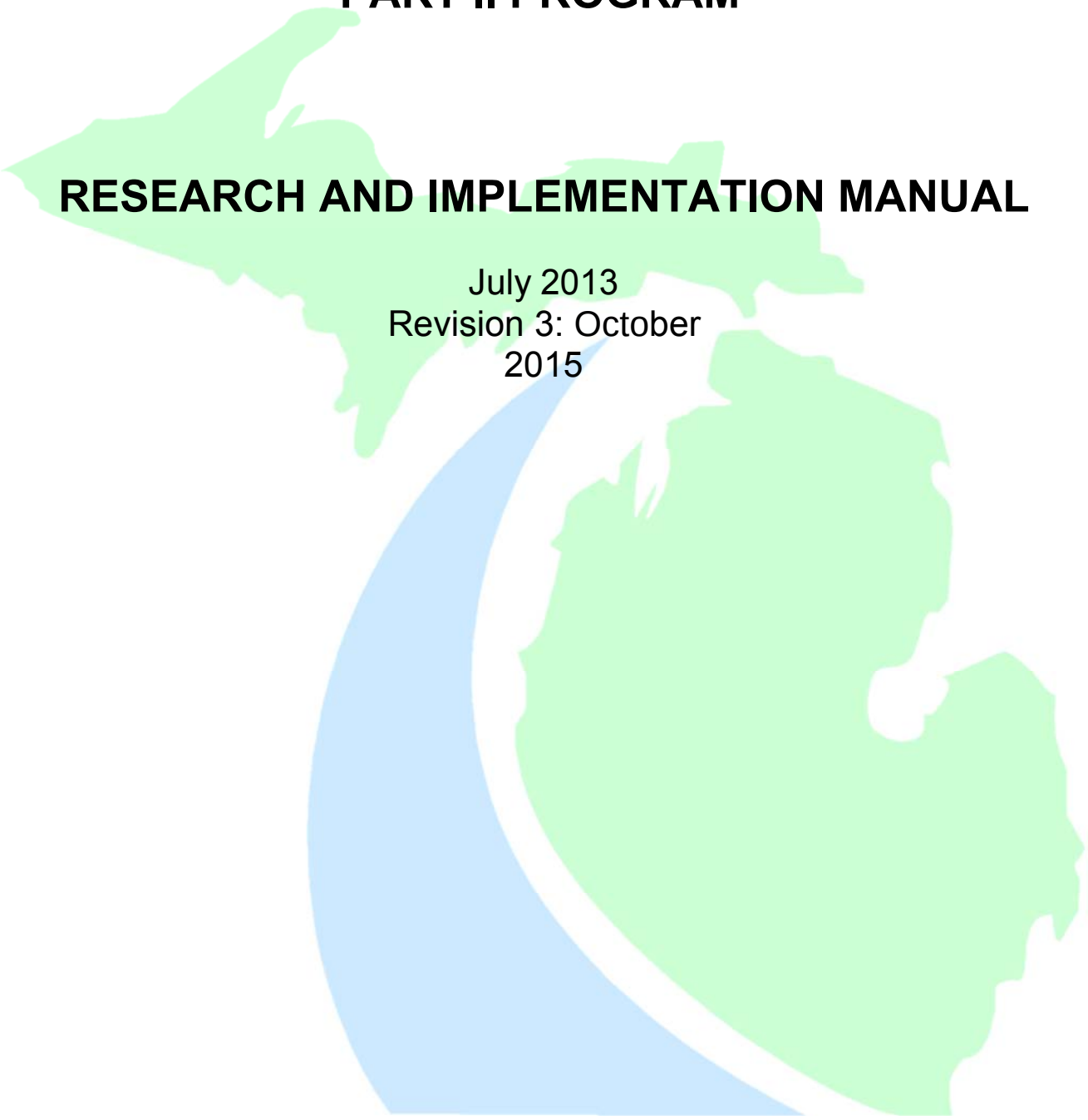
MICHIGAN DEPARTMENT OF TRANSPORTATION
STATE PLANNING AND RESEARCH
PART II PROGRAM

RESEARCH AND IMPLEMENTATION MANUAL

July 2013
Revision 3: October 2015



BUREAU OF FIELD SERVICES
RESEARCH ADMINISTRATION

TABLE OF CONTENTS

Chapter 3: Project Administration

Appendices

Research and Implementation Manual Updates

October 2015 – Revision #3

- Executive Summary; MDOT Three Year Planning and Program Approval Timeline- updated to reflect the example dates used in Chapter 2.
- Chapter 2 – updated to show the program development dates.
- Section 3.1.2 Project Development; Problem Statement Development- replaced 'literature search' with 'annotated bibliography'.
- Section 3.1.2 Project Development; Objectives and Tasks- specified that problem statement objectives should be 25 words or less.
- Section 3.1.2 Project Development; Project Accounting- replaced 'Planning' with 'Transportation Planning Division'.
- Section 3.1.2 Project Development; Research Requirement- specified vendor submittal requirements for Form 5100J.
- Section 3.1.2 Project Development; Commission Audit Requirements- replaced 'require review and approval from' with 'are to be sent to'.
- Section 3.1.2 Project Development; Project Revisions- replaced 'initials' with 'signature'.
- Section 3.1.2 Project Development; Project Revisions- specified that Contract Services Division is involved with project revisions pertaining to subcontract work assignments.
- Section 3.1.2 Project Development; Review and Acceptance Procedures- updated the number of hardbound copies of the final report from four (4) to two (2).
- Section 3.1.2 Project Development; Research Spotlight- updated section to include Appendix, 2.14, the Spotlight Template.
- Section 3.1.2 Project Development- removed Newsletter sub-section.
- Appendix 1.2- Research Program Committee Structure chart- updated to reflect current committee members.
- Appendix 1.3- Research Administration Organization Chart- updated to reflect current Project and Program Analysts.
- Appendix 2.1 – updated to match the example cycle dates used in Chapter #2.
- Appendix 2.3 – updated to match the example cycle dates used in Chapter #2.
- Appendix 2.4- 5308 Problem Statement Form-updated to reflect the revised 5308.
- Appendix 2.7- updated to match the example cycle dates used in Chapter #2.
- Appendix 2.10- updated to match the example cycle dates used in Chapter #2.
- Appendix 2.12 – updated to reflect the current version of Form 5308 Problem Statement with completed examples.
- Appendix 2.14 – created to reflect the required Spotlight template for research projects
- Appendix 3.10 – updated to reflect the new subcontract checklist
- Appendix 3.14 – updated to reflect the current version of Form 5306.
- Appendix 3.18 – created to clarify equipment purchases made with research funds.

ABBREVIATIONS AND ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
CFR	U.S. Code of Federal Regulations
C-TRAK	MDOT's consultant and services contracts tracking system
DOT	department of transportation
EAP	Estimated Accounts Payable
FAM	focus area manager. The staff member who oversees research program development in a focus area, and advises the Research Advisory Committee about research related to that focus area.
FHWA	Federal Highway Administration
FY	fiscal year
IAPP	Implementation Action Plan Proposal. A technical report (10 pages or less) written by the principal investigator that explains how MDOT can best use the results of a study. The report is submitted for approval at the end of a project and can be included as a section of the final report.
MDOT	Michigan Department of Transportation
MFOS	Michigan Financial Obligation System
NCHRP	National Cooperative Highway Research Program
OCA	Office of Commission Audit
PFPM	pooled fund program manager
PI	principal investigator. The lead researcher of a project.
PM	project manager. The MDOT staff member who manages the technical aspects of each research project.
RAC	Research Advisory Committee. An advisory-level committee for SPR, Part II, Program research management at MDOT. The RAC, composed of focus area managers and chaired by a bureau head, advises the Research Executive Committee.
RAP	Research Advisory Panel. A project management-level committee of MDOT staff that oversees a research project.
RD&T	research, development and technology transfer.
REC	Research Executive Committee. The senior Executive Committee that sets strategic priorities for the research program and approves the annual program prior to submittal to FHWA.

RFP	Request for Proposals
RiP	Research in Progress. A database with more than 8,400 current or recently completed transportation research projects. Most of the RiP records are projects funded by federal and state departments of transportation.
RITA	Research and Innovative Technology Administration
RM	research manager. The Research Administration staff member who performs the administrative duties and tasks of each research project.
SEP-14	Special Experimental Project No. 14
SPR	State Planning and Research Program
SPR, Part II	The second part of the State Planning and Research Program that concerns research rather than planning. It is also known as SPR II.
State Ad Board	State Administrative Board
TAC	Technical Advisory Committee. The pooled fund advisory committee.
TPF	Transportation Pooled Fund Program
TRB	Transportation Research Board
TRID	Transportation Research Information Database. The world's largest and most comprehensive bibliographic resource on transportation research information. It is produced and maintained by the Transportation Research Board.
UTC	University Transportation Center

EXECUTIVE SUMMARY

The Research and Implementation Manual describes the administrative processes used by Research Administration to develop and implement the Michigan Department of Transportation (MDOT) research program. Contents of this manual include a discussion of program development, project administration, implementation and federal funding requirements, along with a list of abbreviations and acronyms used in the manual and appendices that supplement each chapter.

MDOT develops and manages its research program using a three-tiered structure: Research Executive Committee (REC), Research Advisory Committee (RAC) and Research Advisory Panel (RAP). The REC sets the strategic direction for research while the RACs develop program recommendations to the REC. Subsequent to program approval, RAPs are assigned to each project to assist the project manager (PM). Research Administration assigns a research manager (RM) to each project based on the project's focus area.

The Engineer of Research oversees the Research Administration Section. The MDOT Research Administration Web site, www.michigan.gov/mdotresearch, provides a wealth of information, including research publications, links to Research Administration e-mail distribution lists and national research Web sites, and program development/project management information. Library services plays a key role in supporting the research program by maintaining a repository of research reports and providing access to research document databases.

Most of the MDOT research program is supported with federal funding from the State Planning and Research (SPR) Program. According to program requirements, at least 25 percent of the annual federal SPR apportionment is dedicated to research (Part II). A portion of SPR, Part II, funds also supports the national Transportation Pooled Fund (TPF) Program. This program provides a means for state departments of transportation (DOTs), Federal Highway Administration (FHWA) program offices and private organizations to combine their resources and achieve common research goals. The FHWA Michigan Division Office works closely with Research Administration staff to ensure that all federal funding requirements are met.

Program Development

The research program is composed of individual projects and pooled fund studies. A slate of individual projects is developed every other year using a rolling three-year planning process. Supplemental individual projects can be added to the program at any time if the need arises. Pooled fund studies are initiated on an as-needed basis.

Every summer Research Administration prepares a summary of the next year's projects for REC and FHWA approval. This annual program approval process requires both MDOT and FHWA approval. If program modifications are needed during the year, amendments are submitted to FHWA for review and approval.

The three-year planning and program approval process is executed through many steps, with the first step beginning approximately one year before the first planned project is posted in a Request for Proposals (RFP). The planning and program approval process has three phases:

- Phase 1: Research idea development.
- Phase 2: Problem statement development.
- Phase 3: Program approval and RFP.

A timeline illustrating the three-phase process is shown in the figure on page 5. This timeline represents the Fiscal Year 2014 (FY 2014) planning process for proposed FY 2015, FY 2016 and FY 2017 projects.

In addition to these individual projects, external stakeholders or MDOT staff can submit projects to Research Administration that supplement the formal three-year planning at any time. Approved pooled fund projects, where MDOT participates either in a lead agency role or as a participant, also are included in the program.

Project Administration

Project administration tasks and level of effort vary depending on the type of research project being administered: individual research projects that are either outsourced or conducted in-house, or pooled fund studies where Michigan is either the lead state or a participating state.

Michigan individual research projects are typically contracted to universities or consultants with MDOT managing the project. A RAP is formed during the project planning phase that includes a focus area manager (FAM), PM, RM, principal investigator (PI) and additional technical experts. Project administration of an individual project begins with the development of a problem statement and concludes at project closeout. Project administration typically includes the following:

- Request for job number and obligating funds.
- Initiation and securing a contract or authorization.
- Kickoff meeting.

- Regular progress meetings.
- Quarterly and annual reporting.
- Invoice review and payment.
- Changes to the contract or authorization.
- Review of intermediate and final project deliverables.
- Project closeout.

MDOT-led pooled fund studies require that MDOT assume the project administration role, which includes drafting a problem statement, identifying the research need, soliciting interest from other states, contracting to do the research and managing the project. If MDOT is a participating state in a pooled fund study, MDOT technical experts serve on a Technical Advisory Committee (TAC) but are not responsible for project administration.

Implementation

Implementation of new innovations, best practices and research findings occur regularly throughout MDOT. The assessment and utilization of new technologies, methods and procedures enable the Department to "provide the highest quality integrated transportation services for economic benefit and improved quality of life." New innovations are the result of many different efforts both in Michigan and nationally. Programs such as the Cooperative Research Programs (highway, transit, rail, air), Transportation Research Board and federally sponsored transportation research all contribute to developing and identifying new innovations in transportation. In Michigan, the MDOT SPR, Part II research program and state funded Centers of Excellence also contribute to the development and identification of new technologies.

Historically, MDOT has implemented new innovations including research findings through the annual construction program. Formal funding for the construction of new innovations has been funded from standard project budgets and not separately. In addition, no implementation funding has been allocated to monitor the construction and long-term performance of new technologies that were incorporated into "standard" construction projects. This has resulted in inadequate monitoring and evaluation of past innovations after initial pilot construction.

Chapter 4 further addresses the steps required to develop an implementation project concept, conduct demonstration projects and deploy new innovations, which may result in updated MDOT standards, procedures and/or guidelines.

Federal Requirements

The federal government supports surface transportation research in many ways. The SPR Program provides federal funding to support state DOT research programs. FHWA encourages state DOTs to develop, establish and implement a research, development and technology transfer (RD&T) program to create a safer, more cost-effective transportation system. State DOTs also are encouraged to share research results through peer exchanges and national research databases to increase the benefits of transportation research at the local, regional and national levels.

The FHWA is responsible for reviewing the annual MDOT research program for funding eligibility. MDOT is granted the authority to manage a research program meeting federal reporting and administrative requirements.

			FY 2011			Fiscal Year 2012												Fiscal Year 2013												FY 2014			
			4th Qtr			1st Qtr '12			2nd Qtr			3rd Qtr			4th Qtr			1st Qtr '13			2nd Qtr			3rd Qtr			4th Qtr			1st Qtr '14		2nd
Phase	Activity	Target Date	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan
1	Research Idea Development	Aug. 2011 to May 2012																														
2	Problem Statement Development	May 2012 to July 2012																														
	FY 13-15 three-year planning complete	July 2012													☆																	
3	Approval of FY 2013 program	August 2012																														
	Post FY 2013 program RFP	October 2012																RFP														
	Post FY 2014 program RFP	January 2013																			RFP											
	Approval of FY 2014 program	August 2013																														
	Post FY 2015 program RFP	January 2014																														RFP
1	FY 16-18 three-year planning begins	August 2013																														

Supplemental projects can be amended into the program at any time. Allow six months for supplemental project approval, RFP and contracting. See Section 2.1.4 for details.

MDOT Three-Year Planning and Program Approval Timeline

CHAPTER 1
INTRODUCTION

The Michigan Department of Transportation (MDOT) conducts research to help fulfill its mission of "providing the highest quality integrated transportation services for economic benefit and improved quality of life." The goal of the research program is to initiate and implement research that supports the MDOT mission.

This manual describes the administrative processes used to develop and implement the MDOT research program. Organization of the manual is based on three key processes that drive the research program: program development, project administration and implementation/technology transfer. Because the majority of the research program receives funding from both federal and state sources, a separate chapter in the manual addresses federal funding requirements.

Each chapter in the manual includes appendices that further explain the material covered in the chapter.

1.1 Organizational Support

1.1.1 MDOT Research Program Committee Structure

In 2010 MDOT performed a complete assessment of the research program, followed by a second assessment in late 2011. One key recommendation resulting from these reviews was to further involve internal and external stakeholders in research program development. Internal stakeholders include staff from all levels and work areas within MDOT; external stakeholders include universities, consultants, FHWA and local government.

The MDOT research program supports all functional areas of the department, including highway engineering, planning, finance and multi-modal. The department's organization, which is made up of bureaus, regions, divisions and offices, does not always effectively support research program development. The diversity of the program requires an organizational structure that is cross-functional and engages all levels of the organization in addition to external stakeholders.

In response to this need, MDOT developed a Research Program Committee Structure to ensure that all MDOT technical experts, technical managers, region staff and executives are involved in research program development. External stakeholders (primarily universities and consultants) also are involved in the early stages of the program development process when research ideas are being solicited and developed.

A culmination of the research idea phase occurs at the Research Summit, where external and internal stakeholders participate in working sessions to discuss and refine research ideas before possible inclusion in the proposed research program. Various research committees then use the information from the Summit to finalize new projects for the research program.

MDOT develops and manages the research program using a three-tiered structure: Research Executive Committee (REC), Research Advisory Committee (RAC) and Research Advisory Panel (RAP). This tiered approach is illustrated in Figure 1.1.

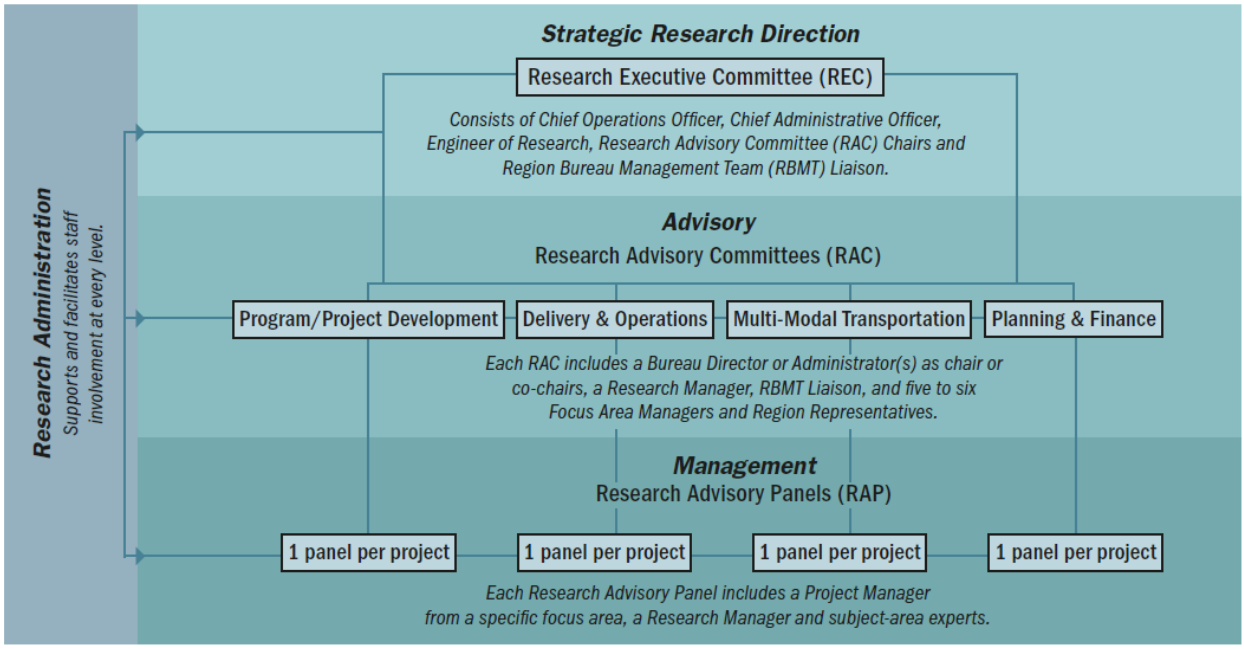


Figure 1.1 Overview of the MDOT Research Program Committee Structure

The REC sets the strategic direction for research while the RACs develop and coordinate program recommendations to the REC. After program approval, RAPs are assigned to each project to assist the project manager (PM).

The REC is co-chaired by the Chief Operations Officer and the Chief Administrative Officer. Additional members include the Engineer of Research, a Region Engineer and all of the RAC chairs.

The RAC includes several specific focus areas, each led by a focus area manager (FAM). FAMs are critical to an effective research program. Their responsibilities include identifying the PM for each research project and overseeing research program development for their respective focus area. FAMs also serve on a RAC and advise the RAC chair about research related to their

respective focus area. Region representatives assist FAMs in maintaining a broad perspective relative to engineering development, delivery and operations. The RAC chairs all serve on the REC and are responsible for communicating the needs of their focus area at the REC meetings.

Additional information about the Research Program Committee Structure can be found in Appendix 1.1 and Appendix 1.2.

1.1.2 Research Administration

The Research Administration section has five core areas: executive, project administration, program management, statistical services and library services. The Engineer of Research oversees the section, which includes research managers (RMs) and engineers, administrative support, analysts, program specialists, statisticians and a librarian. Appendix 1.3 provides further information about Research Administration.

Section responsibilities include initiating, developing, managing and coordinating the MDOT research program; facilitating implementation; encouraging technology transfer; and identifying best practices. Research Administration staff also spends considerable time disseminating information related to research program activities, primarily through publications such as Research Updates and Research Spotlights. The MDOT research Web site, www.michigan.gov/mdotresearch, provides a wealth of information, including research publications, links to Research Administration e-mail distribution lists and national research Web sites, and program development/project management information.

Library services plays a key role in supporting research at the state and national levels. The library provides literature searches on proposed research problems, maintains up-to-date research project information in various national databases and accesses resources upon request for various customers throughout MDOT.

More information about Research Administration is available in Appendix 1.4 and Appendix 1.5.

1.1.3 Federal Highway Administration

The majority of the MDOT research program is supported with federal funding from the State Planning and Research (SPR) Program. The Federal Highway Administration (FHWA) Michigan Division Office has identified a research program coordinator who works closely with Research Administration staff to ensure that all federal funding requirements are met.

FHWA reviews and approves the annual MDOT research program submittal, and assists MDOT with program development funding and scope eligibility inquiries. In addition, FHWA reviews

and approves any modifications to the program that arise after initial program approval. FHWA generally limits its involvement to the overall program level although periodically it will become involved at the project level.

1.1.4 University and Consultant Stakeholders

The MDOT research program relies on external stakeholders for program success. Research activities are almost always outsourced to universities and consultants while MDOT staff performs project oversight responsibilities. Once a research project has been approved, MDOT selects a PM who then forms a RAP. Research Administration assigns an RM to each project based on the project's focus area (as shown in Appendix 1.2).

When soliciting principal investigators (PIs) for a new research project, MDOT typically submits a Request for Proposals (RFP) to Michigan universities. If none of these universities submits an acceptable proposal that addresses the specific research problem, MDOT submits a second RFP nationally to both consultants and universities. After a consultant or university research team is selected, the PI and supporting research team conduct the research at the direction of the PM, meeting all contract requirements unless contract modifications are approved.

1.2 Program Overview

1.2.1 SPR, Part II, Program

The SPR Program provides funding for surface transportation planning and research activities. SPR Program requirements stipulate that at least 25 percent of the annual federal SPR apportionment be dedicated to research (Part II); the remaining 75 percent (Part I) is dedicated to planning activities that are not addressed in this manual.

Federal requirements for the SPR, Part II, Program are outlined in the U.S. Code of Federal Regulations (CFR), Title 23 (Highways), Part 420 ("Planning and Research Program Administration"). Chapter 5 of this manual provides greater detail on these requirements.

SPR, Part II, funding rules require that individual research projects are funded with a mix of 80 percent federal and 20 percent state dollars. A portion of SPR, Part II, funds also support the national Transportation Pooled Fund (TPF) Program. Pooled fund studies can use 100 percent federal funds. More information about the TPF program is available in Chapter 2 of this manual.

MDOT also has entered into a stewardship agreement with FHWA that defines the roles and responsibilities of each agency when delivering the Federal-aid Highway Program, which provides funding for the construction, maintenance and operations of state highway systems. The SPR, Part II, Program, which is part of the larger Federal-aid Highway Program, has specific goals that are outlined in the stewardship and oversight agreement, which is available at www.michigan.gov/documents/mdot/MDOT_StewardshipAgreement12-06-2011_373414_7.pdf.

One additional requirement that occurs periodically is an FHWA research program evaluation. The FHWA Michigan Division Office completed the Fiscal Year 2013 (FY 2013) Research, Development, and Technology Transfer Program Evaluation in partnership with Research Administration. The evaluation outlines some additional goals for the research program beyond those covered in the stewardship and oversight agreement. More information about this evaluation is available in Appendix 1.6.

1.2.2 Centers of Excellence

MDOT funds multiple Research Centers of Excellence located throughout the state. The centers provide expertise related to structures, pavements, materials and geotechnical matters. Each center has a director and an MDOT PM.

Center budgets are funded annually with 100 percent state dollars and are managed similar to an individual research project. An MDOT PM determines specific work tasks for the center to perform, and the center reports on its accomplishments throughout the year. More information about Centers of Excellence is available in Appendix 1.7.

1.2.3 University Transportation Centers

Occasionally, MDOT has chosen to provide administrative and financial support to a Michigan university that is either a University Transportation Center (UTC) or a supporting university (consortium member) to a UTC. UTCs are located around the country and are focused on specific transportation topics.

When partnering with a UTC, MDOT provides technical advice, offers access to MDOT federal aid, assists with setting project focus and supplies the administrative support necessary to meet federal funding requirements. Two agencies within the U.S. Department of Transportation—FHWA and the Research and Innovative Technology Administration (RITA)—provide federal funding to UTCs.

More information about UTCs is available at http://utc.dot.gov/. In addition, the *University Transportation Center Administration Manual*, which outlines the administrative processes of the UTC program, is available at the MDOT research Web site, www.michigan.gov/mdotresearch.

CHAPTER 2
PROGRAM DEVELOPMENT

Program development involves both internal and external stakeholders. The process ensures that strategic priorities are directly linked to project selection and ultimately to the implementation of research results. Executives identify priorities; managers and technical experts lead program development efforts; and external stakeholders assist in developing initial research ideas. Research Administration leads the entire process to ensure that it is timely and effective, and that it conforms to all state and federal requirements.

This chapter explains the steps required to develop the annual research program, which is composed of individual projects and Transportation Pooled Fund (TPF) studies. Individual projects typically are developed using a rolling three-year planning process; however, supplemental projects can be added to the program at any time if the need arises. Pooled fund studies are initiated on an as-needed basis.

2.1 Project Planning and Program Approval

2.1.1 Three-Year Planning

Every two years, Research Administration leads a planning process throughout the department to develop and approve the upcoming three-year candidate program. For example, Research Administration began planning for FY 2011, FY 2012 and FY 2013 in the fall of FY 2010. The next three-year planning process began in the fall of FY 2012 and planned for FY 2013, FY 2014 and FY 2015. Appendix 2.1 provides additional details about the activities involved in the process and also illustrates the overlap of two successive three-year planning processes.

2.1.2 Annual Program

As mentioned earlier, the annual research program includes projects resulting from three separate processes:

- Individual projects selected from the three-year planning process.
- Supplemental projects (see Section 2.1.4).
- Approved TPF projects (see Section 2.2).

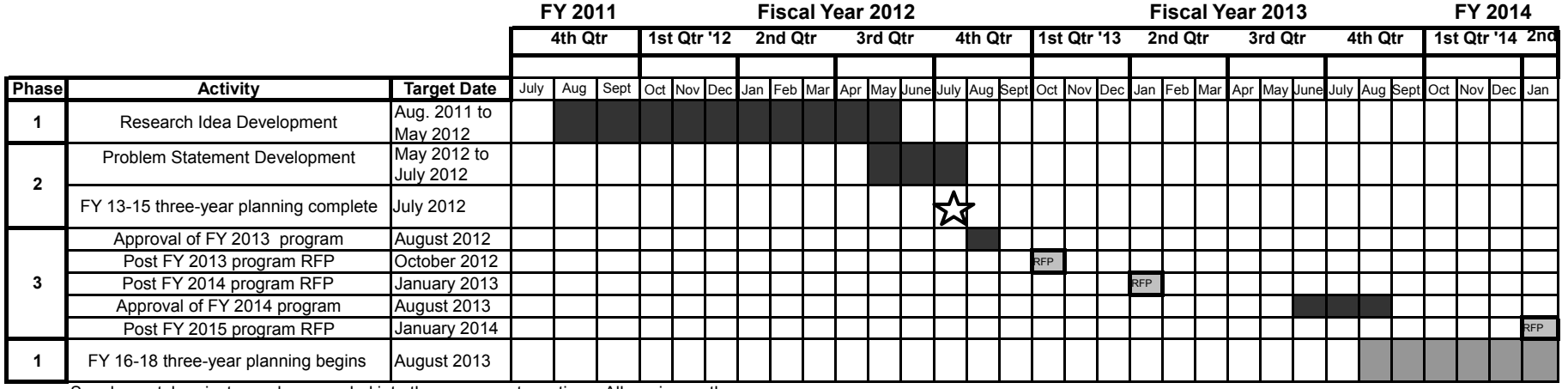
Every summer, Research Administration prepares a summary of the next year's projects for REC and FHWA approval. This annual program approval process requires both MDOT and FHWA approval. Periodically program amendments are submitted to FHWA for review and approval.

2.1.3 Planning and Approval Process

The three-year planning and program approval process is executed in many steps, beginning approximately one year before the first planned project is posted in an RFP. The process is divided into three phases:

- Phase 1: Research idea development.
- Phase 2: Problem statement development.
- Phase 3: Program approval and RFP.

The three-year planning process formally ends after Phase 2. Phase 3 is part of the annual program approval process. The timeline in Figure 2.1 on the next page illustrates the FY 2012 planning process for FY 2013, FY 2014 and FY 2015. Future programs will follow a similar timeline.



Supplemental projects can be amended into the program at any time. Allow six months for supplemental project approval, RFP and contracting. See Section 2.1.4 for details.

Figure 2.1 MDOT Three-Year Planning and Program Approval Timeline

Phase 1: Research Idea Development

The first phase in the three-year planning process is research idea development. During this phase, MDOT determines its strategic priorities; then research ideas that address those priorities are submitted, selected and amended as needed. Research ideas are submitted on Form 5315, Research Idea Form (Appendix 2.2). The form allows stakeholders to provide a preliminary description of a problem and the research needed to address it.

MDOT follows a timeline for research idea development that outlines the steps of the process, including major tasks, due dates and the stakeholder responsible for each task. A sample timeline is given in Appendix 2.3 and summarized below with target dates and example dates for a previous three year planning process (FY 2013, FY 2014 and FY 2015):

Step 1.1 REC meets to determine strategic priorities for research.

Target date: 13-14 months before year one of the three year plan
Example date: August-September 2011

Step 1.2 Engineer of Research calls for research ideas from all stakeholders.

Target date: 12 months before year one of the three year plan
Example date: October 2011

Step 1.3 Stakeholders develop research ideas and submit them on Form 5315, Research Idea Form (Appendix 2.2).

Target date: 10-11 months before year one of the three year plan
Example date: November-December 2011

Step 1.4 Engineer of Research notifies stakeholders of a Research Summit to discuss MDOT's research needs, and to refine and develop research idea content.

Target date: 9 months before year one of the three year plan
Example date: January 2012

- Stakeholders include Research Administration staff, RAC members, FHWA program specialists, project managers, Region representatives, university representatives, consultants and other agency representatives.

Step 1.5 FAMs get input from technical staff and Region representatives to rank research ideas and determine the PM for each idea. The PM's and FAM's roles are defined in Section 3.1.1.

Target date: 9 months before year one of the three year plan
Example date: January 2012

Step 1.6 RAC chairs review the FAMs' rankings and PM assignments. The RAC meets to determine the final ranking to submit to the REC.

Target date: 8 months before year one of the three year plan
Example date: February 2012 (meeting)

Step 1.7 The REC meets, selects research ideas for the next three years (FY 2015 through FY 2017) and confirms selected PMs.

Target date: 7 months before year one of the three year plan
Example date: Early March 2012 (meeting)

Step 1.8 The Engineer of Research submits research ideas to FHWA for SPR, Part II funding eligibility review.

Target date: 7 months before year one of the three year plan
Example date: Late March 2012

Step 1.9 PMs and FAMs receive Summit facilitator and problem statement development training in preparation for Research Summit discussions.

Target date: 6 months before year one of the three year plan
Example date: April 2012

Step 1.10 Stakeholders discuss research needs during the Research Summit.

Target date: 5 months before year one of the three year plan
Example date: Early May 2012 (meeting)

- Research Administration convenes the Research Summit.
- Stakeholders review research ideas and provide input on how to improve them.

Phase 2: Problem Statement Development

During the second phase of planning, PMs convert research ideas into problem statements, and Research Administration compiles these statements into the three-year planning documents for RAC and REC approval. A problem statement clearly defines the objectives, tasks, schedule and budget for a research project. Problem statements are submitted on Form 5308 (Appendix 2.4). Information and resources for developing a problem statement are available in Chapter 3, Appendix 2.5, Appendix 2.6, Appendix 2.11 and Appendix 2.12.

MDOT follows a timeline for problem statement development that outlines the steps of the process, including major tasks, due dates and the stakeholder responsible for each task. A sample timeline is given in Appendix 2.7 and outlined below with target dates and example dates for a previous three year planning process (FY 2013, FY 2014 and FY2015):

Step 2.1 Research Administration provides direction and interim deadlines for the following tasks:

- The librarian conducts literature searches.
- PMs develop draft problem statements.
- PMs recommend the RAP members by submitting Form 5314, Research Advisory Panel Nomination Form (Appendix 2.8), to the appropriate FAM.
- FAMs confirm PM and RAP members after verifying availability.
- FAM, RAP members, RM and statistician review problem statements.

Target date: 5 months before year one of the three year plan
Example date: Late May 2012

Step 2.2 PMs submit problem statements to RAC chairs.

Target date: 4 months before year one of the three year plan
Example date: June 2012

- PMs complete and submit Form 5308, Problem Statement (Appendix 2.4), for 80 percent federally funded projects.
- PMs complete and submit Form 5302, Participating State Pooled Fund Summary & Funding Request (Appendix 2.9), or Form 5308, Problem Statement (Appendix 2.4), for pooled fund studies and other 100 percent federally funded projects that use multiple state funding to address national or regional needs.

Step 2.3 The RACs meet to review problem statements presented by the PMs. RAC chairs provide comments about improving the problem statements. RAC chairs also recommend whether a project should be posted as a nationwide or Michigan-university-only RFP.

Target date: 4 months before year one of the three year plan
Example date: Late June 2012 (meeting)

Step 2.4 The REC meets to approve the upcoming FY research program and projects planned for the next three years (For example, the REC met to approve the FY 2013 research program and the projects planned for FY 2013, FY 2014 and FY2015). The REC also determines the solicitation method for each research project.

Target date: 3 months before year one of the three year plan
Example date: July 2012 (meeting)

Phase 3: Program Approval and Requests for Proposals

Research Administration obtains annual program approval and issues RFPs during the final phase of the planning and approval process. Each summer, Research Administration submits the upcoming fiscal year program for approval and provides a list of projects for which proposals will be requested. A detailed timeline for this phase is shown in Appendix 2.10 and outlined below with target dates and example dates from a previous three year planning process (FY2013, FY 2014 and FY 2015):

Step 3.1 Engineer of Research submits the first fiscal year's program and the second fiscal year's projects for RFP to FHWA.

Target date: 2 months before year one of the three year plan
Example: In early August 2012, the FY2013 program and FY2014 projects for RFP were submitted to FHWA.

Step 3.2 FHWA approves the first fiscal year's program for funding. MDOT Finance Division initiates a project agreement with FHWA that represents the submitted program.

Target date: 2 months before year one of the three year plan
Example: In late August 2012, the FY2013 program was approved for funding.

Step 3.3 Research Administration posts projects starting in the first fiscal year for a best-value-based selection process using an RFP. The RFP process is described in detail in Section 3.1.2.

Target date: The October of the first year of the three year plan
Example: In October 2012, the FY2013 projects were posted for RFP.

Step 3.4 Research Administration posts projects starting in the upcoming fiscal year for a best-value-based selection process using an RFP.

Target date: The January of the first year of the three year plan
Example: In January 2013 for projects starting in FY 2014

Step 3.5 Engineer of Research compiles the second fiscal year's program for funding and the third fiscal year's projects for RFP.

Target date: The June of the first year of the three year plan
Example: In June 2013, the FY2014 program and FY2015 projects for RFP were compiled.

Step 3.6 REC meets to review and approve the second fiscal year's program for funding and the third fiscal year's projects for RFP.

Target date: The July of the first year of the three year plan
Example: July 2013 (meeting)

Step 3.7 Engineer of Research submits the second fiscal year's program for funding and the third fiscal year's projects for RFP to FHWA.

Target date: The August of the first year of the three year plan
Example date: In early August 2013, the FY2014 program and FY2015 projects for RFP were submitted to FHWA.

Step 3.8 FHWA approves the second fiscal year's program for funding. MDOT Finance Division initiates a project agreement with FHWA that represents the submitted program.

Target date: The August of the first year of the three year plan
Example date: In late August 2013, the FY2014 program was approved for funding.

Step 3.9 Research Administration posts projects starting in the third fiscal year for a best-value-based selection process using an RFP. Example: FY2015 projects are posted for RFP.

Target date: The January of the second year of the three year plan
Example date: In January 2014, the FY2015 projects were posted for RFP.

2.1.4 Supplemental Projects

MDOT executives, mid-level managers and technical staff may identify a research need at a time that does not coincide with the program development steps of the three-year planning process. In addition, external stakeholders can identify a supplemental research need that MDOT supports. Both situations require a modified process to ensure that the specific research need is still addressed.

MDOT-Identified Research Need

Step 1 The MDOT stakeholder proposing the research is responsible for developing a problem statement using Form 5308 (Appendix 2.4). The RM can help facilitate drafting of the problem statement. Guidance for developing a problem statement is also available in Appendix 2.5 and Appendix 2.6. Examples of completed problem statements are provided in Appendix 2.12. The PM or MDOT research proposer asks the MDOT librarian to perform a preliminary literature search. An example of a completed annotated bibliography is provided in Appendix 2.11.

Step 2 The RM, research proposer and FAM consult and select a PM.

Step 3 The PM recommends a RAP using Form 5314 (Appendix 2.8) to oversee the research.

Step 4 The PM, with assistance from the RM, submits Forms 5308 and 5314 to the FAM who will obtain approval from the RAC chair and REC chair. The Engineer of Research will supply final approval after RAC chair and REC chair approval. The RM should be copied on all correspondence in this step for project recordkeeping. Section 3.1.1 provides additional details about the roles and responsibilities of the RM, FAM, PM and RAP members.

Step 5 After receiving all MDOT approvals, the Engineer of Research submits the project to FHWA for approval as an amendment to the program. MDOT Finance Division amends the existing project agreement with FHWA.

Step 6 Once FHWA approval is granted, Research Administration, working with MDOT Contract Services Division, secures a contract vendor. It may take up to six months from the time the problem statement is developed to the time the project is contracted and work begins.

External Stakeholder-Identified Research Need

Step 1 External stakeholders may propose a research idea to Research Administration at any time. Research ideas must be submitted on Form 5315 (available in Appendix 2.2 or at www.michigan.gov/mdotresearch) and sent to mdot-research@michigan.gov.

Step 2 Research Administration forwards the idea to the appropriate FAM, who determines whether MDOT should support the idea. If support for the idea is recommended, the FAM requests approval from the RAC chair and REC chair. This decision will determine whether the submitted idea will be further developed into a problem statement.

Step 3 After idea approval, the FAM names a PM, who may consult with the external proposer to develop a problem statement. The next steps are outlined above in "MDOT-Identified Research Need," beginning with Step 1.

2.2 Pooled Fund Program Approval

The national TPF Program provides a means for state departments of transportation (DOTs), FHWA program offices and private organizations to combine their resources and achieve common research goals.

Pooled fund projects are initiated by a state (lead state) or FHWA. Local and regional transportation agencies, private industry, foundations as well as colleges and universities may also participate in these projects. Each participating member of the pooled fund project is required to provide both financial and staff support.

Each state is responsible for posting its specific funding commitment and adding state-specific contact information to the TPF Web site. The lead state is responsible for posting both its specific funding commitment and staff information along with that of all non-state DOT and non-FHWA members. FHWA approval is required prior to solicitation for a pooled fund project.

Because the lead state manages the project, it requires a larger staff commitment than does a participating state. A Technical Advisory Committee (TAC) oversees each pooled fund study. The committee includes a technical advisor from each participating agency and is chaired by the lead state representative. Additional information regarding project administration can be found in Chapter 3.

Participating states like MDOT are required to have an individual project agreement with FHWA for each pooled fund study. This is accomplished by adding the specific pooled fund to the annual SPR, Part II program. In addition, MDOT Finance Division will initiate a project agreement with FHWA.

Each year MDOT participates in 15 to 25 pooled fund projects, either in a lead agency role or as a participant. MDOT also contributes annually, using pooled funds, to several national efforts, including the Transportation Research Board (TRB), the National Cooperative Highway Research Program (NCHRP) and the American Association of State Highway and Transportation Officials (AASHTO) technical service programs.

The following sections outline the steps necessary for MDOT to program a pooled fund project, either as a lead state or as a participating state.

2.2.1 MDOT Role: Lead State

Step 1 The MDOT staff member who proposes a pooled fund research project develops a problem statement using Form 5308 (Appendix 2.4). The RM can help facilitate drafting the problem statement. Examples of completed problem statements are provided in Appendix 2.12. The MDOT librarian performs a preliminary literature search. An example of a completed annotated bibliography is provided in Appendix 2.11.

Step 2 The RM, research proposer and FAM consult and select a PM.

Step 3 The PM, with assistance from the RM, submits Form 5308 to the FAM who will obtain approval from the RAC chair and REC chair. The Engineer of Research will supply final approval after RAC chair and REC chair approval. The RM should be copied on all correspondence in this step for project recordkeeping. The PM also serves as the chair of the pooled fund project TAC. Section 3.3.1 provides additional details about the roles and responsibilities of the RM, FAM and PM.

Step 4 After receiving all MDOT approvals, Research Administration requests FHWA approval to add the pooled fund project to the annual program and to use 100 percent federal funding for the project. Form 5308, Problem Statement (Appendix 2.4), should be enclosed with the request letter.

Step 5 Once FHWA approval is granted for the program amendment, MDOT creates a solicitation on the TPF Web site seeking pooled fund participants. The solicitation will indicate a minimum budget amount needed to initiate the project.

Step 6 FHWA Michigan Division Office forwards a copy of the request to the FHWA Pooled Fund Program Manager (PFPM). The Division Office also sends a confirmation that FHWA Division has approved amending the program and confirmed the eligibility to use 100 percent federal funding for the project.

Step 7 Upon approval, the PFPM updates the TPF Web site to reflect federal approval. In addition, the PFPM formally notifies the FHWA Division Office who will in turn notify MDOT. An automated message of the approval is sent to the lead agency (MDOT) and all other organizations that are listed as pooled fund participants.

Step 8 MDOT, as the lead state, posts the acceptance memo to the TPF Web site and requests all participants to transfer their committed funds to MDOT. In addition, the FHWA Division Office sends a copy of the MDOT acceptance memo to the PFPM.

Step 9 Research Administration, working with MDOT Contract Services Division, secures a contract vendor. It may take up to six months from the time the problem statement is

developed to the time the project is contracted and work begins.

2.2.2 MDOT Role: Participating State

Step 1 The MDOT technical advisor proposing to join a pooled fund solicitation completes Form 5302, Participating State Pooled Fund Summary & Funding Request (Appendix 2.9). The RM can help facilitate drafting the form. An example of a completed form is provided in Appendix 2.13.

Step 2 The MDOT technical advisor forwards the completed form to the appropriate FAM, who determines whether MDOT should support the proposed pooled fund. If support for the idea is recommended, the FAM requests approval from the RAC chair and REC chair. The Engineer of Research supplies final approval after RAC chair and REC chair approval. The RM should be copied on all correspondence in this step for project recordkeeping. Section 3.4.1 provides additional details about the roles and responsibilities of the RM, FAM, PM and RAP members.

Step 3 After receiving all MDOT approvals, Research Administration requests FHWA approval to add the pooled fund project to the annual program and to use 100 percent federal funding for the project. Form 5302, Participating State Pooled Fund Summary & Funding Request (Appendix 2.9), should be enclosed with the request letter.

Step 4 Once FHWA approval is granted for the program amendment, MDOT joins the proposed pooled fund project by means of the TPF Web site. The technical advisor will represent MDOT on the pooled fund project TAC.

CHAPTER 3
PROJECT ADMINISTRATION

Project administration varies depending on the type of research project being administered. In general, individual research projects require more attention and time to administer than pooled fund studies. Taking part in pooled fund studies as a lead state requires more attention and time than joining as a participating state.

Project administration begins with project development and concludes after the project has been completed and accepted. This chapter presents the necessary steps for project administration of two types of Michigan individual projects (outsourced and in-house) and two types of pooled fund studies (Michigan as a lead state and Michigan as a participating state).

3.1 Michigan Individual Projects: Outsourced

Individual research projects are usually contracted to universities or consultants with MDOT managing the project. MDOT technical experts assume the PM role and oversee the project with primary assistance from Research Administration, Contract Services Division and Financial Operations Division. Typically, these projects have budgets under $200,000 and last one to two years. These projects are funded with 80 percent federal dollars and 20 percent state dollars.

Project administration includes the following:

- Request for job number and obligating funds.
- Initiation and securing a contract or authorization.
- Kickoff meeting.
- Regular progress meetings.
- Quarterly and annual reporting.
- Invoice review and payment.
- Changes to the contract or authorization.
- Review of intermediate and final project deliverables.
- Project closeout.

3.1.1 Roles and Responsibilities

A RAP is formed during the project planning phase as explained in Chapter 2. RAP members are involved in reviewing proposals and recommending project award to the successful proposer. After project award, the RAP is responsible for assuring proper execution of the research project, from project kickoff to final report acceptance.

RAP membership includes a FAM, PM, RM, PI and additional technical experts. The PM, along with other RAP members, provides initial project direction during the project development phase. In addition, the PM and RAP ensure that the research remains focused on project objectives, tasks and deliverables. The RM assists the PM to ensure that status meetings are timely; reporting requirements are met; and project cost, schedule and scope issues are properly addressed.

Project Manager

The appropriate FAM recommends a PM for the research project. Typically, the PM is the subject area expert for the research topic. The PM takes the leadership role for the RAP, oversees technical aspects of the project and manages the following project tasks:

- Drafts the problem statement as defined in Chapter 2.
- Recommends the RAP, including completion of Form 5314, Research Advisory Panel Nomination Form (Appendix 2.8).
- Reviews proposals and leads the vendor (researcher) selection team.
- Initiates the contract (authorization) and subsequent modifications.
- Schedules RAP meetings (project kickoff and regular progress meetings) in coordination with the RM.
- Manages project costs, schedule and scope.
- Contacts region staff for approval to conduct any fieldwork in State right-of-way. Permits are required as defined in section 3.1.3 Permits.
- Determines if traffic control is necessary for any fieldwork.
- Reviews and coordinates RAP review and acceptance of project deliverables.

- Accepts and/or rejects invoices.
- Submits the annual report.
- Completes the PI evaluation.
- Recommends implementation measures.

Appendix 3.1 provides additional details about the PM's roles and responsibilities.

Research Manager

The RM is assigned based on the research project's focus area (as shown in Appendix 1.2). The RM provides the following administrative assistance for the research project:

- Assists the PM with problem statement development.
- Records the proposal review and vendor selection process, and tracks approval.
- Works with the PM to ensure essential documents are compiled for contract or authorization initiation, and tracks progress.
- Acts as Research Administration's liaison to the RAP when process questions arise.
- Coordinates meeting responsibilities with the PM to ensure tasks are completed.
- Ensures that all meeting discussions are documented (meeting minutes) by the PM or RM.
- Verifies that reports and deliverables are received.
- Reviews invoices.
- Works with Research Administration staff to ensure that evaluations are complete.

Appendix 3.1 provides additional details about the RM's roles and responsibilities.

Principal Investigator

The PI is the lead researcher (university or consultant) who is awarded the research contract. The PI conducts and manages day-to-day research tasks as defined in the project work plan, including:

- Provides regular progress reports.
- Manages budget, scope and schedule. Informs the PM immediately of any trends in project progress that suggest a future need for changes to project cost, scope or schedule.
- Maintains regular contact with the PM and other RAP members through meetings and other means such as e-mail or telephone.
- Submits project deliverables, responds to RAP review comments and makes changes as directed.
- Ensures that invoices and project deliverables are supplied on a timely basis.
- Leads the research team and provides other project researchers with clear direction.
- Maintains research team focus on project tasks, objectives and deliverables.

The PI, at his or her discretion, may also include co-PIs, subconsultants and other research team members in RAP meetings.

Focus Area Manager

The FAM is the MDOT manager designated to coordinate research projects within a focus area as shown in Appendix 1.2. Not only is the FAM involved in selecting appropriate research topics and planning a project as defined in Chapter 2, but he or she also has an important role in vendor selection and project management:

- Recommends the PM for the project to the RAC chair.
- Approves RAP members.
- Participates in the vendor selection process.
- Remains in contact with PMs, RMs and PIs throughout the project by attending RAP meetings.
- Reports the project status to the appropriate RAC chair shown in Appendix 1.2.
- Reviews and comments on draft deliverables.
- Provides guidance on research results implementation.

Other Research Advisory Panel Members

Additional RAP members may be needed to ensure project success. These include:

- MDOT staff responsible for implementing the research project's outcomes.
- MDOT staff who collect and organize data needed for the project.
- MDOT Region representative.
- Additional MDOT subject area experts.
- Local government staff, FHWA representatives and consultants. (Their participation must be at no cost to the project.)

RAP membership should be carefully considered to ensure that the membership does not exceed six to eight members. Groups that are larger than eight members can sometimes slow project progress. For most projects the PM will appoint a subgroup of the RAP (three to four members) to serve as the scoring team during the vendor (researcher) selection phase.

3.1.2 Project Development

Project development begins during the program planning phase as described in Chapter 2 and continues until the project kickoff meeting after project award. It commences with the development of the project problem statement but also includes RAP member selection as described above. The problem statement must be approved by the appropriate RAC and REC before soliciting proposals. The RAP membership must be approved by the appropriate FAM.

Problem Statement Development

The PM develops the problem statement using Form 5308 (Appendix 2.4) and includes the following:

- Problem to be addressed.
- Objectives and tasks.
- Deliverables.
- Timeline.
- DOT involvement.

- Potential investigator.
- Budget.

Additional guidance and resources for writing problem statements are available in Appendix 2.5 and Appendix 2.6. Examples of completed problem statements are provided in Appendix 2.12. An example of an annotated bibliography completed by the MDOT librarian is provided in Appendix 2.11.

Research Need

The problem statement explains the research need by addressing the following questions:

- What is the problem?
- How is this problem affecting MDOT operations?
- What information is needed to address the problem?
- How will having or not having the information impact MDOT?
- What specifically is MDOT trying to accomplish with the research?
- What is expected to result from the research?

The problem statement must address a research problem and not a project planning or process improvement. It should involve analysis and not just data collection. The research outcomes should result in broad application instead of addressing only one localized issue.

Objectives and Tasks

The objectives outline the expected results while the tasks indicate how the research team will get the results. Tasks can be very specific and still allow the researcher flexibility when developing a work plan. Successful research projects include the following general steps in project execution:

- Ensure Objectives are clear, concise, using 25 words or less.
- Document and learn from existing research.
- Gather new information and/or data.
- Analyze the new information and/or data.
- Report on the results of the analysis.

Deliverables

Deliverables must include a final report. Additional deliverables may include:

- PowerPoint presentation.
- Workshop.
- Excel spreadsheet.
- Training materials.
- Software.
- Equipment.
- Policy recommendations.
- Specifications.
- Procedures.

The PM must give careful thought to what deliverables are required for a specific research project. Deliverables are often identified by understanding what is necessary to implement the findings of the research.

Schedule

The PM should consider how long the research will take and when the results are needed. Most projects take at least 18 to 24 months and start in October. It is important to define project milestones to ensure steady progress and timely intermediate project deliverables. The PM must allow three months at the end of the project for final deliverable review.

Data collection needs for the research can potentially affect project progress. The overall project schedule must account for seasonal restrictions that prevent year-round data collection. The PM must consider when data collection will occur based on the weather, resource availability and university staff availability. Generally, universities can collect the most data during the summer months and are scheduled to begin work with graduate students in September, January or June.

MDOT Involvement

When completing a problem statement, the PM must also document MDOT's role in supporting a research project. Activities to consider include whether MDOT staff members will provide data and in what format, if they will facilitate access to a database or coordination with other organizations, and if they will select specific sites to study. MDOT staff may also be needed to provide fieldwork support, including traffic control or other assistance. This must be clearly defined in the problem statement.

Principal Investigator

The required qualifications of both the PI and the supporting research team should be defined in the problem statement. Additional needs beyond a research topic expert may include various specialty skills such as a statistician or communications expert. These should all be listed on the problem statement form for future use in determining the solicitation method.

Budget

The PM must estimate the project funding needs. Project budgets include three components: university/consultant costs, MDOT staff costs and MDOT fieldwork costs.

❖ University/Consultant Costs

The vendor budget for the university or consultant depends on the scope of work. Budget items such as staffing needs, data needs, laboratory testing requirements and field testing needs all affect the vendor budget.

Hours should be itemized per task to help with estimates. One rule of thumb is $100 per hour as a loaded hourly rate for project estimating. Research Administration can help PMs estimate costs based on similar past projects. The method of payment must be defined in the problem statement. Most university contracts are set up with actual costs as the method of payment, while consultant contracts have milestones or loaded hourly rates as the method of payment.

Actual budgets will be set through the best-value proposal evaluation method described in the Request for Proposals section of this chapter. PMs will be responsible for tracking costs and approving payments for the project as described in the Invoicing section of this chapter.

❖ MDOT Staff Costs

MDOT staff time devoted to research projects is chargeable to research projects as of October 1, 2013. This includes project-related activities beginning at project kickoff and concluding at project closeout. These project-related activities include managing projects, collecting data, attending meetings, assisting the research team, participating in field reviews, assembling information for the research team and evaluating the research team.

The MDOT staff budget is determined by estimating the number of hours MDOT staff will work on the research project. RAP members and other MDOT staff performing work related to the project are eligible to charge to the project job number. The RM does not charge time to the project number and can add further clarification to what staff time is chargeable. The MDOT Research Project Budget Worksheet (Appendix 3.17) is completed by the PM to estimate MDOT project management and fieldwork costs.

❖ MDOT Fieldwork Costs

PMs need to budget for necessary fieldwork support, including traffic control, materials, preparation and sampling costs. The PM assesses the need and estimates these costs when completing the problem statement.

Fieldwork funding requests should be made at or before the project start but no later than three months prior to the date required. The PI submits the request to the PM describing the assistance needed. The PM coordinates the work with MDOT field personnel and approves the use of the funds as needed. Permits are required as defined in section 3.1.3 Permits.

Project Accounting

Each project is assigned a Research Administration file number (OR #), a job number and a contract ID. The OR # is used to track project activities during the project development phase. After project award, a contract ID is assigned resulting from vendor contract authorization. A job number is also assigned either at the time of project advertisement or at project award. The job number is used to track project budgets for the vendor, MDOT staff costs and fieldwork costs. Research Administration staff works with the PM, Contract Services Division and Statewide Transportation Planning Division to establish job numbers and contract IDs.

Contracting

The contracting process includes four steps: RFPs, proposal selection, obligation of funds and contracts/authorizations. Contracting is the last process before the kickoff of the research project.

Request for Proposals

RFPs are issued each January and every other October for projects recommended from the three-year planning process (Appendix 2.1 and Appendix 2.10). Additional RFPs can be issued throughout the year for supplemental projects. The RFP is advertised and the guidelines are posted on MDOT's Vendor/Consultant Services Web site, http://www.michigan.gov/mdot/0,1607,7-151-9625_32842---,00.html.

The RFP contains a summary of the approved problem statement, a cost range; guidelines to follow when preparing the proposal and a proposal due date (four to six weeks after the posting). Proposers can receive RFP announcements by subscribing to "SPRII RFP Announcements" through MDOT's GovDelivery e-mail system at www.michigan.gov/mdotresearch.

Before a project RFP is posted, the REC determines the eligibility criteria of prospective bidders for each research project. The REC determines whether each RFP will be open to Michigan universities only or all consultants and universities nationwide.

When bidding is open to Michigan universities only, an RFP is posted to these institutions. If the proposal scoring team selects a vendor, Research Administration requests the Central Selection Review Team to confirm or reject the selection. If no Michigan university is selected, MDOT then opens bidding to all national consultants and universities.

However, if bidding is initially open to all consultants and universities nationwide, MDOT will request competitive proposals from these organizations, including Michigan universities, according to MDOT's procedures. If the proposal scoring team selects a vendor, Research Administration requests the Central Selection Review Team to confirm or reject the selection.

Proposal Selection

The PM, with input from the FAM, creates a scoring team to evaluate the responsive proposals. Team members usually include the FAM, PM, RM and a smaller subset of the RAP members. The scoring team uses MDOT's best-value selection criteria found in Part VII of the Consultant/Vendor Selection Guidelines for Research Service Contracts, available at MDOT's Requests for Proposals Web page (www.michigan.gov/mdot/0,1607,7-151-9625_32842---,00.html). The evaluation criteria are:

- Understanding of service: 40 points.
- Qualifications of team: 30 points.
- Past performance: 30 points.
- Quality assurance/quality control plan: 5 points.
- Location: 5 points.
- Cost: 40 points.
    - Cost score is based on the lowest cost proposed divided by the current proposer cost multiplied by 40. Lowest bid shall receive 40 points.
    - As part of the best-value selection process, the bid amount is a component of the total proposal score, but not the determining factor of the selection.

    Total Points: 150

Some RFPs have education and experience requirements for statistical staff that must be met to be considered a responsive proposal.

The scoring team's scores for each proposal are tabulated and reported to MDOT's approving body. If only one candidate responds to an RFP, that candidate may be selected if the proposal meets the requirements to complete the work.

After a proposal is selected, the Engineer of Research sends a letter to the preferred consultant stating MDOT's preference to contract with the consultant as the researcher for the project. The Engineer of Research also notifies other submitting proposers that were not selected; each proposer receives a copy of its score sheet along with the notification. If a proposer requests a post-proposal evaluation, a phone interview can be set up to discuss the results of the proposal scoring at the PM's discretion.

Obligation of Funds

Before MDOT can execute a project authorization, federal funding must be obligated. Every year Research Administration requests FHWA approval of each project as part of the annual program approval process. Once FHWA approval is received, Research Administration informs MDOT's Financial Operations Division to request federal fund obligation. Financial Operations Division staff forwards the request with the federal project number and the federal item number to FHWA for approval. FHWA secures fund obligation prior to October 1. Additionally, new fund

obligations are required for new projects throughout the program year. These are initiated through program amendments.

Contracts and Authorizations

After a proposal has been selected, the PM and RM work with the selected PI to finalize a project work plan. Once the PM accepts the work plan, the research project analyst completes Form 5301, Request for New Project Authorization or Contract (Appendix 3.2). The form includes contact information for the PM and PI, budget information as well as the project start and end date. After the PM, RM and Engineer of Research approve and sign the form, it is sent to the Contract Services Division, along with the work plan, to initiate contract or authorization execution.

Consultants are granted new contracts for each project whereas universities are issued work authorizations from an existing Indefinite Delivery Services contract. Authorizations are issued using Form 5185, Acceptance of Priced Proposal & Authorization for University to Proceed (Appendix 3.3).

❖ Research Requirements

Proposals and final work plans follow the criteria given in the Consultant/Vendor Selection Guidelines for Research Service Contracts, available at MDOT's Requests for Proposals Web page www.michigan.gov/mdot/0,1607,7-151-9625_32842---,00.html. The following forms are required:

- Form 5100D, Request for Proposal Cover Sheet (Appendix 3.4).
- Form 5318, Schedule of Research Activities (Appendix 3.5).
- Form 5316, Deliverables Table (Appendix 3.6).
- Form 5100J, Consultant Data and Signature Sheet (Appendix 3.7).
  - » Form is only required for Consultants
- Budget information:
  - » Universities: Form 5319, Research Proposal Budget Form Worksheet (Appendix 3.8).
  - » Consultants: Bid Sheet and Budget Exhibits required in Priced Proposal Guidelines.

❖ Commission Audit Requirements

Contracts exceeding $100,000 are to be sent to the Office of Commission Audit (OCA). Contract Services Division submits the information to OCA staff, who reviews costs and supporting documentation such as labor rates, overhead, escalation, direct expenses and total costs to ensure they meet MDOT and state standards. Budget labor rates cannot escalate greater than 2 percent per year as indicated in Appendix 3.9.

❖ State Administrative Board Requirements

Contracts exceeding $250,000 must be approved by the State Administrative Board (State Ad Board) before MDOT's contract administrator and executive office can execute the contract or authorization. Contract Services Division uses Form 5301, Request for New Project Authorization or Contract (Appendix 3.2), to prepare the contract submittal package for State Ad Board review. The submittal package includes:

- Contract/amendment number or authorization/revision number.
- Vendor name.
- Brief description of the project and location.
- Purpose for amendments/revisions.
- Amount.
- Increase/decrease amount for amendments/revisions.
- Term.
- Funding source.

State Ad Board review and approval typically takes six to eight weeks after submittal.

According to State of Michigan policy, projects with budgets less than $250,000 can be approved by the MDOT contract administrator and MDOT's executive office without State Ad Board approval. Contract Services Division typically obtains approval sooner for these contracts or authorizations, depending on how quickly the consultant or university contracting authority signs and returns the contract. Contract Services Division distributes the awarded authorization or contract as follows:

- E-mail the authorization or contract to the consultant or university contracting authority.

- E-mail the authorization or contract to Research Administration. Research Administration forwards the authorization or contract to the RM, PM and PI.
- Mail original authorization or contract with the work plan to the consultant or university contracting authority.
- File one original authorization or contract in the Contract Services Division contract file.

❖ Subcontracting

Subcontracts exceeding $25,000 require that the university or consultant submit the subcontract to Research Administration for review and approval prior to initiating work. The research project analyst reviews the subcontract for completeness (Appendix 3.10) and communicates any needed changes to the PI. An approval letter is sent to the PI and a signature page is requested. An additional review by the OCA is required for subcontracts that exceed $100,000. The research project analyst communicates any OCA modifications to the PI. Once the PI makes the changes, an approval letter is sent and a signature page is requested.

3.1.3 Project Management

Project management includes both execution and closeout. This phase begins at project kickoff and concludes when final project deliverables are accepted and closeout activities are completed. Project management tasks include leading meetings, reporting, revising contract documents, reviewing and accepting project deliverables, reviewing and approving invoices, evaluating PI performance and completing an internal audit.

Execution

Upon contract award, the PM becomes actively involved with guiding the research. Key tasks that occur after project award include RAP meetings, project reporting, invoice review, permits and possible project revisions.

Meeting Requirements

The initial project kickoff meeting and subsequent progress meetings are critical for project success. These meetings are necessary to guide the project and provide opportunities for MDOT staff to assist the research team in maintaining focus on the project tasks and objectives.

❖ Kickoff Meeting

The PM schedules the first RAP meeting (kickoff meeting) soon after project authorization. At the kickoff meeting, the RAP reviews the work plan and project milestones. The PI and the research team also communicate project data needs at this meeting. Supplying data to the research team and scheduling fieldwork, including traffic control, early in the project schedule are crucial to avoid future delays. ROW Permits are required as defined in section 3.1.3 Permits. The kickoff meeting is an appropriate time to provide MDOT documents for the literature review, provide input about the state-of-the-science surveys, identify survey distribution methods, and select a future date when researchers can meet with MDOT staff to understand policies and procedures related to the state of the practice. The RM takes meeting minutes and distributes them to all RAP members. A sample agenda is given in Appendix 3.11. Subsequent meetings follow a similar agenda.

❖ Progress Meetings

The RAP meets periodically to discuss the project's progress and address outstanding issues. To support the conduct of the study and assure research objectives are being met, the PM schedules meetings that coincide with the research tasks identified in the work plan. In this way, MDOT staff actively participates in the tasks such as:

- Reviewing existing related research.
- Surveying national experts on the state of the science.
- Collecting data.
- Analyzing data.
- Documenting findings and writing reports.
- Demonstrating prototypes.
- Conducting technology transfer.

Project meetings progress well if the PI provides a project status report and a list of outstanding issues or data needs before the meeting so MDOT staff can come prepared to provide input that advances the project.

Although most RAP meetings take place at MDOT, they can be held at data collection sites or in laboratories where experiments are under way or specimens can be evaluated. These on-site

research meetings allow the panel opportunities to identify deficiencies in the research approach or actively participate in data collection.

All RAP members are invited to each meeting. Additional people may need to be invited to meetings to provide input or additional expertise that is not represented on the panel. The RM and PM decide who will record meeting minutes.

❖ Final Meeting

At the final meeting of a project, RAP members discuss the final report recommendations and implementation opportunities. Panel members learn about the results of the research project and consider how MDOT can implement those results. RAP members also provide comments on deliverables so that final revisions can take place before the report is published. Another important objective of the final meeting is to review the list of deliverables found in the work plan.

At times it may be important to invite a larger audience to the final meeting to communicate the results of the project to MDOT staff, local agencies or other end users. Final presentations may also need to take place at conferences or group meetings to reach a larger audience than the RAP. In the past, final presentations have taken place at meetings of the MDOT Bridge Committee, Governor's Traffic and Safety Advisory Commission, Michigan Transportation Asset Management Council and other groups.

Permits

As of August 1, 2014 all universities and consultants, with research contracts, will be required to obtain permits to perform work in MDOT right-of-way. Each university's contracting authority will contact MDOT's central office right-of-way permit agent, Joe Rios at 517-241-2103, to navigate through the permitting process. The contracting authority takes the necessary steps to obtain a permit for each IDS contract. The principal investigator follows up by submitting a notice of activity under the IDS permit for each right-of-way activity. Consultants obtain an annual statewide right-of-way entry permit for each year of a contract. The consultant is also required to submit a request to MDOT, termed a Notice of Activity, when work in the right-of-way is required.

Reporting Requirements

Quarterly reports and the annual report are essential in allowing the PI, PM and Research Administration to communicate and record progress throughout a project. These reports are used to track work completed and project future work.

❖ Quarterly Reports

At the end of each quarter, the PI submits a report (Form 5305, Appendix 3.12) and the Schedule of Research Activities (Form 5318, Appendix 3.5) to Research Administration about the work that was accomplished during that quarter. Below is the schedule for submitting quarterly reports:

- 1st FY quarter: October 1 – December 31; report due January 15.
- 2nd FY quarter: January 1 – March 31; report due April 15.
- 3rd FY quarter: April 1 – June 30; report due July 15.
- 4th FY quarter: July 1 – September 30; report due October 15.

Research Administration forwards the report to the PM for review. If the PM is satisfied with the report, he or she informs Research Administration of their approval. If the PM has a question or concern, he or she works with the PI to resolve the issue. The PM documents all concerns for the project files.

The PM is responsible for itemizing contracted and MDOT expenditures in comparison to expected expenditures. This should coincide with the submittal of each quarterly report submitted by the PI. The PM is responsible for identifying spending trends that may require budget adjustments.

The PM can retrieve project budget and expenditure information by utilizing the Michigan Financial Obligation System (MFOS). Each project will have a single job number that tracks all project costs. MDOT expenses can be determined by subtracting the contract invoiced amount from the total project expenditure reported in MFOS.

If the PI requests a modification to the terms of the authorization or contract, a formal request must be made directly to the PM rather than through the quarterly report. More information about project revisions is found in the Project Revisions section of this chapter.

❖ Annual Reports

At the end of each fiscal year, Research Administration works with PMs to develop a summary report of the research performed throughout the year. Each PM writes a summary of each project using Form 5312, the MDOT Research Project Annual Report – Fiscal Year 20-- (Appendix 3.13), and submits it to Research Administration. The form is due in late October to early November. Research Administration compiles a report containing all of these forms and project expenditure summaries, and submits a copy to FHWA by January 1. Annual reports are available at www.michigan.gov/mdotresearch.

The PM is also responsible for providing annual project budget updates to Research Administration in the spring of each year. This information is needed to develop the annual fiscal year research program, which is finalized in the summer and submitted to FHWA for approval in August. The MDOT Research Project Budget Worksheet (Appendix 3.17) is completed by the PM to estimate MDOT project management and fieldwork costs.

Invoicing

Invoices may be sent monthly or based on milestone payments, depending on the method of payment. Once an invoice is submitted to Research Administration, the following steps are taken:

Step 1 The research project analyst reviews the invoice and then forwards it to the PM for approval, with a copy to the RM.

Step 2 The PM works with the PI to resolve concerns or questions. The PM approves or rejects the invoice and returns it to the research project analyst.

Step 3 The research project analyst requests that payment be issued.

At the end of the fiscal year (September 30), each vendor (university or consultant) estimates the outstanding invoice amounts remaining for the ending fiscal year. This estimate, referred to as Estimated Accounts Payable (EAP), is used to set aside previous fiscal year funds to pay the unpaid invoices when they are received. Research Administration must receive the estimates by the first week of October. Actual due dates will be announced each fiscal year. Prior fiscal year invoices must be submitted to MDOT by November 15.

Project Revisions

A revision in cost, scope, duration and/or staff may be proposed during the contract period using the following process:

Step 1 Initially, the PI submits written communication to the PM explaining the requested changes and providing justification. The PI also submits any supporting documentation related to the changes as described in the following sections. Forms found in Appendix 3.5, Appendix 3.6 and Appendix 3.8 or at the Research Administration Web site (www.michigan.gov/mdotresearch) are used to document these modifications.

Step 2 The PM presents the proposed change along with necessary documentation to the RM for review and concurrence. If the submission is complete, the PM and the research project analyst complete Form 5306, Project Change Request (Appendix 3.14).

Step 3 The PM signs and submits the Project Change Request along with supporting documentation to the research project analyst.

Step 4 The research project analyst electronically obtains the RM's signature and the Engineer of Research's signature on the Project Change Request.

Step 5 The research project analyst submits the signed form and documentation to the Contract Services Division and/or places them in the project file (as required in the sections below).

On average the Contract Services Division (CSD) requires three to four weeks to process a revision. If the revision must be approved by the State Ad Board, it may take six to eight weeks to process. The CSD sends a revised authorization or contract to the university or consultant contracting office for concurrence. MDOT's contract administrator and executive office execute the revised contract by signing the authorization or contract amendment.

❖ Scope

For revisions in scope, the PM submits Form 5306, Project Change Request (Appendix 3.14), to the research project analyst. Attachments should include a scope of work description, and a new deliverables table. The project analyst will then process the request through the CSD. FHWA approval may be required for a scope of work change, as determined by the RM.

❖ Staff

If staff changes occur on a project, the PM submits Form 5306, Project Change Request (Appendix 3.14). The research project analyst will process the change and notify CSD.

❖ Subcontract Work Assignment

These revisions may include work assignment shifts from one subcontractor to another subcontractor, from the subcontractor to the prime contractor or from the prime contractor to the subcontractor. For work assignment revisions, the PM submits Form 5306, Project Change Request (Appendix 3.14), along with an updated budget, a scope of work change description. The research project analyst will process the change through CSD.

❖ Schedule

To request a schedule revision, the PM submits Form 5306, Project Change Request (Appendix 3.14) with an updated schedule (Appendix 3.5); and deliverables table (Appendix 3.6). The research project analyst will process the request through CSD.

❖ Budget

A budget decrease follows the same process as a schedule change except budget tables (Appendix 3.8) must also be submitted.

A budget increase involves several more steps and may extend the approval period to six to eight weeks, or longer if State Ad Board approval is needed. The PM must get approval for budget increases from the RAC chair before submitting Form 5306, Project Change Request (Appendix 3.14), to Research Administration. Research Administration must also gain FHWA approval using the program amendment process outlined in Chapter 2. As approvals are obtained, Contract Services Division must process the contract budget increases.

The additional steps required must be taken to execute a budget increase include:

Step 1 The PI submits written communication to the PM explaining the requested changes and justification. Any supporting documentation that pertains to the budget increase should be attached, including:

- New budget tables (Appendix 3.8).
- Description of the scope of work that corresponds with the additional funding.
- Updated deliverables table (Appendix 3.6) and timeline (Appendix 3.5) if these items are changed.

Step 2 The PM presents the proposed change to the RM and discusses its justification. If the PM and RM agree that the change is justified and the essential documentation is complete, the PM, with research project analyst assistance, prepares Form 5306, Project Change Request (Appendix 3.14). The PM adds the revision information and justification for the change to the form, and supplies the following supporting documentation:

- New budget tables.
- Description of the scope of work that corresponds with the additional funding.
- Updated deliverables table and timeline if these items are changed.
- Documentation of the RAC chair's funding increase approval.

Step 3 The research project analyst obtains the RM's signature and the Engineer of Research's signature on the Project Change Request.

Step 4 The research project analyst submits the signed form and documentation to CSD.

Step 5 MDOT's contract administrator sends an authorization or contract amendment to the university's or consultant's contracting office for approval.

Step 6 If the revision causes the total budget to exceed $250,000 for the first time or if cumulative increases exceed $150,000, the State Ad Board must approve the change before MDOT's contract administrator and director's office can execute a new authorization/contract. Projects with budgets less than $250,000, or with cumulative increases less than $150,000, can be approved by the MDOT's contract administrator and MDOT's executive office without State Ad Board approval.

Closeout

Project closeout includes reviewing and accepting project deliverables, paying the final invoice, evaluating PI performance and completing an internal audit.

Project Deliverables

The PM is responsible for reviewing and approving all project deliverables and providing feedback on drafts and revisions. Project deliverables will include a final report, implementation plan and technology transfer materials. Additional deliverables may include software products,

guidance documents, equipment, presentations, training manuals, training events or demonstrations.

❖ Final Report

Federal regulations require a final report for every research project (23 CFR 420.209.a.6). The report documents the methods used, data collected, analyses performed, conclusions and recommendations. Formatting requirements are shown in Appendix 3.15.

➢ *Review and Acceptance Procedures*

The PM leads the review and approval of final deliverables. Enough time needs to be built into the review process for meaningful revisions. Once the PM accepts the final deliverables, final payments can be made. The PM communicates the final report deliverable expectations according to the following 90-day review process:

Step 1 **Draft report.** The PI submits the draft final report to the PM. The PM reviews the report findings with the FAM to determine whether Engineering Operations Committee approval is required.

Due date: At least 90 days before the authorized final project deliverable date.

Step 2 **MDOT review.** The PM requests comments from the RAP, compiles the comments and communicates the needed revisions to the PI. The RAP makes comments based on the following standards:

- Completeness: The report contains all the necessary content.
- Technical merit: The research is well-documented and the findings are scientifically founded.
- Format and style: The report meets high standards of writing and presentation.

Due date: Within 30 days of receipt of the report.

Step 3 **Resubmittal.** The PI modifies the draft final report and resubmits the report to the PM.

Due date: Within 45 days of receiving the comments from the PM.

Step 4 **Revisions.** The PM checks the needed revisions and works with the PI until all revisions are made and the final project report is initially accepted by the PM. In

some cases, the FAM will determine that the report should be reviewed and approved by the Engineering Operations Committee.

Due date: Before the final deliverable date indicated in the contract or authorization.

Step 5 **Delivery.** Following the report's initial acceptance, the PI submits the final report in hard copy and digital format according to the following specifications:

- Two hardbound double-sided copies.
- At least one searchable PDF file on CD. If the entire report file size is larger than 8 megabytes (MB), the file must be divided into separate parts at logical breaks so that none of the individual files exceed the 8MB size limit.

The PI delivers the final report to the MDOT Librarian at:

MDOT - Library - B155
P.O. Box 30050
Lansing, MI 48909

Due date: Deliverable date indicated in the contract or authorization work plan.

Step 6 **Final acceptance.** The PM is responsible for accepting the final project deliverables unless the FAM determines that the Engineering Operations Committee should be consulted prior to approval.

Due date: The later of the following:

- After final deliverables have been received and approved as indicated in Step 5.
- After the final invoice has been received and approved as indicated in the Invoicing section of this chapter.

➢ *Publishing Prior to Project Completion*

Report publishing prior to MDOT final acceptance is prohibited without special approval from the MDOT Research Advisory Committee Chair. The required approval process is provided in Appendix 3.16. All early published documents resulting from MDOT approval will be provided with the final project deliverables.

❖ Implementation Plan

The PI writes and submits an Implementation Action Plan Proposal (IAPP), which is a technical report of 10 pages or less that explains how MDOT could best use the result(s) of the study. The report should note the recommended implementation steps, the estimated cost of implementation and the benefits of adopting the implementation plan. The PM determines if this implementation plan can be included as part of the final report recommendations or developed as a stand-alone document.

❖ Outreach Plan

If a project requires outreach to a larger audience than the RAP, a component of the implementation plan should include an outreach plan that at a minimum indicates the message(s), the audience(s) and the medium(s).

The project deliverables may also include the following summaries of the research project to promote broader awareness of the research results within MDOT and to external audiences:

- **Research Spotlight:** All PIs are required to complete a spotlight template, found in Appendix 2.14, for a possible Research Spotlight publication. Research Spotlights include a project-related image, project summary information, a PM quote and contact information for the PI and PM. The spotlight template includes all necessary information to satisfy this deliverable requirement.

  Research Spotlights are posted on Research Administration's Web site at www.michigan.gov/mdotresearch.

❖ Software Products

If software is developed as part of a contracted project, the PI provides the source code to MDOT as one of the final deliverables. MDOT has the right to use the software in accordance with the rights authorized in the following paragraph:

> For all services that result in software development for governmental purposes, the consultant will provide MDOT with a worldwide, irrevocable, nonexclusive, fully paid and royalty-free license to use the source code(s) for the software developed in digital format and/or as specified in the scope of work.

❖ Patents and Copyrights

Some projects result in patent applications and copyrights. In these cases, the consultant or university will grant a license not only to MDOT, but also to all Michigan state and local governmental agencies and the U.S. government. These conditions and additional requirements are explained in the following paragraph:

> The consultant will notify the PM of any patent applications and copyrights resulting from work performed under an MDOT authorization. The consultant will grant to all Michigan state and local government agencies and the U.S. government worldwide, irrevocable, nonexclusive, fully paid and royalty-free license to reproduce, publish or otherwise use and to authorize others to use the work for governmental purposes, whether or not a patent or copyright is obtained.

Chapter 5 of this manual provides more information about copyrights and patents.

❖ Equipment

In accordance with 2 CFR 200, property will continue to be used by MDOT at the end of a research project. MDOT shall have possession of equipment purchased by research funds in accordance with the following conditions outlined in Appendix 3.18:

1. At the sole discretion of MDOT equipment will be delivered to MDOT for its possession at the end of each project.
2. At the sole discretion of MDOT equipment may be the possession of a public institution if it costs less than $5,000 at the end of each project.
3. All equipment costing greater than $5,000 shall be transferred to MDOT's possession.
4. All equipment purchased by a private vendor shall be transferred to MDOT's possession.

Administrative Requirements

Research Administration works with the PM to complete various administrative requirements as part of the project closeout process. These requirements include reviewing and paying the final invoice, completing vendor evaluations and completing an internal audit of project billings and payments.

❖ Final Invoice

When the final invoice arrives, the research project analyst works with the PM to determine the status of the final deliverables. Fifteen percent of the total budget is retained until the PM

receives and approves the final deliverables. Once the final deliverables are approved, the research project analyst requests release of the final payment.

❖ Consultant Evaluation

When the research project analyst requests release of the final payment, the PM is reminded to complete a consultant evaluation in C-TRAK. The PM gives a signed original of the evaluation to the research project analyst, who sends a cover letter and a copy of the evaluation to the PI.

The evaluation is placed in the project file. Evaluations are used in future proposal selections to determine past performance scores.

❖ Internal Audit

After a project expires and final payment is released, Research Administration reviews project expenditures to ensure that all payments were processed accurately. OCA must review all projects with a contract value exceeding $100,000. Contracts that are valued at $100,000 or less may also be reviewed by OCA at the request of Research Administration. Once the audit is complete, a letter is sent to the university or consultant seeking concurrence with the results of the audit.

3.2 Michigan Individual Projects: In-House

Although MDOT technical experts rarely conduct individual research projects in-house because of staffing constraints, these projects can be funded with SPR, Part II research funds when requested. Funding is 80 percent federal dollars and 20 percent state dollars

3.2.1 Roles and Responsibilities

Roles and responsibilities are similar to those outlined in Section 3.1. However, the MDOT PM assumes both the PI and PM roles.

3.2.2 Project Development

Project development includes problem statement development, work plan development, job number establishment and federal funding obligation.

- **Problem statement:** A problem statement is developed as outlined in Section 3.1.2 and approved as outlined in Chapter 2.
- **RAP:** The PM recommends a RAP, and the FAM approves members as indicated in Chapter 2.
- **Work plan:** The PM develops a work plan that is approved by the Engineer of Research and RAP, and contains the following:
    - Scope of work describing in a narrative form the way the tasks outlined in the problem statement will be addressed. Itemized budget identifying hours, the staff and their hourly rates, and equipment costs.
    - List of deliverables, including a final report. Form 5316, Deliverables Table (Appendix 3.6).
    - Timeline. Form 5318, Schedule of Research Activities (Appendix 3.5).
- Obligation of funding: Research Administration secures a job number and obligates funds before work can begin.

3.2.3 Project Management

Project management processes are similar to those described in Section 3.1. The PM:

- Holds a kickoff meeting and periodic RAP meetings to organize the work report on progress and obtain panel input.
- Submits quarterly and annual reports to the FAM.
- Reviews job number expenditures and project spending trends, and adapts work assignments to stay within budget.
- Presents any changes to the work plan for FAM and RAP approval.
- Writes the final report and submits it to the Engineer of Research, FAM and RAP for review and approval.

3.3 Pooled Fund Studies: Michigan as the Lead State

MDOT-led pooled fund studies require that MDOT assume the lead role in both the project development and project management phases. The lead state assumes the project administration role, which includes drafting a problem statement, identifying the research need, soliciting interest from other states, contracting to do the research and managing the project. This section explains how MDOT-led pooled fund studies are developed and managed.

3.3.1 Roles and Responsibilities

Each partner state in a TPF research project appoints a technical expert to serve on the project's TAC. Committee members may assist the MDOT PM in developing a problem statement, participate in proposal review and participate in vendor selection. Subsequent to project award, the TAC is responsible for assuring proper execution of the research project, from project kickoff to final report acceptance.

More information about the role and duties of the TAC are available in Chapter 13 of the Transportation Pooled Fund Program Procedures Manual.

Project Manager

The appropriate FAM recommends a PM for a research project. Typically, the PM is the subject area expert for the research topic. The PM takes the leadership role for the TAC, oversees technical aspects of the project and manages the following project tasks:

- Drafts the problem statement as outlined in Phase 2: Problem Statement Development in Section 2.1.3. TAC members also may be asked to assist.

- Determines the need for a RAP and recommends RAP members.
- Reviews proposals and leads the vendor (researcher) selection team.
- Initiates the contract (authorization) and subsequent modifications.
- Schedules TAC meetings (project kickoff and regular progress meetings) in coordination with the TAC members.
- Manages project costs, schedule and scope.
- Works with Research Administration and Finance to secure fund transfer requests from the partner states.
- Reviews and coordinates TAC review and acceptance of project deliverables.
- Accepts or rejects invoices.
- Review project expenditures and track expense trends.
- On a calendar quarter basis, provides project status and progress reports. All progress report information must be posted to the TPF Web site (www.pooledfund.org) within 30 days of the end of the reporting period according to federal regulations (23 CFR 420.117(c)). More information about the required report content is available in Chapter 12 of the Transportation Pooled Fund Program Procedures Manual.
- Ensures that all of the project partners receive all project reports and deliverables.
- Completes the PI evaluation.
- Recommends implementation measures as defined in Chapter 4.

Research Manager

The MDOT SPR, Part II Program Manager is the RM for all pooled fund studies. The RM provides the following administrative assistance for a project:

- Initiates the amendment request with FHWA to add the pooled fund study to the annual work plan.
- Assists the PM with problem statement development.
- Records the proposal review and vendor selection process, and tracks approval.

- Works with the PM to ensure the essential documents are compiled for contract or authorization initiation, and tracks progress.
- Acts as Research Administration's liaison to the TAC when process questions arise.
- Coordinates meeting responsibilities with the PM to ensure completion of tasks.
- Ensures that all meeting discussions are documented (meeting minutes) by the PM or the RM.
- Verifies that reports and deliverables are received.
- Reviews invoices.
- Works with the PM to ensure that PI evaluations are complete.
- Maintains detailed financial records of project funding allocations from partner states.

Principal Investigator

The PI is the researcher awarded the research contract. The PI conducts and manages day-to-day research tasks as defined in the project work plan, including:

- Provides regular progress reports.
- Manages budget, scope and schedule. Informs the lead state's PM immediately of any trends in project progress that suggest a future need for changes to project cost, scope or schedule.
- Maintains regular contact with the PM and other TAC members through meetings and other informal means such as e-mail or telephone.
- Submits project deliverables, responds to TAC review comments and makes changes as directed.
- Ensures that invoices and project deliverables are supplied on a timely basis.
- Leads the research team and provides other project researchers with clear direction.
- Maintains research team focus on project tasks, objectives and deliverables.

The PI, at his or her discretion, may also include co-PIs, subconsultants and other research team members in TAC meetings.

Focus Area Manager

The FAM provides the following assistance:

- Recommends the PM for the project.
- Recommends initiation of an MDOT-led pooled fund to the RAC.
- May assist in vendor selection and project management.
- Approves RAP membership.
- Remains in contact with the MDOT SPR, Part II Program Manager throughout the project and may attend TAC meetings.

- May review and provide comments on draft deliverables.
- Provides guidance to the PM and TAC on appropriate next steps to implementation as defined in Chapter 4.

3.3.2 Project Development

Project development of an MDOT-led pooled fund study begins either during the program planning phase as described in Section 2.1.3 or as a supplemental research project as described in Section 2.1.4. In both cases, the project development steps described in Section 3.1.2 apply with the exception of the proposal selection team members defined in the Proposal Selection section. The proposal selection team for a pooled fund project is composed of TAC members and additional MDOT technical experts.

Tasks for project development begin with completing a problem statement and conclude with a study kickoff meeting. Chapter 5 of the Transportation Pooled Fund Program Procedures Manual provides additional details for establishing a pooled fund project. A summary of the process follows:

- **Problem statement:** A problem statement is developed as outlined in Phase 2: Problem Statement Development in Section 2.1.3. After all necessary MDOT approvals are received, the problem statement is submitted to FHWA for review and approval.
- **RAP:** If necessary, a RAP is assembled to bring additional expertise that augments that of the TAC.
- **Work plan:** Research Administration submits a request to the FHWA Michigan Division Office to add the proposed project to the annual work plan. The submittal may include a request to waive matching funds.
- **Funding:** The PM, with assistance from the RM, posts a project solicitation to the TPF Web site (www.pooledfund.org). The solicitation will indicate a total dollar commitment amount required for the study and will ask interested study members to make minimum funding commitments to participate. A deadline date will also be posted for the study. The PM contacts other state DOTs and requests their participation. If the total dollar commitment amount is not achieved by the deadline date, the study will be terminated, extended or deferred.
- **Federal study number:** If minimum funding commitments are secured, the PM, with assistance from the RM, requests a federal study number from the FHWA Division TPF funding coordinator. Upon assignment of a federal study number, the PM secures and

posts the names of the partner states' TAC members to the TPF Web site (www.pooledfund.org).

- **Vendor selection:** The PM and the TAC review proposals and select a vendor (researcher) for the project.
- **Study award:** The study is authorized and awarded.

3.3.3 Project Management

Project management of an MDOT-led pooled fund study is similar to that of an individual research project. It commences with the project kickoff meeting and concludes with final acceptance. All steps described in Section 3.1.3 apply with one exception: TPF quarterly reports are issued on a calendar quarter basis. Chapter 12 of the Transportation Pooled Fund Program Procedures Manual provides specific details for project management of a pooled fund project. A sequential summary of the project manager's role in the process follows:

- Holds a kickoff meeting and periodic TAC meetings to organize the work, report on progress and obtain committee member input.
- Posts quarterly (calendar) reports to the TPF Web site (www.pooledfund.org) and secures a copy for the MDOT project file. Provides periodic project status updates to the FAM.
- Asks TAC members to review and provide comments on progress reports and preliminary findings from the PI.
- Reviews project expenditures and project spending trends, and adapts work assignments to stay within budget.
- Reviews any changes to the work plan for FAM and TAC approval.
- Obtains TAC review and approval of the final report submitted by the PI.
- Identifies implementation opportunities.
- Accepts or rejects study deliverables, including the final report.

At the end of the project, the RM follows the project closeout procedures as defined in Chapter 17 of the Transportation Pooled Fund Program Procedures Manual. This includes preparation of a separate fund transfer request on Form FHWA-1576 to return any remaining funds to the partner states.

3.4 Pooled Fund Studies: Michigan as a Participating State

Pooled fund studies where MDOT is only a participant require much less attention from MDOT than when the state is acting in the lead role. When participating only, MDOT technical experts serve on a TAC but are not responsible for project administration responsibilities.

3.4.1 Roles and Responsibilities

The TAC's role is as described in Section 3.3.1.

Technical Advisor

The appropriate RAC chair assigns a technical advisor to the project's TAC. In this role, the technical advisor:

- May participate in the vendor selection process.
- Participates in project progress meetings.
- Reviews preliminary and final project deliverables.
- Approves or rejects invoices.
- Reviews and approves final accounting of project expenditures charged to MDOT.
- Assesses and recommends any implementation strategies resulting from the research.
- Provides guidance to the lead agency PM and other TAC members about appropriate next steps to implementation as defined in Chapter 4.
- Works with the RM to initiate fund transfers to the lead agency.
- Works with the RM to prepare annual reports as described in the Reporting Requirements section of this chapter.
- Works with the RM to ensure final study deliverables, including the final report, are received and acceptable.

Research Manager

The MDOT SPR, Part II Program Manager is the RM on all pooled fund studies. The RM provides the following administrative assistance for the project:

- Initiates fund transfers to the lead agency.
- Initiates the amendment request with FHWA to add the pooled fund study to the annual work plan.
- Assists the technical advisor with review and approval of the final accounting of project expenditures charged to MDOT.
- Assists the technical advisor with the TPF Web site (www.pooledfund.org).
- Assists the technical advisor with the preparation of annual reports as described in the Reporting Requirements section of this chapter.
- Works with the technical advisor to ensure final reports and deliverables are received.
- Ensures that the project is closed out according to the federal requirements.

Focus Area Manager

The FAM provides the following assistance:

- Recommends the technical advisor for the project.
- Recommends pooled fund participation to the RAC.
- Provides guidance to the technical advisor about appropriate next steps to implementation as defined in Chapter 4.

3.4.2 Project Development

Project development of a pooled fund study when Michigan is a participating state is minimal. The majority of the tasks involved in this phase are addressed by the lead state. The following activities are required:

- **Work plan:** Research Administration submits a request to the FHWA Michigan Division Office to add the proposed project to the annual work plan. The submittal may include a request to waive matching funds.
- **Fund transfers:** The PM and the RM work with the Finance Division and FHWA to initiate fund transfers to the lead agency.
- **Participation:** The PM, working with the RM, posts MDOT's expressed interest on the TPF Web site (www.pooledfund.org).

3.4.3 Project Management

A summary of the project management process when Michigan is a participating state follows. During this process, the technical advisor:

- Along with other TAC members reviews and approves quarterly report documents before posting to the TPF Web site (www.pooledfund.org).
- Provides periodic updates to the FAM.
- Performs reviews and provides comments on progress reports and preliminary findings from the PI.
- Assists the TAC with the review of project expenditures, tracking expense trends and adapting work assignments to stay within budget.
- Assists the TAC with review and approval of the final report submitted by the PI.
- Works with the RM to prepare annual reports as described in the Reporting Requirements section of this chapter.

CHAPTER 4
IMPLEMENTATION

Implementation of innovative technologies, best practices and research findings occurs regularly throughout MDOT. The assessment and utilization of new technologies, methods and procedures enable the department to achieve its mission of "providing the highest quality integrated transportation services for economic benefit and improved quality of life." Innovation is the result of many different efforts, both in Michigan and nationally. Programs such as the Cooperative Research Programs (highway, transit, rail and air), TRB and federally sponsored transportation research all contribute to developing and identifying innovation in transportation. In Michigan, the MDOT SPR, Part II research program and state-funded Centers of Excellence also contribute to the development and identification of new technologies.

Historically, MDOT has implemented innovative outcomes, including research findings, through the annual construction program. Funding to construct these innovations has come from standard project budgets. In addition, no implementation funding has been allocated to monitor the construction and long-term performance of these new technologies, resulting in inadequate monitoring and evaluation of past innovations after initial pilot construction.

This chapter outlines the steps required to develop an implementation project concept, conduct demonstration projects and deploy innovations into MDOT standards, procedures and/or guidelines.

4.1 Project Concept

Currently under development.

4.2 Demonstration Projects

Currently under development.

4.3 Deployment

Currently under development.

CHAPTER 5
FEDERAL REQUIREMENTS

The federal government supports surface transportation research in many ways. The State Planning and Research (SPR) Program, as described in 23 CFR 420, is a federal program designed to assist state DOTs with funding a surface transportation research program.

SPR Program requirements stipulate that at least 25 percent of the annual federal SPR apportionment (23 CFR 420.107) be dedicated to research (Part II). SPR, Part II, funding rules also require that individual research projects be funded with a mix of 80 percent federal dollars and 20 percent state dollars (23 U.S.C 505). SPR, Part II, dollars also support the national TPF Program (www.pooledfund.org/). Pooled fund studies can use 100 percent federal funds as outlined in 23 CFR 420.119(d).

FHWA encourages state DOTs to develop, establish and implement a research, development, and technology transfer (RD&T) program. The goal of a RD&T program is to improve processes, materials, construction methods, maintenance practices and technologies that result in a safer and more cost-effective surface transportation system. This program uses federal and state funding to conduct and implement research.

State DOTs are also encouraged to share research results with others to increase the benefits of transportation research at the local, regional and national levels. One mechanism used to share research successes and best practices is through research peer exchanges. Other tools used to communicate research include national research databases such as the Transportation Research Information Database (TRID) and the Research in Progress (RiP) database.

5.1 Program Eligibility Requirements

23 CFR 420.113 outlines what activities are eligible for SPR, Part II, dollars. Eligible RD&T activities are described in the following sections.

5.1.1 Research

Research activities related to a research study that are eligible for SPR, Part II, funds include:

- Studies where the purpose is to gain knowledge or understanding of a subject related to surface transportation. This includes individual research studies or projects as well as pooled fund studies. Research activities included in the study scope and project management functions related to the research study are eligible for SPR, Part II, funding.

- Project management functions include all MDOT staff efforts that contribute to meeting the study objectives. These typically begin at the time of the kickoff meeting and conclude with final closeout of the research study. Program administration charges are not eligible for SPR, Part II, funding.
- Data collection that is necessary for a research project. Subsequent data collection required to maintain systems developed with SPR, Part II, funds are not eligible expenses.
- Evaluation of new processes, products, equipment and/or materials.
- Pilot or laboratory studies required to evaluate or validate research findings.
- Research activities at UTCs.
- University graduate student internships that are funded by a research study.
- Evaluation of experimental approaches used in construction projects. This includes projects approved using the Special Experimental Projects No. 14 (SEP-14) process.

5.1.2 Development (Implementation)

Implementation plans, communication plans and demonstration projects are all eligible costs when related to the findings and conclusions of a research study (individual and pooled fund). These state or nationally supported studies may be sponsored by MDOT, another state DOT, FHWA, NCHRP and/or TRB. The following activities are eligible:

- Implementation plans and communication strategies, including:
    - Draft and initiate revised or new standards or specifications.
    - Identify and schedule demonstration projects (field trials).
    - Draft and initiate new or revised policies.
    - Draft and initiate new or revised internal processes or procedures.
- Demonstration projects:
    - Research findings and conclusions may require the demonstration of new technologies, including new equipment, new materials and/or new construction techniques. New technology must be evaluated both during and after construction to

determine the effectiveness of the technology. SPR, Part II, funds can be used to evaluate these new technologies.

- Other eligible charges include evaluation of design, testing or construction protocols, information sharing, initial and long-term data collection, data analysis and reporting. Project management costs are eligible for funding when the activity or activities contribute to the accomplishment of demonstration project objectives.
- The cost to construct demonstration projects typically is funded using construction program dollars. However, SPR, Part II, funds may be used to fund the cost of specific contract items that directly relate to project demonstration elements. Research Administration, consulting with the FHWA Michigan Division Office, will determine eligibility on a case-by-case basis.

5.1.3 Technology Transfer

Technology transfer activities are eligible for SPR, Part II, funding when the technology is a result of state, nationally or internationally recognized transportation research and technology. The following activities are eligible:

- Develop communication materials such as printed materials, electronic materials and video productions.
- Prepare educational or training materials.
- Conduct training sessions.
- Develop and conduct informational seminars related to new technologies.
- Develop and make presentations.
- Deploy previous research or implementation products (Strategic Highway Research Program II, pooled fund studies, research studies performed by other states and the federal government).
- Conduct open houses for projects using new technology.
- Facilitate best practices conferences such as the Research Summit.
- Organize and lead technology transfer efforts.

5.2 Program Management

State DOTs, including MDOT, are granted the authority to administer, manage and direct their RD&T program activities according to 23 CFR 420, Subparts A and B of the federal regulations. FHWA involvement in the SPR, Part II, Program is primarily at the overall program level. However, FHWA staff members occasionally participate on project RAPs and research peer exchanges.

5.2.1 Annual Report

FHWA requires that states report, on an annual basis, the deliverables that resulted from the previous program year (23 CFR 420.117). The annual report must include a detailed summary of costs and accomplishments resulting from the past year's work plan (research program). The report is due to the FHWA Michigan Division Office within 90 days of the fiscal year-end (December 31). A sample annual report is posted on Research Administration's Web site (www.michigan.gov/mdotresearch).

The annual report includes project information for both individual projects and pooled fund studies. It is important that states, including MDOT, reconcile all pooled fund study budgets at the end of each reporting year (fiscal year). This ensures that MDOT pays all committed funds to lead states when MDOT is a participant state and that all participating states pay their annual commitments to MDOT when MDOT is the lead state.

5.2.2 Annual Work Plan

Federal regulations require MDOT to submit the SPR, Part II, funded work plan to the FHWA Michigan Division Office in August of each year (23 CFR 420.111). The work plan consists of individual research projects; pooled funds studies; UTC commitments; and ongoing financial commitments to NCHRP, TRB and AASHTO Technical Service programs. Chapter 2 of this manual provides additional detail about the work plan development process.

An annual certification statement is also included as required by 23 CFR 420.209(c). Appendix 5.1 provides a sample transmittal letter, and Appendix 5.2 is a sample certification statement.

Each project listed in the work plan must have a problem statement that includes a project title, scope of work, research objectives and tasks, project cost and schedule. Information describing how the future research will be implemented for each project should also be included. After FHWA approves the work plan, Research Administration will process a fund obligation request

for each project and work with MDOT Finance Division to initiate a project agreement with FHWA that is consistent with the requirements of 23 CFR 420.115.

5.2.3 Work Plan Amendments

Throughout the program year, revisions regularly occur in the approved work plan. Some modifications require that MDOT formally request approval from the FHWA Michigan Division Office before making the changes to the program (23 CFR 420.117). The following revisions require work plan amendments:

- Modifying an individual project scope.
- Adding a new project or deleting an existing project.
- Making a cost revision that requires an increase to the total work plan budget.

A sample amendment letter can be found in Appendix 5.3.

5.2.4 Policy and Procedures Manual (Research Manual)

Federal regulations require that state DOTs, including MDOT, develop and maintain a manual that documents management processes and procedures needed to administer the SPR, Part II, RD&T program. These requirements are further explained in 23 CFR 420.205(g) and 23 CFR 420.209(b).

5.3 Other Program Requirements

5.3.1 Copyrights and Patents

Federal regulations 23 CFR 420.121(b) and (i) provide guidance on the rights of state DOTs to copyrighted publications and patented inventions or discoveries resulting from the activities performed with FHWA planning and research funds. Any research vendor under contract with MDOT to perform research must notify MDOT of any discoveries and/or inventions resulting from activities performed under the contract. If the researcher copyrights a publication(s) and/or applies for a U.S. patent, he or she must notify MDOT. In addition, under federal regulations state DOTs may copyright any books, publications or other copyrightable materials developed in the course of an FHWA planning and research funded project.

State DOTs are subject to the provisions of 37 CFR 401 governing patents and inventions, and must include the standard patent rights clauses at 37 CFR 401.14. If a research vendor chooses to retain title of an invention, FHWA reserves and state DOTs may also reserve a royalty-free, nonexclusive and irrevocable right to reproduce, publish or otherwise use, and to authorize others to use, the work for government purposes.

For state-led pooled fund studies (see Section 2.2 of this manual), a license-free fee clause is recommended for the contract as well. The lead state DOT is responsible for securing the contract for research. The federal regulations encourage states to negotiate with the selected contractor to include a contract provision that provides all participating states in the study a license-free fee to use the invention for government purposes.

5.3.2 Equipment

Any acquisition, use and disposition of equipment purchased by state DOTs with FHWA planning and research funds must be in accordance with 2 CFR 200.313.

Additional details about equipment acquisition, use and disposition can be found in Chapter 3 of this manual.

5.3.3 Procurement

Each research project must be authorized and executed under an existing Indefinite Delivery Services contract for research services. MDOT has a two-step process to solicit research proposals from potential researchers. According to federal regulation 23 CFR 420.121(n), the first step is to post an RFP to universities (in Michigan) only. If the proposal scoring team selects a vendor, Research Administration will process a recommendation to the Central Selection Review Team requesting award to the selected vendor.

If no proposal is received or no responsive Michigan university is selected, MDOT will go to the second step in the process. As described in federal regulation 23 CFR 420.121(j), MDOT will request competitive bids in accordance with MDOT procedures. This solicitation would invite proposals from both consultants and universities. Michigan consultants and universities are allowed to submit proposals in this second step as well. In addition, state DOT procurement of research services must be in accordance with 2 CFR 200.317.

5.4 Program Review

Federal regulation 23 CFR 420.209 requires a periodic review or peer exchange of a state DOT's RD&T program, or portion thereof, by other state DOT representatives. FHWA, universities and other national transportation representatives such as TRB may also be asked to participate.

The Engineer of Research will assemble a peer exchange team and organize the meeting. The peer exchange can evaluate the entire SPR, Part II, research program or may concentrate on a portion of the program. A peer exchange may occur on-site or virtually using telecommunications technology. States may also decide to have a multi-state peer exchange that involves the review of several state programs at once. The DOT, such as MDOT, will decide what format is used and what topics will be covered.

The peer exchange team must prepare a written report summarizing the meeting findings and submit the report to the FHWA Michigan Division Office after the peer exchange is completed. Travel and other costs associated with a state DOT peer exchange may be identified as a line item in the annual work plan and are eligible for 100 percent federal funding.

MDOT has conducted two peer exchanges in recent years:

- Transforming a State DOT Research Program (December 3-6, 2007).
- Bridging the Gap: Implementing Research Results (December 7-9, 2010).

5.5 Reporting Requirements

Research Administration is required to provide the FHWA Michigan Division Office with the following reports:

- Annual program report.

  A sample annual report is posted on Research Administration's Web site (www.michigan.gov/mdotresearch).

  Due date: No later than December 31.

- Annual work plan (MDOT Research Program) approval.

  Sample annual SPR, Part II program budget tables are shown in Appendix 5.4. The full program document includes additional project information.

  Due date: Submitted in August.

- Annual certification statement for work plan.

  Appendix 5.1 provides a sample transmittal letter, and Appendix 5.2 is a sample certification statement.

  Due date: Submitted in August.

- Work plan (MDOT Research Program) amendments.

  A sample amendment letter is shown in Appendix 5.3.

  Due date: As needed during the fiscal year.

- Policy and procedures manual.

  Due date: Updated as required.

APPENDICES

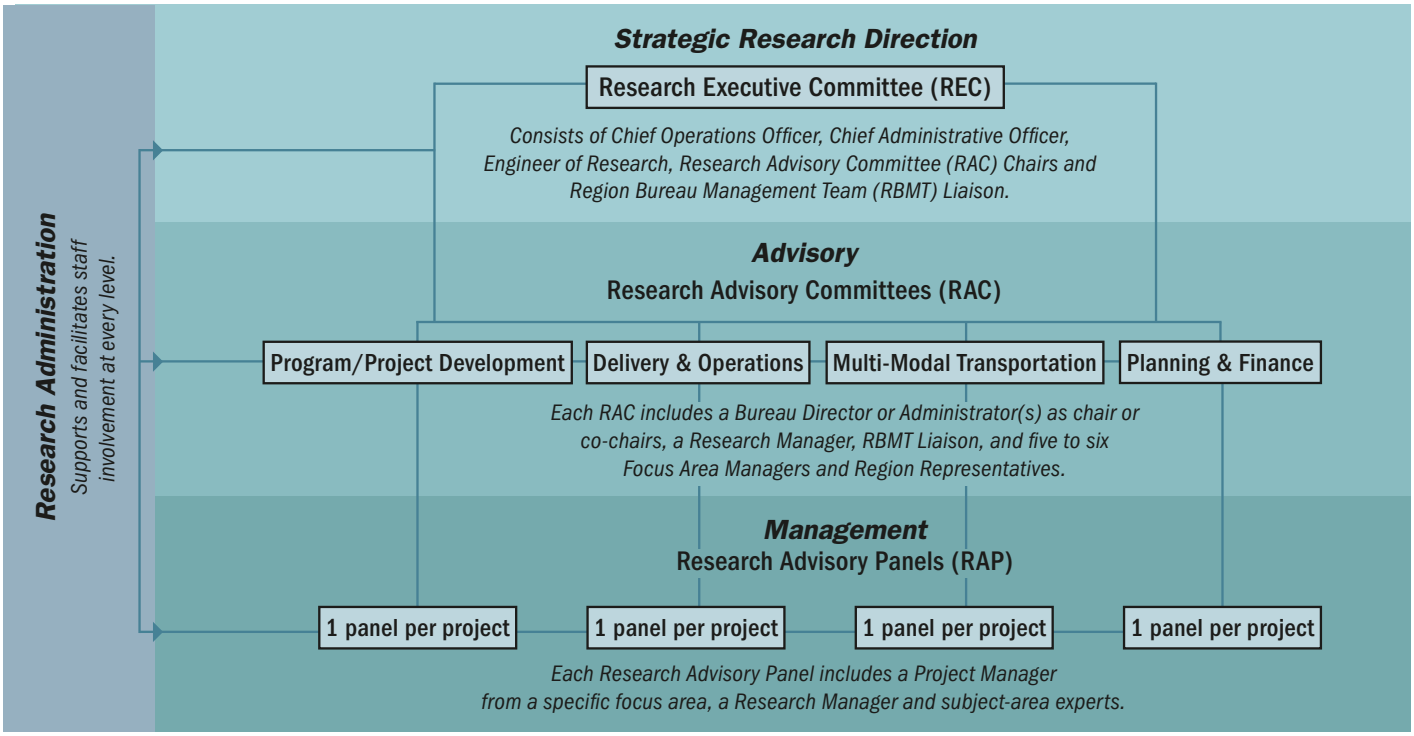
TABLE OF CONTENTS

RESEARCH ADMINISTRATION
Bureau of Field Services
Michigan Department of Transportation

Effective Research Management

Working together to advance Michigan transportation

The Research Administration Section manages research within MDOT. This includes research funded with SPR, Part II federal research dollars and state-funded research. Federally funded pooled fund research is also managed by the Research Administration Section. To most effectively carry out this responsibility, Research Administration has developed a tiered approach to identifying, prioritizing and managing research. This process ensures that department executives provide the strategic direction for research, while engaging managers and subject-area experts in the development and refinement of research ideas and problem statements. A tiered approach also involves focus area managers and subject-area experts in the management of specific research projects, which maintains alignment with strategic research priorities. Below is a listing of key staff and their responsibilities in this process.



Strategic Direction

The REC identifies strategic priorities for the biennial research program, prioritizes research ideas, approves problem statements, approves research projects and reviews research findings for implementation opportunities. The REC sets the tone for effective research management throughout MDOT.

Advisory

RACs prioritize and recommend specific research ideas for REC consideration. RACs also help develop problem statements and project recommendations.

RAC members include Focus Area Managers (FAMs) who are key in all aspects of research program development and implementation. They lay the foundation for implementation by outlining the expected outcomes and benefits, ensuring a clear scope of work, and supporting strong project managers. FAMS work closely with region representatives in the Development and Delivery RACs to ensure alignment with strategic research priorities.

Management

Research Advisory Panels (RAPs) manage the nitty gritty details of funded research projects, from vendor selection to progress reporting to deliverable review and approval. RAPs ensure that the projects run smoothly, meet the needs identified by the RACs and the REC and produce results that MDOT can consider for implementation. RAP membership typically consists of five to seven subject-area experts. The project manager for a RAP is either a FAM or a designee of the FAM.

Research Program Committee Structure

Research Executive Committee (REC)
REC Co-Chairs: Mark VanPortfleet, COO & Laura Mester, CAO
Engineer of Research: Steve Bower
Region Bureau Management Team (RBMT) Liaison to Research: Matt Chynoweth
Research Advisory Committee (RAC) Chairs and Co-Chairs: see below

Research Advisory Committee (RAC)
Hwys Program & Project Development
RAC Chair: Brad Wieferich
Addl Member: Kristin Schuster
RBMT Liaison: Kim Avery
Focus Area Managers (FAM): see below
Research Manager: Michael Townley

- **Bridges & Structures**
  FAM: Dave Juntunen, Corey Rogers
  Region Rep: Steve Katenhus
- **Environment & Water Resources**
  FAM: Environmental Section Engineer
  Region Rep: Bob Batt
- **Innovative Contracting**
  FAM: Chris Youngs
  Region Rep: Lori Swanson
- **Real Estate & Permits**
  FAM: Matt DeLong
  Region Rep: Jared Boll (Permits)
  Tom Jay (Real Estate)
- **Transportation Safety**
  FAM: Mark Bott
  Region Rep: Kim Zimmer
- **Rest Areas, Utilities & Landscaping**
  FAM: Kelby Wallace
  Region Rep: Will Thompson
- **Surveys & Automated Design**
  FAM: Dan Belcher
  Region Rep: Dave Tallon
- **Work Force Development**
  FAM: Don Whiteside, Todd White

Research Advisory Committee (RAC)
Hwys Delivery & Operations
RAC Co-Chairs: Randy Vanportfliet, Mark Chaput
Addl Members: Brenda O'Brien, Mark Geib
RBMT Liaison: Scott Thayer
Focus Area Managers (FAM): see below
Research Manager: Andre Clover

- **Construction**
  FAM: Jason Gutting
  Region Rep: Tom Tellier
- **Geotechnical & Foundation Design**
  FAM: Dick Endres
  Region Rep: Jim Siler
- **Intelligent Transportation Systems**
  FAM: Matt Smith
  Region Rep: Suzette Peplinski
- **Fleet/Facility Management & Operations**
  FAM: Sonja Scheurer
  Region Rep: Janine Cooper
- **Maintenance**
  FAM: Gary Mayes
  Region Rep: Will Thompson
- **Mobility, Systems & Signal Operations**
  FAM: Steve Cook
  Region Rep: Stephanie Palmer
- **Pavements & Materials**
  FAM: Curtis Bleech, John Staton
  Region Rep: Jim Siler
- **Worker/Facility Safety & Security Emergency Management**
  FAM: Eileen Phifer
  Region Rep: Gregg Brunner

Research Advisory Committee (RAC)
Multi-Modal Transportation
RAC Co-Chairs: Michael Trout, Tim Hoeffner, Sharon Edgar
RBMT Liaison: Paul Ajegba
Focus Area Managers (FAM): see below
Research Manager: Mark Polsdofer

- **Aviation**
  FAM: Matt Brinker
- **Freight & Logistics**
  FAM: Nikkie Johnson
- **Freight Rail**
  FAM: Kris Foondle
- **Intercity Bus**
  FAM: Rob Pearson
- **Local Transit**
  FAM: Cathy Hudson
- **Maritime**
  FAM: Larry Karnes
- **Passenger Rail**
  FAM: Therese Cody
- **Private/For Hire Passenger Carriers**
  FAM: Rob Pearson

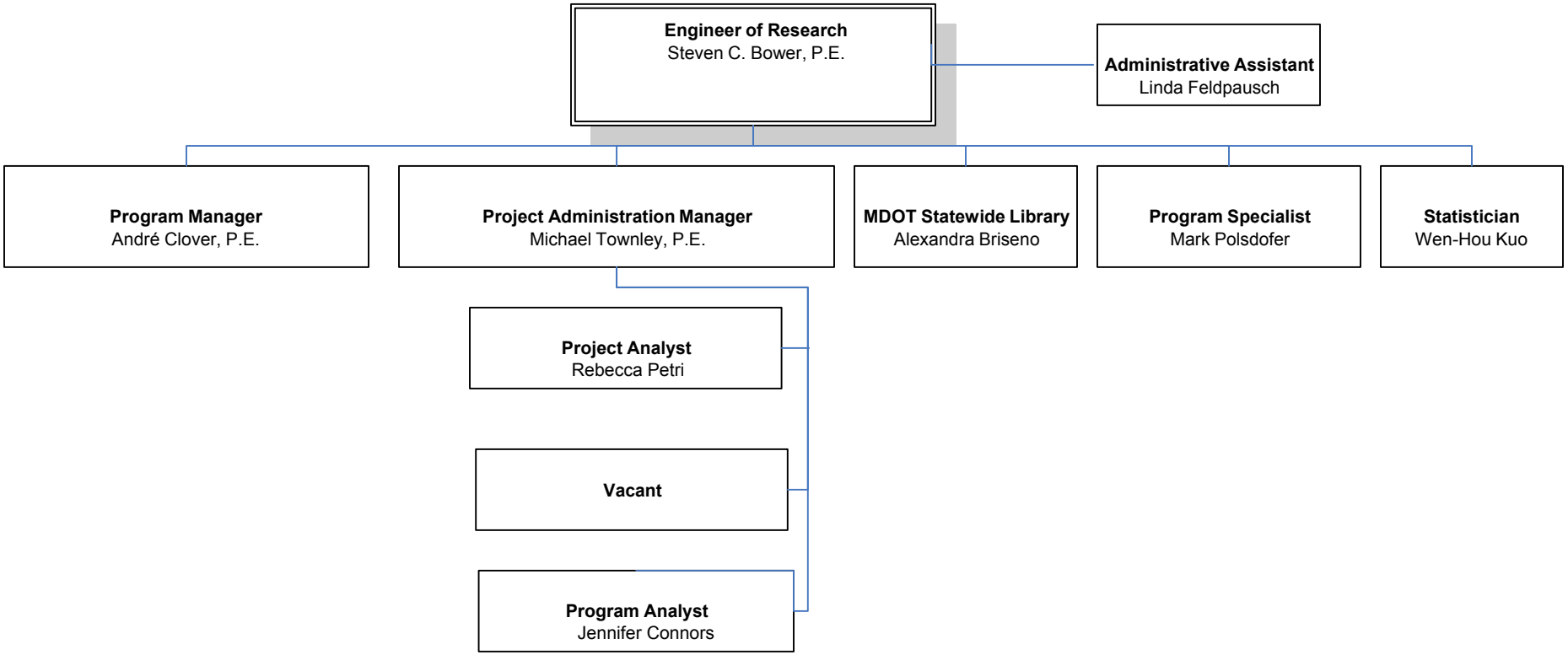
Research Advisory Committee (RAC)
Planning and Finance
RAC Co-Chairs: David Wresinski, Myron Frierson
RBMT Liaison: Roger Safford
Focus Area Managers (FAM): see below
Research Manager: Mark Polsdofer

- **Asset Management**
  FAM: Bill Tansil, Wendi Burton
- **Contract Administration**
  FAM: Demetrius Parker
- **Finance**
  FAM: Ed Timpf
- **Non-Motorized Planning & Development**
  FAM: Deb Alfonso
- **Program Development**
  FAM: Denise Jackson
- **Transportation Policy**
  FAM: Polly Kent
- **Travel Demand Forecasting**
  FAM: Susan Gorski

Michigan Department of Transportation

APPENDIX 1.3

Bureau of Field Services
Research Administration
Organizational Chart



Wednesday, September 22, 2015

Michigan Department of Transportation
Research Administration
Bureau of Field Services

Who We Are

The Research Administration Section includes engineers, research analysts, statisticians, librarians, library assistants, specialists and administrative support staff. Research staff team with MDOT subject area experts, university researchers, private research firms, industry experts, and local government to conduct transportation related research.

How We are Funded

Research projects are funded primarily by the State Planning and Research (SPR) Part II Program. Program administration is funded by state funds.

What We Do

Research Administration oversees the entire MDOT research program which includes both individual research projects and pooled fund studies with other states. Multiple transportation research "Centers of Excellence" are also managed by the Research Administration Section.

MDOT utilizes a tiered approach for program development and project administration. The approach engages senior executives, managers, subject area experts, and field staff. In addition, external research stakeholders ideas are solicited during the research idea development phase of program development to ensure their continued input into the development of the MDOT research program.

Expertise

Our office supports and facilitates research in Program/Project Development, Delivery and Operations, Multi-Modal Transportation, and Planning/Finance. Research projects are managed by experts from Bridges/Structures, Design, Safety, Environment, Workforce Development, Safety & Security, Mobility & System Operations, Pavements, Materials, Construction, Geotechnical, Intelligent Transportation Systems, Connected Vehicle Research, Maintenance, Freight, Passenger Transportation, Rail, Aeronautics, Maritime, Planning, Asset Management, Policy, Finance and Contract Services.

Contact Information

The Michigan Department of Transportation
Research Administration (Mail Code E020)
Construction Field Services Building
8885 Ricks Road
P.O. Box 30049
Lansing, Michigan 48909

Phone: 517-636-4555
Fax: 517-322-1262
Mail: MDOT-Research@michigan.gov
Web Site: www.michigan.gov/mdotresearch

MDOT
Michigan Department of Transportation

APPENDIX 1.5

Bureau of Field Services
Research Administration
Roles and Responsibilities

RESEARCH ADMINISTRATION

- Serve in various roles/on committees, including EOC, Pavement Committee, Research Executive Committee, state TRB representative, AASHTO Research Advisory Committee, TRB coordinator.
- Provide strategic planning for long-term research needs.
- Establish section priorities/direct day-to-day operations.
- Oversee budget.
- Authorize purchases for procurement card and MAIN.
- Process internal financial controls (two years)

RESEARCH PROGRAM ADMINISTRATION

- Update and maintain Research Administration Manual.
- Ensure compliance with State Planning · &· Research (SPR), Part II, federal requirements.
- Manage biennial research program:
  - Individual projects.
  - University Transportation Centers (UTCs).
  - Research Centers of Excellence.
  - Transportation pooled funds.
- Develop and manage program budgets:
  - Research Centers of Excellence.
  - SPR, Part II, program.
- Maintain and support the research project tracking tool spreadsheet.
- Maintain records retention schedule for projects.
- Provide training to MDOT staff in project management and other program administrative roles.
- Maintain forms management process.
- Update Research Administration processes and procedures.
- Conduct/attend research peer exchanges.
- Oversee biennial program development process:
  - RAC/REC meetings.
  - Call for Ideas.
  - Research Summit.
  - Problem statement development.
  - RFP/vendor selection process.

RESEARCH PROJECT ADMINISTRATION

- Process contracts:
  - MPINS.
  - MFOS.
  - Subcontracts.
  - Contract changes.
- Create and maintain project file management systems (paper, electronic).
- Create, publish and distribute annual report.
- Perform project closeouts.
- Administer project quarterly reporting.
- Process monthly invoices.
- Process MAIN entries for invoice payments.
- Administer end-of-year payables.
- Facilitate project meetings:
  - Create and distribute agendas and minutes.
- Transition from program development to project administration.
- Perform project-related activities to transportation pooled funds.
- Update/maintain project information in the research project tracking tool.

LIBRARY SERVICES

- Perform literature searches:
  - Research biennium projects.
  - Others as requested.
- Perform MDOT research project updates to federal research databases:
  - Transportation Research International Documentation (TRID).
  - Research in Progress (RiP).
- Provide lending materials for the PE exam.
- Act as OITT representative for Research Administration.
- Manage Web site updates for both the Library and Research Administration.
- Assist with research requests and other transportation-related material from MDOT staff using library materials and online databases.
- Manage publications:
  - Cataloging for Construction Field Services (CFS) library.
  - Ordering.
  - Publishing to OCLC (national/international library database).
  - TRR access (federal publications).
  - AASHTO.
  - TRB.
- Assist with MDOT research report distribution:
  - Assign report numbers.
  - Upload to CFS Web site.
- Participate in Midwest Transportation Knowledge Network (MTKN).
- Serve as a member of the Transportation Librarian Pooled Fund.
- Act as a repository for MDOT historical documents.
- Creates library marketing materials.
- Facilitates survey requests.

IMPLEMENTATION/BEST PRACTICES

- Identify and communicate best practices.
- Assist with research project selection, management and implementation.
- Identify, track and report implementation success stories.

OUTREACH

- Encourage MDOT staff committee involvement:
  - State (universities, regions, pavement, bridge, contracts, etc.).
  - National (AASHTO, TRB, NCHRP).
  - Information sharing with other state DOTs.
- Facilitate NCHRP annual program ballot.
- Facilitate TRB site visits.
- Provide survey facilitation and retention:
  - AASHTO.
  - FHWA.
  - University.
  - State DOTs.
- Facilitate NCHRP annual problem statement submission.
- Facilitate NCHRP annual panel nominations.
- Conduct annual university and region site visits.
- Participate in MDOT conferences.
- Research staff committee participation.
- Publish newsletters, Research Spotlights, and other relevant research publications.
- Promote innovation in research.

TECHNICAL SUPPORT

- Provide consultation (data collection, modeling, quality assurance, quality control, experimentation).
- Offer workshop training.
- Provide survey support.
- Review statistical aspects of research problem statements and interim/final research reports.
- Review research proposals to identify the least statistical experience required by the research team.
- Provide project management assistance.
- Provide technical writing assistance.

Joint MDOT-FHWA Research, Development, and Technology Transfer Program Evaluation For 2013
March 23, 2012

Introduction

The Research, Development, and Technology Transfer Program (RD&T) provides a structured multi-modal approach to investigate and implement better ways to design, build, operate, and maintain the state's transportation infrastructure. The process is a collaborative effort including MDOT, academia, industry, private research firms, and FHWA. Procedures are documented in MDOT's Research and Implementation Manual.

Management Approach

MDOT Central Office

The Michigan Department of Transportation (MDOT) conducts research in order to help fulfill its mission of "providing the highest quality integrated transportation services for economic benefit and improved quality of life." MDOT's Research Administration Section, Bureau of Field Services is responsible for administering the research program. This includes program development, program management and implementation of program results. Technology transfer is also encouraged from both state level and national level sources of new technology. This is accomplished through cooperative efforts with other states, the federal government and universities through organizations like TRB, NCHRP, pooled fund efforts and the University Technical Centers (UTC).

A tiered approach is used to identify, prioritize, manage, and implement RD&T activities. Overall strategic direction and final prioritization of research needs is provided by the Research Executive Committee (REC). Research Advisory Committees (a total of four committees) help channel research needs from broad functional areas within MDOT. Each research study advances under the direction of a Research Advisory Panel.

The Research Administration Section manages the RD&T program and the development of the SPR, Part II work program in four phases: 1) Research idea development 2) Problem statement development 3) Request for Proposals and 4) Program Management. Each program development cycle spans a two year period. External stakeholders participate in the first two phases of program development. The biennial SPR, Part II work program is submitted to FHWA for approval and funds are obligated on a yearly basis.

MDOT conducts a Peer Exchange every three to five years with other state DOTs, FHWA, TRB and research partners from the private sector. The Peer Exchanges allow MDOT to learn of possible improvements to the RD&T program based on what other states have experienced with their respective research program.

MDOT also sponsors TRB visits every one to two years. This allows TRB representatives to participate in a multi-day session with MDOT staff from various levels throughout the Department. This facilitates information sharing between MDOT and TRB staff on a variety of issues related to transportation.

FHWA Michigan Division
The FHWA works in partnership with the MDOT Research Administration Section to carry out the RD&T program. FHWA reviews the proposed research studies and the annual SPR, Part II work program for eligibility, offers comments, approves the program of eligible studies, and obligates Federal funds. FHWA reviews pooled fund proposals and secures approval for projects where MDOT is lead agency. FHWA also facilitates pooled fund transfers when MDOT is a participant in other pooled fund studies. While FHWA staff participates on some Research Advisory Panels to help refine study objectives and products, the day-to-day management of the RD&T program is MDOTs responsibility.

Specific actions and responsibilities are also identified in the November 2011 MDOT and FHWA Stewardship and Oversight Agreement.

Strengths and Weaknesses

Strengths

- Established program and guidance.
- Existing partnerships with research universities.
- The MDOT three tiered research management approach provides an engaged process, from all levels of the organization, when setting research priorities and guiding research studies.
- Knowledgeable technical staff involvement helps assure research results respond to critical problems.
- Active participation in Pooled Fund projects maximizes the leveraged use of Research dollars.

Weaknesses

- Active Research Advisory Panel involvement by subject area experts competes with regular duties.
- The administrative process for solicitation and award reduces responsiveness in some cases.
- Insufficient state matching funds

Legal Requirements
The legal requirements applicable to the RD&T program are being met.

23 USC 505 provides a two percent set aside of apportioned funds for State Planning and Research activities. Not less than 25 percent of the set aside must be used for State RD&T activities. MDOT documents the proposed use of these funds in work program, referred to as SPR, Part II for approval by FHWA. Applicable legal references are listed below:

- 23 USC 505
- 23 CFR 420
- 49 CFR 18 and 19

Core Elements and Concerns
The RD&T program has four core elements:

1. A process for identifying and prioritizing research needs
2. A process for conducting and managing research studies
3. A process for assess research results and developing promising findings into useful products
4. A process for transferring new technology - implementing and integrating results into standard practice.

This evaluation identified no significant areas of concern. The processes for identifying and conducting research are well established. The processes for assessing and implementing results were evaluated during the last Peer Review and process improvements were made to more clearly identify research deliverables including implementation opportunities. Implementation and technology transfer possibilities, resulting from a proposed research project, are thoroughly considered prior to project initiation.

Technology transfer opportunities also result from collaboration with other states and other national organizations. MDOT actively participates in AASHTO, TRB, NCHRP, SHRP-II and EDC initiatives. The Research Administration section is responsible for coordinating annual TRB attendance and reporting out technology transfer opportunities from the annual meeting. Research Administration also solicits and tracks AASHTO, TRB, and NCHRP surveys and outreach efforts to ensure that MDOT participates and learns from other state DOT's with similar challenges.

Long Term Vision (five to ten year)
The RD&T Program continues to identify, conduct, and implement research that addresses high priority transportation issues. The process takes advantage of strong relationships with Michigan research universities as well as cooperative national pooled efforts that leverage research dollars. The program is structured and positioned to assess the results of national research efforts and promote and implement items that address Michigan issues. MDOT continues to assess the effectiveness of the research program. To this end, the following goals have been identified as part of a long term vision to further improve the program,

1. Further integrate the research program into Department operations.
2. Continue to promote research program involvement from staff throughout the organization.
3. Improve efficiencies in research program development and management.
4. Improve identification and tracking of research implementation results.
5. Quantify cost savings and other benefits from research implementation.
6. Improve performance measures used to measure Research program success.

Joint Program Management Approach
To address the core element concerns and achieve the vision MDOT and FHWA will:

- Work with partners to identify research needs, develop research proposals, secure program approval, and monitor progress.
- Work with partners to achieve efficiencies in managing the RD&T program.
- Assess current processes for identifying, prioritizing, and translating research successes into adopted practices.
- Develop strategies for change as needed.

Performance Indicator

The November 2011 Stewardship agreement identifies the following performance indicator:

Improve the number of projects containing some amount of new research, development, or technology transfer each year.

Potential Risks

No areas of significant risk were identified in this evaluation. One potential "what if" statement was evaluated just to test the no risk assumption:

> **If** the State does not have an effective process to adopt, market, and implement new technology,
> **Then** the benefits to be derived from such innovations in terms of increased efficiency, quality, and durability will not be realized.

The evaluation and scoring of this risk resulted in an extremely low number, 0.94 on a scale of 0 to 4. , However the exercise offered the opportunity to contemplate what could happen if the ability to implement new technology diminished.

Michigan Department of Transportation

RESEARCH CENTERS OF EXCELLENCE

Center for Sustainable Infrastructure & Structural Testing

Lawrence Technological University

Mission and Facilities

The Center for Sustainable Infrastructure & Structural Testing conducts research, education and technology transfer activities related to corrosion mitigation and increased durability of bridges and structures. Under the leadership of Dr. Nabil Grace, the center utilizes a range of specialized laboratory equipment and facilities to evaluate the strength of concrete bridges, identify the causes of deterioration in bridge decks, develop innovative, long-lasting materials, and identify structures that are at high risk for failure.

Lawrence Technological University has the largest structures laboratory in Michigan. This allows the center to conduct full-scale testing of bridges, slabs and structures under large loads and extreme weather conditions. The researchers at the center are able to fabricate bridges in-house and simulate traffic flow, fire conditions, blowing wind and freezing rain.

Rapid-Response Services for MDOT

The center is available to support MDOT staff by providing quick-turnaround evaluation of materials and design concepts. For example, MDOT recently asked the center to investigate the fatigue life of a splice of rebar under 2 million cycles of repeated loading. Another request involved investigating the impact of splice length between two rebars. MDOT staff use the results of these investigations to enhance design and construction work.

The center also focuses on economical and practical methods for evaluating the strength of concrete bridge decks. The center recently completed a project for MDOT in which researchers identified the causes of concrete deterioration in bridge decks and developed a performance-based threshold and procedure to help MDOT staff identify those decks at high risk for falling concrete.

Although Lawrence Tech researchers specialize in research on long-term bridge life, the center also assists MDOT by investigating and developing innovative materials for use in short-term bridge repairs. For example, the center has worked with MDOT to apply a fiber-reinforced polymer (FRP) wrap to temporarily support deteriorating columns. The fix is inexpensive, fast and effective.

Additional services available include examining samples collected in the field, developing guidelines and recommendations for using FRP materials, inspecting bridge components in use, and offering training sessions for MDOT engineers.

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Research Centers of Excellence

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Lawrence Tech Engineering

MDOT

Michigan Department of Transportation

RESEARCH CENTERS OF EXCELLENCE

Center for Structural Durability

Michigan Technological University

Mission and Facilities

The Center for Structural Durability (CSD) was established in 2000 to provide research, education and technology transfer services for MDOT related to bridge durability. CSD researchers have expertise in materials science and structural engineering. Led by director Dr. Tess Ahlborn, the CSD investigates the use of ultra-high-performance concrete in structures, explores rapid construction approaches for prestressed concrete bridges, and monitors long-term durability through nondestructive methods like remote sensing.

The CSD is located at Michigan Technological University (MTU) in the Upper Peninsula. It is a resource for MDOT as well as local agencies and consultants. The Benedict Laboratory at MTU provides an expansive space for testing large concrete structures and a room specifically for mixing ultra-high-performance concrete. The CSD team also accesses a number of additional facilities and equipment on campus for preparing concrete specimens and analyzing the characteristics and performance of all materials.

Rapid-Response Services for MDOT

The CSD is available to provide MDOT staff with a range of quick-turnaround services such as software analysis and modeling, accelerated load testing, lab testing of high-performance concrete, and information gathering. Below are two examples of short-term projects carried out for MDOT.

- MDOT contacted the CSD in 2012 for help in assessing how spreadsheets developed by the Ohio Department of Transportation for performing load rating calculations for corrugated metal pipe culverts could be applied under Michigan conditions. The spreadsheets used both Load Factor Rating (LFR) and Load and Resistance Factor Rating (LRFR) methods. The CSD evaluated the spreadsheets for their adherence to reference guides and then modified them to function with Michigan truck loads (both legal and overweight). The resulting report is helping MDOT engineers better perform load ratings of culverts.

- The CSD helped MDOT create a nomination package to submit to the American Society of Civil Engineers to secure recognition of the Mackinac Bridge as a National Historic Civil Engineering Landmark. The CSD assisted in capturing the rich history of the bridge, from the design and construction of the structure to the individuals who were instrumental in pushing the project forward. The CSD is currently assisting with another bridge nomination package to help MDOT gain recognition for its significant structural accomplishments.

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Michigan Tech MDOT

Michigan Department of Transportation

RESEARCH CENTERS OF EXCELLENCE

Transportation Materials Research Center

Michigan Technological University

Mission and Facilities

Since 1998, the Transportation Materials Research Center (TMRC) at Michigan Technological University has provided MDOT with testing and analysis services related to concrete, asphalt, aggregates and soils. Dr. Stan Vitton manages the center, bringing years of experience in geotechnical, civil and mining engineering. The TMRC utilizes a number of advanced laboratories and pieces of equipment when responding to testing requests, such as:

- A large, multistory concrete laboratory accredited by the AASHTO Materials Reference Laboratory and the Cement and Concrete Reference Laboratory for testing large concrete structures.
- A concrete petrology laboratory that facilitates sophisticated environmental scanning, electron microscopy and mineralogy to identify concrete distress problems.
- A complete geotechnical soils investigation laboratory that supports testing related to resilient modulus for base, subbase and subgrade materials.
- High-strain rate testing equipment for concrete, asphalt and aggregates.
- Two asphalt laboratories for conducting a range of tests related to both warm-mix and hot-mix asphalt, binders, and coarse and fine aggregate properties.

Rapid-Response Services for MDOT

The TMRC readily responds to a range of requests from MDOT staff. For example, in 2012 MDOT staff asked the TMRC to investigate the accuracy and reliability of the Michigan Sand Cone Test, which is used to determine when a given soil will achieve its maximum dry density. MDOT also asked for help investigating the source of distress in pavement joints on M-14, analyzing the freeze-thaw properties of recycled concrete on I-75, studying the overall stability of the highway and slope of US-2 near Epoufette, and making recommendations on how best to stabilize an area experiencing erosion along M-25 in Sanilac County. The TMRC draws on the expertise of Michigan Tech faculty and graduate students to assist MDOT on an ongoing basis by:

- Conducting high-level analysis and microscopic examinations of pavement slab samples.
- Investigating slope failures resulting from erosion or blasting.
- Testing problematic materials in use on a construction project.
- Providing information about the geologic and geotechnical properties and aspects of construction sites.
- Investigating abandoned underground mines.
- Carrying out repetitive testing to validate MDOT's test methods.

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Research Centers of Excellence

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Michigan Tech MDOT

Michigan Department of Transportation

RESEARCH CENTERS OF EXCELLENCE

Pavement Research Center

Michigan State University

Mission and Facilities

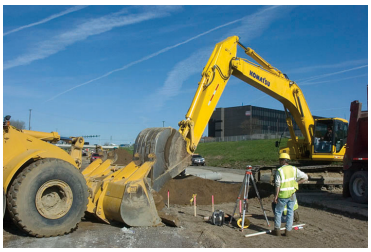
The Pavement Research Center of Excellence (PRCE) was established in 1995 at Michigan State University (MSU) to provide research, education and outreach related to pavements in Michigan. Director Dr. Karim Chatti works closely with faculty and graduate students to carry out a range of pavement-related activities, such as nondestructive testing of asphalt and concrete pavements, roughness characterization, pavement modeling, asphalt mix characterization, pavement performance testing, and preventive maintenance studies.

The PRCE carries out testing and analysis at two laboratories at MSU. The Civil Infrastructure Laboratory supports the evaluation of materials, pavements and structures with large-scale testing facilities and equipment. The asphalt laboratory is accredited by the AASHTO Materials Reference Laboratory. It supports investigations of the mechanical and physical properties of asphalt binders and mixtures to evaluate how they perform in the long-term under different loading and weather conditions.

Rapid-Response Services for MDOT

The PRCE has provided short-term assistance to MDOT staff by investigating drainage problems, substrate structure, and longevity properties of materials. MDOT staff also have turned to the PRCE for help capturing the state of the art on design issues, reviewing performance data for pavement management purposes, and observing pavement performance in the field alongside MDOT engineers.

The PRCE recently conducted a one-day short course related to mechanistic-empirical pavement design to support implementation at MDOT. Additional short courses are available to MDOT staff, based on existing needs. Potential topics include:



- Design of new and rehabilitated asphalt and concrete pavements.
- Rehabilitation of asphalt and concrete pavements.
- Cost-effective pavement preservation policies and practices.
- Maintenance and pavement management systems.
- Role of material characterization in improving pavement performance.
- Best practices for in-place asphalt pavement recycling.
- Use of reclaimed asphalt pavement in hot-mix asphalt layers.
- Quality control and quality assurance to improve highway construction.
- Sustainable road construction and materials.

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Research Centers of Excellence

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MICHIGAN STATE UNIVERSITY | College of Engineering

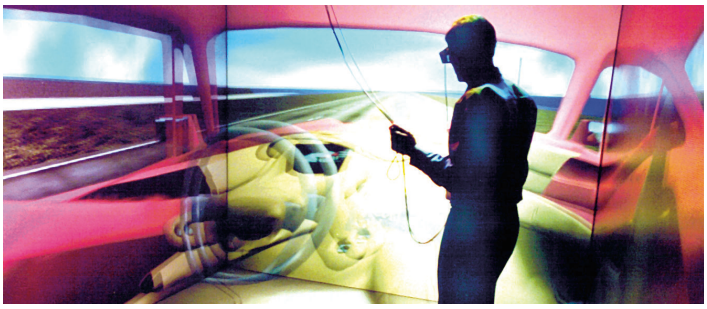
MDOT

Michigan Department of Transportation

RESEARCH CENTERS OF EXCELLENCE

Bridges and Structures Research Center

University of Michigan



Mission and Facilities

The Bridges and Structures Research Center at the University of Michigan focuses on finding innovative, effective and practical solutions to problems related to bridges and structures. Under the direction of Dr. Sherif El-Tawil, the center evaluates new technologies developed by MDOT and supports the development of new materials, components and tools for advancing the preservation and safety of transportation infrastructure.

The center utilizes state-of-the-art facilities and equipment at the university, including a structural engineering laboratory for testing large-scale elements and a computational structural simulation laboratory that supports sophisticated modeling of how structural materials and components will behave under different conditions. The university also boasts one of only a few 3-D visualization laboratories in the country, which can be used for immersive visualizations of models involving intersections, construction sites and structures. The CAVE (Cave Automatic Virtual Environment) includes unrestricted navigation (walking, flying, looking), interaction with virtual objects, and directional sound.

Rapid-Response Services for MDOT

In 2012, the center team met with MDOT staff to present the latest information about ultra-high-performance concrete (UHPC). This specially formulated concrete is capable of achieving high compressive and tensile strength, exceptional energy absorption and durability, and self-healing properties when properly developed and reinforced with steel fibers. The center developed the first non-proprietary UHPC in the United States and is working with MDOT to identify the most effective means for utilizing the new material.

The center also responds to MDOT requests for testing and simulation on an ongoing basis. For example, the center recently provided MDOT research staff with guidance on how to model the response of abutment walls with battered piles. Below are other examples of the services available to MDOT staff through the center.

- Finite element modeling of structural components and systems.
- Evaluation and assessment of bridge systems and components.
- Assessment of the serviceability of structures.
- Assistance with implementation of research findings.
- Full-scale testing of bridge components or systems.
- High-fidelity finite element simulations.

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Research Centers of Excellence

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UNIVERSITY OF MICHIGAN MDOT

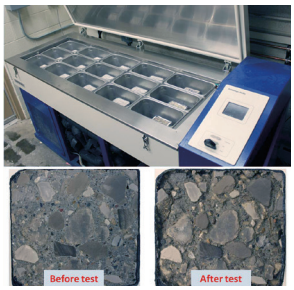
Michigan Department of Transportation

RESEARCH CENTERS OF EXCELLENCE

Concrete Pavement Performance Center

University of Michigan

Mission and Facilities



The Concrete Pavement Performance (CPP) Center at the University of Michigan (U of M) provides technical assistance to MDOT related to the performance of in-service concrete pavements. Under the leadership of Dr. Will Hansen, the CPP conducts forensic investigations of pavement performance, develops surface treatments that extend pavement life, and studies the impact of environmental distress on concrete.

The CPP uses state-of-the-art research equipment for carrying out testing, such as digital microscopes for determining the quality of the concrete, exposure systems for measuring deterioration from salt and frost, a mechanical tester for measuring the strength of concrete, a specialized dilatometer for measuring contraction and expansion of concrete during freeze-thaw cycles, and equipment for determining the resistance of concrete to cracking during heating and cooling.

Rapid-Response Services for MDOT

The CPP carries out both laboratory and field investigations for MDOT on an ongoing basis, such as:

- Conducting forensic investigations into the factors influencing performance of unbonded overlays and jointed plain concrete pavement.
- Developing procedures for finite element analysis and mechanistic-empirical pavement design.
- Studying air-void systems in concrete and their impact on durability.
- Using cryogenic dilation of concrete to measure expansion and contraction associated with freezing and thawing.
- Developing recommendations for combating premature deterioration and other impacts of environmental distress.

In 2012, MDOT staff asked the CPP to investigate the impact of a variety of surface treatments on concrete durability on M-14 using freeze-thaw salt-scaling tests. The MDOT/CPP team developed a poster on the study results for presentation to MDOT staff and U of M students. MDOT staff also asked the CPP to determine how varying cementitious blends and admixtures affect heat development at different temperatures. The CPP is working closely with MDOT staff to incorporate the results into pavement design practices.

In addition, the CPP has begun developing a new cementitious blend for rapid repair concrete applications by experimenting with different types of cements and admixtures. MDOT's goal is to make concrete repairs that are strong enough to withstand traffic within six hours of application. The CPP also is working with MDOT engineers to investigate how to accelerate the curing of rapid repair concrete in colder temperatures when the summer heat is not available to aid the process.

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Research Centers of Excellence

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UNIVERSITY OF MICHIGAN MDOT

Michigan Department of Transportation

RESEARCH CENTERS OF EXCELLENCE

Center for Structural Durability

Western Michigan University

Mission and Facilities

The Center for Structural Durability at Western Michigan University (WMU) evaluates the materials, design, construction, repair and maintenance of highway structures to improve their durability and prolong service life. Led by Dr. Haluk Aktan, the center specializes in performing computer simulations and nondestructive evaluation (NDE) of bridge elements. Using a range of equipment, such as ground-penetrating radar, ultrasonic systems, laser trackers and laser scanners, the center team investigates how structures are performing without damaging them.

Rapid-Response Services for MDOT

The center responds to ongoing requests from MDOT staff to assist with evaluating the conditions of structures in the field. For example, MDOT staff contracted with the center for assistance in determining why certain concrete bridges were cracking. The team developed finely detailed computer models to demonstrate the range of scenarios that could be causing the problem, and MDOT used the results to develop a plan for addressing the damaged structures.

Beyond conducting field evaluations and computer simulation, the center provides guidance and support to MDOT staff involved in evaluating structural components or monitoring bridge health. The center is also available to assess approaches proposed by researchers for using NDE methods as part of new research projects.

The center is currently working with MDOT to develop a process for implementing accelerated bridge construction (ABC), a bridge replacement method in which the bridge components are built off-site and assembled or moved into place. The process is appealing because it reduces road closure time from months to weeks. The center evaluates a range of materials used for connecting and sealing bridge components and recommends materials that will support long-term durability. The team also has the capability to review and evaluate plans submitted by contractors for ABC and provide site-specific implementation advice.

In 2012, the center held a workshop on ABC design and lessons learned for bridge engineers, contractors and project managers. Presenters at the workshop included Dr. Aktan, WSU faculty members, MDOT engineers and FHWA representatives. More than 50 people participated. Dr. Aktan and his team are available to develop and lead additional seminars or workshops on bridge-related topics requested by MDOT.

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Research Centers of Excellence

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Michigan Department of Transportation

RESEARCH CENTERS OF EXCELLENCE

Center for Bridges & Structures Research

Michigan State University

Mission and Facilities

The Center for Bridges & Structures Research at Michigan State University (MSU), directed by Dr. Rigoberto Burgueño, is dedicated to advancing the performance and durability of highway structures in Michigan through research and technology transfer activities. The center explores innovative approaches to materials, design, construction, repair and maintenance of highway structures to extend the time between maintenance applications and prolong overall service life.

The center has access to the Civil Infrastructure Laboratory at MSU, a modern facility that supports both small-scale and large-scale testing of structures and pavements. Researchers can simulate mechanical and environmental loading capabilities when evaluating new concrete technology, proposed repairs and the effects of early-age damage in bridges.

Rapid-Response Services for MDOT

The center offers expertise in fiber-reinforced polymer (FRP) composite materials, which can be used to strengthen and rehabilitate existing structures as well as for new bridge designs. The center is prepared to assist in:

- Specification development for FRP composite materials.
- Design of FRP composites for new construction.
- Testing of FRP composite and other materials and characterization of short- and long-term behavior.
- Evaluation of FRP composite and other advanced materials at very small (nano) scales and very large scales.

The center is also capable of assisting MDOT in developing innovative bridge systems for the future using finite element modeling and analysis and experimental characterization of high-performance concrete materials and structures.

To assist in management and maintenance of MDOT's existing bridge system, the center has testing, monitoring and analytical capabilities in the following areas:

- Evaluation of structural defects and failures.
- Sensor technology and structural health monitoring.
- Precast/prestressed bridge elements and systems.
- Sensor technology and structural health monitoring methods.
- Degradation models for reinforced concrete structures that utilize probability-based approaches, solid mechanics approaches, and artificial intelligence methods.
- Bridge management models and algorithms.
- Testing of bridge components and systems under extreme loads and temperatures.

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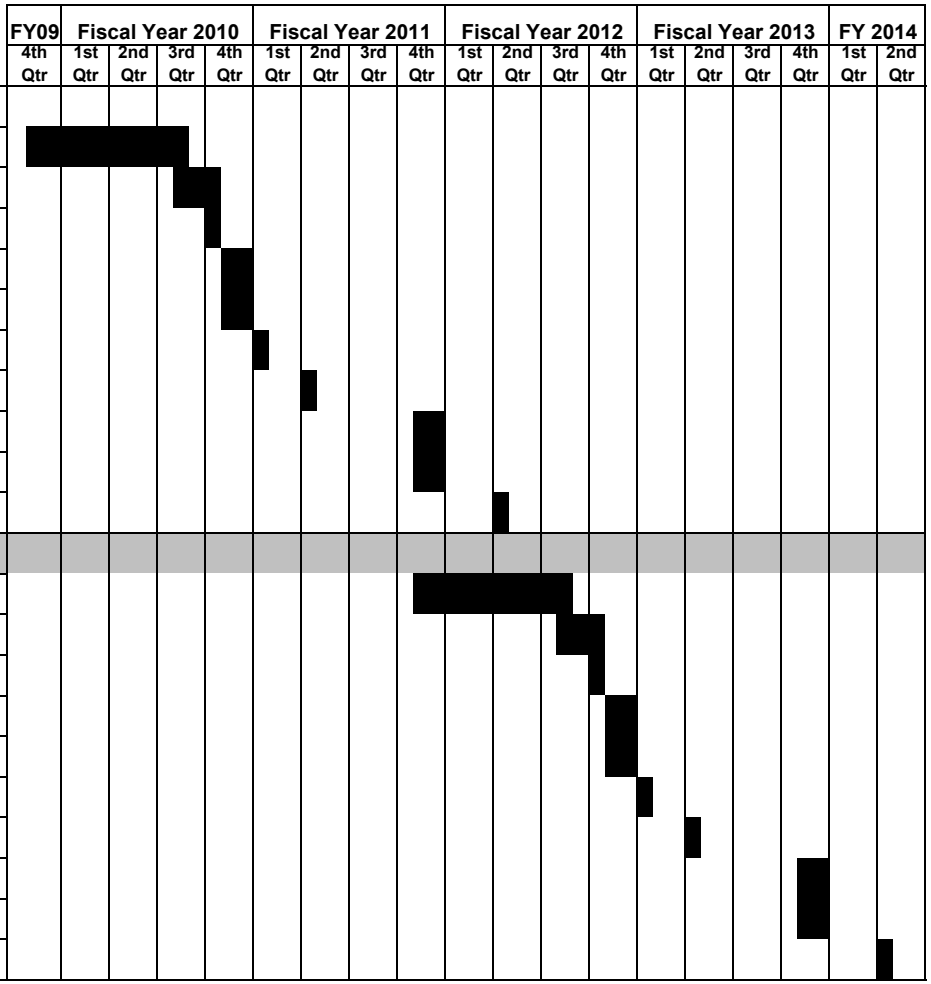
MICHIGAN STATE UNIVERSITY | College of Engineering

MDOT

Appendix 2.1: MDOT Research Project Planning/Programming Process

Activity (Fiscal Year)	Target Date
Research Idea Development (11-13)	August/September 2009 - May 2010
Problem Statement Development (11-13)	May 2010 - July 2010
MDOT Program Approval	July-2010
FHWA Program Approval (11)	August 2010 - Sept 2010
FHWA Pre-Program Approval (12)	August 2010 - Sept 2010
Request For Proposals (11)	October 2010 (Program Year 2011)
Request For Proposals (12)	January 2011 (Program Year 2012)
FHWA Program Approval (12)	August 2011 - Sept 2011
FHWA Pre-Program Approval (13)	August 2011 - Sept 2011
Request For Proposals (13)	January 2012 (Program Year 2013)
Research Idea Development (13-15)	August/September 2011 - May 2012
Problem Statement Development (13-15)	May 2012 - July 2012
MDOT Program Approval	July-2012
FHWA Program Approval (13)	August 2012 - Sept 2012
FHWA Pre-Program Approval (14)	August 2012 - Sept 2012
Request For Proposals (13)	October 2012 (Program Year 2013)
Request For Proposals (14)	January 2013 (Program Year 2014)
FHWA Program Approval (14)	August 2013 - Sept 2013
FHWA Pre-Program Approval (15)	August 2013 - Sept 2013
Request For Proposals (15)	January 2014 (Program Year 2015)



Michigan Department
Of Transportation
5315 (6/12)

RESEARCH ADMINISTRATION
RESEARCH IDEA FORM

For Research staff use only	Research Idea No:	

If you have an idea that you would like to have considered as a future research project please complete and return this form to Research Administration, at the address below, or e-mail to: mdot-research@michigan.gov.

Do not include ideas that are your intellectual property. The selected research ideas will be posted in a competitive request for proposal (RFP).

1. Please list the MDOT strategic research priority number for this idea:

2. Research Idea Title:

3. Problem to be addressed: *(What is the nature of the problem needing solution? What aspects of the problem are especially significant? How does the problem adversely affect transportation facilities or service?)*

4. What research do you propose to solve the problem?

5. Anticipated Benefits: *(If this research is successfully completed, what benefits will the Department realize? What is their value?)*

6. Urgency: *(How urgent is this research? Is it important that it be completed by a particular date? What date and why?)*

7.

Submitted by (name)	
Title	
Bureau/Region or Agency	
Office/TSC or Address	
Section/Unit or City, State, Zip	
Phone	
E-mail	
Date submitted	

Please submit to:

Mr. Steven C. Bower, P.E.
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Research Administration
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E-mail: mdot-research@michigan.gov

Appendix 2.3 - Phase 1 Research Idea Development: MDOT Three-Year Planning and Program Approval Timeline

Illustrated for projects that begin in FY 2013 - FY 2015

				FY 2011			Fiscal Year 2012												Fiscal Year 2013											
				4th Qtr			1st Qtr ('12)			2nd Qtr			3rd Qtr			4th Qtr			1st Qtr ('13)			2nd Qtr			3rd Qtr			4th Qtr		
Phase	**Step**	**Target Date**	**Assigned to**	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
Phase 1. Research Idea Development	1.1 Determine strategic priorities for MDOT	Aug - Sept 2011	REC		X																									
	1.2 Call for research ideas from all stakeholders	Oct 2011	Engr. Research				■																							
	1.3 Develop research ideas	Nov-Dec 2011	Stakeholders					■	■																					
	1.4 Notify stakeholders about the Research Summit	Jan 2012	Engr. Research							■																				
	1.5 Collect input; rank research ideas and determine PMs	Jan 2012	FAMs							■																				
	1.6 Review FAM rankings and submit to the REC	Feb 2012	RACs								X																			
	1.7 Select research ideas; confirm PMs	Early March 2012	REC									X																		
	1.8 Send research ideas to FHWA for eligibility ruling	Late March 2012	Engr. Research									■																		
	1.9 Receive training and prepare for the Research Summit	April 2012	PMs and FAMs										X																	
	1.10 Discuss research needs during the Research Summit	Early May 2012	Stakeholders											X																
Phase 2.	Problem Statement Development	May - July 2012												■	■	■														
Phase 3.	Approval of Annual Programs and RFPs	Aug 2012 - Jan 2014															■		■			■					■	■	■	

■ = Phased Work

X = Meeting

APPENDIX 2.4

RESEARCH ADMINISTRATION
PROBLEM STATEMENT

Choose an item.

PROPOSED RESEARCH PROJECT TITLE Title should be less than 15 words	
OR NUMBER or TPF STUDY NUMBER	MDOT PROJECT CATEGORY & STRATEGIC PRIORITY NO. Choose an item Choose an item Choose an item Choose an item

PROJECT MANAGER OR PROBLEM STATEMENT AUTHOR	
PROBLEM STATEMENT AUTHOR	DATE Click here to enter a date
TELEPHONE NO.	E-MAIL ADDRESS
BUREAU/REGION/OFFICE/SECTION/UNIT	PROJECT MANAGER'S NAME (IF DIFFERENT THAN PROBLEM STATEMENT AUTHOR)

PROBLEM TO ADDRESS

IN 200 WORDS OR LESS, BRIEFLY DESCRIBE THE PROBLEM TO BE ADDRESSED AND WHY IT IS AN ISSUE FOR MDOT

RESEARCH OBJECTIVES

IN 25 WORDS OR LESS, LIST THE RESEARCH OBJECTIVES TO BE ACCOMPLISHED

1. Each objective should be 10 words or less. Press enter for additional entries.

RESEARCH TASKS

LIST THE MAJOR TASKS TO ACCOMPLISH THE RESEARCH OBJECTIVES

1. Tasks should correlate with the estimated person hours on Page 3 of the worksheet. Press enter to add a new task.

ESTIMATED TIMELINE

ENTER START DATE: Enter Project's Start Date ENTER END DATE: Enter Project's End Date

ESTIMATED BUDGET

FROM THE WORKSHEET ON PAGE 3, ENTER THE FOLLOWING: 1.) VENDOR COSTS; 2.) PM/MDOT COSTS; 3.) TOTAL BUDGET

1.) VENDOR COSTS	2.) PM/MDOT COSTS	3.) TOTAL BUDGET
$ 0.00	$ 0.00	$ 0.00

DELIVERABLES

IN 50 WORDS OR LESS, LIST THE DELIVERABLES YOU WOULD RECEIVE AT THE END OF THIS PROJECT. CONSIDER DELIVERABLES SUCH AS 1) DESIGN METHOD, 2) TRAINING, 3) MANUAL OF PRACTICE, 4) PROCEDURE, 5) SPECIFICATION, 6) SOFTWARE AND 7) EQUIPMENT.

1. Deliverables should be 50 words or less. Press enter for additional entries.

IN 100 WORDS OR LESS, EXPLAIN MDOT INVOLVEMENT'S WITH DATA AND SERVICES.

IMPLEMENTATION

DESCRIBE HOW THIS PROJECT WILL BE IMPLEMENTED AT MDOT

EXPLAIN THE EXPECTED BENEFITS/RESULTS FROM THE IMPLEMENTATION OF THIS PROJECT AND POTENTIAL USERS

LITERATURE RESEARCH

SELECT A STATEMENT BELOW REGARDING YOUR REVIEW OF THE LITERATURE AND ADD A NOTE IF RESEARCH IS COMPLEMENTARY:

Choose an item.

NOTE:

POTENTIAL OBSTACLES

IN 25 WORDS OR LESS, WHAT RISKS OR OBSTACLES MAY MAKE CARRYING OUT THIS PROJECT DIFFICULT? WHAT STRATEGIES WILL YOU USE TO OVERCOME THEM?

OBSTACLES	STRATEGIES
❖ Obstacles should be 25 words or less. Press enter for additional entries.	❖ Strategies should be 25 words or less. Press enter for additional entries.

INVESTIGATOR(S)

DESIRED QUALIFICATIONS FOR RESEARCH TEAM:

SELECT THE REQUIRED STATISTICAL QUALIFICATIONS IN AN INVESTIGATOR(S) AND TEAM BELOW:
Choose an item
PRINCIPAL INVESTIGATOR'S NAME: TO BE DETERMINED THROUGH SOLICITATION
ORGANIZATION: TO BE DETERMINED THROUGH SOLICITATION

SEE WORKSHEET ON FOLLOWING PAGES FOR ADDITIONAL INFORMATION AND NOTES

RESEARCH ADMINISTRATION
PROBLEM STATEMENT
WORKSHEET

ESTIMATED PERSON HOURS FOR RESEARCH TASKS

FOR THE RESEARCH TASKS ON PAGE 1, PLEASE LIST THE ESTIMATED PERSON HOURS BELOW:

1.) List Estimated Person Hours for Research Task #1. Hit Enter for additional tasks.

TOTAL ESTIMATED PERSON HOURS CALCULATE TOTAL HOURS ENTERED IN THIS SECTION

ESTIMATED BUDGET

USE THE FOLLOWING EQUATIONS FOR ESTIMATING PROJECT COSTS.
(HOURLY RATES AND PERCENTAGES SHOWN FOR EXAMPLE ONLY.)

1.) CALCULATE VENDOR DIRECT LABOR WITH THIS EQUATION

Estimated Person Hours are the Labor Hours

Direct Labor: Labor Hours x Average pay rate
Example: Direct Labor = 2000 hrs x $45/hr = $90,000.00
Direct Labor: Enter the total estimated person hours from previous section X Average Pay Rate= Cost of Direct Labor

2.) CALCULATE TOTAL VENDOR COST

REQUIRED COSTS
DIRECT LABOR= $ Cost of Direct Labor
FRINGE BENEFITS= $ 10% of Direct Labor Costs
TRAVEL= $ 2% of Direct Labor Costs
SUPPLIES= $ 5% of Direct Labor Costs
OTHER EXPENSES= $ 15% of Direct Labor Costs; Include Student tuition fees
INDIRECT= $ 55% of Total Direct Labor, Fringe Benefits, Travel and Supplies Cost

Total Vendor Cost: Enter DIRECT LABOR Cost+ Enter FRINGE BENEFITS Cost+ Enter TRAVEL Costs+ Enter SUPPLIES Cost+ Enter OTHER EXPENSES Cost+ Enter INDIRECT Cost=$ CALCULATE TOTAL
This is your TOTAL VENDOR COST.
Note: Fill this in on the Vendor Cost section under ESTIMATED BUDGET.

3.) Use MDOT PM BUDGET WORKSHEET to calculate your PM costs.
Enter PM Costs and any notes or calculations. $ Enter Total PM/MDOT Costs
Fill this total in on the PM/MDOT Costs section under ESTIMATED BUDGET

4.) Enter GRAND TOTAL for 2 and 3. $ Enter the totals for #2 and #3 in this section
Fill this total in on the TOTAL BUDGET section under ESTIMATED BUDGET

ANNUAL FINANCIAL BUDGET BREAKDOWN

FY1 $FY1 BUDGET	FY2 $FY2 BUDGET	FY3 $FY3 BUDGET	FY4 $FY4 BUDGET

METHOD OF PAYMENT

SELECT METHOD OF PAYMENT BELOW
Choose an item

INVESTIGATOR(S)

NAMES OF POSSIBLE INVESTIGATORS: Enter names of potential vendors

SELECT RECOMMENDED REQUEST FOR PROPOSAL SOLICITATION: Choose an item.

STAKEHOLDERS

SELECT THE PROJECT'S IMPLICATIONS:
Choose an item.

LIST ANY OTHER STATE, REGIONAL OR NATIONAL AGENCIES AND OTHER GROUPS MAY HAVE AN INTEREST IN SUPPORTING THIS STUDY

DO NOT WRITE BELOW THIS LINE	
FOCUS AREA MANAGER APPROVAL* Select Method of Approval Enter Date of Approval	ENGINEER OF RESEARCH APPROVAL* Select Method of Approval Enter Date of Approval
RESEARCH ADVISORY COMMITTEE CHAIR APPROVAL* Select Method of Approval Enter Date of Approval	RESEARCH EXECUTIVE COMMITTEE CHAIR APPROVAL* Select Method of Approval Enter Date of Approval

*Records of approval are saved in project file.

MDOT employees with questions should contact:
Steve Bower, P.E., Administrator, Research Administration
Phone: 517-636-7777, Fax: 517-322-1262, bowers@michigan.gov
Or review the Research and Implementation Manual

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Project Manager and Focus Area Manager Training
April 17 and 18, 2012

Resources for writing problem statements

1. **Research Idea form**
   This is your starting point. Every problem statement that gets developed has a Research Idea form that was submitted for consideration first. The Research Idea form contains much of the information needed for the full problem statement in abbreviated format. If you weren't the one to submit the Research Idea, talk to the person who did to understand the need driving the research.

2. **Outcomes of Summit discussions**
   Many of the Research Ideas will be developed in more detail by the working groups at the Summit. The cross section of researchers and DOT practitioners in these groups will help you think through potential tasks for completing the project, what deliverables to ask for and what it will take to implement the results.

3. **Networking and connections from the Summit**
   The Summit is a great opportunity to talk with internal and external transportation professionals about research in your focus area. Consider following up with these individuals after the Summit if you need help thinking through a portion of the problem statement.

4. **Literature searches completed by MDOT Library**
   A literature search is a list of citations of completed and in progress research that relates to your topic. MDOT's librarian is skilled in compiling these citations and will provide them to you as you begin to develop your full problem statement. It's critical that you review the results. There may be a completed project that duplicates the research you're proposing. Or a similar study may provide inspiration for the tasks you'll need for a Michigan-specific effort.

5. **Sample problem statements and proposals from past projects**
   Research Administration can provide sample problem statements from previous research projects required similar tasks to what you're proposing, such as laboratory testing and analysis or a survey and data gathering. Reviewing other problem statements can also help you develop the scope of your project, including the estimated person hours and cost.

6. **Problem statement form with guidance**
   Research Administration inserted guidance into a blank Problem Statement form to clarify what information you need to provide and how to present this information in the most compelling way.

7. **TRB Research Needs Statement database**
   This searchable database houses problem statements developed by the TRB technical committees on a wide range of transportation topics. Search this database for projects related to your topic that may help you in scoping your own problem statement.

8. **Research Administration Research Managers**
   Research Administration staff are available to answer your questions, to assist you in thinking through what's needed for a problem statement and to review what you have drafted.

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Project Manager and Focus Area Manager Training
April 17 and 18, 2012

Tips for writing strong problem statements

- You are writing a *problem* statement. Communicate the details of why the current situation is a problem and how the proposed research will help solve the problem.
- Write short, clear sentences that are linked to each other in a logical way. Begin at the beginning, end at the end.
- Avoid acronyms unless you have to use the term over and over and even then spell the acronym out the first time you use it: portland cement concrete (PCC).
- Use technical terms that are required to describe the problem, objectives and deliverables, but avoid jargon that could be replaced by an ordinary word that says the same thing.
- First capture your thoughts in the appropriate section of the form, then go back and rewrite what you've written to make it as clear and simple as possible. Ask someone not in your technical area to read the problem statement to see if they understand it.
- Keep in mind that several different kinds of people will be reviewing your problem statement: other technical people, MDOT managers, investigators, consultants. They will have a transportation background but may not be experts in your area. Make sure what you write is understandable to even those not intimately familiar with the topic.
- Spell check your document.

Plain Language (federal initiative)
http://www.plainlanguage.gov/
Plain language is "communication your audience can understand the first time they read or hear it." Initiated in the mid-1990s, this effort by the federal government emphasizes putting the reader's needs first. Although this initiative is geared toward making federal documents accessible to the public, its lessons translate to a more technical audience as well.

Online Dictionaries
http://dictionary.com
www.onelook.com

Grammar, Punctuation, and Spelling
http://owl.english.purdue.edu/

Appendix 2.7- Phase 2 Problem Statement Development: MDOT Three-Year Planning and Program Approval Timeline

Illustrated for projects that begin in FY 2013 - FY 2015

Phase	Step	Target Date	Assigned to	FY 2011			Fiscal Year 2012												Fiscal Year 2013											
				4th Qtr			1st Qtr ('12)			2nd Qtr			3rd Qtr			4th Qtr			1st Qtr ('13)			2nd Qtr			3rd Qtr			4th Qtr		
				July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
Phase 1.	Research Idea Development	Aug 2011 - May 2012																											
Phase 2. Problem Statement Development	2.1 Set lit review, RAP, & problem statement due dates	Late May 2012	RA																										
	2.2 Submit problem statements to RAC chairs	June 2012	PMs																										
	2.3 Meet to review problem statements	Late June 2012	RACs												X														
	2.4 Meet to approve projects planned for the next three years	July 2012	REC													X													
Phase 3.	Approval of Annual Programs and RFPs	Aug 2012 to Jan 2014																											

= Phased Work

X = Meeting

Michigan Department
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5314 (04/12)

RESEARCH ADMINISTRATION
RESEARCH ADVISORY PANEL NOMINATION FORM

PROJECT TITLE	
PROJECT NO.	OR NO.
PROJECT MANAGER	
PRINCIPAL INVESTIGATOR	
RESEARCH/CONSULTANT AGENCY (If known)	

RAP MEMBERS
The following group is recommended for consideration for the project Research Advisory Panel*

NAME	AREA OF EXPERTISE	DIVISION/REGION TSC	TELEPHONE NO.	E-MAIL ADDRESS

NOTES:

FOCUS AREA MANAGER SIGNATURE	DATE
ENGINEER OF RESEARCH SIGNATURE	DATE

cc: Bureau Director
Research Manager
Project File

Michigan Department
Of Transportation
5302

RESEARCH ADMINISTRATION
PARTICIPATING STATE POOLED FUND SUMMARY & FUNDING REQUEST

STUDY START DATE	STUDY END DATE	MDOT START DATE	MDOT END DATE
STUDY TITLE			
LEAD AGENCY			TPF STUDY NUMBER
LEAD AGENCY CONTACT NAME			
MDOT TECHNICAL ADVISOR			

BUDGET INFORMATION

TOTAL BUDGET (BY FY)	FY1	FY2	FY3	FY4	FY5

PROBLEM TO ADDRESS

OBJECTIVES

TASKS

PAYOFF POTENTIAL AND IMPLEMENTATION

How will MDOT be able to implement results from study?

PRODUCTS/DELIVERABLES

IS OUT OF STATE TRAVEL REQUIRED? ☐ YES ☐ NO	IF SO, WILL SPR, PART II FUNDS COVER TRAVEL EXPENSES? ☐ YES ☐ NO

OTHER CONSIDERATIONS AS APPLICABLE (WILL STATE FUNDS BE REQUIRED?).

DO NOT WRITE BELOW THIS LINE

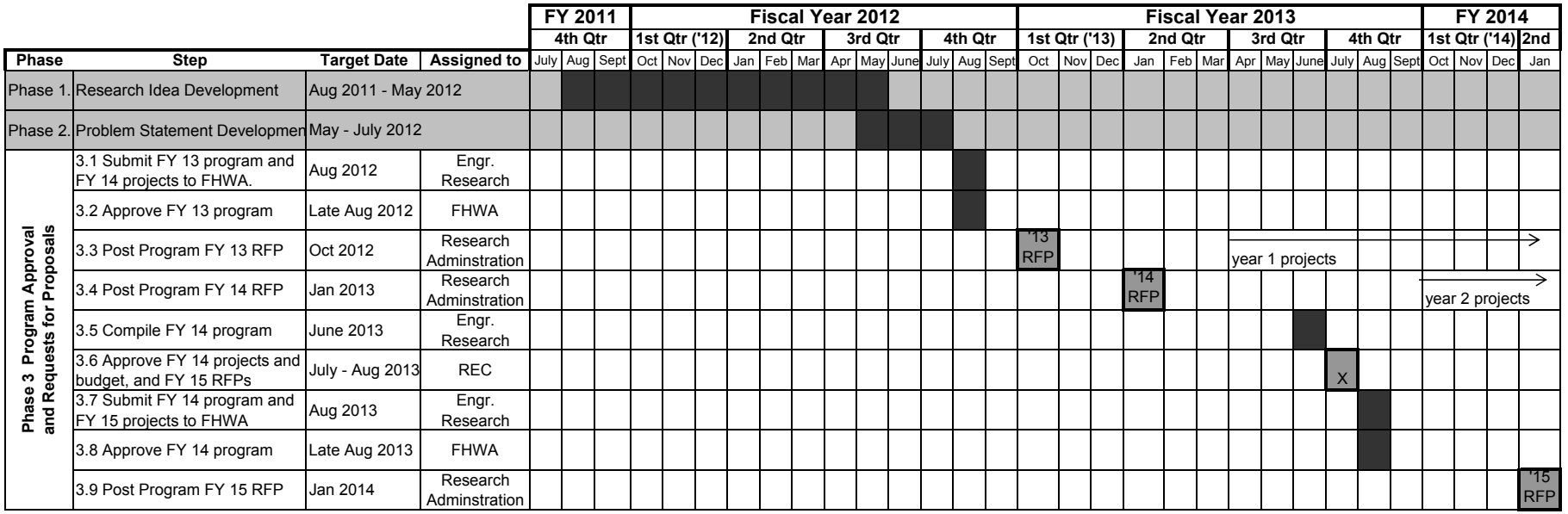
FOCUS AREA MANAGER APPROVAL* ☐ EMAIL ☐ CONVERSATION RECORD ☐ MEETING NOTES	DATE
RESEARCH ADVISORY COMMITTEE CHAIR APPROVAL* ☐ EMAIL ☐ CONVERSATION RECORD ☐MEETING NOTES	DATE
COO OR CAO APPROVAL* ☐ EMAIL ☐ CONVERSATION RECORD ☐ MEETING NOTES	DATE
RESEARCH MANAGER SIGNATURE	DATE
ENGINEER OF RESEARCH SIGNATURE	DATE

*Records of approvals are saved in project file

Appendix 2.10 - Phase 3 Program Approval and Requests for Proposals: MDOT Three-Year Planning and Program Approval Timeline

Illustrated for projects that begin in FY 2013 - FY 2015

Phase	Step	Target Date	Assigned to
Phase 1.	Research Idea Development	Aug 2011 - May 2012	
Phase 2.	Problem Statement Development	May - July 2012	
Phase 3 Program Approval and Requests for Proposals	3.1 Submit FY 13 program and FY 14 projects to FHWA.	Aug 2012	Engr. Research
	3.2 Approve FY 13 program	Late Aug 2012	FHWA
	3.3 Post Program FY 13 RFP	Oct 2012	Research Adminstration
	3.4 Post Program FY 14 RFP	Jan 2013	Research Adminstration
	3.5 Compile FY 14 program	June 2013	Engr. Research
	3.6 Approve FY 14 projects and budget, and FY 15 RFPs	July - Aug 2013	REC
	3.7 Submit FY 14 program and FY 15 projects to FHWA	Aug 2013	Engr. Research
	3.8 Approve FY 14 program	Late Aug 2013	FHWA
	3.9 Post Program FY 15 RFP	Jan 2014	Research Adminstration



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Transportation Literature Search

Evaluating the use of Unmanned Aerial Vehicles (UAVs) for Transportation Purposes

Prepared by MDOT Library

September 14, 2012

Topic/Problem Statement: UAV technology continues to evolve. Transportation uses of UAV technology potentially offer significant benefits to highway maintenance and operations.

Mobility impacts and the resulting increased user costs to the transportation user have increased the need for infrastructure inspection methods that do not negatively impact mobility. Unmanned Aerial Vehicles have the potential to inspect infrastructure from the air without impeding roadway traffic.

In addition, present inspection methods for other highway assets such as bridges, pump stations, roadway lighting fixtures, sewers and culverts all have existing deficiencies that may be mitigated with aerial based inspection methods. Inspection of both confined spaces and high altitude assets can pose safety risks with conventional human based inspection methods. UAV technology has the potential to supplement or replace these traditional inspection approaches thereby eliminating potential worker safety risks.

Keywords: Remote sensing, Technological innovations, Monitoring, Drone aircraft, Aerial surveying, Unmanned aerial vehicles

Databases searched: WorldCat, TLCat, TRID Online, NTL, TRR, TRB's Research in Progress (RIP) database, Research Needs Statements

Summary

Twenty citations are listed below in relation to unmanned aerial vehicles for transportation purposes. Fifteen citations detail completed research, two are TRR journal articles, and three pertain to research in progress.

Citations

Links to online copies of cited literature are provided when available. Contact the MDOT Library to obtain hard copies of citations.

Completed Research

Title:	**Unmanned Aerial Vehicle Route Planning for Traffic Information Collection**
Author(s):	Liu, Xiaofeng / Peng, Zhongren / Zhang, Liye
Date:	2012-2
Performing Org.:	
Sponsor Org.:	
Source:	Journal of Transportation Systems Engineering and Information Technology Volume: 12 Issue Number: 1
URL:	Article available via interlibrary loan – contact MDOT Library
Description:	pp 91-97
Abstract:	In this paper, the unmanned aerial vehicle (UAV) route planning problem is introduced to deploy the UAV for road traffic information collection. The scenario of using limited UAVs to detect road sections is considered, and a multi-objective

	optimization model is developed, which uses the number of the UAVs and UAV maximum cruise distance as constraints and aims to minimize the total cruise distance and maximize the number of detected road sections. A novel non-dominated sorting genetic algorithm for this problem is then proposed. The case study shows that the nearly optimal solution for planning UAV routes can be acquired effectively. Compared the obtained solution with the optimal feasible solution, the total cruise distance is reduced by 13.07% and the number of detected targets is increased by 41.67%. Finally, some issues on deploying UAVs for traffic information collection are discussed.

Title:	**An Unmanned Aerial Vehicle-Based Imaging System for 3D Measurement of Unpaved Road Surface Distresses**
Author(s):	Zhang, Chunsun / Elaksher, Ahmed
Date:	2012-2
Performing Org.:	
Sponsor Org.:	
Source:	Computer-Aided Civil and Infrastructure Engineering Volume: 27 Issue Number: 2
URL:	Article available via interlibrary loan – contact MDOT Library
Description:	pp 118-129
Abstract:	Transportation management systems rely on pavement condition data. Significant progress has been made and new approaches have been proposed for efficient collection of pavement condition data over the last decades. However, the assessment of unpaved road conditions has been rarely addressed in transportation research. Unpaved roads constitute approximately 40% of the U.S. road network and are vital in rural areas. It is important for timely identification and rectification of deformation on such roads. This article introduces an innovative Unmanned Aerial Vehicle (UAV)-based digital imaging system focusing on efficient collection of surface condition data over rural roads. Aerial assessment is proposed by exploring aerial imagery acquired from an unpiloted platform to derive a three-dimensional (3D) surface model over a distressed road area for distress measurement. The system consists of a low-cost model helicopter equipped with a digital camera, a Global Positioning System (GPS) receiver, an Inertial Navigation System (INS), and a geomagnetic sensor. A set of image processing algorithms has been developed for precise orientation of the acquired images, and generation of 3D road surface models and orthoimages, which allows for accurate measurement of the size and the dimension of the road surface distresses. The developed system has been tested over several test sites with roads of various surface distresses. The experiments show that the system is capable for providing 3D information of surface distresses for road condition assessment. Experiment results demonstrate that the system is very promising and provides high accuracy and reliable results.

Title:	**UAV-Based Sensor Web Monitoring System**
Author(s):	Nagai, Masahiko / Witayangkurn, Apichon / Honda, Kiyoshi / Shibasaki, Ryosuke
Date:	2012
Performing Org.:	
Sponsor Org.:	
Source:	International Journal of Navigation and Observation Volume: 2012
URL:	http://www.hindawi.com/journals/ijno/2012/858792/
Description:	7 pgs
Abstract:	An unmanned aerial vehicle- (UAV-) based monitoring system is developed as an intermediate system between aerial survey and ground survey. All the measurement tools are mounted on the UAV to acquire detailed information from low altitudes

	which is different from a satellite or a plane. The monitoring is carried out from the sky, but the spatial and temporal resolutions are freely selected near the ground. In this study, the data is easily acquired with safety and mobility by the utilization of a sensor web. A sensor web is a type of sensor network which is well suited for environmental monitoring. Sensor nodes are spatially distributed and wirelessly communicate with each other. In this study, the UAV-based system is considered as a mobile sensor node. This study proposes a combination of UAV-based monitoring with a ubiquitous sensor network.

Title:	**Analysis of Unmanned Aerial Vehicles Concept of Operations in ITS Applications**
Author(s):	Gebre-Egziabher, Demoz / Xing, Zhiqiang
Date:	2011-6
Performing Org.:	
Sponsor Org.:	
Source:	University of Minnesota, Twin Cities
URL:	http://www.cts.umn.edu/Pu...rts/pdfdownload.pl?id=1512
Description:	43pgs
Abstract:	The work described in this report is about developing a framework for the design of concept of operations (CONOP), which use small uninhabited aerial systems (SUAS) to support of intelligent transportation system (ITS) application of highway and transportation infrastructure monitoring. In these envisioned applications, these vehicles will be used for tasks such as remote collection of traffic data or inspection of roads and bridges. As such, a risk that has to be managed for these applications is that of vehicle-infrastructure collision. Various solutions to ensure safe separation between the unmanned aerial vehicle (UAV) and the object being inspected have been proposed. However, most, if not all, of these solutions rely on a multi-sensor approach, which combines digital maps of the infrastructure being inspected with an integrated Global Position System (GPS)/Inertial navigator. While ``turn key'' solutions for such multi-sensor systems exist, the performance specifications provided by their manufacturers does not provide sufficient information to allow precisely quantifying or bounding the collision risk. Furthermore, size, weight and power (or SWAP) constraints posed by these small aerial vehicles limits the use of redundant hardware and/or software as a risk mitigation strategy. The purpose of the work reported here was to develop a framework for the design of CONOPs, which take these SUAS limitations into account. The method outlined shows, in part, how these vehicle/infrastructure collision risks can be estimated or conservatively bounded.

Title:	**An unmanned aerial vehicle-based imaging system for 3D measurement of unpaved road surface distresses**
Author(s):	Zhang, C / Elaksher, A
Date:	2011
Performing Org.:	
Sponsor Org.:	
Source:	Computer-Aided Civil and Infrastructure Engineering Vol 27 Issue 2
URL:	Article available via interlibrary loan – contact MDOT Library
Description:	Pgs 118-129
Abstract:	Road condition data are important in transportation management systems. Over the last decades, significant progress has been made and new approaches have been proposed for efficient collection of pavement condition data. However, the assessment of unpaved road conditions has been rarely addressed in transportation research. Unpaved roads constitute approximately 40% of the U.S. road network, and are the lifeline in rural areas. Thus, it is important for timely identification and

	rectification of deformation on such roads. This article introduces an innovative Unmanned Aerial Vehicle (UAV)-based digital imaging system focusing on efficient collection of surface condition data over rural roads. In contrast to other approaches, aerial assessment is proposed by exploring aerial imagery acquired from an unpiloted platform to derive a three-dimensional (3D) surface model over a road distress area for distress measurement. The system consists of a low-cost model helicopter equipped with a digital camera, a Global Positioning System (GPS) receiver and an Inertial Navigation System (INS), and a geomagnetic sensor. A set of image processing algorithms has been developed for precise orientation of the acquired images, and generation of 3D road surface models and orthoimages, which allows for accurate measurement of the size and the dimension of the road surface distresses. The developed system has been tested over several test sites with roads of various surface distresses. The experiments show that the system is capable for providing 3D information of surface distresses for road condition assessment. Experiment results demonstrate that the system is very promising and provides high accuracy and reliable results. Evaluation of the system using 2D and 3D models with known dimensions shows that subcentimeter measurement accuracy is readily achieved. The comparison of the derived 3D information with the onsite manual measurements of the road distresses reveals differences of 0.50 cm, demonstrating the potential of the presented system for future practice.

Title:	**New Encoding Scheme-Based Road Edge Detection Algorithm**
Author(s):	Jiang, Wenhua / Chang, Yuntao / Peng, Zhong-Ren
Date:	2011
Performing Org.:	
Sponsor Org.:	
Source:	Transportation Research Board 90th Annual Meeting
URL:	Article available via CD – Contact MDOT Library
Description:	15 pgs
Abstract:	Road edges recognition is important for various applications in Intelligent Transport System . This paper focuses on extracting road edges from an image captured by a Unmanned Aerial Vehicle. Linear feature extraction is an important part of this job which is done by a proposed chain-code based algorithm. This paper brings forward a novel direction encoding scheme (DES) which improves encoding efficiency of digital straight lines and overcome drawbacks of Freeman encoding scheme (FES) successfully. DES also simplifies chain-code based line detecting methods from four stages to three. The new DES chain-code based criteria proposed can extract line segments in O(n) time, and curb errors due to digitalization effectively. A rotation of line (ROL) approach is employed for grouping line segments into much longer ones. Experimental results show that algorithm proposed in this paper works pretty well for road edges extraction.

Title:	**Exploring Transportation Applications of Small Unmanned Aircraft**
Author(s):	McCormack, Edward
Date:	2009-12
Performing Org.:	
Sponsor Org.:	
Source:	ITE Journal Volume: 79 Issue Number: 12
URL:	Article available via Interlibrary Loan
Description:	pp 32-36
Abstract:	This article describes the promise of small unmanned aerial vehicles (UAVs) in transportation-related applications. Small UAVs are increasingly affordable, easy to transport and launch, and can be equipped with cameras that provide information

	usable for transportation agencies. Potential uses of UAVs include accident scene photography, surveying, security inspections, construction data collection, and monitoring the condition and congestion of roadways. However, there are currently limitations that hinder the use of UAVs by state departments of transportation. The limitations are linked to the need to obtain authorization from the Federal Aviation Administration, which has expressed concern about the ability of UAVs to see and avoid manned aircraft. Recent tests were conducted by the Washington State Department of Transportation to evaluate the technical capabilities and institutional concerns related to the use of UAVs. Results from these tests indicate that the UAVs can perform effective and autonomous aerial surveillance, but concerns linger about the reliability of UAVs and the consequences of a crash.

Title:	**Monitoring the Condition of Unpaved Roads with Remote Sensing and Other Technology**
Author(s):	Zhang, Chunsun
Date:	2009
Performing Org.:	
Sponsor Org.:	
Source:	South Dakota State University, Brookings
URL:	http://ntl.bts.gov/lib/42000/42300/42378/FinalReport.pdf
Description:	39 pgs
Abstract:	This project investigated remote sensing technology for monitoring the condition of unpaved roads, which are usually low-volume roads serving remote areas and agricultural business and linking agricultural communities to nearby towns and markets. These unpaved roads are usually inadequately inspected and assessed. The primary thrust of this project was to develop an efficient and cost-effective system and methods for the collection of unpaved road condition data in support of the road management needs of transportation agencies and local government. The use of an Unmanned Aerial Vehicle (UAV) with a Global Positioning System and a digital camera as a road data collection platform was explored, and efficient methods and systems were developed to process UAV images and identify and quantify unpaved road surface condition parameters. The developed system has been tested over a number of rural roads with various surface conditions. Road images have been acquired and processed, and the size and dimension of surface distresses have been measured efficiently with sufficient accuracy. The difference of one centimeter between image-based measurement and precise ground survey demonstrates the capability of the developed system. The developed system is faster, safer and more consistent than manual surveys. The acquired road imagery, together with the derived 3D road images and condition measurements can be directly integrated into a rural road management system, thereby allowing more efficient management of rural road networks.

Title:	**RPV/UAV Surveillance for Transportation Management and Security**
Author(s):	Gebre-Egziabher, Demoz
Date:	2008-12
Performing Org.:	
Sponsor Org.:	
Source:	University of Minnesota, Twin Cities
URL:	http://www.cts.umn.edu/Pu...rts/pdfdownload.pl?id=1056
Description:	48 pgs
Abstract:	This report describes the results of an investigation into some of the technical and operational issues associated with using Unmanned Aerial Systems (UAS) for the application of surveillance in support of transportation infrastructure management and security. As part of this investigation a low-cost, miniature, hand-launched aerial vehicle and supporting ground systems suitable for surveillance of highways and

	traffic infrastructure were developed. Except for the ground station software, this system was built from off-the-shelf components. The ground station software developed was used to enhance ground station operators' situational awareness and simultaneously allow analysis of the data transmitted from the aerial vehicle. In addition, a key system that was developed was an open-source Guidance, Navigation and Control (GNC) software suite for autonomous operation of small aerial vehicles. The culmination of this work was a series flight tests where the UAS developed was used as a tool to enhance situational awareness over a simulated traffic incident or emergency situation. The test consisted of defining a series of waypoints around the area of the simulated incident and launching the miniature aerial vehicle to autonomously fly from waypoint to waypoint.

Title:	**Information-Theoretic Data Registration for UAV-Based Sensing**
Author(s):	Jwa, Sangil / Oezguener, Uemit / Tang, Zhijun
Date:	2008-3
Performing Org.:	
Sponsor Org.:	
Source:	IEEE Transactions on Intelligent Transportation Systems Volume: 9 Issue Number:
URL:	Article available via Interlibrary Loan
Description:	pgs 5-15
Abstract:	This paper provides an approach to data fusion in automatic surveillance and tracking for applications in Intelligent Transportation Systems (ITS). Using an unmanned aerial vehicle (UAV) for sensing, a robust data alignment (RDA) is implemented to the collected data set for data fusion and location relational maps within invariant feature data sets. A cost criterion is presented for the purposed of achieving RDA with data sets without correspondence. This criterion is based upon information theory and attempts to optimize using a mixed search strategy with an integration of a Nelder-Mead simplex method as well as a random search method. A numerical stability test is used by researchers to evaluate the cost criterion and search strategy. Authors propose a means of outlier rejection to further refine the data set. Experimental results indicate that the presented system is feasible.

Title:	**Vision-Based Monitoring of Locally Linear Structures Using an Unmanned Aerial Vehicle**
Author(s):	Rathinam, Sivakumar / Kim, Zu Whan / Sengupta, Raja
Date:	2008-3
Performing Org.:	
Sponsor Org.:	
Source:	Journal of Infrastructure Systems Volume: 14 Issue Number: 1
URL:	Article available via Interlibrary Loan
Description:	pp 52-63
Abstract:	Inspecting and monitoring oil-gas pipelines, roads, rivers, and canals are very important in ensuring the reliability and life expectancy of these civil systems. An autonomous unmanned aerial vehicle (UAV) can decrease the operational costs, expedite the monitoring process, and be used in situations where a manned inspection is not possible. This paper addresses the problem of monitoring these systems using an autonomous UAV based on visual feedback. A single structure detection algorithm that can identify and localize various structures including highways, roads, and canals is presented in the paper. A fast learning algorithm that requires minimal supervision is applied to obtain detection parameters. The real time detection algorithm runs at 5 Hz or more with the onboard video collected by the UAV. Both hardware simulations

	and flight results of the vision-based control algorithm are presented in this paper. A fixed wing UAV equipped with a camera onboard was able to track a 700 m canal based on vision several times with an average cross-track error of around 10 m.

Title:	**The Use of Small Unmanned Aircraft by the Washington State Department of Transportation**
Author(s):	Edward D. McCormack
Date:	2008
Performing Org.:	
Sponsor Org.:	
Source:	Washington State Transportation Center
URL:	http://www.wsdot.wa.gov/research/reports/fullreports/703.1.pdf
Description:	27 pgs
Abstract:	Small, unmanned aerial vehicles (UAVs) are increasingly affordable, easy to transport and launch, and can be equipped with cameras that provide information usable for transportation agencies. The Washington State Department of Transportation conducted a series of UAV tests to evaluate their capabilities while also exploring institutional issues. These tests, while exploring the general capabilities of UAVs, focused on evaluating the use of a UAV as an avalanche control tool on mountain slopes above state highways. WSDOT's maintenance division has an active snow avalanche control program that is designed to reduce highway closure time and hazards to motorists, and the use of UAVs was seen as having some potential operational advantages. The UAVs also captured aerial images suitable for traffic surveillance and data collection. The evaluation found that the main limitation to UAV use is institutional, particularly the need to obtain approval to fly from the Federal Aviation Administration (FAA). This approval process will make UAV use a challenge, but these issues may change as the FAA considers new rules.

Title:	**UNMANNED AIR VEHICLE WORKING GROUP FINAL REPORT**
Author(s):	
Date:	2007
Performing Org.:	
Sponsor Org.:	
Source:	Transport Canada
URL:	http://www.tc.gc.ca/eng/civilaviation/standards/general-recavi-uavworkinggroup-2266.htm
Description:	
Abstract:	This document represents the Final Report of the Unmanned Air Vehicle (UAV) Working Group, established to develop a regulatory framework for the operation of unmanned air vehicles with respect to terms and definitions, aircraft registration and marking, flight crew and maintainer licensing, maintenance, airworthiness and continuing airworthiness, operational flight rules and operational approval. The Unmanned Air Vehicle Working Group was a joint government and industry initiative, convened by Transport Canada, General Aviation in December 2006 to address the increasing volume and complexity of applications for unmanned air vehicle Special Flight Operations Certificates (SFOCs).

Title:	**Surface Transportation Surveillance from Unmanned Aerial Vehicles**
Author(s):	Benjamin Coifman / Mark McCord / Rabi G. Mishalani / Keith Redmill
Date:	2003
Performing Org.:	
Sponsor Org.:	
Source:	Ohio State University
URL:	Article available via interlibrary loan – Contact MDOT Library
Description:	9 pgs

Abstract:	Unmanned Aerial Vehicles (UAVs) promise a low cost means to achieve a "bird's eye view" and a rapid response for a wide array of transportation operations and planning applications, including incident response, coordination among a network of traffic signals, traveler information, emergency vehicle guidance, and measurement of typical roadway usage. However, many obstacles to operational use exist, including ambiguous and sometimes prohibitively restrictive Federal Aviation Administration (FAA) guidelines and liability concerns. This paper expands on these benefits and barriers to deployment and discusses preliminary results of a field experiment in which a UAV was used to monitor freeway conditions, track vehicle movements in an intersection, observe conditions on a network of roadways, and monitor parking lot utilization. This extended field experiment provides a strong indication that the application of the UAV technology to surface transportation surveillance seems viable and potentially valuable. In addition, the experiment clearly points to the need for continued experimentation and refinement to develop and document the potential benefits and familiarize the operations community with this emerging technology.

Title:	**A Survey of Unmanned Aerial Vehicles (UAV) for Traffic Surveillance**
Author(s):	Anuj Puri
Date:	2004
Performing Org.:	
Sponsor Org.:	
Source:	University of South Florida
URL:	Article available via Interlibrary Loan
Description:	29 pgs
Abstract:	The United States Department of Transportation (DOT) has been interested for the past several years in obtaining data on traffic trends and to monitor and control traffic in realtime. Currently, there are several methods by which the DOT regulates and monitors road transport. Cameras mounted on towers, detectors embedded in pavements or pneumatic tubes, and unmanned aircraft have been proven to be expensive and time-consuming solution candidates. However, aerial monitoring has the potential to yield detailed information to help traffic planners, as well as commuters. Unmanned Aerial Vehicles (UAVs) may provide a “bird’s eye view” for traffic surveillance, road conditions and emergency response. The purpose of this technical report is to provide a survey of research related to the application of UAVs for traffic management.

Transportation Research Record Articles

Title:	**Small Unmanned Aircraft Evaluated for Avalanche Control**
Author(s):	Edward McCormack and John Stimberis
Date:	2010
Performing Org.:	
Sponsor Org.:	
Source:	Transportation Research Record: Volume 2169 / 2010
URL:	Article available online – Contact MDOT Library
Description:	6 pgs
Abstract:	The Washington State Department of Transportation's (DOT) snow avalanche control program reduces winter roadway closure times and hazards to motorists. The University of Washington and the Washington State DOT evaluated small unmanned aircraft systems (UASs) as a tool to enhance this program. Because of military investment, UAS technology has dropped in cost as it has become increasingly capable and easier to operate. Commercially available UASs, which fly autonomously, can be operated off a roadway and can collect low-cost, real-time aerial imagery while also carrying payloads. This project conducted a series of test flights involving both

	fixed- and rotary-wing (helicopter) UASs over a roadway in mountainous terrain. The flights demonstrated that UASs can conduct snowpack and terrain surveillance and can accurately drop explosive charges such as those used to trigger controlled avalanches. The rotary-wing UAS was particularly usable because of its ability to hover, which provided a stable camera platform, and because it required minimal area to land. The reliability of UASs is a concern, and their capabilities may be challenged by mountainous terrain and weather. This problem may be reduced as UASs become either less expensive and more expendable or more reliable and all-weather capable. A major barrier to use of UASs is the need to obtain approval to fly from FAA, a process that can be time-consuming and restrictive. FAA is currently updating its plans to integrate UASs into the national airspace, and a number of technology-based solutions are being considered.

Title:	**Processing Traffic Data Collected by Remote Sensing**
Author(s):	Victor L. Knoop, Serge P. Hoogendoorn, and Henk J. van Zuylen
Date:	2009
Performing Org.:	
Sponsor Org.:	
Source:	Transportation Research Record: Volume 2129 / 2009
URL:	Article available online – Contact MDOT Library
Description:	7 pgs
Abstract:	Video data are being used more often to study traffic operations. However, extracting vehicle trajectories from video by current methods is a difficult process, typically resulting in many errors. The process requires extensive labor to correct the trajectories manually. This paper proposes a method to process video data from traffic operations. Instead of detecting a vehicle in each picture of the video separately, the video data are transformed so that the trajectories of the vehicles (their position over time) become visible in a single image. In this single image, the trajectories can be found by detecting lines. The difference from other methods is that trajectories rather than vehicles are detected. Trajectory (line) detection is more robust than vehicle (rectangle) detection; with this method, about 95% of the trajectories are detected correctly and, more important, the segments of each trajectory are much longer compared with results from other methods in the literature. Also, the detection is a quick process because only a single image is required to be analyzed. For a data set 5 min long, transforming costs several minutes, and automatically detecting and tracking costs 40 to 50 min per lane. Manual correction is then necessary, which costs about 10 min per lane. In contrast, with a different method the total processing time for analyzing traffic operations costs about 1 week for all lanes together.

Research in Progress

Title:	**Remote Sensing of Unpaved Road Conditions through the Use of Remote Sensing**
Investigator(s):	Brooks, Colin
Performing Org.:	Michigan Technological University, Houghton
Sponsor Org.:	RITA
Start Date:	2011/8/1
URL:	http://rip.trb.org/browse/dproject.asp?n=31411
Project Description:	The objective of this project is to utilize remote sensing technologies mounted on manned and unmanned aerial vehicles to assess unpaved road conditions.

Title:	**Integrated Remote Sensing and Visualization (IRSV) System for Transportation -Infrastructure Operations and Management Phase II**
Investigator(s):	Chen, ShenEn
Performing Org.:	University of North Carolina, Charlotte
Sponsor Org.:	RITA

Start Date:	2010/1/4
URL:	http://rip.trb.org/browse/dproject.asp?n=31405
Project Description:	In response to the U.D. Department of Transportation-Research Innovative Technology Administration (USDOT-RITA CRS-SI Initiative #2: Transportation Infrastructure Construction and Condition Assessment, this Phase 2 project (USDOT designation) is targeted at (1) validation of new Commercial Remote Sensing and Spatial Information (CRS-SI) applications for bridge management systems at the state and local levels, and (2) application of CRS-SI to existing structure condition assessment. Begun in 2007, a research partnership (University of North Carolina at Charlotte, ImageCat Incorporated, Charlotte Department of Transportation and North Carolina Department of Transportation has completed a proof-of-concept project to develop an Integrated Remote Sensing and Visualization (IRSV) System that integrates LiDAR scan and sub-inch-resolution aerial photography which promises to extend the available CRS-SI tools to enhance bridge inspection and data management. The goal of this project is to enhance IRSV performance and develop a commercialization component through extended partnerships with departments of transportation, state highway administrations and public works agencies across the country.

Title:	**Characterization of Unpaved Road Conditions Through the Use of Remote Sensing**
Investigator(s):	Brooks, Colin / Roussi, Chris / Colling, Tim
Performing Org.:	Michigan Technological University, Ann Arbor
Sponsor Org.:	RITA
Start Date:	2011/1/8
URL:	http://rip.trb.org/browse/dproject.asp?n=28894
Project Description:	According to the Federal Highway Administration (FHWA), in 2008 there were 1,324,245 miles of unpaved road in the United States, accounting for almost 33% of the over 4 million miles of road in our national transportation infrastructure (FHWA and USDOT 2010). Local governments and transportation agencies are responsible for a large part of this unpaved infrastructure. These agencies need to be able to assess cost-effectively the condition of the infrastructure on a periodic basis in order to effectively manage these roads, and to optimize for resource allocation. Most local transportation departments do not have specialized equipment to measure surface conditions, instead relying on visual, spot measurements. Unpaved roads typically have low traffic volumes and, consequently, may receive less time and attention from local agencies with limited funding and limited human resources. These limitations often prevent thorough evaluations of unpaved roads, even though timely identification of road damage is extremely important and these roads have an important role to play in connecting farmers to markets, school buses to school children, and residents to their homes. In supporting a Cooperative Agreement between the United States Department of Transportation (USDOT) Research and Innovative Technology Administration (RITA) and Michigan Technological University, the USDOT-RITA is assisting the Michigan Tech team to put forth the recipient's best efforts to design and develop Characterization of Unpaved Road Conditions through the use of remote sensing which promises to extend the available Commercial Remote Sensing & Spatial Information tools to enhance and develop an unpaved road assessment system. The goals of this third phase research are to develop a sensor for, and demonstrate the utility of remote sensing platform or platforms for unpaved road assessment. The platform could be a typical manned fixed-wing aircraft, a UAV (Unmanned Aerial Vehicle), or both, depending on their relative strengths and weaknesses in meeting user community requirements for unpaved road assessment. To be cost efficient, the same sensor modality would be shared if more than one platform is recommended. Further, the remote sensing method chosen must be practical, economical, and effective for use by the transportation community. The sensor and platforms will allow for rapid identification and characterization of unpaved roads on

	an inventory level and will provide meaningful condition metrics as well as enable mission planning, control of the sensor system, and data processing. Best engineering practices will be employed to rigorously define the requirements of the system and select the best sensor and platform technology to meet the needs of the stakeholders. At the end of the project the capabilities of the prototype system or systems will be demonstrated to stakeholders for their potential implementation.

APPENDIX 2.12

RESEARCH ADMINISTRATION
PROBLEM STATEMENT

MDOT Research Project

PROPOSED RESEARCH PROJECT TITLE Evaluating the use of Unmanned Aerial Vehicles (UAVs) for Transportation Purposes	
OR NUMBER or TPF STUDY NUMBER OR13-008	MDOT PROJECT CATEGORY & STRATEGIC PRIORITY NO. Maintenance N/A N/A N/A

PROJECT MANAGER OR PROBLEM STATEMENT AUTHOR

PROBLEM STATEMENT AUTHOR Steve Cook	DATE 2/22/2013
TELEPHONE NO. 517.555.1555	E-MAIL ADDRESS cooks@michigan.gov
BUREAU/REGION/OFFICE/SECTION/UNIT Highway Field Services/Operations Field Services/Maintenance & Systems Operations	PROJECT MANAGER'S NAME (IF DIFFERENT THAN PROBLEM STATEMENT AUTHOR)

PROBLEM TO ADDRESS

IN 200 WORDS OR LESS, BRIEFLY DESCRIBE THE PROBLEM TO BE ADDRESSED AND WHY IT IS AN ISSUE FOR MDOT

UAV technology continues to evolve. Transportation uses of UAV technology potentially offer significant benefits to highway maintenance, design and operations. Mobility impacts and the resulting increased user costs to the transportation user have increased the need for infrastructure inspection methods that do not negatively impact mobility. Unmanned Aerial Vehicles have the potential to inspect infrastructure from the air without impeding roadway traffic. UAV technology also has the potential to provide survey information from an aerial platform.

Present inspection methods for other highway assets such as bridges, pump stations, roadway lighting fixtures, sewers and culverts all have existing deficiencies that may be mitigated with aerial based inspection methods. Inspection of both confined spaces and high altitude assets can post safety risks with conventional human based inspection methods. UAV technology has the potential to supplement or replace those traditional inspection approaches thereby reducing potential worker safety risks.

RESEARCH OBJECTIVES

IN 25 WORDS OR LESS, LIST THE RESEARCH OBJECTIVES TO BE ACCOMPLISHED

1. Develop UAV technology that will provide visual inspection capabilities for pump stations, roadway lighting fixtures, sewers and culverts from an aerial platform.
2. Develop UAV technology that will provide aerial monitoring of traffic conditions. Image quality must exceed that provided by publicly available web based mapping services such as Google Earth and Bing Maps.
3. Develop UAV technology that will provide bridge condition data from an aerial platform to supplement routine and in-depth inspections. Condition data includes both surface condition and non-destructive structural evaluation of bridge element integrity. These evaluation techniques typically require ultrasonic, infrared, thermos graphic, radar and visual inspection technologies.
4. Develop UAV technology that can collect LiDAR (Light Detection and Ranging) based surveying information.

RESEARCH TASKS

LIST THE MAJOR TASKS TO ACCOMPLISH THE RESEARCH OBJECTIVES

1. Conduct literature search
2. Develop prototype vehicles that meet the requirements of objectives 1, 2, 3 & 4.
3. Obtain approvals from federal and state government to conduct needed unmanned aerial operations required for research and implementation.
4. Collect condition data from multiple sites as determined by MDOT. Conduct field trials of the prototype equipment.
5. Analyze collected data for accuracy. Compare UAV collected data to comparable data obtained from existing collection methods. Provide final data to MDOT in a format specified by MDOT.
6. Produce and deliver a final report that summarizes the results of the data analysis. This includes information that summarizes the quality and effectiveness of UAV collected data.
7. Provide an implementation plan for utilizing the new UAV technology in MDOT operations.
8. Deliver operating UAV equipment and provide user training to MDOT personnel.

ESTIMATED TIMELINE

ENTER START DATE: 4/15/2013 ENTER END DATE: 7/30/2015

ESTIMATED BUDGET

FROM THE WORKSHEET ON PAGE 3, ENTER THE FOLLOWING: 1.) VENDOR COSTS; 2.) PM/MDOT COSTS; 3.) TOTAL BUDGET

1.) VENDOR COSTS	2.) PM/MDOT COSTS	3.) TOTAL BUDGET
$ 265,00	$ 15,000	$ 280,000

DELIVERABLES

IN 50 WORDS OR LESS, LIST THE DELIVERABLES YOU WOULD RECEIVE AT THE END OF THIS PROJECT. CONSIDER DELIVERABLES SUCH AS 1) DESIGN METHOD, 2) TRAINING, 3) MANUAL OF PRACTICE, 4) PROCEDURE, 5) SPECIFICATION, 6) SOFTWARE AND 7) EQUIPMENT.

1. Final Report that documents the effectiveness and quality of UAV collected data.
2. Recommendation and an implementation plan for utilizing the new UAV technology in MDOT operations.
3. UAV equipment
4. Training of MDOT personnel on UAV operation and use.

IN 100 WORDS OR LESS, EXPLAIN MDOT INVOLVEMENT'S WITH DATA AND SERVICES.

MDOT will potentially need to provide minimal traffic control.
MDOT will supply existing asset inventory/survey information for comparison to UAV collected data.

IMPLEMENTATION

DESCRIBE HOW THIS PROJECT WILL BE IMPLEMENTED AT MDOT

UAV technology could be utilized for bridge inspection, pump house inspection, light tower inspection, sewer inspection, culvert inspection, LiDAR based surveying and traffic monitoring.

EXPLAIN THE EXPECTED BENEFITS/RESULTS FROM THE IMPLEMENTATION OF THIS PROJECT AND POTENTIAL USERS

UAV technology could be used for aerial asset inventory inspection which would reduce traffic impacts thereby reducing user costs. The technology could also be used for inspection in confined spaces.

LITERATURE RESEARCH

SELECT A STATEMENT BELOW REGARDING YOUR REVIEW OF THE LITERATURE AND ADD A NOTE IF RESEARCH IS COMPLEMENTARY:

PROPOSED RESEARCH IS COMPLEMENTARY TO EXISTING RESEARCH.

NOTE:

POTENTIAL OBSTACLES

IN 25 WORDS OR LESS, WHAT RISKS OR OBSTACLES MAY MAKE CARRYING OUT THIS PROJECT DIFFICULT? WHAT STRATEGIES WILL YOU USE TO OVERCOME THEM?

OBSTACLES	STRATEGIES
❖ UAV technology is new and not fully developed. The project potentially will require more funds and/or time to complete the tasks based on the progress of the research. ❖ Regular project meetings will be necessary to maintain project focus and monitor intermediate research milestones for impacts on final project completion.	❖ Strategies should be 25 words or less. Press enter for additional entries.

INVESTIGATOR(S)

DESIRED QUALIFICATIONS FOR RESEARCH TEAM:

The team should have experience with inspecting civil infrastructure and developing UAVs.

SELECT THE REQUIRED STATISTICAL QUALIFICATIONS IN AN INVESTIGATOR(S) AND TEAM BELOW:

At Least One (1) college series of statistics courses and working experience in statistical analyses

PRINCIPAL INVESTIGATOR'S NAME: Collin Brooks

ORGANIZATION: Michigan Technological University

SEE WORKSHEET ON FOLLOWING PAGES FOR ADDITIONAL INFORMATION AND NOTES

RESEARCH ADMINISTRATION
PROBLEM STATEMENT
WORKSHEET

ESTIMATED PERSON HOURS FOR RESEARCH TASKS

FOR THE RESEARCH TASKS ON PAGE 1, PLEASE LIST THE ESTIMATED PERSON HOURS BELOW:

1.) Task #1 – 380 hours
2.) Task #2 – 1670 hours
3.) Task #3 – 60 hours
4.) Task #4 – 975 hours
5.) Task #5 – 175 hours
6.) Task #6 – 300 hours
7.) Task #7 – 190 hours
8.) Task #8 – 80 hours

TOTAL ESTIMATED PERSON HOURS 3830

ESTIMATED BUDGET

USE THE FOLLOWING EQUATIONS FOR ESTIMATING PROJECT COSTS.
(HOURLY RATES AND PERCENTAGES SHOWN FOR EXAMPLE ONLY.)

1.) CALCULATE VENDOR DIRECT LABOR WITH THIS EQUATION

Estimated Person Hours are the Labor Hours

Direct Labor: Labor Hours x Average pay rate
Example: Direct Labor = 2000 hrs x $45/hr = $90,000.00
Direct Labor: 3830 X $30 = $114,900

2.) CALCULATE TOTAL VENDOR COST

REQUIRED COSTS
DIRECT LABOR= $ 114,900
FRINGE BENEFITS= $ 11,490
TRAVEL= $ 2,298
SUPPLIES= $ 31,000 ($5,745 base budget +$25,555 for extra UAV development supplies)
OTHER EXPENSES= $ 17,235
INDIRECT= $ 87,828

Total Vendor Cost: $144,900 + $11,490 + $2,298 + $31,000 + $17,235 + $87,828 =$ 264,751 ($265,000)
This is your TOTAL VENDOR COST.
Note: Fill this in on the Vendor Cost section under ESTIMATED BUDGET.

3.) Use MDOT PM BUDGET WORKSHEET to calculate your PM costs.
Enter PM Costs and any notes or calculations. $ 15,000
Fill this total in on the PM/MDOT Costs section under ESTIMATED BUDGET

4.) Enter GRAND TOTAL for 2 and 3. $ 280,000
Fill this total in on the TOTAL BUDGET section under ESTIMATED BUDGET

ANNUAL FINANCIAL BUDGET BREAKDOWN

FY1 $70,000	FY2 $140,000	FY3 $70,000	FY4 $FY4 BUDGET

METHOD OF PAYMENT

SELECT METHOD OF PAYMENT BELOW
ACTUAL COSTS (UNIVERSITY CONTRACTS)

INVESTIGATOR(S)

NAMES OF POSSIBLE INVESTIGATORS: WMU & MTU have worked with UAVs. There are a few contractors in Michigan that build and develop UAVs.
SELECT RECOMMENDED REQUEST FOR PROPOSAL SOLICITATION: CONSULTANTS AND UNIVERSITIES NATIONWIDE

STAKEHOLDERS

SELECT THE PROJECT'S IMPLICATIONS:
NATIONAL

LIST ANY OTHER STATE, REGIONAL OR NATIONAL AGENCIES AND OTHER GROUPS MAY HAVE AN INTEREST IN SUPPORTING THIS STUDY
N/A

DO NOT WRITE BELOW THIS LINE

FOCUS AREA MANAGER APPROVAL*	ENGINEER OF RESEARCH APPROVAL*
EMAIL 5/10/2013	MEETING NOTES 6/12/2013
RESEARCH ADVISORY COMMITTEE CHAIR APPROVAL*	**RESEARCH EXECUTIVE COMMITTEE CHAIR APPROVAL***
MEETING NOTES 6/17/2013	CONVERSATION RECORD 7/24/2013

*Records of approval are saved in project file.

MDOT employees with questions should contact:
Steve Bower, P.E., Administrator, Research Administration
Phone: 517-636-7777, Fax: 517-322-1262, bowers@michigan.gov
Or review the Research and Implementation Manual

RESEARCH ADMINISTRATION
PROBLEM STATEMENT
MDOT Research Project

PROPOSED RESEARCH PROJECT TITLE Evaluating Differential and Non-Differential Freeway Truck and Bus Speed Limits	
OR NUMBER or TPF STUDY NUMBER OR13-009	MDOT PROJECT CATEGORY & STRATEGIC PRIORITY NO. Mobility, Systems & Signal Operations N/A N/A N/A

PROJECT MANAGER OR PROBLEM STATEMENT AUTHOR

PROBLEM STATEMENT AUTHOR Jason Firman	DATE 2/22/2013
TELEPHONE NO. 517.636.4547	E-MAIL ADDRESS firmanj@michigan.gov
BUREAU/REGION/OFFICE/SECTION/UNIT Highway Field Services/Operations Field Services/Maintenance & Systems Operations/Systems Operations/Congestion and Mobility	PROJECT MANAGER'S NAME (IF DIFFERENT THAN PROBLEM STATEMENT AUTHOR)

PROBLEM TO ADDRESS

IN 200 WORDS OR LESS, BRIEFLY DESCRIBE THE PROBLEM TO BE ADDRESSED AND WHY IT IS AN ISSUE FOR MDOT

Michigan presently requires lower truck and bus speed limits on freeways with passenger car speed limits that are 65 mph or 70 mph. The purpose of the research is to determine the impacts of raising freeway truck and bus speed limits from the present 60 mph to 65 mph or 70 mph.

Michigan is one of only a handful of states that have a differential speed limit for passenger vehicles, trucks and buses; Many states have implemented different strategies to setting speed limits making it difficult to determine the effects of these strategies. An analysis shall be performed on whether there is a safety effect on having differential speed limits on freeways. This should include but not limited to frequency and rates for;

- total crash, truck crashes and bus crashes
- total fatalities and serious injuries, truck fatalities and serious injuries and bus fatalities and serious injuries

The analysis should be done on Michigan data and that of other states with and without a speed limit differential. This analysis needs to account for vehicle, truck and bus miles traveled. Emphasis should be made to states with similar weather and driving conditions.

The second part is to evaluate vehicle interactions with trucks and buses for states with and without a speed limit differential. What is the 85 percentile speeds of passenger vehicles, trucks and buses for various speed limits?

The third part is to determine what the economic impacts are for raising or maintaining the existing 60 mph truck speed limit on the State of Michigan and the commercial vehicle operators. The cost benefit analysis needs to include long term infrastructure impacts required to accommodate an increase in truck speed, safety impacts, and economic benefits to the trucking industry. Long term infrastructure impacts includes but are not limited to impacts on pavement conditions by raising the truck speeds.

RESEARCH OBJECTIVES

IN 25 WORDS OR LESS, LIST THE RESEARCH OBJECTIVES TO BE ACCOMPLISHED

1. Determine what safety and speed impacts could occur if Michigan truck and bus speed limits on freeways were increased to 65 mph or 70 mph.
2. Determine the safety and speed impacts that did occur in other states that increased their freeway speed limits including truck and bus speed limits.
3. Determine the safety and speed impacts of states including Michigan that only increased passenger vehicles leaving a speed differential with trucks and buses.
4. Determine the economic impacts to the state and the trucking industry that could occur if Michigan truck speed limits on freeways were increased to 65 mph or 70 mph.

RESEARCH TASKS

LIST THE MAJOR TASKS TO ACCOMPLISH THE RESEARCH OBJECTIVES

1. Literature review includes what speed limits are used for passenger vehicles, trucks and buses on freeways. The primary focus of the literature review will be safety impacts and a secondary focus will be long term infrastructure impacts, air quality, and greenhouse gas emissions and economic impacts.

2. Compile and report before and after safety impacts when other states increased freeway speed limits for trucks and buses.
3. Compile and report before and after effect of h ow passenger vehicle, truck and bus speeds change when speed limits were increased on freeways for passenger vehicles, trucks and buses and just for passenger vehicles.
4. Conduct a cost benefit analysis for long term infrastructure impacts including but not limited to infrastructure condition, safety impacts, greenhouse gas emissions, air quality impacts, and economic benefits to the trucking industry required to accommodate an increase in truck speed. For this task, infrastructure impact, greenhouse gas emission, air quality impacts and economic benefits to the trucking industry required to accommodate an increase in truck speed. For this task, infrastructure impact, greenhouse gas emission, and air quality impact factors should be based on findings of the literature review. Compile and report the findings of the analysis.
5. Final report presentation to MDOT leadership on findings.
6. Publish final report.

ESTIMATED TIMELINE

ENTER START DATE: 2/26/2013 ENTER END DATE: 5/1/2014

ESTIMATED BUDGET

FROM THE WORKSHEET ON PAGE 3, ENTER THE FOLLOWING: 1.) VENDOR COSTS; 2.) PM/MDOT COSTS; 3.) TOTAL BUDGET

1.) VENDOR COSTS	2.) PM/MDOT COSTS	3.) TOTAL BUDGET
$ 177,000	$ 10,500	$ 187,500

DELIVERABLES

IN 50 WORDS OR LESS, LIST THE DELIVERABLES YOU WOULD RECEIVE AT THE END OF THIS PROJECT. CONSIDER DELIVERABLES SUCH AS 1) DESIGN METHOD, 2) TRAINING, 3) MANUAL OF PRACTICE, 4) PROCEDURE, 5) SPECIFICATION, 6) SOFTWARE AND 7) EQUIPMENT.

Final report will provide usable data to recommend if Michigan truck and bus speed limits should be increased to 65 mph or 70 mph and what would be the expected outcomes if this change is made.

IN 100 WORDS OR LESS, EXPLAIN MDOT INVOLVEMENT'S WITH DATA AND SERVICES.

Provide crash and speed data on MDOT freeways.

IMPLEMENTATION

DESCRIBE HOW THIS PROJECT WILL BE IMPLEMENTED AT MDOT

This will assist MDOT in recommending whether a truck and bus speed limit increase should be made on freeways posted 70 mph.

EXPLAIN THE EXPECTED BENEFITS/RESULTS FROM THE IMPLEMENTATION OF THIS PROJECT AND POTENTIAL USERS

This will allow MDOT to determine th safest and most prudent truck and bus speed limit that should be set on MDOT freeways posted 70 mph.

LITERATURE RESEARCH

SELECT A STATEMENT BELOW REGARDING YOUR REVIEW OF THE LITERATURE AND ADD A NOTE IF RESEARCH IS COMPLEMENTARY:

PROPOSED RESEARCH IS COMPLEMENTARY TO EXISTING RESEARCH.

NOTE:

POTENTIAL OBSTACLES

IN 25 WORDS OR LESS, WHAT RISKS OR OBSTACLES MAY MAKE CARRYING OUT THIS PROJECT DIFFICULT? WHAT STRATEGIES WILL YOU USE TO OVERCOME THEM?

OBSTACLES	STRATEGIES
❖ Gathering useful information from other states.	❖ Strategies should be 25 words or less. Press enter for additional entries.

INVESTIGATOR(S)

DESIRED QUALIFICATIONS FOR RESEARCH TEAM:

The proposed team should have extensive experience with Traffic & Safety research.

SELECT THE REQUIRED STATISTICAL QUALIFICATIONS IN AN INVESTIGATOR(S) AND TEAM BELOW:

At Least One (1) college series of statistics courses and working experience in statistical analyses

PRINCIPAL INVESTIGATOR'S NAME: Dr. Timothy Gates

ORGANIZATION: Wayne State University

SEE WORKSHEET ON FOLLOWING PAGES FOR ADDITIONAL INFORMATION AND NOTES

RESEARCH ADMINISTRATION
PROBLEM STATEMENT
WORKSHEET

ESTIMATED PERSON HOURS FOR RESEARCH TASKS

FOR THE RESEARCH TASKS ON PAGE 1, PLEASE LIST THE ESTIMATED PERSON HOURS BELOW:

1.) Task #1 – 300 hours
2.) Task #2 – 300 hours
3.) Task #3 – 1230 hours
4.) Task #4 – 840 hours
5.) Task #5 – 30 hours
6.) Task # 6 – 300 hours

TOTAL ESTIMATED PERSON HOURS 3000

ESTIMATED BUDGET

USE THE FOLLOWING EQUATIONS FOR ESTIMATING PROJECT COSTS.
(HOURLY RATES AND PERCENTAGES SHOWN FOR EXAMPLE ONLY.)

1.) CALCULATE VENDOR DIRECT LABOR WITH THIS EQUATION

Estimated Person Hours are the Labor Hours

Direct Labor: Labor Hours x Average pay rate
Example: Direct Labor = 2000 hrs x $45/hr = $90,000.00
Direct Labor: 3000 X $30= $90,000

2.) CALCULATE TOTAL VENDOR COST

REQUIRED COSTS
DIRECT LABOR= $ 90,000
FRINGE BENEFITS= $ 9,000
TRAVEL= $ 1,800
SUPPLIES= $ 4,500
OTHER EXPENSES= $ 13,500
INDIRECT= $ 57,900

Total Vendor Cost: $90,000 + $9,000 + $1,800 + $4,500 + $13,500 + $57,900 =$ 176,700 ($177,000)
This is your TOTAL VENDOR COST.
Note: Fill this in on the Vendor Cost section under ESTIMATED BUDGET.

3.) Use MDOT PM BUDGET WORKSHEET to calculate your PM costs.
Enter PM Costs and any notes or calculations. $ 10,500
Fill this total in on the PM/MDOT Costs section under ESTIMATED BUDGET

4.) Enter GRAND TOTAL for 2 and 3. $ 187,500
Fill this total in on the TOTAL BUDGET section under ESTIMATED BUDGET

ANNUAL FINANCIAL BUDGET BREAKDOWN

FY1 $93,750	FY2 $93,750	FY3 $FY3 BUDGET	FY4 $FY4 BUDGET

METHOD OF PAYMENT

SELECT METHOD OF PAYMENT BELOW
ACTUAL COSTS (UNIVERSITY CONTRACTS)

INVESTIGATOR(S)

NAMES OF POSSIBLE INVESTIGATORS: WSU, WMU, MTU and MSU have shown interest and expertise in this type of work.

SELECT RECOMMENDED REQUEST FOR PROPOSAL SOLICITATION: MICHIGAN UNIVERSITIES ONLY

STAKEHOLDERS

SELECT THE PROJECT'S IMPLICATIONS:
NATIONAL

LIST ANY OTHER STATE, REGIONAL OR NATIONAL AGENCIES AND OTHER GROUPS MAY HAVE AN INTEREST IN SUPPORTING THIS STUDY
N/A

DO NOT WRITE BELOW THIS LINE

FOCUS AREA MANAGER APPROVAL*	ENGINEER OF RESEARCH APPROVAL*
EMAIL 5/10/2013	MEETING NOTES 6/12/2013
RESEARCH ADVISORY COMMITTEE CHAIR APPROVAL*	**RESEARCH EXECUTIVE COMMITTEE CHAIR APPROVAL***
MEETING NOTES 6/17/2013	CONVERSATION RECORD 7/24/2013

*Records of approval are saved in project file.

MDOT employees with questions should contact:
Steve Bower, P.E., Administrator, Research Administration
Phone: 517-636-7777, Fax: 517-322-1262, bowers@michigan.gov
Or review the Research and Implementation Manual

RESEARCH ADMINISTRATION
PROBLEM STATEMENT
MDOT Research Project

PROPOSED RESEARCH PROJECT TITLE Development, Characterization and Applications of a Non Proprietary Ultra High Performance Concrete for Highway Bridges	
OR NUMBER or TPF STUDY NUMBER OR14-020	MDOT PROJECT CATEGORY & STRATEGIC PRIORITY NO. Bridges & Structures 1 a. N/A

PROJECT MANAGER OR PROBLEM STATEMENT AUTHOR

PROBLEM STATEMENT AUTHOR Steve Kahl	DATE 2/22/2013
TELEPHONE NO. 517.322.5707	E-MAIL ADDRESS kahls@michigan.gov
BUREAU/REGION/OFFICE/SECTION/UNIT Highway Field Services/Operations Field Services/Bridge Field Services/Structures Technical Section/Experimental Studies	PROJECT MANAGER'S NAME (IF DIFFERENT THAN PROBLEM STATEMENT AUTHOR)

PROBLEM TO ADDRESS

IN 200 WORDS OR LESS, BRIEFLY DESCRIBE THE PROBLEM TO BE ADDRESSED AND WHY IT IS AN ISSUE FOR MDOT

Ultra high performance concrete (UHPC) is a specially formulated concrete that is capable of achieving extremely high performance. When properly reinforced with steel or polymer based fibers, the material is capable of achieving the following properties:

1. High compressive strength, near 15,000 psi.
2. High tensile strength several times that of regular concrete, capable of carrying sustained tensile stresses of at least 250 psi.
3. Pseudo-ductility, with tensile softening strains of up to an order of magnitude greater than that of regular concerete.
4. Significant energy absorption prior to fracture.
5. Extremely small crack widths, small enough to effectively eliminate ingress of chlorides.
6. Enhacned durability, primarily enabled by the very small crack widths and the extremely high density of the material.
7. Self-consolidating properties, which simplify construction.

As of 2011, the primary commercially available UHPC on the US market was available through LaFarge and marketed as Ductal ®. Ductal ® is a proprietary material that is much more expensive than regular concretes. Construction using Ductal ® and other similar materials available through European suppliers requires specially certified contractors and costly construction processes, such as pressure or heat treatment, which are impractical to achieve in the field. High material cost coupled with complicated and costly construction procedures have all but eliminated widespread adoption of UHPC in the US.

An alternative UHPC (one is being developed at the University of Michigan) has the potential for removing all obstacles preventing widespread use of UHPC in the State of Michigan and in the US. In additional to the basic properties listed above, this new material would have new critical advantages:

8. It is nonproprietary and made up of components that are available on the US market.
9. Does not require expensive heat or pressure treatment. The non-proprietary UHPC would be mixed with conventional equipment which allows to be commercially made and delivered the same way as regular concrete. The advanced material properties of UHPC would likely be optimized for lower cost, albeit with slightly lower performance.

The objective of this research is to optimize for cost using commercially available materials in the State of Michigan, characterize the mechanical properties of the new UHPC and define appropriate applications, primarily focusing on exploiting the unique properties of the new material for accelerated bridge construction. It is NOT an objective to reverse engineer the key components of proprietary mixes.

RESEARCH OBJECTIVES

IN 25 WORDS OR LESS, LIST THE RESEARCH OBJECTIVES TO BE ACCOMPLISHED

1. Survey and identify potential applications for UHPC, particularly in Precast Birdge Element System (PBES). Examples where the use of UHPC may be most beneficial include: roadway barriers, slabs, slab connections, PBES connections, and pavement joints.
2. Investigate whether the new UHPC material can be made using locally available components. Can the cost be reduced through optimization?
3. Characterize properties of the UHPC, focusing on tensile strength, compressive strength, modulus of elasticity, and durability by laboratory testing and a field demonstration project.
4. Applications for use of UHPC will be developed in conjunction with MDOT staff and their feasibility will be identified through the use of finite element analysis or simulation technology.

5. Select the most promising application and conduct limited tests to show proof of concept. Provide for a batch scale up test for MDOT staff to observe the batching, mixing, placement, curing and sampling characteristics.
6. Develop design, operational, and maintenance guidance on the UHPC chosen applications, such as development length for steel reinforcement, wet concrete properties, and rehabilitation limitations to be considered (hydro demolition, removal methods).
7. Develop use guidance on UHPC with cost/benefit analysis procedure and clearly stated assumptions. Define what criteria would classify a concrete mixture as UHPC.

RESEARCH TASKS

LIST THE MAJOR TASKS TO ACCOMPLISH THE RESEARCH OBJECTIVES

1. Literature review
2. Survery and identify UHPC applications for PBES
3. Development, optimization and characterization of UHPC (lab and field testing)
4. Finite element analysis of optimal UHPC applications in PBES
5. Design guide and final report

ESTIMATED TIMELINE

ENTER START DATE: 10/1/2013 ENTER END DATE: 9/30/2015

ESTIMATED BUDGET

FROM THE WORKSHEET ON PAGE 3, ENTER THE FOLLOWING: 1.) VENDOR COSTS; 2.) PM/MDOT COSTS; 3.) TOTAL BUDGET

1.) VENDOR COSTS	2.) PM/MDOT COSTS	3.) TOTAL BUDGET
$ 293,000	$ 20,000	$ 313,000

DELIVERABLES

IN 50 WORDS OR LESS, LIST THE DELIVERABLES YOU WOULD RECEIVE AT THE END OF THIS PROJECT. CONSIDER DELIVERABLES SUCH AS 1) DESIGN METHOD, 2) TRAINING, 3) MANUAL OF PRACTICE, 4) PROCEDURE, 5) SPECIFICATION, 6) SOFTWARE AND 7) EQUIPMENT.

1. Non-proprietary UHPC mix that can be easily made with conventional methods;
2. Design guide on use of UHPC;
3. Final report with recommendations on best applications for UHPC on PBES components.

IN 100 WORDS OR LESS, EXPLAIN MDOT INVOLVEMENT'S WITH DATA AND SERVICES.

Distribution of survey to other SHA's, information on current practice and specifications for concrete mixes, selection of best fit applications for UHPC in PBES components.

IMPLEMENTATION

DESCRIBE HOW THIS PROJECT WILL BE IMPLEMENTED AT MDOT

Non-proprietary UHPC can be used on selected PBES projects for proof of concept and design guides updated to indicate appropriate use. Develop as necessary special provision to ensure alignment and consistency with use.

EXPLAIN THE EXPECTED BENEFITS/RESULTS FROM THE IMPLEMENTATION OF THIS PROJECT AND POTENTIAL USERS

With its unique properties, UHPC has drawn national and internation attention in recent years as a material that has the potential for dramatically increasing the service life of bridges and other transportation infrastructure components. As such, deployment of UHPC in the state of Michigan can result in significant future savings in maintenance and replacement costs associated with MDOT's infrastructure. In other words, there is the potential for substantial direct and indirect savings in the long term. UHPC is a new material with strong potential for building strucutres that are significantly more durable than is currently possible with conventional materials. Therefore, every structure built at the moment is an opportunity lost to start building a longer lasting infrastructure that is considerably cheaper to maintain in the long run. Therefore, this research is deemed urgent because of the expected long term cost reduction associated with its immediate deployment.

LITERATURE RESEARCH

SELECT A STATEMENT BELOW REGARDING YOUR REVIEW OF THE LITERATURE AND ADD A NOTE IF RESEARCH IS COMPLEMENTARY:

PROPOSED RESEARCH IS COMPLEMENTARY TO EXISTING RESEARCH.

NOTE:

POTENTIAL OBSTACLES

IN 25 WORDS OR LESS, WHAT RISKS OR OBSTACLES MAY MAKE CARRYING OUT THIS PROJECT DIFFICULT? WHAT STRATEGIES WILL YOU USE TO OVERCOME THEM?

OBSTACLES	STRATEGIES
❖ The properties and performance of the non-proprietary UHPC may be substantially less than desired.	❖ By incorporating appropriate design considerations and selecting the best use for the UHPC, a higher performing product can be realized.

INVESTIGATOR(S)

DESIRED QUALIFICATIONS FOR RESEARCH TEAM:

Prior experience and research into UHPC, regardless of proprietary status. Knowledge of MDOT specifications and construction methods. Advanced knowledge of concrete materials and testing. Facilities and experience in materials characterization and optimization. Robust finite element analysis capability.

SELECT THE REQUIRED STATISTICAL QUALIFICATIONS IN AN INVESTIGATOR(S) AND TEAM BELOW:
At Least One (1) college series of statistics courses and working experience in statistical analyses
PRINCIPAL INVESTIGATOR'S NAME: Dr. Sherif El-Tawil
ORGANIZATION: University of Michigan

SEE WORKSHEET ON FOLLOWING PAGES FOR ADDITIONAL INFORMATION AND NOTES

RESEARCH ADMINISTRATION
PROBLEM STATEMENT
WORKSHEET

ESTIMATED PERSON HOURS FOR RESEARCH TASKS

FOR THE RESEARCH TASKS ON PAGE 1, PLEASE LIST THE ESTIMATED PERSON HOURS BELOW:

1.) Task #1 – 340 hours
2.) Task #2 – 130 hours
3.) Task #3 – 1620 hours
4.) Task #4 – 340 hours
5.) Task #5 – 270 hours

TOTAL ESTIMATED PERSON HOURS 2700

ESTIMATED BUDGET

USE THE FOLLOWING EQUATIONS FOR ESTIMATING PROJECT COSTS.
(HOURLY RATES AND PERCENTAGES SHOWN FOR EXAMPLE ONLY.)

1.) CALCULATE VENDOR DIRECT LABOR WITH THIS EQUATION

Estimated Person Hours are the Labor Hours

Direct Labor: Labor Hours x Average pay rate
Example: Direct Labor = 2000 hrs x $45/hr = $90,000.00
Direct Labor: 2700 X $45= $121,500

2.) CALCULATE TOTAL VENDOR COST

REQUIRED COSTS
DIRECT LABOR= $ 121,500
FRINGE BENEFITS= $ 12,150
TRAVEL= $ 4,430
SUPPLIES= $ 26,075 ($6,075 base budget + $20,000 extra budget for specimen supplies)
OTHER EXPENSES= $ 50,225 ($18,225 base budget + $32,000 extra tuition)
INDIRECT= $ 78,185

Total Vendor Cost: $121,500 + $12,150 + $4,430 + $26,075 + $50,225 + $78,185 =$ 292,565 (293,000)
This is your TOTAL VENDOR COST.
Note: Fill this in on the Vendor Cost section under ESTIMATED BUDGET.

3.) Use MDOT PM BUDGET WORKSHEET to calculate your PM costs.
Enter PM Costs and any notes or calculations. $ 20,000
Fill this total in on the PM/MDOT Costs section under ESTIMATED BUDGET

4.) Enter GRAND TOTAL for 2 and 3. $ 313,000
Fill this total in on the TOTAL BUDGET section under ESTIMATED BUDGET

ANNUAL FINANCIAL BUDGET BREAKDOWN

FY1 $156,600	FY2 $156,500	FY3 $FY3 BUDGET	FY4 $FY4 BUDGET

METHOD OF PAYMENT

SELECT METHOD OF PAYMENT BELOW
ACTUAL COSTS (UNIVERSITY CONTRACTS)

INVESTIGATOR(S)

NAMES OF POSSIBLE INVESTIGATORS: MTU, UM and others have begun experimenting with UHPC.

SELECT RECOMMENDED REQUEST FOR PROPOSAL SOLICITATION: MICHIGAN UNIVERSITIES ONLY

STAKEHOLDERS

SELECT THE PROJECT'S IMPLICATIONS:
NATIONAL

LIST ANY OTHER STATE, REGIONAL OR NATIONAL AGENCIES AND OTHER GROUPS MAY HAVE AN INTEREST IN SUPPORTING THIS STUDY
N/A

DO NOT WRITE BELOW THIS LINE

FOCUS AREA MANAGER APPROVAL*	ENGINEER OF RESEARCH APPROVAL*
EMAIL 5/10/2013	MEETING NOTES 6/12/2013
RESEARCH ADVISORY COMMITTEE CHAIR APPROVAL*	**RESEARCH EXECUTIVE COMMITTEE CHAIR APPROVAL***
MEETING NOTES 6/17/2013	CONVERSATION RECORD 7/24/2013

*Records of approval are saved in project file.

MDOT employees with questions should contact:
Steve Bower, P.E., Administrator, Research Administration
Phone: 517-636-7777, Fax: 517-322-1262, bowers@michigan.gov
Or review the Research and Implementation Manual

Michigan Department
Of Transportation
5302

RESEARCH ADMINISTRATION
PARTICIPATING STATE POOLED FUND SUMMARY & FUNDING REQUEST

STUDY START DATE	STUDY END DATE	MDOT START DATE	MDOT END DATE
10/1/2009	9/30/2013	10/1/2009	9/30/2013

STUDY TITLE
Validation and Implementation of Hot-Poured Crack Sealant

LEAD AGENCY	TPF STUDY NUMBER
Virginia Department of Transportation	TPF-5(225)

LEAD AGENCY CONTACT NAME
Kevin McGhee,

MDOT TECHNICAL ADVISOR
Andy Bennett

BUDGET INFORMATION

TOTAL BUDGET (BY FY)	FY1	FY2	FY3	FY4	FY5
$100,000.00	$25,000.00	$25,000.00	$25,000.00	$25,000.00	

PROBLEM TO ADDRESS

Round robin tests at five to seven various laboratories will be conducted. As an outcome of the TPF-5(045) study preliminary threshold(s) for each test were established based on extensive laboratory testing and limited field data. Therefore, a comprehensive field study is urgently needed to validate and to fine-tune the threshold values.

OBJECTIVES

Eight test sections in various climatic regions (dry-freeze, dry-non-freeze, wet-freeze and wet-non-freeze) will be included in the study. Representative crack sealants will be installed in these field sections and monitored for three years. At least five field surveys will be conducted. The field surveys will include sealant inspection and data and sample collection. Collected samples will be used to validate the laboratory tests and the proposed parameter threshold values

TASKS

Task I : Laboratory Validation
Conduct round robin testing to establish test precision and bias for the recently developed six tests.
Develop training program that includes detailed testing procedures.
Task II: Field Validation
Construct eight test sections in the four environmental regions (Wet-Freeze, Wet-Non-freeze, Dry-Freeze, Dry-Non-freeze).
Install two sealant types at each test section.
Task III: Monitoring Test Section for Four Years
Conduct field inspection of crack sealant five times during the project duration. Collect sealant samples annually from the test sections to measure their theological properties and identify any changes. Monitor crack movement and temperature variation to provide insight into the selection of the current temperature shift used in the proposed guidelines.
Task IV: Threshold Value Fine-Tuning
Use field performance to fine-tune the testing parameter thresholds in the proposed guidelines.
Task V: Quantify the Cost Effectiveness of Utilizing Crack Sealants
Measure pavement condition annually, in accordance with SHRP Distress Manual, to examine the cost effectiveness of crack sealant.

PAYOFF POTENTIAL AND IMPLEMENTATION

How will MDOT be able to implement results from study?
Possible Implementation: Based on the field validation study at various test sites, performance thresholds will be updated for the laboratory tests designed for sealant grading. These thresholds were initially determined based on limited field data. The finalized grade system can be used by the states on the selection of sealants in their climatic region. Sealant field installation guidelines will also be available at the end of this project for the use of states.

PRODUCTS/DELIVERABLES

IS OUT OF STATE TRAVEL REQUIRED?	IF SO, WILL SPR, PART II FUNDS COVER TRAVEL EXPENSES?
☐ YES ☒ NO	☐ YES ☐ NO

OTHER CONSIDERATIONS AS APPLICABLE (WILL STATE FUNDS BE REQUIRED?).

DO NOT WRITE BELOW THIS LINE	
FOCUS AREA MANAGER APPROVAL* ☐ EMAIL ☐ CONVERSATION RECORD ☐ MEETING NOTES	DATE
RESEARCH ADVISORY COMMITTEE CHAIR APPROVAL* ☐ EMAIL ☐ CONVERSATION RECORD ☐MEETING NOTES	DATE
COO OR CAO APPROVAL* ☐ EMAIL ☐ CONVERSATION RECORD ☐ MEETING NOTES	DATE
RESEARCH MANAGER SIGNATURE	DATE
ENGINEER OF RESEARCH SIGNATURE	DATE

*Records of approvals are saved in project file

Research Project Spotlight Template

Principal Investigators – Research Spotlights are a required portion of the final report. Please fill out this form with the requested information and adhere to the word count. Click in the space to enter the requested information. Once completed, please send to your assigned Project Manager for their approval, along with the draft final report.

Research Project Information

Report Name: Click here to enter text.

Start Date: Click here to enter a date.

Report Date: Click here to enter a date.

Research Report Number: Click here to enter text.

Total Cost: Click here to enter text.

****

Title/Tagline- Please describe the project results in layman's terms using 10 words or less.

Title/Tagline: Click here to enter text.

Synopsis – Please explain in 100 words or less the context of the problem, a simple description of the research and how the results are being used in layman's terms.

Synopsis: Click here to enter text.

Problem – Please describe using 100 words or less the logical overview of how the problem came about in layman terms.

Problem: Click here to enter text.

Research – In 150-200 words, please provide a broad understanding of the method of research and at least two key findings resulting from it in layman's terms.

Research: Click here to enter text.

Results – Using 275-300 words, please explain in plain language the results of the research study as it relates to the end users at MDOT.

Results: Click here to enter text.

Value: Using 75-100 words, please explain the value of this research to the end users at MDOT.

Value: Click here to enter text.

Research Project Spotlight Template

Please include 2-3 pictures related to the project data collection, problem, or solution. Use a JPG file extension. Be sure to include a one sentence caption.

Principal Investigator

Name: Click here to enter text.

University/Contracting Agency: Click here to enter text.

Address: Click here to enter text.

PI's Email: Click here to enter text.

PI's Phone Number: Click here to enter text.

MDOT Project Manager

Name: Click here to enter text.

Title: Click here to enter text.

Research Project Spotlight Template

Division/Section: Click here to enter text.

Work Address: Click here to enter text.

Work Email: Click here to enter text.

Work Phone: Click here to enter text.

PM Quote: Click here to enter text.

Request a quote from the Project Manager that describes the value of the research project.

PM Picture

Request a photo from the Project Manager with a JPG file extension.

Research Manager and Project Manager Responsibilities
Project Administration and Management

Both the research manager and project manager are essential to the success of a research project. The project manager is the subject area expert and is responsible for managing the research project. The research manager is the research administration staff person that assists the project manager with administrative matters and helps facilitate project progress for a successful outcome. The roles of both the project manager and research manager are further defined in the following table:

Project Phase	**Research Managers (RM) Role**
Problem Statement Development	-Initiate a literature search. -Discuss literature search results with the PM and discuss any impacts on the project merits, cost, scope or schedule. -Assist the Project Manager (PM) with selecting RAP membership. -Assist the PM with development of a project cost, scope, schedule and deliverables. -Review problem statements authored by the PM for completeness. -Review scope; confirm SPR Part II funding eligibility and recommend necessary scope modifications if necessary. -Review traffic control needs and associated costs. -Assess the statistical need for the project. -Assist the PM in determining the solicitation method.
Contracting	-Work with the project analyst to initiate project advertisement (Request for Proposals) -Conduct scoring training for the project selection team. -Facilitate the scoring meetings. -Compile scoring meeting results for Central Selection Review Team review. -Notify the Principal Investigator (successful proposer) of project award. -Request work plan from the Principal Investigator (PI). -Review the work plan for compliance with MDOT requirements. -Facilitate subcontract review and submittal process. -Verify that subcontracts are in place. -Set up debriefing meetings with unsuccessful proposers on request. -Ensure that project information is entered into the Research in Process (RIP) database.
Execution	-Record minutes and/or action items at the kickoff meeting. -Schedule subsequent project meetings in coordination with the PM. -Ensure that all project meetings have documented minutes and/ or action items. Coordinate this responsibility with the PM to ensure completion of the task. Ensure that administrative issues are addressed at project meetings. -Ensure that invoices, quarterly reports and annual reports are received in a timely manner. -Reviews invoices, quarterly reports and annual reports after PM reviews are complete. -Work with PM to process changes to cost, scope and schedule.
Project Closeout	-Ensure that the project deliverables reminder email is sent to the PM. -Facilitate the process of implementation planning with the PM and RAP. -Ensure that final project evaluation is completed. -Ensure final research report is posted online and in the Transportation Research Information Database (TRID).

Research Manager and Project Manager Responsibilities
Project Administration and Management

Project Phase	Project Managers (PM) Role
Problem Statement Development	-Facilitate/lead the research idea work session at the Research Summit. -Develop the problem statement in collaboration with the RAP panel members and other research stakeholders. -Recommend research advisory panel (RAP) members for Focus Area Manager approval. Utilize the Research Advisory Panel Nomination Form (5314). -Identify and confirm necessary MDOT resource and data availability prior to project advertisement. -Determine project cost, scope, schedule and deliverables. -Identify traffic control needs and associated costs. -Recommend the solicitation method.
Contracting	-Receive scoring training as needed. -Review past performance of each proposer. -Chair the proposal scoring meeting. -Respond to proposers formally submitted questions. -Review the work plan of the successful proposer for completeness. -Complete the Request for New Project Authorization form (5301).
Execution	-Schedule the project kick-off meeting. -Copy RM on all communications between the PI and PM. -Schedule and organize all project meetings subsequent to kick-off meeting. - Ensure that all project meetings have documented minutes and/ or action items. Coordinate this responsibility with the RM to ensure completion of the task. -Obtain approval to conduct any fieldwork in State right-of-way. Permits are required. -Contact the PI to communicate technical project issues, meeting dates and deliverable deadlines. -Reviews quarterly reports; writes, completes and submits the annual report; reviews invoices. -Works with PI and RAP to manage technical aspects including follow-up on assigned action items to insure the project stays on time, on budget and in scope. -Recommend changes in cost, scope and schedule. Submit changes on the Project Change Request form (5306) along with necessary supporting documentation.
Project Closeout	-Develop implementation plan. -Identify an implementation coordinator. -Review final report and deliverables. -Complete the project evaluation form.

Michigan Department
Of Transportation
5301 (04/12)

Research Administration
Request for New Project Authorization or Contract

PROJECT TITLE			
VENDOR/UNIVERSITY			
PRINCIPAL INVESTIGATOR'S NAME	EMAIL	PHONE NO.	FAX NO.
MDOT PROJECT MANAGER'S NAME	MAIL CODE	PHONE NO.	FAX NO.
RESEARCH MANAGER	MAIL CODE	PHONE NO.	FAX NO.

START DATE	ENDING DATE	WORK DURATION IN MONTHS	

TOTAL PROJECT COST	
AMOUNT TO BE SPENT BETWEEN 10/1/__ & 9/30/__	AMOUNT TO BE SPENT BETWEEN 10/1/__ & 9/30/__
AMOUNT TO BE SPENT BETWEEN 10/1/__ & 9/30/__	AMOUNT TO BE SPENT BETWEEN 10/1/__ & 9/30/__

Proposal Received – Verify the Following:

Personnel – all labor reported as % of effort (none included in direct expenses)
Sub consultants have submitted a derivation of cost (Sub contract will be required if greater than $25,000)
Special Equipment
- Verified equipment is necessary for the project
- Verified equipment is dedicated to the use of this project
- Verified equipment is prorated for the life of this project

Provide breakdown of direct expenses over $2,000. This includes but is not limited to: Lab supplies, Travel expenses, Phone, Fax, Copying, etc.
Proposed budget is broken down by MDOT fiscal year.

MDOT should be able to determine how expenses were developed from the breakdown provided (ex: Mail-250 letters @ $9/letter)
Please send and Email this completed form along with the proposal (work plan and budget) to Research Administration

PROJECT MANAGER'S SIGNATURE		DATE
ENGINEER OF RESEARCH	RESEARCH MANAGER INITIALS	DATE

FOR RESEARCH STAFF USE:

RESEARCH NO.	JOB NO.	PHASE NO.	PCA CODE	INDEX CODE	OBJECT CODE

Michigan Department
Of Transportation
5185 (09/13)

Contract Services Division

ACCEPTANCE OF PRICED PROPOSAL & AUTHORIZATION FOR UNIVERSITY TO PROCEED

FORM USE: *University Research*
COPY OF THIS SHEET ONLY: *Office of Commission Audits, Engineer of Research Administration*
FULL COPY: *MDOT Project Manager, University, Research Analyst (if applicable)*

CONTRACT NO.	AUTHORIZATION & REVISION NO.	IDS CONTRACT EFFECTIVE DATE	IDS CONTRACT EXPIRATION DATE

AUTHORIZED UNIVERSITY AND ADDRESS	UNIVERSITY ADMINISTRATOR	
	ADDRESS MAIL TO THIS PERSON	
	PHONE NO.	FAX NO.
	E-MAIL ADDRESS	

PRINCIPLE INVESTIGATOR	ASSOCIATE RESEARCHERS	
MDOT PROJECT MANAGER	REGION/TSC	MAIL CODE
PHONE NO. / FAX NO.	EMAIL ADDRESS	

SERVICE DESCRIPTION & LOCATION / Page(s) (1 to _____)

RESEARCH NO.	CS NO.	JOB NO.	% FEDERAL %	PCA CODE	INDEX CODE	REPORTING

INVOICING LIMITATION
The University may only invoice up to 85% of the total authorization amount prior to the submission and subsequent approval of the final deliverables.

On December 1 each year, all prior fiscal year funds will be released from existing obligation. If invoices are submitted on or after November 15 for prior fiscal year work, payment will be delayed

MDOT PAYMENTS AREA TO SEND UNIVERSITY INVOICES

- ☐ Office of Research Administration (Research Admin. Assistant)
- ☐ Contract Services Division – Contract Support Unit
- ☐ Bureau of Transportation Planning

AUTHORIZATION EFFECTIVE DATE (START DATE)	AUTHORIZATION EXPIRATION DATE

COMMENTS

SUMMARY OF COST

FUNDING	FY JN	FY JN	FY JN	AMOUNT
University Share				
MDOT Funding				
Federal Funding				
Totals				
AUTHORIZATION AMOUNT				
Basis of Payment is:		TOTAL AUTHORIZED TO DATE		

UNIVERSITY ADMINISTRATOR	DATE SIGNED
MDOT CONTRACT ADMINISTRATOR	DATE REVIEWED
MDOT AUTHORIZATION BY	DATE EXECUTED

Michigan Department of Transportation 5100D (03/12)

REQUEST FOR PROPOSAL COVER SHEET

PROJECT INFORMATION:		
MDOT PROJECT MANAGER:	JOB NUMBER (JN):	CONTROL SECTION (CS):
RFP DUE DATE:	DBE % GOAL (If applicable):	MDOT REQUISITION NUMBER:

PRIME CONSULTANT INFORMATION:

PRIME FIRM NAME:

ADDRESS:

CITY:	STATE:	ZIP CODE:
PHONE NO.:	FAX NO.:	
CONTACT PERSON:	EMAIL:	

☐ INDIVIDUAL OR SOLE PROPRIETORSHIP ☐ CORPORATION ☐ PARTNERSHIP

LICENSED TO OPERATE IN THE STATE OF MICHIGAN?	CERTIFIED AS A DBE IN MICHIGAN?	DBE % OF SERVICE GOAL:
☐ YES ☐ NO	☐ YES ☐ NO	

LIST APPLICABLE SERVICE PREQUALIFICATIONS AS LISTED IN RFP, (P) PRIMARY OR (S) SECONDARY, AND (DBE) IF DBE CERTIFIED:

eg. Roads and Streets (P) (DBE)	

Add SubConsultant

SUBCONSULTANT INFORMATION:

SUBCONSULTANT FIRM NAME:

ADDRESS:

CITY:	STATE:	ZIP CODE:
PHONE NO.:	FAX NO.:	
CONTACT PERSON:	EMAIL:	

☐ INDIVIDUAL OR SOLE PROPRIETORSHIP ☐ CORPORATION ☐ PARTNERSHIP

LICENSED TO OPERATE IN THE STATE OF MICHIGAN?	CERTIFIED AS A DBE IN MICHIGAN?	DBE % OF SERVICE GOAL:
☐ YES ☐ NO	☐ YES ☐ NO	

LIST APPLICABLE SERVICE PREQUALIFICATIONS AS LISTED IN RFP, (P) PRIMARY OR (S) SECONDARY, AND (DBE) IF DBE CERTIFIED:

eg. Roads and Streets (P) (DBE)	
	Delete SubConsultant

CONFLICT OF INTEREST STATEMENT

_____ (Consultant) certifies that it has read and understands the following:

The CONSULTANT and its Affiliates agree not to have any public or private interest, and shall not acquire directly or indirectly an such interest in connection with the project, that would conflict or appear to conflict in any manner with the performance of the services under this Contract. "Affiliate" means a corporate entity linked in the CONSULTANT through common ownership. The CONSULTANT and its Affiliates agree not to provide any services to a construction contractor or any entity that may have an adversarial interest in a project for which it has provided services to the DEPARTMENT. The CONSULTANT and its Affiliates agree to disclosed to the DEPARTMENT all other interests that the prime or sub consultants have or contemplate having during each phase of the project. The phases of the project include, but are not limited to, planning, scoping, early preliminary engineering, design, and construction. In all situations, the Department will decide if a conflict of interest exists. If the CONSULTANT and its Affiliates choose to retain the interest constituting the conflict, the DEPARTMENT may terminate the Contract for cause in accordance with the provisions stated in this Contract.

☐ Certification for Subject Project. Based on the foregoing, the Consultant certifies that no conflict exists with the subject project for it, its Affiliates, and any sub-consultants.

☐ Disclose of Conflict with Subject Project. Based on the foregoing, the Consultant certifies that the following conflict exists with the subject project for it, its Affiliates, and/or any sub-consultants.

CERTIFICATION OF AVAILABILITY OF KEY PERSONNEL

It is the consultant's responsibility to notify MDOT of any changes to the availability of key staff listed on this form throughout the entire contracting process. Notification of Changes to Key Personnel may be noted on form 5100G.

_____ (Consultant) certifies that the following key personnel are are available and have sufficient time to provide the services as outlined in the Request for Proposal for the life of the above project.

Add Row	NAME	TITLE	AVERAGE NUMBER OF HOURS PER WEEK ON PROJECT	PHONE NUMBER
Delete Row				
Delete Row				

PRIME CONSULTANT SIGNATURE (SIGNER MUST HAVE CONTRACTING AUTHORITY)	DATE

Michigan Department
Of Transportation
5318 (09/12)

SCHEDULE OF RESEARCH ACTIVITIES

An O, R, or X is used to indicate a month with activity.	"O" = Original Schedule	REVISION DATE	TITLE
	"X" = Work Completed		
	"R" = Revised Schedule		

Research Activity		Estimated % of Total Project Budget	FY 20_____												FY20_____												FY20_____											
			Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep
Task 1																																						
Task 2																																						
Task 3																																						
Task 4																																						
Task 5																																						
Task 6																																						
Task 7																																						
Task 8																																						
Task 9																																						
Task 10																																						
Total (should = 100%)																																						

Michigan Department of Transportation
5316 (09/12)

DELIVERABLES TABLE

PROJECT TITLE

NOTE: Deliverables on this table are not considered received by MDOT until submitted to Research Administration. See MDOT's Research and Implementation Manual for standards for the final report. The Principal Investigator is responsible for submitting deliverables.

Products: Examples of products typically most appropriate as stand-alone items include guidebooks, training materials, devices, instruction manuals, and brochures.

Add Row	**No.** (P1, P2, Etc.)	**Stand-Alone Product Description**	**Due Date** (due at or before project termination)	**Comments**
Delete Row				

No.	**Report Description** (Succinctly describe intended contents of each report.)	**Due Date**	**Comments**
R1	Quarterly Reports - Comprehensive and Detailed documentation of all work tasks and results	The 15th of January, April, July, and October while the authorization or contract is active.	Must be submitted to Research Administration on the quarterly report form number 5305.
R2	Draft summary of work performed, findings and conclusions		A draft final report is due 90 days before the final report.
R3			
R4			
Final Report	Summary of work performed, findings and conclusions		See MDOT's Research and Implementation Manual for standards and submittal requirements for the final report.

Date:

Michigan Department
Of Transportation
5100J (07/09)

CONSULTANT DATA AND SIGNATURE SHEET

Required with Non-Prequalified Services Proposal

	DATE
INDIVIDUAL/FIRM	FED. I.D. NO

CERTIFICATION AFFIDAVIT

The undersigned affirms that all information provided is true and correct and includes information necessary to identify and explain the operations of _____.

PRINT OR TYPE NAME, SAME AS SIGNATURE BELOW	TITLE
AUTHORIZED SIGNATURE	DATE

NOTARY SEAL	SUBSCRIBED AND SWORN TO BEFORE ME THIS DAY OF 20
	SIGNED
	Notary Public in and for the

NAME OF CORPORATION		
ADDRESS		
CITY	STATE	ZIP CODE
STATE IN WHICH INCORPORATED		

PERSONS AUTHORIZED TO EXECUTE CONTRACTS

All partners must sign contracts, unless a power of attorney modifying this is supplied. In case of a corporation, only those signatures listed below will be accepted. The following persons are duly authorized to sign contracts and related documents on behalf of _____.

NOTE: In addition, CORPORATIONS will complete the Certificate of Secretary listing those persons authorized to sign contracts.

NAME (Print or type – same as corresponding signature	AUTHORIZED SIGNATURE	DATE

CERTIFICATE OF SECRETARY

The undersigned, being the duly elected secretary of _____

a _____ corporation, hereby certifies that the following resolution was duly adopted by the Board of Directors of said corporation at a meeting held on _____, and that this resolution is in full force and effect.

"RESOLVED, that the following listed persons are hereby authorized to sign, for _____ any contract with the State of Michigan or other governmental entity."

SIGNATURE OF SECRETARY	DATE

Michigan Department
Of Transportation
5319 (10/12)

RESEARCH PROPOSAL BUDGET FORM WORKSHEET

PROJECT TITLE	RESEARCH ORGANIZATION	DATE

SALARIES & WAGES – MUST COMPLY WITH OMB CIRCULAR A-21 Specify number of hours to be worked and hourly rate for each individual below.
Examples of role of individual are Principle Investigator, Technician, Grad Student, etc.

									FY1	FY2	FY3	FY4	TOTAL
NAME OF INDIVIDUAL									ROLE OF INDIVIDUAL				
Enter FY	FY1 rate	FY1 hrs	FY2 rate	FY2 hrs	FY3 rate	FY3 hrs	FY4 rate	FY4 hrs					
Rate & Hrs													
NAME OF INDIVIDUAL									ROLE OF INDIVIDUAL				
Enter FY	FY1 rate	FY1 hrs	FY2 rate	FY2 hrs	FY3 rate	FY3 hrs	FY4 rate	FY4 hrs					
Rate & Hrs													
NAME OF INDIVIDUAL									ROLE OF INDIVIDUAL				
Enter FY	FY1 rate	FY1 hrs	FY2 rate	FY2 hrs	FY3 rate	FY3 hrs	FY4 rate	FY4 hrs					
Rate & Hrs													
NAME OF INDIVIDUAL									ROLE OF INDIVIDUAL				
Enter FY	FY1 rate	FY1 hrs	FY2 rate	FY2 hrs	FY3 rate	FY3 hrs	FY4 rate	FY4 hrs					
Rate & Hrs													
NAME OF INDIVIDUAL									ROLE OF INDIVIDUAL				
Enter FY	FY1 rate	FY1 hrs	FY2 rate	FY2 hrs	FY3 rate	FY3 hrs	FY4 rate	FY4 hrs					
Rate & Hrs													
NAME OF INDIVIDUAL									ROLE OF INDIVIDUAL				
Enter FY	FY1 rate	FY1 hrs	FY2 rate	FY2 hrs	FY3 rate	FY3 hrs	FY4 rate	FY4 hrs					
Rate & Hrs													
NAME OF INDIVIDUAL									ROLE OF INDIVIDUAL				
Enter FY	FY1 rate	FY1 hrs	FY2 rate	FY2 hrs	FY3 rate	FY3 hrs	FY4 rate	FY4 hrs					
Rate & Hrs													
NAME OF INDIVIDUAL									ROLE OF INDIVIDUAL				
Enter FY	FY1 rate	FY1 hrs	FY2 rate	FY2 hrs	FY3 rate	FY3 hrs	FY4 rate	FY4 hrs					
Rate & Hrs													
SUB-TOTAL SALARY & WAGES													

FRINGE BENEFITS – MUST COMPLY WITH OMB CIRCULAR A-21 Indicate employee, appropriate negotiated rate for each and description of who the rate applies to. (e.g. – Sam Smith, 25%, Summer Faculty. This rate is negotiated between the university and it's cognizant agency

									FY1	FY2	FY3	FY4	TOTAL
NAME OF INDIVIDUAL									RATE DESCRIPTION				
(% rate, enter as a decimal)	FY1		FY2		FY3		FY4						
NAME OF INDIVIDUAL									RATE DESCRIPTION				
(% rate, enter as a decimal)	FY1		FY2		FY3		FY4						
NAME OF INDIVIDUAL									RATE DESCRIPTION				
(% rate, enter as a decimal)	FY1		FY2		FY3		FY4						
NAME OF INDIVIDUAL									RATE DESCRIPTION				
(% rate, enter as a decimal)	FY1		FY2		FY3		FY4						
NAME OF INDIVIDUAL									RATE DESCRIPTION				
(% rate, enter as a decimal)	FY1		FY2		FY3		FY4						
NAME OF INDIVIDUAL									RATE DESCRIPTION				
(% rate, enter as a decimal)	FY1		FY2		FY3		FY4						
NAME OF INDIVIDUAL									RATE DESCRIPTION				
(% rate, enter as a decimal)	FY1		FY2		FY3		FY4						
NAME OF INDIVIDUAL									RATE DESCRIPTION				
(% rate, enter as a decimal)	FY1		FY2		FY3		FY4						
SUB-TOTAL FRINGE BENEFITS													

SUBCONTRACTOR – MUST COMPLY WITH OMB CIRCULAR A-21. A copy of the subcontractor's budget must be attached. An MDOT approved subcontract is required for subcontractor costs in excess of $25,000 prior to payment of invoices that contain subcontractor work. List all subcontractors on a separate line.

SUBCONTRACTOR NAME & AMOUNT					
SUBCONTRACTOR NAME & AMOUNT					
SUB-TOTAL SUBCONTRACTOR					

TRAVEL – MUST COMPLY WITH OMB CIRCULAR A-21. Must be in accordance with IDS contract requirements.

	FY1	FY2	FY3	FY4	TOTALS
In-State Travel (Destinations within Michigan) Provide destination, purpose, total mileage, total # of days, total # of meals, Total # trips, name of individual(s) traveling					
Out-of-State Travel (Prior approval required) Provide destination purpose, total mileage, total # of days, total # of meals, total # trips, name of individual(s) traveling.					
SUB-TOTAL TRAVEL					
SUPPLIES – MUST COMPLY WITH OMB CIRCULAR A-21 (Few items not allowed are: computers, printers, monitors, fax machines, printer paper, toner cartridges, pens, pencils, legal pads, clips, rubber bands, post-it notes, books, notebooks, binders, folders, diskettes, postage stamps, chairs, office furniture, calendars, paper punches, business cards, staples, waste cans, etc.) Provide details if cost exceeds $2,000. Individual line items in excess of $1,000 require a detailed explanation regardless of total cost.					
DESCRIPTION					
DESCRIPTION					
DESCRIPTION					
DESCRIPTION					
DESCRIPTION					
DESCRIPTION					
DESCRIPTION					
SUB-TOTAL SUPPLIES					
CAPITAL EQUIPMENT – MUST COMPLY WITH OMB CIRCULAR A-21. Purchased specifically for this project. List items with a value in excess of $500. Equipment in excess of $5,000 requires prior approval.					
DESCRIPTION					
DESCRIPTION					
DESCRIPTION					
DESCRIPTION					
DESCRIPTION					
DESCRIPTION					
DESCRIPTION					
SUB-TOTAL EQUIPMENT					

OTHER EXPENSES – MUST COMPLY WITH OMB CIRCULAR A-21 (Few items not allowed are: memberships in professional & scientific organizations, local telephone lines, cell phones, etc)
Any project expense which does not fall into another category. Provide detailed explanation of the expense and applicable breakdown of costs (e.g., graduate student tuition).

	FY1	FY2	FY3	FY4	TOTAL
DESCRIPTION					
DESCRIPTION					
DESCRIPTION					
DESCRIPTION					
DESCRIPTION					
SUB-TOTAL OTHER EXPENSES					
TOTAL SUB-TOTALS					

INDIRECT COSTS – MUST COMPLY WITH OMB CIRCULAR A-21. Indirect cost rates are negotiated between the university and it's cognizant agency. Indicate the type of negotiated indirect rate used and the percentage (e.g., On Campus Research, 52%)

TYPE	PERCENTAGE (%) ENTER AS A DECIMAL								
	FY1	**FY2**	**FY3**	**FY4**					
Enter $ Amt per FY									
TOTAL INDIRECT COSTS									

TOTAL PROJECT COSTS					
UNIVERSITY MATCHING FUNDS					
TOTAL MDOT PROJECT COSTS					

Contract Services Division

Consultant Advisory

Consultant Advisory

2009-4

April 16, 2009

Guidelines for Price Escalation Clauses in Consultants Priced Proposals

Many consultant contracts cover multiple years. Often, for multiple year contracts, the priced proposal includes an annual hourly rate escalation for consultant employees. The information below provides guidelines for the handling of price escalation in consultant contracts.

Any escalation rate proposed for labor will not be allowed by the Department until the contract extends beyond a twelve month period. (Regardless of when a pay raise is provided to employees.)

For example, a contract is proposed for the period March 1, 2009 to May 31, 2010. In this example an escalation rate will not be allowed for the first year which is March 1, 2009 through February 28, 2010. The Department will allow an escalation rate of two percent for the period of March 1, 2010 through February 28, 2011 and thereafter. If it is a multiple year contract, an escalation rate should be computed on a weighted average basis. The weighted average computation should use the allowable escalation rate which will be applied to the estimated percentage of work to be performed in that year.

MDOT, CSD, Consultant
Contracts Section
P.O. Box 30050
Lansing, MI 48909
Fax/517-355-7446
www.michigan.gov/mdot

Questions regarding this Consultant Advisory should be directed to:

Carol Rademacher
517-373-3382
rademacherc@michigan.gov

Subcontract Checklist and Payment Examples

The following items must be included in all subcontract agreements.
(Please note MDOT approval is not required for subcontracts for less than $25,000.)

1. MDOT/Prime contract number and authorization number (if applicable). All Exhibits must reference the MDOT Prime contract and authorization numbers as well.

2. Prime Consultant's name and description to be used throughout the subcontract (i.e., Engineer, Consultant, etc.).

3. Subconsultant's name and description to be used throughout the subcontract (i.e., Subconsultant, Consultant, etc.).

4. Description of work being performed by the subconsultant, as described in the scope of services. Include job number(s), control section(s),and structure number(s), if applicable.

5. The basis of payment, maximum contract amount, and fixed fee amount (if applicable) must be written into the **body of the** subcontract. A derivation of cost must accompany the subcontract. The derivation of cost can not be used in lieu of the written basis of payment and maximum dollar amount. Amendments, adding additional funds, will need to specify what the basis of payment is, the total amendment and fixed fee (if applicable) amounts, along with new total maximum not to exceed contract and fixed fee amounts.

   Following are basis of payment options and the recommended contract language.

   Actual Cost: compensation for the services will be on the basis of actual cost and will not exceed $ _____, as set forth in Exhibit _____.

   Actual Cost Plus Fixed Fee: compensation for the services will be on the basis of actual cost plus a fixed fee and will not exceed $ _____, which amount includes a fixed fee of $ _____, as set forth in Exhibit _____.

   Lump Sum: Compensation for the services will be on a lump sum basis in the amount of $ _____, as set forth in Exhibit _____.

   Milestone: Compensation for the services will be on a milestone basis in the amount of $_____, payable upon completion of defined milestones, as set forth in Exhibit ____.

   Fixed Hourly Rate – Compensation for the services will be on the basis of a fixed hourly rate plus actual direct expenses and will not exceed $ _____, as set forth in Exhibit _____.

   Unit Price: Compensation for the services will be on the basis of a set unit price and will not exceed $ _____, as set forth in Exhibit _____.

6. A statement must be included in the subcontract that the subcontract shall be governed by the laws of the State of Michigan, as set forth in the prime agreement.

7. A statement must be included that all terms and conditions included in the prime agreement are incorporated in the subcontract.

8. A statement must be included stating that in the event of a conflict between the terms and conditions of the subcontract and those of the prime agreement, the terms and conditions of the prime agreement shall prevail.

9. Per the prime agreement language, subcontracts should state that payment to the sub consultant will be made within (10) days of your receipt of payment from MDOT.

10. Subcontract effective and expiration dates (optional). If these dates are not provided in the original subcontract, the prime agreement's effective and expiration dates will be used. If there is a time extension for the prime agreement, the time extension will automatically carry over to the subagreements,

unless the original subcontract included an expiration date, in which case an amended subcontract will need to be submitted for review and approval.

11. Records are to be maintained for 3 years from final payment.

12. The following certification language must be included in all subcontracts. "The SUBCONSULTANT agrees that the costs reported to the PRIME CONSULTANT for this Contract will represent only those items that are properly chargeable in accordance with this Contract. The SUBCONSULTANT also certifies that it has read the Contract terms and has made itself aware of the applicable laws, regulations, and terms of this Contract that apply to the reporting of costs incurred under the terms of this Contract."

13. The subcontract needs to state: "Subconsultant further certifies that it agrees to use the E-Verify system to verify that all persons hired during the contract term by the Subconsultant are legally present and authorized work in the United States.

The subcontract must be submitted to the department for approval, prior to execution. Once department approval is obtained, an approval letter will be mailed to the prime consultant for execution. An original signed copy of the subcontract should be returned to MDOT for the contract file.

Rev. 12/20/12

MDOT
Michigan Department of Transportation

Kickoff Meeting Agenda
Statewide Planning and Research, Part II
Project Title
Contract and Authorization, Job Number, Research Number
Location
Date and Time

Facilitator:	Research Manager (RM)
Invitees:	Principal Investigator (PI), organization Project Manager (PM) Research Advisory Panel member (RAP), MDOT RAP, MDOT RAP, MDOT RAP, MDOT RAP, MDOT
Purpose:	Confirm schedule, deliverables, and program requirements

AGENDA TOPICS

1. Opening remarks and introductions – RM

2. Summary of research project and schedule as outlined in the contract – RM
   a. Summary
      i. Proposed Start: date
      ii. End Date: date
      iii. Funding: budget

   b. Schedule – Review Gantt Chart

   c. Deliverables – Review Deliverables Table

   d. Implementation Plan – Review Implementation Plan

3. Presentation of research project and schedule as outlined in the contract – PI

   Task 1:
   Task 2:
   Task 3:
   Task 4:
   Task 5:
   Task …….

4. Objectives and expectations for the research – PM
   a. Objectives:
      i. List objectives from work plan or request for proposal

b. Expectations:
   i. *Starting the project well*
   ii. *Defining MDOT's and PI's role*
   iii. *Communication requirements*
   iv. *End results expectations*

5. Consensus on expectations – RM, PI, PM

6. Summary of action items and person(s) responsible – RM

7. Schedule future meetings – RM
   a. List preliminary plan for future meetings
   b. Intermediate meeting – Month
   c. Intermediate meeting – Month
   d. Intermediate meeting – Month
   e. ……..
   f. Final meeting - Month

8. Research project process and outline of responsibilities and expectations - RM
   a. Reporting – Quarter Report (PI), Annual Report (PM)
   b. Invoicing –Invoice limitation at 85%, End of year requirements
   c. Meetings – Initial, Intermediate (PM to determine frequency), Final
   d. Subcontracts – List Subcontracts

Notes:

Michigan Department
Of Transportation
5305 (4/12)

RESEARCH ADMINISTRATION
QUARTERLY REPORT

REPORT FOR QUARTER ENDING	DATE SUBMITTED
PROJECT TITLE	
RESEARCH AGENCY	
PRINCIPAL INVESTIGATOR	
PROJECT MANAGER	
RESEARCH MANAGER	

CONTRACT/AUTHORIZATION NO.			PROJECT START DATE	
PROJECT NO.			PROJECT COMPLETION DATE (Original)	
OR NO.			PROJECT COMPLETION DATE (Revised)	
BUDGET STATUS				
CONTRACT FUNDS APPROVED	$		% PERCENT COMPLETE (By Budget)	%
			% PERCENT COMPLETE (By Work)	%
TOTAL FUNDS EXPENDED TO DATE	$		% PERCENT OF TIME EXPIRED:	%

PLEASE LIST THE TECHNICAL LIAISONS AND OTHER INDIVIDUALS WHO SHOULD RECEIVE A COPY OF THIS REPORT

SUMMARY OF PROGRESS FOR THIS QUARTER

Attach a progress schedule consisting of graphical information depicting a schedule of research activities tied to **each task** defined in the proposal.

PROPOSED WORK FOR NEXT QUARTER

IMPLEMENTATION (if any)

PROBLEMS AND RECOMMENDED SOLUTIONS (if applicable)

Describe any problems encountered or anticipated that might affect the completion of the project within the time, scope, and fiscal constraints set forth in the contract. Describe recommended solutions. NOTING DIFFICULTIES IN THIS SECTION DOES NOT CONSTITUTE A REQUEST OR AUTHORITY TO MODIFY THE PROJECT. Any requests for additional time, money, or scope revisions must be submitted in a separate letter to the Engineer of Research.

EQUIPMENT PURCHASED (if any)

CONTACTS AND MEETINGS

(Describe any meetings or contact with MDOT technical liaisons and other pertinent individuals relative to this project.)

Michigan Department
Of Transportation
5312 (2011)

RESEARCH ADMINISTRATION
MDOT RESEARCH PROJECT
ANNUAL REPORT - FISCAL YEAR 20--

PROJECT TITLE:					
FUNDING SOURCE: ☐ SPR, Part II ☐ OTHER (*PLEASE EXPLAIN)*					
PROJECT MANAGER:					
CONTRACT/AUTHORIZATION NO.			PROJECT START DATE		
PROJECT NO.			COMPLETION DATE (Original)		
OR NO.			COMPLETION DATE (Revised)		
RESEARCH AGENCY					
PRINCIPAL INVESTIGATOR					

BUDGET STATUS

FY 2012 Budget				**Total Budget**		
FY FUNDS	(Original)	$		TOTAL COST	(Original)	$
	(Revised)				(Revised)	
TOTAL FY 2012 EXPENDITURES		$		**Total Contract Amount Available**		$

PURPOSE AND SCOPE

FISCAL YEAR 20-- ACCOMPLISHMENTS

FISCAL YEAR 20--ACCOMPLISHMENTS

.

FISCAL YEAR 20--ACCOMPLISHMENTS

FISCAL YEAR 20--PROPOSED ACTIVITIES

JUSTIFICATION(S) FOR REVISION(S) (List the approval date for the revision(s))

SUMMARY OF THE IMPLEMENTATION RECOMMENDATION (Required the last year of the project)

Michigan Department
of Transportation
5306 (04/12)

RESEARCH ADMINISTRATION
PROJECT CHANGE REQUEST

CHECK ALL THAT APPLY: DURATION CHANGE: ☐ COST CHANGE:: ☐ SCOPE CHANGE: ☐ STAFF CHANGE: ☐

PROJECT TITLE

PROJECT MANAGER	PRINCIPAL INVESTIGATOR	
PHONE NUMBER	PHONE NUMBER	EMAIL ADDRESS
RESEARCH AGENCY	RESEARCH MANAGER	
CONTRACT / AUTHORIZATION NUMBER	PROJECT NUMBER	
OR NUMBER	APPROVED TOTAL COST $	
PROJECT START DATE	APPROVED COMPLETION DATE	

CHANGE IN COMPLETION DATE

ORIGINAL COMPLETION DATE	ORIGINAL START DATE	NEW COMPLETION DATE REQUESTED

REASON / JUSTIFICATION FOR CHANGE

CHANGE IN COST

COST INCREASE/DECREASE	NEW COST
$	$

REASON / JUSTIFICATION FOR CHANGE

CHANGE IN SCOPE OF WORK

DESCRIPTION OF SCOPE CHANGE

REASON / JUSTIFICATION FOR CHANGE

CHANGE IN STAFF

ORIGINAL STAFF PERSON	POSITION TITLE	EFFECTIVE DATE OF CHANGE

NEW STAFF PERSON

REASON / JUSTIFICATION FOR CHANGE

PROJECT MANAGER'S SIGNATURE		DATE
ENGINEER OF RESEARCH SIGNATURE	RESEARCH MANAGER'S INITIALS	DATE

FHWA APPROVAL NEEDED? ☐ NO ☐ YES, if yes, complete the following

DATE FHWA APPROVAL REQUEST WAS SENT	DATE FHWA APPROVAL WAS RECEIVED

cc: Project File

Final Report Format

Research reports need to have a professional consistent format. The following specific sections should be included in a final report unless the project manager provides approval for a different outline unique to a particular research project.

i. Title Page
ii. Abstract Page (see attached)
iii. Acknowledgments and disclaimer (see attached)
iv. Table of Contents
v. List of Tables
vi. List of Figures
vii. Executive Summary
viii. Introduction
    1. Background
        a. Objectives
        b. Scope
    2. Statement of hypotheses
ix. Literature review (if applicable)
    1. Review of previous research
    2. Summary of state-of-the-art
x. Methodology
    1. Experimental design
    2. Equipment
    3. Procedures
xi. Findings
    1. Summary of data
    2. Method of analysis
    3. Presentation of results
xii. Discussion
    1. Validity of hypotheses
    2. Factors affecting the results
    3. Implications
xiii. Conclusions
    1. Conclusions from the study
    2. Recommendations for further research
    3. Recommendations for implementation (The Implementation Plan may be part of the final report or a separate document)
xiv. Bibliography
xv. Appendices
    1. Glossary (optional)
    2. List of Acronyms, Abbreviations and Symbols
    3. Other Appendices (as needed)
        a. Experimental data
        b. Analytical technique details
        c. User Manuals
        d. Other Deliverables

Final Report Format

Examples of completed research reports are available at the following link, www.michigan.gov/mdotresearch. These examples can be reviewed to see the content and format of a completed report.

A well-written report is clear and concise. It communicates all important aspects of the research project to the reader in an effective and professional manner. Format guidelines have been prepared with reference to the NCHRP 20-45 report, *Scientific Approaches for Transportation Research* available at http://onlinepubs.trb.org/onlinepubs/nchrp/cd-22/start.htm. Volume One of the report, *Research Methodologies*, provides useful information for planning, conducting, and reporting on research. “Chapter 5: Reports and Presentations” and “Appendix C: Writing and Format of Reports” provides guidelines for preparing reports.

As noted in MDOT’s *Consultant/Vendor Selection Guidelines for Research Service Contracts*, the consultant or university will provide a quality assurance and quality control plan with designated quality assurance staff to review the report.

While MDOT does not have a format or style guide for the final report, the following requirements must be followed:

- Pages of a final report will be numbered. Pages prior to the Introduction should be enumerated with lower case Roman numerals (i.e., i, ii, etc.). Beginning with the first page of the Introduction, Arabic numerals should be used.
- Text will be at least 12 point in size and in a common font (Times, Arial or an equivalent).
- Acronyms and abbreviations will be spelled out and noted in parentheses upon their first use in a report.
- Figures (including photographs) will be numbered and labeled.
- Tables will be numbered and labeled.
- Equations will be numbered.

The research project analyst will provide a partially completed abstract page with the report number for the project manager and principal investigator about 3 months before the end of the project.

Final Report Format

Research Report Disclaimer

The following MDOT disclaimer must be attached to all research reports and publications:

"This publication is disseminated in the interest of information exchange. The Michigan Department of Transportation (hereinafter referred to as MDOT) expressly disclaims any liability, of any kind, or for any reason, that might otherwise arise out of any use of this publication or the information or data provided in the publication. MDOT further disclaims any responsibility for typographical errors or accuracy of the information provided or contained within this information. MDOT makes no warranties or representations whatsoever regarding the quality, content, completeness, suitability, adequacy, sequence, accuracy or timeliness of the information and data provided, or that the contents represent standards, specifications, or regulations."

Final Report Format

<table>
<tr><td>1. Report No.
RC-</td><td colspan="2">2. Government Accession No.</td><td>3. MDOT Project Manager</td></tr>
<tr><td colspan="3" rowspan="2">4. Title and Subtitle</td><td>5. Report Date</td></tr>
<tr><td>6. Performing Organization Code</td></tr>
<tr><td colspan="3">7. Author(s)</td><td>8. Performing Org. Report No.</td></tr>
<tr><td colspan="3" rowspan="3">9. Performing Organization Name and Address</td><td>10. Work Unit No. (TRAIS)</td></tr>
<tr><td>11. Contract No.</td></tr>
<tr><td>11(a). Authorization No.</td></tr>
<tr><td colspan="3" rowspan="2">12. Sponsoring Agency Name and Address
Michigan Department of Transportation
Research Administration
425 West Ottawa Street
Lansing MI 48933</td><td>13. Type of Report & Period Covered
Final Report</td></tr>
<tr><td>14. Sponsoring Agency Code</td></tr>
<tr><td colspan="4">15. Supplementary Notes</td></tr>
<tr><td colspan="4">16. Abstract</td></tr>
<tr><td colspan="2">17. Key Words</td><td colspan="2">18. Distribution Statement
No restrictions. This document is available to the public through the Michigan Department of Transportation.</td></tr>
<tr><td>19. Security Classification - report
Unclassified</td><td>20. Security Classification - page
Unclassified</td><td>21. No. of Pages</td><td>22. Price</td></tr>
</table>

Early Release of Research Findings

Principal Investigators (PIs) occasionally request MDOT approval to release research findings prior to final acceptance of the project final report. The request, review, and notification procedures are as follows:

1. **PI Request to Publish**: The PI submits a signed letter requesting to publish, present, or share findings to third parties. The letter will outline who the audience is and proposed method used to share the information. A copy of the publication, slides, or other information must be included with the request. The letter is addressed to the MDOT Project Manager (PM).

2. **Project Manager (PM) Review and Recommendation:** The PM reviews the request. The PM may consult with the project Research Advisory Panel (RAP).

    a. The PM reviews the PI's past performance, and evaluates both the quality of the research findings and the potential for external sensitivities to the research conclusions. Questions to consider include,

        i. Do we expect to receive the final report to this project in a timely manner? Is the research project on schedule? Does this paper's content diverge from the research problem statement?

        ii. Is anything noted in the paper(s) contrary to MDOT's position on the subject? Is anything confidential released in this paper that should be held at this time? Is MDOT acknowledged appropriately in the paper(s)? The following MDOT disclaimer must be attached to the publication:

        "This publication is disseminated in the interest of information exchange. The Michigan Department of Transportation (hereinafter referred to as MDOT) expressly disclaims any liability, of any kind, or for any reason, that might otherwise arise out of any use of this publication or the information or data provided in the publication. MDOT further disclaims any responsibility for typographical errors or accuracy of the information provided or contained within this information. MDOT makes no warranties or representations whatsoever regarding the quality, content, completeness, suitability, adequacy, sequence, accuracy or timeliness of the information and data provided, or that the contents represent standards, specifications, or regulations."

        iii. Are the research findings valid? Do the research results support the conclusion(s) drawn?

    b. The PM reviews the recommendation with the Research Manager. The PM provides a recommendation to approve or deny the request to the Focus Area Manager (FAM). (RM).

3. **Focus Area Manager (FAM) Review/ RAC Chair Approval:** The FAM considers the recommendation and works with the PM to make any necessary revisions to the recommendation. The FAM will consult with the appropriate RAC chairperson who will have the final authority for approval or denial of the request.

Early Release of Research Findings

4. **Notification:** The PM is responsible for notifying the PI whether the request is approved or denied by MDOT. The PM will provide a copy of the disclaimer that must be attached to the publication if the request is approved.

Research Administration
MDOT Research Project Budget Worksheet

Project Title:

Project Manager:

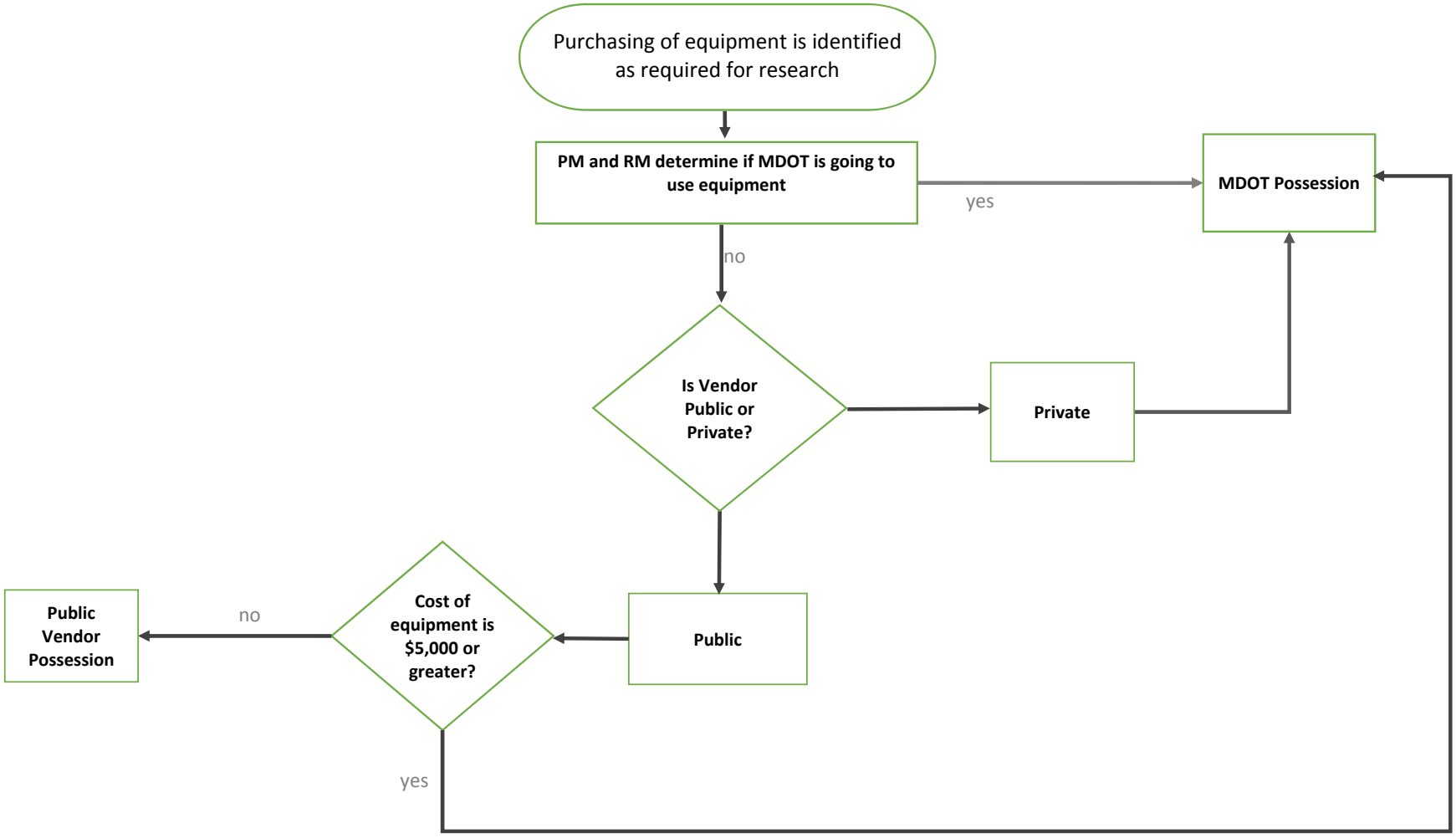
Date of Budget Estimate:

Start Date: **End Date:**

		FY 1	FY 2	FY 3	FY 4	Total
MDOT Staff and Field Work Budget	*Staff Hourly Budget:*					$ -
	Staff Travel Budget:					$ -
	MDOT Staff Subtotal:	$ -	$ -	$ -	$ -	$ -
	Traffic Control Budget:					$ -
	Research Material Budget:					$ -
	Sampling and Preparation Budget:					$ -
	MDOT Field Work Subtotal:	$ -	$ -	$ -	$ -	$ -
	MDOT Staff and Field Work Budget:	$ -	$ -	$ -	$ -	$ -

		FY 1	FY 2	FY 3	FY 4	Total
Total Budget	**MDOT Staff and Field Work Budget:**	$ -	$ -	$ -	$ -	$ -
	University/Consultant Budget:					$ -
	Total Budget:	$ -	$ -	$ -	$ -	$ -

POSSESSION OF EQUIPMENT PURCHASED WITH RESEARCH FUNDS



RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF TRANSPORTATION
LANSING

KIRK T. STEUDLE
DIRECTOR

August 3, 2012

Mr. Donald Cameron
Planning and Program Development Manager
Federal Highway Administration
315 West Allegan Street, Room 211
Lansing, Michigan 48933

Dr. Mr. Cameron:

I have enclosed the Fiscal Year (FY) 2013 State Planning and Research (SPR), Part II Annual Program for your review and approval. The proposed program was approved by the Michigan Department of Transportation's (MDOT's) Research Executive Committee (REC) on July 12, 2012. The annual certification statement is also enclosed as required by 23 CFR 420.209(c).

We request your approval to continue funding all active FY 2012 carryover research projects and provide additional funding for new projects scheduled to begin in FY 2013. Your approval will allow MDOT to proceed with fund obligation prior to October 1, 2012. We are also asking approval to issue Request for Proposals, in FY 2013, for newly identified FY 2014 projects. Table 3 of the work program summarizes these projects.

The program content includes individual research projects and pooled fund studies. In addition, the program supports contributions to the National Cooperative for Highway Research Program, Transportation Research Board Core Services Program, three national University Transportation Centers and nine American Association of State Highway Transportation Officials (AASHTO) Technical Service Program projects. Please refer to the enclosed information (including tables) for more details on the program makeup.

The FY 2013 total program budget amount is $8,823,561. The federal share is $7,504,591, and the state's share is $1,318,970. The program contains a total of 72 projects; 33 federal and state funded FY 2012 continued projects; 14 federal and state funded FY 2013 new projects; and 25 100% federally funded projects (22 Continued and 3 New)

If you have questions or need additional information, please feel free to contact me at 517-636-4777 or Andre Clover, Research Program Manager, at 517-636-6053 or e-mail clover@michigan.gov.

Sincerely,

Steven C. Bower, P.E.
Engineer of Research

Enclosure

cc: K. Steudle
G. Johnson
L. Mester
R. Van Portfliet
M. Chaput
M. VanPortfleet
S. Edgar
M. Trout
M. Frierson
T. Hoeffner
D. Wresinski
A. Clover
M. Townley
M. Polsdofer

MDOT
Michigan Department of Transportation

Statewide Planning and Research (SPR), Part II
Annual Program for Fiscal Year 2013

Certification Statement

23 CFR 420.209(c) Certification Statement

I, Kirk T. Steudle, Director of the Michigan Department of Transportation, of the State of Michigan, do hereby certify that the State is in compliance with all requirements of 23 U.S.C. 505 and its implementing regulations with respect to the research, development, and technology transfer program, and contemplate no changes in statutes, regulations, or administrative procedures which would affect such compliance.

Kirk T. Steudle, Director

JUL 31 2012
Date

STATE OF MICHIGAN
DEPARTMENT OF TRANSPORTATION
LANSING

RICK SNYDER
GOVERNOR

KIRK T. STEUDLE
DIRECTOR

October 1, 2012

Mr. Donald Cameron
Planning and Program Development Manager
Federal Highway Administration
315 West Allegan Street, Room 211
Lansing, Michigan 48933

Dear Mr. Cameron:

The Michigan Department of Transportation (MDOT) is requesting approval of amendment #1 to the fiscal year (FY) 2013 State Planning and Research (SPR), Part II, annual work plan. This request proposes to modify budgets for scope/cost on three existing projects and add two new projects to the work plan. The following provides additional detail on each specific project:

Existing Projects

Project Title - Improving Bridges with Prefabricated Precast Systems

Project Number	OR09-153
Original Budget Amount	$ 264,936
Budget Increase Amount	**$ 135,736**
Revised Budget Amount	$ 400,672

Justification: Additional study is required prior to implementation of the project findings. MDOT will form a subgroup of internal and external stakeholders. The subgroup will work with the research team to finalize a spreadsheet tool that supports the Accelerated Bridge Construction (ABC) decision making process. Several pier cap configurations have been recommended but require further evaluation prior to incorporating these new designs into the bridge design standards. The additional work requires both additional project funding and a 15 month time extension. The revised project completion date is September 30, 2013. For more detail, please refer to the attached Project Change Request form 5306 for this project.

Project Title – Remote Monitoring of Fatigue Sensitive Details on Bridges

Project Number	OR10-041
Original Budget Amount	$ 250,000
Budget Increase Amount	**$ 36,529**
Revised Budget Amount	$ 286,529

Justification: The budget increase is necessary to fund additional project costs for remote monitoring activities. The increased cost is due to additional MDOT support activity that is required to complete the research. For more detail, please refer to the attached revised Problem Statement form 5308 for this project.

Project Title – Evaluation of Bridge Decks using Non-Destructive Evaluation at Near Highway Speeds for Effective Asset Management

Project Number	OR10-043
Original Budget Amount	$ 120,000
Budget Increase Amount	**$ 130,000**
Revised Budget Amount	$ 250,000

Justification: The pre-bid engineer's estimate and estimated hours are insufficient to address the project scope requirements. The proposal review team determined that the bid of the selected proposer was reasonable based on a review of all submitted proposals. The cost increase will fund additional hours along with the purchase of equipment necessary to improve the effectiveness of non-destruction evaluation techniques. For more detail, please refer to the attached revised Problem Statement form 5308 for this project.

New Projects:

Project Title – Evaluating the use of Unmanned Aerial Vehicle (UAVs) for Transportation Purposes

Project Number	OR13-008
Original Budget Amount	$ 225,000
FY 2013 Budget Amount	**$ 150,000**

General Description: Mobility impacts and the resulting increased user costs to the transportation user have increased the need for infrastructure inspection methods that do not negatively impact mobility. Unmanned Aerial Vehicles have the potential to inspect infrastructure from the air without impeding roadway traffic. This proposed research seeks to develop UAV technology that will provide visual inspection capabilities for pump stations, roadway lighting fixtures, and sewers/culverts from an aerial platform. It will also include UAV technology for collecting LiDAR based surveying information and bridge condition data to supplement routine and in-depth inspections. The problem statement is enclosed for additional detail if desired.

Project Title – Evaluating Differential and Non-Differential Freeway Truck and Bus Speed Limits

Project Number	OR13-009
Original Budget Amount	$ 175,000
FY 2013 Budget Amount	**$ 175,000**

General Description: Michigan presently requires lower truck and bus speed limits on freeways with passenger car speed limits that are 65 mph or 70 mph. The purpose of the research is to determine the impacts of raising freeway truck and bus speed limits from the present 60 mph to 65 mph or 70 mph. The problem statement is enclosed for additional detail if desired.

The 2013 fiscal year's SPR-II FHWA approved total program budget amount is $8,823,561. The federal share is $7,504,591, and the state share is $1,318,970. This amendment request will increase the 2013 total program budget amount to $9,450,826, a federal share amount of $8,006,403 and state share amount of $1,444,423.

MDOT would like to solicit proposers for the two new projects in October 2012. Therefore, your prompt consideration of this request would be greatly appreciated. Please feel free to contact me at 517-636-7777 or Mr. Andre' D. Clover, SPR-II Program Manager. Andre' can be reached at 517-636-6053.

Sincerely,

Steven C. Bower, P.E.
Engineer of Research

Enclosures

State Planning and Research (SPR), Part II
Fiscal Year 2013 Program
And
Future SPR, Part II Research Planning
Fiscal Year 2014

Research Administration
Bureau of Field Services

Table 1: FY 2013 State Planning and Research (SPR), Part II, Program

Summary Page

CONTINUED PROJECTS BUDGET: 80% FEDERAL AND 20% STATE MATCH		
Federal Share:	$	3,908,578
State Match Share:	$	977,144
Continued Projects Subtotal Amount:	$	4,885,722
NEW PROJECTS BUDGET: 80% FEDERAL AND 20% STATE MATCH		
Federal Share:	$	1,367,303
State Match Share:	$	341,826
New Projects Subtotal Amount:	$	1,709,129
FEDERAL/STATE FUNDED PROJECTS TOTAL BUDGET:		
Total Federal Share:	$	5,275,881
Total State Match Share:	$	1,318,970
Budgeted Amount:	**$**	**6,594,851**
FEDERAL FUNDED PROJECTS TOTAL BUDGET: 100% FEDERAL		
TPF Program Projects:	$	1,755,710
AASHTO Pooled Fund Projects:	$	223,000
University Transportation Center Projects:	$	250,000
Budgeted Amount:	**$**	**2,228,710**
GRAND TOTAL BUDGET:	**$**	**8,823,561**

Table 2:

MICHIGAN DEPARTMENT OF TRANSPORTATION
STATE PLANNING AND RESEARCH, PART II (SPR-II) PROGRAM
FOR FISCAL YEAR 2013

Federal Project SPR-1284(004)
Federal Item No. RR 7861

Project Research No.	MDOT Project No.	Research Project Decription	FY 2013 Budget Amount	Project Budget Amount	Project Expenditures As of 7/6/12	Project Manager	Vendor	Project Scheduled Completion Date
CONTINUED PROJECTS								
Program/Project Development: Bridges/Structures								
OR08-016	101716	Skewed Bridges	$ 12,422	$ 214,976	$ 202,554	P. Jansson	WSU	Pending Final Deliverables
OR09-150	114488	ID Causes and Solution Strategies for Deck Cracking in Jointless Bridges (MSU)	$ 22,000	$ 169,968	$ 147,968	E. Burns	MSU	Pending Final Deliverables
OR09-153	114496	Improving Bridges with Prefabricated Precast Concrete Systems	$ 114,732	$ 264,936	$ 150,204	Beck	WMU	30-Sep-12
OR09-156	114487	Development and Validation of Models for Concrete Bridge Decks	$ 158,035	$ 299,747	$ 141,712	P. Jansson	MSU	30-Sep-12
OR09-157	114495	Implementation of Sustainable and Green Design and Construction Practices for Bridges	$ 35,696	$ 99,819	$ 64,123	Larkins	MSU	30-Sep-12
OR10-010	114494	Review and Revision of Overload Permit Classification	$ 110,305	$ 209,406	$ 99,101	Wagner	Michael Baker Jr., Inc.	31-Oct-12
OR10-040	114119	Evaluation of Prestressed Concrete Beam in Shear	$ 260,142	$ 277,774	$ 17,632	S. Kulkarni	WSU	30-Sep-13
Program/Project Development: Design								
OR10-048	114502	Re-Examination of the 1994 & Subsequent Sewer/Culvert Installations of Various Pipe Types, Sizes, and Depths	$ 149,625	$ 502,000	$ 352,375	T. Kline	URS	31-Aug-12
OR12-014	115244	Roadsides Corridor Planning	$ 190,000	$ 190,000	$ -	L. Lynwood	TBD	30-Sep-13
Program/Project Development: Traffic & Safety								
OR09-096	114527	Evaluating Pedestrian Safety Improvements: Signage and Traffic Control Countermeasures	$ 93,536	$ 199,999	$ 106,463	D. Thompson	WMU	30-Sep-12
OR10-036	114108	Study of High Tension Cable Barrier on Michigan Roadways	$ 188,683	$ 223,896	$ 35,213	C. Torres	WSU	30-Sep-14

Table 2:

MICHIGAN DEPARTMENT OF TRANSPORTATION
STATE PLANNING AND RESEARCH, PART II (SPR-II) PROGRAM
FOR FISCAL YEAR 2013

Federal Project SPR-1284(004)
Federal Item No. RR 7861

Project Research No.	MDOT Project No.	Research Project Decription	FY 2013 Budget Amount	Project Budget Amount	Project Expenditures As of 7/6/12	Project Manager	Vendor	Project Scheduled Completion Date
OR10-037	114147	Transportation Patterns of Older Driver in Rural Michigan	$ 158,288	$ 227,898	$ 69,610	K. Lariviere	U of M	30-Sep-12
OR09-083	114504	Evaluating the Performance and Effectiveness of Roundabouts	$ 3,773	$ 149,577	$ 145,804	D. Kanitz	Opus Intl.	Pending Final Deliverables
OR09-101	114525	Sharing the Road: Optimizing Pedestrian and Bicycle Safety and Vehicle Mobility	$ 11,047	$ 199,752	$ 188,705	D. Thompson	T.Y. Lin, Intl.	Pending Final Deliverables
OR09-117	114524	Evaluating Performance and Making Best Use of Passing Relief Lanes	$ 3,760	$ 159,888	$ 156,128	D. Kanitz	Opus Intl.	Pending Final Deliverables
OR09-118	115241	Safety Analysis of 4-lane to 3-lane Conversions (Road Diets) in Michigan	$ 11,279	$ 149,281	$ 138,002	T. Leix	MSU	Pending Final Deliverables
Program/Project Development: Environment								
OR10-033	114911	Greenhouse Gas Inventory for the Michigan Department of Transportation	$ 68,000	$ 68,000	$ -	N. Annelin	FTCH	30-Sep-12
Program/Project Development: Work Force Development								
OR10-049	115041	Examining the Disadvantaged Business Enterprise (DBE) Program	$ 168,836	$ 193,065	$ 24,229	P. Collins	UM	31-Aug-12
Delivery & Operations: Mobility & Systems Operations								
OR10-026	114378	Best Practices for Emergency Rerouting	$ 144,583	$ 178,083	$ 33,500	A. Kremer	Kimley-Horn	30-Sep-12
OR10-027	114155	Implementation of Quick Clearance in Michigan	$ 96,255	$ 185,255	$ 89,000	A. Kremer	Cambridge Systematics	31-Aug-12
OR10-028	114077	Transportation Reliability and Trip Satisfaction	$ 107,976	$ 172,901	$ 64,925	J. Firman	WSU	30-Sep-12
Delivery & Operations: Pavements & Materials								

Table 2:

MICHIGAN DEPARTMENT OF TRANSPORTATION
STATE PLANNING AND RESEARCH, PART II (SPR-II) PROGRAM
FOR FISCAL YEAR 2013

Federal Project SPR-1284(004)
Federal Item No. RR 7861

Project Research No.	MDOT Project No.	Research Project Decription	FY 2013 Budget Amount	Project Budget Amount	Project Expenditures As of 7/6/12	Project Manager	Vendor	Project Scheduled Completion Date
OR09-152	114528	Alternative Materials for Sustainable Transportation	$ 81,488	$ 299,961	$ 218,473	N. Maack	MTU	30-Sep-12
OR09-141	114529	Improved Performance of JPCP Overlays	$ 45,525	$ 333,957	$ 288,432	B. Krom	UM	Pending Final Deliverables
OR09-160	114532	The Cost-Effectiveness of the MDOT Preventive Maintenance Program	$ 75,640	$ 179,988	$ 104,348	K. Kennedy	Applied Pavement Tehnology	30-Sep-12
OR10-021	114937	Evaluating the Financial Cost and Impact on Long Term Pavement Performance of Expediting Michigan's Road Construction Work	$ 55,967	$ 66,757	$ 10,790	M. Grazioli	MSU	30-Sep-12
OR10-022	114076	Preparation of Implementation of the Mechanistic- Empirical Pavement Design Guide in Michigan	$ 162,080	$ 400,000	$ 54,000	M. Eacker	MSU	31-Mar-14
Delivery & Operations: Intelligent Transportation Systems								
OR07-002	102045	Evaluation of the Usage and Impact of the Michigan Vehicle Infrastructure Integration Program	$ 1,989	$ 3,500,000	$ 3,498,011	S.Cook	Mixon-Hill	Pending Final Deliverables
OR10-044	114533	Advanced Applications of IntellidriveSM Data Use Analysis and Processing 2 (DUAP2)	$ 1,801,840	$ 3,884,739	$ 470,263	S. Cook	Mixon-Hill	31-Jul-14
OR09-119	114907	Slippery Road Detection and Evaluation	$ 12,142	$ 242,836	$ 230,694	S. Cook	UM	Pending Final Deliverables
Delivery & Operations: Maintenance								
OR10-030	115243	Monitoring Highway Assets with Remote Technology	$ 319,688	$ 489,997	$ -	T. Croze	Dye Managemment	31-Jan-14
Delivery & Operations: Construction & Geotechnical								
OR10-046	114128	Effects of Pile-Driving Induced Vibrations on Nearby Structures and other Assets	$ 172,422	$ 229,371	$ 56,949	R. Endres	UM	31-Mar-13

Table 2:

MICHIGAN DEPARTMENT OF TRANSPORTATION
STATE PLANNING AND RESEARCH, PART II (SPR-II) PROGRAM
FOR FISCAL YEAR 2013

Federal Project SPR-1284(004)
Federal Item No. RR 7861

Project Research No.	MDOT Project No.	Research Project Decription	FY 2013 Budget Amount	Project Budget Amount	Project Expenditures As of 7/6/12	Project Manager	Vendor	Project Scheduled Completion Date
OR09-158	115238	Feasibility of Digital Imaging to Characterize Earth Materials	$ 5,781	$ 129,707		R. Endres	UM	Pending Final Deliverables
Multi-Modal Transportation: Rail								
OR10-031	114908	Timing Issues for Traffic Signals Interconnected with Highway-Railroad Grade Crossings	$ 42,188	$ 89,758	$ 47,570	K. Foondle	WSU	31-Jul-12
		Prior Active Projects Sub-totals:	**$ 4,885,722**	**$ 13,533,412**	**$ 6,706,053**			
CONTINUED PROJECTS: Total Budget			**$ 4,885,722**	**$ 13,533,412**	**$ 6,706,053**			

Table 2:

MICHIGAN DEPARTMENT OF TRANSPORTATION
STATE PLANNING AND RESEARCH, PART II (SPR-II) PROGRAM
FOR FISCAL YEAR 2013

Federal Project SPR-1284(004)
Federal Item No. RR 7861

Project Research No.	MDOT Project No.	Research Project Decription	FY 2013 Budget Amount	Project Budget Amount	Project Expenditures As of 7/6/12	Project Manager	Vendor	Project Scheduled Completion Date
NEW PROJECTS								
Start On or After October 1, 2012:								
Program/Project Development: Bridges/Structures								
OR14-020	TBD	Dev., Characterization, & Apllications of a Non- Proprietary Ultra High Performance Concrete for Hwy. Bridges	$ 200,000	$ 200,000	$ -	S. Kahl	TBD	30-Sep-13
OR10-038	116238	Evaluating Prestressing Strands and Post -Tensioning Cable in Concrete Structures using Nondestructive Evaluation (NDE) methods including Joint Shear Wave Analysis	$ 137,825	$ 250,000	$ -	R. Kathrens	TBD	30-Sep-14
OR10-039	116559	Design and Construction Guidelines for Strengthening Bridges using Fiber Reinforced Polymers (FRP)	$ 100,000	$ 163,524	$ -	S. Kahl	TBD	30-Sep-14
OR10-041	TBD	Remote Monitoring of Fatique Sensitive Details on Bridges	$ 125,000	$ 250,000	$ -	S. Kahl	TBD	30-Sep-14
OR10-042	116521	Side by Side Probability for Bridge Design and Analysis	$ 80,000	$ 102,240	$ -	D. Yalda	TBD	15-Dec-13
OR10-043	TBD	Evaluation of Bridge Decks using Non-Destructive Evaluation (NDE) at Near Highway Speeds for Effective Asset Management	$ 60,000	$ 120,000	$ -	E. Burns	TBD	30-Sep-14
Program/Project Development: Traffic & Safety								
OR10-035	116248	Development of Performance Measures for Non-Motorized Dynamics	$ 201,851	$ 201,851	$ -	D. Thompson	TBD	30-Sep-13
OR13-007	TBD	Evaluation of Non-Freeway Rumble Strips (Phase II)	$ 200,000	$ 310,000	$ -	J. Morena	TBD	01-Apr-14
Delivery & Operations: Mobility & Systems Operations								
OR13-004	TBD	Balancing the Costs of Mobility Investments in Work Zones- Part 1 (Establishing Thresholds)	$ 120,000	$ 370,000	$ -	H. Owen	TBD	30-Apr-15

Table 2:

MICHIGAN DEPARTMENT OF TRANSPORTATION
STATE PLANNING AND RESEARCH, PART II (SPR-II) PROGRAM
FOR FISCAL YEAR 2013

Federal Project SPR-1284(004)
Federal Item No. RR 7861

Project Research No.	MDOT Project No.	Research Project Decription	FY 2013 Budget Amount	Project Budget Amount	Project Expenditures As of 7/6/12	Project Manager	Vendor	Project Scheduled Completion Date
OR13-005	TBD	Evaluating Michigan Commerial Vehicle Enforcement Strategies and Facilities	$ 160,000	$ 320,000	$ -	J. Firman	TBD	01-Jun-14
Delivery & Operations: Intelligent Transportation Systems								
OR14-004	TBD	Cost and Benefits of MDOT ITS Deployments	$ 100,000	$ 175,000	$ -	C. Castle	TBD	30-Sep-14
Delivery & Operations: Maintenance								
OR14-006	TBD	Evaluating the Use of Tow Plows in Michigan	$ 25,000	$ 100,000	$ -	T. Croze	TBD	30-Sep-14
Delivery & Operations: Construction and Geotechnical								
OR10-047	116558	Freezing and Thawing of Frost-Susceptible Soils- Development of a Reliable Predictive Model	$ 99,453	$ 99,453	$ -	R. Endres	MSU	30-Sep-14
Administration: Technology Transfer								
OR14-029	TBD	Research- Communication and Outreach	$ 100,000	$ 239,863	$ -	M. Townley	CTC	30-Sep-14
		Projects Activated On/After October 1, 2012 Sub-totals:	**$ 1,709,129**	**$ 2,901,931**	**$ -**			
NEW PROJECTS: Total Budget			**$ 1,709,129**	**$ 2,901,931**	**$ -**			
FY2013 Federal/State Funded Research Total Budget:			**$ 6,594,851**					
Project's Total Budget:			**$ 16,435,343**					
Project's To Date Expenditures:			**$ 6,706,053**					

MICHIGAN DEPARTMENT OF TRANSPORTATION
STATE PLANNING AND RESEARCH, PART 2 (SPR-II) PROGRAM
FOR FISCAL YEAR 2013

Transportation Pooled Fund (TPF) Projects:

Federal Project No.	Research No.	Research Project Decription	Budget Amount	Future Funds Required	Project Manager	Fed./State Agency	MDOT Funding Amt.
UTC	116226	Transit UTC- University of Detroit-Mercy	$ 100,000	$ -		Mineta National Transit Consortium	$ 100,000
UTC	116233	Transit UTC- Grand Valley State University	$ 50,000	$ -		Mineta National Transit Consortium	$ 50,000
UTC	116234	consortium led by University of Illnois at Urbana-Champaign, Ill/NURail Center	$ 100,000	$ -		University of Illinois at Urbana Champaign, Ill	$ 100,000
AASHTO	OR11-009	Environmental Technical Assistance Program (ETAP)	$ 8,000	$ 16,000	M. Barondess	FHWA	$ 24,000
AASHTO	OR12-016	Technical Service Program (TIG;SICOP;TSP2;EMTSP;NTPEP;APEL;SAFETY;DAMS;LRFDSM)	$ 90,000	$ 90,000	M. Chaput	AASHTO/FHWA	$ 160,000
AASHTO	TBD	Pontis 5.2 Development- AASHTOWare Bridge Management Software	$ 125,000	$ 125,000	D. Juntunen	AASHTO/FHWA	$ 250,000
TPF-5(271)	TBD	Reorganization of Section 5, Concrete Structures, of the AASHTO LRFD Bridge Design Specs.	$ 10,000	$ 20,000	D. Juntunen	AASHTO/FHWA	$ 30,000
TBD	OR09-144	Concrete Pavement (CP) Road Map Operations Support (Solicitation 1329: Next Generation)	$ 15,000	$ 60,000	J. Staton	FHWA	$ 75,000
TPF-5(054)	TBD	Maintenance Decision Support System	$ 25,000	$ 25,000	S. Cook	South Dakota DOT	$ 50,000
TPF-5(174)	OR09-142	Construction of Crack-Free Concrete Bridge Decks, Phase II	$ 10,000	$ -	J. Stallard	Kansas DOT	$ 70,000
TPF-5(183)	OR08-143	Improving the Foundation Layers for Concrete Pavements	$ 35,000	$ -	J. Staton	Iowa DOT	$ 175,000
TPF-5(206)	OR09-146	Systems Operations Applications of Vehicle Infrastructure Integration (VII): Connected Transportation Systems- Two more years	$ 50,000	$ 50,000	M. Smith	Virginia DOT	$ 100,000
TPF-5(209)	OR10-019	Support of the Transportation Curriculum Coordination Council (TCCC)	$ 20,000	$ 20,000	B.O'Brien	FHWA	$ 100,000
TPF-5(215)	OR10-012	Transportation Engineering and Road Research Alliance (TERRA)	$ 7,000	$ 7,000	A. Clover	Minnesota DOT	$ 25,000
TPF-5(218)	OR10-013	Clear Roads Winter Highway Operations	$ 25,000	$ -	T. Croze	Minnesota DOT	$ 50,000
TPF-5(224)	OR10-017	Investigation of Jointed Plain Concrete Pavement Deterioration at Joints and the Potential Contribution of Deicing Chemicals	$ 15,000	$ -	J. Staton	Iowa DOT	$ 60,000
TPF-5(225)	OR10-018	Validation and Implementation of Hot-Poured Crack Sealant	$ 25,000	-	S. Palmer	Virginia DOT	$ 100,000
TPF-5(231)	OR10-015	Enterprise Group (MDOT: Lead Agency)	$ 35,000	$ 35,000	L. Nerderveld	MDOT	$ 175,000
TPF5 (237)	OR10-050	Transportation Library Connectivity and Development	$ 5,000	$ 5,000	A. Briseno	Missouri DOT	$ 10,000
TPF-5(242)	TBD	Traffic and Data Preparation for AASHTO MEPDG Analysis and Design	$ 25,000	$ -	M. Eacker	Louisianna DOT	$ 50,000
TPF-5(247)	OR12-011	Field Testing Hand-held Thermographic Inspection	$ 30,000	$ -	D. Juntunen	Missouri DOT	$ 60,000
TPF-5(254)	OR11-010	Bulb- T Beam Study (LTU)	$ 27,000	27,000	D. Juntunen	MDOT	$ 200,000
TPF-5(269)	TBD	Development of an Improved Design Procedure for Unbonded Concrete Overlays	$ 40,000	$ -	B. Krom	Minnesota DOT	$ 60,000
TPF5 (413)	OR10-014	NCHRP TPF-5(413) for FY13	$ 1,150,000	$ 1,150,000		FHWA	NA
TPF5 (261)	OR12-XXX	TRB Core Program Activities Period Covering- FFY 2013 (TRB FY 2014)	$ 206,710	$ 206,710		FHWA	NA
RESEARCH WITH OTHER PARTNERS: 100% FEDERAL FUNDS			**$ 2,228,710**	**$ 1,836,710**	**$ -**		**$ -**

Table 3:
MICHIGAN DEPARTMENT OF TRANSPORTATION
STATE PLANNING AND RESEARCH, PART II (SPR-II) PROGRAM
FOR FISCAL YEAR 2014

Project Research No.	MDOT Project No.	Research Project Decription	FY 2014* Budget Amount	Project Manager	Vendor	Project Scheduled Completion Date
NEW PROJECTS						
Administration: Technology Transfer						
OR14-028	n/a	2014 Research Summit	$10,000	VanPelt, Portia	n/a	30-Sep-14
Program/Project Development: Bridges/Structures						
OR14-021	n/a	Wireless Data Collection and Retrieval of Bridge Inspection/Management Information	$300,000.00	Kathrens, Rich	n/a	9/30/2015
OR14-019	n/a	Evaluation and Standardization of Accelerated Bridge Construction (ABC) Techniques	$250,000.00	Rogers, Corey	n/a	5/1/2015
OR14-024	n/a	Evaluating Long Term Capacity and Ductility of Carbon Fiber Reinforced Polymer prestressing and post tensioning strands subject to long term losses, creep, and environmental factors	$300,000.00	Chynoweth, Matt	n/a	9/30/2015
Program/Project Development: Design						
OR13-006	n/a	Developing Performance-Based Lighting Standards	$80,000.00	Urda, Steve	n/a	9/30/2014