SD2023-00-G

U.S. Department of Transportation
Federal Highway Administration

SD Department of Transportation
Office of Research

Guidelines for Performing Research for the South Dakota Department of Transportation

Office of Research–Room 157
700 East Broadway Avenue
Pierre, SD 57501-2586
(605)773-3292

June 2023

DISCLAIMER

The contents of this report, funded in part through grant(s) from the Federal Highway Administration, reflect the views of the authors who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the South Dakota Department of Transportation, the State Transportation Commission, or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

The South Dakota Department of Transportation provides services without regard to race, color, gender, religion, national origin, age or disability, according to the provisions contained in South Dakota Codified Law (SDCL) 20-13, Title VI of the Civil Rights Act of 1964, the Rehabilitation Act of 1973, as amended, the Americans With Disabilities Act of 1990 and Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 1994. Any person who has questions concerning this policy or who believes he or she has been discriminated against should contact the Department's Civil Rights Office at 605.773.3540.

ACKNOWLEDGMENTS

This document was produced in cooperation with the United States Department of Transportation Federal Highway Administration.

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
SD2023-00-G		

4. Title and Subtitle	5. Report Date
Guidelines for Performing Research for the South Dakota Department of Transportation	June 1, 2023
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
David L. Huft Thad Bauer	

9. Performing Organization Name and Address	10. Work Unit No.
South Dakota Department of Transportation Office of Research 700 East Broadway Avenue Pierre, SD 57501-2586	11. Contract or Grant No.

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
South Dakota Department of Transportation Office of Research 700 East Broadway Avenue Pierre, SD 57501-2586	Guide; June 1, 2023
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The South Dakota Department of Transportation conducts research to discover knowledge needed to improve transportation technology. The Department's Office of Research performs and manages research under the direction of the Department's Research Review Board. Individual projects are performed under the guidance of project technical panels.

This publication explains the roles of the Office of Research, the Research Review Board, and technical panels in the research management process, and describes the procedures used to develop and administer the research program. Guidelines are presented for preparation of research proposals and reports.

Significant changes from prior editions of this document include:

reference to South Dakota Codified Law (SDCL) 20-13, Title VI of the Civil Rights Act of 1964, the Rehabilitation Act of 1973, as amended, the Americans With Disabilities Act of 1990 and Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 1994 in the inside cover; revision of research proposal evaluation criteria; explicit advice to prospective contractors to review the *Sample Agreement for a Research Study…* in the Appendix to be aware of terms that will govern contractors and subcontractors; statement that SDDOT considers proposals to be privileged and confidential information; changes to reporting requirements, requiring submission of electronic versions of final reports and executive summaries, in lieu of publication of large quantities of paper copies; instructions requiring a stronger treatment of benefits in research proposals; requiring separate budget tables for each subcontractor listed in a research proposal; specifying imperial (English) units, rather than the International System of Units, as the preferred system of measurement units; requirements for an analysis of research benefits in final reports; addition of a section on preparation of technical memoranda; addition of a chapter on invoices and allowable costs; update of sample contract (Appendix A).

17. Keywords	18. Distribution Statement
research; management; administration	No restrictions. This document is available to the public from the sponsoring agency.

19. Security Classification (of this report)	Security Classification (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	71	

TABLE OF CONTENTS

Chapter 1 – INTRODUCTION 1
Chapter 2 – ORGANIZATION AND MANAGEMENT (RESPONSIBILITIES) 2
Research Administration 2
Research Review Board 2
Office of Research 2
Technical Panels 3
Research Program Manager 3
Research Engineer Manager 4
Research Engineer 4
Research Team 4
SDLTAP 5
SDLTAP Advisory Board 5
Chapter 3 – RESEARCH PROJECT DEVELOPMENT 5
Conception 5
Research Suggestion Forms 5
Research Opportunities Workshop 7
Definition 7
Research Project Statements 7
Contract Research 11
In-House Research 11
Request for Proposal 11
Proposal Submission 16
Proposal Organization 17
System of Units 23
Agreement 23
Chapter 4 – RESEARCH PROJECT EXECUTION 23
Kick Off Meetings 23
Research Project Reporting 24
General Formatting Guidance 24
Final Reports 25

Executive Summary 35
Interim Reports 36
Technical Memoranda 37
Progress Reports 38
Publication and Distribution 39
Presentation of Findings 39
Chapter 5 – INVOCIES & ALLOWABLE COSTS 40
Payment for Deliverables 40
Invoice Submission 40
Documentation Requirements for Invoices 40
Chapter 6 – IMPLEMENTATION 43
Tracking & Evaluation 43
Chapter 7 – WORK PROGRAMS AND FUNDING 51
SPR Research Work Program 51
Funding 51
Chapter 8 – NATIONAL AND INTERNATIONAL ACTIVITIES 51
TRB 51
NCHRP (National Cooperative Highway Research Program) 51
RIP 51
TRID 51
ROSA P 52
SPR 52
Pooled Fund Studies 52
Lead Agency 52
Project Development 52
Solicitation and Commitment of Partners 52
Contract and Project Management 52
Participating Agencies 53
Chapter 9 – PROGRAM EVALUATION 53
Overview 53
Performance Evaluation of the Researchers 53
Evaluation of Implementation 53

Peer Exchanges **53**
Chapter 10 – LIBRARY & FILE MANAGEMENT **53**
Library Responsibilities **53**
File Management **53**
Appendix A **56**

LIST OF FIGURES

Figure 1 Research Suggestion Form **6**
Figure 2 Sample Research Project Statement (sheet 1 of 2) **9**
Figure 3 Sample Request for Proposal (sheet 1 of 3) **12**
Figure 4 Considerations for Evaluating Research Proposals **15**
Figure 5 Sample Proposal Title Page **17**
Figure 6 Sample Final Report Title Page **27**
Figure 7 Sample Final Report Inside Cover (1 of 2) **28**
Figure 8 Sample Standard Title Page **31**
Figure 9 Task Completion Graph **39**
Figure 10 Project Completion Graph **39**
Figure 11 Sample Technical Panel Evaluation & Recommendations (sheet 1 of 6) **44**
Figure 12 Sample Implementation Status Report **50**

LIST OF TABLES

Table 1 Sample Task Time Schedule **20**
Table 2 Sample Breakdown of Person-Hours **21**
Table 3 Sample Budget by Fiscal Year **22**
Table 4 Supporting Information Required for Invoices **42**

Chapter 1 – INTRODUCTION

The Office of Research administers and performs research conducted by the South Dakota Department of Transportation (SDDOT), under the direction of the Department's Research Review Board. The research effort addresses topics considered most important to the Department's mission of providing effective transportation to the State of South Dakota.

When sufficient manpower and expertise is available within the SDDOT, the Office of Research may elect to perform research in-house. Alternatively, the Office of Research may contract with other agencies to provide needed services. Contract research is most appropriate when outside expertise, perspective, and manpower are needed.

Guidelines for Performing Research for the South Dakota Department of Transportation provides general information concerning the conduct of research for SDDOT. It also contains specific instructions for preparation and submission of research proposals and describes how proposals are evaluated. Instructions are likewise provided for report preparation.

Additional information may be requested by writing or calling:

South Dakota Department of Transportation
Office of Research
700 East Broadway Avenue
Pierre, South Dakota 57501-2586
Phone: (605)773-3292 Fax: (605)773-4713

Chapter 2 – ORGANIZATION AND MANAGEMENT (RESPONSIBILITIES)

Research Administration

The South Dakota Department of Transportation conducts research to discover knowledge needed to improve transportation technology. Specific goals include evaluation of new materials and methods, development of design and analysis techniques, and study of underlying causes of transportation problems.

The Department's research effort is administered by its Office of Research, which has immediate responsibility for the management and conduct of research. To ensure that research is responsive to the Department's needs, the Research Review Board, composed of managers from throughout the Department, oversees the total research effort. Employees of other offices within the Department assist as members of technical panels which manage individual research projects.

Research Review Board

The Research Review Board oversees the Department's total research effort. Its responsibilities include advising the Office of Research, setting research priorities, and approving funding for studies, and recommending how research results should be implemented.

The Board's membership is broad and includes SDDOT and local government representatives:

- Secretary of Transportation (Chair)
- Director, Division of Planning & Engineering
- Director, Division of Operations
- Director, Division of Finance & Management
- Materials & Surfacing Engineer
- Research Program Manager
- Research Engineer Manager
- Field Operations Representative
- City Government Representative
- County Government Representative
- Federal Highway Administration Research Coordinator
- SD Board of Regents System Vice President for Research

The Secretary of Transportation chairs the Board, and the Research Program Manager is its secretary. The City, County, and Field Operations representatives serve two-year terms, beginning on January 1 of even-numbered years. The other representatives serve as long as they hold their respective positions.

Office of Research

The Office of Research is responsible for performing the work directed by the Research Review Board. Its responsibilities include:

- Developing the annual SPR Research Work Program
- Administration of contract research projects
- Conducting in-house research
- Advising other SDDOT offices

The Office of Research is staffed by the Research Program Manager, Research Engineer Manager, a secretary, and engineers from several disciplines.

Technical Panels

Individual research projects are managed by small panels of experts in the research topic. Each panel's membership is drawn from SDDOT's central and field offices, and may include representatives from outside the Department. The panel's responsibilities include:

- Developing problem statements
- Recommending study funding and duration
- Recommending in-house or contract research
- Evaluating research proposals
- Selecting research contractors
- Monitoring research progress
- Recommending implementation of research

Every panel is chaired by an Office of Research staff person, whose responsibilities include:

- Scheduling panel meetings
- Maintaining contact with researchers
- Monitoring contract compliance
- Writing panel documents

Most panels include a second member of the Office of Research, who assists and serves as a backup to the panel chairman.

Research Program Manager

The Research Program Manager has the following duties and responsibilities in the Office of Research.

- Prepare and administer budgets for the Office of Research and SDLTAP
- Work with Department staff to create a research program that is useful, practical, and provides economical results
- Act as primary point of contact for the research program with the FHWA and national research groups
- Act as the Department's representative to national research groups
- Manage pooled fund studies

Research Engineer Manager

The Research Engineer Manager will be responsible for managing the day-to-day work activities of the research office, which include the following:

- Development of work plans
- Assignment of projects to staff and project managers
- Preparation of project budgets
- Review and approval of changes in project scope and budgets
- Approval of billings for payment based on work products received

The Research Engineer Manager will also be responsible for the following:

- Provide preliminary review of research suggestion forms
- Ensure that research is completed according to work plans and within budgeted amounts
- Ensure contract compliance
- Review draft research results and acceptance of final work product

Research Engineer

Research engineers have the following duties and responsibilities:

- Review South Dakota, national, and international transportation-related research for relevant and beneficial concepts
- Develop and manage research projects
- Prepare and evaluate research problem statements
- Perform engineering analysis and interpretation of research results, form conclusions, and prepare research reports
- Schedule panel meetings
- Maintain contact with researchers
- Monitor contract compliance
- Write panel documents

Research Team

Principal investigators and Co-principal investigators may be DOT employees, university employees, or consultants. They have the following responsibilities:

- Must be familiar with the technical area being investigated, the underlying theory, and research techniques
- Must agree to directly manage the research work on a particular project
- Must possess technical competence in appropriate fields and be designated in the project proposal

SDLTAP

The South Dakota Local Transportation Assistance Program (SDLTAP) provides guidance for local government entities in the state. Local government officials are informed of new publications and training opportunities by the efforts of SDLTAP. Workshops such as asphalt paving, culvert installation, defensive driving, geotextiles, personnel management, risk management, safety awareness, surveying, winter maintenance, work-zone traffic control, and gravel roads are provided by SDLTAP.

SDLTAP Advisory Board

The advisory board for SDLTAP meets biannually to provide direction and be informed by SDLTAP staff concerning the current status of the program.

Members:

- SDDOT Director of Planning and Engineering
- SDDOT Research Program Manager
- SD Chapter, American Public Works Association
- SD Association of County Highway Superintendents
- SD Associated General Contractors
- Northern Plains TTAP Advisory Board
- Federal Highway Administration
- SD Municipal League
- SD Association of County Commissioners
- SDDOT Local Government Assistance
- SD Engineering Society
- SD Association of Towns and Townships

Chapter 3 – RESEARCH PROJECT DEVELOPMENT

Conception

Research Suggestion Forms

Suggestions for research are made on Research Suggestion Forms (Figure 1), which name the problem and describe it briefly. Research Suggestion Forms suggest research objectives, an approach for achieving those objectives, and how the research results might be implemented. The forms provide enough information to allow the Research Review Board to appreciate the significance of the problem, but do not elaborate on details.

South Dakota Department of Transportation
Suggestion for Research

Research Project Title: *(Concisely name the research topic)*

Problem Statement: *(What is the nature of the problem needing solution or the opportunity for improved practice?)*

Research Proposed: *(What research do you propose to solve the problem or exploit the opportunity for improvement?)*

Implementation: *(If the research is successful, how would results be put into practice?)*

Benefits: *(How would research benefit the Department of Transportation and its customers?)*

Urgency: *(How soon must this research be initiated or completed to be useful? Why?*)

Submitted By:
Name:
Title:
Organization:
Address:
City, State, Zip Code:
Phone/Fax:
E-mail:

Figure 1 Research Suggestion Form

Research Opportunities Workshop

Every two to three years, the Office of Research conducts a Research Opportunities Workshop. University professors, SD State government representatives, industry representatives, and SDDOT staff meet to collaborate and generate ideas for possible research projects. Areas of research include materials, pavements, structures, foundations, drainage, operations, safety, planning, and administration. The research ideas generated from the workshop help lay the foundation for the work to be completed by the research program for the next two to three years.

After the workshop, the ideas are rated by SDDOT staff. The Office of Research tallies the ballots and prepares an ordered list of project titles. The list does not represent a final selection of projects; instead, it is a starting point for the Board's discussion of project priorities. Based on its discussion, the Board may promote or demote topics on the list or combine related suggestions into a single topic. Through consensus, the Board determines the projects the research Office will pursue. Additional research projects may be added to the list throughout the year for consideration by the Research Review Board.

Definition

Research Project Statements

For each selected study, the Office of Research begins to assemble a technical panel of five to eight persons knowledgeable of the topic. First, the Research Engineer Manager appoints a research staff member to chair the panel and another to act as an alternate. While the panel chairman and alternate initiate a preliminary literature search through the Transportation Research Information Service (TRIS), the Research Program Manager invites Division Directors and the FHWA Division Administrator to nominate technical panel members.

In addition to Department and FHWA panel members, the Research Program Manager invites members from other state agencies, trade associations, private industry, and universities. Invitations are extended on the basis of known interest and knowledge in the research topic. The goal of the appointment process is to assemble a panel with broad knowledge and diverse viewpoints.

After reviewing background information provided by the literature review, the technical panel meets to develop a Research Project Statement (Figure 2). The panel determines whether research is warranted and, if so, what the nature of the research should be. The panel begins with the Research Project Suggestion Form, but usually modifies the suggestion in consideration of the literature review and the knowledge, experience, and concerns of individual panel members.

The Research Project Statement produced from the meeting describes the problem that motivated the research suggestion and assesses the topic's importance and urgency. The most pertinent findings from the literature review are briefly summarized. Previous results that may obviate the need for research or provide a starting point for further work are cited. Then the panel states its

opinion as to whether research is or is not needed.

If research is warranted, the panel defines the study's objectives (what is to be learned or produced from the study) and tasks (what is to be done to accomplish those objectives). Objectives must be attainable within the research effort. For example, improving safety is probably not an attainable objective because many factors affecting safety lie outside the control of the research investigation, but identifying methods to improve safety could well be attainable. Furthermore, the tasks must be defined so that performing them effectively will likely produce the results sought in the objectives. Crafting the study's objectives and tasks is one of the technical panel's most important duties.

After the objectives and tasks are defined, the panel describes how the results of the study might be used, and recommends the study's budget, duration, and funding source. It describes what involvement the Department must provide to support the research project. Finally, the panel recommends the type of research it feels most appropriate:

- *In-House Research* is appropriate if staff of the Office of Research have expertise in the topic and available time to perform the work.
- *Contract Research* is *appropriate* if expertise or available time do not exist within the Office of Research. Contract research projects are competitively awarded.
- Collaborative Research involves a team consisting of a principal investigator from the Office of Research and co-investigators from South Dakota universities. It is appropriate when the combined expertise of staff from the Office of Research and one or more universities can address the topic effectively.
- National Research is appropriate when the proposed research requires large amounts of funding and the topic is likely to interest other agencies. Potential research mechanisms include the National Cooperative Highway Research Program (NCHRP), the Transit Cooperative Research Program (TCRP), and national and regional pooled fund studies.

Each panel submits its Research Project Statement to the Research Review Board for approval.

South Dakota Department of Transportation
Research Project Statement
Project SD2022-03

Title: Investigation of Poor Compressive Strength and Performance of A45 Structural Concrete Mixes

Problem Description: In the last few years, a higher than usual number of concrete mixes with below specification compressive strengths have been observed by SDDOT. The 2020 and 2021 construction seasons saw dramatic increases in instances of failing strengths, particularly among A45 (4500 psi) structural concrete mixes. Failures missing the 4500-psi requirement by over 500 psi, which under specification, fall under "remove and replace" criteria, have become more common. All these failing mixes, on top of their negative impacts on concrete performance and project costs, have introduced increased risk for SDDOT, contractors, and concrete producers in future projects. Contractors and producers have reported that maintaining and achieving quality concrete performance has become increasingly difficult due to the prescriptive nature of the current A45 specification. The exact cause of these instances of low strength and poor performance is currently unknown. It could be the result of materials issues related to the cement, fly ash, admixtures, aggregates, or even incompatibility between some of these materials. Current mix designs could be outdated and may not reflect the materials used in practice. Outside of the mix design, the batching, delivery, placement, and curing methods currently specified could also be contributing to the low strengths observed. Testing procedures and handling of cylinders also impact strength development. Without investigating the cause of these low strengths and reducing the rate at which they occur, concrete mixes used by SDDOT will continue to have these costly problems.

Importance: Below specification concrete is a major time, energy, and cost sink for all agencies involved in a project. Achieving better concrete performance reduces costs, minimizes risk, and maintains on-time construction schedules.

Urgency: This research should be a high priority. The high rate of below specification strengths should be resolved as soon as is possible, so the issue does not persist into more construction seasons. The sooner the problem is resolved, the greater the benefit to SDDOT, taxpayers of South Dakota, and the traveling public.

Literature Summary: A body of research exists on factors influencing concrete strength. SDDOT addressed a similar problem in the 1997 construction season via study SD1998-03, "Investigation of Low Compressive Strengths of Concrete in Paving, Precast, and Structural Concrete."

Are research results already available? Yes. **If so, how can SDDOT use these results?**

Research project SD1998-03 concluded that extremely low compressive strengths of A45 mixes during the 1997 construction season were the result of weak bonding at the aggregate-paste interface associated with air void clusters and a poorly formed cement paste matrix. The findings of this project can help identify candidate causes of today's instances of below specification strength and inform how SDDOT should investigate this same problem today.

In summary, does research need exist? Yes. **Explain:**

Though similar research has been completed in the past, research is necessary to pinpoint the present, local causes of low strength structural concrete with today's materials, practices, and technologies.

Research Objectives:

1) Determine the factors contributing to the significant increase in instances of below-specification strength A45 structural concrete observed in recent construction years.
2) Recommend changes to current practice (handling, placement, testing, mix design) to reduce future instances of below-specification strength A45 structural concrete following placement in the field.

Figure 2 Sample Research Project Statement (sheet 1 of 2)

Research Tasks:

1) Meet with the project's technical panel to review the project scope and work plan.
2) Review and summarize literature on factors contributing to proper concrete strength development, and report on any known mechanisms that may inhibit the achievement of specified concrete strength, whether they result from materials and mix design; the field conditions in which concrete is prepared, placed, and cured; or other factors.
3) Develop respective survey instruments for distribution to surrounding state DOTs, South Dakota concrete producers, and testing firms to (a) collect information on their experiences with below strength structural concrete; (b) compare surrounding state DOTs' structural concrete mix designs, allowed materials, testing/acceptance practices, and required compressive strengths to those of SDDOT; and (c) understand the extent to which failures observed by contractors have been isolated to SDDOT projects.
4) Collect and analyze SDDOT project data associated with instances of below specification strength A45 structural concrete.
5) Prepare and present to the project's technical panel a technical memorandum summarizing the literature review, survey results, and review of SDDOT project data; and reporting any likely factors contributing to the observed low A45 structural concrete compressive strengths.
6) Develop a laboratory testing plan that (a) uses petrographic analysis and other characterization techniques to examine concrete cores (including those from below strength SDDOT projects) to seek a root cause of poor structural concrete strength and (b) evaluates structural concrete compressive strength and durability as a function of the variables of interest identified in the literature review, survey, and analysis of past project data (e.g., material types, mix design variables, construction practices, curing methods, field conditions, cylinder test procedures).
7) Prepare and present to the project's technical panel a technical memorandum detailing the laboratory testing plan developed in Task 6.
8) Upon panel approval of the test plan, conduct lab testing, leveraging any early findings to select SDDOT projects from the present construction season for inclusion in lab testing (via mix design or testing of core samples from the field).
9) Prepare and present to the project's technical panel a technical memorandum summarizing the results of the Task 8 lab testing.
10) Recommend changes to SDDOT practice to reduce instances of below specification structural concrete strength.
11) In conformance with *Guidelines for Performing Research for the South Dakota Department of Transportation*, prepare a final report summarizing the research methodology, findings, conclusions, and recommendations.
12) Make an executive presentation to the South Dakota Department of Transportation Research Review Board at the conclusion of the project.

Potential Implementation: Successful research will be implemented through modifications to concrete specifications, mix designs, and/or sourcing of materials. The Standard Specifications for Roads and Bridges may be updated via a supplemental update or special provision.

Budget Estimate: $130,000; 24 months **Funding:** State Planning and Research

SDDOT Involvement: SDDOT staff will provide relevant project data from the department's Materials Sampling and Testing (MS&T) system database and deliver concrete samples requested by the researcher.

Recommendation: South Dakota University Contract Research. **Explain:** The technical panel believes that in-state universities have adequate laboratory resources to execute the requested characterization and testing of concrete samples. Selection of a South Dakota university will also facilitate shipment of materials and contact with local concrete producers.

Technical Panel

Thad Bauer ..... Research
Mike Border ..... Research
Hadly Eisenbeisz ..... Bridge Design
John Gerlach ..... Rapid City Area
Marc Hoelscher ..... FHWA
Darin Hodges ..... Materials and Surfacing
Micah Howard ..... Materials and Surfacing
Jay Larson ..... Mitchell Region
Jason Smith ..... Pierre Region
Keld Ditlev ..... SDRMCA
Andy Vandel ..... Research
Steven Weisz ..... Mitchell Region

Figure 2 Sample Research Project Statement (sheet 2 of 2)

Contract Research

Studies for which expertise or available time does not exist within the Office of Research. Contract research projects are competitively awarded.

In-House Research

Studies for which in-house research was recommended require no contractor selection. Instead, the Research Engineer Manager appoints a principal investigator and co-investigators from the staff of the Office of Research. The appointed researchers prepare a work plan in the same format as a research proposal.

Request for Proposal

The Office of Research develops a Request for Proposal (Figure 3) for each study for which contract research was recommended. The RFPs are based upon the Research Project Statements developed by the studies' technical panels.

RFPs are distributed to prospective researchers, including universities, consultants and government agencies. Proposals are due on the date specified on the RFP. Each technical panel reviews all proposals submitted for its research project. The panel selects a research contractor to perform the work on the basis of:

- the proposer's demonstrated understanding of the problem
- the merit of the proposed research approach
- the probability of success in achieving the project's objectives
- the proposer's record of accomplishment in related problem areas
- the adequacy of research staff and facilities
- the proposer's record of past performance for the SDDOT

Panels use a proposal evaluation form (Figure 4) to help identify proposals' strengths and weaknesses.

The importance of the written proposal cannot be overemphasized; it is usually the panel's only means of selecting the researcher to conduct the study. The proposal must be concise, clear, and complete. Most importantly, it must convince the panel that a sound research project will follow.

If the panel identifies specific weaknesses in the selected proposal, it may ask the researcher to address them. This negotiation process must produce a modified proposal that is mutually acceptable to the panel and the researcher. Otherwise, another researcher must be selected or the study delayed or cancelled. The panels present their recommendations to the Research Review Board, which must approve each proposal and authorize funding for the project. Unsuccessful proposers are notified after the contract with the winning proposer has been signed.

South Dakota Department of Transportation
Request for Proposal
Project SD2022-03

Title: Investigation of Poor Compressive Strength and Performance of A45 Structural Concrete Mixes

Problem Description: In the last few years, a higher than usual number of concrete mixes with below specification compressive strengths have been observed by SDDOT. The 2020 and 2021 construction seasons saw dramatic increases in instances of failing strengths, particularly among A45 (4500 psi) structural concrete mixes. Failures missing the 4500-psi requirement by over 500 psi, which under specification, fall under "remove and replace" criteria, have become more common. All these failing mixes, on top of their negative impacts on concrete performance and project costs, have introduced increased risk for SDDOT, contractors, and concrete producers in future projects. Contractors and producers have reported that maintaining and achieving quality concrete performance has become increasingly difficult due to the prescriptive nature of the current A45 specification. The exact cause of these instances of low strength and poor performance is currently unknown. It could be the result of materials issues related to the cement, fly ash, admixtures, aggregates, or even incompatibility between some of these materials. Current mix designs could be outdated and may not reflect the materials used in practice. Outside of the mix design, the batching, delivery, placement, and curing methods currently specified could also be contributing to the low strengths observed. Testing procedures and handling of cylinders also impact strength development. Without investigating the cause of these low strengths and reducing the rate at which they occur, concrete mixes used by SDDOT will continue to have these costly problems.

Research Objectives:

1) Determine the factors contributing to the significant increase in instances of below-specification strength A45 structural concrete observed in recent construction years.
2) Recommend changes to current practice (handling, placement, testing, mix design) to reduce future instances of below-specification strength A45 structural concrete following placement in the field.

Research Tasks:

1) Meet with the project's technical panel to review the project scope and work plan.
2) Review and summarize literature on factors contributing to proper concrete strength development, and report on any known mechanisms that may inhibit the achievement of specified concrete strength, whether they result from materials and mix design; the field conditions in which concrete is prepared, placed, and cured; or other factors.
3) Develop respective survey instruments for distribution to surrounding state DOTs, South Dakota concrete producers, and testing firms to (a) collect information on their experiences with below strength structural concrete; (b) compare surrounding state DOTs' structural concrete mix designs, allowed materials, testing/acceptance practices, and required compressive strengths to those of SDDOT; and (c) understand the extent to which failures observed by contractors have been isolated to SDDOT projects.
4) Collect and analyze SDDOT project data associated with instances of below specification strength A45 structural concrete.
5) Prepare and present to the project's technical panel a technical memorandum summarizing the literature review, survey results, and review of SDDOT project data; and reporting any likely factors contributing to the observed low A45 structural concrete compressive strengths.
6) Develop a laboratory testing plan that (a) uses petrographic analysis and other characterization techniques to examine concrete cores (including those from below strength SDDOT projects) to seek a root cause of poor structural concrete strength and (b) evaluates structural concrete compressive strength and durability as a function of the variables of interest identified in the literature review, survey, and analysis of past project data (e.g., material types, mix design variables, construction practices, curing methods, field conditions, cylinder test procedures).
7) Prepare and present to the project's technical panel a technical memorandum detailing the laboratory testing plan developed in Task 6.
8) Upon panel approval of the test plan, conduct lab testing, leveraging any early findings to select SDDOT projects from the present construction season for inclusion in lab testing (via mix design or testing of core samples from the field).
9) Prepare and present to the project's technical panel a technical memorandum summarizing the results of the Task 8 lab testing.

Figure 3 Sample Request for Proposal (sheet 1 of 3)

10) Recommend changes to SDDOT practice to reduce instances of below specification structural concrete strength.
11) In conformance with *Guidelines for Performing Research for the South Dakota Department of Transportation*, prepare a final report summarizing the research methodology, findings, conclusions, and recommendations.
12) Make an executive presentation to the South Dakota Department of Transportation Research Review Board at the conclusion of the project.

Potential Implementation: Successful research will be implemented through modifications to concrete specifications, mix designs, and/or sourcing of materials. The Standard Specifications for Roads and Bridges may be updated via a supplemental update or special provision.

SDDOT Involvement: SDDOT staff will provide relevant project data from the department's Materials Sampling and Testing (MS&T) system database and deliver concrete samples requested by the researcher.

Available Funding: $130,000 **Anticipated Start Date:** June 15, 2022 **Duration:** 24 months

Terms of Payment: Payment for study services will be made upon SDDOT's acceptance of key project deliverables. For this study, percentages of total project cost will be paid upon satisfactory completion of the following tasks:

Task	% of Total Cost
5	20%
7	20%
9	30%
All Tasks	30%
Total	100%

General Information: The South Dakota Department of Transportation solicits proposals from colleges, universities, research institutes, foundations, consultants, federal, state, and local agencies, and others with demonstrated capability and experience in the subject area.

The South Dakota Department of Transportation provides services without regard to race, color, gender, religion, national origin, age or disability, according to the provisions contained in South Dakota Codified Law (SDCL) 20-13, Title VI of the Civil Rights Act of 1964, the Rehabilitation Act of 1973, as amended, the Americans With Disabilities Act of 1990 and Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 1994. Any person who has questions concerning this policy or who believes he or she has been discriminated against should contact the Department's Civil Rights Office at (605)773-3540.

Proposals must remain valid for at least 120 days after the submission deadline. All submitted proposals 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 specifically annotated as being proprietary. SDDOT considers all information contained in proposals to be privileged and reserves the right to maintain its confidentiality.

South Dakota state statute requires the winning proposal, with proprietary information redacted, to be posted online along with the corresponding contractual agreement.

SDDOT reserves the right to reject any proposals submitted. SDDOT may negotiate with a selected proposer to address specific weaknesses in the selected proposal prior to contract award.

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

Proposal Deadline: Proposals are due to the SDDOT by 5:00 pm on Friday, April 22, 2022. This deadline is firm. Extensions will not be granted.

Proposers may submit eight (8) hard copies of the proposal to:

Micah Howard
South Dakota Department of Transportation
Office of Research
700 East Broadway Avenue
Pierre, South Dakota 57501-2586

Figure 3 Sample Request for Proposal (sheet 2 of 3)

Alternatively, proposers may submit proposals electronically:

- Electronic proposals must be submitted as an e-mail attachment in Portable Document Format (PDF) not exceeding 14MB.
- The e-mail must be addressed to micah.howard@state.sd.us and andy.vandel@state.sd.us.
- Proposers should send the e-mail using "Delivery Receipt" and "Read Receipt" options to verify successful delivery.

Proposal Guidelines: Proposals must fulfill the requirements listed in the document entitled *RESEARCH PROPOSAL PREPARATION, SUBMISSION, AND EVALUATION* and dated April 24, 2019.

Proposal Evaluation: Proposals will be evaluated by a technical panel knowledgeable in the problem area. Selection will be made in consideration of criteria listed in *RESEARCH PROPOSAL PREPARATION, SUBMISSION, AND EVALUATION.*

Proposers will be notified of the results of the selection no later than June 1, 2022.

Project Management: Micah Howard is responsible for management of this project and can be reached at (605) 773-3871 or micah.howard@state.sd.us to answer inquiries.

Figure 3 Sample Request for Proposal (sheet 3 of 3)

South Dakota Department of Transportation **Office of Research: Adverse Weather day Chart** **SD2022-01**
Considerations Evaluating Research Proposals **Date: 4/25/2022** **Evaluator Name:**_____

	AWIS	High Street	ISU	SDSU	Auburn	Notes
1. General						
Proposal properly interprets the Request for Proposal						
Proposal contains no technical errors or omissions.						
2. Problem Statement & Background Summary						
Proposal demonstrates a sound, objective understanding of problem						
Proposal cites relevant literature & explains its significance						
3. Research Plan (Objectives & Tasks)						
Proposal addresses specified objectives clearly & completely						
Proposal addresses specified tasks clearly & completely						
Deviations from RFP's objectives & tasks are explained & justified						
Proposed research plan is feasible						
Proposal demonstrates ability to meet special project challenges & constraints						
4. Products & Implementation						
Proposal clearly defines products to be delivered in the project						
Proposal includes a practical implementation plan that fits SDDOT needs, policies, & procedures						
5. Staffing & Facilities						
Proposal demonstrates that key personnel have specialized expertise, capability, & technical competence needed for the project						
Proposal describes specific roles of key personnel						
Availability of key personnel is clearly defined						
An appropriate balance of professional & support personnel is proposed						
Proposal does not rely excessively on subcontractors or recruited personnel						
Proposal demonstrates access to needed equipment, facilities, & specialized services within the project timeframe						
Proposal demonstrates adequate familiarity & availability to the project locale						
6. Quality & Data Management Plan						
Proposal demonstrates ability to manage a project of this size & complexity						
Proposal identifies procedures for managing data during & after project						
7. SDDOT Involvement						
Proposed SDDOT involvement is clearly described & reasonable						
8. Budget						
Proposal includes complete budget by expense category & fiscal year						
Total budget & payment schedule conform to RFP amounts						
9. Past Performance for SDDOT						
Proposer successfully managed & completed past projects on schedule & budget						
Proposer was cooperative & responsive to SDDOT direction						
Total Points						
Rank						

INSTRUCTIONS: On a scale of 0 to 3, rate each proposal for each item listed. Assign a rating of 3 if the proposal addresses the item completely, 2 if it addresses it well, 1 if it addresses it partially, and 0 if it does not address it at all. For Item #9, if past experience was good rate 3, no past experience with SDDOT then rate 2, bad experience rate 1. This rating will be used as a tool for evaluating each proposal, but will not the sole criterion for awarding a research contract. Other important considerations may also influence the selection decision. After a proposal is selected, use this form to identify any specific weaknesses that should be strengthened prior to final approval of a research contract. Your diligence at this stage of the project will be rewarded as the study progresses.

Figure 4 Considerations for Evaluating Research Proposals

Proposal Submission

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.

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. SDDOT considers all information contained in proposals as privileged and reserves the right to maintain its confidentiality. Selection or rejection of a proposal does not affect these rights.

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.

Prior to submitting a proposal, proposers should review the *Sample Agreement for a Research Study Financed with State Planning and Research Funds Cost Reimbursement Contract*, which is included as an appendix to this document. It specifies the terms that will govern the relationship between SDDOT, the project contractor, and all subcontractors involved.

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 that 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 5:

- Proposal title (from RFP)
- Research project number (from RFP);
- "Submitted by" name, institution, address, and phone and facsimile numbers of proposer
- "Submitted to South Dakota Department of Transportation, Office of Research Room 157, 700 East Broadway Avenue, Pierre, SD 57501-2586"
- Proposal date

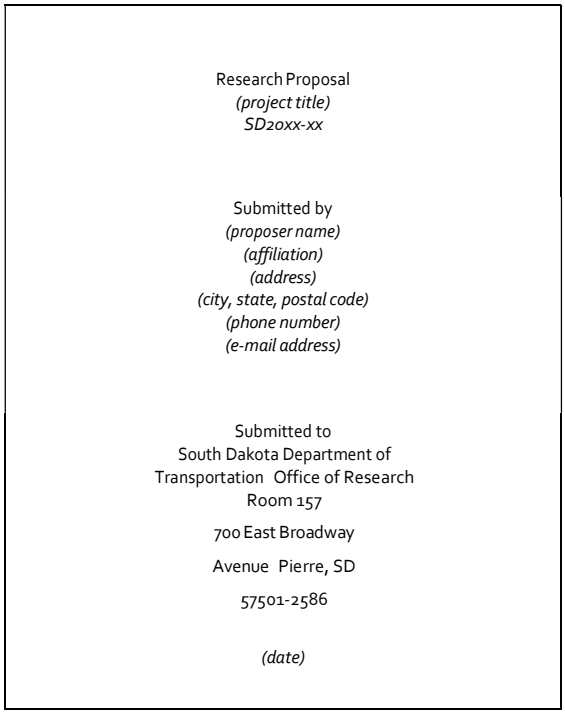

Figure 5 Sample Proposal Title Page

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 the background summary should not be underestimated. A comprehensive 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, in order, each of the study's technical objectives as it is cited in the Request for Proposal. Describe how each objective will be accomplished in the course of the research. Any deviations from the objectives listed in the RFP must be explained and justified.

Research Plan

Describe how the objectives will be achieved through a logical and innovative plan. State, in order, each task as it is cited in the Request for Proposal. Describe in appropriate detail how each task will be performed, and how each task contributes to accomplishing the study's stated objectives. Any deviations from the tasks listed in the RFP must be explained and justified.

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 that will be delivered during the research project. Deliverables might include:

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

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

- Quarterly progress reports
- Draft final report
- Final report
- Executive summary

Electronic copies of the final report and executive summary are required unless permission is specifically granted otherwise.

Implementation

Describe how SDDOT can apply the research results to improve its practice.

- 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, and particular offices within SDDOT.

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

- Identify institutional issues, including resource requirements, that might need to be addressed for successful implementation.

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 strongly influenced by the practicality and direction of the implementation plan presented in the proposal.

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:

- Direct cost savings
- Increased safety
- Increased facility life
- Improved service
- Improved work efficiency

To the extent possible, describe how these benefits can be measured and how their financial value can be credibly determined when study results are put into practice.

Time Schedule

Provide a bar chart or other graphical presentation illustrating the scheduling of the major research tasks (Table 1). Indicate the number of months allocated to each task. Always allow twenty (20) days for SDDOT review of draft reports.

Table 1 Sample Task Time Schedule

	Task	2022								2023							
		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
1	Meet with panel																
2	Review literature																
3	Present findings & test plan																
4	Test concrete mixes																
5	Recommend specifications																
6	Present findings to panel																
7	Prepare final report																
8	Make executive presentation																
	Quarterly progress 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 person-hours (not percentages of time) that will be devoted to each task by research team members, as illustrated in Table 2. 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.

Describe current commitments to other work in sufficient detail to permit assessment of the researchers' 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.

Describe a contingency plan if the principal investigator cannot complete the project. The need for the plan could be due to the principal investigator leaving the organization or an uncontrollable circumstance that prevents them from continuing the work. Describe the process to ensure the successful completion of the project.

Table 2 Sample Breakdown of Person-Hours

Name of Principal Professional or Support Classification	Primary Role in Study	Task								
		1	2	3	4	5	6	7	8	Total
Professor A	Principal Investigator	8	4	8	30	40	8	30	8	136
Professor B	Co-principal investigator	4	4	4	40	30	4	30	4	120
Technical Writer	Report Writing & Review	2	4	2	8	24	2	24	2	68
Graduate Student 1	Field Testing	8	40	8	120	16	8	32	8	240
Graduate Student 2	Analysis	2	20	2	80	12	2	32	2	152
Administrative Staff	Administrative Support	2	2	2	8	5	2	8	0	29
TOTAL		26	74	26	286	127	26	156	24	745

Facilities

Describe the facilities available to accomplish the research. Indicate equipment necessary to completion of the research and specify any restrictions on its use. Specify any equipment that is necessary but not currently on hand. If additional equipment is to be purchased with project funds, identify it in the budget estimate. Equipment purchased with project funds normally becomes the property of SDDOT at the conclusion of the project.

SDDOT Involvement

Describe any assistance 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 records or databases
- Interviews
- Material tests

Quantify the required level of effort as fully as possible.

Budget

Show the estimated cost for the entire research project by fiscal year, as illustrated by Table 3. SDDOT's fiscal years run from July 1 through June 30; for example, FY22 runs from July 1, 2021 through June 30, 2022.

Table 3 Sample Budget by Fiscal Year

Item	FY2022	FY2023	Total
Salaries	18,240	19,000	37,240
Fringe Benefits[1]	2,400	2,800	5,200
Overhead/Indirect Costs (40.0%)[1]	8,256	8,720	16,976
Fixed Fee (8.0%)	1,651.2	1,744	3,395
In-State Travel	750	1,550	2,300
Out-of-StateTravel[2]	0	1,150	1,150
Equipment Purchase[3]	6,000	2,000	8,000
Expendable Supplies[4]	930	800	1,730
Subcontracts	0	9,000	9,000
Computer Time[4]	0	0	0
Report Publication[4]	0	0	0
Total	$38,227	$46,764	$84,991
Cost-Sharing by Proposer	$15,291	$18,706	$33,997
Funded by SDDOT	$22,936	$28,058	$50,994

Notes:
1. May be included with Overhead/Indirect Costs
2. Each trip must be described
3. Must be described and in accordance with 23CFR200
4. Only if normally treated as a direct cost

If the proposal includes effort by subcontractors, a similar budget table should be included for each. Out-of-state travel, which is defined as travel between the researcher's base and destinations other than South Dakota, must be identified separately.

Indirect costs listed in the budget must be substantiated if and when the proposal is selected. Prior to the first contract payment, the successful proposer must submit documentation supporting the bases and rates used to calculate indirect costs by the prime contractor and each of the subcontractors. Examples of indirect cost schedule formats can be found in Chapter 9 of the *AASHTO Uniform Audit & Accounting Guide*.[2]

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.

[2]American Association of State Highway and Transportation Officials (AASHTO) (2001). *AASHTO Uniform Audit & Accounting Guide for Audits of Transportation Consultants' Indirect Cost Rates* [WWW document]. URL http://audit.transportation.org

System of Units

All studies must be conducted and reported using imperial (English) units as the primary system of units. Values in the International System of Units (SI), commonly referred to as "metric" units, may be included in parentheses following the imperial values. This requirement is consistent with the South Dakota Department of Transportation's decision to return to imperial units as its preferred system of units.

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.

Agreement

After researchers are selected, the Office of Research develops a formal agreement for the work. A sample agreement, included as Appendix A, specifies the standard terms for research funded by federal State Planning and Research funds. (In certain cases, SDDOT may elect to fund research with state funds. The agreement for state-funded research is essentially identical, except that SDDOT retains the right to inventions and discoveries.) The agreement incorporates the researcher's proposal by attachment.

After the agreement is executed, the Office of Research notifies the researcher that work may proceed. The researcher then conducts the research in accordance with the agreement and their proposal.

Chapter 4 – RESEARCH PROJECT EXECUTION

After the research contract or (in the case of in-house research) work plan is approved, the researchers may begin the work in accordance with their proposed plan.

The project's technical panel monitors the research throughout its duration. It reviews quarterly progress reports submitted by the researcher, as well as any interim reports specifically required by the agreement. It is the panel's responsibility to ensure that the researcher fulfills the terms of the agreement and that the research objectives are met. Prior to conclusion of the research, the panel reviews the draft final report, and advises the researcher of any changes that are required. The researcher responds the panel's comments and submits a revised final report for publication. Usually, the researcher also makes an executive presentation to the Research Review Board.

Kick Off Meetings

At the beginning of a project, the research team meets with the project's technical panel to review the project scope and work plan. This meeting will allow the technical panel or research team to answer any questions.

Research Project Reporting

Reports are an integral part of the research process. Without reports, it is difficult or impossible to monitor the progress of research or communicate findings and recommendations. This chapter is intended to provide guidance on the preparation and review of several common report formats:

- *Final Report*—A summary of research, findings, and recommendations published at the conclusion of study.
- *Executive Summary*—A condensation, usually of a final report, intended for management review.
- *Interim Report*—Written at a significant milestone prior to completion of a study; may be published or used only for technical review.
- *Progress Report*—Written at regular intervals to permit review of progress during a study.
- *Presentation*—An oral presentation, often with visual aids, usually to technical reviewers or managers.

For each report type, this chapter describes standard formats to encourage:

- consistent appearance
- easier evaluation
- minimal rework
- clarity
- completeness
- adoption of research results

These formats are not intended to limit creativity.

General Formatting Guidance

Beginning with the year 2000, the Office of Research intends to publish its research reports primarily by electronic posting on the Internet. All reports should be formatted in a manner that is internally consistent and conducive to convenient desktop publication. Specific suggestions include:

- Use of standard, readily available fonts is encouraged. For text, a serif font such as Times or New Times Roman, at least eleven points high, is preferred. In tables, a non- serif font such as Arial or Helvetica, at least nine points high, may be used. Fonts should be employed consistently throughout the document.
- To the extent possible, tables should be formatted uniformly throughout the document.
- Formats of chapter and section headings should be used consistently.
- Captions of figures and tables should be formatted consistently throughout the document.

- Figures should be sized appropriately to enable easy interpretation.
- Figures that are scanned photographs should be scanned at a resolution sufficient to ensure clarity, but not at an excessively high resolution that will unnecessarily inflate the document file size.
- Documents should be set up for two-sided printing. Chapters should begin on odd- numbered (right-facing) pages.
- Overcrowding of information should be avoided.

Final Reports

Purpose and Length

At the conclusion of a study, researchers submit a final report to completely describe the research purpose, activity, findings, and recommendations. The report should contain complete details unless length prohibits. Report length depends on the topic's complexity and breadth, but usually a length of 20 to 100 pages is appropriate. In general, the organization of a final report should reflect the organization of the study's project statement and request for proposal. Any final report completed after March 23, 2018, is required to be 508 accessible. After checking for 508 accessibility, the final report will be posted at the ROSA P digital repository. The SDDOT Research webpage will have a link to the ROSA P digital repository for each final report.

Front Matter

The front matter identifies the report and describes its content and format. (To encourage a standard format a Microsoft® Word version of generic front matter is available from the Office of Research.)

Front Cover—The front cover (Figure 6) should be of light colored, heavy paper. It should identify who sponsored and performed the study and indicate the study's title, number, and publication date:

- *Sponsoring Agencies*—The names and logos of sponsoring agencies are shown in the upper left corner of the front cover. For research sponsored entirely by state funds, only the name and logo of the South Dakota Department of Transportation Office of Research is shown. For research sponsored by federal funds, the name and logo of the Federal Highway Administration is also shown.

- *Report Number*—The report number is the study number followed by the letter designation "F", for example SD2016-07-F. If the report consists of more than one volume, the volumes are designated by a final number, for example SD2016-07-F1, SD2016-07-F2, etc.

- *Illustration or Photograph*—Optionally, a relevant photograph or illustration may be used to communicate the subject of the study.

- *Study Title*—The report title is usually the study name used throughout the duration of the study, unless the program manager agrees to another title.

- *Report Type*—The phrase "Final Report" identifies the report as a final report. If the report is a draft, the phrase "DRAFT Final Report" must be used.

- *Submitter*—The lower left corner contains the name and address of the organization reporting the research. Names of individual investigators are not listed.

- *Report Date*—The publication month and year are listed in the lower right corner.

South Dakota DOT
Connecting South Dakota and the Nation

South Dakota
Department of Transportation
Office of Research

U.S. Department
of Transportation
Federal Highway
Administration

SD2016-07-F

SDDOT Maintenance Decision Support System (MDSS) Operation Plan

Project SD2016-07

Final Report

Prepared by

Christofer Harper, Ph.D.
Principal Investigator
Louisiana State University

Daniel Tran, Ph.D., P.E.
Co-Principal Investigator
University of Kansas

Yilei Huang, Ph.D.
Co-Principal Investigator
South Dakota State University

May 2018

Figure 6 Sample Final Report Title Page

DISCLAIMER

The contents of this report, funded in part through grant(s) from the Federal Highway Administration, reflect the views of the authors who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the South Dakota Department of Transportation, the State Transportation Commission, or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

The South Dakota Department of Transportation provides services without regard to race, color, gender, religion, national origin, age or disability, according to the provisions contained in SDCL 20-13, Title VI of the Civil Rights Act of 1964, the Rehabilitation Act of 1973, as amended, the Americans With Disabilities Act of 1990 and Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 1994. Any person who has questions concerning this policy or who believes he or she has been discriminated against should contact the Department's Civil Rights Office at 605.773.3540.

Figure 7 Sample Final Report Inside Cover (1 of 2)

ACKNOWLEDGEMENTS

This work was performed under the direction of the SD2016-07-F Project Technical Panel:

Patrick Brueggeman ..... Research
John Huber ..... Yankton Area
Tim Huffman ..... Pierre Area
Dave Huft ..... Research
Ray McLaughlin ..... Custer Area
Bruce Hunt ..... FHWA
John Mehlhaff ..... Operations
Daris Ormesher ..... Research
Rick Reichling ..... Watertown Area
Craig Smith ..... Mitchell Region
Daniel Varilek ..... Transportation Specialist

Figure 7 Sample Final Report Inside Cover (2 of 2)

Inside Cover—The inside cover (Figure 7) lists SDDOT's standard disclaimer and acknowledgements of the study's technical panel and others who significantly assisted the study.

- *Disclaimer*—The disclaimer identifies the fact that the report represents opinions of the researchers and not adopted policy, specifications, or standards. The wording must be used verbatim.

- *Technical Panel Acknowledgement*—The names and offices of technical panel members are listed to acknowledge their contribution to the study.

- *Other Acknowledgements*—Optionally, a brief acknowledgement of other important contributions may be listed after the Technical Panel Acknowledgement. Gratuitous acknowledgements should be avoided.

Standard Technical Title Page—The Standard Technical Title Page lists key study information in a tabular format used by the Federal Highway Administration and other agencies (Figure 8). It should be a single page numbered "*iii*". Certain entries are required:

- *Report No.*—Box 1 identifies the number of this report and, if applicable, the volume.

- *Title and Subtitle*—Box 4 lists the title and, if applicable, the subtitle of the report exactly as they appear on the front cover.

- *Report Date*—Box 5 lists the month and year of the report is published.

- *Authors*—Box 7 lists the author(s) names.

- *Performing Organization Report No.*—The performing organization may optionally use Box 8 to list its internal report number.

- *Performing Organization Name and Address*—Box 9 lists the name and mailing address of the organization that performed the research.

- *Work Unit No.*—The performing organization may optionally use Box 10 to list its internal project identification number.

- *Contract or Grant No.*—Box 11 identifies the SDDOT contract that funded the work.

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
SD2016-07-F		

4. Title and Subtitle	5. Report Date
SDDOT Maintenance Decision Support System (MDSS) Operation Plan	05/11/2018
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Christofer Harper, Ph.D. (LSU), Daniel Tran, Ph.D. (KU), Yilei Huang, Ph.D. (SDSU)	

9. Performing Organization Name and Address	10. Work Unit No.
Louisiana State University, Baton Rouge, LA 70803 University of Kansas, Lawrence, KS South Dakota State University. Brookings, SD	HRY607
	11. Contract or Grant No. 311297

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
South Dakota Department of Transportation Office of Research 700 East Broadway Avenue Pierre, SD 57501-2586	Final Report Jan 2017 – May 2018
	14. Sponsoring Agency Code

15. Supplementary Notes

An executive summary is published separately as SD2016-07-X.

16. Abstract

Maintenance of transportation assets can be complex due to varying weather effects of snow, ice, wind, temperature, and other factors. The goal of DOTs conducting weather event operations and maintenance is to provide safe and clear roadways for motorists. Currently, the South Dakota Department of Transportation (SDDOT) uses the Maintenance Decision Support System (MDSS) for its winter weather maintenance operations. As the lead state for the Pooled Fund Study PF-(054), SDDOT would like to take advantage of new and emerging technologies to improve its MDSS as well as develop an implementation plan to further deploy the MDSS and its use across the state. The goal of this research project is to develop a comprehensive implementation strategy to infuse new and ever-emerging technologies into the MDSS. To achieve this goal, a rigorous literature review, combined with interviews with SDDOT maintenance staff, discussions and investigations of other state DOTs using the MDSS, and discussions with MDSS vendors were conducted. This process allowed the research team to develop a series of implementation strategies to begin deploying the MDSS to more routes and equipping more trucks with data collection systems, and piloting the use of a tablet device as the interface in trucks. Recommendations for the future use of the MDSS are to expand the MDSS to cover more routes, equip more trucks with mobile data collection data systems, equip trucks with different levels of AVL/GPS data systems, and pilot the use of the Zonar portable device system. Further, SDDOT should consider hiring dedicated MDSS staff to provide expertise and guidance to the agency. The benefits of implementing the strategies include reduced environmental impact, reduced material use, improved labor productivity, reduced fleet maintenance, safer roadways, and less infrastructure damage from efficient use of materials.

17. Keywords	18. Distribution Statement
MDSS, operation plan, implementation strategy.	No restrictions. This document is available to the public from the sponsoring agency.

19. Security Classification (of this report)	20. Security Classification (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	128	

Figure 8 Sample Standard Title Page

- *Sponsoring Agency Name and Address*—Box 12 identifies SDDOT's Office of Research as the sponsoring office.

- *Type of Report and Period Covered*—Box 13 contains the report type (for example, "Final") and the dates, by month and year, the work was started and finished.

- *Supplementary Notes*—Box 15 identifies other reports and executive summaries published as part of the study.

- *Abstract*—Box 16 lists a briefly summarizes the study's objectives, tasks, findings and recommendations.

- *Distribution Statement*—Box 18 describes report availability and any restrictions that may exist. Access is usually unrestricted.

- *Security Classification (of this report)*—Box 19 identifies the report's security classification, which is normally "Unclassified".

- *Security Classification (of this page)*—Box 20 lists the security classification of the Technical Report Standard Title Page itself, normally "Unclassified".

- *No. of Pages*—Box 21 lists the total number of pages in the publication, excluding front matter.

Table of Contents—The table of contents lists the chapters, sections and subsections of the report with page references. The table of contents should begin on page *v*.

List of Figures—The list of figures shows figure numbers, captions, and page numbers. The list of figures should begin on a separate page following the table of contents. The page number is in lower-case Roman numerals.

List of Tables—The list of tables shows table numbers, captions and page numbers. The list of tables should begin on a separate page following the list of figures. The page number is in lower-case Roman numerals.

Report Body

The intellectual content of the report resides in logically organized sections of the report body. Each major section should be titled and should begin on an odd-numbered (right-hand) page to aid location.

The use of appropriate tables and figures is encouraged. They should be located within the body of the report, as near to their references as possible for the convenience of the reader. To conserve

paper and to limit report thickness, the report body must be published double-sided. To aid legibility, margins of at least 25 mm (1 inch) should be used. Text should be in an uncomplicated serif font eleven points or larger. Line spacings should be between 1.2 and 1.5.

Executive Summary—The first chapter of the report should be a summary designed to inform managers within SDDOT and other interested agencies of the study's purpose, general approach, and significant findings, conclusions, and recommendations. The summary should concisely express the most important information about the project, without depending on references to other material in the final report. Usually, from three to ten pages is appropriate.

For consistency, conclusions and recommendations offered within the executive summary should match exactly those presented later in the final report. Because managers are likely to refer to the executive summary more often than to the full report, recommendations should be supported within the executive summary.

Problem Description—The second chapter should describe the problem that motivated the work. The researcher should supplement the description presented in the project's request for proposal with his or her own insights. Often, the discussion offered in the researchers's proposal or work plan, when updated to reflect insights gained during the investigation, comprises a good description of the problem.

Objectives—After the problem is stated, the study's objectives should be stated exactly as they were cited in the study's proposal or work plan. How, and to what extent, each objective was accomplished should also be described. The chapter should explain the relationship of the each research objective to the problem description.

Task Description—This chapter should state the project's defined tasks exactly as they were cited in the study's proposal or work plan. How, and to what extent, each task was accomplished should also be described. Usually, a task-by-task discussion is easiest to follow. The discussion must be sufficiently complete and clear to allow the study's technical panel to determine whether the project's tasks were accomplished fully, partially, or not at all, and to appreciate the technical significance of the work. Experimental plans should be clearly explained. Deviations from the defined tasks—either planned or to overcome problems—should be justified, explained and evaluated. The discussion should also explain the tasks' relationship to the study's objectives.

Findings and Conclusions—This chapter should explain what was learned from the study and assess the reliability of the findings. Results of surveys, tests, analyses, and other experimental techniques should be stated along with explanations of their significance. Any limitations to the validity or applicability of the observations or analyses should be clearly stated.

Implementation Recommendations—The researcher should state, explain and justify any recommendations for implementation of the research. Recommendations may take any of several forms:

- specification changes
- policy changes
- procedural changes
- training recommendations
- further research
- other actions

To ensure that recommendations are correctly identified and properly stated, they should be numbered. The recommendation itself should consist of one to three concise sentences clearly stating what should be done, by whom and, if applicable, when. Recommendations should be sufficiently clear and complete to permit their understanding when quoted later outside of the context of the final report.

After each recommendation is stated, it should be more fully explained and suitably supported by reference to the findings and conclusions provided earlier in the report. Any limitations on the recommendation's applicability should be plainly stated.

Analysis of Research Benefits—The researcher should define a methodology for identifying and quantifying the benefits realized through the completed research. Based on reasonable assumptions established by consensus of the research team and the project's technical panel, benefits should be clearly identified and their potential financial value estimated.

References—Bibliographic references should be listed in a section following the remainder of the report body.

Appendices

Appendices should be reserved for material that is either lengthy or related to the research by reference. Appendices may contain voluminous tables or graphs, samples of survey or analysis forms, standards or other pertinent documents referenced in the report body. The researcher should refrain from including marginally related material in appendices, and should instead limit their use to pertinent information.

Internal Appendices—If appendices are short enough to include in the same volume as the final report, they should appear after the report body in alphabetical order (Appendix A, Appendix B, and so forth). They should be titled according to their content. Appendix titles—both letter and title—should be listed in the report's table of contents.

Glossaries and Acronym Lists—Inclusion of a glossary and list of acronyms as internal appendices is strongly encouraged. They should be included first, as Appendix A and Appendix B.

External Appendices—When appendices are too long to include in the final report, they should appear in supplemental, sequentially numbered (for example SD2016-13-F2) volumes of the final report. Each volume should include its own table of contents.

Copies

Beginning in the year 2000, researchers are no longer required to publish large numbers of final reports. Instead, the complete report, including all figures and tables, must be submitted in word processing format (Microsoft® Word), as well as Portable Document Format (Adobe® .pdf). It is the intent of the Office of Research to publish its research reports primarily by electronic posting to the Internet.

Executive Summary

Purpose and Length

Like the executive summary chapter of the final report, the stand-alone executive summary is designed to inform managers within SDDOT and other agencies of the study's purpose, general approach, and significant findings, conclusions, and recommendations. The summary must concisely communicate the most important information about the project, without depending on references to material in the final report. Usually, from three to ten pages is appropriate.

Conclusions and recommendations offered within a separate executive summary should match exactly those presented in the final report. Because managers are likely to refer to the executive summary more often than to the full report, recommendations should be supported within the executive summary.

Front Matter

With minor exceptions, the front matter of the executive summary follows the same form as the final report. The report number is the same as the final report's, except an "X" replaces the "F" (for example, SD2016-14-X). The report type likewise changes to "Executive Summary". Naturally, the table of contents and lists of figures and tables must match the content of the executive summary, not the final report. Microsoft® Word versions of front matter are available from the Office of Research.

Report Body

In virtually all cases, the body of the executive summary will consist of the final report's executive summary chapter. It is rarely appropriate to publish two different versions of the executive summary.

Appendices

Appendices should never be used in executive summaries.

Copies

Beginning in the year 2000, researchers are no longer required to publish large numbers of final reports. Instead, the complete report, including all figures and tables, must be submitted in word processing format (Microsoft® Word), as well as Portable Document Format (Adobe® .pdf). It is the intent of the Office of Research to publish its research reports primarily by electronic posting on the Internet.

Interim Reports

Purpose and Length

An interim report is similar to a final report, but is usually prepared at some significant juncture in the project, prior to its completion. It may advise the study's technical panel of preliminary findings and recommendations that will influence the direction of the remainder of the project, or report findings that can be adopted prior to project completion. Because an interim report requires substantial effort, it should not be used to report normal study progress. An interim (in contrast to a technical memorandum) is intended for publication.

The appropriate length for an interim report depends on its purpose. In some cases, an interim report may contain many important findings, and its length may compare to that of the final report. In other cases, especially when written early in a project, it may be much shorter.

Front Matter

The front matter of an interim report is prepared in the same manner as a final report, except that an "I" replaces the "F" in the report number (for example SD2016-14-I) and the report type is "Interim Report". The distribution statement in the Technical Report Standard Title Page should reflect SDDOT's intentions regarding publication.

Report Body

The body of the interim report should be organized in sections similar to those in a final report. The purpose of the interim report should be clearly stated. The report's content should focus on that purpose, but should include sufficient background to establish context within the entire project. The report should explain how the interim findings were developed, how they relate to the study's original objectives, and how they will affect the conduct of the remainder of the project.

Typically, the interim report is written upon completion of one or more of the project's defined tasks. The "Task Description" section of the report is a convenient place to describe how each completed task contributed to the interim findings and how future tasks may be affected.

Appendices

Appendices to interim reports should be treated in the same manner as appendices to final reports.

Copies

Beginning in the year 2000, researchers are no longer required to publish large numbers of final reports. Instead, the complete report, including all figures and tables, must be submitted in word processing format (Microsoft® Word), as well as Portable Document Format (Adobe® .pdf). It is the intent of the Office of Research to publish its research reports primarily by electronic posting on the Internet.

Technical Memoranda

Purpose and Length

Like an interim report, a technical memorandum is usually prepared at some significant juncture in the project, prior to its completion. Unlike an interim report, it will not be formally published. Because its audience is generally limited to the project's technical panel, it is typically formatted as a memorandum to the panel or project manager.

A technical memorandum may advise the study's technical panel of preliminary findings and recommendations that will influence the direction of the remainder of the project, or report findings that can be adopted prior to project completion.

The appropriate length for a technical memorandum depends on its purpose. In some cases, it may contain many important findings, and its length may compare to that of the final report. In other cases, especially when written early in a project, it may be much shorter.

Front Matter

Because a technical memorandum is not intended for publication, no specially formatted front matter is necessary.

Report Body

Because the purposes of technical memoranda are varied, no specific format is mandated, but it may be useful to organize a technical memorandum in sections similar to those in a final report. The purpose of the document should be clearly stated. Its content should focus on that purpose, but should include sufficient background to establish context within the entire project. The technical

memorandum should explain how interim findings were developed, how they relate to the study's original objectives, and how they will affect the conduct of the remainder of the project.

Typically, the technical memorandum is written upon completion of one or more of the project's defined tasks. The "Task Description" section of the report is a convenient place to describe how each completed task contributed to the interim findings and how future tasks may be affected.

Appendices

Appendices to technical memoranda should be avoided.

Progress Reports

Purpose and Length

Researchers submit progress reports to advise the project manager and technical panel of activity, accomplishments, and problems during an active study. Studies longer than one year's duration usually require quarterly progress reports. Shorter reporting intervals may be required on shorter studies to ensure that progress is adequately reported.

The appropriate length of progress reports depends on the amount of activity that occurred during the reporting period, the nature of the topic, and the amount of interaction needed between the researcher and the project manager and technical panel. In general, progress reports should be simple and brief to encourage their being read; as few as one or two pages may be appropriate. When significant activity has occurred or is anticipated during the next reporting period, longer reports may be appropriate. Progress reports should rarely exceed ten pages in length.

Front Matter

Because progress reports are rarely bound, front matter is usually unnecessary. Instead, the first page of the report may simply have a header containing the study number and title, progress report number (sequentially from 1), submitter name and organization, and date.

Report Body

The body of the progress report should describe progress made during the reporting period, plans for the next reporting period, and overall project status. A quantitative estimate of the tasks' completion should also be reported.

> *Overview*—A few paragraphs should explain the general status of the project. The extent to which objectives are being or are expected to be met should be stated along with a general

assessment of the project's schedule and financial status. The information provided should allow a reviewer to determine whether the project is progressing satisfactorily or whether project revisions may become necessary.

Task Report—Each task should be identified and discussed within the context of what was completed before the reporting period, what was accomplished during the reporting period, and what yet remains to be done. Problems that were encountered should be explained, as should their solutions. To ensure that resources are available for future work, needs for upcoming SDDOT involvement should be stated. A percentage of completion, as of the end of the reporting period, should be listed.

Completion Graphs—Optionally, the status of task and project completion may be shown graphically. The Task Completion Graph (Figure 9) should identify each task and show the planned and actual progress as of the reporting date. The Project Completion Graph (Figure 10) should show the overall planned and actual progress history from the project beginning through the reporting date.

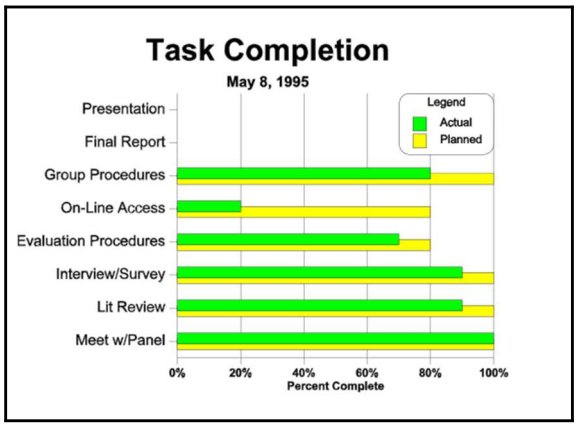

Figure 9 Task Completion Graph

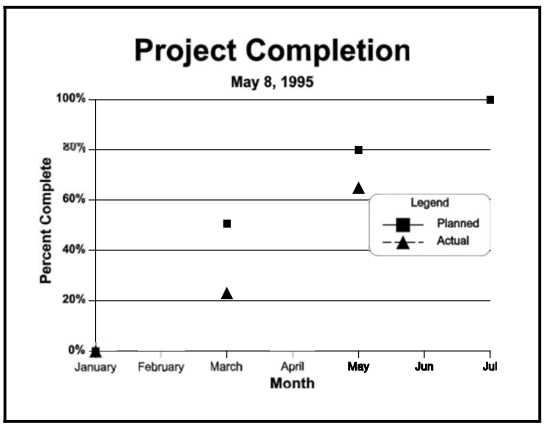

Figure 10 Project Completion Graph

Publication and Distribution

Research staff may publish and distribute final research reports, or the university staff or consultants may do so as part of the project agreement. Occasionally studies may not reach meaningful conclusions, and reports on such studies may not justify full distribution.

Presentation of Findings

If the findings of a reports are of widespread interest, the project manager may request presentation(s) of the report and findings. Presentations may take the form of seminars, training sessions, or workshops. Audiences may range from selected invited specialists to the public. If a project proposer believes that the research results will be appropriate for general presentation, he or she should include the presentation in the original project proposal. Otherwise, presentations may be recommended as an implementation recommendation at the conclusion of a study.

Chapter 5 – INVOCIES & ALLOWABLE COSTS

Research projects typically involve federal funding. The Office of Research relies on the Federal Acquisition Regulation (FAR), Title 48, Chapter 1, Part 31—*Contract Cost Principles and Procedures* for guidance in reviewing cost proposals, negotiating costs, and processing payments for services.

Payment for Deliverables

Payments will be made based upon work received at different stages of the project. The contract will specify how many payments and how much will be paid at the completion of different tasks or group of tasks. The project manager will determine if work is acceptable for payment to be made.

Invoice Submission

Invoices should be submitted in triplicate to the Office of Research. Invoices should be submitted regularly, preferably monthly, within forty-five days following the end of each billing period.

Documentation Requirements for Invoices

The actual documentation requested to process invoices is determined on a case-by-case basis considering:

- funding source, federal or state;
- the company's experience with federal requirements for allowable costs;
- the total amount of the contracts the company has with the Department;
- prior experience with the company's ability to invoice for reasonable, allocable and allowable costs; and
- whether the Department's Office of Internal Audits plans on administratively closing the contract when it is completed with just a desk review or if a full audit will be performed.

Invoice Format

Invoices should list:

- the agreement number of the contract between SDDOT and the contractor;
- the company's job number and the accounting period covered by the claim;
- the personnel, using either names or employee numbers in addition to classifications;
- the base salary rate, claimed hours and an extension for claimed costs;
- a detailed listing of other direct costs, i.e., airfare, lodging, meals, mileage, long distance telephone, etc.;
- indirect costs;
- fixed fee.

Subcontractors' invoices must be included to support the prime contractor's invoice, and must contain the same level of detail and supporting information.

The Office of Research will check the accuracy of each claim and ensure that the claimed costs are reasonable and necessary for prosecution of the project to completion. The project manager will also ensure that contract payment provisions are complied with, including maximum limiting fees, fixed fee limitations, retainage, etc., and that the claims are within the period of performance.

Supporting Information

To ensure compliance with the Federal Acquisition Regulation, the Office of Research and the Office of Internal Audits require supporting information to accompany invoices, as summarized in Table 4.

Allowable Costs

The Federal Acquisition Regulation strictly governs the allowability of costs, both direct and indirect, on projects involving federal funding. A convenient (but not definitive) overview of the regulation is available from the American Association of State Highway and Transportation Officials (AASHTO) web site.[3]

[3]American Association of State Highway and Transportation Officials (AASHTO) (2001). *AASHTO Uniform Audit & Accounting Guide for Audits of Transportation Consultants' Indirect Cost Rates* [WWW document]. URL http://audit.transportation.org

Table 4 Supporting Information Required for Invoices

Cost Category	Supporting Information Required
Direct salary	Copies of time sheets will generally be required.
Indirect costs	A copy of an audit of the company's overhead/fringe benefit rates or a copy of the rate calculation work sheet will be needed prior to the first invoiced payment. Indirect cost rates are to be based on the company's most recently completed fiscal year. Depending on the reimbursement provisions and the duration of the agreement, the company may need to submit this information for multiple fiscal years. Similar information is required for each subcontractor and must be received prior to invoices including subcontracted costs.
Allocations for in-house costs	Copies of work sheets showing the costs (and accounts), usage, and rate calculations will be needed for such in-house allocations as vehicle mileage rates for company-owned vehicles, printing and copies, and computer costs.
Travel	A copy of the company's travel reimbursement policy is needed. Additional documentation to include with invoices would consist of copies of airline tickets and billings, lodging receipts, employee expense reports, and receipts for other reimbursed costs. If the company reimburses meals on an actual cost basis, copies of meal receipts will also be needed. If an employee's expenses include meals purchased for others, the expense report needs to list the individuals and the business purpose for incurring the cost.
Outside purchases other than subcontracts	Copies of vendor invoices supporting these charges may be requested. Sufficient information should be shown on the invoice to show that the expense was necessary for the project.
Subcontracts	A copy of every subcontract is needed. If a subcontract was not identified in the original proposal, a copy of SDDOT's approval for the subcontract is also needed. Subcontracts should include a statement that all provisions of the prime contract are included in the subcontract by reference. This will help ensure that, if federally funded, the subcontract will also be eligible for federal-aid reimbursement. Subcontracts must be fully executed prior to incurring subcontract costs. Costs incurred prior to establishing a subcontract cannot be reimbursed.

Common unallowed expenses include:

- advertising
- trade show expenses
- promotional materials
- memberships in civic organizations
- bad debts
- collection costs
- personal vehicle use
- contributions
- employee gifts
- social activities
- fines & penalties
- key-man insurance
- rework insurance
- interest expense
- lobbying costs
- organization & reorganization fees
- capital raising fees
- patent costs
- unsupported retainer agreements
- travel costs in excess of FTR rates
- goodwill
- alcoholic beverages

Specific questions concerning allowability of costs on any project should be directed to the Office of Research's project manager.

Chapter 6 – IMPLEMENTATION

Upon completion of the study, the project's technical panel advises the Department how to use the research findings. The panel evaluates the validity of the research, and recommends any changes in policy, procedures or practice that should be adopted. As specifically as possible, the panel defines what actions should be taken and identifies which offices in the Department should be responsible for their completion. The panel may recommend:

- specification changes
- policy changes
- design changes
- training
- construction
- additional research

A sample Technical Panel Evaluation and Recommendations document is shown in Figure 11. The Office of Research will annually present to the Research Review Board a Research Implementation Status Report. For a minimum of three (3) years following the completion of each study, the report lists the approved implementation recommendations and the status of each recommendation. Some studies may require additional years of reporting based on the extent and timeline of implementation.

Tracking & Evaluation

Each year the Office of Research publishes a Research Implementation Status Report. For every completed study, the report lists the approved implementation recommendations and the status of each recommendation. The date the recommendation was completed is also listed. A sample page is presented in Figure 12.

Technical Panel Evaluation and Recommendations
SD2018-07: Evaluation of Asphalt Binder Rejuvenators for Use in Recycled Asphalt
October 13, 2021

Researchers: Carolina Rodezno, Ph.D. **Study Duration:** March 2019 – November 2021

Organization: National Center for Asphalt Technology, Auburn University **Study Cost:** $80,000

Study Evaluation:
The researcher achieved the objectives defined for this project in a satisfactory manner. This project sought to assess the state of practice for the use of recycled asphalt binder rejuvenators, prepare and execute a laboratory testing protocol to evaluate at least five rejuvenator products, and develop recommendations for SDDOT's evaluation and use of rejuvenators going forward. SDDOT currently allows a maximum of 20% recycled asphalt pavement (RAP) by asphalt binder replacement (ABR) within its asphalt mixes. This project was initiated to evaluate the ability of rejuvenators to enhance the performance of RAP mixes. In the project's binder tests, the addition of rejuvenators generally reduced binder viscosity and stiffness. In mixture tests, all mixtures displayed adequate rutting performance, but improvements in intermediate temperature cracking resistance with the addition of rejuvenators were minimal when considering the IDEAL-CT test's variability. All 35% and 50% ABR mixtures, both with and without rejuvenators, showed significantly lower CT_{index} values than the control 20% ABR mix. Following completion of the original test plan, the researcher performed a few additional tests, which demonstrated that rejuvenators may yield significantly improved intermediate temperature cracking resistance for RAP mixes via (a) higher rejuvenator dosages and (b) higher asphalt contents, with the latter having a greater effect. An iterative, mix specific, performance-based procedure was then proposed for SDDOT to use for rejuvenator evaluation. Based on the performance of rejuvenated mixes in this research, SDDOT does not recommend an immediate implementation of rejuvenators in QC/QA asphalt mixes.

Research Objectives	Panel Comments
1) *Compile and evaluate data on the state of practice for use of recycled asphalt binder rejuvenators.*	The researcher completed a thorough literature review covering rejuvenator classification and dosage, rheological and chemical characterization of rejuvenators, performance testing of rejuvenated RAP mixes, and field performance of rejuvenated RAP mixes.
2) *Develop a testing protocol or procedure that can be used to evaluate recycled asphalt binder rejuvenators.*	The researcher accomplished this objective in a satisfactory manner, developing a two-phase testing protocol dedicated to evaluating the ability of rejuvenators to (1) restore aged asphalt binder properties and (2) improve the performance characteristics of asphalt mixtures. The researcher also proposed mix-design specific protocol for SDDOT to use for rejuvenator evaluation, which requires asphalt mixture testing results (APA, IDEAL-CT, and DCT) match those of a control mix with SDDOT's current maximum allowed RAP content.

Figure 11 Sample Technical Panel Evaluation & Recommendations (sheet 1 of 6)

Research Objectives	Panel Comments
3) *Evaluate a minimum of five binder rejuvenation products that could routinely be used in South Dakota.*	Five separate rejuvenator products were evaluated successfully with the testing protocol developed by the researcher. These products included two chemically modified, vegetable oil based rejuvenators, two rejuvenators derived from crude tall oil, and one petroleum-based rejuvenator.
Task Description	**Panel Comments**
1) *Meet with technical panel to review project scope and work plan.*	The researcher met with the project technical panel at SDDOT's Central Office on the morning of May 29, 2019.
2) *Review and summarize literature regarding the use of asphalt binder rejuvenators.*	The researcher conducted a comprehensive literature review to identify and synthesize existing studies on the use of asphalt binder rejuvenators. Topics included rejuvenator classifications; determinations of optimum rejuvenator dosages; rheological, chemical, and laboratory characterization of recycled asphalt binders and mixtures with rejuvenators; and field performance of RAP mixes with rejuvenators.
3) *Based on the results of Task 2, develop a survey instrument to be sent to selected U.S. state and Canadian provincial transportation departments to determine how they evaluate and use asphalt binder rejuvenators.*	The researcher developed a survey of U.S. state and Canadian provincial highway agencies to determine how they evaluate and use asphalt binder rejuvenators. Survey questions gathered information about the current use of recycled asphalt, maximum RAP content allowed, performance tests if required, and associated pavement distresses. Questions related to the evaluation, approval, and use of rejuvenators in RAP mixes were also included.
4) *Submit a technical memorandum to the technical panel detailing the results of Task 2 & 3.*	The researcher submitted the project's first technical memorandum on July 1, 2019.

Figure 11 Sample Technical Panel Evaluation & Recommendations (sheet 2 of 6)

Task Description	Panel Comments
5) *Based on literature search and survey results, propose testing procedures for both asphalt binders and asphalt concrete mixes to evaluate the effectiveness of asphalt binder rejuvenators, including methods to predict their long-term effect on pavement performance. Testing must involve a representative sample of five to ten rejuvenators selected by the researcher, to be tested at manufacturer's recommended dosage with virgin binder, 20%, 35%, and 50% RAP materials, and virgin aggregate from the same source to allow for direct comparisons.*	The researcher developed an experimental plan including evaluation of (a) standalone virgin/RAP binders, (b) recycled binder blends with and without rejuvenators, and (c) recycled asphalt mixtures with and without rejuvenators. The test plan was split into two phases: evaluation of rejuvenators' ability to (1) restore binder properties in recycled blends and (2) improve the performance characteristics of asphalt mixtures. A 20% RAP mix (by asphalt binder replacement) served as a control. Six mixes (no rejuvenator, and each of 5 rejuvenators) were prepared with both 35% RAP and 50% RAP. Rotational viscosity, DSR, BBR, and FTIR were proposed for binder performance evaluation. APA, IDEAL-CT, and DCT tests were proposed for evaluating mixtures' rutting resistance, intermediate temperature cracking resistance, and thermal cracking resistance, respectively.
6) *Submit a technical memorandum to the technical panel detailing the results of Task 5 & 6.*	The researcher submitted the project's second technical memorandum on December 16, 2019. The research team received comments from the technical panel on May 16, 2020. A revised version of the memo was submitted on May 29, 2020.
7) *Conduct testing using the procedure approved in Task 6.*	The principal investigator and NCAT staff executed the proposed work plan, beginning in summer 2020. The project's testing phase experienced some disruption from pandemic-related restrictions on lab use and shortages of personnel. All originally proposed lab testing was completed by the end of February 2021. Additional tests exploring the performance of a higher rejuvenator dosage and lower assumed binder availability factor (BAF) were completed in summer 2021. A mix with 35% RAP and an assumed 75% BAF showed significant improvement in performance with the addition of a manufacturer recommended dosage of a vegetable oil based rejuvenator, suggesting that the use of rejuvenators in combination with higher asphalt content may produce mixes with improved intermediate temperature cracking performance. The mix's performance, as measured by an IDEAL-CT index, however, was still below that of the control mix.

Figure 11 Sample Technical Panel Evaluation & Recommendations (sheet 3 of 6)

Task Description	Panel Comments
8) *Submit a technical memorandum to the technical panel detailing the results of Task 8.*	The researcher submitted the project's third and final technical memorandum on May 31, 2021, and presented its content to the technical panel on June 4, 2021.
9) *Develop recommendations for rejuvenator evaluation and use, including any new specifications and test methods.*	The researcher developed a procedure for SDDOT to evaluate rejuvenators for use in recycled asphalt mixtures. The procedure is iterative. An initial rejuvenator dosage is selected based on determination of the high-temperature and low temperature performance grades (PG) of the virgin and RAP binders used for applicable mixes. Mixture performance tests are then carried out post-aging, with mixes required to match the performance of an unrejuvenated, 20% asphalt binder replacement RAP control mix. The procedure must be repeated on a case-by-case basis for all rejuvenated RAP mix designs.
10) *In conformance with Guidelines for Performing Research for the South Dakota Department of Transportation, prepare a final report summarizing the research methodology, findings, conclusions, and recommendations.*	The researcher submitted a draft of the project's final report on August 25, 2021.
11) *Make an executive presentation to the South Dakota Department of Transportation Research Review Board at the conclusion of the project.*	The project's principal investigator delivered an executive presentation to the SDDOT Research Review Board on September 1, 2021.

Figure 11 Sample Technical Panel Evaluation & Recommendations (sheet 4 of 6)

Researchers' Recommendations	Panel's Recommendations
The results of this research were used to develop the following procedure to evaluate the effectiveness of rejuvenators in improving the performance of high recycled mixtures: ***1. Select a control 20% ABR mix with satisfactory performance.*** ***2. Select virgin binder and RAP material and determine their high-temperature (HT) and low-temperature (LT) performance grade (PG) per AASHTO M 320.*** ***3. Select the rejuvenator and high RAP mix design to be evaluated.*** ***4. The rejuvenator dosage should be indicated by the additive manufacturer using the results in step 2) along with the information of the mix design to be evaluated.*** *For this project, the suppliers provided dosages to target the low temperature PG grade of the 20% ABR mix. Since the results of this study indicated that the dosages selected by the suppliers following this approach were too low, other approaches that have been recommended to select rejuvenator dosages should be considered. Examples of these approaches include the selection of rejuvenator dosages to target either the continuous high temperature PG grade or the low temperature PG grade to that of the target asphalt binder that satisfies both climate and traffic requirements (Epps Martin et al., 2018, Rodezno et al., 2021).* ***5. Conduct mixture performance tests to evaluate mixture performance with aging.*** *For APA, samples are prepared from loose mix aged for four hours at 135°C (STOA).* *For IDEAL-CT and DCT, samples are prepared from STOA conditioned mix further aged for six hours at 135°C (LTOA).* ▪ *Prepare samples with the selected RA dosage and RAP proportion combination to conduct the IDEAL-CT test.* ▪ *Compare the IDEAL-CT results of the proposed mix to the results obtained for the control 20% ABR mixture.* ▪ *If the IDEAL-CT results of the proposed mix meet the performance of the control mix, verify that the mix meets the APA threshold of 7 mm rut depth (specified by SDDOT), and the DCT results obtained for the control 20% ABR mix.* ▪ *If the IDEAL-CT criterion is not satisfied, increase the RA dosage and/or increase the binder content of the mix and retest IDEAL-CT, APA, and DCT.*	Though the recommended procedure may be able to successfully evaluate rejuvenator performance, the panel believes it is not practical for full-scale implementation within SDDOT. The proposed iterative evaluation process could require multiple weeks of testing to evaluate individual, rejuvenated asphalt mix designs, making it incompatible with contractor timelines. Furthermore, SDDOT's materials lab has not yet implemented the IDEAL-CT test for assessment of cracking resistance. The researcher's final round of IDEAL-CT tests showed some improvement in cracking resistance with higher rejuvenator dosage, and to a greater extent, with higher asphalt content, for a mix designed with an assumed 75% binder availability factor. SDDOT's current volumetric mix requirements place limitations on increases to asphalt content, but the onboarding of balanced mix design (BMD) in future years could enable more flexibility conducive to the use of mixes with rejuvenators and higher RAP contents. The panel emphasized a need to evaluate rejuvenated mixes over their entire lifetime, from initial placement, when the mix is most susceptible to rutting, to end-of-life, when the mix is most susceptible to cracking. The panel recommends that a high-RAP, non-QC/QA shoulder mix be used as a pilot test for rejuvenated field mixes. The Office of Materials and Surfacing would be responsible for designing this mix and identifying a suitable project for its placement.

Figure 11 Sample Technical Panel Evaluation & Recommendations (sheet 5 of 6)

Researchers' Recommendations	Panel's Recommendations
Does the panel recommend development of a formal implementation plan for this completed study?	The panel does not recommend a formal implementation plan for this project. Based on the project's results, SDDOT does not expect rejuvenated mixes to display adequate or improved cracking performance while still conforming to the volumetric requirements of SDDOT's current asphalt concrete mix design specifications.

Technical Panel:

Kevin Carlson .....Jebro, Inc.
Phil Clements .....Project Development
Bret Hestdalen.....FHWA
Dave Huft.....Research
Shea Lemmel ..... Materials and Surfacing
Aaron Litka .....Research
Bob Longbons .....Research
Daris Ormesher .....Research
Rick Rowen .....Materials and Surfacing
Matt Stone ..... Rapid City Region
Ken Swedeen..... DAPA

Figure 11 Sample Technical Panel Evaluation & Recommendations (sheet 6 of 6)

South Dakota Department of Transportation
Research Implementation Status Report

Project Number: SD2019-05
Title: Evaluation of Granular Density and Moisture Testing
Research Review Board Action: May 9, 2023
Review Date:
Completed by:

#	RRB Recommendation	Responsible Division	Responsible Office	Action to Date	Date Completed
1	The Region Materials Engineers will identify and compile data from past projects. Data will not be limited to one construction season. The Office of Research will contract a researcher to perform an analysis of the moisture/density data and recommend adjustments to the SDDOT Moisture-Density Family of Curves.	Planning & Engineering	Research		
		Operations	Region Materials		
2	The technical panel agrees the SDDOT curves should be converted to wet density for more feasible field use and consistency with current state practices.	Planning & Engineering	Research		
3	The technical panel agrees with the adoption of the SDDOT Moisture-Density Family of Curves once the curves have been adjusted.	Operations	Region Materials		
4	The technical panel does not agree with developing a computer program for use of the SDDOT curves is needed. However, they recommend modifications should be made to MS&T to accommodate the SDDOT curves.	Planning & Engineering	Research		
5	The technical panel agrees with monitoring the DCP test's effectiveness in screening compaction quality. To fulfill this, DCPs will need to be supplied to all the Region Materials offices. Region Materials Technicians will then collect DCP data. Also, the techs will continue normal testing (sand cone and/or NDG) alongside DCP testing. The Office of Research will contract a researcher to analyze and compare the DCP to the other tests.	Planning & Engineering	Materials & Surfacing		
			Research		
		Operations	Region Materials		

Figure 12 Sample Implementation Status Report

Chapter 7 – WORK PROGRAMS AND FUNDING

SPR Research Work Program

Each year the Research Program Manager provides the SPR Research Work Program to the SDDOT SPR coordinator for that fiscal year, which starts on July 1 and ends on June 30 the following year. The SDDOT SPR coordinator then sends the SPR Research Work Program to FHWA. The SPR Research Work Program consists of all active research projects in addition to estimated costs and funding sources for each of the projects, estimated completion dates for projects, and the work that was completed for that project throughout the year. FHWA must agree to any projects added as part of the SPR Research Work Program. Throughout the year if a project needs to be added to the SPR Work Program, the Research Program Manager sends a request to the SDDOT SPR coordinator, who then requests FHWA for their approval.

Funding

The research program manager is responsible for monitoring the expenditures of the SPR Work Program. The SDDOT has a computer program that tracks the monthly and yearly expenditures of the SPR Work Program, which the research program manager reviews.

Chapter 8 – NATIONAL AND INTERNATIONAL ACTIVITIES

TRB

Transportation Research Board (TRB) coordinates transportation research activities to publish research results of interest to states and conduct special research projects when appropriate. The SDDOT supports the activities of TRB through annual contributions to TRB and the NCHRP.

NCHRP (National Cooperative Highway Research Program)

The National Cooperative Highway Research Program (NCHRP), which is a joint program of FHWA and AASHTO, was established in 1962 to provide an objective national highway research program. The Transportation Research Board (TRB) currently administers the program.

RIP

The Transportation Research Board's Research in Progress (RIP) Database contains information concerning current or recently completed transportation research projects. Projects funded by the U.S. Department of Transportation and State Departments of Transportation and research conducted by University transportation research are included in the database. After a contract for a research project is signed, it is the responsibility of the project manager to upload project information into the Research in Progress (RIP) Database.

TRID

TRID is an integrated database that combines the records from TRB's Transportation Research Information Services (TRIS) Database and the OECD's Joint Transport Research Centre's International Transport Research Documentation (ITRD) Database. TRID provides access to more than 1.3 millions record of transportation research worldwide.

ROSA P

ROSA P is the National Transportation Library's Repository and Open Science Access Portal. NTL's collections in ROSA P are full-text digital publications. Context types found in ROSA P include textual works, datasets, still image works, moving image works, other multimedia, and maps. USDOT publications and data products deposited into ROSA P are assigned a digital object identifier, or DOI. All SDDOT reports are to be submitted to NTL. Any report published after March 23, 2018, is required to be 508 compliant.

SPR

The State Planning and Research (SPR) Program is used to fund highway research and planning work. SPR consists of planning and research. Two percent of the annual highway construction fund is dedicated to SPR. At least one-quarter of SPR funds are to be spent on Research, Development, and Technology Transfer activities. SPR funds are usually matched with state funds at a ratio of 80 percent federal to 20 percent state funds. Some programs are funded with 100 percent state funds.

Pooled Fund Studies

For pooled fund studies, resources from several states or other government agencies, universities, and/or industry sources are combined to support a single research effort. Participation in Pooled Fund Studies must be approved by the Research Review Board.

Lead Agency

The lead agency for a pooled fund study conducts or contracts the research and performs the administrative aspects of the study. The lead agency develops the problem statement and solicits interest from other agencies and gets approval from FHWA for the study.

Project Development

After developing a research idea for a proposed pooled fund study, colleagues in other state DOTs will need to be contacted to identify interest and potential partners for the study. Contacting potential partnering states is very critical for the development of a pooled fund study. A project could be cancelled if there are not enough partners and adequate funding for a pooled fund study.

Solicitation and Commitment of Partners

When an idea for a pooled fund study is finalized, the Research Office will forward the ideas to FHWA to determine if the project is eligible for 100% SPR federal funding. If eligible, the idea is posted on the TPF website. Managed by FHWA, the TPF website tracks financial contributions and national participation in pooled fund studies. An email is sent to the AASHTO RAC listserv when a pooled fund study is posted. The solicitation period on the TPF website is not to exceed one year.

Contract and Project Management

When a study has received adequate funding and enough partners, the Research Office inquires FHWA to assign a project TPF study number. The Research Office then may proceed with securing a contract with a research agency to perform the study.

Participating Agencies

Contribute funds and offer technical expertise for the pooled fund study. For a project to be considered a pooled fund study, a minimum commitment from two agencies is required.

Chapter 9 – PROGRAM EVALUATION

Overview

The research program manager routinely evaluates the research program to improve its quality.

Performance Evaluation of the Researchers

After a project is completed, the project manager evaluates the performance of the researchers and sends a copy of the evaluation to the principal investigator.

Evaluation of Implementation

The research manager will monitor implementation efforts for three years after completion of a research project and document the findings. If research results were negative and there were not any implementation actions recommended, monitoring is not required. Monitoring implementation efforts may also conclude sooner if implementation has reached an ending point.

Peer Exchanges

A periodic review of a state DOT's research program by representatives of state DOTs in order to exchange information for best practices. Other state and federal transportation agencies, members of the FHWA, academic institutions, and private firms may participate in a peer exchange. The SDDOT is required to host a peer exchange every 3-5 years.

Chapter 10 – LIBRARY & FILE MANAGEMENT

Library Responsibilities

The Office Research Secretary is responsible for managing research information for current and completed projects. Duties include the following:

- Maintain database for all completed research and research in progress
- Confirm research projects are updated on TRID and RIP
- Maintain research library physical and electronic documents

File Management

Every Contract Project is required to be organized in its own folder with six (6) subfolders named:

- Correspondence
- Data
- Images
- Literature

- Presentations
- Project Documents

These subfolders allow for someone other than the program manager to become up to date on a project without explanation. The items that belong in each folder are detailed below along with the location of the folders.

Standard Project Folders - M:\DOT\Plan_And_Eng\Research\Office\Standard Project Folders

- **Correspondence**
  - Emails, Teams meeting recordings
- **Data**
  - Spreadsheets, other data documents
- **Images**
- **Literature**
  - Project related documents found during the literature search
- **Presentations**
  - Power Points or PDFs of slides
- **Project Documents**
  - **Contract**
    - Contract related documents
  - **Invoice**
    - All paid invoices
  - **Misc**
    - Any project documents that don't fit in other folders. Create additional folders as needed.
  - **Problem Statement**
    - The original Problem Statement submitted and subsequent versions
  - **Project Statement**
    - All versions of the Project Statement. Use _RRB.docx for the final version.
  - **Proposals**
    - **Evaluations**
      - Technical panel evaluation forms
    - **Letters**
      - Proposal acceptance and rejection letters
    - **Proposals**
      - All submitted proposals
    - **RFP**
      - All versions of the Request for Proposals
  - **Reports**
    - **Action Plans**
      - Any action plans produced or work plans
    - **Final Report**
      - The Final Report, one document
      - **Drafts**

- All draft versions of the final report

Implementation

- The technical panel project evaluation and implementation recommendation

Interim Reports

- Any reports prior to the final report that aren't considered Technical Memos

Monthly Mtg Minutes

Quarterly Reports

Technical Memos

- All versions of the tech memos

Appendix A

AGREEMENT FOR A RESEARCH STUDY

FINANCED WITH FEDERAL FUNDS

COST REIMBURSEMENT CONTRACT

Agreement Number _____

This Agreement is made by and between the State of South Dakota, acting by and through its Department of Transportation, referred to in this Agreement as "State," and Legal Name of Entity, of Address, City, State Zip Code, referred to in this Agreement as "Contractor."

1. BACKGROUND:

A. State has indicated the need for work described in this Agreement;

B. Contractor has personnel able to perform the work; and

C. State wants Contractor to perform the work.

The parties agree that Contractor will perform the work in accordance with the following:

2. PROJECT IDENTITY

For purposes of identification, this work will be identified by Project Number Project Number and the Agreement Number assigned by State and listed above. Contractor will identify all invoices, reports, and correspondence submitted to State in connection with this Agreement accordingly. All matters relating to this Agreement will be processed through State's Project Manager.

3. SCOPE OF WORK

A. Contractor, under direction of principal investigator Name of Principal Investigator, will undertake research described as:

Scope of Work Details

B. Contractor will perform those tasks delineated in Contractor's proposal entitled "Title of Proposal," which is attached to this Agreement and incorporated by reference as **Exhibit A**.

4. PERIOD OF PERFORMANCE

Contractor will perform the work beginning on the execution date of this Agreement and Ending Date, unless both parties to this Agreement agree, in writing, to a time extension.

5. AGREEMENT PRICE

Contractor will accept and State will reimburse, as full compensation for all services rendered, materials, and supplies furnished under this Agreement, the actual costs incurred by Contractor in an amount not exceeding Dollar Amount Spelled Out ($Numerical Dollar Amount), as specified in the budget in the attached **Exhibit A**.

6. PRINCIPAL INVESTIGATOR

If a principal investigator becomes unavailable to perform the work, the Contractor will provide a new principal investigator to complete the work. The Contractor will obtain the State's advance approval for any new principal investigator.

7. CHANGES IN SCOPE

Contractor agrees any change in objective and scope of the work which has significant bearing on the research must have State's written approval prior to proceeding. Contractor must submit to State any request for increase in work time or funding before extra work is started and at least thirty (30) days prior to the end of the period of performance. Any increase in work time or funding requires State's approval and the execution of a supplemental Agreement, before any extra work is started.

8. SUBCONTRACTING

A. Contractor will perform all work except specialized services. Specialized services are considered to be those items not ordinarily furnished by Contractor which must be obtained for proper execution of this Agreement. Contractor will not assign, sublet, or transfer this Agreement or any interest in this Agreement without State's prior written permission. Contractor will itemize each subcontract anticipated at the time of proposal in **Exhibit A** to this Agreement. This does not, however, prohibit the subcontracting of work during the course of the execution of this Agreement provided Contractor obtains State's prior written permission.

B. Costs of subcontracted work incurred prior to execution of the corresponding subcontract will not be eligible for reimbursement.

C. Each subcontract must contain all of the provisions of this Agreement.

9. PROMPT PAYMENT

Contractor will pay subcontractors or suppliers within fifteen (15) days of receiving payment for work that is submitted for progress payment by State. If Contractor withholds payment beyond this time period, Contractor will submit written justification to State, upon request. If State determines a subcontractor or supplier has not received payment due without just cause, State may withhold future estimated payments or may direct Contractor to make such payment to the subcontractor or supplier. Prompt payment will also include retainage monies due to the subcontractor if Contractor elects to utilize retainage on subcontract work. The maximum amount permitted for retainage for any subcontract will be 10%. Contractor will release retainage within fifteen (15) days of satisfactory completion of the work.

10. REPORTS

Contractor will submit quarterly progress reports to State on every April 15, July 15, October 15, and January 15, during the period of performance. Contractor will submit the draft final report to State forty-five (45) days prior to the end of the period of performance. After reviewing the draft report, State will advise Contractor as to its acceptability and will request any necessary changes. Contractor will submit the complete final report and the complete executive summary to State fifteen (15) days prior to the end of the period of performance. Compliance with these accessibility standards is mandatory for Federal agencies subject to Section 508 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794D), Contractor will submit all reports in word processing format (Microsoft Word) as well as Portable Document Format (Adobe.pdf) that fully conforms to the applicable Revised 508.

11. PAYMENT

A. State will pay Contractor in insert # lump sum payments upon State's acceptance of completed tasks, as shown in the following table:

B. Contractor will submit invoices to the South Dakota Department of Transportation, Office of Research, 700 East Broadway Avenue, Pierre, SD 57501-2586, in triplicate, within forty-five (45) days following the completion of each group of billable tasks. No payment will be due Contractor until the account has been reviewed and approved by State. State will review invoices and approve allowable costs within fifteen (15) business days of receipt.

C. Final payment to Contractor for work accomplished under this Agreement will be made upon acceptance by State. Allowable final costs will be determined in accordance with the provisions of 2 CFR Part 200.

D. Costs incurred prior to the date this Agreement has been signed by all parties are not eligible for payment.

12. FUNDING

The parties understand and agree that funding for this Agreement is dependent upon continued availability of appropriated funds and expenditure authority from the Legislature for this purpose. If for any reason the Legislature fails to appropriate funds or grant expenditure authority, or funds become unavailable by operation of law or federal funds reductions, this Agreement may be terminated by State. Termination for any of these reasons is not a default by State nor does it give rise to a claim against State.

13. RECORD RETENTION AND AUDIT

A. All project charges will be subject to audit in accordance with the STATE'S current procedures and U.S. Office of Management and Budget (OMB) Circular regulations, found at 2 CFR Part 200. The CFDA Number for these funds is 20.205. Allowable costs will be determined in accordance with 2 CFR Part 200.

B. The Contractor will maintain accurate cost accounting systems for all costs incurred under this Agreement and clearly identified with activities performed under this Agreement.

C. Upon reasonable notice, the Contractor will allow the STATE, through any authorized representative to have access to and the right to examine and copy all records, books, papers, or documents related to services rendered under this Agreement. The Contractor will keep these records clearly identified and readily accessible for a period of three (3) years after the date final payment under this Agreement is made and all other pending matters are closed.

D. If the Contractor expends Seven Hundred Fifty Thousand Dollars ($750,000.00) or more in federal funds during any Contractor fiscal year covered, in whole or in part, under this Agreement, then the Contractor will be subject to the single agency audit requirements of the US Office of Management and Budget (OMB) Circular regulations, found at 2 CFR Part 200. If the Contractor expends less than Seven Hundred Fifty Thousand Dollars ($750,000.00) during any Contractor fiscal year, the STATE

may perform a more limited program or performance audit related to the completion of Agreement objectives, the eligibility of services or costs and adherence to Agreement provisions.

14. INSPECTION OF WORK

Contractor will provide to State proper Contractor facilities for review and inspection of the work described in this Agreement. State will have access to Contractor's premises and to all books, records, correspondence, instructions, receipts, vouchers, and memoranda of every description pertaining to this Agreement.

15. PUBLICATION

A. State and the Federal Highway Administration each reserve a royalty-free, nonexclusive, and irrevocable license to reproduce, publish, and otherwise use, and to authorize others to use, the work for government purposes.

B. Either party to this Agreement may initiate a request for publication of the final or interim reports, or any portions thereof. Neither party to this Agreement will publish or otherwise disclose, or permit to be disclosed or published, the results of the work herein contemplated, or any particulars thereof, during the period of this Agreement, without notifying the other party and securing its consent in writing. Academic theses may be published without written consent, providing the disclaimers contained in this Agreement are provided. Either party may publish without restriction upon termination of this Agreement.

C. When the scheduled time for presentation of a paper by one party to this Agreement does not permit the formal review and approval of a complete report by the other party, abstracts may be used for notification of intent to present a paper based on the work. Such presentations must protect the interests of the other party by inclusion of a Statement in the paper and in the presentation to the effect that the paper has not been reviewed by the other party.

D. Both written and oral releases are considered to be within the context of publication. However, there is no intention to limit discussion of the work with small technical groups or lectures to employees or students. Lectures to other groups which describe the plans, but disclose neither data nor results, are permissible.

E. All reports published by Contractor will contain the following Disclaimer in the credit sheet:

   i. The contents of this report, funded in part through grant(s) from the Federal Highway Administration, reflect the views of the authors who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the South Dakota Department of Transportation, the State Transportation Commission, or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

F. If State and Contractor do not reach agreement concerning any publication of the final report, or any progress report during the period of this Agreement, State reserves the right to publish independently.

G. If State does not elect to publish the final report, publication by Contractor will then be a matter of province of Contractor's policy.

H. Publication by either party will give credit to the other party except: a) upon failure of agreement by both parties on any report of the work or b) if either of the parties requests that its credit acknowledgment be omitted.

16. OWNERSHIP OF DATA

Data collected under this Agreement, together with summaries and charts derived from this data, will be jointly owned by State and Contractor. Copies of all records, reports, documents, or other material related to this Agreement or obtained or prepared by Contractor in connection with the performance of contracted services will become the property of State and will be provided by Contractor to State at termination or expiration of this Agreement.

17. PROPRIETARY AND PATENT RIGHTS

State and Contractor agree that if patentable discoveries or inventions should result from the work conducted under this Agreement, the provisions of **Exhibit C**, attached to and made a part of this Agreement, will apply.

18. NONEXPENDABLE EQUIPMENT

A. Any item of equipment, including instrumentation or component parts, with an acquisition cost in excess of Five Thousand Dollars ($5,000.00) will be considered nonexpendable equipment.

B. If any item of nonexpendable equipment is required to conduct this work and is specified in Contractor's proposal, no further approval is required from State. Any item of nonexpendable equipment not budgeted in Contractor's proposal must have State's prior written approval prior to purchase. Any item of nonexpendable equipment which is budgeted but not specifically identified in Contractor's proposal must have State's written approval prior to purchase.

C. Title to all nonexpendable equipment will rest with State. Ninety (90) days prior to the end of the period of performance, Contractor will supply to State an itemized list, including descriptions, purchase costs, and estimated salvage value, of all nonexpendable equipment purchased during the course of the work.

D. If, at the conclusion of the work, Contractor desires to acquire title to nonexpendable equipment from State, Contractor may ask State for title. If State elects to grant title, State will be allowed a credit from Contractor's final payment equal to the current salvage value as determined by mutual agreement between Contractor and State, subject to applicable surplus property laws.

E. Contractor certifies that no costs for using any item of nonexpendable equipment purchased for the work have been included in the indirect costs that are approved by State for this work.

19. RENTAL OF SPACE, EQUIPMENT, OR FACILITIES

A. The actual cost to Contractor of renting any additional space, special equipment, or facilities not owned by Contractor but required for the work and listed in Contractor's proposal are approved by State, subject to a limitation of the period of performance of this Agreement.

B. State approves the items and classes of items, such as office equipment, typewriters, computers, files, tables, laboratory, or other items shown in Contractor's proposal as the indirect costs of the work. Those costs are included in the Agreement price.

20. TRAVEL

Contractor agrees no out-of-state travel costs will be charged against this Agreement without prior consultation with, and written approval of State. For purposes of this Agreement, out-of-state travel is defined as travel to or from states other than Contractor's location and the State of South Dakota. If no in-state travel is specifically called for in Contractor's proposal, but becomes necessary, said travel must have State's prior approval.

21. AMERICANS WITH DISABILITIES ACT

Contractor will provide services in compliance with the Americans with Disabilities Act of 1990, and any amendments.

22. CIVIL RIGHTS

Contractor will be bound by the requirements of Title VI of the Civil Rights Act of 1964, attached as **Exhibit B** and made part of this Agreement by reference.

23. CODE OF CONDUCT

Contractor warrants that Contractor has not employed or retained any company or person, other than a bona fide employee working solely for Contractor, to solicit or secure this Agreement, and that Contractor has not paid or agreed to pay any company or person, other than a bona fide employee working solely for Contractor, any fee, commission, percentage, brokerage fee, gifts, or any other consideration, contingent upon or resulting from the award or making of this Agreement. For breach or violation of this warranty, State may annul this Agreement without liability, or, in State's discretion, deduct from the Agreement price or consideration, or otherwise recover, the full amount of such fee, commission, percentage, brokerage fee, gift, or contingent fee and prosecute under applicable criminal law.

24. CERTIFICATION REGARDING LOBBYING

A. Contractor certifies, to the best of Contractor's knowledge and belief, that no Federal appropriated funds have been paid or will be paid, by or on Contractor's behalf to any person for influencing or attempting to influence an officer or employee of any agency, a member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of a Federal contract, grant, loan, or cooperative agreement. If any funds other than Federal appropriated funds have been paid or will be paid to any of the above mentioned parties, Contractor will complete and submit Standard Form LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

B. Contractor will require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients will certify and disclose accordingly.

C. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification will be subject to a civil penalty or not less than $10,000 and not more than $100,000 for each such failure.

25. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY, AND VOLUNTARY EXCLUSION

Contractor certifies, by signing this Agreement, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department or agency.

26. INDEPENDENT CONTRACTOR

A. While performing services under this Agreement, Contractor is an independent contractor and not an officer, agent, or employee of the State of South Dakota.

B. No employee of Contractor engaged in the performance of services required under this Agreement will be considered an employee of State. No claim under the South Dakota Workers' Compensation Act on behalf of said employee or other person while so engaged, and no claim made by any third party as a consequence of any act or omission of the part of the work or service provided or to be rendered under this Agreement by Contractor, will be State's obligation or responsibility.

27. RESTRICTION OF BOYCOTT OF ISRAEL

A. In accordance with the State of South Dakota, Office of the Governor, Executive Order 2020-01, the following will apply to all contracts unless the amount being bid is less than $100,000.00. By submitting a bid proposal for this contract, the Contractor certifies and agrees the following information is correct for the bidder and all subcontractors (all tiers) and suppliers with five (5) or more employees:

B. Contractor, in preparing the bid proposal or in considering proposals submitted from qualified potential suppliers and subcontractors, or in the solicitation, selection, or commercial treatment of any supplier or subcontractor; has not refused to transact business activities, has not terminated business activities, and has not taken other similar actions intended to limit its commercial relations, related to the subject matter of the bid proposal, with a person or entity on the basis of Israeli national origin, or residence or incorporation in Israel or its territories, with the specific intent to accomplish a boycott or divestment of Israel in a discriminatory manner. It is understood and agreed that, if this certification is false, such false certification will constitute grounds for the Department to reject the bid proposal submitted by Contractor on this contract and terminate any contract awarded based on the bid. Contractor agrees to provide immediate written notice to the Department if, during the term of the contract awarded to Contractor, Contractor no longer complies with this certification. Contractor further agrees such noncompliance may be grounds for contract termination.

28. INSURANCE

Before Contractor begins providing service, Contractor will furnish State the following certificates of insurance and assure that the insurance is in effect for the life of the Agreement:

A. Commercial General Liability Insurance: Contractor will maintain occurrence based commercial general liability insurance or equivalent form with a limit of not less than $1,000,000 for each occurrence. If such insurance contains a general aggregate limit it will apply separately to this Agreement or be no less than $2,000,000.

B. Professional Liability Insurance or Miscellaneous Professional Liability Insurance: Contractor will procure and maintain professional liability insurance or miscellaneous professional liability Insurance with a limit not less than $1,000.000. The insurance provided for general liability and

errors and omissions will be adequate for the liability presented, and will be written by an admitted carrier in the State of South Dakota.

C. Business Automobile Liability Insurance: Contractor will maintain business automobile liability insurance or equivalent form with a limit of not less than $500,000 for each accident. Such insurance will include coverage for owned, hired, and non-owned vehicles.

D. Workers' Compensation Insurance: Contractor will procure and maintain workers' compensation and employers' liability insurance as required by South Dakota law.

Contractor will furnish copies of the insurance policies if requested by State.

29. PROTECTION OF CONTRACTING AUTHORITY

Contractor will indemnify State, its officers, agents, and employees against any and all actions, suits, damages, liability, or other proceedings which may arise as a result of the negligence, misconduct, error or omission of Contractor or any officer, agent, or employee of Contractor performing services under this Agreement. This section does not require Contractor to be responsible for or defend against claims or damages arising solely from acts or omissions of State, its officers, agents, or employees.

30. REPORTING OF INJURY OR LOSS

A. Contractor will report to State any event encountered in the course of performance of this Agreement which results in injury to any person or property, or which may otherwise subject Contractor, State, or State's officers, agents, or employees to liability. Contractor will report any such event to State immediately upon discovery.

B. Contractor's obligation under this section will only be to report the occurrence of any event to State and to make any other report provided for by Contractor's duties or applicable law. Contractor's obligation to report will not require disclosure of any information subject to privilege or confidentiality under law (for example, attorney-client communications). Reporting to State under this section will not excuse or satisfy any obligation of Contractor to report any event to law enforcement or other entities under the requirements of any applicable law.

31. TERMINATION OF AGREEMENT

A. The State may terminate this Agreement by giving thirty (30) days' written notice to the Contractor. If Contractor breaches any of the terms or conditions of this Agreement, State may terminate this Agreement at any time with or without notice.

B. If State terminates this Agreement without fault on the part of Contractor, Contractor will deliver to State all work product completed to the date of termination. Such work product will be the property of State and Contractor will be paid for work performed and delivered up to the date of termination. The value of the work performed, services rendered and delivered, and the amount to be paid as actual costs will be mutually satisfactory to State and to Contractor. Actual costs to be reimbursed will be determined by audit of such costs to the date of termination except that actual costs to be reimbursed will not exceed the Agreement Price.

C. If State terminates the services of Contractor for fault on the part of Contractor, State will be entitled to recover payments made to Contractor on the work which is the cause of the at-fault termination. State will pay Contractor only for work satisfactorily performed up to the date of termination and delivered to State. State may adjust any payment due to Contractor at the time of termination to cover any additional costs to State due to Contractor's default. After audit of Contractor's actual costs to the date of termination and after determination by State of the amount of work satisfactorily

performed and the additional costs incurred by State due to Contractor's default, State will determine the amount to be paid to Contractor.

D. Upon termination, State may take over the work and may award another party an agreement to complete the work under this Agreement. If, after State terminates for a default by Contractor, it is determined that Contractor was not at fault, State will pay Contractor for eligible services rendered and expenses incurred up to the date of termination.

E. State may suspend this Agreement at any time by giving Contractor written notice, which notice will be effective as of the date established in the suspension notice. State will pay Contractor for services to the date of the suspension, in accordance with the above paragraphs.

32. COMPLIANCE WITH EXECUTIVE ORDER 2023-02

Contractor certifies and agrees that the following information is correct:

In preparing its response or offer or in considering proposals submitted from qualified, potential vendors, suppliers, and subcontractors, or in the solicitation, selection, or commercial treatment of any vendor, supplier, or subcontractor, Contractor is not an entity, regardless of its principal place of business, that is ultimately owned or controlled, directly or indirectly, by a foreign national, a foreign parent entity, or foreign government from China, Iran, North Korea, Russia, Cuba, or Venezuela, as defined by South Dakota Executive Order 2023-02.

Contractor further agrees that, if this certification is false, such false certification will constitute grounds for the State to terminate this Agreement. Contractor further agrees to provide immediate written notice to the State if during the term of this Agreement it no longer complies with this certification and agrees such noncompliance may be grounds for termination of this Agreement.

33. SEVERABILITY

If any court of competent jurisdiction holds any provision of this Agreement unenforceable or invalid, such holding will not invalidate or render unenforceable any other provision of this Agreement.

34. SUPERCESSION

All other prior discussions, communications, and representations concerning the subject matter of this Agreement are superseded by the terms of this Agreement, and, except as specifically provided in this Agreement, this Agreement constitutes the entire agreement with respect to its subject matter.

35. CONTROLLING LAW

This Agreement will be governed by and construed in accordance with the laws of the State of South Dakota. Any lawsuit pertaining to or affecting this Agreement will be venued in Circuit Court, Sixth Judicial Circuit, Hughes County, South Dakota.

36. DISPUTES

Any dispute concerning a question of fact in connection with the work not disposed of by agreement between the parties will be referred to State's Secretary of Transportation or duly authorized representative for determination, whose decision in the matter will be final and conclusive on the parties.

37. SIGNATURES

This Agreement is binding upon the signatories not as individuals, but solely in their capacities as officials of their respective organizations, and acknowledges proper action of State and Contractor to enter into the same.

	State of South Dakota
Legal Name of Entity	Department of Transportation
By: _____	By: _____
Name: _____	Name: Joel M. Jundt
Its: _____	Its: Secretary
Date: _____	Date: _____
(Corporate Seal)	Recommended:
	By: _____
	Name: Thad M. Bauer
	Title: Research Program Manager
	Date: _____

**** ACKNOWLEDGMENTS FOLLOW ****

Acknowledgment

STATE OF _____)

) SS

COUNTY OF NAME OF COUNTY)

On this the ___ day of _____, Year, before me _____, a notary public, personally appeared _____, who acknowledged himself/herself to be the _____ of , a corporation, and that he/she, as such officer, being authorized so to do, executed the foregoing instrument for the purposes therein contained, by signing the name of the corporation by himself/herself as such officer.

In witness whereof I hereunto set my hand and official seal.

_____

Notary Public

[Notary Seal] My commission expires: _____

Acknowledgment

STATE OF SOUTH DAKOTA)

) SS

COUNTY OF HUGHES)

On this the ___ day of _____, Year, before me _____, a notary public, personally appeared Joel M. Jundt, Secretary of the State of South Dakota, Department of Transportation, known to me or satisfactorily proven to be the person described in the foregoing instrument, and acknowledged that he executed the same in the capacity therein stated and for the purposes therein contained.

In witness whereof I hereunto set my hand and official seal.

_____

Notary Public

[Notary Seal] My commission expires: _____

EXHIBIT B

STATE OF SOUTH DAKOTA

DEPARTMENT OF TRANSPORTATION

STANDARD TITLE VI / NONDISCRIMINATION ASSURANCES

MARCH 1, 2016

During the performance of this Agreement, the SUB-RECIPIENT, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

1. **Compliance with Regulations**: The contractor (hereinafter includes consultants) will comply with the Acts and the Regulations relative to Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation, Federal Transit Administration, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.

2. **Non-discrimination**: The contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate directly or indirectly in the discrimination prohibited by the Acts and the Regulations, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR Part 21.

3. **Solicitations for Subcontracts, Including Procurements of Materials and Equipment**: In all solicitations, either by competitive bidding, or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the contractor of the contractor's obligations under this contract and the Acts and the Regulations relative to Non-discrimination on the grounds of race, color, or national origin.

4. **Information and Reports**: The contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Recipient or the Federal Transit Administration to be pertinent to ascertain compliance with such Acts, Regulations, and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the contractor will so certify to the Recipient or the Federal Transit Administration, as appropriate, and will set forth what efforts it has made to obtain the information.

5. **Sanctions for Noncompliance**: In the event of a contractor's noncompliance with the Non-discrimination provisions of this contract, the Recipient will impose such contract sanctions as it or the Federal Transit Administration may determine to be appropriate, including, but not limited to:

    a. withholding payments to the contractor under the contract until the contractor complies; and/or
    b. cancelling, terminating, or suspending a contract, in whole or in part.

6. **Incorporation of Provisions**: The contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations and directives issued pursuant thereto. The contractor will take action with respect to any subcontract or procurement as the Recipient or the Federal Transit Administration may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the contractor may request the Recipient to enter into any litigation to protect the interests of the Recipient. In addition, the contractor may request the United States to enter into the litigation to protect the interests of the United States.

During the performance of this Agreement, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

Pertinent Non-Discrimination Authorities:

- Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d et seq., 78 stat. 252), (prohibits discrimination on the basis of race, color, national origin); and 49 CFR Part 21.
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. § 4601), (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
- Federal-Aid Highway Act of 1973, (23 U.S.C. § 324 et seq.), (prohibits discrimination on the basis of sex);
- Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. § 794 et seq.), as amended, (prohibits discrimination on the basis of disability); and 49 CFR Part 27;
- The Age Discrimination Act of 1975, as amended, (42 U.S.C. § 6101 et seq.), (prohibits discrimination on the basis of age);
- Airport and Airway Improvement Act of 1982, (49 USC § 471, Section 47123), as amended, (prohibits discrimination based on race, creed, color, national origin, or sex);
- The Civil Rights Restoration Act of 1987, (PL 100-209), (Broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, The Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms "programs or activities" to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);
- Titles II and III of the Americans with Disabilities Act, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§ 12131-12189) as implemented by Department of Transportation regulations at 49 C.F.R. parts 37 and 38;
- The Federal Aviation Administration's Non-discrimination statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures Non-discrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;
- Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of Limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);
- Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U.S.C. 1681 et seq).

EXHIBIT C

PROPRIETARY AND PATENT RIGHTS

(1) Contractor agrees to disclose each subject invention to State within a reasonable time after it becomes known to Contractor personnel responsible for the administration of patent matters, and that State may receive title to any subject invention not disclosed to it within such time.

(2) Contractor agrees to make a written election within two (2) years after disclosure to State (or such additional time as may be approved by State) whether Contractor will retain title to a subject invention: provided, that in any case where publication, on sale, or public use, has initiated the one (1) year statutory period in which valid patent protection can still be obtained in the United States, the period for election may be shortened by State to a date that is not more than sixty (60) days prior to the end of the statutory period: and provided further, that State may receive title to any subject invention in which Contractor does not elect to retain rights or fails to elect rights within such times.

(3) When Contractor elects rights in a subject invention, Contractor agrees to file a patent application prior to any statutory bar date that may occur under 35 USCS Section 1 et seq. due to publication, on sale, or public use, and will thereafter file corresponding patent applications in other countries in which Contractor wishes to retain title within reasonable times, and that State may receive title to any subject inventions in the United State or other countries in which Contractor has not filed patent applications on the subject invention within such times.

(4) With respect to any invention in which Contractor elects rights, State and United States government will have a nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced for or on behalf of State or the United States Government any subject invention throughout the world: provided, that the funding agreement may provide for such additional rights; including the right to assign or have assigned foreign patent rights in the subject invention, as are determined by State or United States Government as necessary for meeting the obligations of the United States under any treaty, international agreement, arrangement of cooperation, memorandum of understanding, or similar arrangement, including military agreement relating to weapons development and production.

(5) State retains the right to require periodic reporting on the utilization or efforts at obtaining utilization that are being made by Contractor or Contractor's licensees or assignees: provided, that any such information as well as any information on utilization or efforts at obtaining utilization obtained as part of a proceeding under 35 USCS Section 203 will be treated by State as commercial and financial information obtained from a person and privileged and confidential and not subject to disclosure under 5 USCS Section 552.

(6) Contractor agrees that in the event a United States patent application is filed by or on Contractor's behalf or by any assignee of Contractor there will be included within such application and any patent issuing thereon, a statement specifying that the invention was made with State support and that State has certain rights in the invention.

(7) In the case Contractor is a nonprofit organization, (A) Contractor agrees to prohibit the assignment of rights to a subject invention in the United States without the approval of State, except where such assignment is made to an organization which has as one of its primary functions the management of inventions (provided that such assignee will be subject to the same provisions as Contractor): (B) Contractor will share royalties with the inventor; (C) except with respect to a funding agreement for the operation of a Government-owned-contractor-operated facility, that the balance of any royalties or income earned by Contractor with respect to subject inventions, after payment of expenses (including payments to inventors) incidental to the administration of subject inventions, will be utilized for the support of scientific research or education; (D) that, except where it proves infeasible after a reasonable inquiry, in the licensing

of subject inventions will be given to small business firms; and (E) with respect to funding agreement for the operation of a Government-owned-contractor-operated facility, (i) that after payment of patenting costs, licensing costs, payments to inventors, and other expenses incidental to the administration of subject inventions, 100 percent of the balance of any royalties or income earned and retained by Contractor during any fiscal year up to an amount equal to 5 percent of the annual budget of the facility, will be used by Contractor for scientific research, development, and education consistent with the research and development mission and objectives of the facility, including activities that increase the licensing potential of other inventions of the facility; provided that if said balance exceeds 5 percent of the annual budget of the facility, that 75 percent of such excess will be paid to State and the remaining 25 percent will be used for the same purposes as described above in this clause (D); and (ii)) that, to the extent it provides the most effective technology transfer, the licensing of subject inventions will be administered by Contractor employees on location at the facility.

(8) The requirements of 35 USCS Sections 203 and 204 apply to this research.

(9) If Contractor does not elect to retain title to a subject invention in cases subject to this section, State may consider and after consultation with Contractor grant requests for retention of rights by the inventor subject to the provisions of 35 USCS Section 202 and regulations promulgated hereunder.