MDOT MICHIGAN DEPARTMENT OF TRANSPORTATION

Research & Implementation Manual

SEPTEMBER 2008

MICHIGAN DEPARTMENT OF TRANSPORTATION

RBP

OFFICE OF RESEARCH &
BEST PRACTICES

RESEARCH AND IMPLEMENTATION MANUAL

RESEARCH, DEVELOPMENT, AND TECHNOLOGY TRANSFER PROGRAM

(SUB-SET OF THE STATEWIDE PLANNING AND RESEARCH PROGRAM)

Michigan Transportation Commission

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Foreword

The purposes of this manual are:

- To define the policies and procedures for the Michigan Department of Transportation's (MDOT's) Office of Research and Best Practices' (ORBP's) research program and its various functions;
- To ensure that all research is conducted, managed, documented and implemented in conformance with the legal requirements and policies of ORBP, MDOT and the Federal Highway Administration (FHWA);
- To ensure that the program and projects generated by ORBP are provided for the benefit of MDOT, its employees, other transportation agencies and transportation system users; and
- To guide research administrators, managers and investigators in the successful and efficient initiation, conduct and implementation of the research work program.

This manual is intended for MDOT employees and for individuals and agencies conducting contract research. The first chapter explains the purpose of the manual and provides important information on its scope, distribution and use. The remainder of the manual describes the organizational structure of research administration and the strategic framework, management and implementation of research studies.

The Research and Implementation Manual will give guidance to cooperatively achieve the strategic development of MDOT's problem statements. The problem statements will expertly frame research to achieve targeted, implementable results. This will lay the foundation for MDOT to reach the goals and vision described in the "MI Transportation Plan, Moving Michigan Forward." We will continue to develop and refine MDOT's research programs to maximize our resources while considering every research project as an investment opportunity.

Quick Locator Guide

A resource to quickly locate the most requested information on research project management.

Information	Report Section
Purpose and scope of manual	1.2
Federal requirements for this manual	1.3
Office of Research and Best Practices contact information	1.7
Administration committees: Oversight (REC), Advisory (RAC) and Management (RAP)	2.1.3
Program development timeline	3.1.2
MDOT research focus areas	4.1.1
Required proposal components	4.1.1.2
Request-for-proposal and proposal timeline	4.1.1.4
Project management (RAP) responsibilities	4.3.3
Consultant's quarterly reporting requirements	4.3.4.1
Consultant's invoicing requirements	4.3.5.2
Required components and format/style of a final report	5.2 and 5.3
Final report acceptance criteria	5.4
Implementation steps	6.1

Important New Changes to this Edition

Statewide Planning and Research, Part II, Program funding is managed by MDOT's Office of Research and Best Practices.

Research is administered by three tiers of committees: Oversight (REC), Advisory (RAC) and Management (RAP).

Some work not performed in-house at MDOT may be outsourced using a qualification-based selection process.

Some administrative responsibilities of the Project Manager have been assigned to the Research Manager in ORBP.

Prior FY invoices will only be paid if submitted within two months of the new FY (before December 1).

Consultant performance evaluations will be used to help select consultants for future projects.

Payment of final consultant invoices will depend on satisfactory completion of final reports.

Program development, project selection and implementation processes have been changed to reflect efforts of ORBP staff to improve research management.

MDOT processes (such as accounting and invoicing) have been brought up-to-date.

Table of Contents

Foreword II
Quick Locator Guide III
Important New Changes to this Edition IV
Table of Contents V
Glossary of Acronyms and Abbreviations VI
Acknowledgements VII

Chapter 1. Overview of Manual 2

1.1 Purpose of Research 2
1.2 Purpose and Scope of Manual 2
1.3 Federal Requirement 2
1.4 Organization of Manual 3
1.5 Distribution 3
1.6 Updates and New Editions 3
1.7 Contacting ORBP 3

Chapter 2. MDOT Organization and Strategic Framework 4

2.1 Research Administration 4
2.1.1 MDOT 4
2.1.2 ORBP 4
2.1.2.1 ORBP Research Office 4
2.1.2.2 MDOT Library 4
2.1.2.3 ORBP Key Functions 5
2.1.3 Committee Structure for Research 5
2.2 ORBP Mission, Vision and Values 7

Chapter 3. Program Development & Administration 8

3.1 Program development 8
3.1.1 Biennial program 8
3.1.2 Project development steps: timeline 8
3.1.3 Project development steps: additional details 10
3.1.4 Pooled Fund Studies 13
3.1.5 Program alteration and expedited project development 13
3.2 Program administration 13
3.2.1 Program initiation 13
3.2.1.1 Project job numbers 13
3.2.1.2 Obligation of funds 13
3.2.2 Program oversight 14
3.2.2.1 Revisions 14

3.2.2.2 Monitoring 14
3.2.2.3 ORBP monthly meetings 14
3.2.3 Annual reporting 14
3.2.3.1 Annual status reports to FHWA 14
3.2.3.2 ORBP annual report 14
3.2.3.3 Centers of Excellence annual report 15
3.2.3.4 Transportation Research Board annual Field Visit report 15
3.2.4 Peer exchange 15

Chapter 4. Research Project Management 16

4.1 Initiation 16
4.1.1 New projects 16
4.1.1.1 Request for proposals for new research 18
4.1.1.2 Proposal for new research 18
4.1.1.3 Consultant selection for new research 20
4.1.1.4 Timeline 20
4.1.1.5 Research Advisory Panel 22
4.1.2 Continuation projects 22
4.2 Contracting 22
4.2.1 Types of Contracts 23
4.2.2 Work Authorization 23
4.3 Execution 24
4.3.1 Start-up 24
4.3.1.1 Kickoff meeting 24
4.3.1.2 Periodic meetings 24
4.3.2 Start of research work 24
4.3.3 RAP members for project management 24
4.3.3.1 Focus Area Manager (FAM) 24
4.3.3.2 Research Manager (RM) 25
4.3.3.3 Project Manager (PM) 25
4.3.3.4 Technical Monitor (TM) 25
4.3.3.5 Project Advisor (PA) 26
4.3.3.6 Principal Investigator (PI) 26
4.3.3.7 Implementation Manager (IM) 26
4.3.4 Interim reporting 26
4.3.4.1 Quarterly Progress Reports 26
4.3.4.2 Annual Interim Reports 28
4.3.5 Financial 28
4.3.5.1 MDOT Processing 28
4.3.5.2 Invoice submission 29
4.3.5.3 Invoice payment 30
4.3.6 Consultant delays in deliverables 30

4.3.7 Changes in scope, Cost and/or Completion Date 31
4.4.1 Final Report 31
4.4.2 Final Invoicing 31
4.4.3 Audit 32
4.4.4 Consultant Evaluation 32
4.4.5 Project Evaluation 32
4.4.6 Letter of Closure 32
4.5 Implementation 32

Chapter 5. Final Reporting 34

5.1 Federal Requirement for Final Report 34
5.2 Components 34
5.3 Format and Style 34
5.4 Acceptance 35
5.4.1 Initial Acceptance 35
5.4.2 Delivery Criteria 36
5.4.3 Final Acceptance 36

Chapter 6. Implementation and Technology Transfer 38

6.1 Implementation 38
6.1.1 Responsibilities for Implementation 38
6.1.1.1 Implementation Manager (IM) 38
6.1.1.2 Technical Monitor (TM) 38
6.1.1.3 Project Manager (PM) 39
6.1.1.4 Principal Investigator (PI) 39
6.1.2 Implementation Guidelines 39
6.1.3 Implementation Action Plan 40
6.1.4 Implementation Process 41
6.1.4.1 Strategic Assessment 42
6.1.4.2 Pilot Implementation 42
6.1.4.3 Adoption of Practice 42
6.2 Research Spotlights 42
6.3 Technology Transfer 43

APPENDIX A: MDOT Organization and Strategic Framework

APPENDIX B: Program Development and Administration

APPENDIX C: Research Project Management

APPENDIX D: Implementation and Technology Transfer

Glossary of Acronyms and Abbreviations

For new management committees and roles, brief definitions are provided below.

CATS	**Contract Administration Tracking System**
CSD	**Contract Services Division**
FAM	**Focus Area Manager**—Chairperson of the Research Advisory Panels in each of 18 focus areas. Sits in an advisory capacity on a Research Advisory Committee.
FHWA	**Federal Highway Administration**
FY	**Fiscal Year**
IM	**Implementation Manager**—Implementation expert serving on each Research Advisory Panel.
MDOT	**Michigan Department of Transportation**
MFOS	**Map Financial Obligation System**
MPINS	**Map Project Information System**
NCHRP	**National Cooperative Highway Research Program**
ORBP	**Office of Research and Best Practices**
PA	**Project Advisor**—Additional expert or stakeholder serving on a Research Advisory Panel.
PI	**Principal Investigator**
PM	**Project Manager**—MDOT staff that manages the technical aspect of each research project.
RAC	**Research Advisory Committee**—Advisory-level committee for SPR, Part II, Program research management at MDOT.
RAP	**Research Advisory Panel**— Management-level committee of the individuals responsible for conducting a research project.
RD&T	**Research, Development and Technology**—Basic or applied research project or study, development or technology transfer activity.
REC	**Research Executive Committee**—Oversight-level committee of executives that approves SPR, Part II, Program research and implementation.
RFP	**Request for Proposals**
RM	**Research Manager**—ORBP staff that manages the administrative tasks of each research project.
SAB	**State Administrative Board**
SPR	**Statewide Planning and Research**
TM	**Technical Monitor**—Technical expert serving on a RAP.
TRB	**Transportation Research Board**
TSC	**Transportation Service Center**

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An acknowledgment and special thank you to everyone who helped prepare and finalize the Michigan Department of Transportation's (MDOT's) Research and Implementation Manual. Without the support and guidance of the Executive Team, this revision would not have been possible. I extend my gratitude to Larry Tibbits, our Chief Operations Officer, for his guidance throughout this endeavor and Randy Van Portfliet, our Superior Region Engineer, for his timely review and expert advice. I would also like to extend a special thank you to the members of the Research Administration Manual Panel: Paul Ajegba, Metro Region; Donald Cameron, Federal Highway Administration; Joanie Pereida, Financial Operations; Dorothy Iredu, Civil Service; Anu Taneja, Contract Services; Roger Till, Construction and Technology; Andre Clover, Sudhaker Kulkarni, and Angela Nelson from the Office of Research and Best Practices (ORBP) who began this work in the fall of 2006, for their dedication and investment into MDOT's research program.

I would also like to thank everyone who attended, asked questions, and provided input during the Project Managers' Meeting that was held on November 14, 2007, and the University Partners' Meeting held February 21, 2008. I extend special appreciation to Mike Blackledge, Mike Smith, Kelly Villarreal, and Kathy Popoff from Contract Services who helped us hone and communicate the contract related portions of our manual.

A special thank you to Kim Henderson, Brian Whitfield and the staff from Graphic Design and Mapping Services for transforming our documents into the professional manual you see now. In addition, a sincere thank you to Pat Casey, Kim Linsenmayer and Brian Hirt from CTC & Associates, L.L.C., of Madison, Wisconsin, and Angela Nelson who kept us on target and did a wonderful job getting our manual to its final stages.

Most importantly, I would like to thank the entire ORBP staff who painstakingly mapped the processes and procedures ensuring the accuracy of this manual to the best of our ability. The staff who participated, but have not yet been mentioned, include Trisha Aper (retired); Alexandra Briseno, Librarian; Nancy Crider, Research Analyst; Wen-hou Kuo, Statistician; and Homer Sprague, Statistician. Mark Becker from the Performance Excellence Division expertly guided us through these months of analysis and became a cohesive member of the team in the process.
I would also like to thank the two newest members of our team who will be instrumental during the implementation of the contents of the following pages; Aubrey Marron, Departmental Analyst, and Annette Nealey, Research Administrative Assistant.

We look forward to further developing and refining MDOT's research programs to best utilize all of our associated resources in achieving relevant research results. This will maximize our investment opportunities with every research project. The Research and Implementation Manual will guide MDOT in cooperatively developing strategic problem statements that will expertly frame research to achieve targeted, implementable results. This will lay the foundation for MDOT to reach the goals and vision described in the "MI Transportation Plan, Moving Michigan Forward."

Calvin Roberts, P.E.
Engineer of Research and Best Practices

Chapter 1. Overview of Manual

This chapter describes the purpose of this manual and provides important information on its scope, distribution and use.

1.1 Purpose of Research

Michigan Department of Transportation (MDOT) conducts research in order to help fulfill its mission of "providing the highest quality integrated and transportation services for economic benefit and improved quality of life." All research, development and technology activities described in this manual are selected, conducted and implemented toward accomplishing this mission. Specific areas of research addressed by MDOT are listed in Chapter 3 ("Research Program Development").

1.2 Purpose and Scope of Manual

The federal Statewide Planning and Research (SPR) Program provides funding for transportation research and planning activities. Part II of the SPR Program requires that at least 25 percent of the annual apportionment be dedicated to research.

This Research and Implementation Manual describes the processes for conducting MDOT's research, development and technology (RD&T) activities under the SPR, Part II, Program. Some structures and processes described here are modeled, like many other states, on the successful research management methods used by the National Cooperative Highway Research Program (NCHRP). However, many structures and processes are unique and designed to best meet Michigan's needs.

This Research and Implementation Manual does not describe research processes for federally mandated research in Michigan called out in national transportation funding legislation (most recently, the federal act SAFETEA-LU), such as University Transportation Centers.

This manual replaces the July 2003 edition of MDOT's Research Administration Manual.

MDOT's SPR, Part II, Program research activities are managed by MDOT's Office of Research and Best Practices (ORBP). The manual is published by ORBP as approved by the Federal Highway Administration (FHWA).

1.3 Federal Requirement

MDOT's publication of its Research and Implementation Manual complies with federal rules for SPR, Part II, Program funding. According to the U.S. Electronic Code of Federal Regulations, Title 23 ("Highways"), Part 420 ("Planning and Research Program Administration"), Section 209, Paragraph b:

Documentation that describes the State DOT's management process and the procedures for selecting and implementing RD&T activities must be developed by the State. (CFR 23.420.209.b)

See *http://www.gpoaccess.gov/ecfr/* for additional details on this code and federal compliance requirements.

1.4 Organization of Manual

This manual is organized into the following sections:

- Chapter 1. Overview of Manual
- Chapter 2. Research Administration and Strategic Framework
- Chapter 3. Research Program Development
- Chapter 4. Research Project Management
- Chapter 5. Final Reporting
- Chapter 6. Implementation and Technology Transfer
- Appendices

1.5 Distribution

This manual is distributed to the following stakeholders of the research program:

- MDOT Director
- MDOT Chief Operations Officer
- MDOT Chief Administrative Officer
- MDOT Engineer of ORBP
- MDOT ORBP Staff
- MDOT Deputy Directors
- MDOT Central Division Administrators (Contracts, Finance, Planning, Design, etc.)
- MDOT Region and Transportation Service Center (TSC) Managers and Project Development Engineers
- MDOT Library
- MDOT Project Managers
- FHWA
- Centers of Excellence Research Managers
- Principal Investigators at the research facilities
- University Contract Administration offices

An electronic copy of this manual is available on ORBP's Web site.

1.6 Updates and New Editions

Changes to this manual occur periodically and are documented as updates. Updates are distributed to all recipients listed above. The Engineer of ORBP conducts a comprehensive review of the manual and distributes a revised edition every three years.

1.7 Contacting ORBP

Office of Research and Best Practices • Michigan Department of Transportation

Mailing: P.O. Box 30050 Lansing, MI 48909

Shipping: 425 West Ottawa Street Lansing, Michigan 48933

Phone: 517-373-8755

Web site: *http://www.michigan.gov/mdotresearch*

Chapter 2. MDOT Organization and Strategic Framework

This chapter presents the organizational structure of research administration and management. It also presents the mission, vision and values of ORBP that help guide research.

2.1 Research Administration

2.1.1 MDOT

MDOT has about three thousand full time employees and annual budget of about $3.4 billion. MDOT's organization has central offices in Lansing, seven Regions and 26 Transportation Service Centers located through the state.

2.1.2 ORBP

On December 18, 2007, MDOT's Office of Research and National Best Practices changed its name to the Office of Research and Best Practices, dropping the word "national" from its name. This change reflects a recognition of Michigan's role in a global transportation network and its commitment to pursuing and achieving excellence at an international level. For a current organization chart, see Appendix A1.

The Engineer of ORBP reports to the Chief Operations Officer, who in turn reports to the Director of MDOT. All Development, Delivery/Operations, Regions and TSCs also report to the Chief Operations Officer. For a current organization chart, see Appendix A2 and MDOT's website.

ORBP manages three program functions known as the Research Office, the MDOT Library, and Best Practices, see Appendix A3. This manual will not address the Best Practices Program.

2.1.2.1 ORBP Research Office

The ORBP Research Office organizes, manages, and disseminates the results of research conducted within MDOT. It coordinates the process for identifying, selecting, and managing research projects funded through the Federal Statewide Planning and Research, Part II, Program, and it helps develop and manage research funded by other agency programs.

The SPR, Part II, Program – including research, technical transfer and implementation – is the focus of this manual.

2.1.2.2 MDOT Library

The MDOT Library is an integral part of ORBP. The MDOT Library serves staff, consultants, other government agencies and the public by finding information on topics, conducting literature searches, locating facts and statistics, identifying information and additional sources, and obtaining articles and books through a state and national library network. For more information, see Appendix A4.

2.1.2.3 ORBP Key Functions

Some of the key functions that ORBP performs are: giving approvals for new projects and research task agreements; making revisions to the program's projects, funding or schedules; setting priorities for research; and tracking implementation activities for research results. Processes are described later in this manual.

Review: ORBP reviews all approved research activities and obtains necessary authorization for each research project.

Progress Reports: ORBP receives progress reports pertaining to each SPR, Part II, and Transportation Pooled Fund research project from Principal Investigators on a quarterly basis. These reports are based on information obtained from the Project Manager, Research Manager, the Contract and Finance Manager, the Technical Monitor, the Federal Programs Manager and the Principal Investigators.

Budget: The Engineer of ORBP approves all research budgets and ensures that research activities are conducted within the constraints of available resources.

Extensions/Revisions: The Engineer of ORBP approves all revisions to approved research projects and any extensions required to complete the research within the limits of the approved work program. A budget change that involves an increase in the total federal funds authorized for the work program requires prior FHWA approval and authorization. Similarly, changes in the work program (adding a line item, subcontracting, etc.) as specified in 49 CFR 18.30(d) require prior FHWA approval.

2.1.3 Committee Structure for Research

SPR, Part II, Program research is guided and carried out through a tiered structure of oversight, advisory and management committees as shown in Figure 2.1.

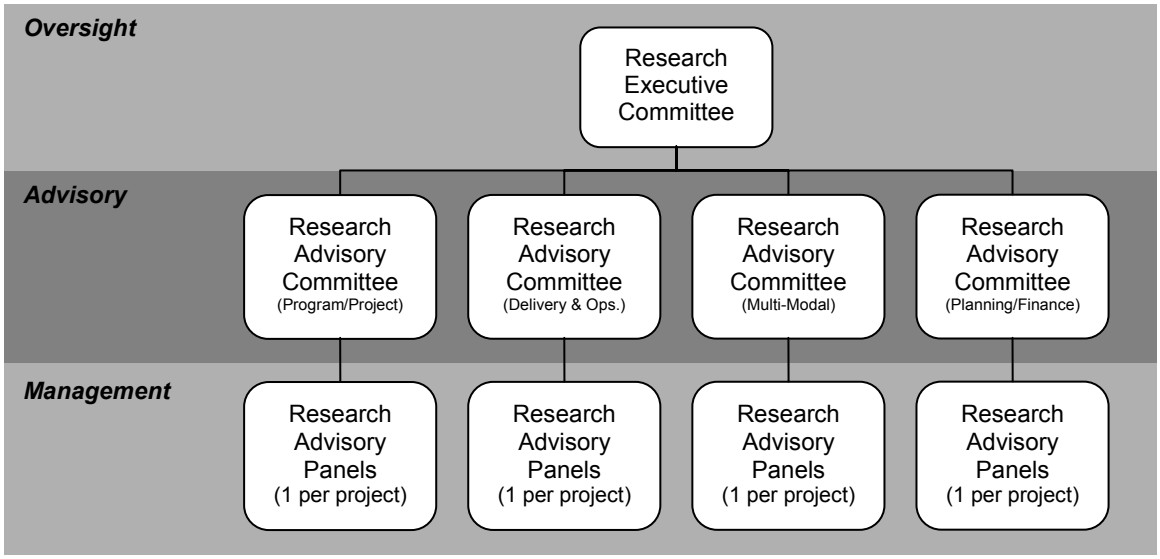


Figure 2.1—Oversight, advisory and management committee structure

Details on each of these three types of committees follows.

Oversight. Research Executive Committee (REC)

The REC meets four-to-six times per year and oversees and approves the annual program recommendations.

Members:

- MDOT Chief Operations Officer
- MDOT Chief Administrative Officer
- Engineer of ORBP
- MDOT Bureau Deputy Directors
- Regional Representatives

Duties:

- Sets strategic direction
- Defines research goals
- Approves recommended research
- Reviews key research findings
- Reviews and approves/disapproves all recommendations for research results implementation

Advisory. Research Advisory Committee (RAC)

There are a total of four RACs, in the areas of:

- Program/Project Development
- Delivery & Operations
- Multi-Modal Transportation
- Planning & Finance

Members of each RAC:

- Chair (Bureau Deputy Director for each RAC)
- FHWA representative
- ORBP representative
- 4 to 6 focus area managers (see section 4.1.1)

Duties:

- Align research projects with the strategic direction of MDOT
- Provide input to creation of research problem statements
- Prioritize research needs
- Recommend research needs to REC

- Receive reports and presentations on research results
- Lay implementation foundation by describing outcomes and benefits of recommended research
- Advance research results by submitting a formal request to REC for their review and approval

Management. Research Advisory Panels (RAP)

A RAP is formed for every research project. RAP membership and duties are detailed in Chapter 4, "Project Management."

2.2 ORBP Mission, Vision and Values

ORBP Mission

The Office of Research and Best Practices' (ORBP's) mission is to:

- Coordinate and manage research programs for the Michigan Department of Transportation (MDOT)
- Monitor learning and innovation in development and operations on integrated transportation systems
- Promote implementation of learning and innovation throughout MDOT
- Encourage research which supports integrated multi-modal transportation and MDOT's strategic goals

ORBP Vision

ORBP's vision is to be a recognized leader in coordinating applied research and implementing results. We will accomplish this by:

- Identifying cutting edge research topics
- Implementing research results
- Coordinating development of research projects

Our core strength results from a highly integrated network of dynamic partnerships among transportation professionals.

ORBP Values

ORBP's values are:

- Quality
- Teamwork
- Customer Orientation
- Integrity
- Pride
- Determination
- Innovation
- Partnership

Chapter 3. Program Development & Administration

This chapter describes the process for developing MDOT's SPR, Part II, Program research. Title 23, U.S. Code Section 505(b)(1) requires at least 25 percent of the Statewide Planning and Research (SPR) apportionment (or its equivalent from other authorized sources) be restricted to research activities. A 20 percent state match is required.

SPR, Part II, money is federally regulated to conduct true research striving for implementable results. This money can be used for research development and technology transfer activities necessary in connection with the design, construction, management, and maintenance of highways, public transportation, and intermodal transportation systems. Other uses include studies, research, and training on the engineering standards and construction materials for transportation systems described above. This fund can also pay for the evaluation and accreditation of inspection and testing, as well as the regulation and taxation of their use. Most SPR, Part II, projects have a two year duration and average $100,000 for the two years. This money can not be used for any project that would qualify for the funding sources announced annually in MDOT's integrated call for projects.

This chapter also describes administration of the program by the Office of Research and Best Practices. Management of specific projects is described in Chapter 4.

3.1 Program development

3.1.1 Biennial program

SPR, Part II, Program research is administered as a series of biennial (two-year) programs. Each biennial program starts with even-numbered fiscal years. For example, a biennial program begins at the start of Fiscal Year (FY) 2010 (October 1, 2009) and runs through the end of FY 2011 (September 30, 2011).

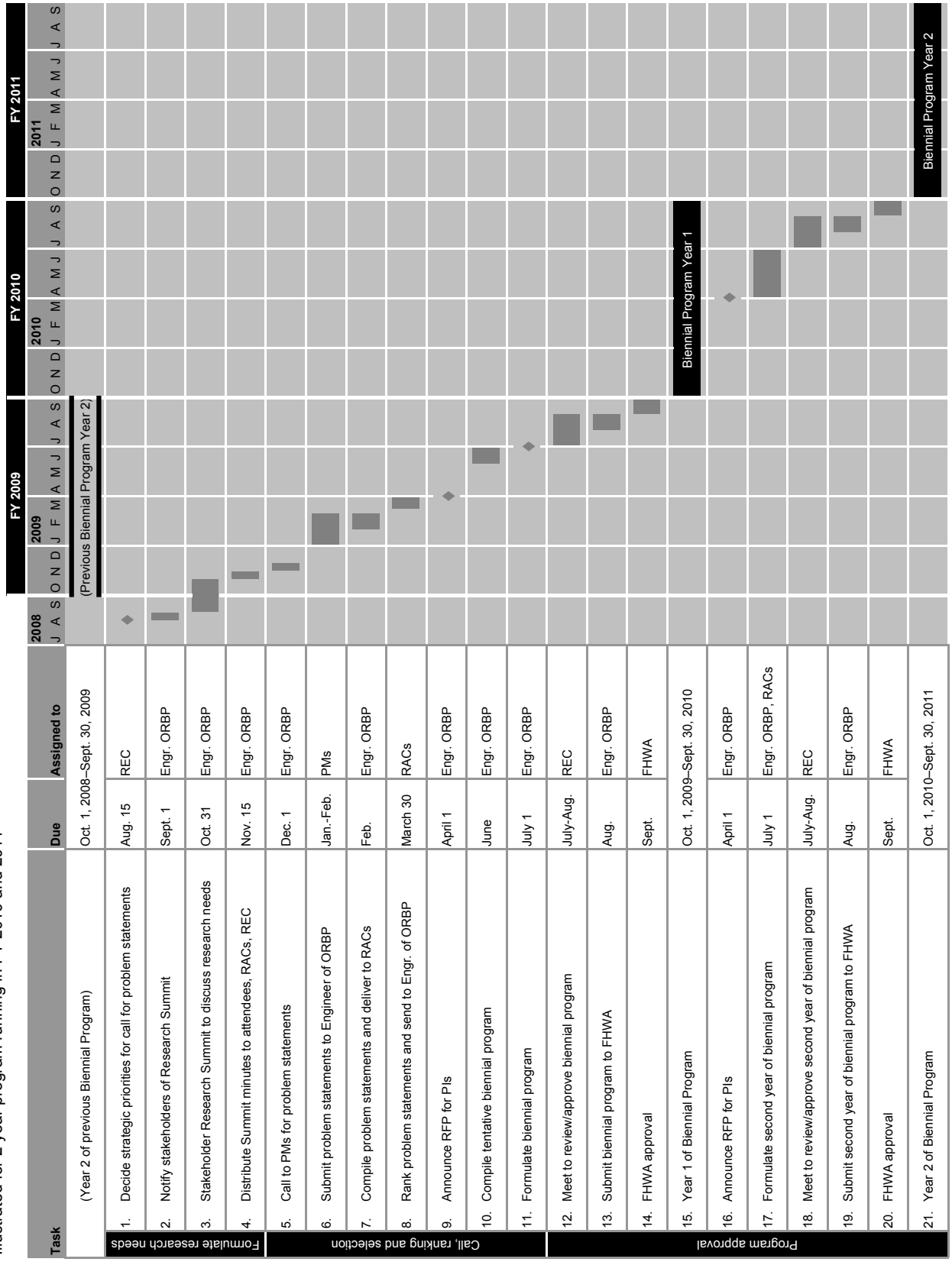
3.1.2 Project development steps: timeline

Project development and approval is a multi-step process, with the first step occurring more than a year before the biennial research program begins. A project development timeline (Figure 3.1) outlines the steps of the process, including major tasks, due dates, and the assigned party for each task. The process is divided into three phases: call-for-problem statements, ranking/selection and program approval. Stakeholders outside of MDOT participate in the first of the three phases.

Advisory boards and other bodies outside of MDOT not named in the process below may address their comments and input directly to MDOT's Research Executive Committee for its consideration.

The timeline illustrates the biennial program in FY 2010 and 2011. Other biennial programs, such as the subsequent program in FY 2012 and 2013, follow the same timeline pattern.

Figure 3.1—MDOT Biennial Project Development Timeline
Illustrated for 2-year program running in FY 2010 and 2011



3.1.3 Project development steps: additional details (illustrated for FY 2010-2011 biennium)

Formulate research needs

Step 1 REC decides strategic priorities for MDOT and communicates this to the Engineer of ORBP.
Target date: August 25, 2008.

Step 2 The Engineer of ORBP notifies stakeholders of a Research Summit to discuss Michigan's research needs.
Due date: September 1, 2008

- Stakeholders include members of ORBP, RAC, FHWA, project managers, TSCs, region representatives, university representatives and other agency representatives.

Step 3 Stakeholders discuss research needs during the research summit.
Due date: October 1, 2008.

- ORBP convenes the research summit.
- Stakeholders review recently completed research, current research and technical investigations, problem areas/research needs, input from Regions and input from Transportation Service Centers.
- MDOT's major research focus areas are:
  - bridges and structures
  - design and geotechnical
  - real estate services
  - urban corridors
  - security
  - system planning and strategic measures
  - safety and systems operations and mobility
  - pavements, construction, materials and maintenance
  - intelligent traffic systems
  - freight and logistics
  - passenger transportation
  - rail
  - aeronautics
  - maritime
  - strategic planning programs/programming
  - geological services and transportation data
  - bike and pedestrian
  - environment

Step 4 Engineer of ORBP distributes minutes of the Research Summit to stakeholders, RACs and the REC.
Due date: November 15, 2008.

Call, ranking and selection

Step 5 Engineer of ORBP issues a call to MDOT's Project Managers for research problems
Due date: December 1, 2008

Step 6 PMs or others within MDOT submit problem statements to ORBP.
Due date: February 15, 2009

- Complete and submit MDOT form 5303, see Appendix C5.
- For Pooled Fund Studies, also complete and submit form 5302, see Appendix B1.
- Problem statements should include estimated cost limits.
- If PMs consult with or receive assistance in problem statement formation from stakeholders outside of MDOT, such as university or private consultants, they are to be reminded that problem statements may be distributed publicly and should not contain proprietary information.

Step 7 Engineer of ORBP compiles problem statements into four lists (by RAC area) and submits them to the four RACs
Due date: February 28, 2009

Step 8 The RACs prioritize problem statements, calling on MDOT or external experts as needed. RACs send ranked problem statements to Engineer of ORBP, along with their selection criteria.
Due date: March 30, 2009

- MDOT experts rank the problem statements in their areas of interest and expertise. ORBP will provide standard minimum criteria for project ranking and selection. RACs may expand on these criteria to meet their needs.
- MDOT experts include members of ORBP staff, RAC members, presumed project managers, region representatives and Transportation Service Center representatives.
- Ranking consists of identifying the problem statement as having a high, medium or low research priority.
- At least five experts must rank each problem statement.

Step 9 Some tentative projects will be open to a qualifications-based selection process using a request for proposals process. RFPs will be advertised, noting that funds are pending ORBP, REC and FHWA approval of the research program. This will be described in detail in section 4.1.1.3 of this manual through future updates. A timeline for the process is shown in Figure 4.3.
Due date: April 1, 2009

Step 10 The Engineer of ORBP compiles the tentative biennial program.
Due date: July 1, 2009

- The Engineer of ORBP reviews the prioritized project lists and other supporting information. A tentative project listing is sent to FHWA for information only.

Step 11 The Engineer of ORBP formulates biennial program
Due date: July 1, 2009
- The program includes first-year projects with funding requests, and second year programs without funding requests.

Program approval

Step 12 Research Executive Committee meets to review/approve biennial program.
Target date: July-August 2009

Step 13 The Engineer of ORBP submits the biennial program to FHWA.
Due date: August 30, 2009

Step 14 FHWA approves the first year of the biennial program.
(October 1, 2009 – September 30, 2010)
Due date: September 30, 2009
- The Engineer of ORBP sends the approved SPR Part II program to all stakeholders.

Step 15 ORBP advertises RFPs for those projects starting in the second year of the biennium that will be awarded using a selection process yet to be determined
Due date: April 1, 2010

Step 16 The Engineer of ORBP and RACs formulate the second year of biennial program.
Due date: July 1, 2010
- The program includes second-year programs with funding requests.

Step 17 REC meets to review/approve second year of biennial program.
Target date: July-August 2010

Step 18 The Engineer of ORBP submits second year of biennial program to FHWA.
Due date: August 30, 2010

Step 19 FHWA approves the second year of the biennial program
(October 1, 2010 – September 30, 2011)
Due date: September 30, 2010
- The Engineer of ORBP sends the approved SPR Part II program to all stakeholders.

3.1.4 Pooled Fund Studies

Pooled Fund studies are an important part of the SPR, Part II, Program.

Pooled Fund studies are led by a state or FHWA, with other states, private companies, foundations or universities participating. Each participating state obligates its own funds, which can be 100% SPR funds, and enters into its own agreement with FHWA.

Applications for MDOT to participate in a new or existing Pooled Fund studies can be submitted at anytime using MDOT form number 5302, see Appendix B1. Pooled Fund study requests must first receive bureau approval prior to being submitted to ORBP, see Appendix B2. We will determine eligibility and availability of SPR, Part II, funds. If funding is available and approved by the ORBP Engineer, the study will be added to the SPR, Part II, program template for review and approval by the REC. If approved by the REC, ORBP will post MDOT's expressed interest to be a contributing partner in that study to the TPF Web site and the template is forwarded to FHWA. Once FHWA approves the template, we notify the interested parties that the study has been funded. An annual report is required at the end of each fiscal year for all Pooled Fund studies that MDOT participated in during the prior year, see Appendix B3. We continue to update the TPF Web site with the names and phone numbers of the technical contacts, the agency contact person, and MDOT's funding commitment levels.

3.1.5 Program alteration and expedited project development

Unforeseen events or changes in MDOT's strategic priorities may require changes to the agreed-upon SPR, Part II, Program. Requests from upper management to initiate immediate research to address critical issues are accommodated in a timely manner with an expedited approval process at the REC level.

3.2 Program administration

3.2.1 Program initiation

3.2.1.1 Project job numbers

The job numbers for approved projects are created using MDOT's computerized Map Project Information System (MPINS). Project title, scope of work, cost and other basic information is input to this system by the Research Analyst of ORBP. The Office of Statewide Planning and Programming in the Planning Bureau assigns the job numbers.

3.2.1.2 Obligation of funds

Funds are obligated for SPR, Part II, Program projects with MDOT's computerized Map Financial Obligation System (MFOS), following these steps:

- The Research Analyst of ORBP prepares the request for funds and submits the request to the Financial Operations Division (FOD).
- FOD staff reviews the request, obligates the funding
- FOD staff forwards the request with the federal project number and the federal item number to FHWA for its financial approval

The process should take approximately 7–10 days and should be completed as near as possible to the start of the fiscal year. For all new projects, work authorization must be received from the Contract Services Division before any work for the project may begin. The work authorization process is detailed in Chapter 4.

3.2.2 Program oversight

3.2.2.1 Revisions

The Engineer of ORBP must approve all changes in scope, cost and time during the execution of the project, with requests submitted using ORBP forms. The project Research Manager reviews requests before forwarding them for approval.

3.2.2.2 Monitoring

The Engineer of ORBP monitors the cost of the overall program using fiscal controls set by the federal-aid annual work program.

3.2.2.3 ORBP monthly meetings

ORBP administrative staff and other identified and invited MDOT personnel meet monthly to review issues related to work, costs and schedules for the program as a whole as well as individual projects. The objective of these meetings is to ensure the program and individual projects are completed on time and within budget.

3.2.3 Annual reporting

3.2.3.1 Annual status reports to FHWA

ORBP prepares annual reports on the progress of the SPR Part II program for FHWA. These reports include:

- a review and status of major program activities, program milestones and anticipated future progress
- financial status reports

3.2.3.2 ORBP annual report

ORBP issues an annual report with one-page summaries of each research projects completed during the previous fiscal year. Summaries include:

- brief project description
- research findings of research
- cost
- project manager
- implementation efforts for research results

The annual report also contains a list of pooled fund studies in which MDOT is currently participating, a list of all the technical investigations that the Construction and Technology Division is conducting, and a list of total research contract dollars (SPR funds) received by each MDOT-contracted university.

3.2.3.3 Centers of Excellence annual report

Each Center of Excellence annually summarizes its work in the following areas:

- problem statement formation
- teaching and technology transfer efforts to assist MDOT
- implementation of the research findings
- presentation of research papers at the annual Transportation Research Board (TRB) conference

ORBP compiles this information in a Centers of Excellence annual report.

3.2.3.4 Transportation Research Board annual Field Visit report

ORBP's state TRB representative facilitates a biannual visit from TRB staff. TRB issues an annual report on its field visits early each year on state DOTs RD&T programs and integrated transportation systems. The report reflects both accomplishments and national transportation issues and challenges. This report is a TRB-sponsored activity.

3.2.4 Peer exchange

SPR federal regulations require peer exchanges to help DOTs improve the quality and effectiveness of research management.

- A peer exchange is held at MDOT every three to five years. The Engineer of ORBP organizes ORBP's peer exchange by selecting the team and conducting the meeting in accordance with the federal regulations.
- The peer exchange team may consist of representatives of other state DOTs, FHWA, universities, TRB, other agencies and the private sector.

Chapter 4. Research Project Management

This chapter describes the process for managing research projects in MDOT's SPR, Part II, Program. Management tasks are primarily carried out by members of the Research Advisory Panel designated to each project. The chapter is organized according to the five stages of research project management: initiation, contracting, execution, closeout and implementation (Figure 4.1).

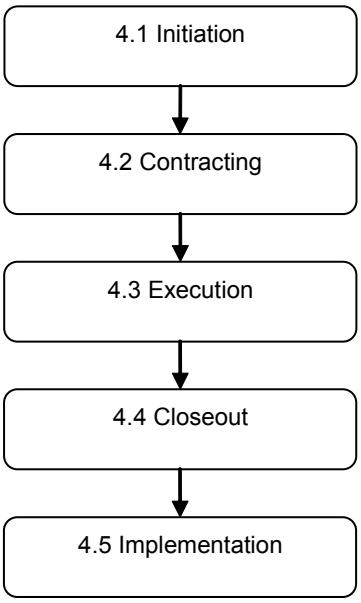


Figure 4.1—Five stages of research management

This chapter describes the responsibilities of the members of the Research Advisory Panel according to these five steps. Commonly-used abbreviations are found at the bottom of each page of this chapter.

4.1 Initiation

Project initiation at the start of each biennial cycle follows different steps for new projects (4.1.1) and continuation projects (4.1.2).

4.1.1 New projects

All problem statements for new research selected and approved for the biennial research program fall into one of 18 focus areas. This list is subject to change and expansion based on the identification of other priority areas of research.

- bridges and structures
- urban corridors
- freight and logistics
- design and geotechnical
- security
- passenger transportation
- real estate services
- intelligent traffic systems
- rail

- strategic planning programs/programming
- geo services and transportation data
- system planning and strategic measures
- pavements, construction, materials and maintenance
- aeronautics
- bike and pedestrian
- safety and systems operations and mobility
- maritime
- environment

A Research Advisory Panel will be formed for each problem statement selected during Program Development (Chapter 3). RAP members steer the research project through its life cycle.

Each project's RAP will chaired by the Focus Area Manager from the appropriate MDOT bureau, designated by the appropriate bureau chief. The FAM will be responsible for selecting all MDOT staff that serve on each project's RAP, see Appendix C1. Prior to selection of the principal investigator (PI) and RAP formation, the FAMs sit on the appropriate Research Advisory Committees that will guide the consultant selection process. The four Research Advisory Committees and the FAMs that serve on each of them are shown in Figure 4.2.

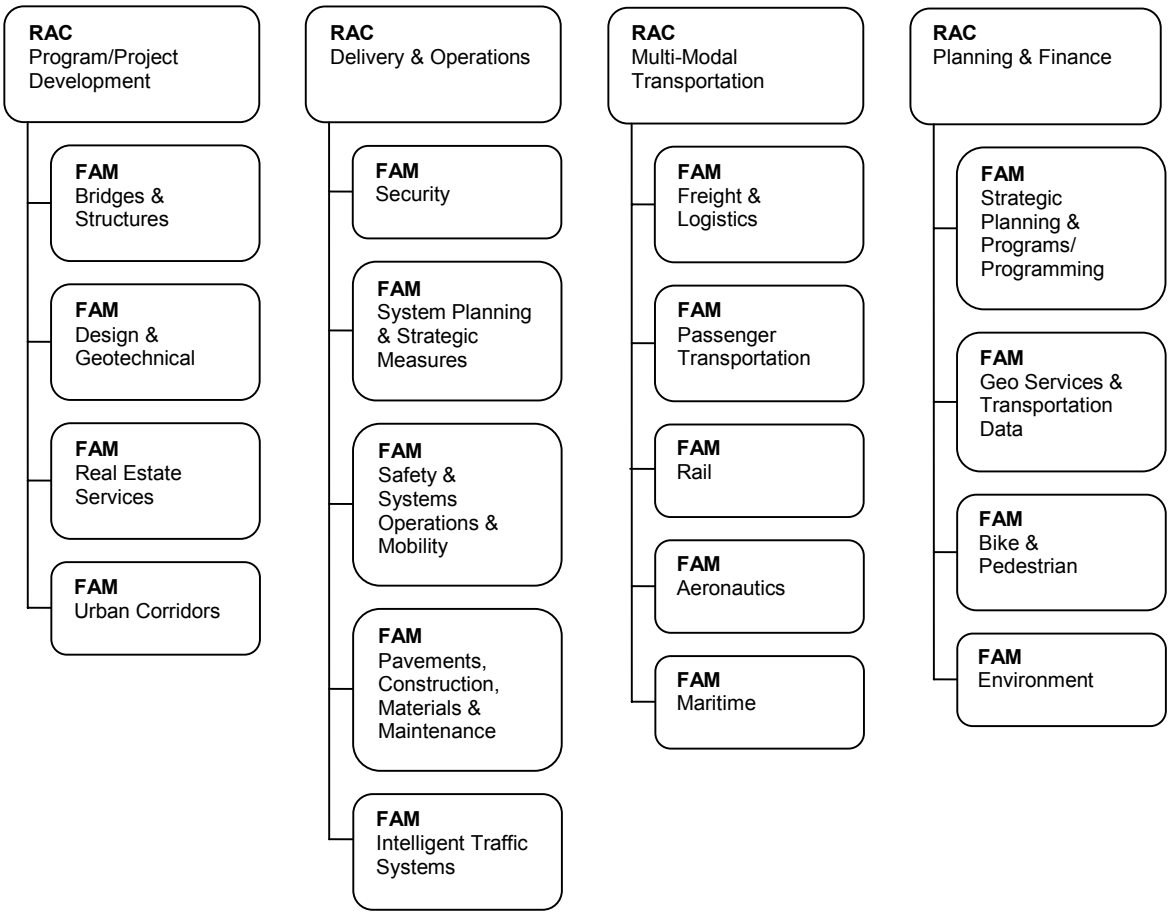


Figure 4.2—The four RACs and the FAMs that serve on each of them

RAP Abbreviation Guide

RAP	Research Advisory Panel	**FAM**	Focus Area Manager	**PM**	Project Manager
RM	Research Manager	**PI**	Principal Investigator	**TM**	Technical Monitor

4.1.1.1 Request for proposals for new research

A predetermined selection process may be used to select the consultant. Based on the problem statement, the RAP issues a request for proposals (RFP). The RFP is advertised on MDOT's Web page: www.michigan.gov/mdot. The details of this process will be defined in future updates. The RFP could include:

- A brief description of work, number of copies of proposal required, and mailing address of MDOT's ORBP.
- Research proposal requirements
- Experience and qualifications of the research team
- Cost limits for the project
- Time to complete the work
- Due date for the proposal
- Evaluation criteria for the proposal

There will be exceptions to the RFP process, as determined by MDOT.

4.1.1.2 Proposal for new research

Pre-qualified applicant consultants (universities, agencies or private firms) submit full proposals in response to advertised RFPs. Candidate proposals should include the following in their work plan:

Title Page

Project title, principal investigator, date, contract period, and total contract amount

Research Problem Statement and Background on Project

Description of the problem to be studied and the current state of the art in the subject area

Objective of the Research

- Stated objectives of the research
- Description of how fulfilling the objectives will remedy the problem and benefit MDOT through implementation of research findings

Research Plan by Tasks

- Typical tasks include literature review, laboratory testing, field testing, field applications, and report
- Stated objectives to be satisfied by the task, when applicable
- Defined responsibilities for obtaining field samples, field testing, traffic control
- Anticipated results describing benefits and how they apply to MDOT practices

Implementation Plan

- This element of the work plan is critical. For applied research projects, if there is not an anticipated use for the results of the research, or if there are not any project champions encouraging a solution to a problem, then the value of this research must be questioned at the time of project initiation. Although results cannot be known prior to the conduct of the research, a number of scenarios can be described with anticipated results. Implementation planning should be based on this type of estimation. For further details on implementation, refer to Chapter 6 and Appendix D1.

- State how the research results may be used and by whom to solve the problem
- A cost/benefit analysis of implementing results, where applicable
- A listing of barriers to implementation
- Suggested methods of implementation (e.g., training, specifications, demonstration project, revision of standards, etc.)

Deliverables

- Quarterly progress reports, annual interim report for two-year projects (due on October 1), and final report
- Identification of the final report's technical editor
- Final report to be delivered in all of the following formats:
- Final report in PDF format, on CD storage media, with searchable text
- Twenty-one printed copies of the final report, double-sided and bound
- One additional copy of the final report, single-sided and unbound

Details on the final report are in Chapter 5 of this manual

Schedule of Progress by Tasks

- Duration of each task and completion schedule for the entire project
- Meeting schedule for review of work progress and direction

Itemized Budget

- Completed standard budget spreadsheets (submitted electronically), as provided by ORBP, see Appendix C2.
- Work hours and cost by tasks and by fiscal year
- Salaries, fringe benefits, sub-consultants, equipment, material, travel, communications, and indirect cost rate, as applicable
- Cost sharing, if applicable
- Detail of traffic control costs for freeway data collection. If approved, the PI will arrange details with the PM with the typical outcome that this will be funded through a special MDOT account for this purpose.

Management Plan

- Description of how the PI will coordinate with the members of the research team, respond to interim developments, and provide continuity to the project
- Quality control/quality assurance method to be used to ensure valid results

Research Team

- Names, titles, pertinent background information, e-mail addresses, and phone numbers of principal investigator and associate team members
- The consultant is responsible for the quality and delivery of any part of the project handled by a sub-consultant (including another university). The sub-consultant(s) and the scope of the subcontract will be detailed in the work plan. MDOT has the right to approve any change in scope of the subcontract, including the assignment of sub-consultant, see Appendix C3.

Equipment and Facilities

- Type and character of equipment facilities required and availability to perform work
- Identification of shared facilities.
- Justification of needs for special equipment or material purchases
- Cost of maintaining traffic during data collection (consultant must follow safety rules and regulations, during data collection on MDOT's trunk line system).

4.1.1.3 Consultant selection for new research

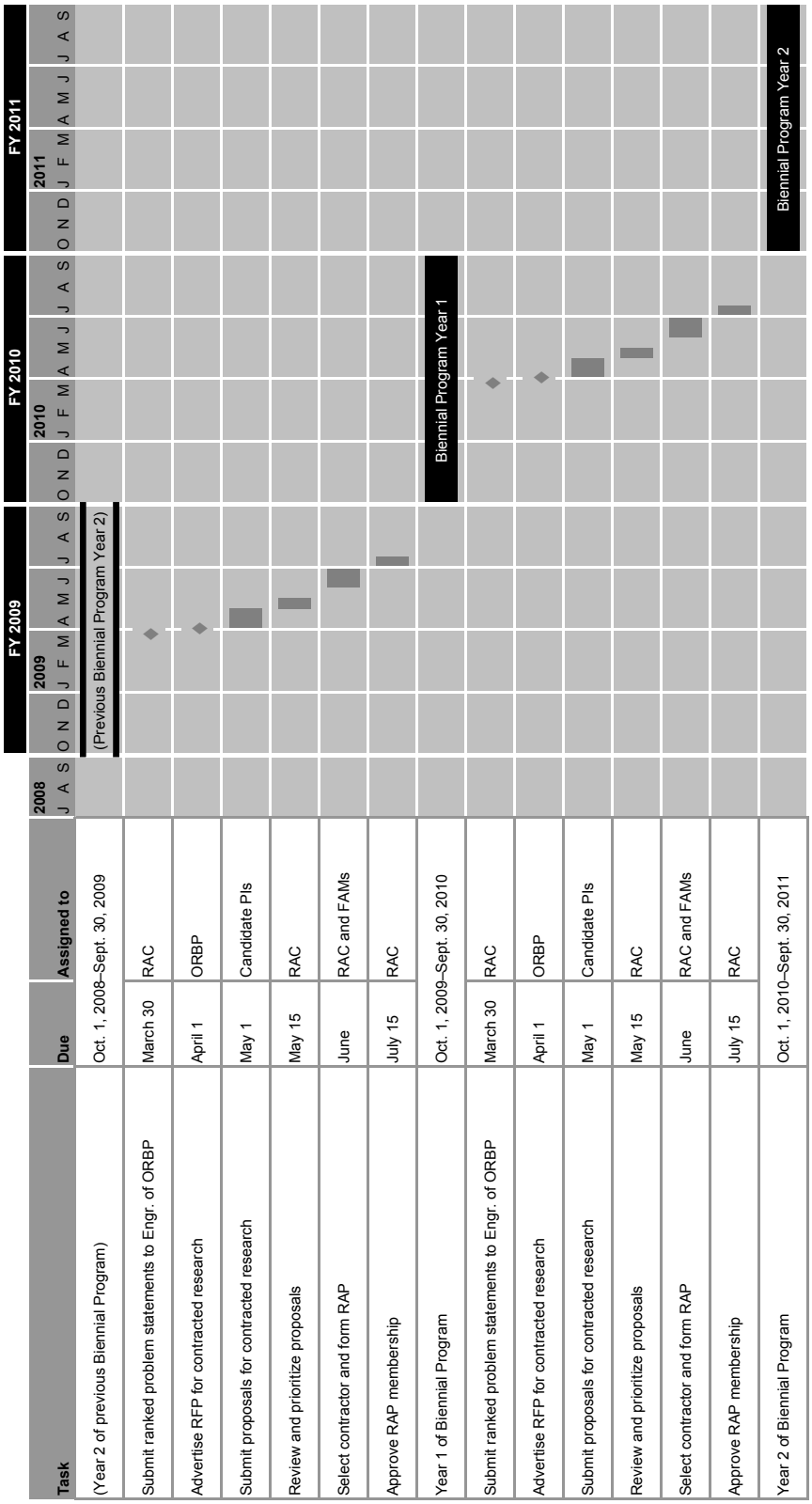
For those projects to be awarded by RFP, the appropriate RAC evaluates all proposals using the MDOT's Guide for Research Proposal Evaluation (Yet to be developed at the time of this printing). If only one candidate responds to an RFP, that candidate, most likely, may be selected based on meeting minimum requirements to complete the work. After selection is completed, the Engineer of ORBP sends a letter to the consultant stating the selection for the research project.

4.1.1.4 Timeline

The anticipated timeline for consultant selection is shown in figure 4.3 The REC approves the program by August prior to the start of the funding year (see Chapter 3). RFPs for tentative new projects are advertised by April 1. Proposals are due by May 1. Consultants are selected in June.

Figure 4.3—Contractor Qualification-Based Selection
Illustrated for both years of 2-year program running in FY 2010 and 2011

Task	Due	Assigned to
(Year 2 of previous Biennial Program)	Oct. 1, 2008–Sept. 30, 2009	
Submit ranked problem statements to Engr. of ORBP	March 30	RAC
Advertise RFP for contracted research	April 1	ORBP
Submit proposals for contracted research	May 1	Candidate PIs
Review and prioritize proposals	May 15	RAC
Select contractor and form RAP	June	RAC and FAMs
Approve RAP membership	July 15	RAC
Year 1 of Biennial Program	Oct. 1, 2009–Sept. 30, 2010	
Submit ranked problem statements to Engr. of ORBP	March 30	RAC
Advertise RFP for contracted research	April 1	ORBP
Submit proposals for contracted research	May 1	Candidate PIs
Review and prioritize proposals	May 15	RAC
Select contractor and form RAP	June	RAC and FAMs
Approve RAP membership	July 15	RAC
Year 2 of Biennial Program	Oct. 1, 2010–Sept. 30, 2011	



RAP Abbreviation Guide

RAP Research Advisory Panel
RM Research Manager
FAM Focus Area Manager
PI Principal Investigator
PM Project Manager
TM Technical Monitor

4.1.1.5 Research Advisory Panel

The Focus Area Manager forms a Research Advisory Panel for each project. The FAM selects a Project Manager, typically the MDOT project champion who submitted the problem statement for the project. ORBP assigns a Research Manager. Members of the RAP are shown in Figure 4.4.

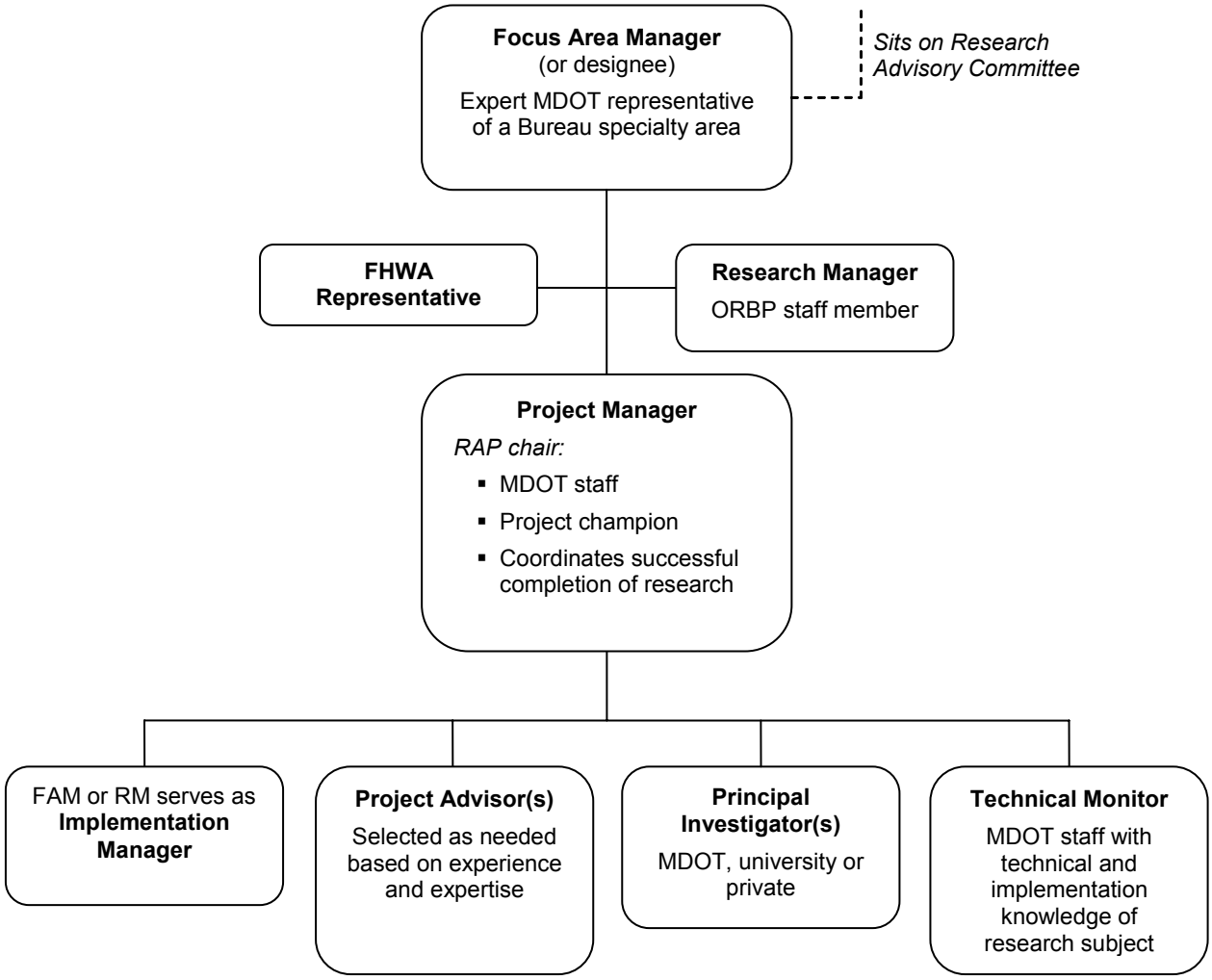


Figure 4.4—Research Advisory Panel

4.1.2 Continuation projects

A RAP will already be in place for each existing project continuing into the new biennium. The RM collects technical and financial information for the remaining effort and updates the department administrative monitoring and control mechanisms, using MPINS and MFOS systems.

RAP Abbreviation Guide

RAP	Research Advisory Panel	**FAM**	Focus Area Manager	**PM**	Project Manager
RM	Research Manager	**PI**	Principal Investigator	**TM**	Technical Monitor

4.2 Contracting

4.2.1 Types of Contracts

The Engineer of ORBP approves all research projects for contracting. For new projects, the Qualification-based selection process described in chapter 4.1 will typically be used and a project specific contract will be signed.

In cases where unique expertise is required, the Engineer of ORBP can request approval for a sole source contract. In general these involve a short duration (less than one year) and expenditures less than $100,000. Approval of the Chief of Operations and CSA must be received prior to initiating a sole source contract.

4.2.2 Work Authorization

The consultant does not begin work before receiving work authorization. Work authorization consists of these steps:

- **Research Manager** submits the Project Manager's Check List (Appendix C4), project proposal (Appendix C5), budget (Appendix C2) and completed State Administrative Board questionnaire (Appendix C6) for processing by ORBP and approval by the Engineer of ORBP. Typical time between the submission deadline and State Administrative Board approval is six weeks.
- **Contract Services Division** checks MFOS to ensure that funding is secure for at least one fiscal year of the project, and notifies ORBP if funding is not in place.
- **Contract Services Division** schedules projects of $25,000 or more for State Administrative Board in Contract Administration Tracking System (CATS) according to Contract Services Administrative Board deadlines.
- **Contract Services Division** also submits projects of $100,000 or more to Office of Commission Audits for cost approval.
- **State Administrative Board** and **Office of Commission Audits** approve the project as required.
- **Contract Services Division** processes authorization and e-mails PDF file to the principal investigator for signature.
- **Principal Investigator** submits two original signed and dated authorization forms to Contract Services Division.
- **Contract Services Division, Contract Administration Unit** obtains signature from the Executive Office and awards authorization.
- **Contract Services Division** manually dates the authorization forms with the effective and expiration dates and enters these dates into CATS.

- **Contracts Service Division** distributes the awarded authorization as follows:
  - faxed copy of authorization to Principal Investigator
  - faxed copy of authorization to ORBP, for distribution to RM and PM
  - copy of authorization and proposal sent to ORBP
  - one original authorization mailed with proposal to the Principal Investigator
  - one original authorization filed in the Contract Services Division contract file

4.3 Execution

4.3.1 Start-up

4.3.1.1 Kickoff meeting

The full RAP meets after the consultant receives work authorization. At this kick-off meeting, the PM and the PI should review the work to be completed, deadlines, expectations, and other issues appropriate to the project. Traffic control issues are addressed at this time. The Principal Investigator takes and distributes meeting minutes to all RAP members.

4.3.1.2 Periodic meetings

The RAP meets periodically to discuss the project's progress and address outstanding issues. The frequency of these meetings are project-appropriate, with quarterly meetings recommended and semiannual meetings as a minimum. The Project Manager documents these meetings.

4.3.2 Start of research work

Research work starts on the date listed on the authorization. The project manager keeps track of tasks, timelines and expenditures for reporting purposes. Work related to creating a problem statement, RFP, or work plan is not billable to MDOT.

4.3.3 RAP members for project management

This section describes the responsibilities of each member of the RAP in overseeing the execution of the research project. In practice, a RAP – especially for small projects – may not include all of the members listed below. It may minimally include a Focus Area Manager, a Project Manager (this might be the same person as the FAM) , a Research Manager and a Principal Investigator. For larger and more complex projects, Technical Monitors and Project Advisors may be added as required.

4.3.3.1 Focus Area Manager (FAM)

The Focus Area Manager is MDOT staff designated by appropriate bureau. FAMs do not, in general, manage projects (although in specific instances the person serving as FAM might also serve as Project Manager). FAMs attend quarterly RAP meetings held by the PM to keep abreast of progress and report back to the Research Advisory Committee. They may assign designees if necessary.

Responsibilities include:

- Selects the project manager for the project
- Approves RAP membership
- Remains in contact with PMs, RMs, TMs and PIs throughout project to ensure milestones and met and documented
- Notifies RMs, TMs and PIs on questions or concerns regarding scope of work or methods
- Reviews and comments on draft final report and other research products

4.3.3.2 Research Manager (RM)

- With ORBP's Analyst, the first point-of-contact with Principal Investigator for administrative aspects of the project (invoices, quarterly reports, deliverables, requests for changes in scope or budget).
- Keeps track of missing/late administrative items and works with PM and PI to resolve these issues
- Facilitates scope of work with consultant
- Ensures timely milestone delivery
- Develops, administers, and markets research program in functional area
- Acts as contract ORBP's liaison
- Facilitates approval of consultant costs, requests and contractual changes

4.3.3.3 Project Manager (PM)

- MDOT staff
- Manages and oversees technical and engineering aspects of the project
- Selects remainder of RAP (such as needed, such as Project Advisors or Technical Monitors) for the FAM's approval
- Convenes in-progress review meetings of the RAP at least once per quarter and leads these meetings
- Approves invoices, reports and deliverables received by ORBP.
- Reviews and comments on scope of work
- Notifies FAM, RMs and PIs on questions or concerns regarding scope of work or methods
- Provides FAM a list of customers and users to include in progress and final review meetings
- Reviews and comments on interim, draft, and final reports
- Drafts summary of how project will affect MDOT business process

4.3.3.4 Technical Monitor (TM) if needed

- MDOT staff
- Provides additional expertise on technical, implementation, or user issues
- Notifies FAM, PMs, RMs and PIs on questions or concerns regarding scope of work or methods

4.3.3.5 Project Advisor (PA) if needed

- MDOT staff or external
- Provides additional expertise on any issues relevant to the research project

4.3.3.6 Principal Investigator (PI)

- Conducts day-to-day research tasks
- Provides progress and final reports
- Manages budget and schedule
- Maintains contact with FAM and other RAP members
- Participates in outreach (publications, presentations, summary documents)

4.3.3.7 Implementation Manager (IM)

This role is filled by the RM or FAM.

- Facilitates, evaluates, and documents agency-wide implementation based on implementation plan
- Directs consultant activities related to implementation
- Oversees development of research notes and implementations summaries

4.3.4 Interim reporting

4.3.4.1 Quarterly Progress Reports

PIs submit reports (Appendix C7) to ORBP by the 15th of the month following the end of a quarter:

- 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 – Sept. 30; report due October 15

The fourth quarterly report for each project, due by October 15, summarizes all four quarters of the previous fiscal year for that project. If that project was a continuation project that started in the

previous FY, the report will also contain summarized information from the start of the project. ORBP sends a copy of each fourth quarter project summary report to FHWA.

The reports provide task status, encountered problems and solutions, the following quarter's work plans and estimated completion dates and costs.

Progress report are required on a quarterly basis. Progress Reports must be submitted for processing to ORBP, not to the Project Manager. The preferred method of submission is an electronic file in Microsoft Word. Alternatively, printed reports (2 copies) are acceptable.

For quarterly reports submitted *electronically* (preferred method):

The Principal Investigator e-mails the Microsoft Word file to both the ORBP Research Analyst and the Project Manager. ORBP will then send the Project Manager a Report Evaluation form (Appendix C8) to complete and return within 10 working days to ORBP.

For quarterly reports submitted as *hard copy* (alternative method):

The Principal Investigator sends the file to ORBP's Research Analyst at the address listed in Chapter 1 of this manual. Upon receiving the two printed progress reports, ORBP files one copy in the project contract file and sends the other, with a Report Evaluation form (Appendix C8), to the Project Manager. The Project Manager has 10 working days to complete and return it to ORBP.

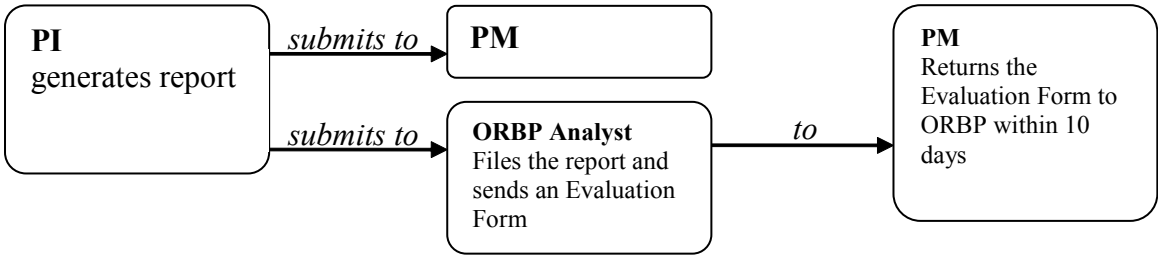
When progress reports are not submitted per the schedule outlined in the contract, the project in question is subject to cancellation due to lack of activity. Progress reports document activity; it is important to thoroughly and accurately provide feedback on the period of research being evaluated.

4.3.4.2 Annual Interim Reports

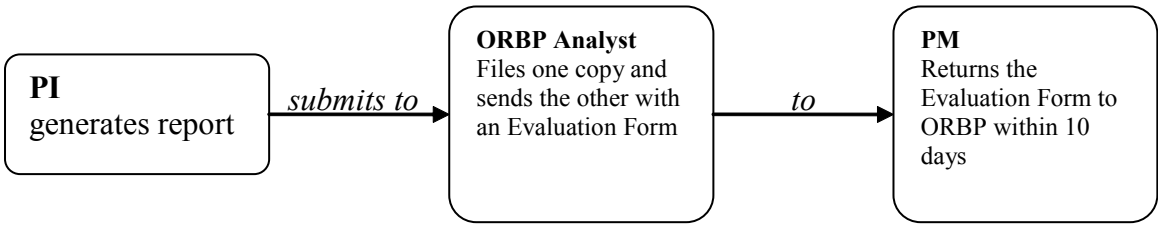
For multi-year projects, the PI submits to the RM on October 30 a fiscal year-end interim report in the same format as the final report (detailed in Chapter 5). Delivery of annual interim reports is a requirement of the Federal Highway Administration.

For quarterly or annual reports, responsibility process maps are as follows:

Report submission (electronic copy)



Report submission (hard copy)



Missing reports

4.3.5 Financial

4.3.5.1 MDOT Processing

All projects are initiated in the departmental financial system using MAP Project Information System (MPINS) and MAP Financial Obligation System (MFOS) by ORBP Research Analyst through the initiation of a blanket purchase order (BPO). A department purchase order encumbers funds from the BPO and enables all invoices and other expenses to be paid and accumulate to the specific research project. For SPR funded projects, the Federal Aid Project Agreement is submitted previously to FHWA to document availability of the funds for the project.

4.3.5.2 Invoice submission

The PI submits quarterly invoices on a timely basis according to the language in the Indefinite Services Contract. As with progress reports, invoices are sent directly to the ORBP office, where they are time-stamped upon receipt. Invoices should be submitted as hard-copy.

ORBP promptly sends an Invoice Approval form (Appendix C9) to the Project Manager. The PM returns the form to ORBP within 10 working days for timely processing.

Invoices must include the following information (Appendix C9a, C9b and C9c):

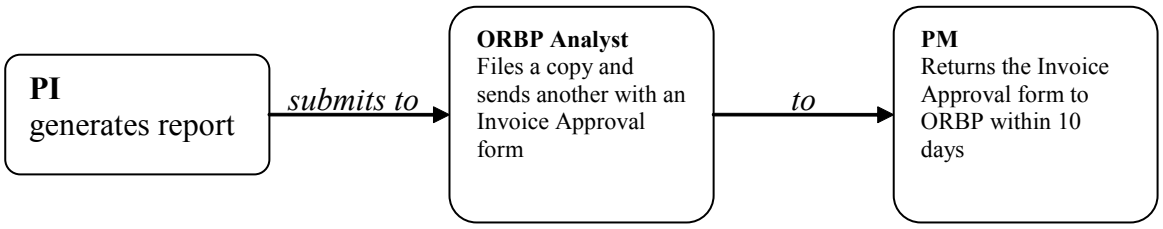
1. Contract information
2. MDOT contract number
3. Total contract amount
4. Billing period
5. Total percentage of completion previously invoiced (both % done and $ billed)
6. Percentage of completion for current billing period (both % done and $ billed)
7. Total percentage of work completed (both % done and $ billed)
8. Itemized list of items being billed this period

The following important information is noted with respect to invoicing:

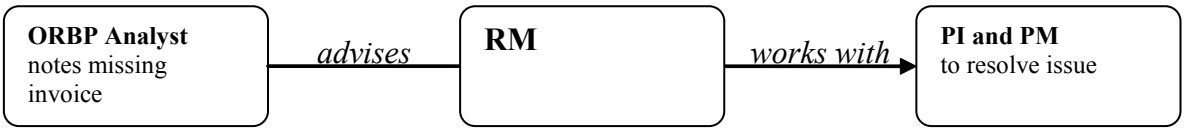
- ORBP will process invoices only after it has received a Progress Report for the billing period and an approved Progress Report Evaluation form from the Project Manager.
- Consultants may only bill through 85% of the total contract amount prior to the submission and subsequent approval of the final deliverables (noted in section 4.4.2 of this manual).
- Invoices will not be paid for work performed outside of the contract start and end dates: all work for a given project must be carried out between the start and end dates written in the contract.
- If a PI wants a contract amended or extended, the PI must request the amendment or extension in a timely manner (that is, before the contract expires). Either the PI or the PM may contact ORBP to formally request the amendment. However, ORBP will only process contract amendment requests that have been approved by the PM.

Responsibility process maps are shown here:

Invoice submission



Missing reports



In some cases, contracts may be issued where payment is based on stated milestones and deliverables rather than quarterly completion. Quarterly invoices should be submitted based on completion of milestones noted in each quarter's report.

The State of Michigan's fiscal year runs from October 1 to September 30. After the start of a the new fiscal year (October 1), the consultant must submit as quickly as possible all invoices for work from the ended fiscal year. The consultant must notify ORBP's Research Analyst so that MDOT's accounting system may be adjusted to accommodate payment from prior year funds. Prior-FY invoices must be submitted to MDOT within two months of the new FY (i.e., before December 1).

On December 1, all prior FY funds will cease to be available. Invoices submitted on or after December 1 for prior FY work will not be paid.

4.3.5.3 Invoice payment

Upon receipt of an invoice from a PM with the PM's initial approval based on knowledge of the project, ORBP's Research Analyst provides the RM with an invoice approval form and the project budget sheet. Consulting with the PM as needed, the RM reviews the invoices and either approves or disallows charges and sends invoices to the Engineer of ORBP for final approval.

If approved, ORBP's Research Analyst and ORBP's University Research Administrator process payment. The University Research Administrator indicates approval in MAIN, and the Research Analyst inputs information into the MAIN system to initiate a payment voucher to the consultant.

If disallowed, an invoice is handled in one of two ways:

- The RM may discuss the problem with the PM and PI to find a workable solution or receive required missing information.
- The invoice may be returned to the consultant with an explanation of the disallowance. The consultant is responsible for making necessary changes and resubmitting the invoice.

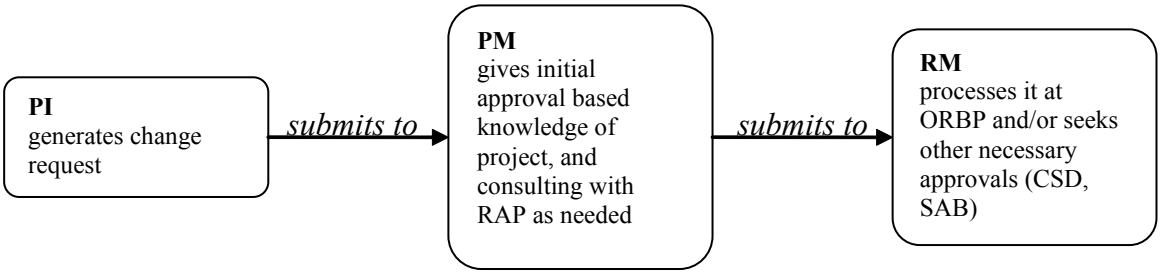
4.3.6 Consultant delays in deliverables

MDOT will request that an investigator refrain from publishing on contract-related activities if its work or deliverables are behind schedule. MDOT will retain the right to cancel a contract if the investigator publishes following such a request.

4.3.7 Changes in scope, Cost and/or Completion Date

During the execution of a research project, if there is any need to revise the scope of work, cost and/or completion date, the PI discusses this need with the PM. If the PM agrees in principle to the changes (discussing with the FHWA liaison and full RAP as necessary), either the PM or PI will complete MDOT form number 5306 (Appendix C10), the PM will sign, date, and submit the request and recommendation for approval to the RM. The RM submits a request for approval of changes in the project scope, cost and/or completion date to the Engineer of ORBP. If approved, these changes may also require notification and approval from Contracts Services Division, State Administrative Board, and FHWA.

A responsibility process map is shown here:



4.4 Closeout

A project is completed when all deliverables are received by MDOT according to the contract. Closeout procedures are detailed in this section.

4.4.1 Final Report

The final draft must be submitted for MDOT's review three months prior to the end of the contract. The PM convenes the RAP meets with the purpose of serving as a report review panel, and may call in additional staff with expertise as needed. The panel reviews the final report for completeness, technical merit, and format/style. Detailed requirements for final report delivery are in Chapter 5 of this manual.

4.4.2 Final Invoicing

Upon project completion, the PI submits a final invoice to ORBP. 15% of the total contract amount will be withheld by MDOT pending delivery and approval of all deliverables named in the contract.The amount withheld may be lowered in special cases with the approval of the Engineer of ORBP. The consultant should plan for the final 15% withheld at the end of the contract period, and budget time for completing the final deliverables within the contract period.

The project will not be closed and the final invoice will not be paid until the final deliverable(s), including the report, are approved by the RAP and submitted to the Engineer of ORBP.

4.4.3 Audit

When the research contract is complete, ORBP's Research Analyst requests an audit in CATS. The Research Analyst provides the total amount paid to the consultant and identifies any remaining funds to be paid. The Research Analyst coordinates the audit, makes the final payments to close the contract, and sends a memorandum of completed audit to the Engineer of ORBP.

4.4.4 Consultant Evaluation

Upon acceptance of the final report, the RM and PM complete a PI/consultant performance evaluation (Appendix C11). Performance measures include quality of work and timeliness of delivery (reports, invoices). A copy of evaluation is provided to the PI/consultant, the Engineer of ORBP, and the Research Analyst for the office's records. Evaluations may be used to help MDOT select consultants on future projects.

4.4.5 Project Evaluation

RAP members evaluate the project to determine the estimated value of the research to the department, to identify research successes, and to identify possible areas of improvement.

Benefits may be in the form of:

- Cost savings (quantitative or qualitative)
- Improved processes that reduce cost or improve safety.
- Improved information for management decision-making and policy formation

4.4.6 Letter of Closure

ORBP issues a letter of closure to the PI at the end of a project.

4.5 Implementation

Research projects must have a compelling implementation component. Anticipated implementation deliverables are detailed in the implementation plan of the work statement (4.1.1.2) and implementation considerations are addressed throughout project execution by the Implementation Manager (4.3.6).

During its final review of the project, the RAP/review panel make will make implementation recommendations to the RAC.

The full scope of project implementation is addressed fully in Chapter 6 of this manual.

Chapter 5. Final Reporting

5.1 Federal Requirement for Final Report

According to the U.S. Electronic Code of Federal Regulations:

> *RD&T activities [must be documented] through the preparation of final reports. As a minimum, the documentation must include the data collected, analyses performed, conclusions, and recommendations. (CFR 23.420.209.a.6)*

A research project is not complete if a final report has not been satisfactorily delivered by the consultant and accepted by MDOT.

5.2 Components

A final report contains the following sections:

1. Title Page
2. Abstract Page, including report number
   • The consultant will secure a report number for the final report by contacting Materials Section Secretary at 517-636-0305 to get an abstract page and a report number. The abstract page will be completed, including the report number, and inserted into the report directly after the title page.
3. Acknowledgment (optional)
4. Table of Contents
5. List of Tables
6. List of Figures
7. Executive Summary
8. Action Plan for Research
9. Introduction
10. Objective
11. Scope
12. Methodology
13. Discussion of Results
14. Conclusions
15. Recommendations for Further Research
16. Recommendations for Implementation
17. List of Acronyms, Abbreviations and Symbols
18. Reference Cited or Bibliography (if applicable)
19. Glossary (optional)
20. Appendix
21. Conversion Table for the U.S. Customary and Metric Units

5.3 Format and Style

A well-written report is correct, clear and concise. It communicates all important aspects of the research project to the reader in an effective and professional manner. As noted in 4.1.1.2 of this manual, the consultant will assign a technical editor to the report.

While MDOT does not prescribe a specific format or style guide for all aspects of a final report, the following requirements must be followed:

- Pages of a final report will be numbered
- 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 for their first

use in a report. For example, "The Office of Research and Best Practices (ORBP) is headquartered in the Van Wagoner Building. ORBP staff are also located at other department facilities in Lansing."
- All units will be in U.S. customary units. The use of metric units or dual units (metric and U.S.) is not acceptable.
- Figures (including photographs) will be numbered and labeled
- Tables will be numbered and labeled
- Equations will be numbered

Beyond these requirements, the following are useful resources for writing a technical report:

- Scientific and Technical Reports—Preparation, Presentation and Preservation. ANSI/NISO Z39.18-2005. *http://www.techstreet.com/cgi-bin/detail?product_id=1262085.* "Chapter 6. Presentation and Display" includes information on subordination, units, footnotes, tables, etc.
- United States Government Printing Office Style Manual. *http://www.gpoaccess.gov/stylemanual/index.html*

5.4 Acceptance

A condition for final payment to the consultant is MDOT's acceptance of the final report. The report must be accepted by the Research Advisory Panel.

5.4.1 Initial Acceptance

Noted in 4.4.1, the RAP and other experts as needed serve as a final report review panel, led by the PM. The RAP determines initial acceptance based on:

- Completeness. Does the report contain all the necessary components, listed in sections 5.1 and 5.2 of this manual?
- Technical merit. Is the research well document and are the findings scientifically rigorous?
- Format and Style. Does the report meet high standards of writing and presentation?

The consultant will make revisions to the final report requested by the RAP until it meets the standards for acceptance.

5.4.2 Delivery Criteria

Following initial acceptance consultant will deliver to MDOT the final report in all of the following modes:

Send to:

Materials Section Secretary
C&T Building
8885 Ricks Rd.
P.O. Box 30049
Lansing, MI 48909

- 1 master CD of searchable PDF files
- 15 copies of either the searchable PDF files on CDs or printed bound copies
- 1 unbound original final copy

Send to:

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

- 1 searchable PDF file on CD
- 3 hardbound double-sided copies

Send to the Project Manager:

- 1 searchable PDF file on CD
- 3 hardbound double-sided copies

The consultant will also identify the report's technical editor.

5.4.3 Final Acceptance

- The RM determines final acceptance based on whether the report is delivered according to all of the criteria listed in 5.3.2. Criteria for deliverables will vary by project: it will include the final report plus any other deliverables described in the contract, such as software, special equipment, and testing data.

Chapter 6. Implementation and Technology Transfer

6.1 Implementation

The objective of MDOT's research program is to produce findings that significantly enhance the operations of the department. In many cases, research reports include specific recommendations for altering procedures or practices. In other cases, the findings contribute to the body of knowledge that serves as the basis for daily operational decisions, planning decisions and/or the prioritizing of future research options. In any case, the research process is not complete until the implementation of applicable results has been accomplished. Implementation of research results is the most tangible means of measuring the effectiveness of the research program.

Implementation is addressed throughout the entire cycle of research process:

- Manual section 4.1.1.2: As a part of project selection, the consultant includes anticipated implementation in the proposal's required Implementation Plan.
- Manual section 4.3.6: During the research process, the RAP's Implementation Manager:
  - Facilitates, evaluates, and documents agency-wide implementation based on implementation plan
  - Directs consultant activities related to implementation
  - Oversees development of research spotlights and implementations summaries
- Manual section 5.2: "Recommendations for Implementation" is a mandatory component of the consultant's final research report.

This chapter further defines responsibilities, guidelines and processes related to implementation.

6.1.1 Responsibilities for Implementation

6.1.1.1 Implementation Manager (IM)

As described in section 4.3.3.7, for a research project, the Research Manager within the ORBP is the designated Implementation Manager and is responsible for facilitating, evaluating, and documenting research implementation activities. The IM is responsible for communicating intended uses of research results and helping to manage the research to meet those needs.

Each Research Manager is responsible for working with the Principle Investigator, Project Manager and Technical Monitors to develop an Implementation Plan for SPR projects in their subject area.

The IM may also serve as a Technical Monitor for implementation (see below)

6.1.1.2 Technical Monitor (TM)

The probability of relevant findings increases greatly when the users are involved in the research process. The Technical Monitor is an MDOT user/expert in the technology under investigation, and it is the Technical Monitor's responsibility to ensure that the research project team continuously considers the unique requirements of the functional area throughout the active stages of a project. It is the responsibility of the IM to not only ensure that the Technical Monitor clearly understands this aspect of the role from the outset, but also to create a working format in which this is possible.

Depending on the IM's other duties within MDOT and technical expertise, the IM and TM may be the same person. Otherwise, additional MDOT staff with the necessary background and expertise may be called upon as needed to serve as a Technical Monitor.

6.1.1.3 Project Manager (PM)

Each Project Manager is responsible for working with the RAP members to assess the Implementation Plan and implementation aspects of a project throughout its life cycle: from inception, during execution, and upon completion.

6.1.1.4 Principal Investigator (PI)

While the Principal Investigator will not be responsible for implementation of research results, the research approach and products influence the ability to implement the findings of a research project. Therefore, the PI is encouraged to understand how research results are intended to be used at completion of the project. For example: will the results be incorporated into a department policy, procedure, manual or existing data system? Will the product be use by department staff in one program only, throughout the department, or by users outside of MDOT as well. The PI will work with the Implementation Manager and Technical Monitor to understand these intended uses and prepare recommendations for appropriate use of research results at the completion of the project.

As discussed in section 4.1.1.2 ("Proposals for new research"), the PI will include an Implementation Plan as a part of all research proposals.

6.1.2 Implementation Guidelines

The precise roles of the Implementation Manager and Technical Monitor, and the functions of the Implementation Plan, will depend greatly upon the nature of the research project. To help direct the research project, the following items should be considered by MDOT and the PI and when developing the problem statement and research proposal.

1. ***Think about the end results.*** Know what is hoped to be gained from the project when it is done. Work with colleagues and RAP members to spell it out in concrete terms.
2. ***Understand the environment.*** No project exists in a vacuum. Gather as much information as possible about steps that will need to be taken to implement results. Ask questions such as: Will the project require specialized computer software or hardware? Who has to approve a decision to implement a result? What will the costs of implementation be?
3. ***Describe the potential benefits.*** Work with the Research Advisory Panel established for the project to identify the potential benefits and how this will help address the need.
4. ***Know the customers.*** List everyone who might benefit from the project and include others who may influence those who benefit. Divide the list into two categories – those who benefit most and others. Spend more time reaching out to the first category.
5. ***Involve the right players.*** Don't go too far without making sure that the right team is assembled. Include representatives of the groups who benefit the most helping plan the course of action. If they aren't on the RAP, consider expanding it or find another way to gather their ideas.

6. ***Explore the most appropriate method for technology transfer.*** The methods of technology transfer may include the development of formal training programs, workshops, publications and one-on-one outreach efforts. Steps 1-5 help in gathering information about what tool might be most effective for the project.

7. ***Define implementation.*** Be specific. As much as possible, write down expectations of anticipated uses for research results, which documents a finding might need to be included in, whether software deployment will be needed, etc. Define what needs to happen to get there, how it will happen, when it will happen, and who will be involved.

6.1.3 Implementation Action Plan

When an SPR project is nearing completion and a draft report is available, the Implementation Manager will complete an Implementation Action Plan. The Technical Monitor will assist as necessary. The Implementation Action Plan will containing the following information:

- ***Project title.***
- ***Project number.***
- ***RAP members involved in implementation:***
  - Principal Investigator
  - Project Manager
  - Research Manager
  - Implementation Manager
  - Technical Monitor (if different from IM)
- ***Brief description of problem.*** What important problem or opportunity was this research intended to solve and why is it a priority?
- ***Major discovery.*** What new information, procedure or knowledge was gained from this research? Did this research solve the identified problem or advance the state of knowledge?
- ***How the information will be used in MDOT?*** Who in the department, such as regional materials engineers, department engineers and planners or metropolitan planning organization staff will use this information? How will the findings be fully implemented in the department? This could include further research, field tests, training programs, manual revisions, specification changes, policy recommendations, or the purchase of equipment and software.
- ***Value Added to MDOT.*** What are the tangible benefits of this research to the department? Has it resulted in a new product or procedure that is more cost effective than current practice? Has it improved the capability of department staff? Has it advanced the state of practice in an emphasis area? Did it result in a measurable cost benefit?
- ***Implementation Action Plan Checklist.*** What are the results achieved through this research and what action is needed to implement the results?

	Results achieved through this research (check all that apply)		**Items/Actions needed to implement results** (check all that apply)
	Knowledge to assist MDOT		Management decision
	Manual change		Funding
	Policy development or change		Training
	Development of software/computer application		Information technology deployment
	Development of new process		Information sharing
	Additional research needed		Other (specify)
	Project produced no usable results		
	Other (describe)		

Figure 6.1.3.1. Implementation Action Plan checklist.

The Implementation Action Plan will help guide the Research Advisory Committee and MDOT executives in changing department policy or practices (see section 6.1.4, Implementation Process). In addition, ORBP will use the Implementation Action Plan to develop communication and marketing tools to disseminate information gained through research to a broad audience.

6.1.4 Implementation Process

At the conclusion of the study, MDOT may immediately implement small-scale changes in practice as warranted by research results. These are formally announced by MDOT.

For potentially large-scale changes in practice, MDOT conducts the following process to determine whether the research results will be implemented. The steps are as follows:

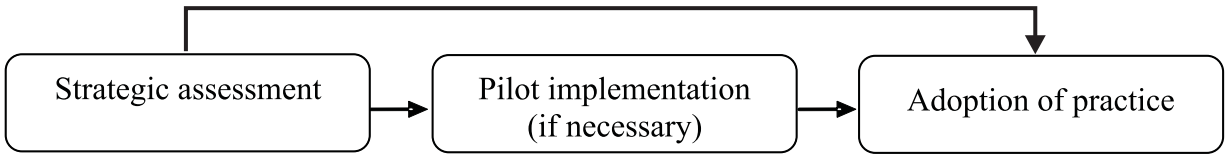


Figure 6.1—Three steps of implementation

The steps are elaborated upon in the following paragraphs.

6.1.4.1 Strategic Assessment

The Research Advisory Committee considers the implementation recommendations made by the consultant, as well as additional recommendations and analysis offered by the Implementation Manager and the Implementation Action Plan. Based on this information, the RAC makes a recommendation to the Research Executive Committee whether to:

- not implement changes,
- implement a change in practice on a limited-scale "pilot" basis, or
- implement a change in practice on a large-scale basis.

6.1.4.2 Pilot Implementation

If the REC determines that the strategic assessment warrants a pilot project, then the IM will formulate a pilot implementation plan. MDOT will conduct the pilot implementation through the appropriate department or bureau.

At the conclusion of the pilot program, the REC will consider its results to determine whether or not to implement a change in practice on a large-scale basis.

6.1.4.3 Adoption of Practice

If the REC determines that either a strategic assessment or a pilot project warrants a change of practice, MDOT will formally announce the adoption of a change in practice.

Process maps for Strategic Assessment and for Adoption (including a possible pilot implementation project) are included as Appendix D1 to this report.

6.2 Research Spotlights

Research Spotlights are a two to four page communication and marketing tool for the purpose of disseminating information gained through research to a broad audience. They are intended to provide a non-technical overview of the research project to attract broader awareness (Appendix D2).

Most SPR, Part II, projects will be developed into a Research Spotlight. The Research Spotlight should be drafted to include the following information:

- Background
- The problem
- What we did
- What we learned
- What the researchers recommend
- How MDOT plans to use the results
- Contact information for the Principal Investigator and Research Manager

Research Spotlights are distributed to the MDOT Executives, members of the sponsoring Research Advisory Committee, relevant technical specialists within MDOT, the FHWA Division Office, the Principal Investigator, the AASHTO Research Advisory Committee, and others identified by the Technical Monitor and Research Manager.

6.3 ORBP Newsletters

ORBP Newsletters are a four–to–six page communication and marketing tool that disseminates the progress and accomplishments in transportation research throughout MDOT (Appendix D3). This publication started as the Materials and Technology Engineering and Science Newsletter (MATES), which was first published in October 1986. These provided a record of the research conducted by and for MDOT. They were produced and published in-house through the summer of 1994. In 1995, MDOT enlisted the help of the Local Technical Assistance Program (LTAP) at Michigan Technological University to publish and print the new Research Record. When ORBP was established in late September 2005, the Research Record became the ORBP Newsletter. The changing focus and direction of research throughout the department created the need to communicate a broader view of transportation research activities at MDOT.

6.4 Technology Transfer

The SPR, Part II, Program requires robust technology transfer activities. Technology transfer methods include:

- Literature dissemination
- Training
- Demonstration and pilot projects
- Conferences and other presentations
- Library displays
- Pooled-fund activities—Regional
- National pooled-fund studies
- Entry of results into department and national databases
- Other technology transfer activities