# Review of Background Resources

## 1. Introduction

The objective of this project is to establish a clear understanding of business needs and potential State Department of Transportation (DOT) Research Program Management Database (RPMD) functions to manage research projects across their entire lifecycle. This is the deliverable for Task 2.1 – review of background information and identification of additional information gathering needs.

Section 2 of this document reviews the following resources:

* Presentation on the initial RPMD Transportation Pooled Fund (TPF) study work: “Transportation Research Program Management Database: Lessons from a Pooled Fund Project” delivered by Leni Oman at the 2013 AASHTO RAC & TRB State Representatives Annual Meeting
* AASHTO RAC State DOT RPMD Surveys
* 2015 WSDOT Information Gathering in support of the RPMD TPF study
* Kentucky Transportation Cabinet (KYTC) SPR Tracking Database Project Initial Deliverable
* Montana Department of Transportation (MDT) Research Business Process Models and Requirements Documents (January 2014)
* Caltrans WebRPMD Specification Document (Cambria, 2011)
* NCHRP Project 20-63B - Performance Measurement Tool Box and Reporting System for Research Programs and Projects (2006)
* Background on FHWA State Planning and Research (SPR) Funding
* 2013 RAC Survey on Uses of SPR Part 2
* Variations across DOTs in research business processes (email)

Section 3 briefly summarizes observations and suggests next steps.

## 2. Summary of Background Resources

### Pooled Fund Study Initial Work

Recognizing the common need for a robust state DOT research program and project database management capability, in 2008, seven DOTs (AK, CA, IN , MI , NE , NY, WA) initiated a Transportation Pooled Fund Study: Transportation Research Program Management Databases [TPF-5(181)]. The purpose of this study was to adapt and enhance an existing research program management database (RPMD) in FileMaker Pro developed by the California Department of Transportation (Caltrans) to meet the needs of the participating states. Specific research objectives were:

1. Accommodate the system modifications needed for implementation by the Washington State Department of Transportation (WSDOT),
2. Identify the needs and proposed modifications for participating states, and
3. Enhance the RPMD to add new functions to meet additional research program management business needs of participating states, including management of the Transportation Pooled Fund (TPF) Module.

According to a July 2011 progress report for the project and the project’s Technical Advisory Committee, the first two tasks were completed but the third was put on hold because “It provided to be difficult to recreate the functionality of the database in .net. An effort was initiated to do a straight conversion to the web environment but the project was terminated before completion due to concerns with product delivery.” The project’s Technical Advisory Committee also determined that “modifying the RPMD was not the most feasible strategy for development of state DOT research databases as both modification of the system for other agencies and the development of new modules is more difficult with a more complicated schema than most state DOTs need.”

A presentation by the WSDOT Research Director at the 2013 RAC & TRB State Representatives Annual Meeting identified several challenges faced during the project. New requirements within Caltrans for the RPMD emerged which added scope and costs. Changing priorities and limited IT staff resources made it difficult to absorb these changes without impacting the research project scope and budget. Adapting the Caltrans program for other DOTs proved more difficult than anticipated due to the size and complexity of Caltrans’ research program relative to other DOTs, as well as agency differences in reporting needs and environments. A key lesson learned through the project was the importance of having “a clear business need and functional outline before pursuing database development.”

### State DOT Practice Survey (2013)

The AASHTO Research Advisory Committee (RAC) commissioned a survey of state DOT research databases in 2013, updating a prior similar survey conducted in 2008. CTC & Associates conducted the survey and summarized its results. Forty-six agencies responded to the 2013 survey. Findings were as follows:

* 40% of respondents used spreadsheets; 60% used databases.
* 24% of spreadsheet users and 19% of database users were satisfied with their current system.
* 46% of database users used Microsoft Access; others included Oracle, SQLServer, SharePoint, FileMaker Pro.
* 51% of database users considered their system very transferable or moderately transferable to other states; 27% didn’t know.
* 27% of database users reported that their system was integrated with other DOT systems (e.g. financial system.)
* Databases included: SPR-funded, state-funded, pooled fund studies, UTC projects, Innovative Bridge and other FHWA projects, Experimental Features projects, and other types of research projects.
* Information included in databases varied and included: problem statements, RFPs, proposals submitted, oversight committee members, research topic areas, investigator contact information, contracts and amendments, quarterly progress reports, invoices, detailed financial information, implementation information, and email notifications.
* Reports included: problem statements, project summaries, annual FHWA work programs, annual reports of completed and in-progress projects, quarterly progress reports, financial summaries, and implementation status reports.

### WSDOT Information Compilation for TPF-5(181) (2015)

Building on the 2013 practice survey, WSDOT (Steve Hanson and Leni Oman) requested detailed information from state DOTs on their current research databases. Forty-one agencies responded to the request; 33 provided useful information (e.g. databases, screen shots, lists of data elements, etc.)

The key business purposes of an RPMD were summarized as follows:

* Collect research need statements
* Support project selection
* Manage contract and financial data for projects
* Manage program contributions
	+ (NCHRP, TRB Core Services, AASHTO Technical Service Programs, Transportation Pooled Fund (TPF)Program)
* Manage all types of research projects (SPR, TPF, other national, university, state, or local programs)
* Manage problem statements submitted to national programs
* Manage matching funds
* Manage people associated with state and national projects
* Provide program and project alerts
* Collaboration support for research project management

Detailed information on specific attributes maintained by each state was compiled and synthesized. Common attributes were grouped into seven categories:

* General (Project)
* Problem Statements
* Contracts – agreements, amendments/modifications
* Funding (Budget) – budgets, invoices, payments
* Schedule – events, project tasks/milestone tracking
* People (Groups) – researchers, agency staff, committees
* Results (Product) – deliverables/reports, performance measures/outcomes, implementation activities

Key observations were:

* There are several common/similar attributes in transportation research management databases.
* There are similar interests in research management but varied levels of functionality.
* There is variation in what is tracked, how it is tracked, and what things are called.
* Generally, there is little automation of workflow and reporting (though opportunity to improve efficiency by doing so).
* There is opportunity to improve the efficiency of research program and project management with technology.
* The majority of States are not satisfied with their current RPMD solution.
* Most states do not have financial support to develop/improve their research management databases.

Appendix A summarizes information compiled for each agency.

### Kentucky Transportation Cabinet (KYTC) SPR Tracking Database Project

One of the resources collected by WSDOT was a memo pertaining to a Kentucky Transportation Cabinet project to develop a State Planning and Research (SPR) tracking database. The project’s objectives were: “To develop and implement a web-based project management tool for SPR research projects. This management tool will provide easily accessible, up-to-date information on project accomplishments and milestones, the current status of the project, and quick links to any project deliverables. In addition to tracking the progress of active projects, the system will provide the capability to track the implementation of research results for a specified time frame (to be determined) following project completion.”

A draft deliverable (dated July 1, 2014) was provided by KYTC. The deliverable was prepared by Joe Crabtree, director of the Kentucky Transportation Center and submitted to Jason Siwula, Innovation Engineer of the Kentucky Transportation Cabinet. It included a review of RPMD systems in Louisiana, Minnesota and Washington State, North Carolina, Illinois, Texas and Virginia – as well as FHWA’s Turner Fairbanks lab. Substantial detail was included for the Louisiana system, which was judged to be the most fully featured system of those reviewed. The report noted that: “The prospect of adapting the LTRC system for use in another state is rather daunting, but much can be learned from the LTRC system in terms of the types of capabilities that such a system can provide.”

The research team followed-up with Joe Crabtree about the status of this project. He stated that the project is nearing completion with the draft final report nearly complete. Through the project, the research project database system was developed and is currently in use. Key database capabilities include the ability to:

* Store basic project information for active and completed projects
* Produce QPRs for the SPR program
* Create a website/homepage for each project, complete with project status
* Link to key project documents stored on Dropbox
* Store basic financial information for each project
* Track back end performance measures and implementation action items (though not currently utilized)

The system does not have the ability to manage the research solicitation process, though there is a website for submitting ideas. These ideas are then prioritized and final decisions are made and selected ideas are scoped and entered as projects into the database.

Findings included in the document and follow-up conversation were incorporated into Appendix A.

### Montana Department of Transportation (MDT) Research Business Process Models and Requirements Documents (January 2014)

MDT developed a set of detailed business process models for their research management function. Four high level processes were identified:

* Program Management - monitoring and controlling federal appropriations and obligations as well as research program reporting
* Project Management - selecting and monitoring research, experimental and other project status and progress
* Contract Management - soliciting and monitoring research contracts
* Budget Management - developing, implementing, monitoring and closing the research program budget for each state fiscal year

Appendix B summarizes the hierarchy of the process models for these four areas. The mapping focused on the Project and Contract Management processes. The document identifies key organizations/positions, applications, and issues pertinent to each of the process steps. These detailed process maps will be useful as we proceed with the Business Requirements task.

In addition to the process models, a spreadsheet of research requirements was provided (see Appendix C.)

A business case document for a general agency Contract Tracking and Monitoring (CTM) system was also provided, along with a requirements spreadsheet for a CTM system. The general CTM requirements were mapped to the research requirements, presumably to determine which research data tracking needs could be addressed by a general CTM system.

The research team followed up with Sue Silick about the status of their system. The following information was provided.

MDT is currently using spreadsheets for research program, project, contract and financial management, but would like to implement more robust database tools. They have mapped business processes and developed requirements, focusing on research project and contract management elements. They are currently exploring use/adaptation of several different systems for meeting these requirements:

* **SciQuest Total Contract Manager (TCM)** – statewide system acquired by the Montana DOA. MDT is evaluating use of this system for Research, Consultant Design and Purchasing-defined requirements. An initial analysis indicates that it won’t meet several of MDTs requirements; follow-ups with the vendor are being conducted. (Sue provided an updated version of a contract tracking requirements spreadsheet that indicates which requirements may not be met.)
* **Consultant Information System (CIS)** – in-house developed tool used by MDT Consultant Design for financial tracking (funding, expenditures, etc.). This system may meet some of the Research financial management needs.
* **Planisware Project Portfolio Management (named EPS at MDT)** – this system has been implemented in MDT Construction for project management/scheduling. Research is currently talking to the vendor about the possibility of using this system to meet Research project management requirements. The system includes an “ideation” component, which is well-suited to meet research concept/idea tracking needs.
* **PPMS –** In-house program management system, tracks funding splits, obligations for construction projects. A requirements effort is underway for updating this system – Research is participating in this. The system may meet the program and financial management needs of Research, but it will take time to implement (completion of requirements, business case, RFP.)
* **MnDOT Automated Resource Tracking System (ARTS) –** Based on a state DOT survey, MnDOTs system best matched with MDT’s needs. MDT spoke with the developer of ARTS and obtained an estimate for what it would cost to adapt this system for MDT. This is still a possibility, but MDT is exploring the other options above first.

The business process mapping focused on project and contract management rather than program and financial management because it was hoped that existing MDT systems would be covering those. Sue provided examples of spreadsheets that she uses to meet the following needs:

* Tracking obligations, invoices (including those on hold), expenditures, running balances for each project – by funding source; with summaries by state and federal fiscal year
* Tracking state budget authority, expenditures and pending projects by state fiscal year
* Tracking federal unobligated funds against planned expenditures (with and without match)
* Tracking federal obligations and expenditures for SPR funds by project – cumulative and current FFY
* Tracking future projected federal obligations and expenditures for SPR funds by project – 8 year time horizon – including estimates of apportionments, prior year unobligated funds, prior year release/overrun, and TPF funding transfers

### Caltrans WebRPMD Specification Document (Cambria, 2011)

This report provides a detailed specification for upgrading the existing Caltrans Filemaker Pro research program database system to a web-based system.

The document describes the Caltrans research project life cycle as follows:

1. Development of a Project Concept
2. Conduct of a Preliminary Investigation (PI) for the concept, involving a literature review
3. Development of a Project Plan focused on producing a deployable product; including plans for one or more Tasks
4. Approval of Task Plans for funding
5. Execution of Task Plans (through contracts or in-house work)
6. Quarterly progress tracking of Tasks
7. Approval of changes to task scope, schedule or budget
8. Completion and documentation of Task deliverables
9. Task closeout
10. Recommendation for project deployment activities
11. Project closeout
12. Documentation of project outcomes

A “Project” can consist of multiple “Tasks” in order to produce a research product. The term “Task” is what other DOTs typically refer to as “Project” within their RPMDs.

The overall functions of the WebRPMD are outlined as follows:

* Project and Task Development and Maintenance
	+ Manages information and transactions needed to support Project Plan and Task Plan management, and the Division of Research and Innovation (DRI) Research, now called the Division of Research, Innovation and System Information (DRISI) Project Lifecycle
	+ Allows entry and maintenance of projects, tasks, participants, contracts and supporting transaction details
* Transportation Research Program Approval
	+ Tracks approval of the transportation research program through the required series of committees, sessions and approval cycles
	+ Allows ranking and rating of proposed concepts, projects and tasks, as well as changes to approved task and project scope, schedule and budgets
* Procurement and Contract Support
	+ Supports tracking, ranking and selection of research proposals
	+ Supports tracking of the contract procurement process
* Financial Management
	+ Tracks financial transactions related to projects, tasks and contracts. Funding will be maintained at a variety of levels, including fiscal year and includes:
		- Budgets/Funding: requested, approved and modifications
		- Obligations: obligated, approved by FHWA
		- Expenditures: downloaded from the Caltrans InfoAdvantage (aka “EFIS”) system

The specifications document presents use cases covering three core processes: project concept development, project and task development, and project and task maintenance. Then, it presents detailed application interface specifications, including screen layouts and flow descriptions. The document references or includes a requirements log, a data model, a data dictionary and a glossary.

Appendix D provides an outline of the process steps included in the document. In contrast to the Montana business process mapping which was more general in nature and “system agnostic,” the Cambria document emphasizes processes related to using the RPMD.

Based on communication with Joel Retanan, the specifications were not implemented and Caltrans continues to use a Filemaker Pro database. Appendix E provides an outline of the current Annual Research Process.

### NCHRP Project 20-63B: Performance Measurement Tool Box and Reporting System for Research Programs and Projects

This report was reviewed because it was an effort to provide a common functionality supporting state DOT research program and project performance measurement and reporting. The project included identification of research performance measures and development of several tools supporting their application and reporting. Products included: (1) a research 101 tutorial, (2) a wizard for selecting research performance measures, (3) a resource collection supporting measure calculation, (4) worksheets for estimating research benefits, (5) a database and web-based interface for storing research project performance, and (6) a set of configurable reports for performance reporting at the national, state, program, and project levels.

The products were designed for use by research program managers and staff, and include provision for data creation and submittal by research contractors – for subsequent review and uploading by research program staff. The database includes tables for research agencies, projects, research products, contractors, people, subjects, and performance measures at the agency, project and research product levels. The report includes detailed system and database documentation (screen shots, entity-relationship diagram, data element listings.)

The report recommended that all agencies:

* adopt three standard outcome performance measures (number of lives saved, number of crashes avoided, and dollar cost savings to the agency)
* seriously consider tracking research project and program performance, even if only on several highly successful research projects each year, and load this information into the national RPM-Web database (created as part of NCHRP 20-63B)
* consider requiring that contract researchers provide an estimate of expected benefits for the sponsoring agency if products from the research project are fully implemented by the research sponsor

Sue Sillick provided the following information about the current status of this product:

The RPM website has been discontinued due to lack of use. The old site was linked to Research in Progress (RiP); States could enter project information including costs and performance measure values. A portion of the original site related to High Value Research (HVR) has been retained and is available at <http://www.highvalueresearch.org/rpm/>. HVR will continue importing of RiP records. TRB is maintaining this site for AASHTO (Natasha Linzau is now responsible, replacing Mina Tran at TRB).

### Background on FHWA State Planning and Research Funding (provided by Leni Oman)

The research team requested background on FHWA State Planning and Research (SPR) Funding from Leni Oman in order to understand the business needs for a Research Program Management Database. Because FHWA SPR Funding is one of the primary sources of support for state DOT research activities, the requirements of utilizing these funds should be considered as an integral part of planning for a Research Program Management Database.

* FHWA State Planning and Research (SPR) funds are the primary source of support for state DOT research activities. SPR funds consist of a 2% set aside of each State's apportionments from the National Highway Performance Program (NHPP), Surface Transportation Program (STP), Highway Safety Improvement Program (HSIP), and Congestion Mitigation and Air Quality Improvement Program (CMAQ). States must provide a 20% match on SPR funds.
* States are required to expend an amount equivalent to a minimum of 25% of their total SPR allocation for research, development and technology transfer (RD&T) activities. The RD&T portion is known as “SPR Part 2.”
* Based on the 2013 FHWA SPR Distribution Tables, the minimum required SPR Part 2 funding ranges from $756,777 (DC) to $17,413,055 (CA). The average is $3,621,424. See Table 1 below.
* SPR funds can be used for:
	+ NCHRP Support (5.5% of total SPR – though many states fund this from Part 2 only)
	+ TRB Core Services
	+ AASHTO Technical Services
	+ SHRP Implementation
	+ State research program staffing, projects and activities
	+ Local Technical Assistance Program (LTAP) match
	+ University Transportation Center (UTC) match
	+ Other university partnerships
	+ New product evaluation
	+ Transportation Pooled Fund (TPF) Product contributions
	+ Library Services

### Uses of SPR Part 2 - 2013 State DOT Survey

* RAC members were surveyed about current uses of SPR Part 2
* 37 states and the District of Columbia responded
* 23 of the 37 respondents funded NCHRP contributions exclusively from SPR Part 2
* 30 of the 37 respondents funded TRB Core Service contributions exclusively from SPR Part 2
* 24 states use less than 20% of SPR Part 2 for state directed research activities, and nine states use less than 15% of SPR for state directed research activities.
* Four states used $700,000 or less for state directed research activities.

Table 1. FY2013 State Planning and Research (SPR) Part 2 Funding

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| State | SPR Part 2 (FY2013) |  | State | SPR Part 2 (FY2013) |
| CALIFORNIA | $17,413,055 |  | **COLORADO** | $2,542,001 |
| TEXAS | $15,051,808 |  | **ARKANSAS** | $2,474,251 |
| FLORIDA | $9,010,753 |  | **ALASKA** | $2,406,023 |
| NEW YORK | $7,957,218 |  | **CONNECTICUT** | $2,397,677 |
| PENNSYLVANIA | $7,831,291 |  | **OREGON** | $2,382,832 |
| ILLINOIS | $6,734,342 |  | **MISSISSIPPI** | $2,311,424 |
| OHIO | $6,376,987 |  | **IOWA** | $2,289,295 |
| GEORGIA | $6,161,001 |  | **WEST VIRGINIA** | $2,093,202 |
| MICHIGAN | $4,999,499 |  | **MONTANA** | $1,964,462 |
| NORTH CAROLINA | $4,969,217 |  | **KANSAS** | $1,786,766 |
| VIRGINIA | $4,857,157 |  | **NEW MEXICO** | $1,758,489 |
| NEW JERSEY | $4,745,193 |  | **NEVADA** | $1,732,927 |
| INDIANA | $4,541,591 |  | **UTAH** | $1,534,358 |
| MISSOURI | $4,520,960 |  | **NEBRASKA** | $1,370,646 |
| TENNESSEE | $4,035,931 |  | **IDAHO** | $1,365,183 |
| ALABAMA | $3,628,021 |  | **SOUTH DAKOTA** | $1,342,370 |
| WISCONSIN | $3,584,694 |  | **WYOMING** | $1,224,548 |
| ARIZONA | $3,493,188 |  | **NORTH DAKOTA** | $1,173,461 |
| LOUISIANA | $3,349,335 |  | **RHODE ISLAND** | $1,042,099 |
| WASHINGTON | $3,219,435 |  | **VERMONT** | $964,876 |
| KENTUCKY | $3,179,312 |  | **MAINE** | $876,768 |
| MINNESOTA | $3,098,470 |  | **HAWAII** | $803,164 |
| OKLAHOMA | $3,025,693 |  | **DELAWARE** | $803,122 |
| SOUTH CAROLINA | $2,997,817 |  | **NEW HAMPSHIRE** | $785,085 |
| MASSACHUSETTS | $2,878,605 |  | **DIST. OF COL.** | $756,777 |
| MARYLAND | $2,850,222 |  |  |  |

### Variations Across States in Research Program Management Functions (Notes from Leni Oman, 2017)

The research team also requested information from Leni Oman about variations across states in research program management functions. As the research team is tasked with identifying generic business processes and needs which can be applicable to multiple organizations, it is important to understand how different states vary in their research program management functions. This information provides a starting foundation from which to identify these general processes.

* Research Statement Development : The format and content of problem statements vary across state DOTs for their state programs. Problem state formats also vary across the programs that state DOTs may submit problem statements to. This adds complexity in automating problem statement content.
	+ State-Sponsored (SRP-funded)
	+ Cooperative Research (NCHRP, TCRP, ACRP, Others)
	+ AASHTO Quick Response
	+ Domestic Scan Program
	+ International Scan Programs
	+ Pooled Fund Studies
	+ Other (Innovative Bridge, SHRP2 Implementation Studies)
* Research Solicitation Process: States also have different cycle times and audiences for soliciting problem statements. This is also true of national research programs.
	+ Internal agency staff only vs open solicitation for research needs
	+ Targeted topic solicitation versus open to all needs
	+ Topic selection (and who/how decisions are made)
	+ Problem statement format
* Research Committees: The type of structure for managing research investments varies.
	+ One or multiple committees and roles
	+ Ad hoc or standing
* Research Project Management for:
	+ Project management practices vary based on the type of research program and whether the state DOT is the lead agency or a project partner.In-house Research
	+ Pooled Fund Studies
	+ Other (UTC, NCHRP, etc)
* Types of Research
	+ States research program portfolios vary and may or may not include the following types of research activities.Longer term research studies
	+ Literature studies
	+ Synthesis studies
	+ In-house Quick Response
	+ Policy Research
	+ Soft Side Research (e.g, Planning, Risk Management…)
	+ Student Studies
	+ Libraries
	+ New Product Development
	+ Experimental Features
	+ Number of national programs
	+ Partnerships with other organizations (UTCs, counties, etc.)
* Funding Sources: The majority of state DOTs research programs work with SPR funding only but some receive additional funding from multiple sources. Some also manage other federal funding activities related to innovation.
	+ SPR
	+ Other: state match, state funded research (beyond match),local government programs – Match
	+ National Program Funding: AID, IBRD, etc
* Research Cycle: Research process lifecycles vary from rolling solicitations to biennial solicitations but the project management lifecycle is similar regardless of the frequency of the program.
	+ Annual
	+ Biennial
	+ Transportation Pooled Fund Studies: rolling, quarterly, annual, other
* Research staffing: Staffing varies significantly across states and there isn’t a standard workload for a research manager.
	+ Size/roles/location in organization/how paid
	+ Staff/roles for research implementation
	+ Number of projects managed per person
* Research contract management: Procurement and contract execution responsibilities vary across state DOTs.
	+ Within research office
	+ Within contracting office
	+ Shared responsibility
* Contracts: Contracting practices vary by state based on their contracting laws . Some state restrict solicitation to in-state businesses. Variations include:
	+ Use of On-Call contracts or Master Agreements
	+ Solicitations directed to consultants and/or academia
	+ Project-Specific contracts only
	+ Breadth of solicitation allowed
* Implementation/Dissemination Activities: State DOT research program responsibilities for implementation and outreach products produced vary across state DOTs. Variations include:
	+ Outreach materials produced: Newsletter, project information on websites, videos
	+ Open houses
	+ Library Activities
	+ LTAP Activities
	+ Other

## 3. Observations and Next Steps

There is a wealth of available information that can be tapped for identifying business and functional requirements for a state DOT RPMD. In particular, the business process models and requirements specifications from Montana, and the specification document for the Caltrans webRPMD provide an excellent starting point for these tasks. Several states have RPMD’s with a fairly extensive feature set (California, Washington, Minnesota, Louisiana, New Jersey, Ohio) that provide a solid picture of business needs and system functions to support these needs. The relatively simple spreadsheet-based tracking tools are also instructive, as they point to some of the most basic tracking needs common to state DOTs.

Based on this review, it is clear that while there are variations in business processes across DOT research offices, there are common core research management functions and tracking needs. It is also clear that the level of complexity in record keeping and automation varies considerably across agencies – depending on the scale of the research program. The key challenge of this project will be to define processes and requirements in a manner that is applicable to a range of DOTs – yet sufficiently detailed to be helpful for agencies seeking to improve their RPMD capabilities. One approach to this would be to define multiple levels of requirements representing different levels of complexity.

WSDOT’s analysis of state DOT RPMDs identified seven key types of information included in RPMDs: Problem Statements, Projects, Contracts, Financial Information, Schedule Information, People, and Results. This work provides a good foundation for exploring variations across agencies in business processes, definitions and requirements for tracking and reporting.

A final observation is that many of the current DOT RPMDs include fairly generic program, project, contract, contact, document and workflow management functions. In fact, several agencies were using agency contract and project management systems for research program management. This observation should be considered in Task 5.1 (Develop RPMD Options) – for example, there may be an option developed to configure and/or integrate existing software to meet specific research management needs.

The following next steps are recommended:

* Proceed with development of draft business models and high level functional requirements based on the available information;
* Conduct stakeholder interviews to validate the draft models and requirements, and to fill in identified gaps; and
* Revise and refine the draft business models and functional requirements based on the interview results.

## Sources

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10. Montana Department of Transportation, Contract Tracking and Monitoring Business Case, May 19, 2014
11. Crabtree, Joe, Draft Memorandum report for Development of a Research Project Tracking System (project KYSPR 14‐491) Deliverable #1: Identification and Assessment of Effective Online Project Management Systems in Other States, Kentucky Transportation Center, July 1, 2014
12. Hanson, Steve; RPMD Technical Report – Outlining Phase 1 (Draft), June 12th, 2015
13. Hanson, Steve: TPF-5(181) RPMD State of the States, presentation to the TAC, April 6, 2015
14. Files provided by Steve Hanson: RPMD Phase 1 Raw Data; RPMD Phase 1 Metadata Analysis, RPMD Phase 1 “7 buckets”; individual RPMD documentation and sample files provided by state DOTs (collected in 2015)
15. Email from Leni Oman, WSDOT: “Research Lifecyle: One Look”, January 20, 2017 – highlighting variations across state DOT research programs

## Appendix A. State DOT Research Project Management Databases (as of 2015)

| State | System Name/Platform | Features |
| --- | --- | --- |
| Alabama | No information available |  |
| Alaska | Simple (single form) MS Access database – no longer in active useLast contact indicated intent to use agency’s general project management reporting system (MRS). | Older research database included tracking of project objectives, problem statement, manager, PI, advisory panel, schedule, status, implementation items, comments and associated website |
| Arizona | Research Track (MS Access) | Research contact management (internal , vendor, FHWA) – organizations and peopleProject tracking – TAC members, consultants, milestones, tasks and deliverablesProject financial tracking – funding by source, budget and remaining contract amount, invoicesReport editing workflow Research product distribution trackingSummary view for library Implementation tracking (free form) |
| Arkansas | Spreadsheet | Project info: objectives, agency performing, deliverables, implementation actions, committee comments and actions, simple milestone status (standard items with Y/N for completion) Links to RFP, proposal, contract, tracking form, final reportPI contact information |
| California | Research Program Management (RPM) Database (Filemaker Pro) | Problem statement and proposal trackingProject/task tracking – scope, expenditure authorization/funding sources, budget, schedule, milestonesBudget request workflow (by task)Project financial tracking (no interface with accounting system; double-entry required)Pooled fund tracking (lead state info, other/in-kind contributions)Contract tracking – task orders, amendments, vendor informationProject close outProgram budget, expenditure, balance tracking (including non-project items)Standard reports: project plan, annual work program, annual financial summary, project status |
| Colorado | ResearchDB (Microsoft Access) | Project tracking – links to progress reports, scopes, contract documentsProject financial tracking (no automated link to SAP, but structured to facilitate manual updates from SAP)Contract trackingPooled fund contribution tracking |
| Connecticut | No information available |  |
| DC | Spreadsheets | Current and historical project listsResearch idea listsPooled fund participation lists |
| Delaware | No information available |  |
| Florida | Research Contract Administration (RCA) System (SQL) | New in 2015 – limited information available  |
| Georgia | No information available |  |
| Hawaii | No information available |  |
| Idaho | No information available |  |
| Illinois | Transportation Project Database (Microsoft Access) | Basic project tracking – budget, schedule, commentsProject technical review panel membershipPI EvaluationsTechnical advisory group members and meeting trackingProject close-out formBasic queries and reports – project list, panel membersImplementation tracking |
| Indiana | Joint Transportation Research Program (JTRP) Database (Microsoft Access) | Project tracking – including budget and time extensions, milestones/eventsResearch personnel/contacts tracking |
| Iowa | SPR Access Database (as of March 2015, were evaluating use of the Iowa Grants Online site) | Project trackingProject financial tracking (not linked with accounting system)Implementation tracking |
| Kansas | Spreadsheet | Very limited information on University and other contract Research. |
| Kentucky | SQL Server | Store basic project information for active and completed projectsProduce QPRs for the SPR programCreate a website/homepage for each project, complete with project statusLink to key project documents stored on DropboxStore basic financial information for each projectTrack back end performance measures and implementation action items (though not currently utilized) |
| Louisiana | Louisiana Transportation Research Center (LTRC) Project Management and Tracking System (web-based, custom developed) | Research problem submittal and evaluation workflowSearchable project databaseSummary work program information downloadProject document repositoryProject status and deliverable trackingProject financial tracking (direct interface with financial system)Automated progress reportingEmail notifications Publication workflow trackingImplementation activities and status trackingProgram and project performance measure tracking |
| Maine | No separate Research database.  | Use ProjEx project management system and TRACS contract database |
| Maryland | SharePoint  | Track basic task information (cost, notice-to-proceed date, project number, Principal Investigator) and invoice receipt and payment information. |
| Massachusetts | No information available |  |
| Michigan | Spreadsheets | Basic project tracking informationWorking (2015) on spreadsheet with consolidated accounting information |
| Minnesota | Automated Research Tracking System (ARTS) (Microsoft Access, custom developed) | Research needs statements entryContract development process trackingSearchable project databaseCustomizable reportsProject document repositoryProject status and deliverable trackingProject financial tracking (with reconciliation across accounting systems)Automated progress reportingEmail notifications Project evaluation formsClient database |
| Mississippi | Database (Microsoft Access) | Proposal review trackingProject trackingProject financial trackingResearch organizations and people tracking |
| Missouri | Enterprise Project Management (SharePoint) – integrated with MS Project, currently looking at new system options due to change in enterprise agreements | Project information tracking – description, objectives, quarterly summary, yearly summary, forecast for next year (all open ended). Project dates – start, estimated finish, actual finish. Status: on-time, late, extension Track Pooled Fund Contributions in the systemFinancial tracking: budget for FY, Financial: yearly estimate of anticipated expenses. Tracks vendor IDFHWA reporting: SPR work program and QPR. System also has many functions that they are not using, including timesheets, workflows, etc., detailed project schedules using MS Project, etc.)  |
| Montana | As of 2015, were investigating customization of existing engineering project management software |  |
| Nebraska | No information available |  |
| Nevada | Spreadsheet | Agreement tracking |
| New Hampshire | Research Projects Database (Microsoft Access) | Project TrackingPersonnel/Roles TrackingQuarterly Progress ReportingDocument tracking/links |
| New Jersey | eProMPTS (Microsoft Access, being converted to Oracle) | Research need/problem statement trackingRFP and Proposal submittal/evaluation trackingProject trackingDeliverable trackingDocument transmittal tracking and workflow (task orders, invoices, contract mods, final reports, etc.)Quarterly Progress ReportingProject financial trackingCustomer and implementation survey trackingOrganizations and personnel tracking |
| New Mexico | Project Management Database (Microsoft Access) | Project trackingProject financial trackingProject personnel tracking |
| New York | No information available |  |
| North Carolina | 3 separate MS Access databases:Project Management, Program Development and Research Contacts | Research idea collection and management of review processBasic project tracking – funding by source, scheduleResearch committee member trackingResearch contact management – mailing labels, email lists |
| North Dakota | No information available |  |
| Ohio | Research Administrative Research Management System (ARMS) (.NET system) | Project trackingDeliverable trackingProject financial trackingProject personnel trackingContract tracking – including addenda workflow |
| Oklahoma | No information available |  |
| Oregon | Spreadsheets | SPR budget development and management |
| Pennsylvania | Research Program Management System (RPMS) Database (Oracle) | Selection committee membershipQuotes tracking (proposals)Project trackingProject financial trackingContract trackingStaffing and roles trackingResearch agencies/vendor tracking |
| Rhode Island | Spreadsheet | Basic project listAddendumsInvoicesProgress Reports |
| South Carolina | Research database (Microsoft Access) | Proposed Project trackingResearch input trackingProject trackingInvoices trackingProgress reportingFinal Report tracking |
| South Dakota | Spreadsheets | Suggestions trackingProposal trackingProject trackingProgress reportingContract trackingProject evaluation trackingImplementation tracking |
| Tennessee | No information available |  |
| Texas | Research Management System (Microsoft Access) | Project trackingProject deliverables trackingProject personnel trackingProject financial tracking |
| Utah | Research database (Microsoft Access) | Project trackingProject financial trackingProject personnel trackingContract tracking |
| Vermont | No information available |  |
| Virginia | Research database (Microsoft Access) | Project trackingProject financial tracking (no interface with financial system)Implementation tracking: publication reference and implementation activities, and benefits |
| Washington | Research Program Management Database (RPMD) (Filemaker Pro) – modified version of California’s system | Problem statement and proposal trackingResearch Advisory Committee (RAC) members Technical Advisory Panel (TAC) membersProject/task tracking – scope, expenditure authorization/funding sources, budget, schedule, milestonesBudget request workflow Project financial tracking (work order expenditures can be imported), invoices and payments Master Agreement, Reimbursable Agreement, Task Order tracking –amendments, vendor informationProject close out – documentation of publicationsImplementation action and results trackingORLS biennial budget Standard reports: project plan, annual work program, annual financial summary, project status |
| West Virginia | Research database (Microsoft Access) | Project tracking – including PIs and contract monitor namesProject financial tracking (no interface with financial system) |
| Wisconsin | SPR Track (Microsoft Access) | Project trackingProject milestone trackingProject financial tracking (no interface with financial system)Contract trackingResearch organizations trackingResearch contact tracking |
| Wyoming | No information available |  |

## Appendix B. Montana Department of Transportation Research Business Process

1. Research Program Management (not mapped)
2. Research Budget Management (not mapped)
3. Research Project Management (not mapped)
	1. Receive Research Topics
		1. Determine Project Category
		2. Identify Sponsor and/or Champion
			1. Solicit for Sponsor and/or Champion (if needed and not identified in request)
			2. Notify Submitter (if solicitation unsuccessful)
			3. Archive Request (if solicitation unsuccessful)
		3. Determine Priority
		4. Notify Submitter
		5. Archive Request (if rejected)
		6. Publish Project (if accepted)
	2. Determine Approach
		1. Investigate Request
			1. Determine Technical Panel Need
			2. Select Technical Panel (if needed)
			3. Investigate Research Topic
			4. Establish Project (if need established)
			5. Implement Existing Research (if research already done)
			6. Cancel Research Project (if need not established)
				1. Cancel Project
				2. Notify Submitter
				3. Archive Request
		2. Develop Project Scope
			1. Develop Scope of Work (if project need established or existing project modified)
			2. Review Scope of Work
			3. Revise Scope (if changes requested)
			4. Obtain Scope Approval
			5. Determine Need for RFP (if scope approved or scope not needed)
			6. Cancel Research Project (if scope not approved)
		3. Solicit Proposal (if no RFP needed)
		4. Develop and Select Proposal (if RFP needed)
			1. Develop RFP
				1. Identify RFP Review Committee
				2. Develop RFP
				3. Review RFP
			2. Address RFP Questions (if questions received)
				1. Compile Questions
				2. Research PM Respond to Questions
				3. RFP Review Committee Respond to Questions
				4. Compile Responses to Questions
			3. Evaluate Proposals (if proposals received)
				1. Prepare Review Committee
				2. Review Proposals
				3. Request Information (if needed)
				4. Select Proposal
				5. Update Management System (Proposed Project)
			4. Evaluate Options (if no proposals received)
				1. Discuss Proposal Options
				2. Reissue RFP
				3. Revise Scope
				4. Break Project into Phases
				5. Cancel Research Project
	3. Establish Funding Structure
		1. Obtain Funding Approval (for Proposed Projects)
			1. Provide Recommendation
			2. Review Panel Comments
			3. Revise Proposal (if revisions requested)
			4. Cancel Research Project (if proposal rejected)
			5. Update Management System
		2. Establish Project Coding (if funding approved)
			1. Add to SPR Work Program (if SPR funded)
			2. Open Special Project (if not SPR funded)
			3. Open Project
		3. Award Research Contract (if project selected) (see 4.1)
		4. Develop Contract
		5. Review Contract
		6. Obtain Signatures
		7. Award Contract
		8. File Contract
	4. Conduct Research
		1. Monitor Project Progress (see 4.2 Monitor Contract)
		2. Report on Project Progress
		3. Present Results
	5. Close Project
		1. Conduct Exit Survey
		2. Document Technology Transfer Activities
		3. Review Implementation Activities
		4. Close Research Project
4. Contract Management
	1. Award Research Contract (same as 3.3.3)
	2. Monitor Contract
		1. Review Contract Scope
		2. Amend Contract (if changes needed)
		3. Review Payment Request
		4. Check Contract
		5. Request New Invoice (if errors found)
		6. Submit Payment Request (if approved)
		7. Refuse Payment (if not approved)
		8. Hold Payment (if applicable)
	3. Close Contract
		1. Verify Contract Scope
		2. Obtain Champion Approval
		3. Resolve Issues (if applicable)
		4. Signoff on Contract (if approved)

## Appendix C. MDT Research Requirements

|  |  |
| --- | --- |
| 001 | The system needs to be accessible by MDT employees and external stakeholders. |
| 002 | Research needs the ability to post (publish) project specific information to the internet and intranet by saving the documents to the research share drive web folder in PDF format. Note: Security and other formatting requirements for internet posting need to be included in the PDF document.Note: Web service request from ISD is completed each time there is a need to post new research project or reporting information to the internet or intranet.  |
| 003 | Stakeholders need the ability to submit research and experimental ideas within the system. The ideas may come from MDT employees or external stakeholders. The ideas need to be saved into the new system and include at a minimum; date submitted, title, submitter with contact information, and topic statement. The idea may also include; champion, sponsor, and category.  |
|  |  | For research projects the following data is required; date submitted, title, submitter with contact information, topic statement, background statement, research proposed, IT component, urgency and expected benefits, and implementation plan. |
|  |  | Contact information includes; name, title, organization, email address, phone number, address |
| 004 | Research needs the ability to distinguish ideas from projects. The current process each idea is given a unique identifier and each research projects has a different identifier (Project Number). |
| 005 | Research needs the ability to apply a type to an idea or project. Types include Research, Experimental or Other. A project may have more than one type. |
| 006 | Research needs the ability to associate one or many ideas with a research project and the ability to associate a research project with a highway construction project or maintenance project. Note: not all ideas are associated with a project if they do not move forward. |
| 007 | Research needs the ability to identify and track tasks within a research project. |
| 008 | Research needs the ability to manage idea and project categories. The category may be identified by submitter or determined by the Research Program staff. The category may be changed at any time.  |
| 009 | Research needs the ability to track all ideas submitted and their status with a history of changes. Ideas my become research projects; experimental projects; pool fund studies, etc.  |
| 010 | Research needs the ability to identify if a Technical Panel or RFP is needed. If there is a need additional fields are available for Technical Panel and/or RFP related information |
| 011 | Research needs the ability to cancel, or close and archive any idea or project at any time during the project lifecycle, including justification and notify the appropriate people. |
| 012 | Research needs the ability to establish idea and project roles. Roles include submitter, champion, project manager, sponsor, technical panel member, RFP review committee, etc. |
| 013 | Research needs the ability to associate people to roles. One or many people may have the same role on a project or idea. One person may have multiple roles on a project or idea. |
| 014 | Research needs the ability to remove or add people to a role on a project.  |
| 015 | Research needs the ability to establish a “Technical Panel” and panel members for some projects. The “Technical Panel” needs to include “Panel Chair” and "Research Project Manager" roles. |
| 016 | Research needs the ability to identify potential “Technical Panel” members when an idea is submitted and the ability to add or remove panel members at any time through the life of the project. |
| 017 | The system needs the ability to maintain a history of changes to an idea or project. |
| 018 | The role of champion or sponsor can only be assigned to MDT employees. The role of sponsor can only be assigned to a division administrator, district administrator, deputy director or director. |
| 019 | Research needs the ability to validate MDT employees for champion or sponsor.Note: This could be met by a drop down list of MDT employees or an autofill field based on MDT employees. |
| 020 | Research needs the ability to prioritize ideas. Current prioritization process is a go (high) or no-go (low) from the Research Review Committee. |
| 021 | The system needs the ability to develop a prioritization process that includes scoring criteria to establish project prioritizations. |
| 022 | Research needs workflow capabilities that allow for notification of project status or other project information. |
|  |  | Workflow examples include email notification if the idea or project is canceled; or submitting work-plans to FHWA for review and approval. |
| 023 | Research needs the ability to define or format workflow notifications. |
| 024 | Research needs the ability to attach documents, emails, pictures, videos, maps, etc. to projects and notifications. |
|  | Research needs the ability to establish version control for attached documents. |
| 025 | The system needs to be geospatially enabled. This includes latitude, longitude, and length, or route designation and beginning and ending reference points. |
| 026 | Research needs the ability to map research and experimental projects. Research currently maintains an online map of all research projects. This functionality needs to remain and be automated with the new system.Note: Current process the information is populated to a spreadsheet. this process could continue from the new system. |
| 027 | Research needs the ability to generate reports, and add or update project information from a mobile device or a remote location (laptop in the field). |
| 028 | Research needs the ability to add or modify project information at any time during the project lifecycle. |
| 029 | Research needs the ability to add comments or notes related to a project and idea. |
| 030 | Research needs the ability to define a project scope within the system.Note: This is the process of drafting a scope of work for review and approval. |
| 031 | Research needs the ability to add an event to an idea or project. Events may include selection of champion or sponsor, Technical Panel meetings, Scope approval, Research Review Committee Meeting, Field Visit, RFP Review, Funding Proposals, etc. The event needs to include date, event name, event category/type, event goals or agenda, notes, action items, etc. |
| 032 | Research needs the ability to attach document, emails, pictures, video, etc. to a specific event. |
| 033 | For scope or other approvals there is a need to capture approver name(s) and date of approval. Approvals may be by one or many people. |
| 034 | Research needs the ability to report on the distribution of funds on projects by various criteria. A single project may be associated with one or more criteria. |
|  |  | Criteria may include: project type (NCHRP, SHRP2, TRB Core Services Support, Pooled Funds, Research Projects, Overhead), project subject (administration, bridge/hydraulics, environmental, highways, maintenance, NCHRP, planning/safety, SHRP2, technology transfer, traffic)In-state or out-of-state, WTI or Non-WTI, Funding Source (state, federal, SPR funds, Other) |
| 035 | Research needs the ability to manage reporting criteria for requirement 035. |
| 036 | Research needs the ability to create ad hoc and reusable reports. |
| 037 | Research needs the ability to include user defined fields. |
| 038 | Research needs the ability to submit funding recommendations and track the review and approval of project funding. |
| 039 | Workflow for funding recommendations review and approval is captured in requirements 032-034.  |
| 040 | Research needs the ability to add a project and assign it any status(Proposed, pending, active, contract complete, implementation, project complete) (for experimental status may be; proposed, pending, active, complete)Note: Research projects need to follow the RIP statuses. |
| 041 | Reach needs the ability to apply a project dollar estimate including funding source breakdown, federal appropriations and Indirect Cost calculation. Funding is applied to most projects during the proposal stageNote: funding sources may include in-kind match and other matching funds not tracked in MDT financial systems. |
| 042 | Planning needs the ability to query, or Research needs the ability to submit, Research project and program information including funding to assist in developing and modifying the SPR Work Plan. |
|  |  | Information needed in the Annual Work Plan (AWP) includes; project #, type of research, people involved, estimated dollar amounts by federal fiscal year. |
| 043 | Research needs the ability to identify special projects that require inclusion in PPMS and unique federal programming through the Project Analysis Bureau and Fiscal Programming Section. |
| 044 | Research needs the ability to create project dollar estimates for any state and/or federal fiscal year. |
| 045 | Research needs the ability to notify planning if project changes require modification of the AWP or if expended dollars are going to exceed the federal fiscal year approved. |
| 046 | Research needs the ability to monitor special projects to ensure expended dollars do not exceed project estimated dollars. |
| 047 | Research needs the ability to create an RFP using an RFP template and populating project specific information. |
| 048 | Research needs the ability to edit the RFP template. (Same as R054) |
| 049 | Research needs the ability to track RFP development status. Including review and approval of RFP; Developing and posting RFP question responses; and Compiling references.Note: additional information includes; best and final offer, and information requests |
| 050 | Research needs the ability to track who submitted proposals, proposal evaluations and comments. |
| Note: | Workflow for RFP review and approval is captured in requirements 032-034. The same for reference check workflow. Note: check notes for RFP requirements. |
| 051 | Research needs the ability to generate email notifications for workflow. |
| 052 | Research needs the ability to populate fields in contract and grant templates from system information. |
|  |  | Note: The requirement is to have MS Word templates with defined fields that are populated from within the system upon request.  |
|  |  | Example: If a project manager wants to create a contract they can choose a contract template and associate it with a project and vendor and the contract will be created including the vendor information associated with the project. |
| 053 | Research needs the ability to modify contract information after the contract is created. |
| 054 | Research needs the ability to modify the templates. |
| 055 | Research needs the ability to track contract status. |
|  |  | Contract status may include: Developed, Submitted for Signature, Signed |
| 056 | Research needs the ability to use an electronic signature process for contracts. |
| 057 | Research needs the ability to develop a notice to proceed. |
| 058 | Research needs the ability to update contract information. |
|  |  | Data needed includes but is not limited to: contract amount, start date, stop date, deliverables and deliverable due date, contract number, contract amendments, cost categories (ability to change category)(categories include; labor, equipment, travel, materials, consulted services, profit, overhead, IDC), contractor name, project number(one contract on a project, phases may have different contracts) |
|  |  | One or more projects can be associated with a contract |
|  |  | Each phase may have a different contract or the same contract can be associated with multiple phases of a project, however you can only have one contract associated with the one phase. |
|  |  | Enter contract deliverable status and date (Status: submitted for review, in review, returned for edits, accepted or published) |
| 059 | Contractor can submit an invoice for payment (either direct input or data file submittal).  |
| 060 | The contractor can attach supporting documentation and include invoice number |
| 061 | Research staff can enter invoice information into system. |
| 062 | Research staff can enter project coding for invoices. This could be accomplished with an interface to CARES. |
| 063 | System edit check to verify invoice totals. |
| 064 | System edit check to verify deliverable status (is the contractor up to date on deliverables) |
|  |  | If the contractor is not up to date on deliverables the system could provide a warning to Research staff and hold invoice for payment. |
| 065 | Research needs the ability to approve invoices for paymentNote: invoice amount cannot exceed category dollar amounts listed in requirement 054 |
| 066 | Approved invoices are submitted to the Accounts Payable system electronicallyNote: this needs to include an approval process. |
| 067 | Research needs the ability to hold an invoice |
| 068 | Research needs the ability to decline an invoice. |
| 069 | System notify Research PM when the contractor approaches an established percent expended.Note: research needs the ability to define the percent expended for each contract.  |
| 070 | System could reject an invoice for errors or non-reimbursement request. |
| 071 | Research needs the ability to amend a contract |
|  |  | Contract amendments are adjustments that can include changes in dollars or scope. An audit trail in needed to track who made contract amendments. |
| 072 | System can recalculate percent expended if additional money is added to a contract. |
| 073 | System can notify project manager if change in percent expended will allow for payment on an invoice. |
| 074 | Business rule: Payments on invoices received after the contract is closed are not allowed. |
| 075 | Research needs the ability to reopen a closed contract to allow for the payment of an invoice if the project is still open. |
| 076 | Research needs the ability to track performance measures associated with projects |
|  |  | Performance measures could include but are not limited to: Customer satisfaction, project reports submitted, project within budget, project on time, project implemented, quality of life project, safety project, agency cost-saving project, research reports published, number of graduate students involved, project benefit-cost ratio |
|  |  | Note: Research performance information is published to the Research Performance Measures website. |
| 078 | Research needs the ability to publish performance measures to the MDT internet. |
| 079 | Research needs the ability to document assumptions |
| 080 | Research needs the ability to document sources for information |
| 081 | Research needs the ability to associate a project with defined agency strategic objectives |
| 082 | Research needs the ability to add implementation activities and track their status. Note: information tracked includes but is not limited to: responsible party, deadline, and resources. |
| 083 | Research needs the ability to associate implementation recommendations received from the vendor. |
| 084 | Research needs to associate responses to the implementation recommendations and relate both to implementation activities. |
| 085 | Research needs the ability to generate an exit survey based on a survey template. |
| 086 | Research needs the ability to generate a report of survey responses. This is for both the RFP reference responses and exit survey responses. |
| 087 | Research needs the ability to develop an annual report summary. |

## Appendix D. Caltrans web RPMD Process Steps (Cambria, 2011)

1. **Project Concept Development**
	1. Identify and Develop Project Concept
	2. Enter/Edit Draft Project Concept Details
	3. Delete Concept (if not a good one)
	4. Assign Technical Advisory Panel (TAP)
	5. Assign Project Manager
	6. Assign Project Manager Delegates (optional)
	7. Assign Project Panel Members (optional)
	8. Edit Project Concept Details (optional)
	9. Informal Review of Project Concept (optional)
	10. Withdraw Project Concept (if not good)
	11. Assign to an Approval Cycle (if good)
	12. Project Concept Evaluation and Approval
2. **Project and Task Development**
	1. Create Preliminary Investigation (PI) Task (if concept approved)
		1. Conduct literature review
	2. Edit Task Details
	3. Upload PI Documentation
	4. Edit Project Details
		1. Develop Draft Project Plan
	5. Informal Review of Project Task Plans (optional)
	6. Assign Approval Cycle (if OK)
	7. Task Evaluation and Approval
3. **Project and Task Maintenance**
	1. Project Revisions
		1. Enter Project Request for Plan Revision (RPR) (if scope change)
		2. Assign RPR to an Approval Cycle
		3. Task Evaluation and Approval
		4. Enter Project Non Scope Change (if non scope change)
	2. Task Revisions
		1. Enter Task Request for Plan Revision (RPR) (if budget, scope or time change)
		2. Assign RPR to an Approval Cycle
		3. Task Evaluation and Approval
		4. Enter Task Non Budget, Scope, Time Change (if non scope change)
	3. Quarterly Progress Reports
		1. Enter Progress Report

## Appendix E. Caltrans Annual Research Process (Caltrans, 2014)

1. **Research Program Development**
	1. Preliminary investigation
	2. PSC management meetings
	3. PSC portfolio direction
	4. Determine needs
	5. Completed project plans
	6. Develop FY portfolio
	7. Submit portfolio for review
	8. Prepare FY portfolio DC review
	9. Confirm FY portfolio
	10. Final portfolio review
	11. Prepare FY portfolio for approval
	12. PSC prioritization and request summary
	13. Portfolio ready for RDAC
	14. RDAC meeting
	15. Approved annual portfolio