally the research program is developed through a departmentwide solicitation of "problems needing solutions." Projects are also generated in response to litigation, disasters, and emergency needs. Solicitations have normally been requested separately for the multiple needs of the research program: Caltrans research, NCHRP problems, pooled-fund studies and each of the other programs not within the facilities R&D program. Consideration is now being given to using a continuous solicitation process, accepting all types of problems.

The solicited problem statements are shared with appropriate functional divisions which screen, prioritize, and define the final project. The prioritized projects are placed in a composite

program and submitted to the Caltrans R&D committee for reevaluation and program determination. The R&D committee, composed of select division chiefs, recommends a program of projects to the Caltrans deputy director for transportation management for approval before transmittal to the FHWA.

All projects are conducted in-house, as dictated by policy, unless a lack of Caltrans expertise necessitates contracting.

Formerly, the Office of Research prepared project contracts. Project work, monitoring, and report approval were performed by the designated functional unit manager. Currently, the subject-specific contract documentation and contract monitoring are performed by the functional unit; the general contract documents are prepared by the contracts office.

Contractor Solicitation

Contractor solicitation and selection are normally the responsibility of the designated Caltrans project manager. If the required expertise is known to exist in the California university system and the knowledgeable person has the time, desire, and staff assistance to perform the research, then a sole source request for research can be issued. On receipt of a proposal from the selected contractor, the scope of work and the budget are negotiated by the project manager from the functional unit. The technical information is used by the contracts office to complete an agreement with the contractor which must then be approved by the process previously defined.

If the required expertise is known to exist somewhere within the academic system, a limited RFP is sent to that part of the system. Contractor selection would then proceed with a review of the proposals received, using the criteria described in the RFP. After a contractor is selected, the work plan and budget are negotiated. This information is again given to the contracts office to prepare the contract. Most university contracts use an existing master agreement, which is referred to in the developed technical agreement.

When the required expertise does not exist in academia, or is not specifically known, a general RFP is advertised in the State Contracts Register and professional periodicals and is sent to university contracting offices and private contractors. The proposals received are reviewed using the criteria defined in the RFP. After a proposal has been selected, the scope and budget are negotiated; the general contract terms are compiled by the contracts office for execution.

Contractor Selection

In sole source contracts, the contractor is selected on the basis of expertise, specialized equipment and facilities, or proprietary data. In all other cases the contractor is selected by the project manager on the basis of the criteria listed in the RFP. The proposals' ability to meet the criteria and project objectives are scored and the proposals ranked. Scope and budget negotiations are conducted with the top ranked contractor. If the scope cannot be negotiated, the second ranked contractor may be contacted for negotiations. There is no obligation to award if the project objectives cannot be met.

Negotiating Agreements

Fixed-price agreements are currently used for all contracts. This arrangement gives more latitude to both the researcher and the financial monitor in tracking payments. It also conforms to the university's contract office invoicing process. Except liability, all terms of the agreement are negotiated. The research methodology, schedule, and deliverables are reviewed by a project committee for large or complex projects. Negotiations and contract modifications are deemed to be more amicable with the university system than with private consultants. One reason is the state's long-term relationship with the universities, which has been made easier with the basic agreement.

The deliverables of projects have always been problematic with contract research, but universities are being pressed to appreciate the importance of reporting. The total burden (fringe benefits plus indirect costs) varies among universities. At one university, the fringe is less than 10 percent of the investigator's salary and the indirect charges are 49 percent of direct costs. At another university the fringe is as much as 34 percent of the investigator's salary and the indirect charges are only 10 percent of the direct costs.

Monitoring Contractor

Small projects typically are monitored by the designated project manager from a functional area. Project technical committees are formed for the larger, complex contracts and may have nondepartmental experts on the committee as well as appropriate department staff. A committee's responsibility is generally for project direction and review. Day-to-day monitoring is performed by a contract monitor, who is appointed by the functional area to provide project continuity and accountability. Contract monitors evaluate invoices, progress, deliverables, and timeliness of the project using a standard quarterly report and approve invoices for payment after satisfactory completion of the designated tasks. All monitors are supposed to be trained in the legal requirements of contracts and they have the authority to reject payment of invoices for substandard or otherwise unacceptable work.

A formal process exists to close out contracts. A letter report developed by the contract monitor gives the status of all items required for project completion and is sent to the FHWA for federally supported projects. The items include the final report, total contract expenses, salvageable value of equipment purchased for the project and its disposition, and an estimate of the savings for a 3-year period if the findings are implemented.

Implementation of Results

Implementation of research results is variable. When training is part of the contract, or is undertaken by the contract

manager, implementation proceeds rapidly. There is some degree of technology transfer through subsequent contracts that address implementation directly, rather than using the research contract. For most contracts implementation results from report distribution rather than from a concerted effort within the project.

A discontinued quarterly research newsletter historically contained a technology transfer article. A renewed effort to improve the implementation process is planned and it will take advantage of the findings of the NCHRP project on implementation and consider the reorganization within Caltrans.

Over many years of experience with contract research, Caltrans has used several mechanisms with varying degrees of success, which often depends heavily on the contract monitor. Caltrans has developed effective relationships between the universities, Caltrans functional units, and the office of research. This relationship accounts for the strong research program despite staff reductions, department reorganizations, and a down-turned economy. Contract research has expanded over time. It provides the bulk of the solutions to the research needs of the department and it is constantly evaluated to improve the implementation process. Details on any aspect of the research program at Caltrans can be obtained from the Chief of the Office of Research, 916–654–9776.

Minnesota

1994 Background Information:

Program Funds—$1110 k(SPR), $6010k (State)
Organizational Reporting—Planning
Staff—12 (Office of Research Administration)
Contract Projects—88 (Univ.) (35 Cons.)
Staff Projects—40

Management of the Minnesota Department of Transportation (MnDOT) has developed a strong research environment. An effective program development and project investigator selection process exists between the Center For Transportation Studies (CTS) at the University of Minnesota and the operating units of MnDOT. University staff are sought after as primary participants in the MnDOT research program. The Guidestar program has considerable traffic management experience and stable funding and provides effective solutions to traffic problems in the Minneapolis-St. Paul area. The Minnesota Road Research Project (MnROAD) has strong financial support and the potential to address Minnesota's pavement design concerns.

History

Until recently the work of MnDOT's research unit concentrated on materials and pavement. One of the earliest programs, the Minnesota Local Road Research Board (LRRB), was started in 1959 to perform maintenance and construction research for municipal and county road authorities. In 1980, at MnDOT's request, the legislature authorized the Cooperative Program For Transportation Research (COPTRS), which dedicated funds for the University of Minnesota. A basic agreement between the department and the university ensured that the research needs of the department would be addressed. Upper management oversight and strategic direction were given by the predecessor of the Research Management Council, which continues this function with quarterly meetings. The result was a research program expanded from materials and pavement efforts to include traffic and eventually all functional areas of the department.

Several organizational changes were made with research over the past 10 years resulting in the current Office of Research Administration (ORA), the Office of Minnesota Road Research, and the Office of Special Projects/Guidestar. The ORA is responsible for the research needs identification, program development, project management, technology transfer, project implementation, and contract management functions. The Office of Minnesota Road Research conducts research with staff and manages the MnROAD program. The Office of Special Projects/Guidestar uses a multimillion dollar program to advance transportation user service for the state and national community in the IVHS (ITS) project category.

In 1989, the CTS was formed at the University of Minnesota and the Institute for Transportation Systems was added to it with federal funding from the ISTEA legislation. Additionally, MnDOT's district offices financially support the Maintenance Operations Research (M.O.R.E.) program.

In 1980 the research program had a staff of 8 and a budget of less than $1 million. Including all the financial and organizational resources available to research in the department, the FY '94 research program had a staff of more than 40 people and a budget of almost $12 million. The ORA is only a part of the overall program. The other components are listed in the following sections.

Program Development

MnDOT formerly developed its research program from the suggestions of research staff. But in 1992 the department reached out to the statewide transportation and government community for research needs. Brainstorming sessions were conducted for local roads, materials, traffic and safety, bridges, environmental, and construction activities. This program development process included projects in the IVHS (ITS) category of the Guidestar Project. Hundreds of ideas for research were condensed to 20 in each category. The screening, evaluation, and scoping of the 100 prioritized ideas proved very unwieldy for the research staff and subsequently a modified process was devised using a focus group. The focus group reviewed suggested topics prior to a meeting at which the group developed problem statements and suggested researchers and project reviewers for each project. This later process is the one MnDOT will use every 2-3 years to assemble a major part of its research program.

In addition to funds available for the Guidestar Project, MnDOT has several financial resources available to address research:

- State Planning and Research (SPR)
- Cooperative Program For Transportation Research (COPTRS)
- Maintenance Operations Research (M.O.R.E.)
- MnROAD Project
- Center for Transportation Studies (CTS)
- Local Road Research Board (LRRB)
- Various office operating budgets.

The abundance of funding sources and capable researchers allows MnDOT to address many of its most critical research needs, but the proliferation of research talent forces considerable brokering before the work program is assembled.

Contractor Solicitation

After determining which projects will be conducted in-house by the Office of Minnesota Road Research, the remaining problem statements from the described process are submitted to the CTS at the University of Minnesota. The CTS categorizes the problems and advertises selectively within the university system, which generally results in only one proposal for each problem statement. MnDOT has developed a formal procedure for the preparation of project proposals (See Appendix E). The highest ranked projects are then selected within the available funding. The remaining problems are considered for NCHRP submission or pooled-fund efforts. An RFP process is being implemented for projects in the traffic and environment categories to solicit private consultants. The Guidestar and the MnROAD Projects selection processes are now administered by the ORA.

Contractor Selection

Academics submitting proposals are expected to scope the project and provide a schedule and budget for the effort. A copy of the detailed instructions given to university proposers is included in Appendix E. Because the problem statements are sent to the appropriate area within the university, it is unusual for more than one proposal to be submitted in response to each problem statement. MnDOT's technical experts, contact persons, problem originators, and ORA staff form a technical advisory panel (TAP) to evaluate the proposals. There have been occasions when MnDOT bypassed the advertisement and selected a specific academic as the principal investigator when a direct match existed.

The highest ranked projects are then selected within the available funding. The remaining problems are considered for the NCHRP or pooled-fund efforts.

Negotiating Agreements

A basic agreement is executed biennially between MnDOT and the university to establish essential standard language. Subsequent task order contracts are used for individual projects. Lump-sum agreements for each contract with the university have recently replaced cost reimbursable agreements. The research methodology, budget and deliverables are negotiated between the TAP and the proposer. Publication rights are not an issue as the academic freedom of the principal investigators is a time-honored principle. Staff at ORA enjoy good working relations with the university academics.

The total burden (fringe and indirect costs) varies with the staff on the project and the funding source. Fringe is applied at 38 percent of the graduate assistants' salary, but not to the principal investigators. Indirect charges are applied at the negotiated federal rate (currently 40 percent) of modified charges for nondepartment funded projects, but there is no indirect charge on state funded projects, which have a 10 percent charge on modified costs for administrative support.

Monitoring Contractors

The TAP determines the procedures that will be used for monitoring the technical progress of the individual projects. Each panel has historically had one project to oversee, but the program has grown so large that panels sometimes assume responsibility for several related projects. The panels are assisted in their efforts by full time research coordinators in traffic operations and maintenance. This concept will soon be expanded to the other functional areas of the department.

Staff of the ORA track expenditures on the projects. The ORA staff panel member judges the status of work against the invoice on cost-reimbursable contracts. Close monitoring by the TAP usually allows it to foresee the need for contract extensions in either time or cost. MnDOT has developed an Automated Research Tracking System (ARTS), which provides information on the project, funding, contract, encumbrances, payments, panel, keywords, and final report. An example of the project and funding screen information is shown in Appendix E.

State law requires an audit on each contract at closeout. There is no retainage on University of Minnesota contracts. Notation is made on the last invoice that it is the final payment.

Implementation of Results

MnDOT has recently incorporated implementation milestones within its research process. These include:

- Research needs (problem statements) identify in general terms the potential benefits and possible avenues of implementation of the research results. This is the responsibility of the functional (operational) unit that submits the problem statement. A copy of the Transportation Research Problem Statement form used by MnDOT is in Appendix E.
- Research work plans address implementation benefits and approaches in more detail. This is the responsibility of the principal investigator with panel input/review.

- A detailed implementation plan is developed before a final research report is published. This plan addresses technology transfer methods, product development, organizational (marketing) issues, and evaluation methods. The affected functional group is responsible to develop and execute this plan. Research funds and technology transfer staff are available to support the execution of the implementation plan.
- A separate report provides an evaluation of the research project through implementation. This is the responsibility of the ORA.

The research effort at MnDOT is coordinated by the Office of Research Administration, using all functional areas as active participants, the Offices of Minnesota Road Research and Special Projects/Guidestar (ITS) as research participants, and the University of Minnesota as a pool of research investigators. Both cost-reimbursable and fixed-price contracts are currently being used with the University. For more detailed information on the MnDOT program, contact Director of ORA, 612–282–2267.

New Jersey

1994 Background Information:

Program Funds—$3238k (SPR) $0 (State)
Organizational Reporting—Design
Staff—106
Contract Projects—6 (UNIV.) 9 (Cons.)
Staff Projects—40

Open contracting, as opposed to sole source contracting as with a university, has been a difficult and lengthy process for the research unit of the New Jersey Department of Transportation. Although research was not contracted regularly until 1991, New Jersey has selectively let contracts for more than 20 years. Furthermore, there have been basic agreements with universities and colleges in the state since 1982. But university research did not start in earnest until the University Transportation Centers (UTC) were formed in 1988.

History

The research unit as a distinct division was formed in 1964. For almost 30 years, staffing of the research unit fluctuated around 45 to 50 people. In 1990, in a staff reduction mode, the department cut the unit to 26 members and 2 years later the unit was reduced to 16 members. Department policy was altered to foster contract research and an immediate result of the staff reductions and policy changes was a plan to complete the existing staff research program. A more recent organizational change has placed research in the design area of the department, after 30 years in the planning area.

The research division has involved the management of the department, as a Research Council, in reviewing and approving its program since the late 1960s. A Research Users Committee was formalized in the early 1980s to elicit the assistance of division directors for both the development of the program and the fostering of the implementation effort. Neither committee has been used since 1990. Efforts to restore the former committee structure are being considered.

Program Development

The research unit has a long-standing practice of soliciting research problems from the operating units of the department; solicitations outside the department have never been made. The problems are reviewed by staff, who make recommendations on the method of conducting the research, that is: staff, contract (open or through a basic agreement with a university), the University Transportation Center program (UTC), NCHRP, pooled fund, or a staff technology transfer effort. Many problems are returned to the originator with information on the solution. The majority of problems fall in the category of staff technology transfer and are subsequently returned to the submitter with information on the solution. In the UTC program area, the actual projects that are supported come from both the department and the consortia that form the UTC.

Contractor Solicitation

The open contract solicitation process is conducted in two steps. A notice soliciting interest is published nationwide in the *Commerce Business Daily* and statewide in the *New Jersey State Register,* giving details of the problem, project objectives, and an upper limit to the project budget. The letters of interest are reviewed by a project panel, using predetermined criteria, and a short list is recommended to the NJDOT Consultant Selection Committee (CSC) for receipt of a Request for Proposals (RFP). An approved list of up to five potential consultants is sent an RFP.

For potential university contracts, the problems can come from either the department solicitation process or from the university. If a problem is from the university, a "sponsor" must be found in the department before consideration is given to supporting a contract research effort.

Contractor Selection

For the open contracts, the consultant proposals received in response to the RFP are reviewed by the project panel, using predetermined criteria. The top three recommendations are sent to the CSC for a review that includes the existing work load of the firm with the department, ratings of the firm's prior work, and the presence of a state-based office. Some impediments to the selection of a firm include a total burden (administrative overhead and fringe benefits) in excess of 125 percent, wage rates more than the Commissioner's salary, excessive fees, or a distant physical location of the contract staff. To speed up the selection process, NJDOT is investigating the prequalification of consultants for select research contracts.

Sole source contracting has only been used with universities. Further, task orders under the university basic agreements have only been used with two universities.

Negotiating Agreements

Cost-plus agreements are used for all open contracts. The only negotiated terms of the contract are the schedule and insurance, with a rare negotiation of some aspects of the scope. There has not been a sufficient current history of open contracts to relate experiences with modifications during the term of the contract, although there were no difficulties with the few contracts that had been let over the past 20 years.

Cost-reimbursable contracts (with a ceiling) are used with universities. The scope, schedule, and cost of these agreements are negotiated. If a university proposes a project, the scope is negotiated with a client in the department who agrees to sponsor the project. Project reporting, both cyclical and final, are contract terms not sufficiently followed by universities. NJDOT will review with universities acceptable processes for timely reporting of work.

The fringe and indirect rates used on contracts are variable. With private consultants a total overhead of up to 125 percent is permitted. At times a higher rate has to be negotiated. With universities the fringe currently charged is between 24 and 32.5 percent and the indirect rates are between 50 and 59 percent.

Monitoring Contractors

For open contracts, project panels include a member from research and a representative from at least two other units of the department affected by the project results. Project and implementation tracking efforts are conducted with regularly scheduled project meetings between the panel and contractor and by reviewing the contractor's cyclical reports. Although there is very little current experience with open contracts, closing out a contract in the past has proven problematic because of financial considerations.

Monitoring university contracts is less formal. The department's client is expected to track the project and meetings are held less frequently. University contracts are being reviewed to improve implementation and current task orders include an implementation task to help improve the process.

Implementation of Results

University contracts have not had an implementation statement, but open contracts call for training packages or prototypes, depending on the project. The primary impetus for implementation, though, comes from operating units within the department. The history of contract research from which implementation success can be gleaned has involved only universities to this point, and only a few operating units in the department. Therefore, the translation of research results into operating practice has not occurred to a large extent.

In summary, the organizational changes, staff reductions, and recently instituted contract program by the NJDOT are compelling the research unit to address procedural, interactive, and staff training issues. Although the open contract process is lengthy, the problems are unique to each project and contractor. More detailed information on the research and contract program at NJDOT can be obtained from the manager, 609–530–5956.

North Carolina

1994 Background Information:

Program Funds—$1898k (SPR), $617k(State)
Organizational Reporting—Planning and Programming
Staff—7
Contract Projects—20 (Univ.) 0 (Cons.)
Staff Projects—2

The North Carolina Department of Transportation (NCDOT) conducts its research program primarily with the Institute for Transportation Research and Education (ITRE), an agency of North Carolina State University (NCSU), although staff from other in-state universities have also been used. Contracts are issued on a sole source basis, exclusively with a select member of the academic staff. This kind of relationship has existed since 1959, although on a small scale at the beginning. Substantial modifications have been made to the research process during the 1992–1993 period and implementation success has improved with it.

History

Research contracts had been let with NCSU since 1959 by the State Planning Engineer. In 1967 a Research Coordinator was appointed; the Coordinator acted in consultation with a Research Steering Committee until 1986. Since then staff has increased to seven full-time employees, which includes professional staff as research administrators, clerical staff, and a librarian. The current organization is titled the Research and Development Unit. In 1993, the Research Coordinator became the State Highway Research Engineer.

The Research and Development Committee was reorganized in 1993 to include the Chief Engineer for Operations, the Deputy State Highway Administrator and the Director of Planning and Programming. Three technical subcommittees covering operations, materials, and planning were organized to report to management.

The initial basic agreement with ITRE was signed in 1981; it was revised in 1988, 1992, and most recently in June 1994. In 1980 the State Highway Administrator allocated $562,300 in state funds to ITRE for research, marking the start of a large-scale research program with the NCDOT.

Program Development

In October of each year a problem solicitation request is sent by the Research and Development Unit to the operating

units of the Division of Highways and ITRE. The submitted problem statements are distributed among the three subcommittees for review. By early January recommendations for further action on the problems are submitted to the Research and Development Committee. In FY '94 about 50 problems were received; after prioritizing the problems, proposals were requested for 15. Formal proposals are requested based on problem statements that include a title, problem definition, and research objectives. No more information than this is necessary because many of the requests for proposals are sent to the academic staff who submitted them originally.

Contractor Solicitation

The Research and Development subcommittees recommend sending each problem statement to a specific academic for formal proposal development. The preselected principal investigator is the academic who submitted the problem statement or, in the case where the problem was submitted by a member of the NCDOT, a qualified member of the university system. Generally, proposals are to be returned by mid March.

Policy has never permitted technical bidding on proposals. However, in FY '94 one announcement was distributed throughout the university system for proposals, but only one proposal was received. In this one instance invitations were sent to selected academics in ITRE, the Highway Safety Center of UNC, NCSU, and the University of North Carolina at Charlotte.

Contractor Selection

Proposal evaluation criteria are made available to the technical subcommittees. The criteria cover the understanding, objectives, work plan, budget, schedule, and implementation statements of the proposal. Because principal investigators are selected to make submissions, that aspect of criteria is not included in the evaluation. Although only one proposal is received for each project, not all projects are recommended to the Research and Development Committee for acceptance in the work program. Reasons for rejection include nonresponsive proposals, recent developments in research that the proposed research would duplicate, or a lag in a construction or research schedule on which the proposed research was dependent. Of the 15 projects for which proposals were received, only seven were accepted for the FY '94 work program.

Negotiating Agreements

All contracts are cost reimbursable. The standard language is contained in the basic agreement that exists between the ITRE and NCDOT. Every so often terms of the agreement are questioned. The most recent was a request by NCSU to upwardly revise the indirect cost rate. After discussion it was left at the historic rate of 15 percent; the total burden (fringe plus indirect cost) is approximately 37.5 percent. Indirect rates are charged against direct costs less capital equipment.

The schedule for the project is generally set by the state; revisions can be made depending on investigator needs and state budgetary considerations. The budget for the project is developed by the principal investigator; justified revisions during the project are usually granted. The project work plan is developed by the principal investigator in the proposal; changes may be requested by the project technical advisory committee during the course of the research.

Publication policy is set relative to the sensitivity of the research issue. A delay in publication of up to a year may be stipulated in the contract.

Modifications to the research are viewed as normal risks to the research effort and are invariably granted.

All contract documents are prepared by the university.

Monitoring Contractors

Project technical advisory committees are formed for all projects. The committee director is selected from the unit that submitted the problem or from the unit most directly affected by the research, with representation from the Research and Development unit. Other members are selected as their association with the problem warrants. The committee's responsibilities do not include monitoring expenses or approving invoices; the committee concentrates on the accomplishments and reporting requirements of the contractor. The State Highway Research Engineer acts as the mediator, approves contract modifications, reviews invoices, and judges the project accomplishments.

There is no formal process for closing out projects at their conclusion. With the submission of the draft final report a final invoice is approved. If the contract was covered by SPR funds, a letter is sent to the FHWA. Modifications to the report are accomplished without compensation. There is no withholding of funds during the contract.

Implementation of Results

The implementation process at NCDOT has been more successful since staff were included in the development and monitoring efforts. All areas of the Division of Highways are supportive of the research needs development process. This supportiveness has led to a desire to monitor and advance the contract research effort.

In the bridge design area, problem workshops are held to advance issues for the research agenda. The depth of structural design expertise in universities is regularly referred to by the NCDOT. The bridge management system was developed by a close association of staff and university academics. Similar success has been experienced in traffic engineering and innovative pavement design when staff suggested operational improvements that the university academics accomplished. In these instances the staff was very enthusiastic about the

research need and the academic was well qualified to do the work.

There are some problems with the implementation effort. In the absence of a formal implementation policy, implementation has been left to the discretion of the responsible unit or branch in the Division of Highways. Sometimes the problems relate to ineffective communication between staff and the principal investigator. In other cases, the research result is not closely aligned to the field needs to be useful to the engineer. There is also the problem of a shortage of funding to advance promising research results. Finally, the resistance to change is ever present, making the translation of research into practice a large "sales" effort.

The recent changes to the project development and monitoring processes in the NCDOT have met with enthusiastic and effective staff involvement. The increases in staff in the Research and Development unit have allowed the processes to advance smoothly. After 13 years of formal involvement with ITRE, NCSU, and other universities, the schools have built a staff with expertise in many of NCDOT's operational areas. The culture for research that exists both within the university system and at the NCDOT has strengthened over time. The result is a common desire by the involved parties to generate useful products and results. More detailed information on the research and contract program at NCDOT can be obtained from the State Research Engineer, 919–733–9790.

South Dakota

1994 Background Information:

Program Funds—$640k (SPR), $450k (State)
Organizational Reporting—Planning
Staff—9
Contract Projects—5 (Univ.) 8 (Cons.)
Staff Projects—33

Research at the South Dakota Department of Transportation (SDDOT) has grown in staff and breadth over the past eight years. This has occurred in an environment of a moderately growing state economy and with a continuity of leadership in the department. The RFP is used to solicit contractors for projects that are deemed necessary to go to contract. Recent collaborative arrangements have been started with select university academics, where project tasks are shared between the academic and the DOT research staff.

History

Prior to 1972, research at SDDOT was one of the functions performed in Planning. In 1972 a Physical Research unit, concentrating on materials and pavement related work, was formed under Materials with six staff members. A reorganization in 1984 placed the Office of Research as a subdivision of Planning, with a staff of five people. Program development and project monitoring procedures were developed in 1989, drawing heavily on the operating units of the department. The Office of Research then started to address all functional areas of the department. Four years later a formal implementation procedure was adopted (see Appendix E). A Research Review Board, comprising department management and representatives of city and county government, oversees the research effort. The current research staff of nine maintains a strong in-house research effort and organizes the project technical panels.

Program Development

Similar to many of the other states, SDDOT continues to improve the procedures used in the research process. In 1994 the research unit conducted a research opportunity identification meeting. Representation from throughout the department and the FHWA separated into five focus groups, covering the functional areas of the department, and prioritized 10-15 problems in each group. The research review board selected the final projects for the work program. The consensus of the opportunity identification meeting was very positive, and the output of the meeting may be sufficient that only one meeting be held every 2 or 3 years. In addition, the research unit, through its staff and contract efforts, usually generates several projects a year that are added to the new research projects to form the work program. Technical Panels, comprising primarily department staff, are formed through the efforts of the Office of Research for each of the approved research projects.

Prior to the process described, an open solicitation to the department and outside researchers was used to generate research problems. The research staff also interviewed region and central office managers annually. These methods may still be used in interim years between the research opportunity identification meetings.

Contractor Solicitation and Selection

The Technical Panel determines the researcher for the approved project, either department research staff, open contract, a collaborative effort with select academics at one of the state universities, NCHRP, or a pooled or regional fund effort. The collaborative effort is currently being considered only with a contract amount of less than $25,000.

Regardless of the choice made, the Technical Panel prepares a problem statement in the same format of project objectives, scope, and budget that is presented to the researcher or research organization. Proposal evaluation criteria are also included.

For those projects that go to contract, the SDDOT uses the RFP process. More than 200 firms, regional and state universities, and national consultants are on the mailing list. The RFPs are mailed at the end of November to accommodate the universities' schedule and a 2-1/2 month proposal preparation period is given. The research unit has prepared a publication, "Guidelines for Performing Research for the South Dakota Department of Transportation," which is provided to all

potential proposers. The section of the Guidelines covering "Proposal Preparation and Submission" is included in Appendix E.

The Technical Panel considers the usual factors in the proposal evaluation and contractor selection process. There are no barriers to the selection of a consultant.

Negotiating Agreements

The Technical Panel reviews the proposal with the selected contractor and negotiates any exceptions to the RFP. The project budget is predetermined by the Panel. Most contracts are cost reimbursable with a ceiling.

Contract modifications of time are acceptable, of scope are unusual, and of cost are rare, unless there is a change in scope. Fringe and indirect rates for all contract work are charged at the actual and audit approved amount.

Monitoring Contractors

The Technical Panel maintains continuity with the research effort by serving as the monitoring body for the research. The research representative chairs the panel at meetings held with the principal investigator at the beginning and end of the project; other meetings are held at the discretion of the panel depending on the complexity and length of the research effort. Project tracking is usually accomplished by reviewing the project reports. The implementation potential for a research effort has only recently been monitored by the panel.

The research staff monitor the invoices, compare the progress against the invoiced amount, and make recommendations to the Research Engineer relative to payment. A formal process is followed in closing out a contract. The final report is accepted, an executive presentation is made by the principal investigator, the disposition of the nonexpendable equipment is settled, and a final billing is made with a close-out clause.

Implementation of Results

Implementation at the SDDOT is addressed from both the contract document and management overview. Some contracts have a built-in task requiring the contractor to perform either a training exercise, make an installation, or conduct a workshop. The contractor organizes the technology transfer effort and suggests possible attendees. The management overview of the implementation effort begins with the Technical Panel's evaluation and recommendations on the research effort. These are commented on by the region and division offices. The research review board then signs off individually on the recommendations, which are presented to the secretary of the department for approval. The Office of Research maintains a summary of the recommendations, responsible divisions, actions to date, and completion status of the implementation effort for each project. An example of the management overview process is included in Appendix E.

Noteworthy advances have been introduced in the past few years at the SDDOT to improve the research process, from the brainstorming effort of project development to the assignment and tracking of the implementation effort. The attention to the details of these processes is the aim of staff in the entire department. For more information on any of the procedures at the SDDOT contact the Research Engineer, 605–773–3358.

CHAPTER EIGHT

CONCLUSIONS

The recent increase in federal funding and reductions in staff in many state research units have brought about nationwide expansion of programs to contract transportation research. The expansion in contract work requires scrutiny of all aspects of research. Project development must be more precise to avoid contractual modifications; project monitoring must prevent implementation slippage; and implementation, to be successful, must be a continuous effort, planned from the project development phase. There is no simple formula a state can follow; the best process has to be the one developed by the entire community and refined through use. The core of an effective research program is its research staff.

The importance of the implementation effort, information exchange, program efficiency, and innovative techniques compels each state to evaluate the particular needs of staff, private consultant, and university research.

Information supplied by the states emphasized the need for a more extensive study and analysis of several issues which are discussed at the end of this chapter.

All but one reporting state has a contract research program. As a percentage of the entire program, the states' contract programs have increased from 50 percent in 1987 to 70 percent in 1994, reflecting the states' staff limitations of number or of expertise. The size of a state's research unit is inversely related to the size of the contract program.

Although the research effort has become mainly contractual, the program development process appropriately involves the needs of the operating units. The pragmatic needs of the transportation agency are regularly solicited and assessed for the program, but the long-term technical needs may not be receiving the attention they require. Research problem solicitation efforts, such as those described for the Minnesota and South Dakota needs development process, can be effective in deciding future technical needs.

As agencies trim staff, they must find ways to retain talent. The MnDOT maintains research liaison staff within its operating units; contract agencies also may have to be more interactive with research units. The close relationship that some states now have with state universities may be an effective model.

The convenience of contracting with universities through the basic agreement, as well as legislative requirements in some states, has resulted in two-thirds of states sending RFPs to universities only. The benefits to the state of maintaining this relationship are the ease of contracting, the ongoing enhancement of agency-university interaction, and the development of future talent in the transportation field. The exclusive use of university talent for a research program, however, may ignore the wealth of talent among private consultants that some states' research programs may require. Many states could investigate a broader based research talent pool than they now use.

States generally use three methods for selecting contractors for the research program: sole source, RFP to universities (in some cases the RFP is in response to a problem statement that is submitted by an academic), and RFP to any interested party.

Whatever the means of soliciting contractors, all proposals are subject to a technical and/or budgetary evaluation. Although the majority of states use all the accepted factors in the evaluation, very few states give weight to the factors. Even when only one proposal is received, there are total budgetary limits to the work program that may not accommodate all proposals. Consequently, when there are competitive proposals, adding a numerical value to the quality evaluation maybe useful in making a final list. Factor weighing does not have to control the selection process; it is a convenient tool.

Very few states bar a potential contractor from submitting a proposal. The most prevalent reason for not accepting a proposal from a potential contractor is prior poor performance.

The existence of a basic agreement makes states' contract negotiations with universities simpler than with private consultants. Eighty percent of states have a basic agreement with universities and only one state that contracts solely with universities has reported negotiating problems.

The terms of the contract that are negotiated with contractors or have been set by the state vary considerably between states. Only one agency (District of Columbia) sets all the terms. Two states (Rhode Island and Utah) negotiate all the contract terms. Every item of the agreement is negotiated by a few states but no items are negotiated by all. As expected, the schedule is the most negotiated agreement item. The scope of work is negotiated by two-thirds of the states. Although the scope is the most important item of the research to the states and there are important reasons for the states to decide it, there are a few reasons that favor negotiating this item:

- The contractor is given latitude in arriving at the objectives;
- Funds budgeted for the project are limited and the scope must be tailored;
- The original proposal may have been submitted by the contractor.

Modifications to a contract are generally problem free for the states. The only difficult item is the budget. Frequently, budgetary changes are unforeseen and the contractor may not be willing to settle for a low estimate of the staff time required to complete the agreed upon additional work. The higher contractor estimate has a contingency in it to cover additional unknowns. It is more difficult to negotiate these changes with

private consultants than with universities. Even the best scoped research projects can expect modifications, but this is another reason to include all affected parties in the developmental aspects of the project.

Contract performance is monitored to improve the probability of implementation. If only research staff monitor the work (as is true for 20 percent of responding states), the essential input of operations staff must be accommodated in another manner, since the operations staff are the eventual implementors. On the other hand, if research staff are not used in the monitoring effort (which is the case in 10 percent of the responding states), a project champion must be found in operations whose time will be shared between research and operational responsibilities.

To cover the administrative and technical aspects of the monitoring effort while assuring a successful implementation process, research staff must work in harmony with operations staff. The partnership starts at the project development stage. The success of fully implementing a project cannot be easily judged, but an Arizona study reported considerable variation—from no implementation in one state, to full implementation in two states. Some lack of success in implementation may be linked to the methods used to monitor the work.

Communication between the state and the contractor is stressed as the most important dimension of monitoring to assure a high level of contractor performance. Only 35 percent of the responding states hold regular meetings with the contractor; therefore, communication could be weak. Reports are important, but personal discussions can strengthen participation while minimizing surprises. Part of the communication between parties is the verbal feedback given to the contractor. Feedback is meaningful when it is based on a technical and administrative evaluation of the work to-date.

All aspects of the contract are important to monitor and most states report monitoring most items. However, maintaining staffing levels and the potential for implementation receive the attention of fewer than half the states. Because staff expertise is considered the most important factor in selecting a contractor, contract staffing should be maintained as closely as the deliverables. Although the contractor may not be in the loop, implementation potential should be monitored continuously.

Most states report that some form of action is taken to encourage adherence to the terms of the contract. The methods of action may include verbal or written advisories or payment deferments.

State and federal government agencies have a pragmatic view of research: research translates into operational improvements through implementation. There is general agreement that the implementation process starts with problem identification. From this point, the agency must decide if the problem can be addressed with existing technology or if a research study is required. In either case, the implementation process must preserve the factors of success: credibility, champions, and communication.

The increased use of contractors to conduct research does not have to severely complicate the process. Credibility is maintained by close monitoring, champions are identified before the contractor is involved, and communication is fostered by perseverance and meetings. The agency has the authority to nourish implementation; staff have to be available to effect it.

Several suggestions for further research arose from state research managers' responses to the questionnaire.

- A system for rating contractors: Several methods are currently used by states to select or disqualify contractors. Prior performance of a contractor may not address the "success" of the contractor. Any system that is devised must be fair and unbiased enough to withstand possible litigation. This is a very sensitive area in which to develop an objective rating system. It involves an analysis of the different research teams that the contractor worked with, the nature of research performed, resource limitations to prior studies, client support, personalities, and other factors.
- Methods to hasten the RFP process: When states contract outside of the basic agreement with universities, there may be lengthy procedures that delay the start of the research. Although the accounting and legal processes differ for each state, there may be techniques (in use or yet-to-be-developed) that could be adapted by states. This research could draw on the results of the work on rating contractors, evaluate the roles of administrative and technical panels in the process, appraise accounting and legal procedures, incorporate procedures from a basic agreement with private consultants (see item below), and investigate widespread approval of "boiler plate" items.
- Synthesis of contract research methods for all states: This synthesis covers highlighted aspects of the contract programs of most states, but there are only five in-depth case studies to show the flow of a state's process. For states to determine the efficacy of introducing select procedures or changes in existing procedures to their own processes, it would be appropriate to understand the entire process and its effects in a state that uses the procedure.
- Development of a basic agreement with private consultants: The success of the basic agreement process with universities in achieving prompt contractual agreements has led to the suggestion that a similar arrangement with private consultants would be beneficial. There are substantial obstacles to overcome in this effort. An analysis of the procedures within the states may be a starting point. Potential consultants would have to be categorized by research type, basic agreement terms, in-state and out-of-state consultants assembled, negotiable items in the task order, and many other considerations determined.
- Methods to achieve timely research reporting: The final report is one of the most important deliverables of research. Without it the implementation process could be seriously hampered. With all phases of the research completed, the last step could be as simple as accumulating the previous documents prepared for the project into one final report. Three approaches could be addressed in this study: instructive, punitive, and incentive. There are several current examples of methods used in each of these areas.

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GLOSSARY

Administration—a nonresearch committee of a transportation agency.

Administrative staff—nonresearch staff that includes secretarial, administrative assistants, and others who have no association with contract research.

Basic Agreement—A process that allows the state to contract in a prompt manner and without a competitive bid.

Contract Administration—professional and administrative staff whose primary function is to monitor contract research.

Contractor—Either a university or private consultant that does research for the state.

Implementation—The process of getting research results into use.

Operating Unit—a planning, design, construction, or maintenance unit of a transportation agency.

Pooled Fund—the grouping of states' contributions for the purpose of funding a research project.

Private Consultants—nongovernment firm, other than a university, that contracts research for profit.

Request for Proposal (RFP)—A statement of work that asks for formal proposals to accomplish it.

Research Council—either the middle management or upper management research committees of a transportation agency.

Researchers—professional staff who actually do the research.

Statement on Deliverables—the explanation of milestones that are expected during the course of a project.

Task Order—Specific work effort that is contracted using the basic agreement.

Technology Transfer—the process of getting technical information to potential users; this could include efforts to achieve implementation.

University—research organization that does not work for profit; this usually includes staff at university.

APPENDIX A

Questionnaire

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Project 20-5, Topic 25-14

Managing Contract Research Programs

QUESTIONNAIRE

Name of respondent:_____
State:_____
Title:_____
Phone No:_____

Note: For the purpose of this survey, Fiscal Year 1994 processes and data are requested, except where noted.

For a description of the terms used in this questionnaire please see the glossary of terms on the last page.

1. BACKGROUND INFORMATION

a) How many staff members are in the research unit?_____
(If research is conducted in any other unit of the transportation agency please add another sheet and define the organization.)

Researchers (number) _____
Administrative _____
Contract Administration _____

b) How many research projects will be started in FY '94?_____

c) How many total research projects are underway? _____

d) What are the sources of FY '94 funds?

SRP $_____
State $_____
Other? **(Explain)** $_____ _____
_____
_____
_____

e) By category, what is the number and budget of the projects under way? **(State the source of funds used for FY '94 starts by category).**

Category	FY '94 No.	FY '94 $(x1000)	Total (on going) No.	Total (on going) $(x1000)
Private Consultant	____	____	____	____
University	____	____	____	____
Pooled Fund	____	____	____	____
In-house Staff	____	____	____	____
Other?_____	____	____	____	____

f) How is the Contract program changing? **(circle the change)**

Over past 5 yrs.?	Decreased	Remain same	Incr. Mod.	Incr. Greatly
Expected in the future?	Will decrease	Remain same	Incr. Mod.	Incr. Greatly

g) How is the In-house program changing? **(circle the change)**

Over past 5 yrs.?	Decreased	Remain same	Incr. Mod.	Incr. Greatly
Expected in the future?	Will decrease	Remain same	Incr. Mod.	Incr. Greatly

h) Please give an average for the past 3 years of:

Number of completed projects per year _____
Average project length (in time) _____

2. SELECTING A CONTRACT PROGRAM

a) Are the research problems suggested and the research program developed by: **(check as many as apply)**

	Problem Suggested	Program Developed
Research Staff	_____	_____
Research Council	_____	_____
Operating Units (Dept.-Wide)	_____	_____
Administration	_____	_____
Combination of Pvt/Ind/Univ.	_____	_____
University	_____	_____
Other?_____	_____	_____

b) How many research projects are included in each functional area, and how many will go to contract and be conducted by in-house staff? **(FY '94 data)**

	FY '94	To Contract	In-House
Administration			
Bridge			
Construction			
Economic			
Environment			
Geotechnical			
Maintenance			
Materials			
Pavement			
Planning			
Policy			
Traffic			
ISTEA "Mangmnt Areas"			
Other?_____			

c) Is the decision to select specific research problems for contract decided by: **(check as many as apply)**

Research Staff _____
Research Council _____
Administration _____
Other?_____ _____

d) What degree of importance is given to the reasons/criteria to use contract or in-house research?

(H - high, M - medium, L - low)

	Contract	In-House
Limited research staff		
Limited staff expertise		
Operating unit requested		
Complexity of research		
Department policy		
Funding Requirements		
Other?_____		

e) Is the research program affected by state law?
Yes_____ No_____ **If yes, briefly explain:**

_____
_____

3. CONTRACTOR SOLICITATION AND SELECTION

a) Briefly describe the process used to solicit (not select) contractors?

_____
_____
_____

b) Is there a competition between contractors in the selection process, and if there is, on what percentage of projects?

Yes_____ % of Projects_____
No _____

c) On what basis is a contractor selection made?

Technical Evaluation _____
Budget " _____
Tech/Budget " _____
Other?_____ _____

d) If a technical basis is used to select a contractor, what factors are used? **(check as many as apply)**

Understanding of Problem _____
Approach to Solution _____
Staff Expertise _____
Staff Availability _____
Facility Availability _____
Statement on Deliverables _____
Other?_____ _____

Comment on the weighting of factors:
_____
_____

e) Are there impediments (i.e., out-of-state contractor, excessive overhead, etc.) to selecting a contractor?

(Please list them)

Yes_____ _____
_____
No _____ _____
_____
_____

f) Are some contractors barred from bidding?

Yes_____

No _____

If Yes, what are the reasons?

_____
_____
_____

g) Do you have "basic agreements" with universities?

Yes _____
No _____

If Yes, what type of research is given to universities?

_____
_____
_____

4. **WRITING AN AGREEMENT**

a) What types of contract are used?

	University Contract	Private Consultant
Cost Reimbursement	_____	_____
Cost Reimbursement (with ceiling)	_____	_____
Fixed Price	_____	_____
Other?_____	_____	_____

Reason for choice and reason for any difference between University and Private Consultant contracts.

_____

_____

_____

b) What degree of importance is given to the following terms of a contract: **(H-high, M-medium, L-low)**

	Staff	University	Private
Scope of work	_____	_____	_____
Schedule (work budget)	_____	_____	_____
Deliverables	_____	_____	_____
Invoicing	_____	_____	_____
Liability	_____	_____	_____
Reporting	_____	_____	_____
Publication of Results	_____	_____	_____
Implementation	_____	_____	_____
Other?_____	_____	_____	_____

c) What terms of the contract are negotiated **(N)** and which are set by the state **(S)**? (Give either **S** or **N**)

	Universities	Private Consults.
Scope	_____	_____
Schedule	_____	_____
Budget	_____	_____
List of Deliver-ables	_____	_____
Invoicing	_____	_____
Liability	_____	_____
Reporting	_____	_____
Publication Rights	_____	_____
Technology Transfer	_____	_____
Other?_____	_____	_____

d) Are there terms that require difficult and long negotiations for each contract? **(Explain)**

_____
_____
_____

e) What degree of difficulty is there in negotiating modifications to contracts? **(H-high, M-medium, L-low)**

	Universities	Private Consultants
Scope	_____	_____
Schedule	_____	_____
Staff	_____	_____
Budget	_____	_____
Other?_____	_____	_____

5. **MONITORING CONTRACT PERFORMANCE**

a) Which methods are used in monitoring a contract? **(If a formal procedure is available, please attach)**

Technical/Adm. Panel _____

Operating Staff Liaison _____

Research Staff Liaison _____

Other?_____ _____

b) What is required of a contractor and on how regular a basis **(monthly, quarterly, etc)**

Reports (Status and Budget) _____
[Please attach sample forms]

Meetings _____

Formal Presentation _____

Other?_____ _____

c) What aspects of a contract are regularly monitored, and list what actions are taken to ensure adherence to the contract terms? **(Actions are listed below)**

	Regularly Monitored	Actions Taken
Scope	_____	_____
Technical Progress	_____	_____
Schedule	_____	_____
Budget	_____	_____
Staff	_____	_____
Implementation Potential	_____	_____
Other?_____	_____	_____

Potential Actions: (State circumstances for taking action.)

1-Verbal Actions
2-Written advisory
3-Payment deferment
4-Removal from contractor availability list
5-Other?_____

d) List items (e.g., final report, audit, etc.) necessary to close out a contract:

_____
_____
_____

e) If technology transfer assistance is included in the agreement with a contractor, briefly comment on the contractor's involvement in implementation efforts, marketing, and staff training. **(Include procedures if these are available.)**

_____
_____
_____
_____
_____

f) Are follow up negotiations required of a contractor to foster technology transfer?

Yes_____ No_____

g) If there are other aspects of contract research that you have questions about, or there are further comments you wish to make please do so below or attach a sheet.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

****

THANK YOU FOR YOUR ASSISTANCE!

Please send responses to:

Eugene F. Reilly, P.E.
85 Hazelwood Avenue
Metuchen, NJ 08840

If you have any questions, please call Gene on (908) 549-5212. If you would like to submit your questionnaire response by facsimile, please do so on (908) 549-2262.

We would appreciate your response by May 31, 1994

****

GLOSSARY OF TERMS

Researchers - professional staff that actually do the research.

Administrative staff - non-research staff that includes secretarial, administrative assistants, etc. that have no association with contract research.

Contract Administration - professional and administrative staff whose primary function is to monitor contract research.

Private Consultants - non-government firm that contracts research for profit.

University - research organization that does not work for profit; this usually includes staff at university.

Pooled Fund - the grouping of states' contributions for the purpose of funding a research project.

Research Council - either the middle management or upper management research committees of a transportation agency.

Administration - a non-research committee of a transportation agency.

Operating Unit - a planning, design, construction or maintenance unit of a transportation agency.

Statement on Deliverables - the explanation of milestones that are expected during the course of a project.

Technology Transfer - the process of getting technical information to potential users; this could include efforts to achieve implementation.

Basic Agreement - A process that allows the state to contract without competitive bid.

APPENDIX B

Summary of Responses to Questionnaire

Question 1a.

STAFF IN RESEARCH	
Number Of Staff	Percent Of States (42 responses)
<6	36
6-10	19
11-15	19
16-20	7
21-25	7
>25	12

Question 1b.

NUMBER OF 1994 PROJECT STARTS	
Number Of Projects	**Percent Of States (42 responses)**
0-5	**17**
6-10	**29**
11-15	**17**
16-20	**12**
>20	**25**

Question 1c.

TOTAL NUMBER OF RESEARCH PROJECTS *	
Number Of Projects	Percent Of States (41 responses)
0-10	10
11-20	19
21-30	17
31-40	14
>40	40

* Including 1994 project starts

Question 1d.

PROGRAM FUNDS (OTHER THAN SPR AND STATE)	
Fund Source	State(s)
ISTEA	AR, UT
FHWA Demo	AL, CO, GA, IN, MS, NJ, NM, WA
FHWA Bridge	CT
Industry	IN, WV
State (Univ. specific)	KY
IVHS	IA, MN, WA
FAA	TX
NSF	WV
LTAP	CT, FL, NC, OR, WY
SAFETY (402)	PA

Question 1d.

SPR AND STATE FUNDS	
Funds (x $1000)	Percent Of States (42 responses)
< $500	17
$500-1500	29
$1500-2500	14
$2500-3500	14
$3500-4500	12
>$4500	14

Question 1.e

NUMBER OF '94 PROJECT STARTS BY CATEGORY OF RESEARCHER					
Number Of Projects	Percent Of States (41 responses)				
	Private Consultant	University	Pooled Fund	Staff	Other*
None	55	7	35	27	83
1-2	32	17	22	27	15
3-4	7	15	17	15	2
5-6	2	10	12	17	0
7-8	2	10	2	2	0
>8	2	41	12	12	0

* Examples - USGS, State Agencies, SHRP, CRREL

Question 1.e

NUMBER OF TOTAL PROJECTS BY CATEGORY OF RESEARCHER					
Number Of Projects	Percent Of States (41 responses)				
	Private Consultant	University	Pooled Fund	Staff	Other
None	39	3	27	20	75
1-4	39	8	34	22	25
5-8	5	24	13	3	0
9-12	9	15	8	3	0
13-16	3	18	8	13	0
>16	5	32	10	39	0

Question 1.f

CHANGE IN RESEARCH PROGRAM OVER PAST 5 YEARS				
Researcher	Percent Of States (42 responses)			
	Decrease	Remain Same	Mod. Increase	Large Increase
Contract	5	5	52	38
Staff	26	34	32	8

Question 1.g

EXPECTED CHANGE IN RESEARCH PROGRAM IN FUTURE				
Researcher	Percent Of States (42 responses)			
	Decrease	Remain Same	Mod. Increase	Large Increase
Contract	7	27	59	7
Staff	9	43	43	5

Question 1.h

PROJECT COMPLETIONS AND PROJECT LENGTH			
Project Completions Per Year	Percent Of States (42responses)		Average Length Of Project (Years)
	Completions	Project Length	
0-10	71	10	<1.5
11-20	17	58	1.5-2.5
21-30	5	29	2.6-3.5
31-40	5	3	3.6+
41+	2		

Question 2.a

SOURCE OF RESEARCH PROBLEMS AND AUTHORITY TO DEVELOP PROGRAM		
Group	Percent Of States (42 responses)	
	Source of Problems	Authority For Program
Research Staff	81	79
Research Council	36	62
Dept. Operating Units	93	31
Administration	48	29
Combination of Priv./Industry/University	50	17
University	81	33
Other	15	0

Question 2.b

'94 PROJECT STARTS DISTRIBUTED BY CONTRACT AND STAFF		
Functional Area	Percent Of Projects	
	Contract	Staff
Bridge	75	25
Construction	67	33
Economic	83	17
Environmental	94	6
Geotechnical	74	26
Maintenance	74	26
Materials	64	36
Pavement	39	61
Planning	76	24
Policy	80	20
Traffic	92	8
ISTEA	76	24
Other	72	28

Question 2.c

SELECTORS OF CONTRACT PROJECTS	
Selecting Group	Percent Of States (41 responses)
Research Staff	67
Research Council	60
Administration	48
Other	14

Question 2.d

REASONS FOR USING CONTRACT RESEARCH			
Reasons	Percent Of States (42 responses)		
	High	Medium	Low
Limited Staff	81	7	12
Limited Expertise	67	21	12
Operations Request	10	19	71
Complexity	55	21	24
Policy	24	5	71
Funding Requirement	10	17	7

Question 2.e

Yes/No	Legislation	States
Yes	Funds To University Only	IN, KY, TX, UT
	Funds To Research	CA, IA, OR
	Form Of Contract	FL, MS, OH
	Partial Funds To University	CT, IL
	Merge University/DOT	LA
	Strategic Plan	ID
No	No Legislation	67% Of States (42 responses)

Question 3.a

CONTRACTOR SOLICITATION PROCESS	
Method	Percent of States (42 responses)
RFP To Universities Only	64
RFP To Private Consultants and Universities	33
Sole Source	10

Question 3.b

COMPETITION ON AWARDING CONTRACTS	
Percent Of Competitive Contracts	Percent Of States (41 responses)
No Competition	27
<20	28
20-40	12
41-60	7
61-80	2
>80	24

Question 3.c

BASIS FOR CONTRACTOR SELECTION	
Basis	Percent Of States (42 responses)
Technical Evaluation	45
Budgetary Evaluation	10
Technical/Budgetary Evaluation	67
Other	7

Question 3.d

FACTORS USED TO SELECT CONTRACTORS		
Factors	Percent Of States*	Percent Of States That Weigh Factors*
Understanding Of Problem	88	12
Approach To Solution	88	12
Staff Expertise	93	17
Staff Availaibility	79	2
Facility Availability	74	2
Statement On Deliverables	67	5
Implementation Plan	5	-
No Weighting Of Factors	-	52

*42 responses

Question 3.e

IMPEDIMENTS TO CONTRACTOR SELECTION	
Impediment	Percent Of States (42 responses)
No Impediment	64
Excessive Overhead	19
Use Of State University or DOT Staff	10 (See 3.a)
Lengthy Process	7
Excessive Budget	5

Question 3.f

BARRIERS TO A CONTRACTOR BIDDING	
Reason	Percent Of States (42 responses)
None Barred	76
Poor Performance	12
University Only	5 (See 3.a)
Conflict of Interest	5
Fraud	2

Question 3.g

UNIVERSITY BASIC AGREEMENT		
Yes/No	Type Research	Percent Of States (42 responses)
No	-	22
Yes	All Types	52
	Limited	26

Question 4.a

CONTRACT TYPE		
Type	Number Of States (42 responses)	
	University	Private Consultant
Cost Reimbursable	7	3
Cost Reimbursable With Ceiling	25	16
Fixed Price	18	19
Cost Plus		1

Question 4.b

DEGREE OF IMPORTANCE TO CONTRACT TERMS (Number of States)				
Terms of Agreement	University (42 responses)		Private Consultant (28 responses)	
	High	Low	High	Low
Scope	36	0	26	0
Schedule	24	2	18	2
Deliverables	34	0	25	0
Invoicing	7	18	10	9
Liability	4	21	6	10
Reporting	24	0	19	0
Publication	26	6	18	5
Implementation	26	2	17	4

Question 4.c

NEGOTIATING TERMS OF CONTRACT (Percent of States)				
Terms	University (42 responses)		Private Consultant (28 responses)	
	Negotiated	Set By State	Negotiated	Set By State
Scope	68	29	57	43
Schedule	95	5	89	11
Budget	78	20	75	25
Deliverables	71	27	64	36
Invoicing	15	80	18	82
Liability	15	78	11	89
Reporting	39	59	29	71
Publication	39	59	32	68
Tech. Transfer	56	37	46	46

Question 4.d

DIFFICULT CONTRACT TERMS
Description (Number of States; 42 responses)
Indemnification, Insurance (3)
Publication Schedule (2)
Data Rights (2)
Scope (2)
Equipment, Software
Involvement of Auditor
Overhead
Confidentiality
Budget
Varies With Project
30 States Expressed No Problems

Question 4.e

DIFFICULTY IN NEGOTIATING MODIFICATIONS (Percent of States)				
Terms	University (42 Responses)		Private Consultant (28 Responses)	
	High	Low	High	Low
Scope	5	51	18	39
Schedule	3	67	7	54
Staff	3	77	7	46
Budget	31	26	46	25
Reports	3	-	4	-
Intell. Property	-	-	4	-

Question 5.a

METHOD OF MONITORING A CONTRACT	
Method	**Percent Of States (42 responses)**
Technical/Adm. Panel	57
Operating Staff Liaison	48
Research Staff Liaison	88
Other	0

Question 5.b

DELIVERABLES REQUIRED OF CONTRACTOR						
Deliveries	**Percent Of States (42 responses)**					
	Time Requirements					
	M/Q	**SA**	**A**	**BA**	**F**	**N**
Reports	76	18	3	3	100	-
Meetings	19	11	5	3	-	50
Oral Report	5	-	10	-	19	31

Notations:

M/Q - Monthly/ Quarterly
SA - Semi-Annual
A - Annual
BA - Biennial
F - Final
N - As Needed

Question 5.c

ITEMS MONITORED IN CONTRACT WITH ACTIONS TAKEN				
Items Monitored	Percent Of States (42 responses)			
	Verbal Advisory	Written Advisory	Payment Deferment	Remove From List
Scope	76	45	17	5
Technical Progress	81	55	36	5
Schedule	83	60	33	2
Budget	64	57	40	5
Staffing	45	38	10	2
Implementation Potential	45	36	7	2

Question 5.d

CONTRACT CLOSE OUT REQUIREMENTS	
Item	Percent Of States (42 responses)
Final Report	95
Audit	55
Invoice	24
Deliverables	12
Disposition Of Equipment	12
Implementation Plan	7
Presentation	5
Formal Process	5
Certification	5
Evaluation Report	2

Question 5.e

CONTRACTOR INVOLVEMENT WITH TT	
Method	Percent Of States (42 responses)
None	40
Training/Seminar	29
Implementation Plan	12
Product/Deliverable	10
Project Specific	7
Presentation To Staff	7
Audio-Visual Product	5
Association With University	2

Question 5.f

FOLLOW-UP NEGOTIATIONS FOR TT	
Yes/No	Percent Of States (42 responses)
No	78
Yes	22

Question 5.g

ADDITIONAL COMMENTS ON CONTRACTING
Private contractors are not responsive
Research units should seek funding other than SPR
Two separate units conduct R/D within DOT
A method of expediting past due research reports must be found
The amount of retainage is problematic
Do all university contracts reference OMB-21?
How do states dispose of equipment?
What happens to a study when the principal investigator leaves the university?
The state is considering using the RFP process instead of solely the universities
There should be an alliance for transportation research between industry and government
There are excessive in-state audit requirements
The technical advisory committee improved the focus of contract research
There is a problem in achieving timeliness in reporting
There is an imperative to identify competent contractors

Note: Refer to Chapter 5 for a brief discussion of these items.

APPENDIX C

Federal Highway Administration Contract Process

The FHWA uses the Federal Acquisition Process to contract for a multitude of research studies and research related services with all types of organizations. Although the FHWA process may not apply to states, its solid procedures and checks and balances could be useful in meeting the shared objective of efficient use of taxpayer dollars.

Several decisions are made before the actual contract process begins. After the tiered group arrangement of giving critical area direction, putting together the problem statements and prioritizing the problems by area, an acquisition plan is prepared on each proposed project and submitted for approval. The following funding and contract decisions are then made:

- Funding alternatives (any or all may apply to a specific contract requirement)
  - Program funds budgeted from the individual R&D offices
  - Split funds phased over time
  - Cost sharing or shared funding with other agencies
  - Option funds which can be decided on an annual basis.
- Competitive/Solicitation Process
  - Sole Source (noncompetitive; requires justification that only one source is available or Congressional legislation specifies a source)
  - Invitation for Bid (IFB; competitive; open to all bidders; selection is based on low price alone)
  - Request for Proposal (RFP; competitive; open to all potential offerers; selection is based on a combination of price and technical factors)
  - Broad Agency Announcement (BAA; competitive; limited definition of scope because exact nature of research and approach is not known)
  - Set Aside (competition is limited to small business)
- Type of award
  - Contract (base years, and may include option years)
  - Cooperative Agreement
  - Cooperative research and development agreement (CRADA)
  - Grant
  - Purchase order (under $50,000)
  - Purchase from GSA schedule
  - Basic ordering agreement.

Competitive contracts typically take the following steps (budgetary limits usually are not published): 1) a notice is published in the Commerce Business Daily (CBD); a brief description of the project is given so that interested parties may request a copy of the solicitation (RFP, IFB, BAA). 2) a Request For Proposals or an Invitation for Bid is issued (for BAA's the CBD notice is the solicitation and no second step is required). 3) for purchases of less than $25,000 a telephone solicitation may be made; a limited written bid may be requested. For purchases between $25,000 and $50,000 a purchase order is issued subsequent to the CBD notice and review of bids.

Under RFP's, technical proposals are received and evaluated in accordance with specified criteria that are developed and ranked for importance in a way that matches the unique needs of each contract. The following basic factors are often considered when developing technical evaluation criteria:

- responsiveness to the technical requirements in the statement of work
- staff resources and qualifications
- organizational experience and capability
- facility and equipment resources
- past performance.

Cost negotiations are conducted for acceptable proposals received in response to an RFP. An award is made to the contractor with the best combination of technical proposal and cost. For bids received in response to an IFB, there is no cost or technical evaluation; low price is the only factor considered. Modifications to a contract must be within the scope of the original contract, otherwise a new contract may have to be negotiated.

All contracts are monitored by a technical representative (COTR) and a contract administrator. This team approves the invoices. The contract closeout process includes the following items:

- a final report or product
- the disposition of equipment or property
- audit closeout
- final payment is made.

The contract process for RFPs only follows these steps:

1. Requisition package (including description of work, estimate of cost, completion date, etc.) is prepared by the Program Office and approved by senior FHWA officials
2. Requisition package received by Contracts Office (CO)
3. CBD announcement of solicitation is published
4. Request For Proposals (RFP) prepared and issued by Contracts Office
5. Offerers prepare and submit proposals
6. RFP closes
7. Technical evaluations (based on the Selection Plan, which includes evaluation criteria, procedures and cost estimates, in addition to other information) conducted and report sent to CO
8. Preliminary business evaluations conducted by CO
9. Determination of competitive range (elimination of proposals deemed not competitive)

10. Notification to unsuccessful offerers
11. Cost-Price analysis is prepared (a detailed analysis of cost elements that will assist in negotiations); development of prenegotiation position; audit (if necessary)
12. Negotiations (a Prenegotiation Plan establishes negotiation objectives based on the technical and cost analyses)
13. Best and Final Offer (BAFO) received and evaluated (this is included with the assessment by the Technical Evaluation Panel)
14. Offerer selected for award (a Source Selection Official makes a final selection based on a report that includes at least an analysis of proposals, cost aspects, assessment of past performance and any other issues)
15. Contract package prepared, reviewed, and mailed to offerer
16. Contract signed by offerer
17. An award is finalized with contract signing by CO
18. Nonselected offerers are notified and debriefings are held
19. Contract administration commences with technical performance monitoring, voucher review, and processing
20. Contract Close-Out (at conclusion of contract performance period).

APPENDIX D

Strategic Highway Research Program Contract Process

One of the most intensive research programs to be undertaken in the transportation field in the United States was the Strategic Highway Research Program (SHRP). SHRP was "a highly focused, five-year, $150 million research program funded under the Surface Transportation and Uniform Relocation Assistance Act of 1987. SHRP was supported through a mutual agreement with the Federal Highway Administration, the American Association of State Highway and Transportation Officials and the National Research Council, and administered as an independent unit of the National Research Council. The program provided contracts for applied research providing timely solutions for specific operational problems facing highway officials and practitioners."

Focused national meetings produced the strategic SHRP Research Plan in May 1986. Using this plan, technical advisory committees developed detailed contract plans that were approved by the SHRP Executive Committee. Staff subsequently developed requests for proposals (RFPs). To maintain control in the SHRP office, the RFPs were then reviewed by technical advisory committees and submitted by staff to the Executive Committee for approval. The Executive Committee was a very motivated and committed group of 15 high level representatives of the transportation community. Eight members of the Committee were from state departments of transportation.

Contractor Solicitation

A work program was mailed at the beginning of each year to more than 4,000 individuals and organizations. This mailing was considered important to allow potential submitters the time to assemble a team and schedule a proposal response to the RFP. By design, many of the recipients were new to the transportation field. Sole source agreements were rarely used.

The work program included projects in the four major areas of asphalt, highway operations, concrete and structures, and pavement performance. Each proposed project was described by:

- a reference to the SHRP Research Plan,
- the expected duration of the research,
- the expected time of issue of the RFP during the year,
- the range in budget for the project, and
- a description of the objectives, work effort, related work, and the expected product.

A quarterly program announcement that included the RFP gave contractors 60 days to submit a proposal. Several proposals resulted in submissions by consortia. The only barrier to a proposer was poor past performance. Conflicts that involved the inclusion of committee members on proposal teams were resolved by asking the committee members to remove themselves from either committee or the proposing team.

Proposal review criteria were developed for technical committees, called expert task groups. Although the contractors work plan and research team were invariably the most important criteria, weighing of the criteria items was left to the technical committee. Contractors were chosen by the SHRP Executive Committee based on the results of the technical review.

Negotiating Contracts

The administrative effort to process the contract documents was expedited by using dedicated contract staff. The technical committees were used to ensure that the scope of work was acceptable.

The principal problems with contracts involved the insurance requirements. Otherwise, contract problems were isolated to selected universities, which had project scheduling and invoicing difficulties..

All contracts were issued as cost plus a fixed fee, that was set at a maximum of 7 percent. Future modifications to the contract did not increase the fee. To further maintain control over the escalating cost of modifications, a cap on the burden (fringe plus overhead) was negotiated for the original contract and was retained throughout.

Monitoring Contracts

Although technical panels were organized to monitor individual projects, there were times when panels monitored several related projects. SHRP staff, working with the panels, kept the Executive Committee advised at quarterly meetings. The close technical contact maintained between contractors and review panels allowed development of modifications to proceed quickly. Panel and SHRP staff reviewed the project expenses and compared those to the technical accomplishments and the overall budget. Discrepancies were effectively handled before they became an insoluble problem. Again, the delay in invoicing that was experienced with some of the universities caused panel monitoring problems in judging progress against expenditures.

Some of the contract problems were difficult enough to warrant a separate review by the Executive Committee or a special subcommittee.

Implementation was not a primary concern in either the contract letting stage or the monitoring effort. The feeling of

SHRP Executive Committee and sponsors was that the implementation process was sufficiently complex and time consuming that it could not be fit into the Research Plan budget. An implementation effort has subsequently been undertaken.

Contracts were closed out when a memo from the project manager was signed by SHRP and the contractor. The memo basically stated that the project deliverables were received and the contractor performed all required tasks. A final invoice contained a 5 percent withholding. A final audit was only performed if there were unresolved financial issues.

It is generally felt by SHRP staff that the contracting process was expeditious and burden free.

APPENDIX E

Preparation of Application for Project Work Plan (MnDOT)

Proposal Preparation and Submission (SDDOT)

Advertisement for Letter of Interest (Sample used by NJDOT)

Proposal Evaluation Form (NJDOT)

Project Task Completion Schedule (WVDOT)

Automated Research Tracking System (ARTS) (MnDOT)

MnDOT Transportation Research Problem Statement

SDDOT Implementation Process Forms

MINNESOTA DEPARTMENT OF TRANSPORTATION OFFICE OF RESEARCH ADMINISTRATION *RESEARCH PROJECT WORK PLAN* 6/29/95	DATE REC'D	TOC NO
	CONTRACT NO	
	PROJ NO	
	FWHA NO	

TITLE OF PROJECT (DO NOT EXCEED 65 TYPEWRITER SPACES).	
IS THIS A RESPONSE TO A SPECIFIC MN/DOT NEED? ___ NO ___ YES IF YES, STATE NAME OF CONTACT PERSON FROM MN/DOT.	
PRINCIPAL INVESTIGATOR (LAST, FIRST, MIDDLE).	
POSITION TITLE/DEGREES	
MAILING ADDRESS	TELEPHONE AND FAX (AREA CODE, NUMBER, EXT.) TEL: FAX:
	E-MAIL:
	DEPARTMENT
	LENGTH OF PROPOSED PROJECT (MONTHS)
NON-MN/DOT FUNDING SOURCES AMOUNT SOURCE	NAME OF APPLICANT ORGANIZATION/FIRM ADDRESS
KEY PERSONNEL OTHER THAN PRINCIPAL INVESTIGATOR.	
NAME POSITION TITLE ORGANIZATION DEGREE(S) ROLE ON THE PROJECT	NAME POSITION TITLE ORGANIZATION DEGREE(S) ROLE ON THE PROJECT
NAME POSITION TITLE ORGANIZATION DEGREE(S) ROLE ON THE PROJECT	NAME POSITION TITLE ORGANIZATION DEGREE(S) ROLE ON THE PROJECT
KEY WORDS	

MINNESOTA DEPARTMENT OF TRANSPORTATION
OFFICE OF RESEARCH ADMINISTRATION

RESEARCH PROJECT WORK PLAN

ABSTRACT - SEE INSTRUCTIONS

IMPLEMENTATION

What methods, procedures, products, and/or standards should change as a result of this research project ?

What are the specific benefits of this change(s), and why would this change(s) be important to Mn/DOT and/or our customer, and how can these benefits be measured ?

DETAILED BUDGET FOR YEAR 1 ONLY *DIRECT COSTS ONLY*					FROM	THROUGH
PERSONNEL (APPLICANT ORGANIZATION ONLY)	PERCENT EFFORT ON PROJ	EMPL STATUS	CAL MTHS	EFF MTHS	DOLLAR AMOUNT (OMIT CENTS)		
NAME/ROLE					SALARY/ WAGE COST	FRINGE BENEFITS	TOTALS
PRINCIPAL INVESTIGATOR							
SUBTOTALS ⇒	100%	SUBTOTALS ⇒					
SUBCONSULTANT/SUBCONTRACTOR COSTS							
EQUIPMENT (ITEMIZE)							
SUPPLIES (ITEMIZE BY CATEGORY)							
TRAVEL							
OTHER EXPENSES (ITEMIZE BY CATEGORY)							
TOTAL PROJECT COST FOR INITIAL BUDGET PERIOD (1 YEAR)							

DETAILED BUDGET FOR YEAR 2 ONLY *DIRECT COSTS ONLY*					FROM	THROUGH
PERSONNEL (APPLICANT ORGANIZATION ONLY)	PERCENT EFFORT ON PROJ	EMPL STATUS	CAL MTHS	EFF MTHS	DOLLAR AMOUNT (OMIT CENTS)		
NAME/ROLE					SALARY/ WAGE COST	FRINGE BENEFITS	TOTALS
PRINCIPAL INVESTIGATOR							
SUBTOTALS ⇒	100%	SUBTOTALS ⇒					
SUBCONSULTANT/SUBCONTRACTOR COSTS							
EQUIPMENT (ITEMIZE)							
SUPPLIES (ITEMIZE BY CATEGORY)							
TRAVEL							
OTHER EXPENSES (ITEMIZE BY CATEGORY)							
TOTAL PROJECT COST FOR INITIAL BUDGET PERIOD (1 YEAR)							

BUDGET FOR ENTIRE PROPOSED PROJECT PERIOD

DIRECT COSTS:

BUDGET CATEGORY TOTALS	INITIAL BUDGET PERIOD (FROM PAGE 3 AND 3A)	ADDITIONAL YEARS OF SUPPORT REQUESTED	
		3RD	4TH
PERSONNEL: Salary and fringe benefits Application Organization Only			
CONSULTANT/SUBCONTRACTOR COSTS			
EQUIPMENT			
SUPPLIES			
TRAVEL			
OTHER EXPENSES			
TOTAL DIRECT COSTS			
INDIRECT COSTS (IF APPLICABLE)			

TOTAL COSTS FOR THE ENTIRE PROPOSED PROJECT $

COMMENTS/JUSTIFICATION - See instructions.

PRINCIPAL INVESTIGATOR:
I agree to accept responsibility for the scientific conduct of the project and to provide the required progress reports. Willful provision of false information is a criminal offense. I am aware that any false, fictitious, or fraudulent statement may, in addition to other remedies available to Mn/DOT, subject me to civil penalties under the Program Fraud Civil Remedies Act of 1986 (45 CFR 79). I also agree to abide by the terms of the Mn/DOT-University of Minnesota "Basic Agreement" , and the task order contract for this project.

SIGNATURE OF PRINCIPAL INVESTIGATOR:
(In ink. "Per" signature not acceptable).

DATE:

CONTRACT ADMINISTRATOR:
I certify that the statements herein are true and complete to the best of my knowledge, and accept the obligation to comply with the terms of any contract that may result from this application. A willfully false certification is a criminal offense. I am aware that any false, fictitious, or fraudulent statement may, in addition to other remedies available to Mn/DOT, subject me to civil penalties under the Program Fraud Civil Remedies Act of 1986.

SIGNATURE OF CONTRACT ADMINISTRATOR:
(In ink. "Per" signature not acceptable).

DATE:

PROJECT INFORMATION

PLEASE ATTACH SEPARATE SHEETS THAT PROVIDE ALL OF THE INFORMATION LISTED BELOW:

BACKGROUND: Include any background information pertinent to the research including any previous related work performed for Mn/DOT or the Center for Transportation Studies. Maximum length = 300 words.

OBJECTIVE: Concisely describe the goals or objectives of the project. Maximum length = 200 words.

SCOPE: Briefly describe the range or scope of work encompassed by this project. Maximum length = 200 words.

TASKS: In chronological order list each major task or milestone necessary to complete the project. The work on each task will be reviewed to track progress of the project and to determine when payment should be made.

Deliverable: For EACH TASK list any deliverables that result from work on this tasks such as reports, test results, maps, software, etc. The MINIMUM deliverable for ANY task is a 1-2 paragraph write-up describing the outcome of the task. (See instructions for more information.)

Duration: For EACH TASK indicate the amount of time needed to complete the task. List the time in NUMBER of months, not Jan-Mar, etc.

BUDGET BY TASK: Indicate the lump sum cost of each task.

Task 1	$ 1,500
Task 2	$13,200
Task 3	$ 9,375
Task n	$ 8,125
TOTAL	$32,200

PROJECT SCHEDULE: Include a project schedule such as the one shown here: *Note: This is a Sample!*

TASK	MONTH												
	1	2	3	4	5	6	7	8	9	10	11	12	13...
Title of task 1	xxxxxxxxx												
Title of task 2		xxxxxxxxxxxxxxxxxxxxxxxxxxxx											
Title of task 3									xxxxxxxx				
Title of task n										xxxxxxxxxxxxx			

Because the start of a project is sometimes delayed due to processing of the contract, the months in the schedule should be listed by NUMBER from the time the contract is approved, not Jan, Feb, Mar, etc.

Mn/DOT ASSISTANCE: If the project requires specialized help or input including data, materials, equipment, facilities etc., it should be documented. Include names or job titles if necessary.

LITERATURE SEARCH: Include your findings related to this project from a literature search. A literature search is required before any contract negotiations begin.

RESUMES: Attach a resume for the principal investigator and co-principal investigators. Maximum length is 2 pages per person, additional page will be removed and discarded.

SOUTH DAKOTA DEPARTMENT OF TRANSPORTATION

PROPOSAL PREPARATION AND SUBMISSION

The Office of Research solicits research proposals from colleges, universities, research institutes, consultants, government agencies and others who possess extensive, demonstrated capability and experience in the subject areas.

Proposal Submission

Proposers must submit ten (10) copies of their proposals to the Office of Research. Proposals must arrive at the Office of Research on or before the time and date specified in the Request for Proposal. Proposals arriving after the deadline will not be accepted. Researchers' proposals must remain valid for at least 120 days after the deadline.

The Office of Research will not acknowledge receipt of proposals unless a stamped, self-addressed post card is included in the proposal package. All proposals submitted become the property of the South Dakota Department of Transportation. SDDOT has the right to use all information presented in any proposal, unless it is annotated as being proprietary. Selection or rejection of a proposal does not affect this right.

SDDOT reserves the right to reject any and all proposals submitted. It may, under certain conditions, negotiate with the proposer to address specific weaknesses in a submitted proposal.

SDDOT is not responsible for any costs incurred by researchers, including proposal preparation, prior to execution of a contract.

Proposal Organization

The research proposal should be a well prepared document that defines the research problem and objectives, provides a detailed work plan for achieving the objectives, and indicates how the research findings are expected to be used. Proposals should simply and economically provide a straightforward description of the researcher's ability to meet the requirements of the RFP.

The following instructions are intended to help researchers prepare a proposal which will be accepted with a minimum of changes. Proposals **must** comply with these instructions to be considered. Failure to comply will seriously jeopardize the proposal's chances of selection.

Title Page

The proposal cover should include the following information, as illustrated by Figure 1:

- Proposal title (from RFP);
- Research project number (from RFP);
- "Submitted by" name, institution and address of proposer;
- "Submitted to South Dakota Department of Transportation, Office of Research Room B-116, 700 East Broadway Avenue, Pierre, SD 57501-2586";
- Proposal date.

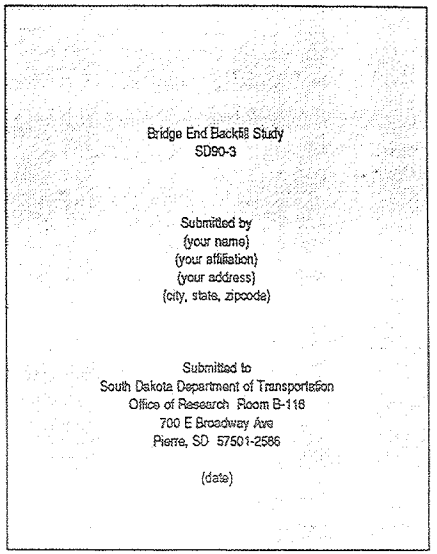


Figure 1 Sample Title Page

Table of Contents

On a separate page, list the proposal's sections and page numbers.

Problem Statement

Concisely express your understanding of the problem presented in the RFP. Do not simply repeat the wording of the RFP, but rather demonstrate your own insight into the problem.

Background Summary

Include background information on the research topic. Summarize the findings of a preliminary literature search and state the relationship of the proposed study to prior research. The summary should reveal your understanding of underlying principles and should clearly express your appreciation of the problem.

The importance of this part of the proposal should not be underestimated. A comprehensive background summary ensures that all aspects of the research topic have been adequately considered so new research can build upon prior work rather than duplicate it.

Objectives

State the technical objectives of the study. Explain and justify any deviations from the objectives listed in the RFP.

Benefits

Identify potential benefits expected from the research. Describe how the research results can be used, and by whom, to improve transportation practice. Possible benefits include:

- Cost savings;
- Increased safety;
- Improved service;
- Improved procedures.

Research Plan

Describe how the objectives will be achieved through a logical and innovative plan. Use the task descriptions given in the RFP as a basis for developing the research plan. Specifically identify the tasks which will be performed. Explain and justify any deviations from the tasks listed in the RFP.

The plan should also describe the technical basis of the research. Describe the following, as appropriate:

- Principles or theories to be used;
- Significant variables to be tested;
- Analytical and statistical procedures;
- Experimental and testing procedures;
- Evaluation criteria;
- Inspection and survey methods;
- Controls to be used;
- Material or procedure development.

The plan should be complete, providing the greatest level of detail that the researcher's understanding of the problem permits.

Products

List the products which will be delivered during the research project. Deliverables might include:

- Reports;
- Computer programs;
- Manuals;
- Photographs;
- Video or other audio/visual materials;
- Physical models;
- Data bases.

Unless directed otherwise in the RFP, always include the following items as products:

- Quarterly progress reports (1 copy)
- Draft final report (10 copies);
- Final report (25 copies, 1 camera-ready copy)

Table 2 Sample Task Time Schedule

Task \ Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Field Surveys																
2 Literature Review																
3 DOT Interviews																
4 Field Tests																
5 Observe Construction																
6 Analyze Cost Effectiveness																
7 Develop Recommendations																
8 Prepare Final Report																

Implementation

Describe how the research results can be applied by SDDOT to improve its practice. Include the following:

- Describe the form in which the research findings may be reported, such as a mathematical model, a laboratory test procedure, or a design technique. Describe these results in terms of the practicing engineer or administrator.

- State who would logically be responsible for applying the research results, such as the American Association of State Highway and Transportation Officials (AASHTO), the Federal Highway Administration (FHWA), the South Dakota Department of Transportation or a particular office within SDDOT.

- Identify specific standards or practices which might be affected by the research findings, such as AASHTO or SDDOT specifications, SDDOT policies and procedures, legislation or fiscal requirements.

- If findings will not be suitable for immediate application at the conclusion of the research project, indicate what further work might be necessary.

It is understood that the actual research may produce unanticipated findings, making changes in the implementation plan necessary. This is acceptable. The proposal selection will be greatly influenced by the practicality and direction of the implementation plan presented in the proposal, however.

Table 3 Sample Breakdown of Man Hours

Name of Principal Professional or Support Classification	Role in Study	Task 1	Task 2	Task 3	Task 4	Task 5	Total
Professor A	Principal Investigator	20	30	10	0	10	70
Professor B	Co-principal investigator	15	25	20	20	0	80
Graduate Student 1	Field Testing	10	15	5	10	10	50
Graduate Student 2	Analysis	10	15	5	15	5	50
Administrative Staff	Administrative Support	5	5	5	10	5	30
Clerical Staff	Report Preparation	5	10	5	10	20	50
TOTAL		65	100	50	65	50	330

Time Schedule

Provide a bar chart or other graphical presentation illustrating the scheduling of the major research tasks (Table 2). Indicate the number of months allocated to each task. Always allow twenty (20) days for SDDOT review of draft reports.

Staffing

Include pertinent background information for principal investigators and other team members significantly participating in the project. Describe how academic, professional and research experiences relate to the project. Include a summary of past accomplishments in the same or closely related problem areas.

Provide a table showing the number of man hours (not percentages of time) which will be devoted to each task by research team members, as illustrated in Table 3. List the names of principal investigators and other key professionals who will be involved. Support personnel may be identified by classification. If subcontracting is necessary, include subcontractors' key personnel and support staff in the table. Clearly identify subcontractors' involvement.

List current commitments to other work in sufficient detail to permit assessment of the researcher's ability to meet the proposal's commitments. Include a statement that the level of effort proposed for principal and professional members of the research team will not be changed without written consent of SDDOT.

Facilities

Describe the facilities available to accomplish the research. Indicate equipment which is necessary to completion of the research and specify any restrictions on its use. Specify any equipment which is necessary but not currently on-hand. If additional equipment is to be purchased with project funds, identify it in the budget estimate.

SDDOT Involvement

Describe any assistance which may be required from the South Dakota Department of Transportation. Include such items as:

- Traffic control;
- Construction;
- Highway maintenance;
- Drilling and sampling;
- Access to transportation facilities;
- Access to written information or databases;
- Interviews.

Quantify the required level of effort as well as possible.

Budget

Show the estimated cost for the entire research project by fiscal year, as illustrated by Table 4. SDDOT's fiscal years run from July 1 to June 30.

Table 4 Sample Budget by Fiscal Year

Item	FY93	FY94	FY95	Total
Salaries	6,000	4,000	4,000	14,000
Fringe Benefits	900	600	600	2,100
In-State Travel	750	500	800	2,050
Out-of-State Travel	0	0	0	0
Equipment Purchase	1,000	0	0	1,000
Expendable Supplies	350	250	300	900
Subcontracts	0	0	0	0
Overhead/Indirect Costs	2,400	1,600	1,600	5,600
Computer Time	0	0	0	0
Report Publication	0	0	400	0
TOTAL	$11,400	$6,950	$7,300	$26,150

Out-of-state travel, which is considered to be travel between the researcher's base and destinations other than South Dakota, must be identified separately.

Total funding should not exceed the amount indicated as "Funds Available" on the Request for Proposal. This amount represents what SDDOT feels the research topic merits and what level of funding should be necessary to complete the work. Proposers should set the scope and depth of study accordingly. Because of budget constraints, additional funding is highly unlikely. No budget extensions should be anticipated.

International System of Units

Beginning with SDDOT's 1993 program, all studies must be conducted and reported using the International System of Units (SI), commonly referred to as "metric" units. This requirement is consistent with federal mandates resulting from the Omnibus Trade and Comptetiveness Act of 1988. Proposals must use metric units. Optionally, values in imperial (English) units may be included in parentheses following the metric values.

Guidance on use of the metric system is given in ASTM Standard E380 for Metric Practice, available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ADVERTISEMENT FOR LETTER OF INTEREST (NJDOT)

(a)

DIVISION OF RESEARCH AND DEMONSTRATION BUREAU OF TRANSPORTATION SYSTEMS RESEARCH

Notice of Request for Expression of Interest

Professional Services for the Development, Design and Testing of Improved Street Hardware

Public Notice

Take notice that the New Jersey Department of Transportation is seeking qualified universities or engineering firms (consultants) interested in submitting letters of interest to conduct a research study for the development, testing, and design of improved methods for resetting highway hardware (manhole covers and inlet grates) to match the height of a newly resurfaced pavement.

As part of FHWA grant NJ 91-101, the New Jersey Department of Transportation (NJDOT) is seeking qualified universities or engineering firms (consultants) interested in submitting letters of interest to conduct a research study for the development, testing, and design of improved methods for resetting highway hardware resurfaced pavement. The research study will establish generic design procedures, specifications and improved prototype extension frame devices to facilitate that objective.

The research study will consist of the following: (1) developing analysis and design criteria for the extension frames; (2) testing the validity of those developed criteria through means of laboratory, test track, and actual field installations; (3) development of a testing protocol, specifications and prototype of an improved generic extension frame design; and (4) development of an implementation package to permit transfer/ demonstration of the improved technology developed to other highway agencies.

The Department encourages applications from qualified minority contractors and disadvantaged business enterprises (DBE). The New Jersey Department of Transportation has a DBE target of 20 percent.

A contractor will not be eligible to bid on this work if there is a preexisting relationship with a vendor of highway hardware which could cause even the appearance of a conflict of interest or unfair competitive advantage. A conflict of interest will be deemed to exist if the contractor has previously been involved in the development or marketing of highway hardware which might be evaluated in this research or in the development of technical criteria to be used in the acquisition of such highway hardware.

The selection of the contractor will be done in two phases. The first phase will be a review of letters of interest to evaluate the contractors' capabilities and experience in performing the work required for this project. Such letters shall also indicate the DBE status of the contractor and any subcontractors to be utilized and the nature of any preexisting relationship with a vendor of highway hardware. Secondly, based on the review of the letters of interest, Requests for Proposals will be sent to up to five contractors for their use in preparing proposals. The final selection will be based on a review of the proposals submitted. Understanding of the work, proposed staffing, relevant experience of the personnel and firms and required licensing will be elements in short listing and final selection.

This effort is to be completed within 36 months of the beginning of work, which is scheduled to begin in early 1993.

There is $650,000 available for this contract.

The work on this effort must be supervised and approved by a licensed professional engineer.

Organizations and joint ventures wishing to be considered for this study should submit three copies of: (1) a letter of interest, not exceeding four single side, letter sized pages, providing a level of detail adequate for the review mentioned above, and summarizing the firm's understanding of the project, qualifications of the firm, prior relevant experience, team organization and key personnel; (2) a list of references claimed as relevant experience by each firm and each key individual including: name, title, agency, address and telephone number of client agency program manager; (3) an organizational chart showing proposed key personnel names, position titles and reporting relationship of each firm; (4) an organizational chart showing proposed key personnel names, position titles, professional licenses and/or registrations and reporting relationships; and (5) completed NJDOT Form SA87 to:

Mailing Address:

New Jersey Department of Transportation
Division of Research and Demonstration
CN 612
Trenton, NJ 08625-0612

Office Location: 1600 North Olden Avenue, Trenton, NJ.

The deadline for receipt of letters of interest is

Solicitation number: 22003571

Any questions on this effort should be directed to:

New Jersey Department of Transportation
Division of Research and Demonstration
CN 612
Trenton, NJ 08625-0612
Telephone:

For a blank copy of NJDOT Form SA87, contact the NJDOT Bureau of Professional Services at (609) 530-2452.

NEW JERSEY DEPT. OF TRANSPORTATION

PROPOSAL EVALUATION CRITERIA

UNDERSTANDING OF THE PROBLEM (WEIGHT _____ %)

Something more than a mere duplication or rephrasing of the problem statement is desired as an indication of a good understanding of the problem.

PROPOSED RESEARCH APPROACH (WEIGHT _____ %)

This should include a scientific and practical approach to experimental design, data collection, analytical procedures, cooperative features, innovative concepts, and reliability of equipment proposed for use. Consideration should also be given to whether or not the approach is sufficiently detailed, both in terms of work and budget allocations by tasks.

QUALIFICATIONS OF STAFF (WEIGHT _____ %)

An evaluation of both expertise and experience should be made. This should include consideration of technical disciplines of the principal investigator and the other supporting staff as well as related work with which their firm has been involved. The relative efforts of all members of the research team should also be considered.

ADEQUACY OF RESOURCES (WEIGHT _____ %)

Depending upon the nature of the project, an evaluation of facilities, equipment, and other resources should be made. It should be noted, for example, whether equipment and facilities presently exist or are being proposed to be purchased or built.

APPLICATION OF RESULTS (WEIGHT _____ %)

A realistic appraisal of the prospects for successful accomplishment of project objectives is desired. Consideration should be given to the means of reporting results and the degree of thought that has been given to a plan for implementation.

STRENGTHS AND WEAKNESSES (NOT A WEIGHTED ITEM)

When appropriate, it may be desirable to list specific strengths and weaknesses of the proposal to aid in determining its ultimate ranking.

Project Task Completion Schedule

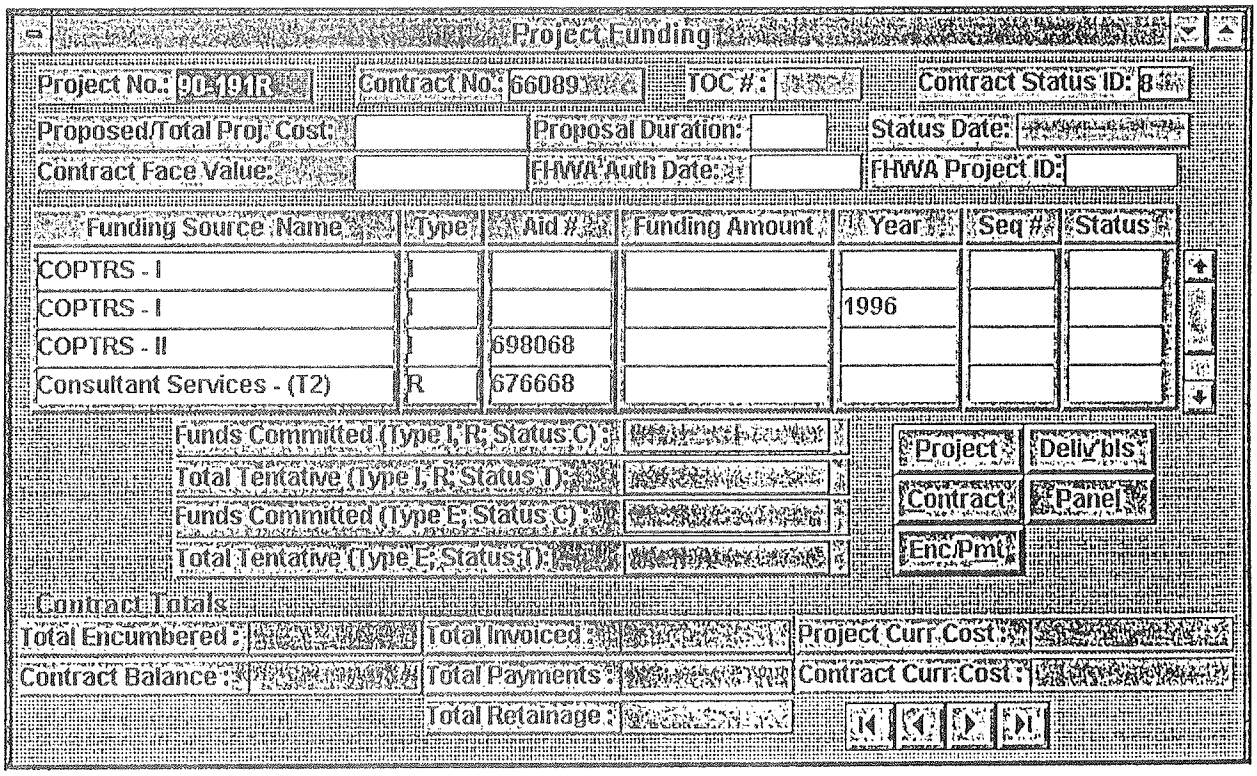
(Sample Used By West Virginia)

Project Task	% of Project	% Task Completed To Date	% Project Completed
Literature Review			
Data Collection			
Synthesis and Analysis			
Loading Criteria			
Theoretical Analysis			
Parametric Analysis			
Comparative Analysis			
Final Report			
TOTAL	100		

FUNCTIONAL SPECIFICATION: Mn/DOT ORA
Automated Research Tracking System

PROJECT FUNDING INFORMATION

When the user chooses to view Funding information on a project, the following screen is displayed:



The button panel is again available for the user to move between screens:

Project	(Or the Alt_P key) Display the project screen.
Contract	(Or the Alt_C Key) Display the Contract screen for the selected research project and allow the user to make changes to it.
Enc/Pmt	(Or the Alt_M Key) Display the Encumbrance and Payments screen for the selected research project and allow the user to make changes to it.
Deliv'bls	(Or Alt_V keys) Loads the deliverables screen for the selected project.
Panel	(Or the Alt_L Key) Opens the Panel member screen.

Tentative funding is indicated with a Funding status code of "T", and Committed funding is indicated with a code of "C". The total Tentative and Committed funds for both internal and external funding sources are displayed in the center portion of the window.

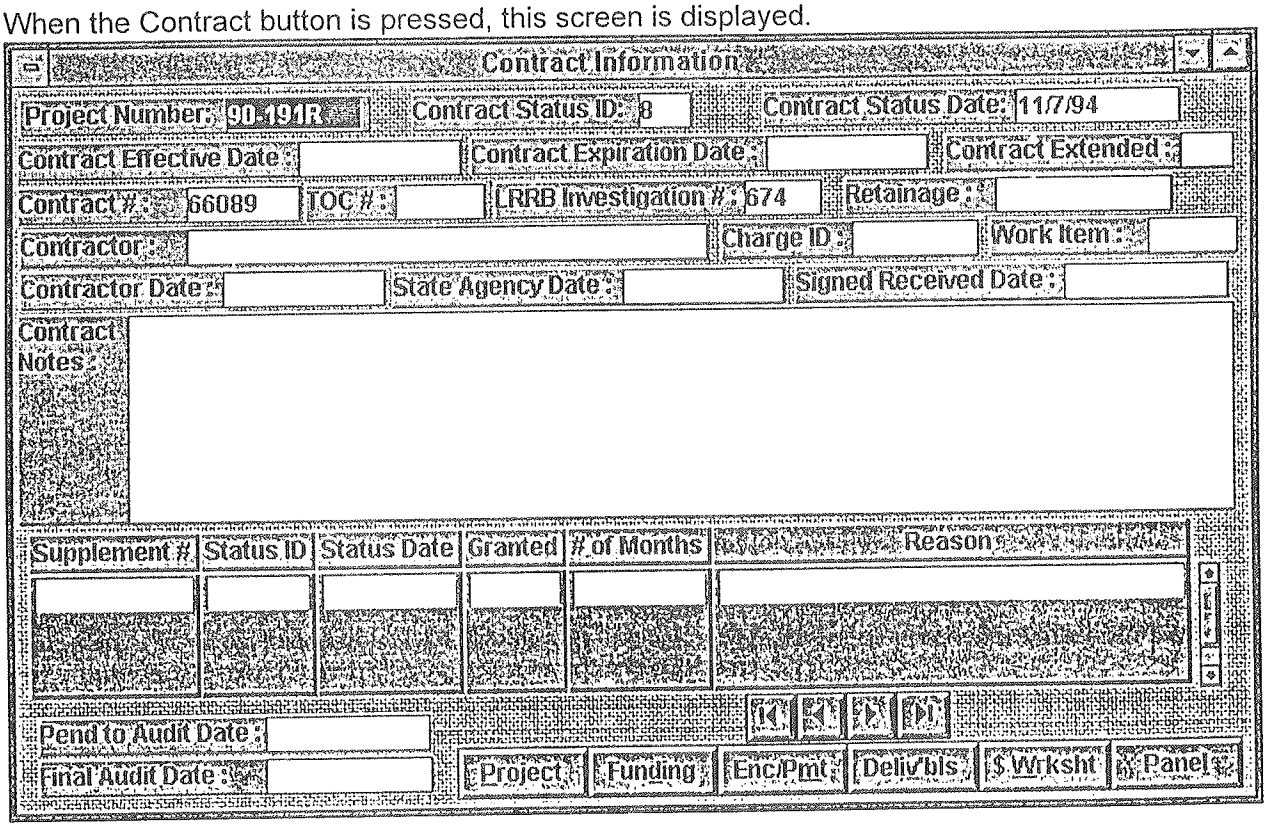
When new funding records are added and subsequently saved, or existing records are changed, the new amount or the amount changed (previous value less new value) is adjusted in the FUNDBAL table, in the record for the current funding source/fiscal year, in the "Project Amount Promised" field.

The "Retainage" amount is computed as the product of the [Retainage] field of the project table (set up through the Contract screen; assumed to be 1 if blank), which is a percentage, and the total contract balance, which is a dollar amount.

FUNCTIONAL SPECIFICATION: Mn/DOT ORA
Automated Research Tracking System

CONTRACT INFORMATION

When the Contract button is pressed, this screen is displayed.



Contracts must be set up before Encumbrances can be entered. Enter all pertinent information on this screen when the contract is received.

The button panel is again available for the user to move between screens:

Project	(Or the **Alt_P** key) Display the project screen.
Funding	(Or the **Alt_F** Key) Display the Funding screen for the selected project and allow the user to make changes to it.
Enc/Pmt	(Or the **Alt_M** Key) Display the Encumbrance and Payments screen for the selected research project and allow the user to make changes to it.
Deliv'bls	(Or **Alt_V** keys) Loads the deliverables screen for the selected project.
Panel	(Or the **Alt_L** Key) Opens the Panel member screen.

MnDOT

Transportation Research Problem Statement

** Submittal **

==========

Contact Person(s)_____

Address:_____

Phone/FAX No.:_____

==========

Research Idea Information

Title (Brief/Concise):_____

Problem (Clearly and concisely describe the problem):

Research You Propose (State how you see the research to be done):

If research is successful, what are the potential benefits ?

In general, what would have to be done to gain the benefits from these research results ?

Qualified Researchers (List name, address, phone of researchers who may be qualified to conduct this work):

Name:_____ Phone/Address:_____

Name:_____ Phone/Address:_____

Project Review (List persons who should be involved in reviewing a research proposal on this topic):

Name:_____ Phone/Address:_____

Name:_____ Phone/Address:_____

Key Words (Provide a list of descriptive key words to assist in the literature search):

Please return this form to: * Office of Research Administration * 117 University Avenue
Ford Building 2nd Floor * St. Paul MN 55155 * MS 330 * Phone (612) 282-2688 * Fax (612) 296-6599

SDDOT IMPLEMENTATION PROCESS FORMS

South Dakota Department of Transportation
Research Project Statement
Project SD93-10

Title: Increased Efficiency Through Integrated Project Filing

Problem Description: Construction project documentation exists in multiple files distributed throughout the Department. The Office of Central Services maintains a central project file, but it is not readily accessible or up to date. Thus individual offices maintain separate files, which leads to unnecessary duplication, inconsistency, and occasional loss. Because documents prepared in one office are not readily accessible by other offices, design progress may be delayed. Similar situations arise with plans prepared by consultants. Consequently, manpower expended on maintenance of multiple files is unavailable for more productive purposes. Furthermore, storage of multiple paper files consumes valuable space.

Several new technologies may provide solutions to this problem. Document management software can index all of a project's files and documents by type, author, date, or location. Document viewing programs recognize and display various word processing file formats and can search for specific words or phrases in a set of electronic documents. Similar programs display drawings generated by computer aided drafting systems, and allow reviewers to mark up drawings without actually changing CAD files. Imaging systems scan paper documents optically, producing an electronically recorded image which can be indexed, retrieved and viewed. By using a combination of these technologies, it may be possible to create and maintain a single, integrated project file electronically. The file would be complete, current, authoritative, and accessible to the Department's technical staff in the central office and field offices. It could also support an Executive Information System for management. But at present, the Department has not specifically identified how a combination of appropriate technologies can be most effectively used for this application.

Urgency: Manpower and space are becoming more valuable every day. This project could increase the availability of information and reduce handling time and storage.

Literature Summary: A preliminary review of the literature indicates that image processing is a rapidly emerging technology. Corporations which have begun using image processing have realized substantial savings—up to 30%—in document storage and retrieval costs alone. In more complex tasks, such as case and project management, savings have been even higher. The literature review also indicates that, because image processing can strongly affect an organization's basic business processes, it is not a simple undertaking. Electronic image processing should not be considered a single solution, but rather one of several tools which can be used to reduce paperwork and improve management of information.

Are research results already available? Yes **If so, how can SDDOT implement these results?** General electronic imaging system information and component specifications are available but cannot address the complexity of SDDOT's project file system. The Bureau of Administration's Information Processing Services office is presently conducting a more global project called FOCUS, the results of which will be of some value for this project.

In summary, does research need exist? Yes **Explain:** There is a need for more efficient document access in the DOT. Although several hardware and software tools are available, we don't know how to most effectively apply them to our needs.

Research Objectives:

1) To assess the need for automated management of department- and consultant-prepared project documents in SDDOT's central and field offices.
2) To identify appropriate technologies for integrating construction project files into a single inclusive file accessible to all of SDDOT's central and field offices.
3) To develop a plan to effectively implement these technologies, assessing costs and benefits.

Research Tasks:

1) Meet with the technical panel to review project scope and workplan.
2) Review literature review pertinent to current technologies and other state DOT's methods of integrated project filing.
3) Assemble individual and global needs summaries by:
   a) Reviewing existing project files from project authorization through completion and acceptance.
   b) Developing a questionnaire to identify subject area, frequency, quantity, importance, type, and other specific problems relating to project files.
   c) Scheduling and conducting interviews and completing questionnaires in affected offices in the Divisions of Engineering, Finance, and Planning, and in the Pierre Region and in the Pierre Area offices.
4) Identify appropriate technologies to satisfy needs based on research thus far.
5) Assess the usefulness of SDDOT's current Local Area Network and proposed Wide Area Network as the technical architecture for the proposed system.
6) Submit an interim report summarizing needs and outlining preliminary options to satisfy needs and meet with technical panel to review interim report.
7) Develop an implementation plan including procedural and organizational changes, necessary purchases, costs, benefits, and other relevant considerations.
8) Submit a final report and executive summary summarizing relevant literature, research methodology, findings and conclusions.

Potential Implementation: Implementation may create significant procedural changes in construction document handling. The project goal will be to streamline and integrate project files thus eliminating unnecessary redundancies and discrepancies. Also reduction of paperwork and mailings (postage) for inter-office review and a savings of document storage space. Technology demonstrated may be applicable to other areas, including management correspondence and on-line manuals.

Budget Estimate: $ 50,000, 6 months **Funding:** HPR

SDDOT Involvement: SDDOT will provide a senior analyst from its Office of Data Services to assist the consultant one-half time through the duration of the study. Personnel from the Divisions of Engineering, Finance, Planning and the Pierre Region and Area offices will be interviewed.

Recommendation: Contract Research **Explain:** This project requires expertise unavailable within the Department and a commitment of time and effort beyond the Department's capability.

Technical Panel:

Mary Bisson, Bureau of Administration	773-4632	Randy Kleinschmidt, Central Services	773-3582
Jim Douglas, Bureau of Administration	773-3807	Paul Orth, Office of Research	773-3544
Mark Gageby, Central Services	773-4017	Al Yocom, Data Services	773-3597
David Huft , Office of Research	773-3358	Forrest Wixon, Project Management	773-3634
Jerry Jacobsen , Office of the Secretary	773-5103		

South Dakota Department of Transportation
Request for Research Proposal
1993 Program

Problem Number: SD93-10

Title: Increased Efficiency Through Integrated Project Filing

Problem Description: Construction project documentation exists in multiple files distributed throughout the Department. The Office of Central Services maintains a central project file, but it is not readily accessible or up to date. Thus individual offices maintain separate files, which leads to unnecessary duplication, inconsistency, and occasional loss. Because documents prepared in one office are not readily accessible by other offices, design progress may be delayed. Similar situations arise with plans prepared by consultants. Consequently, manpower expended on maintenance of multiple files is unavailable for more productive purposes. Furthermore, storage of multiple paper files consumes valuable space.

Several new technologies may provide solutions to this problem. Document management software can index all of a project's files and documents by type, author, date, or location. Document viewing programs recognize and display various word processing file formats and can search for specific words or phrases in a set of electronic documents. Similar programs display drawings generated by computer aided drafting systems, and allow reviewers to mark up drawings without actually changing CAD files. Imaging systems scan paper documents optically, producing an electronically recorded image which can be indexed, retrieved and viewed. By using a combination of these technologies, it may be possible to create and maintain a single, integrated project file electronically. The file would be complete, current, authoritative, and accessible to the Department's technical staff in the central office and field offices. It could also support an Executive Information System for management. But at present, the Department has not specifically identified how a combination of appropriate technologies can be most effectively used for this application.

Research Objectives:

1) To assess the need for automated management of department- and consultant-prepared project documents in SDDOT's central and field offices.
2) To identify appropriate technologies for integrating construction project files into a single inclusive file accessible to all of SDDOT's central and field offices.
3) To develop a plan to effectively implement these technologies, assessing costs and benefits.

Research Tasks:

1) Meet with the technical panel to review project scope and workplan.
2) Review literature review pertinent to current technologies and other state DOT's methods of integrated project filing.
3) Assemble individual and global needs summaries by:
   a) Reviewing existing project files from project authorization through completion and acceptance.
   b) Developing a questionnaire to identify subject area, frequency, quantity, importance, type, and other specific problems relating to project files.
   c) Scheduling and conducting interviews and completing questionnaires in affected offices in the Divisions of Engineering, Finance, and Planning, and in the Pierre Region and in the Pierre Area offices.
4) Identify appropriate technologies to satisfy needs based on research thus far.
5) Assess the usefulness of SDDOT's current Local Area Network and proposed Wide Area Network as the technical architecture for the proposed system.
6) Submit an interim report summarizing needs and outlining preliminary options to satisfy needs and meet with technical panel to review interim report.
7) Develop an implementation plan including procedural and organizational changes, necessary purchases, costs, benefits, and other relevant considerations.

8) Submit a final report and executive summary summarizing relevant literature, research methodology, findings and conclusions.

Funds Available: $ 50,000

Contract Period: 6 months

SDDOT Involvement: SDDOT will provide a senior analyst from its Office of Data Services to assist the consultant one-half time through the duration of the study. Personnel from the Divisions of Engineering, Finance, Planning and the Pierre Region and Area offices will be interviewed.

General Information: The Office of Research of the South Dakota Department of Transportation (SDDOT) solicits proposals from colleges, universities, research institutes, foundations, engineering or other consultants, federal/state/local agencies or others who possess extensive, demonstrated capability and experience in the subject area.

Proposal Deadline: Proposals are due at the following address by 5:00 pm on February 12, 1993:

South Dakota Department of Transportation
Office of Research Room B-116
700 East Broadway Avenue
Pierre, South Dakota 57501-2586

This deadline is firm. Extensions will not be granted. Ten copies of the proposal must be submitted.

Proposal Guidelines: Proposals must be prepared in accordance with instructions given in the SDDOT Office of Research brochure entitled *Guidelines for Performing Research for the South Dakota Department of Transportation* dated November 1992.

Proposal Evaluation: Proposals will be evaluated by SDDOT Research staff and a technical panel knowledgeable in the problem area. Selection is made by the panel in consideration of:

1. the proposer's demonstrated understanding of the problem;
2. the merit of the proposed research approach;
3. the probability of success in achieving the project's objectives;
4. the proposer's record of accomplishments in related problem areas;
5. the adequacy of research staff and facilities.
6. the proposer's past record of performance for SDDOT.

Proposers will be notified of the results of the selection in writing no later than March 31, 1993.

Project Management: Paul Orth has responsibility for management of this project, and can be reached at (605) 773-3544 to answer inquiries.

Ownership of Proposals: All proposals become the property of the South Dakota Department of Transportation. SDDOT reserves the right to reject any and all proposals submitted. SDDOT is not responsible for any costs incurred by proposers, including proposal preparation, prior to execution of a contract.

Technical Panel Evaluation and Recommendations
SD93-10 Increased Efficiency Through Integrated Project Filing
October 15, 1993

Researcher: James E. Morrow
Organization: Strategic Management Solutions, Inc.
2519 McMullen Booth Rd, Suite 510-S
Clearwater, Florida

Study Duration: May, 1993 to October, 1993
Study Cost: $49,650

Study Evaluation:

In the opinion of the panel, the researcher completed the study's specified tasks and objectives. The work was done within budget, and well within the six-month period allocated for the project.

The strongest aspect of the project was the researcher's study of the Department's plans development process. Through extensive interviews, questionnaires, and site visits in the Department's central, Aberdeen Region, Pierre Region and Huron Area offices, he gained a thorough understanding of how plans are developed, how project files are used, and what problems exist.

This study provided a conceptual plan for establishing an electronic project filing system, but not a detailed list of hardware and software components. Because of the rapid pace of technological development in this area, the technical panel felt specific recommendations would be outdated quickly anyway. Instead, he concentrated his effort on making a fair assessment of the costs which would be necessary and benefits which would result. The consultant provided a list of potential vendors, but did not endorse any specific systems.

The consultant's implementation plan recommended a phased approach which included a proof-of-concept, a pilot installation, and two phases resulting in a Department-wide system. This approach seems appropriate in that it would allow the Department to develop expertise and confidence while overcoming problems encountered along the way. The last phase of the implementation plan would also allow more sophisticated techniques, such as optical character recognition and full-text indexing, to be re-evaluated.

The consultant's evaluation of the network available to support an integrated filing system was good. More information specific to the Microsoft network environment would have been useful, but that specialized knowledge was not available to this consultant.

In summary, the study produced a good conceptual plan, a realistic assessment of costs and benefits, and numerous guidelines to aid the Department's future activities in this area.

Research Objectives	Panel Comments
1) *To assess the need for automated management of department- and consultant-prepared project documents in SDDOT's central and field offices.*	The consultant accomplished this objective well. The need assessment was based on extensive interviews, and generally portrays the needs and opportunities for improvement accurately.

2) *To identify appropriate technologies for integrating construction project files into a single inclusive file accessible to all of SDDOT's central and field offices.*

The consultant described a general architecture for establishing an image-based filing system and described advantages and disadvantages of alternatives. He did not develop specific lists of hardware, but this was not specified in the Department's request for proposal.

3) *To develop a plan to effectively implement these technologies, assessing costs and benefits.*

Potential benefits were extensively described. The consultant's estimates were intentionally conservative, such that estimates of costs tended to be high and estimates of benefit tended to be low. The plan was general, so details of the hardware, software, and methods for indexing documents will have to be defined further by the Department.

Research Tasks:

Panel Comments

1) *Meet with the technical panel to review project scope and work plan.*

The consultant met with the panel immediately after the project's start date and thoroughly reviewed the project's scope and work plan.

2) *Review literature pertinent to current technologies and other state DOT's methods of integrated project filing.*

The consultant contacted numerous state DOT's and private organizations to determine their activities related to the topic. In general, he found that most states have interest, but have not yet accomplished much. Although the consultant demonstrated good knowledge of the industry, his reports did not summarize general literature.

3) *Assemble individual and global needs summaries by:*

   a) *Reviewing existing project files from project authorization through completion and acceptance.*
   b) *Developing a questionnaire to identify subject area, frequency, quantity, importance, type, and other specific problems relating to project files.*
   c) *Scheduling and conducting interviews and completing questionnaires in affected offices in the Divisions of Engineering, Finance, and Planning, and in the Pierre Region and Area offices.*

The consultant did a thorough study through review of project files and business processes, questionnaires, and interviews in the central and field offices. He acquired an excellent understanding of the Department's use of construction files, and assembled accurate summaries of need.

4)	*Identify appropriate technologies to satisfy needs based on research thus far.*	The consultant identified generic technologies which can be combined to accomplish an integrated filing system. Because of the rapid developments in this area, he did not recommend specific hardware and software components. The technical panel felt that in some instances, further explanation of how conclusions were reached would have been worthwhile.
5)	*Assess the usefulness of SDDOT's current Local Area Network and proposed Wide Area Network as the technical architecture for the proposed system.*	The consultant assessed the general network architecture and communication requirements and identified a weak link between the Department's region and area offices. He did not completely address specific problems which might arise from the Department's using a Microsoft network rather than the more common Novell network, but this issue is complex and probably beyond the scope of this study.
6)	*Submit an interim report summarizing needs and outlining preliminary options to satisfy needs and meet with technical panel to review interim report.*	Because of the project's short duration, the close contact between the researcher and technical panel, and the consultant's early delivery of the final report, the requirement for an interim report was dropped. The draft final report took its place.
7)	*Develop an implementation plan including procedural and organizational changes, necessary purchases, costs, benefits, and other relevant considerations.*	The consultant developed a general plan to implement an integrated filing system in a phased approach. The plan did not provide detailed recommendations for equipment and software purchases, but it did provide clear direction for the Department to follow. The recommendations did not involve any significant organizational changes to the Department.
8)	*Submit a final report and executive summary summarizing relevant literature, research methodology, findings and conclusions.*	The consultant prepared a final report and executive summary as required, and in addition, will make oral presentations to the Department's Research Review Board and interested persons in other state agencies. His written report, while acceptable, tended to be somewhat weaker than the oral presentations.

Researcher's Recommendations:	Panel Comments:
1) *SDDOT should implement an automated, integrated project filing system.*	The panel agrees with this recommendation. The complete implementation of the automated, integrated project filing system will require a considerable capital outlay and the dedication of two permanent full time employees—a system administrator and a technician. However, the payback should be realized within 2½ years from the beginning of the pilot phase. As a first step, the Division of Finance should demonstrate the proof of concept for an integrated imaging system with an in-house, small-scale project designed to simply demonstrate the appearance and functionality of an integrated filing system. This differs slightly from the consultant's plan, which is a more in-depth demonstration involving an outside software vendor. The panel feels that this step can be adequately executed with in house software and hardware. Upon approval of the Department's MIS Steering Committee, this task could be accomplished in three months.
2) *SDDOT senior management must make a long-term commitment to realize the long-term benefits outlined in this report.*	The panel agrees with this recommendation. At the successful completion of the proof of concept, the Department's MIS Steering Committee should adopt a plan of phased implementation, including a pilot implementation and two phases of capital investment as described in the study's final report. This could happen in three years, if resources were added.
3) *SDDOT should form a Joint Application Development Team to carry out the next phase of the analysis.*	The panel agrees with this recommendation. The MIS Steering Committee should establish a technical team to direct implementation of the integrated project filing system. The team should be headed by the Director of the Division of Engineering. It should pursue implementation in accordance with the plan developed in this study, but should remain open to new technical developments which may appear as implementation progresses.

4) *SDDOT should use present and planned hardware investments to support implementation of the filing system.*

The panel agrees with this recommendation.

If the Department establishes an integrated project filing system, all Divisions and Regions should consider allocating some of their new computer hardware to support it. The Department's upgrade plans appear flexible enough to accommodate the implementation plan described by this study, but successful establishment of an image-based integrated filing system may further accelerate future demand for computer purchases.

5) *All levels of SDDOT management should support the resulting technology-driven culture change.*

The panel agrees that significant procedural and culture changes may result from the establishing an integrated project filing system. These changes will be predominantly positive, but consistent management support will be essential to the success of the effort.

To fully take advantage of the potential benefits of integrated filing, the panel recommends that upon the conclusion of each phase of implementation, the MIS Steering Committee review progress and invite suggestions for streamlining business processes. Suggestions should be incorporated in to the next implementation phase.

The panel also recommends that one year after full implementation, the MIS Steering Committee authorize a study to assess the effectiveness of the implementation.

Technical Panel:

Marry Bisson .... Bureau of Administration
Jim Douglas ..... Bureau of Administration
Susan Dutt ..... Office of Data Services
Mark Gageby .... Office of Internal Services
David Huft ..... Office of Research
Jerry Jacobsen ..... Office of Data Services
Randy Kleinschmidt Office of Internal Services
Paul Orth ..... Office of Research
Forest Wixon . Office of Project Development
Al Yocom ..... Office of Data Services

South Dakota Department of Transportation
Region & Division Review Comments
SD93-10 Increased Efficiency from Integrated Project Filing
November 12, 1993

Region/Division	Comment
Aberdeen	No comments. *Larry Afdahl*
Mitchell	The Mitchell Region supports the recommendation of the Technical Panel *Pat Kappenman*
Pierre	I certainly have no quarrel with this program. Sooner is better.If the technology is there,it appears the economics will justify moving ahead. *Lloyd Potter*
Rapid City	No comment. *Dennis Landguth*
Engineering	[Who are the technical] team members? [The team] should consist of representation of all disciplines in the DOT to assure the system meets the functional needs of the Department. *Larry Weiss*
Finance	The Division of Finance agrees with the technical panel recommendation that a department-wide electronic filing system would be beneficial and create many efficiencies within SDDOT. I have reservations concerning use of our very limited resources to bring this effort about, however, I can support the pilot program, if it doesn't tie up major resources to accomplish. Al Yocom is out of town this week and we have not discussed this in any length. However, he is a member of the panel and I know you have incorporated his views into the recommendations. I am just very concerned about the use of our resources. Data Services already has several major projects in the works. Randy Kleinschmidt tells me that we would be the only state in the county to have such a system, if it was developed. And that it would cost big bucks! The use of our personnel and the dedication of those "big bucks" might be better taken up during an Executive Team meeting.
Operations	I support the technical panels recommendations. *Clyde Pietz*
Planning	No comment. *Jim Jenssen*
Railroads	No comment. *Dave Jagim*
Office of the Secretary	None received.

South Dakota Department of Transportation
Research Review Board
Research Implementation Recommendations

Study Number: SD93-10 **Principal Investigator:** James Morrow
Title: Increased Efficiency Through Integrated Project Filing **Organization:** Strategic Management Solutions, Inc.
Study Duration: May 1993 to November 1993 **Study Cost:** $49,650

Research Review Board Recommendations

1. The Department's MIS Steering Committee should establish a Joint Application Development Team to carry out the next phase of analysis regarding integrated project filing. The team should be headed by the Director of the Division of Engineering.
2. Under direction of the Joint Application Development Team, the Division of Finance's Office of Data Services should demonstrate the proof of concept for an integrated imaging system with an in-house, small-scale project designed to demonstrate the appearance and functionality of an integrated filing system.
3. At the conclusion of the proof of concept demonstration, the MIS Steering Committee should consider the other recommendations of the researcher and technical panel:
   - SDDOT should implement an automated, integrated project filing system.
   - SDDOT senior management should make a long-term commitment to realize the benefits of integrated project filing.
   - SDDOT should use present and planned hardware investments to support implementation of the integrated project filing system.
   - All levels of SDDOT management should support the resulting technology-driven culture change.

Research Engineer _____ Date of Board Approval _____

Division of Engineering Review

Director, Division of Engineering Date

Division of Finance Review

Director, Division of Finance Date

Division of Operations Review

Director, Division of Operations Date

Deputy Secretary Review

Deputy Secretary Date

Division of Planning Review

Director, Division of Planning Date

Secretary of Transportation Action & Comments

Division of Air, Rail & Transit Review

Director, Division of Air, Rail & Transit Date

Action: Approve
Disapprove

Secretary of Transportation Date

South Dakota Department of Transportation
Research Implementation Recommendations

Study Number: SD93-10 **Research Review Board Action:** 11/19/93
Title: Increased Efficiency Through Integrated Project Filing **Secretary of Transportation Directive:** 07/10/94

#	Research Review Board Recommendation	Secretary's Directive	Responsible Division	Responsible Office	Action To Date	Date Completed
1	The Department's MIS Steering Committee should establish a Joint Application Development Team to carry out the next phase of analysis regarding integrated project filing. The team should be headed by the Director of the Division of Engineering.	Approved	MIS Steering Committee	Secretary		
2	Under direction of the Joint Application Development Team, the Division of Finance's Office of Data Services should demonstrate the proof of concept for an integrated imaging system with an in-house, small-scale project designed to demonstrate the appearance and functionality of an integrated filing system.	Approved	Finance	Data Services	Data Services is currently negotiating with a vendor to provide equipment for proof of concept demonstration.	
3	At the conclusion of the proof of concept demonstration, the MIS Steering Committee should consider the other recommendations of the researcher and technical panel: • SDDOT should implement an automated, integrated project filing system. • SDDOT senior management should make a long-term commitment to realize the benefits of integrated project filing. • SDDOT should use present and planned hardware investments to support implementation of the integrated project filing system. • All levels of SDDOT management should support the resulting technology-driven culture change.	Approved	MIS Steering Committee	Secretary		
Additional Comments and Direction from the Office of the Secretary:		I recommend that the proof of concept be done first and then if satisfactory the Joint Application Development Team be established to completed the project. *Dean Schofield, Deputy Secretary* After the "Proof of Concept" demo, the MIS steering committee shall recommend whether or not to proceed, review the TISP to Establish priority, develop a budget, and obtain approval from the Office of the Secretary! *Richard L. Howard, Secretary of Transportation*				