STRATEGIC ENTERPRISE ARCHITECTURE DESIGN AND IMPLEMENTATION PLAN FOR THE MONTANA DEPARTMENT OF TRANSPORTATION

FHWA/MT-16-007/8238-001

Final Report

prepared for
THE STATE OF MONTANA
DEPARTMENT OF TRANSPORTATION

in cooperation with
THE U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

August 2016

prepared by
Robert C. Cooney
Mark C. Paxton

eVision Partners, Inc.
Raleigh, NC

RESEARCH PROGRAMS

MDT★

STRATEGIC ENTERPRISE ARCHITECTURE DESIGN AND IMPLEMENTATION PLAN FOR THE MONTANA DEPARTMENT OF TRANSPORTATION

FINAL REPORT

Prepared by:

Robert C. Cooney, PMP
President

Mark C. Paxton, CGCIO
Managing Consultant

eVision Partners, Inc.
9660 Falls of Neuse Road
Suite 138 #256
Raleigh, NC 27615

Additional contributions made by:

Kevin Green, PMP, eVision Partners, Inc.
Keyur Shah, PMP, Parsons Brinckerhoff
Kirt Clement, P.E., eVision Partners, Inc.

August 2016

1. Report No. FHWA/MT-16-007/8238-001	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle **STRATEGIC ENTERPRISE ARCHITECTURE DESIGN AND IMPLEMENTATION PLAN FOR THE MONTANA DEPARTMENT OF TRANSPORTATION**	5. Report Date **August 2016**	
	6. Performing Organization Code	
7. Author(s) **eVision Partners, Inc.**	8. Performing Organization Report No.	
9. Performing Organization Name and Address **eVision Partners, Inc.** **9660 Falls of Neuse Road** **Suite 138 #256** **Raleigh, NC 27615**	10. Work Unit No.	
	11. Contract or Grant No. **RFP Number 15-3109T** **Contract # 8238-001**	
12. Sponsoring Agency Name and Address **Research Programs** **Montana Department of Transportation (SPR)** http://dx.doi.org/10.13039/100009209 **2701 Prospect Avenue** **PO Box 201001** **Helena, MT 201001**	13. Type of Report and Period Covered **Final, 6/2015 – 8/2016**	
	14. Sponsoring Agency Code **5401**	

15. Supplementary Notes Research performed in cooperation with the Montana Department of Transportation and the US Department of Transportation, Federal Highway Administration**.**

16. Abstract

    The purpose of this research report is to develop a Strategic Enterprise Architecture (EA) Design and Implementation Plan for the Montana Department of Transportation (MDT). Information management systems are vital to maintaining the State's transportation infrastructure and are critical components for activities such as asset management, forecasting, QC/QA efforts, and data collection and analysis. In order for MDT to carry out its mission successfully, it is essential to appropriately incorporate and utilize technology. The development of a Strategic EA design provides a technology and data roadmap to help MDT align its technology investments to deliver the greatest business value, identify and resolve system and data inconsistencies that interfere with the sharing of data and information, and ultimately support MDT's evolving IT needs and strategies. MDT's existing information systems in some areas are fragmented or narrowly focused in support of a single business unit's needs within the agency. A relevant number of MDT's systems are technology silos limiting MDT's Information Services Division's (ISD) ability to provide responsive support and service to the MDT business community. Many primary business systems are based upon technologies near or beyond end of technical life, limiting service life. Lastly, ISD must remove impediments and recommend business process improvements for a strategic data management and governance approach. This report provides a Strategic Enterprise Architecture addressing these concerns aligned to MDT business drivers and strategic initiatives, along with an EA Implementation Plan, Recommendations by EA layer, along with estimated costs, benefits, risks, and risk mitigation strategies for the EA.

17. Key Words **Asset Management, Benefit Cost Analysis, Best Practices, Computer Science, Cost Effectiveness, Data Management, Guidelines, Information Management, Information Technology, Risk Management, Strategic Planning, System Architecture, System Analysis, Technology Analysis, Transportation System Management, Enterprise Architecture, Industry Best Practices, Data Governance, Technology Governance, IT Strategy, and Business Software Applications**	18. Distribution Statement **Unrestricted. This document is available through the National Technical Information Service, Springfield, VA 21161.**

19. Security Classif. (of this report) **Unclassified**	20. Security Classif. (of this page) **Unclassified**	21. No. of Pages **220**	22. Price

DISCLAIMER STATEMENT

This document is disseminated under the sponsorship of the Montana Department of Transportation (MDT) and the United States Department of Transportation (USDOT) in the interest of information exchange. The State of Montana and the United States assume no liability for the use or misuse of its contents.

The contents of this document reflect the views of the authors, who are solely responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the views or official policies of MDT or the USDOT.

The State of Montana and the United States do not endorse products of manufacturers.

This document does not constitute a standard, specification, policy, or regulation.

ALTERNATIVE FORMAT STATEMENT

MDT attempts to provide accommodations for any known disability that may interfere with a person participating in any service, program, or activity of the Department. Alternative accessible formats of this document will be provided upon request. For further information, call (406) 444-7693, TTY (800) 335-7592, or Montana Relay 711.

ACKNOWLEDGEMENTS

We recognize and thank the numerous Montana Department of Transportation (MDT) staff members and external stakeholders listed in the appendices who participated in the data collection and validation aspects of this project through interviews and attending validation and To-Be design workshops.

We would also like to give special recognition and thanks to Kris Christensen, MDT Project Manager and the Technical Review Panel for their project guidance and assistance in identifying stakeholders to participate in interviews and workshops and Jack Dartman, along with the Information Systems Division (ISD) Architecture team for their assistance in obtaining documentation and project guidance, as well as tireless assistance in coordinating the multitude of meetings, workshops, and interviews.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

STRATEGIC ENTERPRISE ARCHITECTURE DESIGN AND IMPLEMENTATION PLAN FOR MDT

FINAL REPORT

A. EXECUTIVE SUMMARY

This section of the report provides an Executive Summary of the Montana Department of Transportation (MDT) Strategic Enterprise Architecture (EA) Design and Implementation Plan. eVision Partners, Inc. was engaged by MDT to develop a strategic Enterprise Architecture (EA) design and supporting implementation plan for the agency. This document summarizes the project work, provides an assessment of MDT's current information systems environment, and a set of conclusions and recommendations to guide the implementation of the Enterprise Architecture Design.

An Enterprise Architecture (EA) is a strategic information technology plan that aligns technology with the strategic plan of the agency, integrates the technology needs of the agency, and leverages the agency's data, systems, technology infrastructure, and staff knowledge to implement technology systems to support the efficient delivery of the programs, operations, and services of MDT.

MDT's mission is clearly complex and highly diverse. Due to that complexity, it is essential MDT effectively utilize information technology to leverage limited resources in terms of employees and funding. However, the current information systems environment at MDT, for the most part, is a fragmented collection of standalone or silo-based systems and processes. These systems include both older inhouse developed systems and a number of best-of-breed commercial off-the-shelf solutions, typically selected by one business unit to meet their specific needs and not selected from a holistic enterprise perspective.

This type of fragmentation is common in larger organizations utilizing information systems for four or more decades, as the majority of the systems were not developed in any cohesive fashion under a singular strategic vision. Some of these applications are old and support for them increasingly challenging due to their age and potential obsolescence of software or people familiar with the systems. Many of these systems were developed for specific functional areas and never designed to integrate with any overall architecture. This situation has resulted in limited data integration, and in some cases, requires the same information to be entered into multiple systems across the same or different business units.

As a part of the early project, the eVision Partners team interviewed MDT staff and stakeholders. These interviews captured agency business drivers; business functions and objectives of MDT; alignment of the agency's critical success factors to those objectives; identified agency challenges; technology systems used, being implemented, or planned; and identified strengths and challenges of the current technology environment at the agency. This information was distilled and documented for validation and agreement in subsequent workshops.

Following the interviews, the eVision Partners team conducted six validation workshops with agency staff. These validation workshops focused on Information Technology (IT) and five business functional areas (Project Delivery, Maintenance and Asset Management, Business Support Services, Multi-Modal and Grants Management, and Transportation Operations Management.). These workshops were interactive and resulted in validation of the identified business drivers and critical success factors (CSFs). During the validation workshops, the eVision Partners team had attendees validate, modify, and supplement the business drivers captured during the interviews. In addition, attendees were tasked with aligning those business drivers to the agency's CSFs (Quality, Safety, Cost Effectiveness, Economic Vitality, and Environmental Sensitivity). In all cases, as expected, business drivers aligned with at least one CSF, while many business drivers aligned with all of the CSFs. Last, the attendees validated the list of technology systems employed in each of the sub-functions within the business functions. Based on the stakeholder interviews and workshops, this report documents our team's findings about the MDT As-Is information technology environment.

Using enterprise architecture best practices, the findings from the Current Situation Analysis (As-Is) and the eVision Partners team's experience coupled with the current and anticipated state and federal legislative environment as inputs, the eVision Partners team defined a preliminary MDT To-Be Strategic Enterprise Architecture. In a series of workshops with MDT stakeholders, this preliminary To-Be architecture was reviewed, validated, and refined. The eVision Partners team also developed an EA Implementation Plan depicting a mix of short-term, intermediate, and long-term implementation projects. The eVision Partners team conducted multiple reviews on the EA Implementation Plan to obtain feedback and to tune the EA Implementation Plan content. The final version of this plan is included in this report.

Table 1 summarizes the key high-level recommendations. A more detailed set of findings and recommendations is included in the report Appendices (see page H-3).

TABLE 1: SUMMARY OF RECOMMENDATIONS

Challenge or Opportunity	Recommendation
TRANSPORTATION PROJECT DELIVERY	
Implement Next Generation PPMS	Implement a next generation PPMS based on industry best practice that is tightly integrated with the MDT's Planisware® scheduling application. The new PPMS should also be designed to tightly integrate with MDT's asset management systems. Implementation of this new system should be guided by a governance team comprised of management from all MDT divisions with subject matter experts assigned to the project team from each division
Implement Next Generation TIS/LRS & Roadway Inventory	Continue with design and implementation of the new Transportation Information System, Location Referencing System and Roadway Inventory application as a foundational of the To-Be MDT Enterprise Architecture
Implement ROW and Utility Relocation system	Implement new Right-of-Way Management system and Utility Relocation System using a COTS solution or COTS framework.
Extend Planisware® implementation to support resource management	Extend capabilities of Planisware® to support resource management
Reengineer As-Built process	Re-engineer As-Built process to more effectively utilize available technologies. Re-engineered must consider impact of 3D design and asset management requirements
Establish and Implement Design Model Strategy	Develop design model and GIS integration strategy and begin piloting and phased deployment based on defined strategy
Implement AASHTOWare™ Project Construction and Materials	Implement AASHTOWare™ Project Construction and Materials including utilization of mobile technology where possible along with full-range of LIMS functionality
MAINTENANCE AND ASSET MANAGEMENT	
Define Enterprise Asset Management Strategy	Define an asset management systems strategy to provide data integration between individual asset management systems (bridge, pavement, safety and the next generation maintenance management system) to support agency business requirements defined in the MDT transportation asset management plan. As an initial focus, design and establish an Asset Data Warehouse which provides a single point of access to information about transportation assets (through preferably virtual integration of data from core management systems). In future years, design and develop cross asset analysis tools as business policy and process requirements are defined and as product offerings in this area mature in the marketplace.
Extend SIMS functionality	Implement additional safety management system capabilities with an emphasis on multi-disciplinary data elements such as EMS run tickets, trauma registry information and conviction data.
Implement Modeling and Analytics for Structures	Define requirements for modeling and analytics functionality and evaluate capability of Advitam ScanPrint IMS to meet these requirements. If Advitam does not meet requirements, evaluate and select alternative solution.
Extend MMS to handle ancillary assets	Continue and build on existing efforts through the MMS project to utilize the new AgileAssets MMS to support ancillary assets.
TRANSPORTATION OPERATIONS MANAGEMENT	
Implement new COTS Traveler Information System	Replace the existing Traveler Information System with a COTS application as the core of the new solution
Implement new Outdoor Advertising System	Replace existing Outdoor Advertising application preferably with a COTS solution; evaluate potential for utilizing existing MDT technology (AgileAssets, Advitam, Bentley) to perform this function prior to bringing in another solution
Continue implementing SMARTCOP enhancements	Continue targeted enhancements to SMARTCOP including opportunities to enhance data integration with other agencies
Implement Mobile Technology support	Evaluate mobile platform alternatives, select solution and integrate with EVMS and a solution in alignment with an enterprise mobility strategy
ePart Enhancements	Extend ePart implementation to address priority enhancements

Challenge or Opportunity	Recommendation
MULTI-MODAL AND GRANTS MANAGEMENT	
Implement Enterprise Grants Management Solution	Evaluate the opportunity to implement a single grants management application; this evaluation should include analyzing capabilities of any statewide grants management solution which may be initiated
BUSINESS SUPPORT SERVICES	
Implement Financial Suite as part of ERP project	Proceed with implementation of Financial Suite as initial step to provide enhanced budgeting, forecasting, finncial reporting and analysis tools prior to implentation of an ERP. Project should be designed to anticipate future ERP and minimize future re-work when MDT legacy financial systems are replaced with an ERP
Implement State's ERP solution as financial system of record for MDT	Implement an enterprise resource planning (ERP) application at the agency level or by extending the functionality in the State's SABHRS PeopleSoft application to meet the full range of MDT requirements. This ERP application will provide a highly integrated commercial off-the-shelf (COTS) solution to support financial management, human resource management and procurement functionality as well as an enterprise-wide contract management system
Implement Talent Management solution	Implement a COTS-based enterprise wide Talent Management solution with an initial focus on an e-Learning that can support all MDT training requirements (employees, local programs, contractors, consultants, etc.)
Implement Discipline & Grievance Management solutions	Implement existing or enhanced capabilities within SABHRS HR to meet Discipline, Grievance Management and other HR requirements not currently being met by SABHRS
Implement a Case Management System	Implement COTS-based Case Management Software; integrate solution with new Enterprise wide Content Management solution
CROSS-FUNCTIONAL	
Implement Enterprise Content Management (ECM)	Define an enterprise wide content management strategy designed to meet all agency requirements and then implement an enterprise wide content management system to meet these requirements. In the interim, proceed with implementation of the new Engineering document management solution to meet immediate business needs. The To-Be solution may involve multiple COTS solution and should leverage existing state investments where appropriate. Include requirements for collaboration tools.
Implement Mobile Technology support	Evaluate mobile platform alternatives, select solution and integrate with EVMS
INFORMATION TECHNOLOGY ORGANIZATION AND GOVERNANCE	
Retire all Oracle Forms Applications	Prepare a work plan and timeline for retiring all Oracle Forms applications either through a specific project initiative or migrating Oracle Forms applications to either COTS applications or a Java based custom application
Establish Data Governance Program	Establish a data governance initiative to implement industry best practices in data governance, data standards, and data stewardship
Implement Data Warehouse, Business Intelligence (BI), and Analytics	Implement a Data Warehouse (DW) with a set of business intelligence and analytics tools.
Define and implement data services strategy	Define and implement data service strategy for external stakeholders
Implement single sign-on	Implement approach in conjunction with deployment of new systems and then transition other systems
Define and implement Disaster Recovery Planning (DRP) and Strategy	Define and implement a disaster recovery strategy and fully test the strategy
Develop Cloud Strategy	Develop and implement a single agency-wide cloud strategy
Develop Mobile Device or Mobility Strategy	Develop and implement a mobile device strategy including determining whether there should be an enterprise mobile platform.
Establish IT Governance	Implement an MDT Technology Council comprised of a mix of senior level and mid-level managers from all business areas to review and recommend agency IT investments. Implement a project scoring and investment decision process that is aligned with agency business objectives. Develop a project scoping and screening process to ensure a reasonably detailed business case is prepared for a project prior to making a decision to move forward with the project.

Challenge or Opportunity	Recommendation
Establish Agency Technology Procurement Policy	Require approval by the Director of ISD of all proposed technology acquisitions to ensure consistency with MDT standards and ensure appropriate planning for implementation of the proposed technology and its integration with other MDT technology infrastructure
Establish enterprise strategy and framework for effective use of IT resources across agency	Need to identify strategies for creating more alignment (inclusion of Project Managers on all project teams, use of enterprise standards, etc.). Also, need to assess whether it would be more efficient and effective for MDT as a whole if some positions are transitioned within ISD. From a best practices approach, project managers (internal and contract) should either be housed in IT or if housed in a business unit must have a matrixed relationship to the ISD PMO; Application developer positions should generally be housed in the IT organization, while business analyst positions, where domain knowledge of the business function is essential, may be housed either in the business unit with a matrixed reporting relationship to ISD or in ISD with a matrix reporting relationship to the business unit. Project Managers should also be housed within the MDT Project Management Office in ISD, or if contracted for externally, should report to the PMO on a matrix-based reporting basis.
Establish consistent use of IT standards and polices MDT-wide for all programs/projects with an information technology component	Provide education sessions for MDT business units on applicable standards
	Require compliance with MDT standards in all IT contracts (whether managed by ISD or business unit)
	Establish a multi-disciplinary team to own and manage updates to standards
Establish Effective IT Contract services capabilities	Establish a retainer contract to obtain services of RFP writers and contract specialists to augment internal skills and experience

Included in this report, the eVision Partners team has also prepared an enterprise readiness or organizational change management strategy in support of the recommended MDT Strategic Enterprise Architecture implementation plan. Successfully implementing change in an organization is truly about people; change leaders who initiate the effort, staff that manage and support the effort, and ultimately the staff affected by the change. eVision Partners has also prepared a draft Information Technology Governance Strategy as a part of the Final Report. This draft defines the management structures needed to guide implementation of the MDT Strategic Enterprise Architecture Plan.

eVision Partners has prepared a seven-year Implementation Plan for deploying the proposed recommendations. Individual projects to implement each recommendation or a grouping of related recommendations were sequenced within the plan based on priority and complexity and interrelationships between the various recommendations. The plan is intended to be constrained both by financial capacity, resource capacity, and business unit subject matter expert availability to work on projects tempered by the amount of change it is reasonable for MDT to absorb at the same time. This Implementation Plan was provided to MDT as a draft and reviewed with both the Technical Panel and the MDT executive management team. eVision Partners then updated and finalized the plan reflecting input from MDT on the prioritization of recommendations and assumptions about financial and other resource capacity constraints across the seven-year planning horizon.

The total implementation cost of the recommendations within the proposed Enterprise Architecture Program is $72.9 million over the seven-year period. The program includes

projects, which are eligible for Federal funding at various percentage splits, as well as some projects, which are expected to be 100% MDT funded. The research team worked with the Technical Panel and the MDT executive management team to sequence the timing of the various projects to balance the total cost and the total MDT share of the cost within each fiscal year of the proposed program.

Based on our team's experience, eVision Partners anticipates a number of benefits directly related to the establishment of the Enterprise Architecture program itself, as well as benefits from the individual projects proposed within the Enterprise Architecture program. Examples of anticipated benefits related to the establishment of the MDT Enterprise Architecture program include:

- Structured documentation of an organization's business drivers, which promote improved planning and decision making;

- Improved communication and collaboration both within the business organization and between business units and the technology organizations;

- Business-centric architectural views, which:

  o Assist with communicating the complexity of large systems;

  o Assist in understanding interactions between systems; and

  o Facilitate on-ongoing management of complex technology environments;

- A focus on the strategic use of emerging technologies which:

  o Drive implementation of business efficiencies,

  o Drive process standardization; and

  o Improve the ability of the business to meet changing requirements;

- Improved sharing of information across the enterprise by promoting:

  o Consistency, accuracy, and timeliness of information; and

  o Integrity, quality, availability, and access to information;

- A structured technology investment process, which:

  o Aids in the identification of benefits, impacts, and life-cycle cost of proposed technology projects;

  o Provides a consistent way to analyze alternatives, risks, and trade-offs; and

- o Provides prioritization of candidate technology projects based on business value;

- Better leveraging and management of MDT's technology spend as a result of the ability to:

  - o Design more quality and flexibility into applications without increasing costs;

  - o Achieve economies of scale through sharing services; and

  - o Expedite the integration of both legacy and new systems.

It is expected that quantified benefit streams will be identified and a return on investment analysis prepared for individual projects within the Enterprise Architecture program as part of detailed project planning for each initiative. Examples of anticipated benefits from individual projects proposed within the Enterprise Architecture program include:

- Increased efficiency in the delivery of the transportation program through better project prioritization and selection tools, improved project management tools and a holistic asset management systems strategy;

- Improved effectiveness in the use of the agency's maintenance budget through improved life-cycle cost management, as a result of implementation of an integrated transportation asset management solution with life-cycle cost modeling, needs identification, trade-off analysis, and performance-based budgeting capabilities;

- Increased automation of accounting and other support functions allowing some MDT staff time currently spent on transaction processing to be re-directed to higher value activities;

- Improved contract management capabilities through the consolidation of multiple contract management systems into a single contracts management application that is tightly integrated with SABHRS ERP;

- Redirection of some MDT IT staff to supporting more mission specific business applications by leveraging SABHRS, Oracle Taleo and potentially the future statewide grants management solution and other statewide solutions for the department's financial, contract management, human capital management and procurement management system requirements; and

- Standardized reporting capabilities with more timely and accurate data and improved management analytics and performance measurement capabilities through the new Data Warehouse environment.

The eVision Partners team prepared this report, which packages the various work products into this EA Strategic Plan Final Report. The eVision Partners team updated the Final Report based on feedback from MDT and upon MDT's approval, published this Final Report and Executive Summary.

To summarize, this Final Report provides an Enterprise Architecture aligned to the MDT business drivers and strategic initiatives, providing an EA Implementation Plan, Recommendations by EA layer, along with estimated costs, benefits, risks, and risk mitigation strategies for the EA. After the initial draft of this report was created for MDT review, the Montana Convergence Plan was announced (directed by Governor's Executive Order 09-2016). MDT ISD is assessing the impact this initiative will have to the EA Implementation Plan. However, the eVision Partners team believes that MDT is well positioned to proceed to the next steps to implement the Enterprise Architecture and the recommendations in this Final Report.

B. INTRODUCTION

The Montana Department of Transportation (MDT) is the lead state-level agency for planning and executing the transportation program for the State of Montana. MDT's scope of services is diverse, including highways, public transit, rail, aeronautics, motor fuel tax collection, and motor carrier safety. MDT delivers its services through a headquarters function in Helena, Montana and five district offices across the state.

Some of the key responsibilities of MDT include:

- Planning and design for highway projects;

- Highway construction contract administration and oversight;

- Materials design and testing;

- Property acquisition;

- Fiscal programming and cost accounting;

- Motor fuel collection and enforcement;

- Enforcing vehicle weight and dimension laws;

- Outdoor Advertising control;

- Managing the state motor pool;

- Highway, Bridge and Rest Area maintenance;

- Public Transportation and Rail Programs and Planning;

- General Aviation Airport Planning; and

- Highway Traffic Safety.

MDT's mission is "to serve the public by providing a transportation system and services that emphasize quality, safety, cost effectiveness, economic vitality, and sensitivity to the environment." It performs this function using a combination of Federal and State funds and in collaboration with a range of stakeholders including Metropolitan Planning Organizations (MPOs), Montana counties and cities and various private sector partners such as planning and engineering consultants and construction contractors. There is currently a limited state transportation program, thus MDT is extremely dependent on its Federal funding. This also

creates a need for strong financial stewardship and an emphasis on driving efficiencies and effectiveness to the extent possible throughout the organization.

Critical to successfully carrying out this mission is the ability to effectively utilize information technology to leverage MDT's scarce resources in terms of employees and available funding. There are a number of challenges facing MDT in terms of information technology, including:

- Application systems are fragmented in scope and purpose resulting in the need to utilize multiple applications to support a single business process;

- There are application systems which are narrowly focused on the needs of a single business unit;

- There are limitations in data sharing between systems, requiring duplicate and redundant data entry;

- There are key functional gaps in applications, which often result in the need for end users to develop off-line applications or shadow systems to fully meet business needs;

- A number of application systems are written in older programming languages. As a result, these systems are difficult to maintain and enhance, and have limitations in responding to changing business requirements. Likewise, many of these systems are approaching the end of their technical useful life; and

- A number of new best of breed commercial off-the-shelf (COTS) solutions have been, or are being, implemented across MDT. These COTS solutions have typically been selected for their ability to best meet the needs of the individual business unit sponsoring the project and have not necessarily been evaluated or implemented in terms of how the solution can fit holistically within an overall MDT Enterprise Architecture to minimize redundant data entry, reduce data silos and optimize information sharing between various MDT management systems.

As is typical of most organizations that have utilized information systems for more than 40 years, the majority of the agency's systems were not developed in a comprehensive fashion under a singular strategic vision. Some systems are old and supporting these systems is challenging due to their age and the possible obsolescence of the software comprising the system or a lack of MDT staff familiar with the systems. Many of these systems were developed (or are being developed) for an individual business unit and never designed to integrate with any overall

architecture. As a result, there is limited data integration, requiring the same information to be entered into multiple systems across different business units.

The current information technology environment limits MDT's capacity to realize efficiencies in core areas, such as business process streamlining and systems integration and consolidation. In response to these challenges and opportunities, MDT has begun to take steps to address this information systems deficit. The initiation of this project is one example.

eVision Partners, Inc. was engaged by MDT to develop their strategic Enterprise Architecture (EA) Design. This document is the Final Report of the Strategic Enterprise Architecture Design and Implementation Plan project. The organization of the remainder of this report is as follows:

- Section C. MDT EA Project—this section outlines the primary objectives of the project for the Development of a Strategic Enterprise Architecture (EA) Design and Implementation Plan for MDT and provides an overview of the eVision Partners team's approach.

- Section D. Overview of Baseline Architecture—this section describes the MDT "As-Is" environment or baseline architecture for each of the primary components of the Enterprise Architecture (EA) model: Business Architecture, Applications Architecture, Data Architecture and Technology Architecture. It also includes a description of the existing MDT Information Technology organization, staffing model and governance processes.

- Section E. Conclusions and Recommendations—this section outlines the project team's conclusions and recommendations.

- Section F. Strategic EA Implementation Plan for Recommendations—this section outlines the high level EA Implementation Plan, along with a Cost/Benefit Analysis, Risk Analysis, and recommendations for Organizational, Enterprise Architecture Change Management, and Project specific change management.

C. MDT EA PROJECT

C.1 PROJECT OBJECTIVES

The objective of this project is to develop a customized, executable, Strategic Enterprise Architecture (EA) design for MDT. As such, the intent is for MDT to implement this Strategic Enterprise Architecture through a series of separate follow-on projects. An Enterprise Architecture (EA) is a strategic technology plan that aligns with the strategic plan of the agency, integrates the technology needs of the agency, and leverages the data, systems, technology infrastructure, and knowledge of staff members to implement technology systems to support the efficient delivery of the programs, operations, and services of MDT.

The term Enterprise Architecture (EA) was first used in a journal article in 1987 by John Zachman (Zachman 1987). As initially defined by Zachman, Enterprise Architecture was intended to address two major issues:

(1) System complexity, resulting in more and more money being spent on information technology systems; and

(2) Poor business alignment between information technology and business objectives, resulting in it becoming increasingly more difficult to keep these expensive systems aligned with business needs.

Enterprise Architecture addresses these issues by providing an overall blueprint to guide technology investment decisions. An Enterprise Architecture is a process with the following objectives:

- Establishes the organizational mission;

- Identifies information necessary to perform the mission;

- Identifies technologies necessary to perform the mission; and

- Provides transitional processes for implementing required technologies.

The objectives of this project are to:

- Complete an analysis and document the As-Is organizational business processes and supporting Information Systems Architecture for MDT;

- Make specific recommendations for a To-Be future state for the agency, with respect to business processes and information system architecture; and

- Based on the analysis conducted, develop recommendations for the implementation of appropriate governance mechanisms and change management procedures.

To develop this EA for MDT, the eVision Partners team's work is based on and adapted from the Open Architecture Method (TOGAF) 9.1 and the TOGAF Architecture Development Method (ADM). The project approach has been highly collaborative, with frequent interaction with MDT stakeholders through stakeholder interviews, validation workshops, and To-Be Design workshops. Figure 1 illustrates this approach.
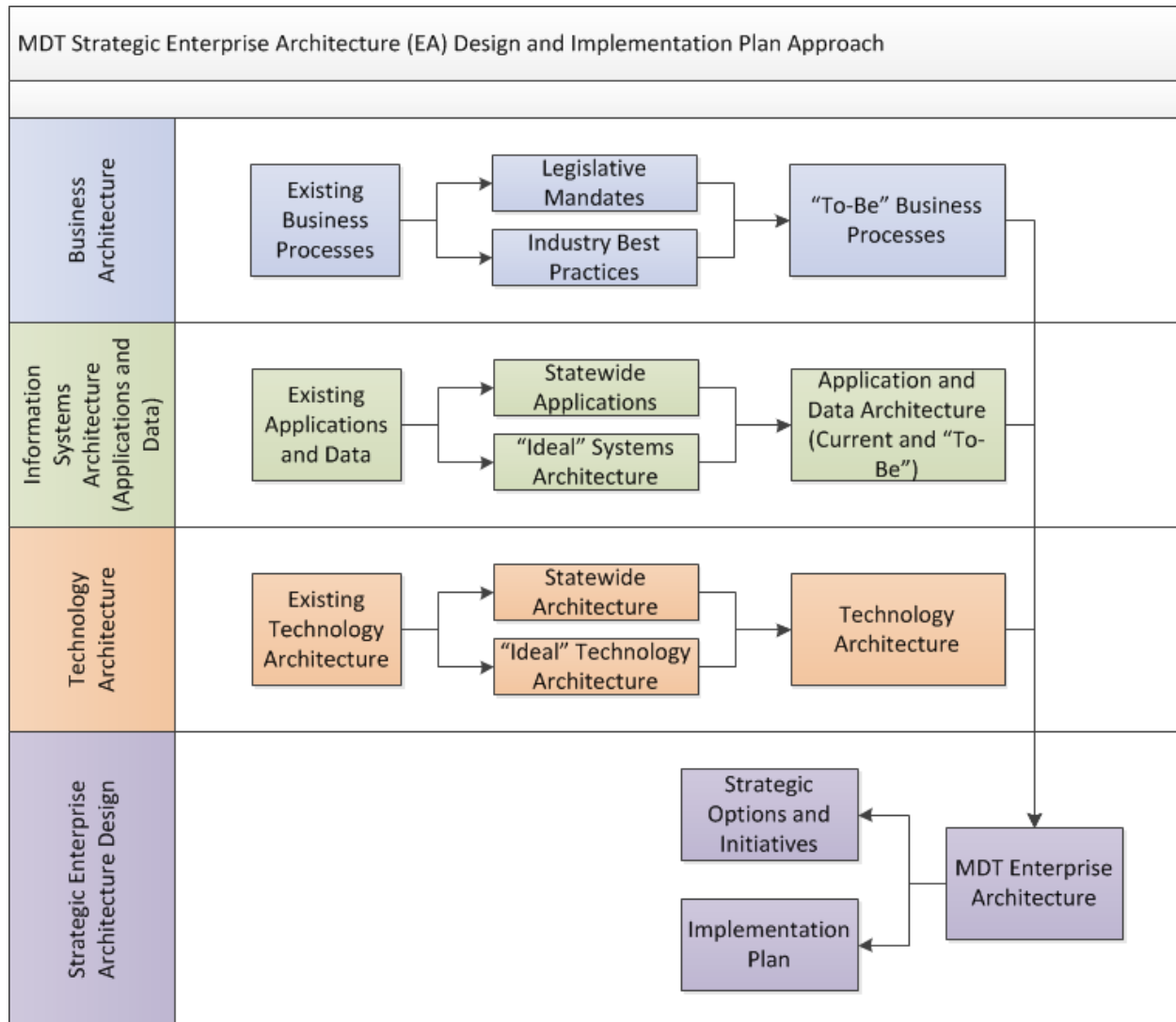
FIGURE 1: eVISION PARTNERS PROJECT APPROACH

MDT's Enterprise Architecture design will consist of:

- Business Architecture—defines the functional structure of MDT in terms of its business processes and organization and its associated business information needs.

- Applications Architecture—delineates the capabilities of specific applications used to support MDT's business functions and how these various applications work together or integrate to support MDT's enterprise-wide information requirements.

- Data Architecture—establishes data standards for all of MDT's systems to support integration and information sharing between these systems.

- Technology Architecture—describes the technical infrastructure, software technologies, and other specific hardware and operating system level software technologies required to support the various business applications; and

- Implementation support strategies—describes the support strategies required to facilitate the transition to the To-Be Enterprise Architecture including:

  o A proposed information technology governance strategy;

  o A recommended information technology investment prioritization process;

  o Identification of any information technology resource skill gaps and recommended approaches to address these gaps;

  o Recommendations for any changes which are appropriate to the organizational structure or composition of the various business units which provide technology leadership and/or technology focused services in MDT; and

  o An organizational change management and communication strategy to guide the further planning and execution of the transition to the To-Be environment.

- Implementation Plan—delineates a timeline and recommended sequencing of a series of projects or initiatives to implement the To-Be Enterprise Architecture. This seven-year plan delineates activities to be accomplished within the first year, following two years, as well as activities to be accomplished in the final four years.

As part of preparing the To-Be Enterprise Architecture design and supporting implementation plan, the eVision Partners team, in collaboration with MDT stakeholders, is employing the following set of principles and guidelines upon which this plan will be based:

- It would not be practical for MDT to abandon all of their systems and completely redevelop its systems environment. Therefore, migration to the To-Be environment should be staged based on the relative business benefit of different systems replacement efforts.

- MDT has either recently completed or is currently undertaking new system implementation projects and upgrades to some of its existing systems. Recent technology investments should be leveraged within the recommended MDT Enterprise Architecture. Strategies should be developed to ensure these new systems integrate with other systems to be implemented in the future and any potential re-work or interim interfaces between systems minimized.

- There are systems that need to share data. If they did, business processes would be streamlined and more efficient. On the other hand, there are systems that do not need to share data. Therefore, those systems could be developed on a separate evolutionary path.

C.2 SITUATION ANALYSIS

The situation analysis consisted of the activities shown in Figure 2:
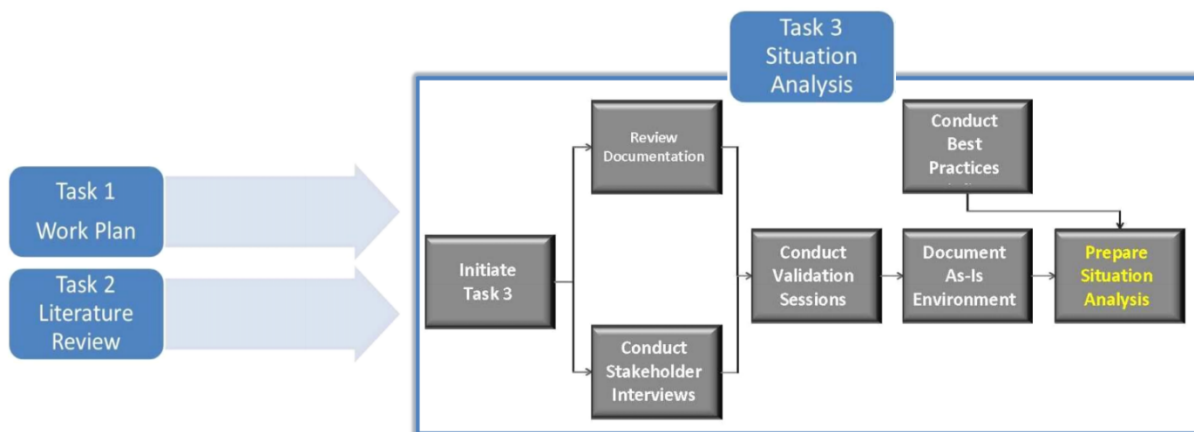
FIGURE 2: SITUATION ANALYSIS—BASELINE APPROACH SCHEMATIC

Additional details on the activities performed during the situation analysis are provided in the sub-sections below.

C.2.1 Stakeholder Interviews

The eVision Partners team conducted stakeholder interviews across MDT, including management and staff from various divisions within headquarters and staff from all discipline areas in the Great Falls District. Interviews were conducted with 141 MDT staff members.

All of the interviews conducted followed a consistent format designed to:

- Capture the business functions and objectives of MDT;

- Capture the alignment of the agency's critical success factors to those objectives;

- Identify challenges to the agency;

- Identify technology applications currently being used, and those being implemented, or planned; and

- Identify the strengths and challenges of the current technology environment at MDT.

The interviews were typically one hour in duration. Some of the MDT IT staff participated in more than one interview, both by choice and for continuity. The interview questions that were used can be found in the Appendix (on page H-12).

C.2.2   Validation Workshops

The eVision Partners team conducted six validation workshops with MDT staff. One of the validation workshops focused specifically on Information Technology (IT) while the other five validation workshops focused on business functional areas. The eVision Partners team identified and organized the five MDT business functional areas based on the core business processes illustrated in Figure 3 (page 17).

These five functional validation sessions were as follows:

- Transportation Project Delivery

- Maintenance and Asset Management

- Transportation Operations Management

- Multi-modal and Grants Management

- Business Support Services

Depending on the scope and complexity of each functional area, these validation workshops took between two and six hours to complete. The eVision Partners team prepared materials for the validation workshops, which addressed:

- Recurrent and notable themes documented from the stakeholder interviews using information gathered during the interviews;

- Documentation provided and obtained from the agency's website; and

- Project team developed listings of the business software applications in use and those planned for implementation.
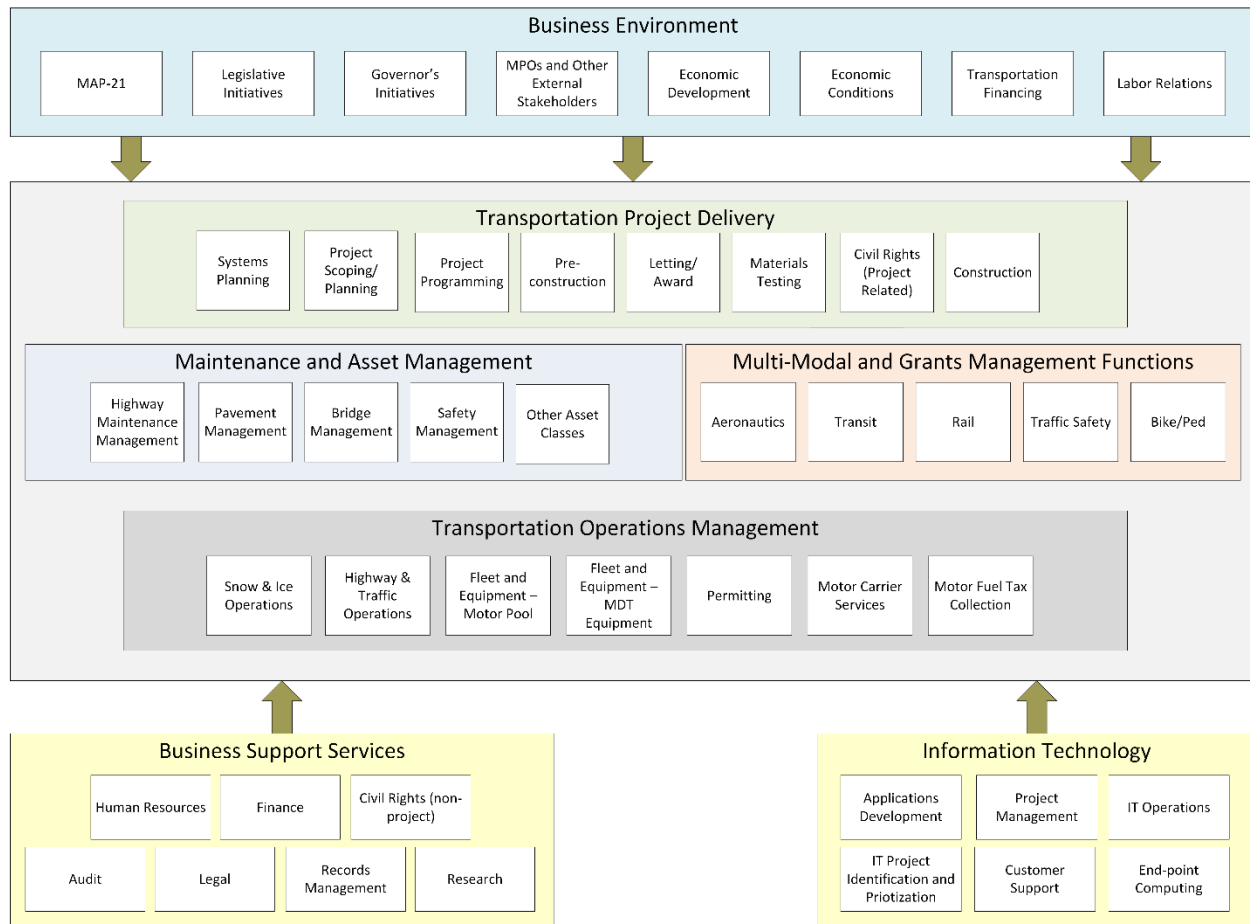
FIGURE 3: MDT CORE BUSINESS FUNCTIONS—VALIDATION SESSION FRAMEWORK

The six validation workshops included cross-functional staff members along with internal IT staff and were designed to:

- Validate the documented interview themes;

- Validate the key business drivers;

- Validate the alignment of business drivers to the agency's critical success factors; and

- Validate and revise listings of applications used by each business function.

During the validation workshops, the eVision Partners team also engaged attendees in discussions on their experiences, providing the opportunity for the eVision Partners team to discuss various technology deployment options and share the team's experiences from other public and private sector organizations. During these workshops, participants were encouraged to consider, discuss, and brainstorm about various agency-specific technology issues, implementation options, and the agency's current and future technology environment.

C.2.3   Document As-Is Environment

Based on information gathered during the review of documentation, the stakeholder interviews, and the validation sessions, the eVision Partners team began to build and document the MDT As-Is environment. The As-Is environment is prepared and presented in this report and includes an overview of the existing MDT Information Technology organization and governance.

C.2.4   Situation Analysis Interim Report

The eVision Partners team documented the results of its work in Situation Analysis and presented MDT with an interim report in December 2015. As part of that report, the team identified and documented preliminary recommendations the team believed MDT should consider (or begin to plan), rather than waiting on the completion of the Strategic Enterprise Architecture Design and Implementation Plan project and the contents of the Final Report.

C.3 STRATEGIC ENTERPRISE ARCHITECTURE DESIGN AND IMPLEMENTATION PLAN

This sub-section describes the tasks completed in order to create the Strategic Enterprise Architecture Design and Implementation Plan. This includes:

- Prepare EA Design;

- Prepare Implementation Plan;

- Prepare Strategic Options and Initiatives; and

- Publish MDT EA Final Report.

Figure 4 depicts the process of defining MDT's Strategic Enterprise Architecture Design and Implementation Plan.
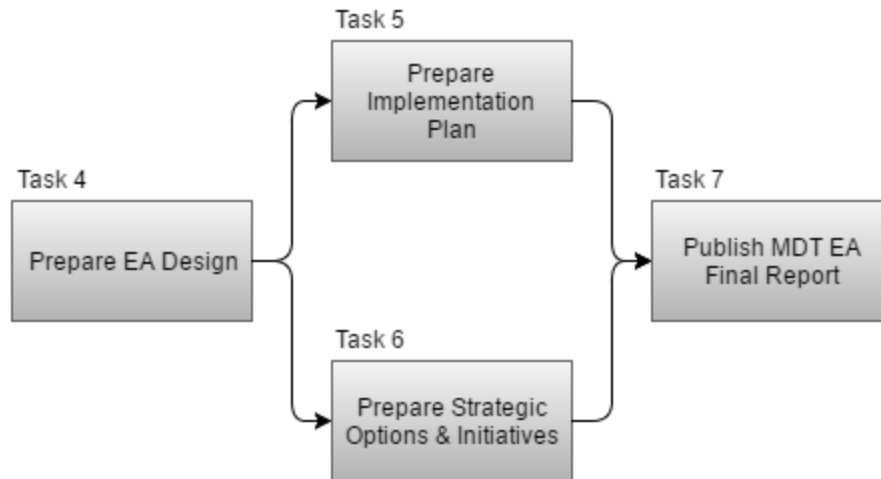
FIGURE 4: STRATEGIC ENTERPRISE ARCHITECTURE DESIGN APPROACH SCHEMATIC

C.3.1 Enterprise Architecture Design

Using enterprise architecture best practices, the findings from the Current Situation Analysis and the eVision Partners team's experience coupled with the current and anticipated state and federal legislative environment as inputs, the eVision Partners team defined a preliminary MDT To-Be Strategic Enterprise Architecture. In a series of workshops with MDT stakeholders, this preliminary To-Be architecture was reviewed and validated during the week of February 15, 2016. In contrast to the Current Situation Analysis, which was accomplished through various workshops organized by business function, these To-Be workshops were driven from the enterprise level and examined MDT's technology needs holistically. The validation workshops centered on broad topic areas, addressing the four layers of an EA: Business Architecture, Application, Data Architecture, and Technology Architecture.

C.3.2 Enterprise Architecture Implementation Plan

The eVision Partners team also developed an EA Implementation Plan depicting a mix of short-term, intermediate, and long-term implementation projects in addition to options and initiatives.

The implementation plan addressed the following key points:

- Prioritization of the recommendations from the eVision Partners team based on a high, medium, or low priority;

- An order-of-magnitude cost estimate for each recommendation;

- High-level work plans for implementing each recommendation;

- Anticipated benefits of implementing these enterprise architecture recommendations; and a

- Risk management plan, outlining potential implementation risks and general risk mitigation strategies.

The eVision Partners team conducted multiple reviews on the EA Implementation Plan with the MDT Technical Panel and MDT executive management to validate, obtain feedback, and tune the EA Implementation Plan content. The final version of this plan is included in this report.

C.3.3   Strategic Options and Initiatives

Included in this report, the eVision Partners team has prepared an enterprise readiness or organizational change management strategy in support of the recommended MDT Strategic Enterprise Architecture implementation plan. Successfully implementing change in an organization is truly about people; change leaders who initiate the effort, staff that manage and support the effort, and ultimately the staff affected by the change. That philosophy is especially true in major technology changes where staff members have become very accustomed to "their" systems and "their" ways of doing "their" business. Accepting change is typically not easy for many people, and for some accepting change is extremely difficult. Any organization's ability to successfully manage change often makes the difference between success and failure.

eVision Partners has also prepared a draft Information Technology Governance Strategy as a part of the Final Report. This draft defines the management structures needed to guide implementation of the MDT Strategic Enterprise Architecture Plan. This includes:

- Implementing an MDT Technology Council consisting of policymakers and senior-level staff to provide enterprise-level technology governance and guidance to the Strategic Enterprise Architecture Implementation Plan. This includes establishing policies and procedures related to technology projects and providing overall strategic direction on technology investments and deployment; and

- Establishing a Technology Investment Prioritization Process closely aligned with MDT's strategic objectives, critical success factors, and supporting business drivers.

C.3.4   Enterprise Architecture Final Report

The eVision Partners team prepared a draft Final Report and executive summary and provided the report to MDT for review. The Final Report packages the various work products into this Enterprise Architecture Strategic Plan Final Report. The eVision Partners team updated the Final Report based on feedback from MDT and upon MDT's approval, published this Final Report and Executive Summary.

D. OVERVIEW OF BASELINE ARCHITECTURE

This section describes MDT's existing baseline or As-Is architecture and is organized as follows:

- Business Architecture—this subsection describes the existing MDT Business Architecture including the overall MDT business environment and the major internal and external influences on this environment, the major functions of MDT, and the major business objectives or business drivers within each functional area along with how these business drivers map to MDT's overall Critical Success Factors. Using a series of validation workshops, the eVision Partners team confirmed these business drivers, critical success factors, and the software applications used by the following business functional areas:

  o Transportation Project Delivery;

  o Maintenance and Asset Management;

  o Transportation Operations Management

  o Multi-modal and Grants Management;

  o Business Support Services; and

  o Information Technology.

- Applications Architecture—this subsection describes MDT's As-Is Applications Architecture. It consists of an overview of MDT's key application systems by business functional area including high-level schematics showing the major systems in use by MDT and their interrelationships.

- Data Architecture—this subsection describes MDT's As-Is data architecture including data governance processes, data integration capabilities and data warehouse and business intelligence capabilities.

- Technology Architecture—this subsection provides an overview of MDT's As-Is technology architecture which includes all non-application specific elements of the MDT information technology environment.

- Information Technology Organization and Governance—this subsection describes MDT's current information technology organizational structure, staffing, and governance processes.

D.1 BUSINESS ARCHITECTURE

Business Architecture defines the functional structure of MDT in terms of its business processes and organization, along with associated business information needs. The business of MDT aligns with its vision, mission, and strategic and business plans, and is measured against critical success factors, or CSFs. The eVision Partners team used the following CSFs for MDT:

- Quality;

- Safety;

- Cost Effectiveness;

- Economic Vitality; and

- Environmental Sensitivity.

The Business Architecture is influenced by these key business initiatives, or drivers, for the agency, in combination with external and internal factors that affect the business of MDT, and the agency's business functions and deliverables. The business and technology environments of the agency affect the technology needs of the agency and its readiness to support an Enterprise Architecture.

The remainder of this subsection of the report:

- Identifies MDT business functions categorized for the project;

- Presents MDT's business environment as developed by the eVision Partners team in collaboration with the MDT Technical Panel and stakeholders who participated in the various validation workshops; and

- Presents the developed and validated business drivers that align with the agency's critical success factors in each of the business functions.

D.1.1 MDT Business Functions

After multiple meetings and interviews with MDT staff for this project, and utilizing its experience from working with other state departments of transportation, the eVision Partners team identified four core business functions of MDT plus two business functions providing support for the overall operation of MDT.

The core business functions identified were:

- Transportation Project Delivery;

- Maintenance and Asset Management;

- Transportation Operations Management; and

- Multi-modal and Grants Management.

The two support business functions identified are:

- Business Support Services; and

- Information Technology Management.

Figure 3 (page 17) presents a visual representation of the core business functions of the MDT. The schematic demonstrates that the MDT internal and external business environment influences the entire agency while the support services business functions provide support for the core business functions of the whole agency.

The business function model depicted in Figure 3 was used throughout Situation Analysis phase of the project. The validation workshops were conducted for each of the identified business functional areas. In each workshop, attendees were asked to validate the Business Architecture through validation of the recurrent and notable themes from staff and stakeholder interviews, and the business drivers developed for that business function, along with the alignment of those business drivers with the agency's critical success factors. These same validation workshops were used to validate and supplement the listings of technology applications used in each business area, which are discussed in the Applications Architecture section of this report.

D.1.2   MDT Business Environment

The overarching business environment affects the agency's operations (Figure 3, page 17), and includes both internal and external business factors that influence MDT such as:

- Legislative, executive, and public policy initiatives and impacts;

- Relationships with transportation partners;

- Economic development initiatives;

- Economic conditions/transportation finance; and

- Labor.

Examples of recent business factors affecting MDT include:

- Passage of a new five-year Federal transportation bill in November 2015. This should alleviate, to some extent, concerns about the level of near-term Federal funding for transportation projects.

- Requirements under the previous Moving Ahead for Progress in the 21st Century Act (MAP-21), such as requirements for a transportation asset management plan which will drive business requirements for enhanced analytical capabilities in the department's core asset management systems (at a minimum affecting bridge, pavement and safety), and improved data integration between these asset management systems.

- Funding for the State Transportation Program has been an increasing challenge inasmuch as the State Gas Tax is currently 27 cents per gallon and has not been raised since 1994.

- The impact of state mandated budget increases for employee salaries and benefits, which in effect has required MDT executive management to make budget cuts in other areas to balance the agency budget. This has resulted in MDT having to find ways to improve the efficiency and effectiveness of its service delivery in order to simply maintain the same level of service to the public.

- Specific to information technology, there are a number of current or planned initiatives by the State Information Technology Services Division (SITSD), which may affect technology choices available to MDT. One example is the information technology Convergence Plan directed by the Montana Governor's Executive Order 09-2016, issued during the finalization of this report. This Executive order mandates execution of a Convergence Plan resulting in the full use of a SITSD based shared enterprise infrastructure (to be completed by December 31, 2017) and the utilization of enterprise systems, noting specifically enterprise content management (ECM), directory services, email, telecommunications (voice, video, and data), in state data centers to ensure effective usage of enterprise information technology. As of the completion of this report, ISD is evaluating the effort and impact.

- Initiatives planned by the State Financial Services Division, State Human Resources Division or other divisions within the Montana Department of Administration may also impact MDT operations. Examples include the recent deployment of the Oracle TALEO Cloud-based application to support e-Recruitment functionality; potential enhancements to the State's PeopleSoft based Statewide Accounting, Budgeting and Human Resource (SABHRS) application or the Montana Acquisition and

Contracting System (eMACS) procurement system, which is based on Sciquest and implemented in July 2015.

D.1.3   MDT Business Drivers and Critical Success Factor (CSF) Alignment

For the purpose of this project, a business driver is a high-level work function that defines the scope, functions, and in some cases, the deliverables of the business function. The eVision Partners team identified business drivers for the four core business functions of the agency and the two business support functions, which were validated by attendees of the validation workshops where the participants were asked to validate, modify, and supplement those business drivers. The process was interactive, and in most if not all cases, resulted in cross-functional collaboration to finalize the business drivers presented below.

In addition to validating business drivers, the validation workshop attendees were asked to align those business drivers to the agency's critical success factors (CSFs). In all cases, as expected, business drivers aligned with at least one CSF, while many business drivers aligned with all of the CSFs.

The subsections below provide a brief definition of the scope of each of the four core business functions of MDT and the two business functions that support the overall operation of MDT as these functions were initially categorized by the eVision Partners team and validated with MDT stakeholders. In this report, for each business function, an inventory of the validated business drivers for that business function is provided, with the alignment of each business driver to the MDT critical success factors indicated.

D.1.3.1   Transportation Project Delivery

The Transportation Project Delivery business functional area is responsible for all aspects of the Transportation Project Delivery lifecycle from initial systems planning to detailed project scoping through environmental, preconstruction, construction and project closeout. Figure 5 illustrates the scope of the Transportation Project Delivery business function as defined for this analysis effort.

FIGURE 5: TRANSPORTATION PROJECT DELIVERY BUSINESS PROCESSES

For analysis purposes, the Transportation Project Delivery business functional area was broken down into the following sub-functions:

- Systems Planning

- Project Scoping/Planning

- Project Programming

- Preconstruction

- Letting/Award

- Construction

- Materials Testing

- Civil Rights (project related)

Transportation Systems Planning includes preparation of the statewide transportation plan. It also includes other project planning activities including identifying, prioritizing and evaluating candidate transportation projects identified through MDT transportation asset management systems and/or by various stakeholders; preparing scoping studies to further develop the project concept; and developing initial planning-level cost estimates.

Preconstruction functions include environmental decision-making, highway design, structure design, right-of-way acquisition, and utility relocation. Environmental decision-making consists of planning for and executing the environmental decision-making process consistent with the National Environmental Policy Act (NEPA). Engineering and design functions support preparation of preliminary and final plans, including roadway design, pavement design, structural design, geotechnical, hydraulics and other required design elements, as well as any required project surveys and management and support of engineering and design tools. Right of Way consists of identifying and managing the acquisition of any parcels required to initiate the proposed construction project according to the Federal Uniform Act and Federal and State regulations. Utility Relocation involves coordinating with public and private utility companies to secure the timely removal and relocation of utilities that are in the right-of-way prior to starting construction. In addition, Consultant Selection and Management include identifying the need to utilize an external consultant to support preconstruction activities and the on-going management of the consultant throughout the duration of the consultant contract.

Letting and award of contracts for construction projects includes preparing the bid specification package, receiving bids from potential contractors, analyzing bids, and determining the lowest responsive and responsible bidder.

Construction management and Materials Testing includes managing and performing oversight of the construction contractor and ensuring the quality of materials utilized during the construction process through various materials certification and testing processes.

Project specific civil rights functions include monitoring the utilization of companies who are certified disadvantaged business enterprises (DBEs) during the project lifecycle, as well as monitoring compliance with other Federal program goals such as payment of fair market wages to employees and utilization of trainees at the levels agreed to on the construction project.

The table below lists the business drivers and critical success factor alignment for the Transportation Project Delivery functional area in the MDT.

TABLE 2: PROJECT DELIVERY: CRITICAL SUCCESS FACTORS

Busines s Driver	Quality	Safety	Cost Effectiveness	Economic Vitality	Environmental Sensitivity
Maximize utilization of Federal Funds			✓	✓	
Ensure that all available Federal Funds are obligated			✓	✓	

Busines s Driver	Quality	Safety	Cost Effectiveness	Economic Vitality	Environmental Sensitivity
Promote department operations in a streamlined, efficient manner	✓	✓	✓		
Deliver projects within scope on-time and on-budget	✓	✓	✓	✓	✓
Scope projects effectively to meet MDT goals within funding constraints	✓	✓	✓	✓	✓
Develop realistic project delivery schedules and manage these schedules to deliver on time, in scop and within budget	✓	✓	✓	✓	✓
Prepare realistic budgets that are based on accurate and complete estimates which are updated at appropriate points throughout the project delivery lifecycle	✓	✓	✓	✓	✓
Promote environment stewardship by integrating environmental management best practices as appropriate throughout the project delivery lifecycle	✓			✓	
Implement data driven decision-making for project prioritization and selection	✓	✓	✓	✓	✓
Incorporate MAP-21 requirements into project planning and selection	✓	✓	✓	✓	✓
Incorporate maintenance and asset management considerations throughout the project delivery lifecycle and beyond	✓	✓	✓	✓	✓
Ensure conformance with state and federal regulations regarding real-estate acquisition and utility relocations	✓		✓		✓
Implement e-construction practices including paperless project delivery to the extent possible across the project delivery lifecycle	✓		✓		
Implement processes, methods, and technologies to leverage planning and design data through construction	✓		✓		
Utilize innovative technologies to efficiently collect photogrammetric, survey and GIS data for the agency	✓		✓		
Implement Model Centric Design and integrate with GIS	✓		✓		
Lead the delivery of a high-quality construction program through the development and implementation of policies, specifications, guidance, and support	✓	✓	✓	✓	✓
Utilize effective technology and processes to ensure timely and accurate estimates, payments, and reimbursements	✓		✓	✓	
Execute the delivery of projects to minimize the impacts to citizens, contractors, and MDT staff through the use of innovative maintenance of traffic and work-zone safety management plans	✓	✓	✓	✓	✓
Implement innovative quality control and quality acceptance methods, construction inspection methodologies, and materials and testing standards	✓	✓	✓	✓	✓
Ensure construction quality through use of highly trained and experienced project monitoring staff, value engineering principles, and partnering practices	✓	✓	✓	✓	✓
Champion the participation of disadvantaged business enterprises (DBEs) in delivery of the MDT construction program	✓			✓	
Ensure timely project close-out	✓		✓		
Capture lessons learned from all phases of the project delivery lifecycle, making them available for future use	✓	✓	✓		✓

D.1.3.2 Maintenance and Asset Management

The American Association of State Highway and Transportation Officials (AASHTO) Subcommittee on Asset Management defines Asset Management as follows: "*transportation asset management is a strategic and systematic process of operating, maintaining, upgrading, and expanding physical assets effectively through their life cycle. It focuses on business and engineering practices for resource allocation and utilization, with the objective of better decision-making based upon quality information and well defined objectives.*" (US Department of Transportation, Federal Highway Administration n.d.) The primary goal of transportation asset management is to minimize life-cycle costs for managing and maintaining transportation assets, including roads, bridges, tunnels, rails, and roadside features. The application of various transportation asset management practices, processes and tools allows a DOT to more comprehensively view and evaluate collected data before making decisions as to how specific resources should be deployed. The information made available through transportation asset management systems and processes should be applied throughout the planning process, from initial goal setting and long-range planning to development of a Transportation Improvement Program (TIP) and Statewide Transportation Improvement Program (STIP) and to operations, preservation, and maintenance.

The Maintenance and Asset Management functional area as defined for purposes of this project consists of the following sub-functions:

- Highway Maintenance Management

- Pavement Management

- Bridge Management

- Safety Management

- Other asset classes

The table below highlights the business drivers and critical success factor alignment for the Maintenance and Asset Management function within the MDT.

TABLE 3: MAINTENANCE & ASSET MANAGEMENT: CRITICAL SUCCESS FACTORS

Business Driver	Quality	Safety	Cost Effectiveness	Economic Vitality	Environmental Sensitivity
Conduct maintenance and asset management operations in a streamlined and efficient manner	✓	✓	✓		

Business Driver	Quality	Safety	Cost Effectiveness	Economic Vitality	Environmental Sensitivity
Perform winter maintenance activities that provide consistent levels of service and optimize MDT resources	✓	✓	✓	✓	✓
Continue to research new equipment, materials, and processes to improve winter driving conditions of roadways	✓	✓	✓	✓	✓
Monitor pavement distresses, select appropriate treatments and perform pavement preservation activities to improve the system index	✓	✓	✓	✓	
Improve customer satisfaction levels for Rest Area maintenance	✓	✓	✓		
Provide visible, legible, and understandable signs and pavement markings to ensure the traveling public's safety	✓	✓	✓	✓	
Ensure 85% of roads under MDT jurisdiction will meet reflectivity standards for striping by July 1 annually	✓	✓	✓	✓	
Utilize the Pavement Management System analysis to appropriate at least 90% of federal funding for pavement preservation work associated with the state maintenance program	✓	✓	✓	✓	
Ensure at least 70% of available federal and state resources are prioritized into a performance based funding plan to support core state highway system needs (I, NH, P) based on system goals defined through Performance Programming Process (P3)	✓	✓	✓	✓	
Provide a ride experience for the traveling public within desirable or superior range (average ride index above 60) with less than 3% of lane miles exhibiting poor ride characteristics	✓	✓	✓	✓	
Reduce the structurally deficient bridge deck area (square feet)	✓	✓	✓	✓	
Select projects which support the goal and objectives of the CHSP to reduce fatal and incapacitation injury crashes by half by 2030	✓	✓	✓		
Develop and implement a MAP-21 compliant transportation asset management plan	✓	✓	✓		
Develop and implement a performance-based maintenance planning and budgeting process which uses asset condition data to drive decisions for allocating resources	✓	✓	✓		
Develop and implement policies to support cross asset trade-off analysis	✓	✓	✓		
Provide real-time information about maintenance program outcomes to support management decision-making	✓		✓		
Improve staff efficiency and data accuracy through application of mobile solutions	✓	✓	✓		
Develop consistent asset ownership and data collection strategies for ancillary assets leveraging existing processes and systems to extent possible	✓	✓	✓		
Provide for data integration throughout the lifecycle of assets	✓	✓	✓		

D.1.3.3   Transportation Operations Management

Transportation Operations Management consists of the processes and activities to maintain and operate MDT's transportation infrastructure in addition to snow and ice removal, management of the statewide traffic operations centers/functions, collection and dissemination of traveler information through various media, management of highway incidents, and the required

emergency management services coordination with other State agencies. Likewise, it includes the management of the Intelligent Transportation Systems (ITS) program and associated infrastructure.

The Oversize/Overweight Permits function handles processing of overweight and oversize vehicle permits requested by the motor carrier industry. In addition, the review of applications for various other MDT permits such as utility crossing permits and driveway access permits fall within this business function.

Motor Carrier Enforcement addresses the support for enforcement and monitoring of Montana State laws with respect to commercial and privately owned vehicles. Motor Fuel Tax Collection includes the collection of motor fuel taxes, the administration of the program and required enforcement and compliance activities to ensure all taxes due to the state are collected.

The MDT Transportation Operations Management function also consists of the MDT Fleet and Equipment functions. This includes the Statewide Motor Pool function operated by MDT for all State agencies and MDT's Equipment Management function, which procures, maintains and manages the full asset lifecycle for heavy equipment utilized by MDT Districts in its maintenance and construction operations and various light duty trucks utilized across MDT.

Specifically, the Transportation Operations Management functional area consists of the following sub-functions:

- Snow and Ice Operations;

- Highway and Traffic Operations;

- Fleet and Equipment – Motor Pool;

- Fleet and Equipment – MDT Equipment;

- Permitting;

- Motor Carrier Services; and

- Motor Fuel Tax Collection.

The table below lists the business drivers and critical success factor alignment for the Transportation Operations Management business function.

TABLE 4: TRANSPORTATION OPERATIONS MANAGEMENT: CRITICAL SUCCESS FACTORS

Business Driver	Quality	Safety	Cost Effectiveness	Economic Vitality	Environmental Sensitivity
SNOW AND ICE OPERATIONS					
Perform winter maintenance activities that provide consistent levels of service and optimize MDT resources to ensure 90% or more of Maintenance Survey respondents are satisfied with MDT's winter maintenance service	✓	✓	✓	✓	✓
Continue to research new equipment, materials, and processes to improve winter driving conditions of roadways by participating in national winter maintenance pooled fund organizations such as Clear Roads and the Pacific Northwest Snowfighters	✓	✓	✓	✓	✓
HIGHWAY AND TRAFFIC OPERATIONS					
Develop traffic engineering policies and standards, and performance measures to monitor system performance	✓	✓			
Support traffic operations through engineering support, signal repair, and sign design and fabrication	✓	✓	✓	✓	
Use innovative practices, technological advancements, and partnerships to effectively manage traffic and incidents	✓	✓	✓		✓
Continue to develop and enhance mobile applications that provide timely and relevant traveler information	✓	✓		✓	
Support traffic operations through engineering support of signal efficiency, signal coordination, and control upgrades.	✓	✓	✓	✓	
FLEET AND EQUIPMENT – MOTOR POOL					
Provide efficient and reliable vehicles on a daily and extended use basis to state employees conducting official business	✓	✓	✓		
Maintain or reduce variance between actual and projected needs as identified in the annual fleet analysis	✓	✓	✓		
Ensure 90% of the fleet is meeting the Level II preventive maintenance schedule	✓	✓	✓		
Ensure safety inspections are performed on 50% of the fleet each year	✓	✓			
Ensure that each light duty vehicle that is purchased meets or exceeds the CAFÉ standard in order to provide fuel efficient vehicles to Motor Pool customers	✓		✓		✓
Maintain or enhance Motor Pool customer satisfaction through a biennial survey	✓				
FLEET AND EQUIPMENT – MDT EQUIPMENT					
Provide safe and reliable vehicles and equipment to meet the needs of the department's users	✓	✓	✓		
Maintain or reduce variance between actual and projected needs as identified in the annual fleet analysis	✓	✓	✓		
Ensure 90% of the fleet is meeting the Level II preventive maintenance schedule	✓	✓	✓		
Ensure safety inspections are performed on 95% of the light duty fleet each year	✓	✓			
Ensure that each light duty vehicle that is purchased meets or exceeds the CAFÉ standard in order to provide fuel efficient vehicles to department users	✓		✓		✓

Business Driver	Quality	Safety	Cost Effectiveness	Economic Vitality	Environmental Sensitivity
PERMITTING					
Process oversize/overweight permits in a timely and efficient manner to facilitate the safe movement of freight while safeguarding assets on the transportation network	✓	✓	✓	✓	
Facilitate application intake, review and processing of permit requests to MDT, with a goal to process as much of the permit applications online as possible	✓	✓	✓	✓	
Manage outdoor advertising control program so as to ensure compliance with appropriate Federal and State laws and regulations	✓	✓	✓	✓	✓
MOTOR CARRIER SERVICES					
Protect Montana's and the federal investment in Montana's highway system and assure the safety of the traveling public through customer service oriented regulation and enforcement of the commercial motor carrier industry	✓	✓	✓	✓	
Establish 24/7 availability of services to the commercial motor carrier industry through the Internet	✓	✓	✓	✓	
Maintain or enhance commercial motor carrier size and weight compliance through the annual development of the Federal Size and Weight Enforcement Plan. Annually submit the Federal Certification of Accomplishment Report	✓	✓			
Maintain or enhance commercial motor carrier safety compliance through development and implementation of Montana's Commercial Vehicle Safety Plan and Certification	✓	✓			
Decrease the number of commercial vehicle related crashes and fatalities by reducing the number of safety non-compliant commercial vehicles and commercial drivers and motor carriers who operate on Montana roadways through effective vehicle, driver inspection and, public education and motor carrier compliance programs	✓	✓			
MOTOR FUEL TAX COLLECTION					
Manage efficient, effective and timely collection of motor fuel taxes			✓	✓	✓
Encourage taxpayer compliance through a comprehensive audit program that will level the playing field for all taxpayers			✓	✓	

D.1.3.4   Multi-Modal and Grants Management

MDT is also responsible for planning for and supporting the growth and development of other modes of transportation within the State including aviation, rail, and transit. The MDT Grants Bureau within the Rail, Transit, and Planning Division manages funding programs of the Federal Transit Administration (FTA) and the National Highway Traffic Safety Administration (NHTSA), as well as the Emergency Medical Services grants, Safe Routes to School grants and limited state transit funds. It also manages the Montana Essential Freight Loan Program.

MDT allocates funds from various program sources and assists grantees to ensure compliance with the laws and regulations associated with the use of these funds. FTA funded projects include rural transit and intercity bus services. NHTSA projects include supporting law

enforcement and local projects to reduce impaired driving and increase safety belt usage. NHTSA projects also include collection and analysis of crash data.

The MDT Aeronautics Division is responsible for providing the protection and promotion of safety in aeronautics. The Aeronautics Division facilitates the maintenance of airports and the various components of airport infrastructure, including visual and electronic navigational facilities and flying aids.

MDT's Aeronautics Division owns and operates Yellowstone Airport and 14 other public use airports across the State. The Aeronautics Division offers educational programs to promote aviation safety, registers aircraft and pilots in accordance with Montana laws and regulations; and coordinates and supervises aerial search and rescue operations. The Aeronautics Division also administers a loan and grant program to municipal governments to fund airport development and improvement projects.

For purposes of this analysis, the eVision Partners team divided the Multi-Modal and Grants Management functional area of MDT into the following sub-functions:

- Aeronautics

- Transit

- Rail

- Traffic Safety

- Bike/Pedestrian

The table below lists the business drivers and critical success factors for the Multi-Modal and Grants Management functions within the agency.

TABLE 5: MULTI-MODAL AND GRANTS MANAGEMENT

Business Driver	Quality	Safety	Cost Effectiveness	Economic Vitality	Environmental Sensitivity
Maximize utilization of Federal Funds			✓	✓	
Ensure that all available Federal Funds are obligated			✓	✓	
Promote department operations in a streamlined, efficient manner	✓	✓	✓		
Promote coordination between entities for highway traffic safety programs		✓	✓		

Business Driver	Quality	Safety	Cost Effectiveness	Economic Vitality	Environmental Sensitivity
Advance further growth and promote Montana Aviation				✓	✓
Provide for the protection of the flying public and the promotion of flight safety and accident prevention programs and other state aviation interests		✓	✓		
Continue to expand and improve the statewide air search and rescue program		✓			
Continue to provide aviation education and a resource aviation education center for Montana teachers and students		✓	✓		
Provide airport development programs to assist airport sponsors to plan, construct, and maintain Montana's public use airports	✓	✓	✓	✓	
Provide safe, modern, well-maintained state-owned and operated airports including the Yellowstone commercial service airport		✓	✓	✓	✓
Ensure 50% of the public and transportation stakeholders perception of MDT's overall quality of service at an A or B level in our TranPlan 21 Public involvement surveys	✓	✓			
Ensure that all MDT projects consider multi-modal elements and solutions	✓	✓	✓		✓
Allocate safety grant funding to ensure most effective use of funds in improving safety on the transportation network		✓	✓		

D.1.3.5   Business Support Services

Business Support Services includes various administrative support, back-office, and management processes, which support MDT in its daily operations. The primary sub-functions within this functional area include:

- Finance

- HR

- Civil Rights (non-project)

- Audit

- Legal

- Records Management

Included within the scope of this function are the financial functions required to support delivery of the MDT construction program. This includes:

- Management of Federal funds;

- Establishment of project specific funding agreements with the Federal Highway Administration (FHWA) or other funding partners required to deliver the program; and

- Billing FHWA and other funding partners for reimbursement.

The table below lists the business drivers and critical success factor alignment for the Business Support Services function.

TABLE 6: BUSINESS SUPPORT SERVICES: CRITICAL SUCCESS FACTORS

Business Driver	Quality	Safety	Cost Effectiveness	Economic Vitality	Environmental Sensitivity
FINANCIAL MANAGEMENT					
Support fiscal management and constraint over the long term for both State and Federal dollars	✓	✓	✓	✓	✓
Maximize utilization of Federal Highway Funds	✓	✓	✓	✓	
Ensure that all available Federal Funds are obligated	✓		✓		
Provide services which support delivery of department operations in a streamlined, efficient manner	✓		✓		
Protect departmental assets by continuing to assess, implement and monitor internal controls associated with the department's material business processes	✓		✓		
Lead MDT in the establishment of accounting and reporting policies, principles and practices to ensure conformity with governmental accounting standards and regulations	✓		✓		
Establish cost accounting methods to provide for the analytical evaluation of activity costs	✓		✓		
Implement budgeting methodologies to manage obligation of federal funds, cash flow, operating budget and maximize the funds available to deliver the highway improvement program	✓	✓	✓	✓	✓
Develop efficiencies in employee time and payroll processing to minimize manual effort required, reduce errors	✓		✓		
Capture procurement and payment information at source once in order to reduce manual effort and eliminate redundant data entry	✓		✓		
Provide management with sound financial information to make operational and investment decisions by continuously monitoring department finances, trends and revenue data to project budgetary needs and fund stability	✓		✓		
HUMAN CAPITAL MANAGEMENT					
Develop a strategic workforce development plan that fully integrates the department's approach to total talent management and places an emphasis on recruitment and selection and customer service	✓	✓	✓	✓	✓
Provide challenging career paths that best leverage employee talents and skill sets	✓	✓	✓	✓	✓
Encourage a safe working environment for all work locations by increasing oversight, training, and consultation services to managers and employees	✓	✓	✓		✓

Business Driver	Quality	Safety	Cost Effectiveness	Economic Vitality	Environmental Sensitivity
Implement and regularly review HR operations programs including MDT's compensation plan and collective bargaining contracts	✓		✓		
CIVIL RIGHTS					
Ensure compliance with the law and Federal and State guidance on the following programs: Affirmative Action, Contractor Compliance, Disadvantaged Business Enterprise (DBE) and DBE Supportive Services, External and Internal ADA, Non-Discrimination and Equal Employment Opportunity, and On-The-Job Training (OJT) and OJT Supportive Services	✓			✓	✓
Ensure MDT conducts business in an environment free of discrimination, harassment, and retaliation on the grounds of race, color, national origin, sex, age, pregnancy, parental/marital status, disability (physical or mental), religion, creed, political ideas, or genetic material in State, Federal and Federally-assisted MDT programs	✓			✓	✓
AUDIT					
Encourage taxpayer compliance through a comprehensive audit program that will level the playing field for all taxpayers	✓			✓	
Ensure consultants and contractors comply with contract requirements and federal costs principles when performing work and billing MDT	✓		✓	✓	
Ensure business processes have proper segregation of duties and internal controls	✓		✓		
Provide management with independent, objective assurance and consulting services designed to add value and improve the effectiveness of the department operations and internal controls	✓		✓		
Streamline department policy and guidance documents to ensure consistency and eliminate redundancy	✓		✓		
LEGAL					
Develop and roll-out standardized contract templates	✓		✓		
RECORDS MANAGEMENT					
Ensure department records are maintained in a consistent format per established laws and policies	✓	✓	✓		
Facilitate and ensure ease of access to department records including key word search and other dynamic query capabilities	✓	✓	✓		
Promote an environment that embraces change	✓		✓		

D.1.3.6　Information Technology

Technology is a business support function, however due to the complexity of information technology it is also identified as a specific business driver. Information Technology Management includes planning for, acquiring, implementing, and operating and maintaining the technology infrastructure necessary to support MDT's business & functional operations.

This includes the following sub-functions:

- Information Technology Governance—this sub-function includes establishing and managing information technology standards, practices, and processes. It also includes establishment and execution of an IT investment process.

- Manage Applications Architecture—this sub-function includes planning, acquisition, implementation, and maintenance and support of the various business systems utilized across MDT.

- Manage Technology architecture—this includes planning for, acquiring, implementing, maintaining, and supporting database management systems, document management software, collaboration software, as well as basic infrastructure software such as operating systems software. It also includes planning for, implementing, and maintaining MDT's technical infrastructure such as workstations, mobile devices, servers, and the MDT network.

The table below lists the business drivers and critical success factor alignment for the Information Technology support function.

TABLE 7: INFORMATION TECHNOLOGY: CRITICAL SUCCESS FACTORS

Business Driver	Quality	Safety	Cost Effectiveness	Economic Vitality	Environmental Sensitivity
ESTABLISH & INSTITUTIONALIZE TECHNOLOGY GOVERNANCE					
Provide leadership in the establishment of technology policies, practices, and guidance that promote strategic technology implementation, procurement, and development	✓		✓		
Create and foster consistent use of a technology governance process to prioritize technology investments that support agency needs and is consistent with the established architecture plan	✓		✓		
Enhance relationships between business groups and external partners to ensure effective data usage through the use and development of enterprise systems	✓		✓		
IMPLEMENT IT SOLUTIONS TO MEET CUSTOMER NEEDS					
Implement new IT systems identified and approved by the MDT Executive	✓		✓		
Continue implementation of major new systems such as the MMS, ePart, and Safety Management	✓	✓	✓		
Identify, implement, and maintain quality, industry-tested, commercially available software applications that serve the unique and general business needs	✓		✓		
Develop and maintain software applications with internal and external resources to best serve the needs of agency when commercially available applications are not available	✓		✓		
Challenge business areas to improve business processes in conjunction with technology projects	✓		✓		

Business Driver	Quality	Safety	Cost Effectiveness	Economic Vitality	Environmental Sensitivity
Continue to implement Business Continuity Plans for MDT	✓		✓		
Analyze and plan system improvements for the Engineering Division	✓		✓		
Support system improvements for MAP21 compliance	✓		✓		
IMPLEMENT IT SERVICE IMPROVEMENTS					
Establish a "customer first" philosophy to provide effective and efficient tools, technologies, and services to support agency's business functions	✓		✓		
Implement an ISD service portal	✓		✓		
Implement an electronic records management solution for MDT	✓		✓		
Develop and implement a GIS strategic plan	✓		✓		
Develop and implement a web strategy	✓		✓		
Assess video conferencing alternatives	✓		✓		
Assess IT training needs	✓		✓		
Assess and upgrade existing technologies	✓		✓		
ESTABLISH A CULTURE OF DATA GOVERNANCE AND DATA STEWARDSHIP					
Establish a data governance structure that leads to single points of data entry, minimizes redundant data, and provides a common platform for data reporting and analysis	✓		✓		
Enable the effective use of data through the implementation of user-friendly applications that empower staff, stakeholders, and the public to utilize data to make informed decisions	✓		✓		
Protect the integrity and security of agency data, and provide the tools and resources to best utilize, maintain, & integrate these data	✓		✓		
IMPROVE IT BUSINESS PROCESSES					
Develop and implement a disaster recovery strategy	✓		✓		
Assess and manage IT risks	✓		✓		
Implement a security program for MDT	✓		✓		
Develop and implement change management processes	✓		✓		
Develop and implement a decision and communication processes	✓		✓		
Define the information architecture and technology strategy	✓		✓		
Implement project management processes	✓		✓		
Assess and implement new application development methodologies	✓		✓		

Business Driver	Quality	Safety	Cost Effectiveness	Economic Vitality	Environmental Sensitivity
Develop a strategy for assessing and migrating old technologies	✓		✓		
RESEARCH AND DEVELOP NEW TECHNOLOGIES AND SERVICES					
Provide and maintain reliable and secure technology infrastructure including the data network, servers, desktops, laptops, mobile devices, and telecommunications to meet the needs of the agency	✓		✓		
Assess and develop mobile computing solutions and endpoint management tools	✓	✓	✓		
Investigate file sharing and collaboration tools	✓		✓		
Assess unified communication technologies	✓	✓	✓		
Assess desktop computing alternatives	✓		✓		
Develop a Software-as-a-Service (SaaS) strategy	✓		✓		
Investigate cloud storage strategies	✓		✓		
Develop a business intelligence technology for MDT	✓		✓		
DEVELOP THE IT WORKFORCE					
Assess future human resource needs and develop staffing and recruitment strategies	✓		✓		
Assess and implement technical and soft-skill training, provide cross-training opportunities, and update all career ladders	✓		✓		
Explore employee incentives and recognition strategies	✓		✓		
Provide team collaboration opportunities	✓		✓		
Enhance relationships between business groups and external partners to ensure effective data usage through the use and development of enterprise systems	✓		✓		

D.2 APPLICATIONS ARCHITECTURE

This subsection includes an overview of MDT's As-Is applications architecture, along with a summary of the key interview findings related to Applications Architecture.

One of the components of the information systems architecture layer within an Enterprise Architecture, the Applications Architecture component, describes the structure and behavior of applications used to support the Business Architecture. An Applications Architecture shows how applications interact with each other and with users. An Applications Architecture focuses on the data consumed and produced by applications rather than on their internal characteristics, such as

their programming languages, or whether they are custom or inhouse developed, or commercial off-the-shelf applications.

The MDT Applications Architecture consists of a mix of statewide solutions, agency specific commercial off-the-shelf (COTS) solutions licensed by MDT, custom developed agency specific solutions, and various third party owned solutions utilized by MDT staff as part of performing business functions.

Statewide solutions include several applications managed by various divisions within the Montana Department of Administration. These systems include:

- The State's PeopleSoft based Statewide Accounting, Budgeting and Human Resource (SABHRS) application managed by the State Financial Services Division and State Human Resources Division;

- Oracle® TALEO, a Cloud-based application to support e-Recruitment which was recently deployed; and

- The Montana Acquisition and Contracting System (eMACS) procurement system, which is based on Sciquest, was implemented in July 2015.

MDT business units have recently implemented a number of projects to develop new systems or replace older systems with COTS packages. Examples include the Pavement Management System, Equipment Vehicle Management System (EVMS), Safety Information Management System (SIMS) and new Maintenance Management System (MMS), which are based on various AgileAssets modules which were procured through separate project initiatives; and the Structures Management System (SMS) being developed using Advitam ScanPrint® IMS. Another example is the Planisware® based project scheduling system. Likewise, the core of MDT's Commercial Vehicle Information System and Network (CVISN) functionality was recently migrated to a CELTIC™ Systems solution through the ePart project that went live in May 2016. As mentioned previously, while these best of breed solutions meet the specific needs of the sponsoring business units, the systems may not have always been selected or implemented with an eye towards how these systems should integrate or co-exist within a holistic enterprise architecture.

Many of the older agency specific custom systems were originally developed as client/server applications utilizing Oracle® Forms. More recent custom applications are being developed as Web-based applications in JAVA. The Information Services Division (ISD) is planning to either replace the remaining Oracle Forms applications through a COTS solution or migrate these remaining Oracle Forms applications to a JAVA platform.

In addition to State and MDT systems, MDT staff also utilize partner agency systems as required to perform various business functions. Examples include FHWA's Fiscal Management Information System (FMIS) and the FTA's Transportation Electronic Award Management (TEAM) application.

A descriptive overview of the Applications Architecture by business function is provided in the sub-sections following the diagrams.

D.2.1 Transportation Project Delivery

MDT utilizes an inhouse developed Program and Project Management System (PPMS) to manage planning for and monitoring the overall delivery of its construction program. Because this system is utilized at different points in the project lifecycle by users from the Administration (Finance), Planning, and Engineering Divisions, there have been challenges defining a clear business owner for the system. MDT has recently initiated a requirements gathering effort to define the system requirements for a next generation PPMS application.

MDT recently implemented the latest version of Planisware® as its project scheduling system to replace a prior generation of Planisware® software known as OPX2. Stakeholders identified a lack of resource management capability as a primary concern with this system. As an example, Planisware®, as implemented, will not allow a manager of a specialty group such as Geotechnical or Right-of-Way to easily see a roll-up or summary of the requirements for their resources across multiple projects in the program. Likewise, it is not tightly integrated with the current PPMS system,

MDT utilizes ESRI's ArcGIS application as its GIS software. This software is an integral component of transportation planning activities. MDT has a custom developed Transportation Information System (TIS), Road Log and Location Referencing application which is approaching the end of its functional life. MDT's Planning Division is currently defining requirements and planning for a new TIS/Roadway Inventory/LRS application, which will be a foundational element within the MDT applications architecture.

MDT utilizes Bentley® MicroStation as its Computer Aided Design and Drafting (CADD) toolset and Bentley® GEOPAK and OpenRoads as its engineering design and modeling tools. MDT is currently planning for migration towards greater use of three-dimensional (3D) models. MDT is also taking greater advantage of newer data collection methods, such as aerial surveys and LIDAR. These data collection methods tend to be network and data storage intensive requiring advanced planning and coordination between business units and information technology staff to ensure the MDT environment is appropriately sized to support processing and storage of the resulting data files.

The Engineering Document Management System (DMS) is at the end of its functional and technical life. The technical framework for the system is based on Oracle® 10G, which is no longer supported. The system also contains several complex and hard to maintain custom functions, such as the Docuplot feature and the consultant design vault, and has a number of functional gaps including plans management and dynamic search capabilities. As a result, Engineering has initiated a requirements definition effort to develop system requirements for a new Document Management System application. This effort is currently an Engineering only effort and is not being done from the context of an enterprise wide document or content management solution.

MDT is also evaluating replacement of its Parcel Acquisition System with a new Right-of-Way Management System, as well as replacement of its Utility Relocation and Tracking Application. There are several COTS applications or frameworks in the marketplace, which may be able to perform one or both of these functions. In a similar fashion, the West Virginia Department of Transportation recently implemented AgileAssets to perform these functions so there is the potential that MDT could extend its existing AgileAssets environment to support these two functions.

The Consultant Information System is an inhouse developed application utilized to manage the selection of consultants to perform planning and engineering work and support the subsequent administration of consultant contracts. Part of the capability of this system is mirrored in the Contracts Tracking System owned by the Administration Division, which tracks actual contract expenditures against all department contracts.

In terms of managing the letting and award of construction contracts, MDT utilizes the AASHTOWare™ Project PreConstruction application, which is generally accepted as a best practices solution for supporting this function. For electronic bidding MDT utilizes InfoTech's Bid Express and AASHTOWare™ Project Expedite. These solutions are also utilized by a number of State DOTs. MDT is also currently implementing AASHTOWare™ Project Estimation.

MDT has recently completed an implementation of AASHTOWare™ Project SiteManager for construction management and materials testing functionality. This application is currently utilized by over 20 State DOTs. While stakeholders indicated there was initially a significant learning curve associated with the implementation of SiteManager, the system environment is now reported by stakeholder as having stabilized. With SiteManager, construction management functionality is confined primarily to the office or construction trailer environments with only limited mobile capabilities for daily diaries using the SiteManager "pipeline" process, which is a complex batch data upload/download and synchronization process.

In terms of materials testing, prior to SiteManager, MDT utilized primarily a paper process. Consequently, MDT is not yet seeing one of the primary benefits of the electronic tracking of materials testing which is streamlining the effort to perform the materials certification process at the end of a project. The benefits associated with reducing the materials certification effort will occur as more projects are completed within SiteManager. Likewise, MDT chose not to implement the laboratory information management system, or LIMS capabilities, within SiteManager. The LIMS functionality provides workflow management capabilities to manage the processing of a test sample within the laboratory environment. MDT is beginning to plan for the migration to AASHTO's replacement for SiteManager known as AASHTOWare™ Project Construction and Materials. This system has additional mobile capabilities and includes the initial LIMS functionality in SiteManager, as well as some enhancements to its LIMS capabilities.

D.2.2   Maintenance and Asset Management

MDT utilizes an AgileAssets based solution for its Pavement Management System. This system is currently being upgraded to the latest AgileAssets release. The capabilities of the Pavement Management System are generally consistent with industry best practices. Two challenges identified by stakeholders during the interviews are that maintenance activities are not accounted for in the Pavement Management System (as there is no linkage between the existing Maintenance Management System and the Pavement Management System) and that there are still various off-line pavement systems maintained in the districts which provide more specific details for use by district staff in evaluating and selecting candidate pavement sections for potential treatments.

MDT implemented a Safety Information Management System (SIMS) in 2014. SIMS is based on the AgileAssets Safety Analyst module and is designed to assist in identifying high crash location and evaluating potential countermeasures. While based on an AgileAssets solution, the SIMS application is implemented in a different technical environment from the Pavement Management System or the new Maintenance Management System described below. The initial SIMS implementation focused on integrating crash reporting and highway inventory data. AgileAssets Safety Analyst can also support other elements, which are considered best practices in terms of a fully functional Safety Management System such as integration with conviction data from the courts; emergency management system (EMS) run tickets; and trauma registry data. These datasets could be added in future deployment phases, as data sharing agreements are put in place with the agencies who own these different data sources.

MDT is currently implementing a new Structures Management System (SMS) based on the Advitam ScanPrint® IMS application. The initial focus of this implementation effort is on bridge

inventory and bridge inspection functionality and not necessarily on the full bridge management system capabilities, which would include extensive modeling and analytics capabilities.

The current MDT Maintenance Management System is at functional end of life. As an example of a limitation with the existing system, there is a significant delay (up to 30 days) in being able to access data from the system to support management decision-making. MDT has initiated a project to implement a new Maintenance Management System or MMS using AgileAssets Maintenance Manager, which is currently underway. The MMS project will also support consumable inventory, sign shop functionality, and facilities management requirements. Likewise, the MMS project is intended to establish asset inventory/registry functionality for various ancillary assets, which do not have an official management system. This will allow these assets to be inventoried within a management system versus one or more off-line systems. At the time of the stakeholder interviews and validation sessions, the strategy to include ancillary assets was clearly stated and explained to the project team by the MMS project owners but it was not clear based on feedback from interviewees who own some of these ancillary assets that the strategy had been fully communicated or was understood agency wide.

While MDT has either implemented or is implementing best of breed solutions for each of its major asset classes, there is currently no data integration strategy to support a true asset management system for the department. Some examples include how data would be pulled from each system to support cross asset trade-off analysis or how data would be integrated to identify opportunities to combine one or more projects from different asset classes, which are in close proximity to each other to gain efficiencies and economies of scale in project delivery.

D.2.3   Transportation Operations Management

Snow and Ice Operations utilize both the MMS and the Roadway Weather Information System (RWIS), as well as automated vehicle locator (AVL) and GPS technologies. One potential advancement being considered in terms of information available during Snow and Ice operations is to share images from the cameras on the snowplows with the public to allow the public to evaluate for themselves the conditions of the roads and to make an informed decision as to whether or not it is safe to travel.

The current Traveler Information System is an inhouse developed application and approaching the end of its functional and technical life. This application is the most accessed webpage in Montana State Government. MDT is initiating a business case to evaluate options for replacing this system. There are a various COTS solutions or COTS frameworks, available in the marketplace, which should be evaluated by MDT in terms of architecting the next generation Traveler Information System solution.

The AgileAssets based Equipment Vehicle Management System (EVMS) supports MDT's Motor Pool and Equipment Management functions. This system was recently upgraded to the latest release of AgileAssets Fleet Manager (Version 7) and will now be in the same technical environment with the new AgileAssets based MMS, which will facilitate utilizing vendor supported data integration points between these two systems. While the upgrade to the new version was reported to be a challenge by system users, due to the significant change in the user interface between the older version and the new Version 7 of AgileAssets, the system appears to meet most of MDT's functional requirements for fleet and equipment management and user concerns about the new system should begin to lessen as they become accustomed to the new user interface. One potential enhancement to EVMS currently being evaluated is the use of tablets by equipment technicians on the shop floor.

The Outdoor Advertising Control application is approaching the end of its technical life. Users reported during interviews significant problems in loading data from the field data collection application into the main database. Likewise, users of the system are requesting various data collection and location referencing enhancements.

SmartCOP provides the core of the Motor Carrier Enforcement Systems. Capabilities within SmartCOP include:

- Computer aided dispatch;

- Law enforcement records management; and

- Shared system interoperability with the Montana Highway Patrol.

MDT is currently implementing or planning to implement several priority enhancements to SmartCOP. These enhancements include:

- Electronic recording of commercial motor vehicle (CMV) citations at the roadside;

- Electronic transfer of CMV information to the Federal Motor Carrier Safety Administration (FMCSA) SAFETYNET application;

- Loading of driver and vehicle information by barcode; and

- Sharing of citation and crash data electronically with other systems.

The Commercial Vehicle Information Systems and Network (CVISN) framework is currently primarily supported by a solution provided by Xerox. This application supports:

- International Registration Plan (IRP);

- International Fuel Tax Agreement (IFTA);

- Oversize/Overweight Permitting (OS/OW);

- Safety and Fitness Electronic Records Integration (SAFER); and

- Commercial Vehicle Information Exchange Window (CVIEW).

CVISN functionality is being migrated to a new application from CELTIC Systems in May 2016 through the ePart initiative. As part of this project, additional functionality is being incorporated into the new system, which will allow for streamlining various business processes and eliminating off-line systems (for example, various spreadsheets currently utilized by MDT Finance and Audit staff).

D.2.4 Multi-Modal and Grants Management

The Grants Bureau within the MDT Rail, Transit and Planning Division is currently moving all of its grant programs to a multi-agency e-Grants application based on a COTS solution. This grants management application is intended to support the full lifecycle for managing a grant from grant application to evaluation, selection and then management of the grant award. Public Transit had previously utilized an inhouse developed application known as Public Transit Management System (PTMS), while the other grant programs utilized spreadsheets or other off-line tools.

The Aeronautics Division is currently completing implementation of an Aeronautics Suite to support all of its core business functions including grants management. This application was developed inhouse for Aeronautics by the MDT Information Services Division (ISD). While the Aeronautics grants management functionality was built within the same application framework as the functionality supporting other Aeronautics Division operations, MDT may want to assess the potential value of migrating the Aeronautics grants to the same applications platform that will support other MDT grants. The e-Grants application is based on a COTS solution, which should continue to be upgraded by the vendor over time, while MDT will need to maintain and enhance the custom developed grants solution within the Aeronautics Suite.

Likewise, the State of Montana is evaluating a statewide grants management initiative. MDT will need to monitor this project, and once designed and implemented, evaluate whether it will continue utilizing the existing multi-agency e-Grants initiative or migrate to the statewide solution. In fact, it is possible the statewide effort may impact the long-term sustainability of the current multi-agency effort. As such, MDT would benefit from being a participant in requirements and design workshops for the statewide solution. This would also be beneficial to the statewide initiative in terms of both being informed of MDT's unique requirements, as well as the lessons learned that MDT will obtain through the implementation and initial use of both the e-Grants program and the Aeronautics Suite.

D.2.5 Business Support Services

Budget functions are supported by the State Budgetary Accounting Reporting System (IBARS) and two inhouse MDT applications:

- Budget Development System, which supports the development of MDT's operating budget; and

- Personnel Services Budget Monitoring (PSBM) system, which tracks and supports forecasting of payroll expenditures.

Accounting and financial management functions are supported by the State of Montana's PeopleSoft based SABHRS Finance application and a set of inhouse developed agency applications, which provide for employee time capture and financial management and control at the level of detail required to manage MDT's construction program. Examples of these MDT applications include:

- Cost Accounting Record Entry System (CARES), which is the cost capture and cost accounting engine for MDT;

- Accounts Payable, which is used to capture, ensure proper coding and then support internal MDT reviews and approvals of accounts payable voucher invoices prior to transmitting to SABHRS;

- Billing Voucher, which manages billing for reimbursement to FHWA;

- State Share, which manages and tracks the State's share of a transportation project;

- Contract Tracking System, which manages and tracks contract balances;

- Employee Timesheet, which is utilized to collect employees time charged to MDT projects and overhead accounts; and

- Payroll System, which processes the employee time obtained on each timesheet and prepares it for transmission to SABHRS Human Capital Management (HCM) for final payroll processing and check generation.

MDT staff also utilize various partner agency systems such as: FHWA FMIS to manage obligation of Federal highway funds and request FHWA reimbursement; FTA's ECHO system to manage FTA reimbursement requests, and the United States Department of Transportation's DELPHI financial management system for NHTSA, FMCSA and Federal Aviation Administration reimbursements; and NHTSA's Grants Tracking System (GTS).

Overall, MDT appears to have strong transactional financial management and accounting systems. In addition, several interviewees reported that some of the systems have improved in terms of usability as result of their being migrated to a Web-based platform from Oracle Forms. One example of this is the Employee Timesheet.

At the same time, stakeholders reported that it is often difficult to obtain information from the financial systems to support management reporting and analytics. For example, there is a CARES reporting tool and an Accounts Payable reporting tool, which has been developed, but there is no Billing Voucher reporting tool. In addition, some of the forecasting and modeling tools (e.g., for revenue forecasting and cash forecasting) are currently spreadsheets. MDT has initiated a project to address these gaps through a Financial Suite application, which is intended to provide management reporting and analysis capabilities from MDT's financial system. Requirements definition has started for this project but the effort will now be moving at a slower pace than originally expected due to agency funding constraints.

In terms of Human Resource Management, MDT utilizes the state's SABHRS Human Capital Management solution, Oracle® Taleo, which was recently implemented for e-Recruiting, several agency systems and a number of offline spreadsheets. MDT human resource management systems include:

- Talent Management System (TMS); and

- Discipline and Grievance Management System.

MDT's Human Resource Division is currently focused on re-engineering the service delivery of HR functions within MDT. Technology has the potential to play a significant part in this re-engineering effort. Opportunities within the current HR systems include the potential for increased use of SABHRS functionality to allow replacing some MDT systems or off-line functionality. Stakeholders that were interviewed, who have worked at both MDT and other agencies and have a knowledge of SABHRS, believe there is a strong possibility that there is existing SABHRS functionality not utilized by MDT, which could benefit MDT HR Operations. In addition, from the project team's experience in other State DOTs, there is reasonable likelihood the existing PeopleSoft footprint could be expanded through, for example, additional modules to meet MDT business requirements. One potential area where expanded use of SABHRS may be appropriate is in Discipline and Grievance Management, allowing for replacement of a current inhouse MDT system, which is at the end of its functional life.

MDT HR is also seeking to implement a fully functioning Talent Management system with an initial focus on e-Learning. The Oracle® Taleo solution, a Cloud-based solution, which has been implemented for e-Recruiting, has the potential to provide other Talent Management

functions, including e-Learning. While the initial statewide deployment of Oracle® Taleo for e-Recruiting encountered some challenges within MDT, due in part to the deployment team not fully engaging MDT staff to understand MDT requirements coupled with limited end-user training during the system roll-out, Oracle® Taleo has the functionality to provide support for the full range of Talent Management System requirements and should be further evaluated.

In terms of records management, while MDT has a fairly well defined set of records management business processes, it does not actually have a records management system. This represents a gap in system functionality, which should be addressed in the intermediate term, potentially in conjunction with deployment of an enterprise content management strategy.

MDT's Research Section provides informational and research services to all MDT divisions, such as contracted research projects, deployment evaluation, literature searches, and surveys. The Research Section also shares information from other research entities with staff and shares MDT research information with others outside of MDT, using Transportation Research Board (TRB) resources, the National Transportation Library, and a research performance database. They also provide education and guidance in the utilization of research and resources. Research makes use of the MDT Contract Management System because it is required, in addition to tracking contracting and financial information manually in spreadsheets. These spreadsheets are reconciled monthly with CARES and SABHRS, and errors in CARES and SABHRS are subsequently transmitted to the appropriate MDT office. FMIS is used for pooled funds and special projects; however, beginning in federal fiscal year 2017, all research projects will be programmed individually in FMIS. They are gathering requirements for a research program and project management system, conducting gap analyses, and are considering alternatives, including vendor software such and software developed by other state DOTs. They use the Sirsi-Dynix integrated library system software and the OverDrive® application access to electronic and audio library content.

D.2.6   Information Technology

Application systems supporting IT Operations include:

- Trac, which is based on the JIRA COTS solution, for logging and tracking software bugs in existing systems;

- BuyIT, an inhouse developed program, for tracking IT procurements;

- ProgramIT, an inhouse developed work request system for logging requests for new system projects or enhancements to existing systems;

- Altiris, for asset management and endpoint management;

- AirWatch, for enterprise mobility management, a function which includes managing mobile devices, wireless networks, and other mobile computing services;

- MDT's Radio database to tracks assets comprising the radio system; and

- Microsoft Project, which is utilized as the project management tool on ISD led information technology projects to develop, monitor, and manage project plans.

D.3 DATA ARCHITECTURE

This subsection provides an overview of MDT's As-Is Data Architecture. The Data Architecture component is another part of the information systems architecture layer within an Enterprise Architecture. It describes the data standards for all of MDT's systems to support integration and information sharing between these systems. It also includes data administration policies and procedures, approaches for data collection, how data is stored and arranged, and the extent to which data is integrated and utilized in application systems.

MDT's existing data architecture environment is a set of silo systems from which it is difficult to share information between systems or obtain information for management reporting and analysis. Likewise, no formal Data Governance or Data Stewardship policies exist. Data Governance refers to the overall management of the availability, usability, integrity, and security of an organization's data. A Data Governance Program typically includes a governing body or council, a defined set of procedures, and a plan to execute those procedures. Data Stewardship is an element of data governance and refers to the management and oversight of an agency's data assets to assist business users with easy access to accurate, timely, and high quality data.

In addition, while MDT ISD has begun evaluating Business Intelligence (BI) tools, there is currently no Data Warehouse environment or suite of BI tools available for end-users to mine data for management reporting and analytical purposes. BI tools include various software products designed to allow users to access, retrieve, transform, analyze and report on data. The lack of Data Governance and Data Stewardship policies and procedures, and the lack of a data warehouse and business intelligence environment for ready access to department information, are significant gaps in terms of best practices.

D.4 TECHNOLOGY ARCHITECTURE

This subsection includes an overview of MDT's As-Is technology architecture. The technology architecture layer of an Enterprise Architecture describes the organization's technical infrastructure. This includes all non-application specific elements of an organization's IT environment. It includes elements such as application development languages; integration

technology; database technology; geospatial analysis tools (an essential element for a State Department of Transportation); document management; collaboration tools; security; network communications; and hardware platforms.

Most of MDT's legacy custom systems were developed as client/server applications using Oracle® Forms with Oracle as the database management system. MDT has now adopted JAVA as its development language for new applications and beginning to migrate older applications from Oracle Forms to JAVA. Currently, there is not a specific migration plan, but the existing Oracle code base is being retired as applications are migrated to a COTS solution, or re-developed as a custom application to address changes in user business requirements.

MDT has standardized on the Oracle database platform. Most applications are on Oracle 11G, with plans for migration to Oracle 12. There are some applications, however, such as the Document Management System, which are still running on Oracle 10G, creating challenges in providing on-going support for these applications.

MDT utilizes ESRI's ArcGIS platform as the department's Geographic Information System application toolset. It also utilizes Oracle® Spatial from a database management perspective. The ArcGIS capabilities reside within the Rail, Transit, and Planning Division, while ISD has responsibility for managing Oracle® Spatial.

As discussed in the context of Engineering's Document Management System (DMS) under Applications Architecture, there is no enterprise content management solution at MDT. MDT accomplishes document management through custom applications, such as DMS or the As-Built system, or through numerous shared file directories on the network. There are currently no enterprise standards for collaboration tools.

From a security/identity management perspective, MDT utilizes Active Directory and operates as a child domain within the State of Montana's forest. There is currently no single sign-on capability to applications, requiring MDT users to sign on and off various applications throughout the day. The lack of a single sign-on was raised by users in numerous interviews and in most validation sessions as a capability that needs to be addressed as a priority item.

MDT has a series of local area networks within its facilities, which are maintained by the MDT ISD. Wide Area Network capabilities are used to interconnect MDT facilities through the state network managed by SITSD.

MDT's server environment is located in the state's Data Center. MDT staff has responsibility for managing these servers. ISD interviewees reported that there is currently a "data recovery plan" in place, but no disaster recovery plan *per se*.

MDT does not currently have a Mobile Device Strategy. Individual business units are currently making mobile platform decisions based on what is the best solution to meet their specific business requirements. In addition, connectivity issues in various parts of the state complicate delivery of mobile solutions.

MDT also does not currently have a Cloud Computing Strategy though individual business units are evaluating Cloud solutions to meet business requirements. In addition, there appear to be some concerns on the part of SITSD, and other stakeholders, about security in cloud-based solutions that need to be addressed through a set of minimum standards established as part of a cloud computing strategy.

D.5 INFORMATION TECHNOLOGY ORGANIZATION AND GOVERNANCE

This subsection describes MDT's current information technology organization, staffing and governance practices.

D.5.1 MDT IT Delivery Capabilities

MDT's information technology delivery capabilities reside within four different units within the department:

- Information Services Division, which has responsibility for planning, designing, developing and maintaining most of the information technology systems for MDT;

- GIS application development and technology support for the Transportation Information System (TIS), RoadLog, Location Referencing System (LRS) and the Highway Performance Monitoring System (HPMS) applications reside within the Rail, Transit and Planning Division's Data and Statistics Bureau;

- Application support for various Engineering Division systems, such as Planisware® and the Document Management System, reside within the Engineering Division's Engineering Information Services Section; and

- Application support for the AASHTOWare™ Project software resides within the Construction Systems Section of the Engineering Division's Construction Administration Services Bureau.

In addition, some of the business units have engaged consultants as project managers to lead specific information technology application development efforts.

While there appear to be good working relationships and collaboration between staff to accomplish required work activities (for example data base support by ISD for AASHTOWare™

development efforts), there is limited formal coordination between these different IT competency centers. In addition, while ISD has developed a set of Information Technology Standards for the department, it is not clear that all of the MDT IT groups had the opportunity to contribute to the development and on-going update of these standards, nor is it clear that these standards are used by the different IT groups, or by contractors engaged by each of the IT groups.

The decentralized nature of the information technology delivery capabilities within MDT and the interrelationships between these different groups is an area the project team believes requires additional study by MDT executive management. It is clear from the interviews and workshops that the decentralization of some of the IT delivery capacity has tremendous benefits in terms of user satisfaction and service levels in specific business units. However, it is not clear given MDT's need to effectively marshal scarce resources that this approach is optimal from an overall enterprise perspective. At a minimum, strategies for greater coordination between the groups and ensuring collaboration in developing, leveraging, and consistently using enterprise standards are needed. From a best practices perspective, it is recommended that pure application development resources should be housed within the information technology unit. True Business Analyst resources may be housed organizationally in the information technology unit, sometimes co-located with the business staff they support, or be placed organizationally within a business unit with a liaison role back to application development resources within the information technology organization.

If the department decides to move to a centralized information technology strategy, the ISD will need to secure the necessary FTEs to accommodate the increased workload under the assumption that FTEs in the current decentralized IT model would not be reallocated to ISD. IT Project Managers should also be housed within the MDT Project Management Office in ISD, or if contracted for externally, should report to the PMO on a matrix-based reporting basis.

D.5.2   IT Staffing and Resourcing

Traditionally, MDT has been viewed within Montana state government as a leader and innovator in information technology and hence a preferred agency to work for. It is not clear from our stakeholder interviews of IT staff that this is still the case. Likewise, due to the number of information technology companies who have located within Montana, the marketplace for IT resources has become more competitive, making it more difficult for MDT and other state agencies to compete for IT resources. This results in positions often going unfilled for extended periods. This constraint on IT staffing is a consideration that needs to be addressed within the Strategic Enterprise Architecture Design. An example of a strategy, which may need to be considered in light of this challenge, is application-managed services, where an IT services firm is engaged to build, operate, and maintain the solution for MDT. Variants of this approach have been utilized by MDT supporting the Planisware® scheduling system and the AASHTOWare™

products where MDT can engage AASHTO's support vendor through the purchase of service units that provide a predetermined number of hours of vendor support.

D.5.3   IT Governance

There is an IT governance process in place to prioritize small application development efforts (less than 500 hours) within each Division. This process is driven by a liaison role between ISD and the business units that have been established in each division. Based on our observations from the interviews and validation sessions this small application development prioritization process appears to work reasonably well. However, there is no defined IT governance process for division liaisons to use for requesting work from IT systems. The request systems for user support or web enhancements are simple tickets without a defined prioritization or review process. Additionally, there is no IT governance practice to encourage division liaison interaction.

Larger projects (500 hours or greater) are supposed to be prioritized by Division Directors on a cross-divisional or enterprise basis. However, from the interviews and workshops, it does not appear that all MDT Divisions consistently participate in this process. This leads to project efforts launched within an individual division without clearly understanding all of the types of resources and support (database, infrastructure, etc.) that may be required by the project and the potential impact of doing a project that may have on other already approved projects.

Further, there were concerns raised by stakeholders during the interviews and workshops regarding how well scoped or defined projects are before they are submitted for review. This further suggests that projects may be reviewed and approved without a full understanding of the effort that will be required to execute the project. Likewise, some stakeholders indicated during the interviews that they did not understand the prioritization process or the reasons why some projects were approved and other projects were not.

The project team believes that establishing a strong Information Technology Governance process is a critical element to implementing and sustaining a Strategic Enterprise Architecture. This includes a clearly defined, well communicated, and well understood IT investment decision-making process that is consistently utilized across the enterprise by all business units.

D.5.4   IT Procurement

There appears to be a great deal of operational autonomy within MDT for information technology purchases. This flexibility can have the unintended consequence of an IT procurement being initiated without a full understanding of any prerequisites that may need to be in place to support the implementation of the acquired software or hardware component. Examples of unanticipated prerequisites might be the need for additional network bandwidth,

additional storage capacity, additional supporting software, or the availability of various staff to provide technical support during implementation. Further, this flexibility also carries the potential issues of acquiring duplicative technology, or technology that does not integrate well into the existing technology environment.

As a best practice, the project team would recommend that all information technology procurements be reviewed and approved by the department's Chief Information Officer (CIO) as the agency's senior information technology thought leader to ensure all potential issues and dependencies around a proposed IT acquisition have been thoroughly vetted. In many states in which our team has worked, this type of oversight is mandated by the State CIO, and oftentimes the State CIO, or designee, is also required to sign-off on technology procurements over a certain size, or that involve new types of technology.

D.5.5   Project Management

MDT has invested in developing a project management capacity with the establishment of a MDT ISD PMO within ISD. The project managers assigned to this group appear to be highly experienced. In addition, ISD has developed a set of project management methodologies based on the Project Management Institute's Project Management Body of Knowledge (PMBOK®). The ISD project managers are assigned to major projects delivered by ISD and some projects led by other divisions.

There does, however, appear to be a disconnect between ISD Project Management and ISD Applications with respect to traditional "Waterfall" project management approach embraced by ISD Project Management versus the "Agile" project management approach embraced by ISD Applications. Internal customers appear to be frustrated, perceiving traditional "Waterfall" to be needlessly bureaucratic. Decisions on approach based on the type of project need to be standardized and communicated, to ensure consistency, and eliminate unnecessary frustration.

As was discussed above in regards to standards, the project management standards developed by the ISD PMO are not utilized consistently on all MDT information technology projects.

E. CONCLUSIONS AND RECOMMENDATIONS

E.1 APPLICATIONS ARCHITECTURE

This section focuses on Applications Architecture recommendations by the eVision Partners team. The eVision Partners team has developed recommendations for each of the following functional areas:

- Transportation Project Delivery

- Maintenance and Asset Management

- Transportation Operations Management

- Multi-Modal and Grants Management

- Business Support Services

- Information Technology

E.1.1 Applications Architecture — Transportation Project Delivery

E.1.1.1 Implement Next Generation PPMS (AA-1)

The eVision Partners team recommends that MDT implement the next generation of a Program and Project Management System (PPMS).

The current Program and Project Management System (PPMS) has significant functional gaps and lacks clear business ownership. In response to this challenge, MDT has initiated a PPMS replacement project, which is currently in the requirements definition phase. It is recommended that MDT continue this project as planned and implement a next generation PPMS based on industry best practice that is tightly integrated with the MDT's Planisware® scheduling application. The new PPMS should also be designed to tightly integrate with MDT's asset management systems. The scope of the new PPMS should support the full project lifecycle as illustrated in Figure 6 from the identification of candidate projects through project selection and programming, the management, control and monitoring of the execution of the project through integration with Planisware® and project closeout activities.
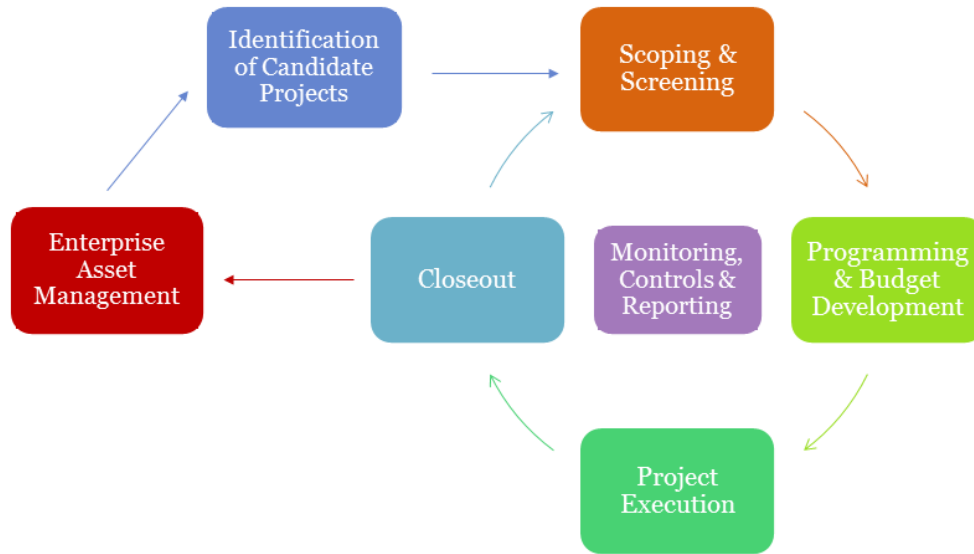
FIGURE 6: PPMS FUNCTIONAL SCOPE

Capabilities of the proposed PPMS solution will include:

- Project definition and tracking – The system would track each MDT project from project request to project completion and closeout. The system will support managing all MDT projects (construction projects, research projects, multi-modal grant programs, information technology projects, etc.);

- Unique Project Identification – Each project would be assigned a unique project identification project number, and would maintain project-related descriptive phase and category information;

- Work Break Down Structures (WBS) – These WBS elements would be configurable and multi-level, providing support for project, phase, task, activity, sub-activity, line item, and category;

- Project Templates – The system would support the ability to create and maintain a set of standard project templates for each major project type, thus ensuring consistency in project planning as well as providing a productivity tool for planning construction projects;

- Project Structure Creation – This feature supports the ability for copying in the WBS from another project or template, again ensuring consistency and providing productivity;

- Project Hierarchy – This supports the ability to have subprojects linked to a primary project and the roll-up of reporting of related subprojects;

- Establish Project Budgets – This provides the ability to allocate and track budgets at any WBS level as well as roll-up reporting at any WBS level;

- Track/Control Revenues and Expenditures – This supports tracking, management and control of the project against the established project budget;

- Record Expenditures – This feature supports, through integration with MDT's CARES application, the capability of recoding project cost information against the budget, managing pre-encumbrances, encumbrances, expenditures, anticipated revenues, and receivables;

- Integration with Planisware® – This would provide the ability to view schedule status including comparison of actual schedule performance against baseline schedule and support earned value analysis for a project including the calculation of schedule and cost performance metrics;

- Historical Project Data Drill Down and Linkages – This would provide inquiry through integration with CARES and the future PeopleSoft project accounting solution capability for a user to drill into project details such as time charges and payments stored in other systems;

- Workflow Capabilities – This would provide automatic workflow management throughout the system with automatic notifications when it is time to perform a specified task;

- Partner Self-Service Capabilities – This would provide support for project identification and query by MPOs and other local partners;

- Document Attachments – This would provide support for attaching various files types to each project as required during the project's lifecycle;

- Integration with the agency's Enterprise Content Management Solution – This would provide the ability to view documents created by the PPMS solution, along with all other agency content stored in the agency's ECM solution; and

- Integration with Microsoft® Office® – This would provide support for using Microsoft® Access®, Microsoft® Excel®, Microsoft® PowerPoint®, Microsoft® SharePoint®, and Microsoft® Word®.

E.1.1.1.1   Project Steps

Because of the breadth of the functionality of the proposed PPMS project which supports business functions in the Administration, Engineering and Planning divisions, implementation of

this new system should be guided by a governance team comprised of management from all MDT divisions with subject matter experts assigned to the project team from each division.

Figure 7 on the following page provides a timeline for the proposed PPMS implementation. This timeline assumes completion of the requirements definition phase, issuance of an RFP and selection of a software solution and systems integrator in calendar year 2016. Implementation is estimated to take approximately 18 months beginning in late 2016, with Go-Live of the new system by December 31, 2018.

ID	Task Name	Start	Finish	Duration	2016				2017				2018			
					Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	**PPMS Implementation**	**3/1/2016**	**12/31/2018**	**740d**												
2	Complete requirements, solution design & RFP	3/1/2016	9/30/2016	154d												
3	Evaluate and select solution	10/3/2016	2/28/2017	107d												
4	Configure, Test and Deploy Solution	3/1/2017	12/31/2018	479d												
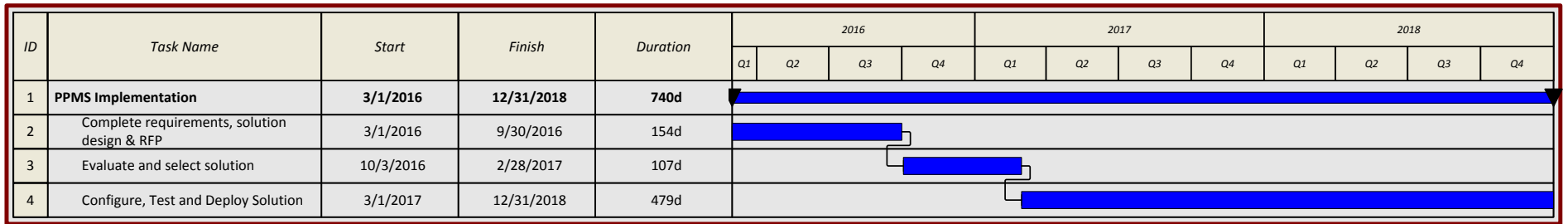
FIGURE 7: IMPLEMENTATION TIMELINE FOR IMPLEMENT NEXT GENERATION PPMS (AA-1)

E.1.1.2 Implement Next Generation TIS/LRS & Roadway Inventory (AA-3)

The eVision Partners team recommends MDT continue with their implementation of the new TIS/LRS and Roadway Inventory as a foundational element.

MDT utilizes ESRI's ArcGIS application as its GIS software. This software is an integral component of transportation planning activities. MDT has a custom developed Transportation Information System (TIS), Road Log and Location Referencing application, which is approaching the end of its functional life. MDT's Planning Division is currently defining requirements and planning for a new TIS/Roadway Inventory/LRS application, which will be a foundational element within the MDT applications architecture.

E.1.1.2.1 Project Steps

The eVision Partners team recommends the following steps:

- Continue with design and implementation of the new Transportation Information System, Location Referencing System and Roadway Inventory application as a foundational of the To-Be MDT Enterprise Architecture; and

- Establish multi-disciplinary governance team to guide effort.

A recommended implementation timeline is on the next page. This timeline is based on the completion of requirements definition and solution design in the fall of 2016, initiation of implementation in late 2016 and go-live for the new system by the end of June 2018.

ID	Task Name	Start	Finish	Duration	2016				2017				2018	
					Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1	**Implement Next Generation TIS/LRS and Roadway Inventory**	**3/1/2016**	**6/29/2018**	**609d**										
2	Complete Requirements & Solution Design	3/1/2016	9/30/2016	154d										
3	Evaluate and Select Solution	10/3/2016	12/30/2016	65d										
4	Configure, Test and Deploy Solution	1/2/2017	6/29/2018	390d										
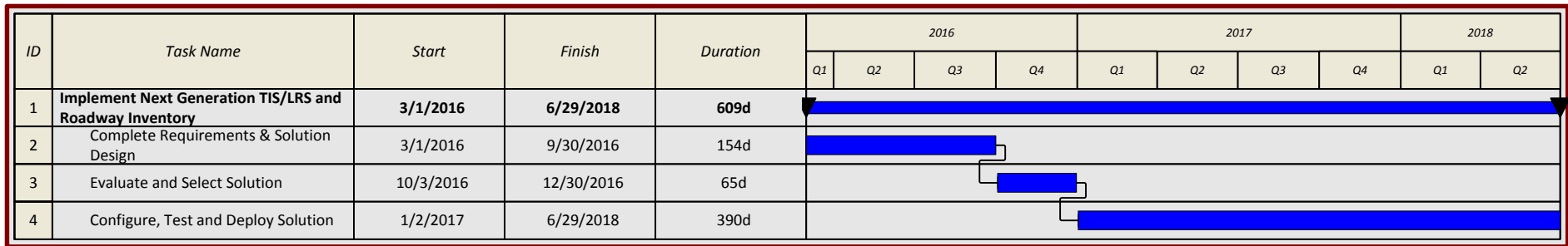
FIGURE 8: IMPLEMENTATION TIMELINE FOR IMPLEMENT NEXT GENERATION TIS/LRS & ROADWAY INVENTORY (AA-3)

E.1.1.3 Implement ROW, Utilities Relocation, and Outdoor Advertising system (AA-4, AA-15)

The eVision Partners team recommends the implementation of a Utilities, Right-Of-Way (ROW), and Outdoor Advertising System.

E.1.1.3.1 Right-of-Way Management and Utilities Relocation

A best practices ROW Management system would be an integrated solution supporting the full lifecycle of the acquisition processes for Right-Of-Way during construction projects and would include these supporting features (Parsons Brinckerhoff 2015):

- Tracking right-of-way phase project information;

- Identification of parcels that are acquisition candidates;

- Appraisal;

- Negotiation;

- Condemnation processes (when required);

- Business Relocation Services; and

- Residential Relocation Services.

A ROW management system would also include the following functionality and support:

- Provide support for tracking required utility relocation activities on a project along with various property management activities that may be performed by an agency;

- Provide support for integrated workflows, which automatically route or move a task to be completed from one step or user to another within the system based on predefined business rules;

- Provide the capability to generate the numerous required forms and letters within the system based on business rules; and

- A ROW management system would be integrated with an agency's financial management system to reduce redundant data entry and additionally be integrated with the agency's Enterprise Content Management solution.

The diagram shown in Figure 9 illustrates how the proposed ROW system would interface with other MDT systems and recommendations in this document.
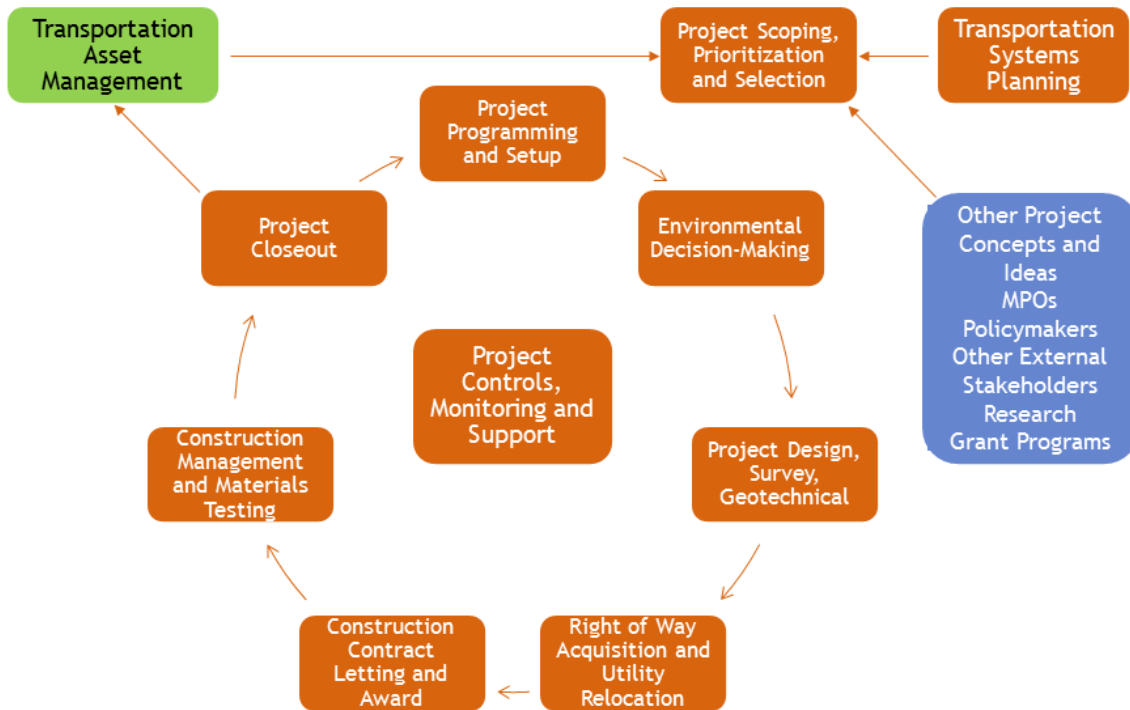
FIGURE 9: ROW SYSTEM INTERFACES WITH OTHER MDT SYSTEMS

E.1.1.3.2   Outdoor Advertising Control

The Outdoor Advertising Control application is approaching the end of its technical life. The interviews conducted by the eVision Partners team surfaced significant challenges loading data from the field data collection application into the main database. Users of the system also requested various data collection and location referencing enhancements.

The eVision Partners team recommendation is to evaluate software solutions already licensed by MDT to determine whether one of these solutions would prove to be a viable solution. From our team's experience in other states, there are several solutions already licensed by MDT, which may be configurable or extendable to support this function.

If this approach does not meet MDT's requirements, there are COTS products designed specifically to support Outdoor Advertising. However, this approach would likely prove to be more expensive, as it would require a larger implementation effort. The minimal key data elements needed for a Best Practice Outdoor Advertising and Salvage Yard System consists of the following:

- Maintain an inventory of outdoor advertising signs:
    - Store owner/licensee;
    - Store permit number;

- o Store sign type;

- o Store number of sign faces;

- o Store permit issued date;

- o Store permit expiration date;

- o Store location of sign in terms of left or right of centerline along with station number; and

- o Integrate with ERP accounts receivable to manage billing and collection of required outdoor advertising licensing and permit fees.

- Maintain an inventory of salvage yards:

  - o Store owner/licensee;

  - o Store permit number;

  - o Store permit issued date;

  - o Store permit expiration date; and

  - o Integrate with ERP accounts receivable to manage billing and collection of required salvage yard licensing fees.

E.1.1.3.3   Project Steps

The eVision Partners team recommends the implementation follow the phases described below:

- Project Pre-planning — Develop an RFP and select a consultant to assist the team to develop the systems requirements, perform the fit-gap analysis, and consulting services to develop an RFP for the systems solution and a systems integrator.

- Requirements Definition — Develop detailed systems and interface requirements to guide an integrator's delivery of a system that will meet the business needs and provide the interconnectivity needed for other MDT systems.

- RFP(s) — Develop necessary RFPs for a software solution (if required) and integrator resources.

- Implement — Implement the system and begin production support.

The recommended implement timeline is on the following page.

ID	Task Name	Start	Finish	Duration	2016			2017				2018				2019				2020				2021				2022				2023	
					Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1	**Utilities, ROW, & Outdoor Advertising**	**7/2/2018**	**4/11/2023**	**1247d**																												
2	Requirements Definition	7/2/2018	12/28/2018	130d																												
3	RFP	12/31/2018	6/28/2019	130d																												
4	Implement Utilities	7/1/2019	10/1/2020	329d																												
5	Implement ROW	10/2/2020	1/5/2022	329d																												
6	Implement Outdoor Advertising	1/6/2022	4/11/2023	329d																												

FIGURE 10: IMPLEMENTATION TIMELINE FOR IMPLEMENT UTILITIES, ROW, AND OUTDOOR ADVERTISING SYSTEM (AA-4, AA-15)

E.1.1.4 Extend Planisware® to support resource management (AA-5)

The eVision Partners team recommends MDT's plans to extend Planisware® functionality.

The MDT Planisware® scheduling solution as currently implemented at MDT does not provide resource management functionality. While Planisware® has the capability to perform resource management this functionality has not been configured and deployed for MDT.

The lack of resource management capabilities within MDT's current version of Planisware® makes it difficult for a functional discipline (such as Right-of-Way or Geotechnical) to roll-up resource requirements across multiple projects and get a true picture of the demand for resources to support delivery of MDT's capital program. To address this gap, it is recommended that the resource management functionality be configured, tested, and deployed. The implementation of this recommendation will not only require software configuration work and testing but business process decisions from MDT in terms of how this functionality should be deployed to support resource management at a program level.

E.1.1.4.1 Project Plans

A proposed implementation timeline is on the following page.

ID	Task Name	Start	Finish	Duration	2016			2017				2018				2019				2020				2021	
					Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1	**Implement Resource Management capability in Planisware®**	**7/1/2016**	**3/29/2019**	**716d**																					
2	Requirements Definition	7/1/2016	12/30/2016	131d																					
3	Implement	1/2/2017	3/29/2019	585d																					
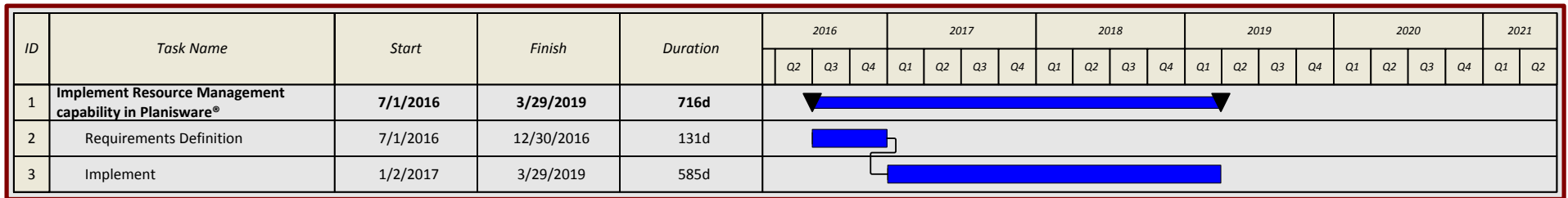
FIGURE 11: IMPLEMENTATION TIMELINE FOR EXTEND PLANISWARE® TO SUPPORT RESOURCE MANAGEMENT (AA-5)

E.1.1.5 Reengineer As-Built Process (AA-6)

The eVision Partners team recommends MDT reengineer as-built processes to more effectively utilize available technologies. Re-engineering must also consider the impact of 3D design and asset management requirements. Updating MDT's current as-built process will enable the agency to obtain accurate and electronic as-built drawings promptly at the end of a project.

The key improvements expected from this recommendation over current processes include:

- Receiving as-built drawings during the course of the project to clearly document changes as they are made, and then submitting a complete set of as-built drawings promptly after final construction/contract acceptance;

- Design drawings shall be kept up to date throughout construction to aid in the preparation of accurate as-built drawings; keeping documents up to date as the project progresses is important to make them useable for all parties throughout construction; and

- Require electronic as-built drawings along with project properties and attributes, which will allow MDT to quickly retrieve the information.

Re-engineering as-built process would require the following considerations:

- Review current contract requirements for as-built drawings for timeliness, format and attributes;

- Update contract requirements for projects to require electronic drawings, identifying the following:

  - Format (AutoCAD vs. MicroStation);

  - 2D vs. 3D;

  - Project types that require electronic as-builts (all projects vs. projects above a certain dollar threshold); and

  - Data requirements (including accuracy requirements).

- Review projects where 3D drawings would benefit future tracking—including for asset management activities—and require the provision of 3D drawings; and

- Define the attribute information that will assist with asset management (e.g., location, length/width, type of material, etc.).

The key benefits of an improved as-built process would include the following:

- More consistent and accurate as-built documents that will become key resources for future planning, maintenance and management of assets, as well as references for future improvements/projects;

- Improved access and retrieval of asset data with a more portable data format;

- Reduced effort to translate data; and

- Facilitating faster project closeout and payment release.

E.1.1.5.1 Project Plan

A proposed implementation timeline is on the following page.

ID	Task Name	Start	Finish	Duration	2016			2017				2018				2019				2020				2021	
					Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1	**Reengineer As-Built Process**	**7/3/2017**	**4/30/2019**	**477d**																					
2	Process Reengineering	7/3/2017	12/29/2017	130d																					
3	Solution Design	1/1/2018	4/30/2018	86d																					
4	Requirements Definition	5/1/2018	6/29/2018	44d																					
5	Implement	7/2/2018	4/30/2019	217d																					
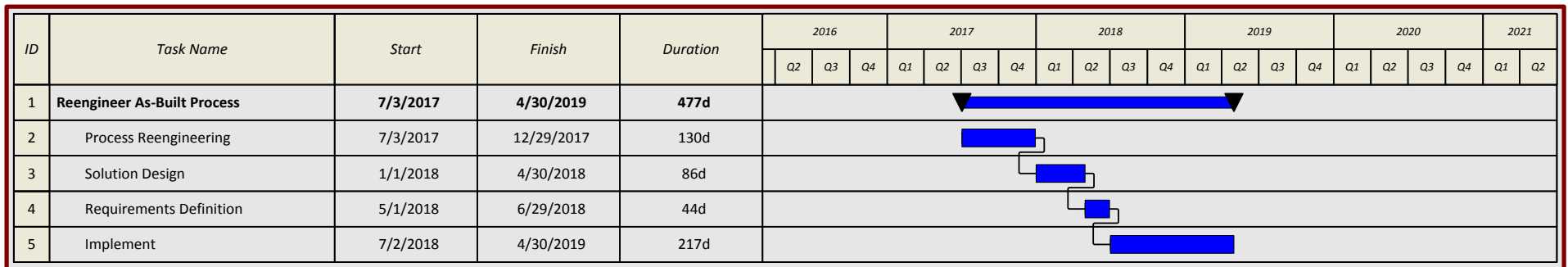
FIGURE 12: IMPLEMENTATION TIMELINE FOR REENGINEER AS-BUILT PROCESS (AA-6)

E.1.1.6　Establish and Implement Design Model Strategy (AA-7)

The eVision Partners team recommends that MDTT establish and implement a CADD/3D and GIS integration strategy and begin piloting a phased deployment based on the defined strategy.

Establishing and implementing a design model strategy will enable MDT to leverage 3D and GIS technology to improve overall design quality and accuracy, and improve the as-built documentation process. This design model strategy will act as a precursor to requiring contractors to provide electronic as-built drawings.

This recommendation involves:

- Identifying electronic design standards (standard symbols, electronic format, etc.) for preparing design models;

- Identifying location attributes required for asset management and other purposes;

- Piloting standards on test projects and recording the benefits, challenges, and lessons learned; and

- Updating standards based on pilot projects and then expanding the use of these design standards to major projects and eventually, all projects.

The key benefits would include:

- Improved tracking of project as-built drawings, along with attribute data to assist with asset location and tracking;

- Enabling future changes to assets as well as increasing the efficiency of construction activities through integration of 3D drawings with downstream applications, such as automated machine guidance (AMG) equipment for earthwork and paving operations;

- Enhancing quality assurance; and

- Access to detailed geospatial data.

E.1.1.6.1　Project Steps
The proposed implementation timeline is on the following page.

ID	Task Name	Start	Finish	Duration	2016			2017				2018				2019				2020				2021				2022	
					Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1	**Implement Design Modeling Strategy**	**7/3/2017**	**6/30/2021**	**1043d**																									
2	Define Strategy	7/3/2017	12/29/2017	130d																									
3	Requirements Definition	1/1/2018	4/30/2018	86d																									
4	RFP	5/1/2018	6/29/2018	44d																									
5	Implement	7/2/2018	6/30/2021	783d																									
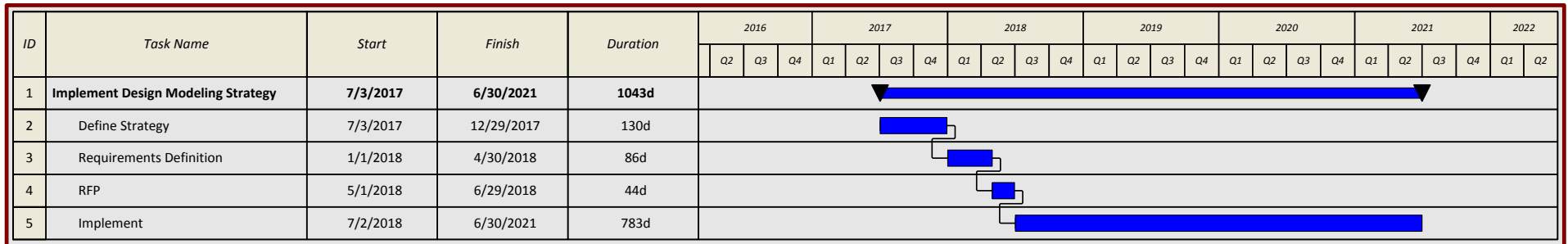
FIGURE 13: IMPLEMENTATION TIMELINE FOR ESTABLISH AND IMPLEMENT DESIGN MODEL STRATEGY (AA-7)

E.1.1.7 Implement AASHTOWare™ Project Construction & Materials (AA-8, AA-9)

The eVision Partners team recommends MDT continue their implementation of AASHTOWare™ Project Construction and Materials as planned.

There are significant opportunities to build on MDT's prior implementation of SiteManager to further automate and streamline construction management processes. Inasmuch as MDT did not implement Laboratory Information Management System (LIMS) functionality as a part of its prior SiteManager implementation, the eVision Partners team recommends that this functionality be implemented now, as a part of this project using AASHTOWare™ Project Construction and Materials.

E.1.1.7.1 Project Steps

A proposed implementation timeline for this recommendation is on the next page.

ID	Task Name	Start	Finish	Duration	2016			2017				2018				2019				2020				2021	
					Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1	**Implement AASHTOWare™ Project Construction & Materials**	**3/1/2016**	**1/1/2019**	**741d**																					
2	Requirements Definition	3/1/2016	3/1/2017	262d																					
3	Implement	3/2/2017	1/1/2019	479d																					
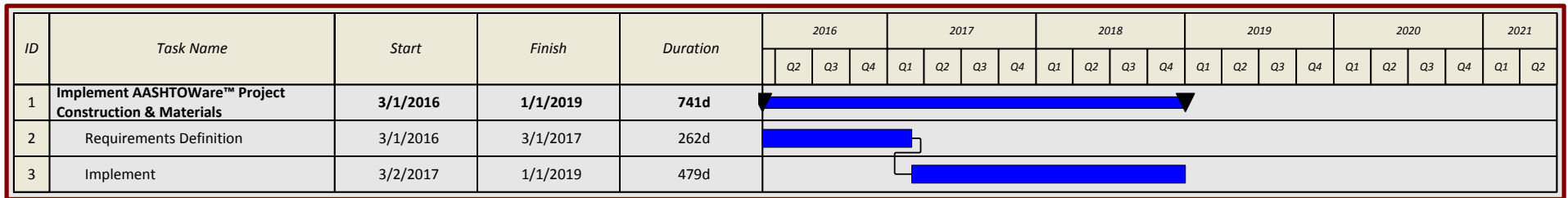
FIGURE 14: IMPLEMENTATION TIMELINE FOR IMPLEMENT AASHTOWARE™ PROJECT CONSTRUCTION & MATERIALS (AA-8, AA-9)

E.1.2 Applications Architecture — Maintenance and Asset Management

This subsection addresses the four Application Architecture recommendations related to Maintenance and Asset Management for MDT.

E.1.2.1 Define Enterprise Asset Management Strategy (AA-10)

The eVision Partners team recommends MDT define and implement an Enterprise Asset Management Strategy.

MDT has an interest in creating an integrated Asset Management System with benefits that are referenceable. During the interviews and subsequent workshops, some of the business requirements, key benefits, and business drivers that surfaced included:

- Single point of data entry reducing staff time, improving data quality, and data consistency;

- Clearly identified data ownership from an organizational and system perspective, improving the ability to access data and support standardized processes, and centralized location for data across MDT applications;

- Consistency of Business Rules/Processes;

- Ability to share or view work plans, such as viewing PMS work plans in MMS for planning and scheduling;

- Elimination of silos across people, data, and strategies;

- Shared access to data to increase collaboration in achieving common organizational goals and metrics;

- Dashboards, metrics, and standardized outcomes for transparency and proper management for managing defined goals;

- Meet mandatory FHWA requirements for improving data integration between asset management systems[1];

- An EAM Systems Strategy providing data integration between individual asset management systems (bridge, pavement, safety, and the next generation maintenance management system) supporting agency business requirements defined in the MDT transportation asset management plan, which would include:

---

[1] The Moving Ahead for Progress in the 21st Century Act (MAP-21) requires each DOT develop and use a transportation asset management plan that will drive business requirements for enhanced analytical capabilities in the department's core asset management systems (at a minimum affecting bridge, pavement, and safety), and calls for improved data integration between these asset management systems. (US Department of Transportation, Federal Highway Administration 2012)

o   Ability to share the Asset Class Inventory (description, location, and attributes) to support geographic and data searches showing all assets (or a filtered asset type) based on a set of criteria, such as corridor, geometric shape, and data fields (such as Asset Name, Asset Date of Installation, Asset Type, Asset Condition, etc.);

o   Ability to share the Asset Class Annual Plan to ensure the proper coordination and timing of projects across the network (for example, ensure that a pavement overlay project for a given location that overlaps with a maintenance work order to repair a leaking pipe is sequenced properly to avoid ripping up newly paved roadway);

o   Ability to feed analytics to with asset inventory, location, and condition data, to optimize the set of projects resulting from the analysis; and

o   Ability to generate maintenance and other work orders by asset class system in response to inspections, MDT observations, and/or citizen service requests.

- A centralized data repository supporting a holistic view to asset data at a high-level, including viewing bridge and pavement condition data and planned projects on a map.
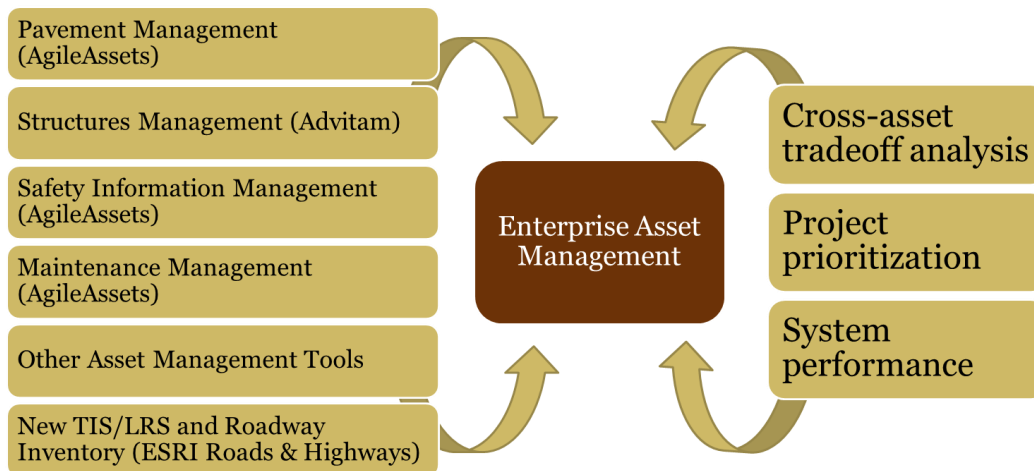
FIGURE 15: ENTERPRISE ASSET MANAGEMENT INTEGRATION

The eVision Partners team recommendation calls for development of a clear policy for asset management vision, definition, and system/tools of the functionality required to achieve this vision, depicted in Figure 15. As such, the following elements should be included in the recommendation and resulting vision:

- Alignment to the TAMP;

- Inclusion of data from new construction in the asset management vision;

- A focus on integrating data from new construction into asset management systems and processes supported by data/design models, such as design drawings, as-built, material testing data; and

- A linkage to projects in PPMS and the asset system, such as Pavement, Bridge, and so forth, back to impacted assets.
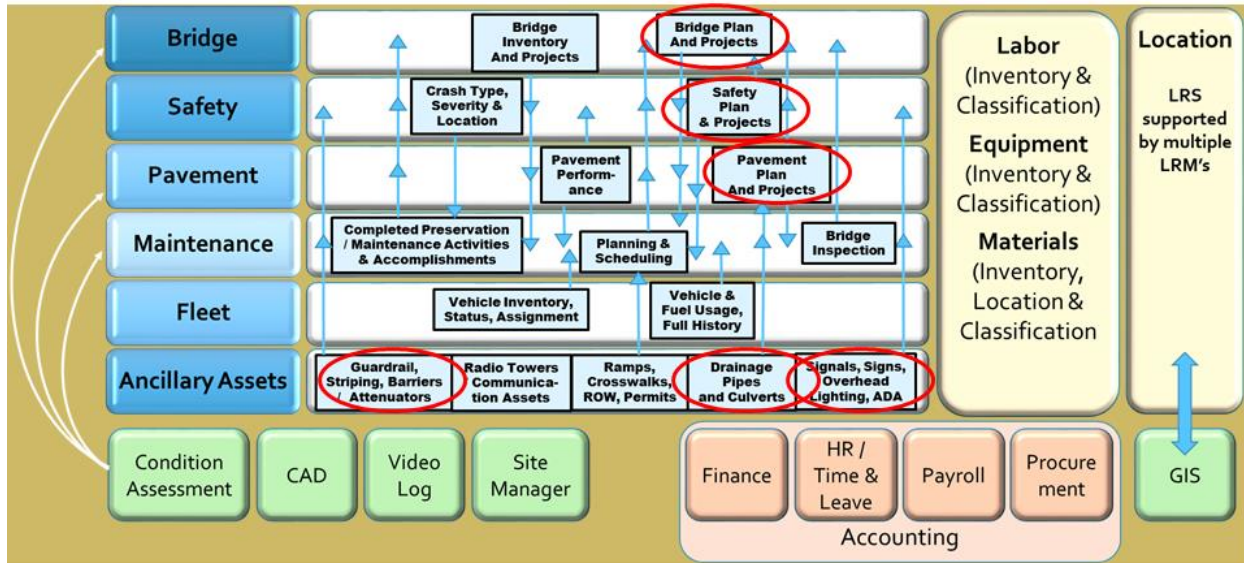
FIGURE 16: ENTERPRISE ASSET MANAGEMENT SHARING

Figure 16 indicates industry best practices for business requirements and integration related to Asset Management data. Table 8 illustrates the integration flows also found in best practices.

TABLE 8: ASSET MANAGEMENT DATA SHARING OPPORTUNITIES

Owning Source	Data Shared System	Description of Data and usage
AMS	ALL	Asset ID, Location, condition and attribute data
AMS	AMS	Share the Safety, Pavement, Bridge and Maintenance work plans and condition data to avoid wide gaps between assets (for ex. Pavement project vastly improving road, but leads to a bridge in poor condition and approach)
AMS	PMS	Ancillary Structures (pipes) -> PMS: Integrate with transportation asset Inventory to capture, store, view and retrieve all existing drainage structures including their size, length, material type, condition, estimated remaining life before replacement and any existing problems.
BMS	MMS	Integrate bridge inspection and maintenance crew activities using Maintenance Staff (pull over activities and dates into MMS for crew assignment and once completed the MMS crew leader will update both MMS and BMS systems, if possible feed the BMS updates from MMS).
ERP	AMS	Integrate accounts payable, accounts receivable and billing, asset management, cost accounting and cost allocation, facilities management, fleet management, inventory, leave accounting, learning management personnel administration, procurement and time and labor (21).

Owning Source	Data Shared System	Description of Data and usage
ERP	AMS	Integrate with ERP purchasing and accounts payable functions to track part inventory purchases by vendor, vendor location, purchase order number, vendor invoice or procurement card transaction number.
ERP	AMS	Integrate with videolog system to allow linkage to and display of video images and attribute data obtained from video logs as a "drive down that section of road" feature.
ERP	AMS	GIS for updates to LRS including updates to event data (requires multiple LRMs and means to run Asset Management Programs synchronization separately and managing asset classes through user defined segments (known as maintenance or pavement sections, bridges as points or beg/end locations).
ERP	AMS	Integrate with ERP purchasing and accounts payable functions to track part inventory purchases by vendor, vendor location, purchase order number, vendor invoice or procurement card transaction number.
Grants Management	MMS	Integrate with grants management system to provide a list of State grants provided to a port facility and allow drill down to obtain more detailed information about a specific grant.
Materials Testing	PMS	Materials Testing Repository: retrieving documents/data associated with a pavement assets including: boring log and other information about test cores; geo-technical test results; and design plans and specifications.
Materials Testing	PMS	Import and store test and research pavement sections from Federal Highway Administration (Long Term Pavement Performance) research databases.
MMS	BMS	Integrate with the maintenance management to obtain, display and utilize in various analyses a history of maintenance activities and bridge condition including both internal and contracted maintenance work.
MMS	ERP	Integrate with accounts receivable to manage billing and collection of required outdoor advertising licensing and permit fees and Logo Signs.
MMS	ERP	Integrate with accounts receivable to manage billing and collection of required salvage yard licensing fees.
MMS	Facilities	Integrate with Facilities management system to link to additional facility specific attributes and condition assessments.
MMS	PMS	Multi-Direction Share Pavement Projects and Maintenance Plans/Activities to assist coordination and timing (avoiding a striping project being obliterated by a soon to follow pipe replacement or thin overlay).
MMS	PMS	Once maintenance activity is completed, notify PMS. PMS to update asset with history and asset condition.
PMS	STIP	Candidate projects for use in what if analysis in STIP function (PMS outbound)
PPMS	AMS	Integrate with Accounting/Project Management System(s) to obtain budget information and approved projects that deprecate from that budget.
PPMS / SiteManager	MMS	Integrate project management / Construction Data (SiteManager™) to obtain and display information and utilize information in analyses about current or planned construction projects. Information should include construction limits, project scope, year in program and estimated cost.
Road Condition Survey	PMS	Road Condition Surveys - investigate ways to combine Pavement and Maintenance roadway surveys to perform a single pass (pavement collection across entire state network every 2 years), single source supporting both pavement sections and maintenance sections and assets.
SiteManager	BMS	Access to Construction Management application to obtain and display construction history for the structure and use in analysis.
TIS/LRS	AMS	GIS for updates to LRS including updates to event data (requires multiple LRMs and means to run Asset Management Programs synchronization separately and managing asset classes through user defined segments (known as maintenance or pavement sections, bridges as points or beg/end locations).
Video Log	AMS	Integrate with Video Log system to allow linkage to and display of video images and attribute data obtained from video logs as a "drive down that section of road" feature.

As MDT matures its processes, such as data governance/stewardship and technology governance, MDT can begin to shift focus to techniques and tools for analyzing how to best influence the overall Transportation Infrastructure Network using key elements from their integrated asset management program. This will allow MDT to optimize investments and

analyze the network's performance based on time, budget, and resource constraints. With respect to Asset Trade-Off Analysis and Portfolio Management, forecasts for the next five or more years could be folded into future recommendations for long-term consideration and planning.

The recommended concept is to use the analysis and project building tools and features within each asset management system (with a primary focus on bridge, pavement, and safety systems) to develop a set of projects composed of related criteria across these asset classes. Included criteria would consist of:

- Planning horizon (2 - 20 years);

- Budget (typical or desired budget); and

- Performance or level of service utility function, across bridge, pavement, and safety.

The recommended Asset Trade-Off Analysis and Portfolio Manager Tool would use these sets of projects from each asset system to optimize the overall transportation infrastructure network based on time, budget, and performance, constrained at the enterprise level or across all asset classes, rather than the asset class level. This analysis would perform numerous analysis runs, each run within an asset class to perform an overall network level analysis. Additionally, if funds were available for preservation or maintenance work (or budgets were reduced), this tool could provide the analysis to identify projects to be funded or pulled from the authorized list of projects for the planning year.

In short, this would be an extremely powerful analysis tool; however, it would be dependent on stable and mature asset management systems to provide reliable and trustworthy sets of project data based on condition and deterioration curves for configuration analysis. Therefore, it is necessary to get all of the largest assets and systems (bridge, pavement, and safety) to the same level of maturity and stability, which will take time to achieve.

Figure 17 illustrates how project sets from each asset class would be used in this type of Asset Trade-Off Analysis Tool. Further, it illustrates how sets of projects can be modified during this high-level analysis and similarly changed in the asset class software system, potentially being further refined or directly consumed by the Asset Trade-Off Analysis tool.
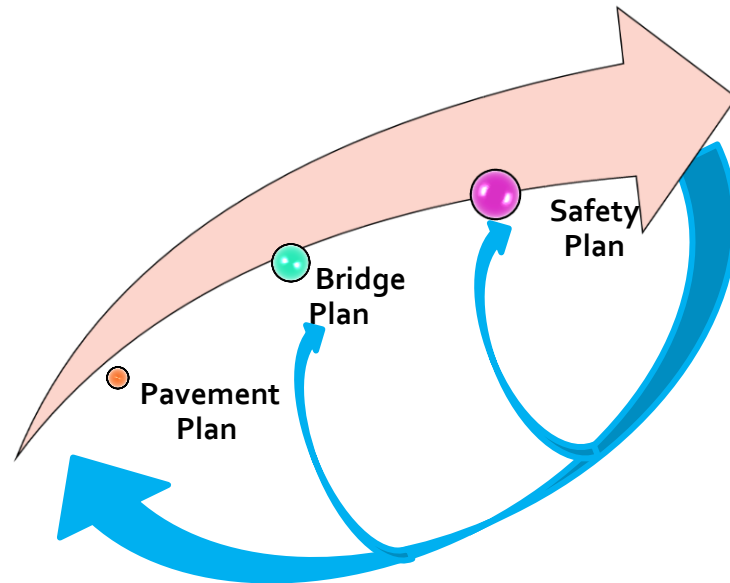
E.1.2.1.1 Project Phases

The eVision Partners team recommendation for project implementation includes the following steps:

- Prioritize integrations and identify dependencies;

- Identify MDT owned solutions or new COTS solutions for the central data repository for general access to the high-level asset data;

- Develop the strategy and resource requirements; and

- Develop an implementation plan with a phased implementation to drive value from the integrations.

The proposed implementation timeline is on page 84 (Figure 18). The proposed timeline consists of three stages:

- Definition of requirements, design, development, and testing of a Transportation Asset Warehouse to provide a GIS-enabled, one-stop source for asset inventory and condition assessment information for various MDT functional disciplines. The Transportation Asset Warehouse will integrate with existing MDT systems that serve as the system of record for various asset classes. It may also serve as the system of record for some assets, which do not currently have a home system. It is envisioned that work on designing and developing this application would commence in the near-term (likely by the end of calendar year 2016) with implementation by June 30, 2018;

- Asset management business policy and process work required to establish the To-Be asset management business model consistent with MAP21 over the next several years; and

- Based on the business policy and process work and the MDT To-Be Asset Management business model, definition of requirements, design, and implementation of cross-asset analysis capabilities beginning in 2020, as the business needs are more clearly understood and the capabilities available in the marketplace mature sufficiently to meet those needs.

ID	Task Name	Start	Finish	Duration	2017				2018				2019				2020				2021	
					Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1	**Implement Transportation Asset Warehouse**	**1/2/2017**	**6/30/2021**	**1173d**																		
2	Define requirements and prepare RFP	1/2/2017	4/28/2017	85d																		
3	Evaluate and select systems integrator	5/1/2017	7/31/2017	66d																		
4	Implement solution	8/15/2017	3/29/2019	424d																		
5																						
6	**Develop Transportation Asset Management Policies and Strategies**	1/2/2018	6/28/2019	389d																		
7																						
8	**Implement Cross Asset Analysis Toolset**	**9/2/2019**	**4/30/2020**	**174d**																		
9	Define Requirements and Prepare RFP	9/2/2019	12/31/2019	87d																		
10	Evaluate and select solution	1/2/2020	4/30/2020	86d																		
11	Implement solution	5/15/2020	6/30/2021	294d																		

FIGURE 18: IMPLEMENTATION TIMELINE FOR ASSET MANAGEMENT STRATEGY (AA-10)

E.1.2.2 Extend SIMS functionality (AA-11)

The eVision Partners team recommends MDT extending the functionality in the Safety Information Management System (SIMS) to support multi-disciplinary safety information including:

- EMS run tickets;

- Trauma Registry; and

- Conviction Data.

This recommendation is in alignment with proposed Safety Management system enhancement projects in the State of Montana Traffic Safety Records Plan.

Additional best practices and data integration recommendations for the MDT Safety Management System within the seven-year enterprise architecture planning horizon include:

- Integrate road inventory and pavement history data as a basis to understand safety risk and events (For example, crashes on road curves exceeding design specifications or intersections that require signals identified in planning but missed in design or in execution and sharing crash data with Maintenance to support statewide repair cost recuperation from insurance companies.):

  o Integrate crash history with pavement condition to determine pavement conditions that contribute most to crashes;

  o Integrate pavement condition with crash reports to determine distress type, which may contribute to the number of crashes; and

  o Temporal data from the Pavement Management System to view road condition data as of the date of a crash.

- GIS for crash history information;

- CADD/3D modeling environment for design documents/data and updates since initial installation;

- Integrate asset inventory and maintenance history information to obtain and display history of maintenance activity at or in the proximity of the crash site;

- Integrate with Department of Justice driver license information for driver history involved in a crash and driver traffic conviction history; and

- Integrate with motor carrier citation information to track issued motor carrier citations.

E.1.2.2.1   Project Phases

The recommended project steps include:

- Coordinate with other State of Montana agencies to define and implement data governance required to access the multi-disciplinary safety information;

- Prioritize information sets and identify dependencies (business processes, technology, method of exchange, and so forth);

- Develop strategy and resource needs, develop detailed implementation plan with phased implementation to drive value from inclusion of data;

- Develop process to align planned SIMS enhancements with Annual Safety Plan and the Traffic Records Plan.

A proposed implementation timeline is on the following page.

ID	Task Name	Start	Finish	Duration	2018		2019				2020				2021				2022	
					Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1	**Extend Sims Functionality**	**7/1/2019**	**6/30/2021**	**523d**																
2	Requirements Definition	7/1/2019	8/30/2019	45d																
3	RFP	9/2/2019	11/1/2019	45d																
4	Implement	11/4/2019	6/30/2021	433d																
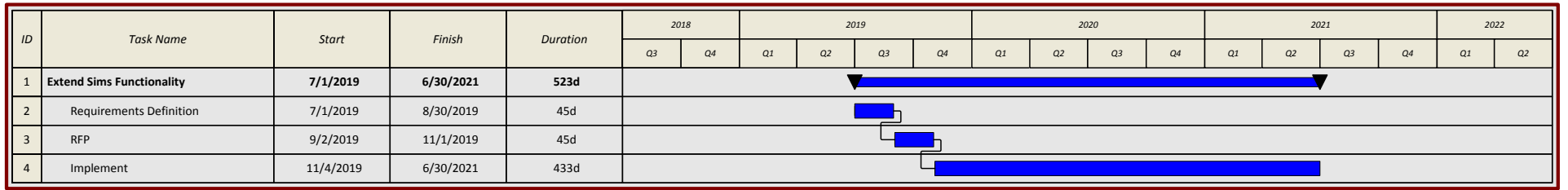
FIGURE 19: IMPLEMENTATION TIMELINE FOR EXTEND SIMS FUNCTIONALITY (AA-11)

MDT Strategic EA Final Report

E.1.2.3 Implement Modeling and Analytics for Structures (AA-12)

The eVision Partners team recommends that MDT implementing modeling and analytics support structures, and evaluate capabilities of Advitam ScanPrint IMS in meeting its requirements.

Bridge Modeling and Analysis best practices, along with the typically expected features, include support for the following:

- Deterioration models;

- Alternatives identification;

- Level-of-service criteria;

- User cost estimation;

- Maintenance cost minimization; and

- Multi-period optimization

The eVision Partners team recommends MDT continue its work defining its requirements for bridge modeling and analysis with Advitam, including support for the above list of best practices as well the functionality detailed in Table 9.

TABLE 9: BRIDGE MODELING AND ANALYSIS FEATURES

Functionality	Functional Description / Requirement
Deterioration Models	Maintain complete historical record of inventory characteristics, condition, and maintenance and improvement actions, as well as associated costs for each structure. The information should be capable of estimating and updating lifecycle costs and deterioration models.
Deterioration Models	Provide set of deterioration and optimization models which utilize the bridge inventory, inspection and appraisal data to project future conditions and recommend candidate projects based on various user-defined priorities and parameters.
Deterioration Models	Provide deterioration models which project the nature, extent and severity of deterioration of each element.
Deterioration Models	Provide deterioration models which project overall condition of a bridge and condition ratings for the deck, superstructure and substructure.
Deterioration Models	Ensure deterioration models reflect most current updates to bridge inventory or inspection information or maintenance work performed.
Improvement Models	Support various improvement models including rehabilitation (widening, raising, strengthening), replacement and maintenance.
Improvement Models	Log reasons for changes to cost estimates for candidate projects over time (inflation, scope change, introduction of new technology, enhanced cost estimating models, etc.).
Reporting	Support ability to download information to an external cost estimating model.
Integration	Integrate with ERP purchasing and accounts payable functions to track part inventory purchases by vendor, vendor location, purchase order number, vendor invoice or procurement card transaction number.
Configuration	Allow system administrator or other authorized user to revise parameters and formulas for running the analytical models through a table-driven online function.
Analysis	Support use of other constraints in modeling such as federal funding limitations, matching ratios, level-of-service criteria, or minimum allocations of funds to districts.

Functionality	Functional Description / Requirement
Deterioration Model	Ensure the optimization model accounts for structure deterioration, traffic growth, agency and user costs and the time value of money.
Analysis	Consider immediate and future costs and benefits of the various courses of action and their effects on future conditions. In particular, the model weighs the benefits of preventative maintenance versus costlier (but less frequent) corrective maintenance.
Reporting	Produce reports concerning the input data, intermediate results deemed important such as the results of formula or cost calculations, and the final results of computer runs for various model scenarios.
Configuration	Allow system administrator or other authorized user to revise parameters and formulas for running the analytical models through a table-driven online function.

E.1.2.3.1   Project Phases

The eVision Partners Project Team recommends the following steps:

- Complete bridge modeling and analysis business requirements;

- Conduct formal gap/fit assessment with Advitam;

- Collaborate with other agencies utilizing Advitam to obtain any lessons learned. As an example, the New York Metropolitan Transportation Authority Bridges and Tunnels (B&T), another organization using Advitam IMS ScanPrint for asset inventory and condition assessment at some of its facilities, is launching an alternatives analysis study to assess the feasibility of developing analytical capability within in Advitam or whether it needs to look at other software solutions within a recently acquired MTA-wide enterprise asset management software solution; Eon plan; and

- Implement functionality in a phased approach.

The proposed implementation timeline is on the next page.

ID	Task Name	Start	Finish	Duration	2018		2019				2020				2021				2022	
					Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1	**Implement Modeling & Analytics for Structures**	**1/1/2019**	**6/30/2020**	**391d**																
2	Requirements Definition	1/1/2019	3/4/2019	45d																
3	RFP	3/5/2019	5/6/2019	45d																
4	Implement	5/7/2019	6/30/2020	301d																
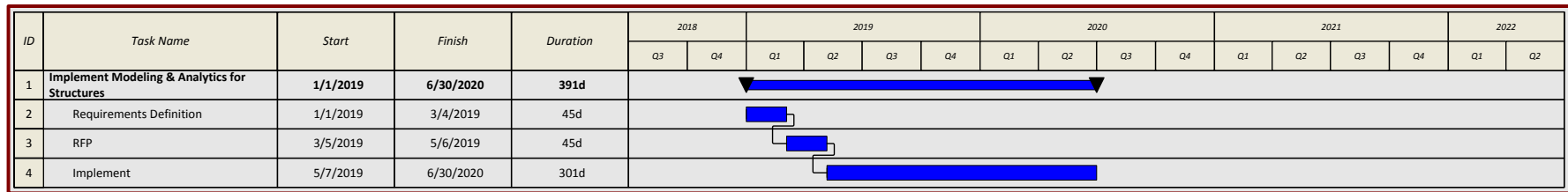
FIGURE 20: IMPLEMENTATION TIMELINE FOR IMPLEMENT MODELING AND ANALYTICS FOR STRUCTURES (AA-12)

E.1.2.4   Extend MMS to handle ancillary assets (AA-13)

The eVision Partners team recommends MDT define and implement a formal strategy for supporting ancillary assets. This strategy should include the following elements:

- Identification of assets to be formally managed/tracked;

- Identification of an asset owner;

- Identification of the group or groups within MDT responsible for collecting the asset inventory and condition data and the reviewers/approvers of the data collected;

- Identification of a system of record for each asset class and a process for maintaining currency of the data; and

- Development of an implementation plan for each asset class and management as a program of projects, phasing in the assets over time and asset inventory information is available and as the assets are ready to be added to the planned system of record.

There is a strong need to develop governance and the business processes to ensure that all asset classes have an identified owner, as well as defined methods and owners to collect and maintain the inventory, condition, and attribute data. This would include such things as:

- Determine whether inventory needs to be maintained at a 100% level or sampling data is adequate;

- Determine frequency for updating inventory and condition data;

- Ancillary assets will need to be prioritized for integration/implementation in the system. Prioritization criteria should include a risk analysis and identification of dependencies, which should include:

  o Safety issues/concerns for guardrails, pavement markings,

  o Past failures for overhead sign structures, and

  o Expected federal or other policies and rulings for retro-reflectivity standards for signs, etc.

The full set of ancillary assets need to be tied into the asset management strategy, since the assets are all related. Examples would include a culvert failing under a road causing a road closure, or guardrails that improve safety when there are challenges (e.g., expense or difficulty) to change road alignment/curves. At least one of the tasks performed when adding an ancillary

asset would be to review the planning and work order processes to ensure these are properly aligned and fully supported.

Once MDT has established the governance and business processes to manage ancillary assets, it can then prioritize the ancillary assets for inclusion in MDT information systems and establish detailed work plans for the actual implementation effort.

E.1.2.4.1 Project Phases

The eVision Partners team recommends the following project phases:

- Define the governance and business processes to address Ancillary Assets:

  o Define the Ancillary Asset Data Governance: Identification and prioritization of Ancillary Assets (only those that feed decision-making and planning activities),

  o Identify an owner for the asset, an owner for the collection/data quality and scrubbing efforts, and an owner for the maintenance of the asset inventory, location, condition, and attribute data, and

  o Establish policies for data sharing strategies across the asset systems and a strategy for assets without a home, using a defined asset business value and need/urgency to drive out the ancillary asset strategy;

- Perform necessary data preparation activities: Ancillary Asset data owners will need to review existing data and validate or scrub that data including adding attribute data or additional data feeds into that single source in preparation for the initial load into the system. If the data does not exist or is determined to not be usable, the data owner will be required to establish a method to collect asset data and implement that method, with validation and review of final results, ensuring it is ready to load into its home application; and

- Development implementation plan: While the asset data is being reviewed, collected and revised, MDT will develop an Ancillary Asset Implementation Plan phasing in the assets into production in the selected MDT asset management system, staging the implementations based on insights gained in the data preparation task. If the asset has specifications that will not be supported by an asset management application already owned by MDT, an exception for handling that asset class will have to be requested and granted through the governance process defined in item 1 above.

A proposed implementation timeline is on the following page. This implementation timeline assumes a phased approach to addressing ancillary assets over a several year period based on the priority for each asset class.

ID	Task Name	Start	Finish	Duration	2016			2017				2018				2019				2020				2021				2022				2023	
					Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1	**Establish ancillary assets & Asset Management Governance**	**7/1/2016**	**1/1/2021**	**1176d**																												
2	Develop policies, strategy, and business requirements	7/1/2016	6/30/2017	261d																												
3	Implement (phased)	7/3/2017	1/1/2021	915d																												
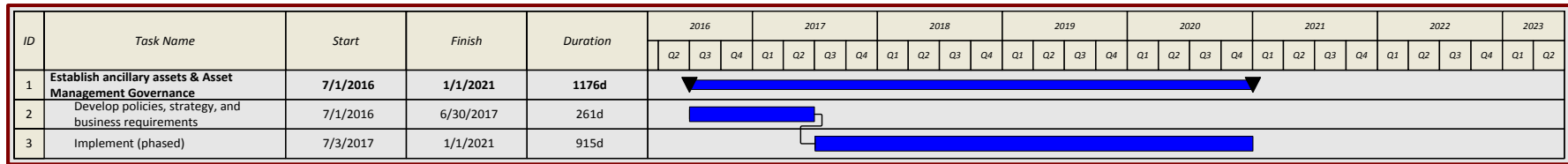
FIGURE 21: IMPLEMENTATION TIMELINE FOR EXTEND MMS TO HANDLE ANCILLARY ASSETS (AA-13)

MDT Strategic EA Final Report

E.1.3 Applications Architecture — Transportation Operations Management

This subsection outlines the recommendations in regards to Transportation Operations Management.

E.1.3.1 Implement new COTS Traveler Information System (AA-14)

The eVision Partners team recommends the implementation of a new Traveler Information System with a COTS application as the core of the new solution to replace the current Traveler Information System, an inhouse developed application approaching the end of its functional and technical life.

The current Traveler Information System is the most accessed webpage in Montana state government. MDT has initiated a business case to evaluate options for replacing this system. The eVision Partners tem understands that MDT is considering implementing an inhouse solution from another state and recommends that a full cost-benefit analysis be done, developing the Total Cost of Ownership (TCO) for the options, before deciding on the path to deploy this software versus selecting a COTS solution/framework for architecting the next generation Traveler Information System solution.

The core of the system will require many data and video streams in order to support present day citizen expectations. The replacement project will need to take a holistic view across all of the department and inter-agency feeder systems.

Other functionality and support features MDT should consider would include integrated support for:

- Mobile applications;

- Travel Times/Congestion VMS (variable message sign);

- Alerts (such as emails, automated calls, text messaging, radio broadcast data system broadcasts, and so on);

- Command and control of field equipment:

  o Camera control and viewing;

  o Variable message sign (VMS) management to create messages, view and report status;

  o Roadway sensor data collection;

  o Traffic sensors (loop detectors, acoustic, radar, and video, etc.);

- o Weather sensors;

- o Traffic signal monitoring and operations; and

- o Highway Advisory Radio (HAR).

- Camera views available from plows and other equipment;

- Incident logging, tracking, and reporting (unplanned):

  - o Accidents;

  - o Incidents; and

  - o Weather observations.

- CCTV (closed circuit TV cameras);

- Weather stations;

- Bike routes;

- Parking in downtown areas for special events;

- Ability to push information to mobile devices for display;

- Travel planning tools including alternatives based on historic conditions;

- Construction and maintenance activities (logging, planning, coordinating, and reporting):

  - o Construction project status,

  - o Highway maintenance activity logging,

  - o Signal malfunction logging,

  - o Road closure approvals,

  - o Highway work permits,

  - o OS/OW permitting and routing, and

  - o Detour routing;

- Traffic analysis and reporting (customizable);

- Traffic management center (TMC) activity logging, reporting, performance analysis, and communication logging;

- Vehicle and staff dispatch and related tracking and reporting:

  o Highway assistance program trucks, and

  o ITS equipment repair (VMS, camera, signals, sensors, etc.);

- Emergency Transportation Operations (ETO); and

- Map based views of construction and maintenance projects, equipment status, incidents, accidents, road and traffic conditions, travel time (map front end for data and reports).

E.1.3.1.1   Project Phases

The eVision Partners team recommends the following project phases in the implementation of this recommendation:

- Define requirements;

- Perform fit/Gap with available COTS packages or frameworks and finalize the go-forward direction;

- Identify and develop any governance associated with the use and consumption of cross department and inter-agency data and video feeds; and

- Finalize solution selection and implement solution.

A proposed implementation timeline is on the next page.

ID	Task Name	Start	Finish	Duration	2016			2017				2018				2019				2020				2021				2022				2023	
					Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1	**Replace Traveler Information System**	**7/2/2018**	**4/1/2020**	**458d**																														
2	Project Planning and Preparation	7/2/2018	12/28/2018	130d																														
3	Requirements Definition	12/31/2018	3/1/2019	45d																														
4	Develop RFP	3/4/2019	5/31/2019	65d																														
5	Implement	6/3/2019	4/1/2020	218d																														
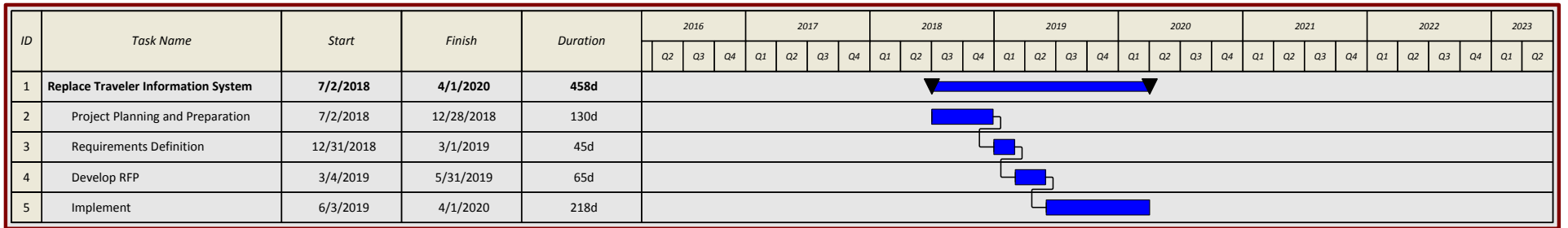
FIGURE 22: IMPLEMENTATION TIMELINE FOR IMPLEMENT NEW COTS TRAVELER INFORMATION SYSTEM (AA-14)

E.1.3.2 Continue SmartCOP enhancements (AA-16)

The eVision Partners team recommends that MDT continue with targeted enhancements to SmartCOP, including addressing opportunities to enhance data integration with other agencies.

SmartCOP provides support for the Motor Carrier Enforcement Systems, providing the following capabilities:

- Computer aided dispatch;

- Law enforcement records management; and

- Shared system interoperability with the Montana Highway Patrol.

MDT is currently implementing and/or planning to implement several priority enhancements to SmartCOP, including:

- Electronic recording of commercial motor vehicle (CMV) citations at the roadside;

- Electronic transfer of CMV information to the Federal Motor Carrier Safety Administration (FMCSA) SAFETYNET application;

- Loading of driver and vehicle information by barcode; and

- Sharing of citation and crash data electronically with other systems.

E.1.3.2.1 Project Phases

The eVision Partners team recommends that MDT implement the identified enhancements as a series of small projects on a priority basis based on funding and other resource availability. It is anticipated that these enhancements would be completed between FY 2017 and FY 2021.

E.1.3.3 Implement ePart Enhancements (AA-24)

The eVision Partners team recommends enhancing the ePart system after implementation to address high priority enhancements identified during the implementation project. During the implementation project, the ePart project team identified two critical enhancements:

- Implementation of automated permit routing functionality for oversize/overweight/over-dimension vehicles; and

- Implementation of document management functionality.

The automated permit routing functionality, which would allow permits within a certain envelope or set of dimensions to be automatically routed upon request by a motor carrier through the customer self-service functions in ePart is a natural extension of the capabilities of the CELTIC platform. In terms of the document management system, it is recommended that MDT

evaluate whether this functionality should be provided as part of ePart or through integration with the MDT enterprise content management solution (AA-2, page 116).

E.1.3.3.1   Project Phases

The IT team supporting ePart will need to further evaluate and determine the priority, timing, and associated costs of the proposed enhancements. Based on the current situation we are recommending the following steps:

- Stabilize the system post implementation (expected to be 3-6 months following production cutover in May 2016);

- Prioritize the critical issues and high value enhancements and identify dependencies (business processes, technology, method of exchange, etc.);

- Evaluate most appropriate approach for addressing document management requirements; and

- Develop detailed work plans for approved enhancements; and

- Design, develop, test, and deploy priority enhancements.

It is expected that the high priority enhancements will be completed, subject to funding availability, in FY 2017 or FY 2018. The recommended timeline is on the following page.

ID	Task Name	Start	Finish	Duration	2016			2017			
					Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	**Implement ePart Enhancements**	**5/30/2016**	**10/1/2027**	**2960d**							
2	Stabilize ePart Implementation	5/30/2016	9/30/2016	90d							
3	Prioritize Enhancements and Obtain Approvals	7/5/2016	9/30/2016	64d							
4	Configure, Design, Develop, Test and Deploy Approved Enhancements	10/3/2016	10/1/2027	2870d							
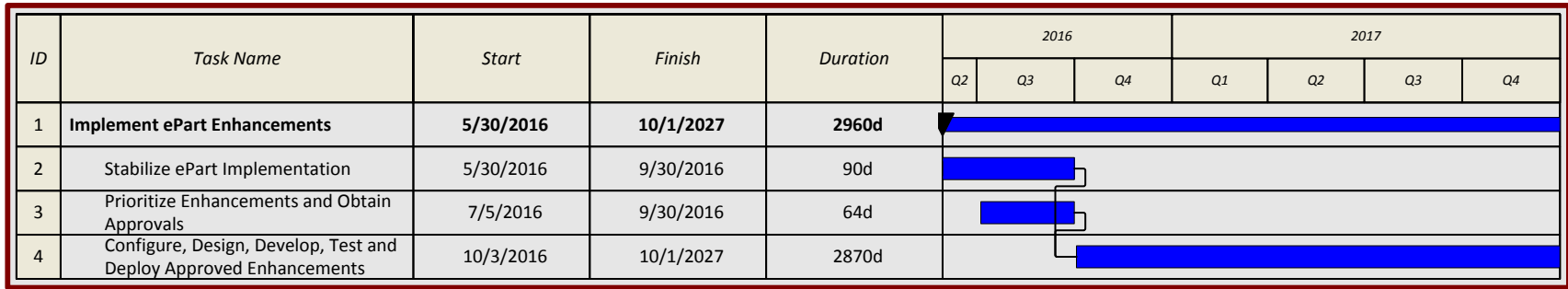
FIGURE 23: IMPLEMENTATION TIMELINE FOR EPART (AA-24)

E.1.3.4   Implement Enterprise Grants Management Solution (AA-18)

As noted earlier in this report, the State of Montana is evaluating a statewide grants management initiative. It is recommended that MDT participate in this initiative in order to ensure MDT's business requirements are captured and addressed as part of the statewide solution. After the state's initiative has been implemented and stabilized, MDT should evaluate whether it will continue using the existing multi-agency e-Grants initiative and the internally developed the Aeronautics Suite, or migrate to the statewide solution.

Minimally, a basic Grants Management System would include support for the following features:

- Planning — Develop, compare, and rate potential funding scenarios;

- Agency Management — Ability to add recipient agencies and organizations;

- Fund Source Builder — Ability to build state or local fund sources as needed by agency or recipient;

- Allocation Tracking and Financial Production — Ability to manage allocations or funding;

- Invoicing and Drawdown — Ability to collect and track invoices and monitor balances;

- Milestone/Progress Reporting — Reporting supporting both federal and state requirements;

- Grant Builder — Ability to create grant agreements; and

- Audit and Closeout — Checklists and final reports needed.

Figure 24 highlights the integrated processes typically implemented in the Life Cycle of Grants Management.
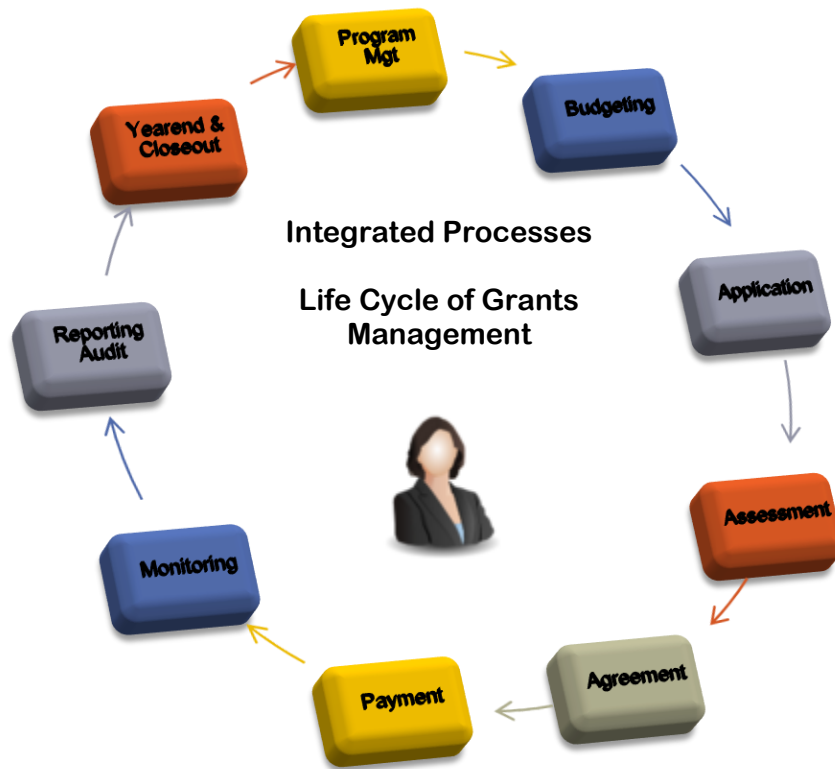
FIGURE 24: GRANTS MANAGEMENT SOLUTION INTEGRATED PROCESSES

E.1.3.4.1   Project Phases

The recommendation consists of the following high-level steps:

- Finalize Approach — complete assessment of the state's initiative and determine MDT direction.

- Develop/Design Interfaces — develop interfaces into existing MDT systems.

- Develop RFP for implementation resources — if required.

- Implement solution.

A proposed implementation timeline is on the next page.

ID	Task Name	Start	Finish	Duration	2020		2021				2022				2023				2024	
					Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1	**Implement Enterprise Grants Management Solution**	**7/1/2021**	**12/29/2022**	**391d**																
2	Requirements Definition	7/1/2021	9/1/2021	45d																
3	RFP	9/2/2021	11/3/2021	45d																
4	Implement	11/4/2021	12/29/2022	301d																
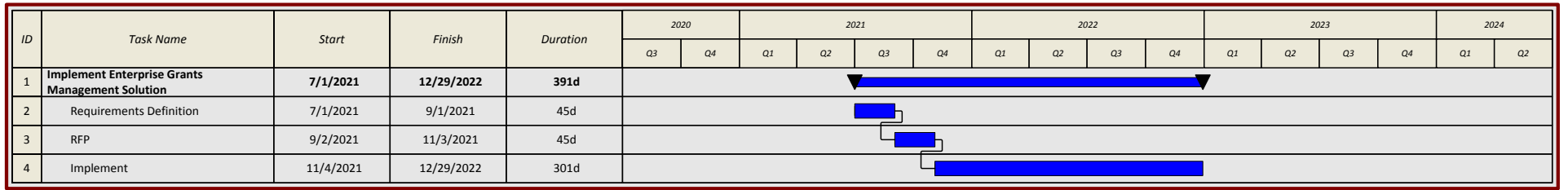
FIGURE 25: IMPLEMENTATION TIMELINE FOR IMPLEMENT ENTERPRISE GRANTS MANAGEMENT SOLUTION (AA-18)

E.1.4　Applications Architecture — Business Support Services

E.1.4.1　Implement Financial Suite (AA-19)

The eVision Partners team recommends that MDT enhance its existing forecasting, reporting, and analysis tools integrating these new analysis tools with its existing legacy financial and accounting transaction systems.

The preferred recommendation would be to immediately begin work on the implementation of the state's PeopleSoft SABHRS ERP solution as the agency's financial system of record (AA-20, AA-21). However, the project team recognizes that given existing constraints and priorities, the agency is better served in the short-term by following this recommendation, and implementing the state's ERP solution as the agency's financial system of record as a later phase (as reflected in the Overall EA Implementation Plan shown in Figure 42 (page 153)).

This recommendation will address the issue that stakeholders reported that it is often difficult to obtain information from the current financial systems to support management reporting and analytics. MDT has received a legislative appropriation of $3 million to move forward with this recommendation. Requirements definition has started for this project, but the project is proceeding at a slower pace than originally planned due to current constraints in the department's available cash flow. Our recommendation is to continue with this project, subject to cash flow considerations, as a short-term solution pending implementation of SABHRS as MDT's agency financial system of record. This project will be an initial step to provide enhanced budgeting, forecasting, financial reporting and analysis tools prior to implementation of an ERP. However, the project should be developed in anticipation of the future ERP and minimization of future re-work when the MDT legacy financial systems are replaced with SABHRS in the near future.

E.1.4.1.1　Project Steps

The recommended project implementation steps include:

- Complete the business requirements for the Financial Suite application solution, identify higher priority issues, and seek out short-term solutions that will provide the greatest value;

- Develop and finalize an implementation plan; and

- Implement the short-term solution.

A proposed implementation timeline is on the following page.

ID	Task Name	Start	Finish	Duration	2016				2017				2018				2019				2020				2021	
					Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1	Implement Financial Suite	7/3/2017	10/1/2020	849d																						
2	Define Requirements, create RFP, and select vendor	7/3/2017	6/28/2019	520d																						
3	Implement	7/1/2019	10/1/2020	329d																						
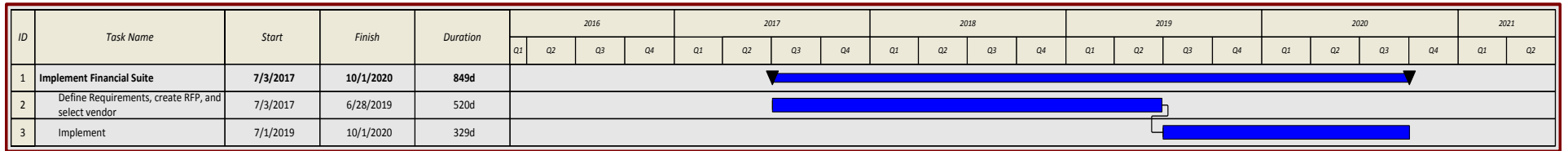
FIGURE 26: IMPLEMENTATION TIMELINE FOR IMPLEMENTING FINANCIAL SUITE (AA-19)

E.1.4.2 Implement State's ERP solution as financial system of record (AA-20, AA-21)

The eVision Partners team recommends the implementation of an enhanced version of the state's PeopleSoft-based SABHRS ERP solution for MDT's financial system of record. This recommendation results in the replacement of a number of MDT financial systems including: CARES, Accounts Payable, State Share, Contract Tracking System, and Consultant Information System.

This recommendation is closely associated with two other recommendations; see E.1.4.1 Implement Financial Suite (AA-19) (refer to page 105) and Implement State's ERP for Talent Management and Additional HCM Capabilities (AA-22, AA-23) (refer to page 110) for more information on those recommendations. The underlying assumption in this recommendation is that MDT can leverage the investment the State has already made in the State's ERP solution primarily by extending this solution as necessary to meet MDT specific business requirements. It is worth noting that the state's ERP solution, PeopleSoft, is successfully running in multiple state DOTs; this means there is prior experience and expertise that can be leveraged to help MDT meet its unique department of transportation business requirements not found in other state agencies within Montana. These business requirements are primarily focused on project budgeting, project costing and project billing including billing of FHWA, FTA and other Federal partners.

Based on eVision's experience in other states, the scope of the ERP implementation should include implementation of PeopleSoft Project Costing and potentially other modules not currently implemented within SABHRS to meet MDT's unique financial management requirements. Further, also recommended is the implementation of enhanced contracts management functionality, either in the eMACS system or as part of SABHRS (PeopleSoft Services Procurement module), to meet all MDT requirements in this area.

The scope of the project should also include configuration changes to existing modules to support MDT's unique business requirements.

Other considerations include:

- Development of interfaces with PPMS, AASHTOWare™ Project, and various other MDT agency systems;

- Data migration from existing MDT systems, development of MDT specific training materials;

- Delivery of training for MDT staff;

- Multiple MDT specific testing phases (unit, system, integration, user acceptance, performance, etc.); and finally the

- Deployment of the enhanced SABHRS system to production status.

E.1.4.2.1 Project Steps

The project steps for implementation are:

- Create ERP Project Steering Committee;

- Develop and finalize business requirements for the implementation of the state's ERP solution for MDT;

- Establish an interdepartmental memorandum of understanding with the Department of Administration to establish roles and responsibilities and planned cost sharing for the proposed implementation project;

- Construct, issue, and evaluate an RFP for implementation services for migrating MDT onto the state's ERP solution as the agency's financial system of record; and

- Implement the enhanced SABHRS solution to support MDT business requirements.

The proposed implementation timeline is on the following page.

ID	Task Name	Start	Finish	Duration	2018		2019				2020				2021				2022				2023	
					Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1	**Financial ERP**	**7/1/2019**	**9/30/2022**	**850d**																				
2	Define Requirements, create RFP, and select vendor	7/1/2019	6/30/2020	262d																				
3	Implement	7/1/2020	9/30/2022	588d																				
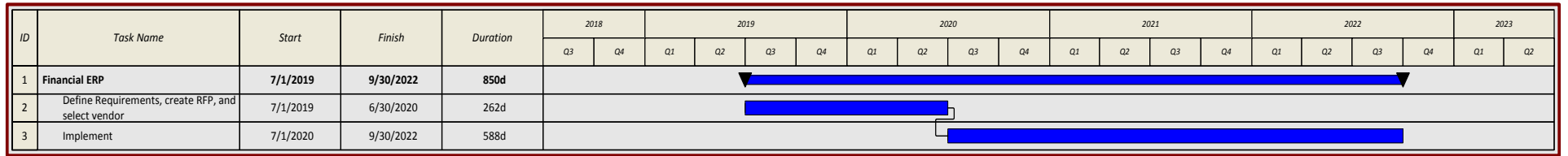
FIGURE 27: IMPLEMENTATION TIMELINE FOR IMPLEMENT STATE'S ERP SOLUTION AS FINANCIAL SYSTEM OF RECORD (AA-20, AA-21)

E.1.4.3 Implement State's ERP for Talent Management and Additional HCM Capabilities (AA-22, AA-23)

The eVision Partners team recommends MDT implement either additional capabilities within Oracle Taleo or additional human capital management (HCM) capabilities in SABHRS to address MDT's human resource management and talent management requirements. This recommendation would be a Phase II project to the initial recommendation to implement the state's ERP solution as the financial system of record (AA-20, AA-21), on page 107.

During the stakeholder interviews and validation sessions, an enhanced eLearning environment was identified as a priority business requirement. Oracle Taleo was implemented to provide eRecruiting functionality for the State and has a learning management function. Oracle Taleo also has other talent management functionality, such as performance management.

On a like note, MDT's Discipline and Grievance Management System is at end of technical life. Furthermore, MDT is not likely taking advantage of all the inherent features and capabilities of SABHRS HR, creating the need to utilize multiple off-line and paper-based solutions. To address these issues, the recommendation is to implement existing or enhanced capabilities within SABHRS HR to meet Discipline, Grievance Management and other Human Resource requirements not currently met by SABHRS.

The Discipline and Grievance Management System is at end of technical life. Further, MDT is not likely taking advantage of all the inherent capabilities of SABHRS HR, thereby resulting in the need to utilize multiple off-line and paper-based systems. To address these issues, the recommendation is to implement existing or enhanced capabilities within SABHRS HR to meet Discipline, Grievance Management and other Human Resource requirements not currently met by SABHRS. The optimal recommendation would be to include this effort within the scope of the ERP initiative (AA-20, AA-21) however, the eVision Partners team recognizes that due to existing constraints and priorities, the agency is better served in the short-term by executing this project as a standalone effort.

E.1.4.3.1 Project Steps

The eVision Partners team recommendation for implementing this recommendation includes the following steps:

- Establish a steering committee for the project;

- Define MDT's business requirements from HR and the other business units;

- Conduct a fit analysis with Taleo using the business requirements gathered earlier;

- Evaluate the fit and determine whether Taleo is a viable selection; Select and evaluate another solutions if Taleo is determined to not be a viable solution; and

- Implement solution.

The proposed implementation timeline is on the following page.

ID	Task Name	Start	Finish	Duration	2020		2021				2022				2023				2024			
					Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	**Implement HR ERP Talent Mgt, Disc, & Grievance Mgt**	**7/1/2021**	**6/28/2024**	**782d**																		
2	Define Requirements and Strategy	7/1/2021	10/13/2021	75d																		
3	RFP	10/14/2021	12/22/2021	50d																		
4	Vendor Selection	12/23/2021	4/6/2022	75d																		
5	Implement	4/7/2022	6/28/2024	582d																		
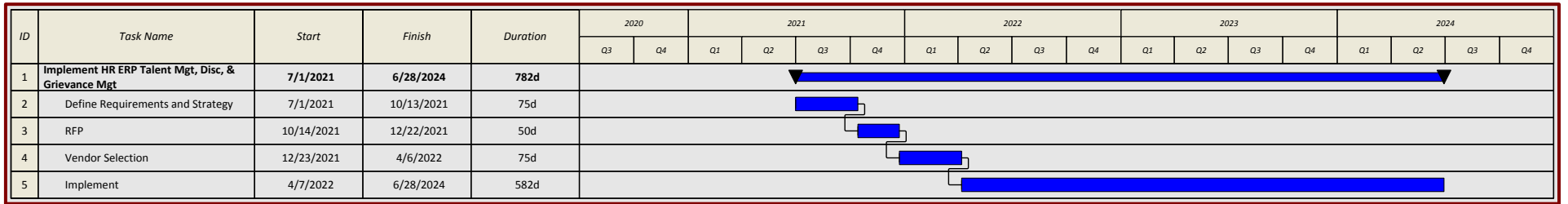
FIGURE 28: IMPLEMENTATION TIMELINE FOR IMPLEMENT STATE'S ERP FOR TALENT MANAGEMENT (AA-22, AA-23)

E.1.4.4   Case Management System (AA-26)

The eVision Partners team recommends MDT define detailed requirements, evaluate potential COTS solutions, and implement a case management tool that supports MDT Legal Services.

The MDT Legal Services Unit, a division in the Director's Office, consists of one chief counsel, nine staff attorneys, one paralegal, and one legal secretary at Helena Headquarters. The areas of practice are eminent domain, real estate, contracts, outdoor advertising control, rail and transit, motor fuels tax, motor carrier services, administrative law, environmental review and litigation, legislation, collection of accounts receivable for damage to MDT property, and labor/employment.

MDT Legal Services currently uses a manual system of spreadsheets, Microsoft Outlook® Calendar, and handwritten notes to manage caseloads. This combination of tools has been able to meet the needs of the unit until recently. However, this combination also requires a higher level of staff knowledge and experience requiring many staff hours to manage and align dates, meetings, and required submissions associated with contracts, court workload, and legal advisor duties. However, after recent retirements, new less-experienced staff is doing their best to continue to support and coordinate the division workload using these same techniques. The burden of this manual and labor-intensive system has proven difficult for these newer staff members, more accustomed to using more sophisticated software solutions to manage their workload. Additionally, there are staff members in Bozeman and Missoula that require access to case management information, strengthening the need for a centralized system solution.

The MDT Chief Counsel has requested implementation of a case management tool and has provided an initial set of business requirements. Additionally, the Legal Services Unit conducted a statewide survey to identify software currently in use for case management. With respect to other state agencies, some use COTS solutions and others have internally developed solutions.

E.1.4.4.1   Project Steps
The eVision Partners team recommends the following steps:

- Finalize the business requirements;

- Evaluate how the case management solution should integrate with the proposed enterprise content management system defined in AA-2 (page 116);

- Evaluate alternatives (including feasibility of a state solution) and select a software solution;

- Identify any potential synergies from a licensing perspective if adopting a solution already utilized by another State agency; and

- Implement and support selected solution.

The proposed implementation timeline is on the following page.

ID	Task Name	Start	Finish	Duration	2018		2019				2020	
					Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1	**Case Management Implementation**	**7/2/2018**	**2/28/2020**	**435d**								
2	Complete requirements definition	7/2/2018	9/28/2018	65d								
3	Evaluate fit of solutions already used in State government	10/1/2018	11/16/2018	35d								
4	Establish integration approach with planned MDT ECM solution	10/1/2018	11/16/2018	35d								
5	Prepare RFP for COTS solution	11/19/2018	3/29/2019	95d								
6	Evaluate responses and select solution	4/1/2019	5/10/2019	30d								
7	Configure, test and deploy solution	6/3/2019	2/28/2020	195d								

FIGURE 29: IMPLEMENTATION TIMELINE FOR CASE MANAGEMENT SYSTEM (AA-26)

E.1.5   Applications Architecture — Cross-Functional

This section addresses cross-functional recommendations that would affect multiple MDT divisions.

E.1.5.1   Implement Enterprise Content Management (ECM) (AA-2, TA-5)

The eVision Partners team recommends the development of an Enterprise Content Management (ECM) Strategy and solution.

MDT is currently evaluating document management solutions for engineering applications, and this has a high priority as the current Document Management System (DMS) is at technical end-of-life. Under this recommendation, implementation of a DMS replacement would continue as a separate project effort, while in parallel MDT focuses on an overall Enterprise Content Management (ECM) strategy and solution. The DMS replacement effort will have a very narrow scope, focusing on management of engineering plans. The MDT-wide effort will have a broader scope focused on a complete end-to-end content management solution. The solution chosen to replace DMS subsequently would be integrated into the overall MDT enterprise content management solution.

Many organizations are struggling to implement workable document management solutions, while business requirements and technology have continued to evolve beyond simple document management requirements requiring organizations to manage all of an organization's "content", extending beyond simple management of "documents". Laptops, Tablets, smartphones, eBook readers, and other forms of mobile devices have each contributed to changing the way people interact with an organization's content, and have subsequently contributed to the need to find new ways for organizations to look at content management.

Content, in the broader sense, can be defined as any information the organization stores or records, which can range from the simple to quite complex, including but not limited to:

- Text;

- Images;

- Audio recordings;

- Video recordings;

- Digital assets, such as:

    o PDF files containing simple to complex multi-layered design documents;

    o Multimedia;

- "Rich media" (while the term "rich media" was initially coined to describe Internet advertising for web page ads using advanced technology, such as streaming video and downloaded applets (programs) that immediately interact with the user or content that changes when the user's mouse passes over it, the concept/technology does have applicability for the public sector as well);

- Social media; and

- Metadata.

For example, an ECM Solution would be expected to address requirements in the following areas:

- Sophisticated search and access support;

- Document Management;

- Business Process Automation;

- Records Management;

- Team Collaboration;

- Web Publishing;

- Secure File Sharing;

- Mobile Content Management;

- Archiving;

- Integration with:

  - Enterprise Applications, such as an ERP;

  - Social Media, such as Facebook; and

  - Mobile Devices.

- Support for Metadata, Email, conversion of proprietary formats into neutral or open formats (e.g., PDF), Scanning and OCR;

- Scalability (given that content is always increasing);

- Content Streaming; and

- Support for various operational and interoperability standards (such as Content Management Interoperability Services (CMIS), Security and Access Control (such as LDAP, Active Directory, etc.), Records Management (such as DoD 5015.02-STD), etc.).

All of these requirements should be coordinated with the Data Governance initiative (DA-1). The recommendation to create an ECM Strategy means that the strategy derives first based on business requirements and then technology. That is, the organization should have an underlying ECM Strategy on which to base the project and ensure meeting its business objectives. As with the basic foundational concepts for many other concepts/areas, an ECM Strategy should be based upon four basic foundational concepts:

- People — the human element;

- Process — organizational steps and procedures supporting business operations;

- Content — encompasses both structured and unstructured content, as well as the categories noted above; and

- Technology — underlying technology needed to support organization's business requirements.

Drivers for the ECM for each of these four basic foundational areas can be found in Figure 30. The key point is that development of an ECM Strategy should be a balanced approach focused on each of the noted four elements. The implementation of the strategy, or program, will consist of multiple projects that need to coordinate the organization's current content management practices followed by standard gap analysis, roadmap or implementation plans, and a content governance plan in concert with the Data Governance Program (DA-1).

FOUNDATIONAL CONCEPTS	DRIVERS and INFLUENCERS
People	• Change Management • Training • Awareness: ECM Content Governance (Data Governance)
Process	• Need to standardize processes (process realignments) • Process Change and Impact Analysis • Realignment of processes with content governance framework • ECM Content Governance (Data Governance)
Content	• Control and visibility • Digitation, Scanning, and OCR • Content Migration • Data Conversion aligned with application rationalization • Standard enterprise information architecture • Data Governance (or ECM Content Governance)

FOUNDATIONAL CONCEPTS	DRIVERS and INFLUENCERS
Technology	• Application rationalization • Migration/Conversion • Implementation • Needs to support Data Governance (or ECM Content Governance)

FIGURE 30: ECM STRATEGY DRIVERS & KEY INFLUENCERS

An effective ECM Strategy and Implementation Project must include all of the appropriate business drivers and influencers for each of the four foundational concepts. This would be the product of the Project Committee finalizing the ECM business and technical requirements for the resulting RFP.

E.1.5.1.1   Project Steps

The eVision Partners team recommends the ECM Strategy and Implementation Roadmap be developed as depicted in the high-level implementation timeline shown on the next page.

ID	Task Name	Start	Finish	Duration	2016			2017				2018				2019				2020				2021				2022				2023			
					Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	**Develop Enterprise Content Management (ECM) Solution**	**3/1/2016**	**6/30/2023**	**1914d**																																
2	**Engineering Solution**	**3/1/2016**	**6/29/2018**	**609d**																																	
3	Finalize Engineering Requirements	3/1/2016	8/30/2016	131d																																	
4	RFP	8/31/2016	12/30/2016	88d																																	
5	Implement	1/2/2017	6/29/2018	390d																																	
6	**Enterprise ECM Solution**	**7/1/2016**	**6/30/2023**	**1826d**																																	
7	Define ECM enterprise requirements	7/1/2016	6/30/2017	261d																																	
8	RFP	7/3/2017	9/22/2017	60d																																	
9	Implement (Phased)	9/25/2017	6/30/2023	1505d																																	

FIGURE 31: IMPLEMENTATION TIMELINE FOR IMPLEMENT ENTERPRISE CONTENT MANAGEMENT (ECM) (AA-2, TA-5)

E.1.5.2 Implement Mobile Technology Strategy and Support (AA-17, TA-4)

The eVision Partners team recommends that MDT evaluate and develop a comprehensive mobile device strategy, including smartphones, tablets, Internet of Things (IoT)[2] devices and sensors, and alternatives and solutions for supporting Equipment Vehicle Management Systems (EVMS).

Developing a Mobile Technology Strategy is likely more complex than most might initially perceive. The business knows they want to be able to use mobile devices to accomplish certain tasks, knowing they are also under pressure from external stakeholders and citizens who have unmet expectations as well. As an electronics consumer, the average person often perceives these solutions to be simple plug and play. On the other end of the spectrum, CIOs and the IT organizations they manage understand the complexities of delivering these kinds of solutions and the underlying infrastructure and strategy required to deliver these services in a reliable and secure fashion. This wide range of understanding and opinion underscores the importance of a strategy for mobile devices in the organization.

It is up to MDT to balance the challenges between the increasingly challenging security management and deployments risks expected under a mobile enterprise model, while at the same time providing mobile users with high levels of mobile design, user experience, ease of use, and discoverability. Implied in the all of this is the simple fact that in many organizations, an increasing number of employees are using their own devices in their daily work, known as BYOD (Bring Your Own Device). BYOD and the consumerization of IT represents one of the largest drivers for mobile enterprise deployments and is also one of the most significant challenges for organizations since increasing numbers of smartphones used today are owned by employees rather than the organization.

The Internet of Things (IoT) has been described as the future of Internet technologies. IoT could be expected to be found in virtually every object around us, connected via some type of network to every other object and the ability to send and receive data. They will become a part of our personal and working environments and ultimately envisioned to include, but are not limited to, the devices noted in Table 10:

TABLE 10: IoT/IoE CAPABLE DEVICES

IoT / IoE Devices
environment monitoring sensors
actuators
monitors
controllers
processors
tags

---

[2] In addition to IoT, the concept is also often referred to as the Internet of Everything (IoE).

IoT / IoE Devices
labels
stickers
projectors
displays
cameras
computers
digitally augmented walls, floors, windows, doors, and ceilings
communicators
appliances
Gateways
high-definition IP TVs, etc.

Planning for intelligent cities and counties utilizing IoT or IoE technology will provide integration opportunities for many state agencies. With respect to transportation, these devices will minimally be found in:

- V2V (Vehicle-to-Vehicle) communications;

- Highway sensors for real-time traffic analysis; and

- Unmanned aerial drones utilized for LIDAR and photogrammetry.

Therefore, to be prepared for this future, the importance of a Mobile Device Strategy and Framework is clearly an important requirement. It would be important for this strategy and framework to be scalable, flexible, and regularly revaluated and maintained. Fundamental elements of this recommended mobile strategy and framework would need to address and include:

- Comprehensive BYOD policy (supported or not permitted), including the following if permitted:

  o Acceptable Use Policy (AUP); and

  o IT Help Desk Support.

- Address procurement considerations to avoid the "buy first frenzy" many organizations experience (that is, without the proper controls and procedures in place, it is often far too easy for an organization's business units to "buy first" and let IT worry about how to make it all work in a safe and secure fashion, often before IT has had the opportunity to fully research the topic and develop a viable strategy—see recommendation E.4.2 Establish Agency Technology Procurement Policy (IT-2) on page 149, as these recommendations are related);

- Device and device operating system considerations, such as what devices and operating systems will be supported (see IT-2);

- Application enablement decisions/factors (inherent in the strategy and decision making process are further considerations like cloud deployment (see E.3.3 Develop Cloud Strategy (TA-3) on page 138) versus on premise backend systems);

- Mobile Device Management (MDM) Solution, which are part of a holistic corporate security policy; and

- Other policies and procedures for Security threats.

With respect to MDM, it is important that the business strategy be in place first, before looking at software solutions for device management. Best practices for an organizational MDM solution would address these points:

- Software distribution;

- Mobile inventory management;

- Policy management;

- Mobile security and access control policy; and

- Service management.

There are a myriad of potential future applications that will undoubtedly surface in a mobile device arena, which will need a fundamental Mobile Device Strategy in order to be addressed successfully. The following areas have been identified and discussed as potential areas for further exploration:

- Maintenance;

- Construction;

- Motor Carrier Enforcement;

- Equipment and Fleet; and

- Project Planning.

E.1.5.2.1   Project Phases

The eVision Partners team recommends the following steps:

- Identity mobility needs and priorities across the Department (opportunities identified by the MDT staff using the MDT Technology Council (see recommendation IT-1) and Technology Governance process);

- Define and develop the necessary underlying policies;

- Define requirements and business drivers;

- Perform a fit/gap with current asset management vendor mobile solutions for needs and fit with the Enterprise mobile strategy;

- Identify alternative solutions that also fit the Enterprise mobile strategy; and

- Finalize solution direction and define an implementation plan with phased projects to realize benefits from these mobile solutions.

A proposed implementation timeline is on the following page.

ID	Task Name	Start	Finish	Duration
1	**Implement Internal, External, & Client-Facing Mobile Technology**	**7/1/2016**	**6/30/2022**	**1565d**
2	Establish Governance and Develop Strategy	7/1/2016	3/1/2017	174d
3	Requirements Definition	3/2/2017	8/1/2017	109d
4	Develop RFP(s)	8/2/2017	12/5/2017	90d
5	Implement mobile technology solutions phased implementations	12/6/2017	6/30/2022	1192d
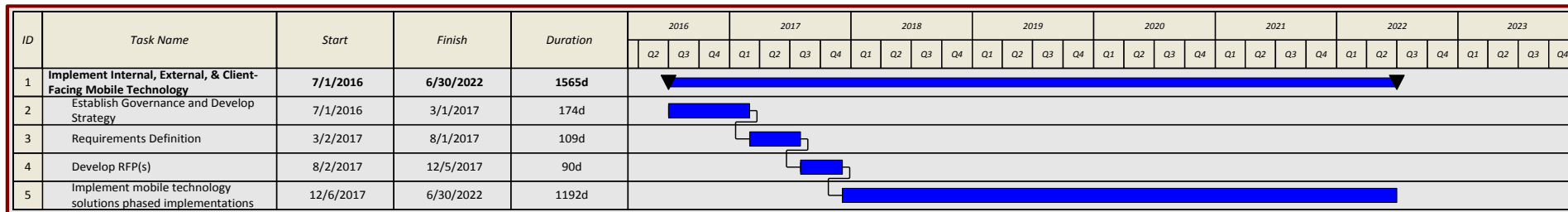
FIGURE 32: IMPLEMENTATION TIMELINE FOR IMPLEMENT MOBILE TECHNOLOGY SUPPORT (AA-17, TA-4)

E.1.5.3   Retire all Oracle Forms Applications (AA-25)

The eVision Partners team recommends MDT continue in its efforts to retire all use of Oracle Forms Applications. This recommendation needs to be managed as a disciplined IT project, beginning with a detailed inventory of Oracle Forms Applications and a replacement plan for each form or application system. Each form will likely surface multiple avenues for modernizing and the inventoried form applications should be evaluated and appropriate course of action determined:

- Retire — determine whether the form application is no longer in use, or barely used; if so, consider dropping the form application.

- Replace — replace form application with functionality in another COTS Solution or Software as a Service (SaaS) solution. These solutions may exist in other recommendations included in the EA Implementation Plan, or other solutions.

- Rewrite — if neither of the above alternatives can achieve the requirements of the form application, rewrite the application.

E.1.5.3.1   Project Phases

The recommendation includes following these high-level steps for each form application not addressed through another initiative:

- Complete detailed inventory of all mainframe applications;

- Develop action plan for each mainframe system; and

- Execute the plan.

As noted above, it is anticipated that the migration of any Oracle Forms based applications not addressed through another initiative will occur as a series of subprojects during FY 2017 – FY 2022.

E.2 DATA ARCHITECTURE

This section outlines recommendations in the data architecture layer.

E.2.1   Establish a Data Governance Program (DA-1)

The eVision Partners team recommends that MDT establish a Data Governance Program to enforce data stewardship for the protection and management of this agency asset. Further, a data governance program is necessary for the successful deployment of a Data Warehouse (DA-2)

and the management of the various challenges inherent from the increased access to information resulting from the deployment of mobile devices and remote sensors (AA-17, TA-4).

In this report, the terms data, information, and knowledge are implicitly and explicitly mentioned multiple times. It is important there be consensus on the meaning of each, including the concept of wisdom. Typical definitions for these concepts would be:

- Data are simply facts;

- Information is data with some form of context;

- Knowledge is the application of information; and

- Wisdom is knowledge tempered by experience.

Intuitively, these concepts clearly build upon one another forming a scale that looks like Figure 33. This diagram illustrates why what we refer to today as "Information Technology" was called "Data Processing" in the 1950s and 1960s. By the late-1980s, the industry began an era that could have redefined the industry as "Knowledge Management," although not many organizations have fully matured into this era.

While the future opens possibilities for knowledge management and machine intelligent processing undreamt of in the early days of data processing, the bottom line is that this progression of transforming raw, unfiltered facts and symbols into information, knowledge, and eventually intelligence and wisdom must begin with a solid handle on the organization's basic data. This helps us understand where and why Data Governance is relevant and why it is important. Further, if we accept that data and information are organizational assets, then they certainly deserve to be managed as organizational assets, further underscoring the reasons why Data Governance and data stewardship are important critical success factors for the organization.

Progressing towards increasing levels of "understanding"...
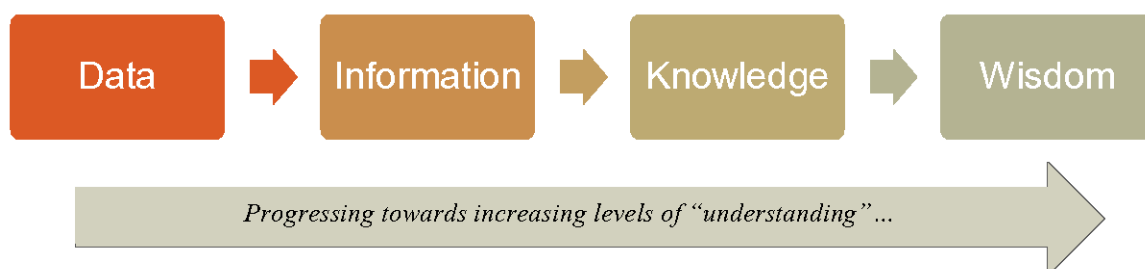
FIGURE 33: DATA, INFORMATION, KNOWLEDGE, WISDOM

Data Governance is a part of an integrated governance structure, as shown in Figure 34. Data Governance begins with senior management's recognition that information needs to be managed

as an enterprise asset. This recognition also ensures that the business and IT act in concert with respect to this precept.

Data Governance is a business program and not an IT program. Any enterprise pursuing Data Governance implies that they want to do something better (or are not satisfied with what is currently going on). The organization must take an "enterprise" view with respect to information and wean itself off a dependency on silo databases and Microsoft® Excel® spreadsheets and Microsoft® Access® databases. In short, Data Governance exists to provide roles, rules, policies, and controls for data assets of the enterprise and applies to everyone in the enterprise.

FIGURE 34: DATA GOVERNANCE—PART OF AN INTEGRATED GOVERNANCE STRUCTURE

Data Governance should eventually become an unconscious act of the agency. That is, it should become second nature or a part of the organization's standard operating procedures. Everyone must do data governance once adopted. As such, it requires formal Organizational Change Management (OCM), which implies culture change. If you do not manage the organizational behavior change, you typically fail to get Data Governance to stick.

Leadership for the Data Governance Program is extremely important. Information is a shared resource and the lead of the Data Governance Program needs to be the personification of a "sharing type" to ensure the program succeeds otherwise data silos will continue to persist. Data ownership, unlike many other business concepts, is often taken quite personally, which can be challenging behavior to change over time.

E.2.1.1   Program Phases

This sub-section discusses the iterative Program/Project Phases for the Data Governance Program. Figure 35 provides a high-level overview of how a Data Governance Program can be rolled out. (Ladley 2012)
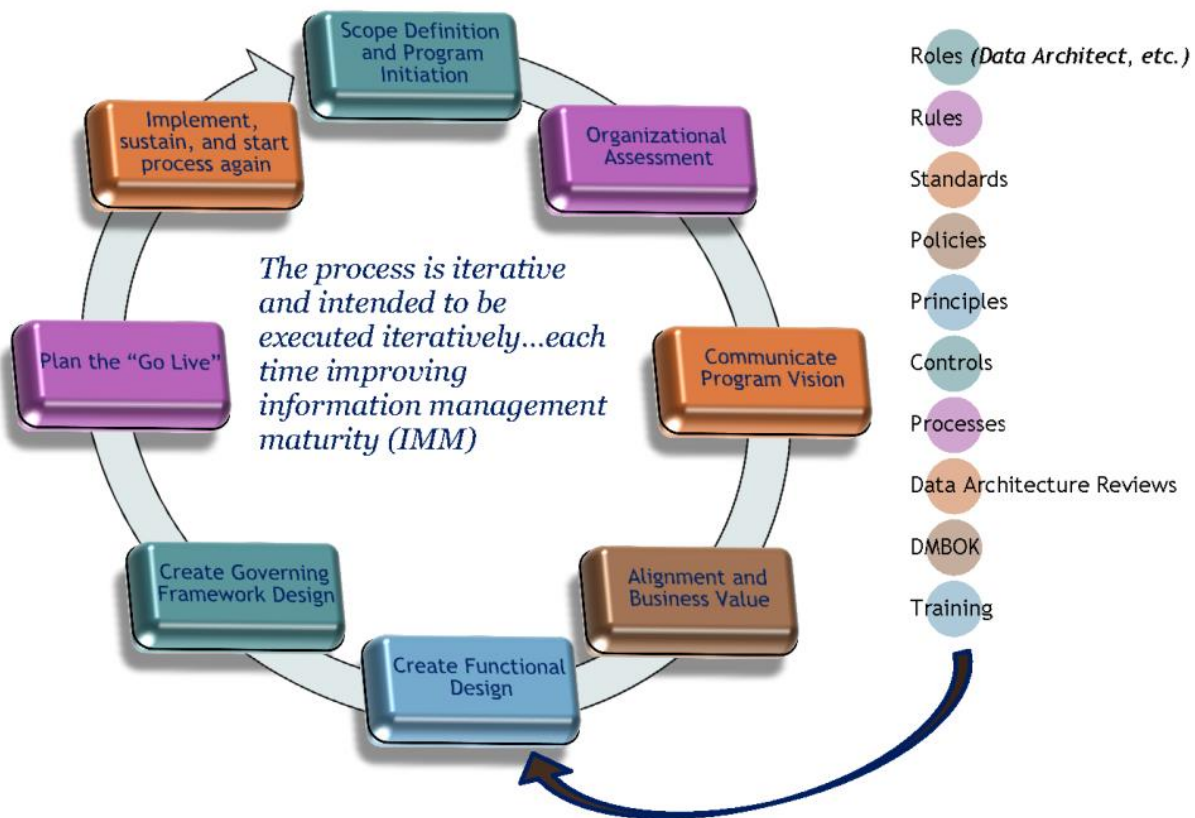
FIGURE 35: DATA GOVERNANCE METHODOLOGY

It should be understood that the Data Governance team will be developing a tactical plan for a program that will evolve over several years, which is why it needs to integrate with other projects and initiatives. The rollout should provide opportunities for frequent feedback, as the program needs to be designed to change behavior. The organization should focus on not allowing situations where the organization can make excuses to defer or ignore Data Governance. The steps should hew to the organization's culture, maturity, and readiness to accept change. Organizational Change Management practices should be utilized, remembering that onetime directives, infrequent newsletters, singular training events, or publishing one-page schedules are typically overlooked by many in most organizations. The Data Governance team will need to be evangelists for Data Governance, finding creative ways to engage the organization, perhaps even going so far as to find ways to make it fun.

The steps depicted in Figure 35 include the following:

- Scope and Initiation - A Data Governance Program is much like any other program or project given that there needs to be clarity regarding its scope, as illustrated in the initial step in Figure 35. The eVision Partners team recommends that the MDT utilize consultants to assist them in defining the scope for this program and initiating it. One of the expected outcomes would be the definition of the Data Governance team, and the need for specific roles in the organization, such as a Chief Data Officer (CDO) and a Data Architect. In addition, selecting a key initiative to pilot data governance activities can often improve the success of a Data Governance Program, as well as the initiative itself.

  This recommendation embraces the concept of Enterprise Information Management (EIM), emphasizing that a Data Governance Program is an enterprise effort, just as an ERP Implementation will be an enterprise program and effort. Once the program's scope has been defined and approved, the next phase would consist of the required organization assessments.

- Organizational Assessments - The assessment focuses on the ability of the organization to govern, and be governed. The assessment begins with the agency's capacity for change, noting that the desire for change is not always an indicator of the organization's capacity for change. Another assessment is the organization's ability to work cross-functionally and collaborate.

- Communicate Program Vision - This phase utilizes various techniques tailored to the audience to communicate the vision throughout the organization.

- Alignment and Business Value - In this phase, the Data Governance team examines the potential links between Data Governance, business strategy and goals, and improving the organization in a financially beneficial manner.

- Create Functional Design - This phase creates the functional design of the Data Governance Program where the details are developed and clarity developed around how it will actually work. Expected outcomes from this phase would include:

  o Principles;

  o Policies; and

  o Process Designs.

- Create Governing Framework Design - Once the functions have been defined in the Functional Design, these must be placed into an organizational framework, which is tantamount to saying that these functions need to be integrated into everyday

behavior of the organization. Another outcome of this phase is the identification of information stewards, or owners, or custodians.

- Plan the "Go Live" - This phase develops the details around going live with the newly defined Data Governance Program. This includes support and sustaining of the Data Governance Program.

- Implement and Sustain - This step is similar to the "Implement and Maintain" steps within a typical software project implementation, recognizing that a Data Governance Program needs to be sustained to ensure the organization transitions from non-governed data assets to governed data assets.

- Summary - The steps described above are encapsulated within the Foundational Programs category shown on Figure 42 (MDT High-Level Enterprise Architecture Implementation Plan), which can be found on page 153 later in this report.

The following page contains a recommended timeline.

ID	Task Name	Start	Finish	Duration	2016		2017				2018			
					Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	**Data Governance Implementation**	**7/5/2016**	**10/31/2018**	**607d**										
2	Define Scope and Initiate Program	7/5/2016	7/29/2016	19d										
3	Perform Organizational Assessment	7/18/2016	8/31/2016	33d										
4	Communicate Program Vision	8/1/2016	8/31/2016	23d										
5	Establish Alignment with Business Objectives	9/6/2016	10/31/2016	40d										
6	Create Functional Design	10/3/2016	12/30/2016	65d										
7	Create Governing Framework Design	12/1/2016	1/31/2017	44d										
8	Prepare Implementation Plan	12/1/2016	1/31/2017	44d										
9	Implement and Support	2/1/2017	10/31/2018	456d										

FIGURE 36: IMPLEMENTATION TIMELINE FOR DATA GOVERNANCE (DA-1)

E.2.2　Implement Data Warehouse, BI, and Analytics (DA-2)

The eVision Partners team recommends MDT implement a Data Warehouse, Business Intelligence (BI), and Analytics program. This recommendation will:

- Improve user access to information and help to address the current challenges in accessing information from various transaction systems;

- Facilitate integrating information from various systems for reporting; and

- Provide enhanced management reporting and business analytics capability.

MDT currently utilizes the TIBCO Jaspersoft business intelligence toolset. Some of the MDT information technology staff expressed concerns about whether this toolset would be able to adequately scale to support an MDT-wide data warehouse. While TIBCO continued enhancement to this solution, it will be up to MDT to assess whether these tools will adequately meet its business requirements as a Data Warehouse, Business Intelligence, and Analytics toolset.

It is recommended that MDT pilot the TIBCO Jaspersoft toolset on one or two moderately sized data marts and evaluate the efficacy of these tools to meet MDT requirements. One potential pilot could be the Transportation Asset Data Warehouse, envisioned in Recommendation AA-10. These pilots will then position MDT for continued expansion to its final enterprise data warehouse solution, in conjunction with the implementation of various application projects and to substantially grow the size and scale of the data warehouse in conjunction with the ERP implementation.

E.2.2.1　Project Phases

The eVision Partners Project Team recommends the following steps:

- Select pilot business areas/ data marts;

- Design, develop, test and deploy initial data marts; and

- Continue to extend data warehouse functionality in conjunction with application system implementation projects and as funding constraints allow over the seven-year EA planning window.

A proposed implementation timeline is on the next page.

ID	Task Name	Start	Finish	Duration	2016				2017				2018				2019				2020				2021				2022				2023	
					Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1	Data Warehouse	7/1/2016	6/30/2023	1826d																													
2	Identify Pilot Functions	7/1/2016	8/26/2016	41d																													
3	Define Requirements for Pilot Functions	8/29/2016	11/25/2016	65d																													
4	Design, Develop, Test and Deploy Pilot Data Marts	11/28/2016	6/30/2017	155d																													
5	Evaluate Data Warehouse Tool Post Pilot	7/3/2017	7/31/2017	21d																													
6	Develop and Deploy Additional Data Warehouse Functionality (phased)	8/1/2017	6/30/2023	1544d																													

FIGURE 37: IMPLEMENTATION TIMELINE FOR IMPLEMENT DATA WAREHOUSE, BI, AND ANALYTICS (DA-2)

E.2.3   Define and implement Data Services Strategy (DA-3)

The eVision Partners team recommends the development of a Data Services Strategy to effectively manage the sharing of MDT data with external partners including Federal and State agency partners, counties, cities, potential grant recipients, engineering consultants, and construction contractors among others.

Sharing data with external partners and stakeholders is difficult for business users. There is no clearly defined or communicated strategy/approach for providing open data services to external partners/stakeholders, resulting in end-user developed workarounds of varying levels of sophistication, quality, and security.

The eVision Partners team recommends the MDT fully assess their overall business requirements and the tools available within MDT and SITSD. Working with data governance, SITSD, and the MDT ISO, the MDT IT Division should develop a strategy and set of solutions to handle each business requirement and provide the necessary communication and training to the end user community to mitigate security and other operational risks and improve service levels.

An open data services strategy can be viewed from two perspectives:

- A means to provide data to external stakeholders; and

- As a part of the agency's strategy to engage citizens.

With respect to the latter point, utilizing data services as a part of the agency's strategy to engage citizens, this could be as a part of a larger agency strategy to engage and involve citizens. Other portions of this strategy might include:

- Utilization of social media platforms;

- Open data as a part of a transparency initiative;

- Virtual meetings and agendas; and

- Crowdsourcing[3].

In short, the MDT needs an effective strategy and set of objectives with which to evaluate solutions the state and/or MDT may already own, or need to procure to address these requirements. Once the strategy has been developed, an assessment of software solutions can be performed and any tools required to support the strategy can be acquired.

---

[3] Crowdsourcing is a decade old term for the concept of obtaining ideas and content (even services) from larger groups of people, typically online, and utilized by the public sector for citizen engagement. (Eggers and Hamill 2012)

E.3 TECHNOLOGY ARCHITECTURE

This section outlines recommendations for the technology architecture layer.

E.3.1 Implement Single Sign-on (TA-1)

The eVision Partners team recommends MDT investigate and procure the requisite tools to implement Single Sign-on (SSO) for its business applications. This recommendation stems from numerous end-user complaints during stakeholder interviews regarding the myriad of logins and passwords the end users have to manage throughout a normal business day. This is understandably the result of point solutions being implemented over many years regard to any central or holistic vision.

When discussing SSO capabilities and solutions, it is important that these two key concepts are understand:

- Authentication — verification of who you are; and

- Authorization — verification of what you are authorized to do.

Single sign-on (SSO) solutions provide support for authenticating once, and subsequently and automatically authenticating when accessing other target application systems, thus eliminating the need to repeatedly authenticate and sign on into various other applications and systems. Transparent to the user, a SSO solution responds to those prompts behind the scenes and maps the credentials back to the initial login and password. To the end user, it appears as if they have only had to enter their credentials once to gain access to all of the applications they need to perform their duties.

The recommendation is that MDT should investigate the feasibility, or interest level, in forming a partnership with the Montana State CIO on this as a statewide initiative. There would be clear synergy for all internal and external stakeholders to leverage this as a statewide initiative, since every end user in the state would potentially benefit from a shared services approach. To be clear, the mention of both internal and external stakeholders was intended to suggest that the SSO solution not be limited to state employees accessing internal applications, but could also be considered for external stakeholders with credentials to access public facing state applications as well.

Whether the MDT executes this project in partnership with SITSD or independently, the following basic steps would need to be executed:

- Develop business and technical requirements;

- Determine whether the state already owns the required software tools or MDT needs to go through a software evaluation and acquisition process;

- Plan the project; and

- Implement, by first implementing the SSO tool and subsequently modifying all legacy applications and ensuring that any new system implemented utilizes this SSO solution as the new state/agency standard.

E.3.2 Define and implement Disaster Recovery Planning (DRP) and Strategy (TA-2)

The eVision Partners team recommends that MDT define and implement an actionable Disaster Recovery Plan (DRP).

The eVision Partners team understands that the MDT has a Business Continuity Plan (BCP) initiative underway, in addition to the Disaster Recovery Plan (DRP) requirements of the IT Division, and within the agency, there has been misunderstandings as to how the two are interrelated, even to the point where progress on either is impeded. Therefore, it is important to understand the difference between a Disaster Recovery Plan (DRP) and a Business Continuity Plan (BCP):

- A BCP is a plan that covers the way the business plans for and maintains critical business functions, directly before, during, and after a disaster; these functions may or may not include technology. The plan is set up to ensure day-to-day operations continue, and covers the entire organization.

- A DRP focused on what happens after the disaster, and focuses on technology, especially in the areas of data backup and recovery, as well as the recovery of critical computer systems in a timely fashion.

In short, a DRP is often simply a component or subset of an overall BCP. The BCP focuses on the entire organization, while the DRP focuses more on technology. A BCP without a DRP is of questionable value to the organization while the DRP can stand on its own merits, and many organizations arguably do not necessarily need a full BCP.

While the BCP and DRP are clearly different, they do share similar goals, which is to provide previously tested and approved answers to questions for support and assistance throughout a disaster.

Typical components of a DRP include:

- Operational plans for disasters that could happen based on geography (such as hurricanes, tornados, flooding, earthquakes, fires, workplace violence, pandemic, terrorism, and so forth);

- Clear lines of authority, such as who can declare a disaster, and who can take over in the event there is a disruption in the chain of command (i.e., succession plans for senior management);

- Employee training (and awareness), cross-training, and role definition during a disaster;

- Communication plans (mass notification, use of social media, etc.) that include methods of communicating when phone systems and networks are inoperable;

- Dissemination of accurate information (for both internal and external stakeholders);

- Off-premise fallback locations for staff and managers to meet and work, ensuring that an off-premise location is selected to avoid being taken down by the same event;

- Backup procedures for systems and data, including tested recovery procedures;

- Testing and training of staff to validate recovery procedures in realistic scenarios; and

- Periodic reviews, audits, and updates of plans to ensure relevance (system changes, introduction/use of mobile devices, and many other factors can easily be overlooked in keeping the plan viable and current).

As with any other project, the steps required to execute include a clear scope definition and clearly defined objectives coupled with a plan designed to complete the project. It should be clear that while having a BCP in place would provide an umbrella framework for the DRP to exist within. However, the existence or lack of a BCP exists should not be a deterrent in completing a DRP.

E.3.3 Develop Cloud Strategy (TA-3)

The eVision Partners team recommends MDT develop a Cloud Strategy to plan an effective and appropriate use of cloud computing. Given the Governor's recent executive order, issued as this report was under development, directing all State agencies to consolidate IT infrastructure within SITSD, it is assumed that this recommendation would be developed as a collaborative effort between MDT and SITSD.

Failure to have an appropriate cloud strategy typically results in an organization executing a series of accidental cloud adoptions potentially resulting in a disparate series of platforms, vendors, and solutions that could be difficult to manage and fail to achieve the desired or projected benefits. Worse can be the prospect of the organization finding itself locked into arrangements that do not provide any or all of the expected benefits. Prior to selecting technology and tools, enterprise or holistic planning is necessary to understand all of the business requirements and technical drivers. In other words, it is important to prevent technology alone from driving decisions, but instead allow business requirements to drive decisions as well. Organizations with an enterprise-wide Cloud Strategy are typically more successful using the cloud to reduce costs, improve efficiencies, and improve business agility than those without an enterprise-wide cloud strategy.

Unfortunately, the term "cloud" is generic and does not describe anything specific, as it is applied generically to a variety of technologies and services. It is important to understand the landscape and terminology of cloud computing. Organizations considering a move to cloud computing need to understand the various aspects of cloud computing and assess their situation to decide the solutions that are appropriate for their unique needs. It is clear that cloud computing is accelerating and a viable option within IT and over time will likely become the default method of IT delivery.

To avoid potential terminology confusion, the following establishes basic definitions for the most commonly used cloud computing service models (IaaS, PaaS, and SaaS):

- Infrastructure as a Service (IaaS) — under this model, application virtual machines (VMs) are simply moved from the on-premises data center to the cloud. This is frequently an easy migration strategy with benefits such as cost savings, replacing capital funds expenditures with operational funds. However, under this model, the inhouse IT operations staff still need to perform tasks as patch management, updates, and upgrades. Nevertheless, IaaS is one of the most common cloud models because it reduces the time between purchasing and deployment to almost nothing. Additionally, because it is similar to how IT has always operated it provides an easy cloud model for IT. Organizations with a large investment in their traditional IT infrastructure typically wait for those investments to "earn out" before considering this model.

- Platform as a Service (PaaS) — under this model, the cloud provider maintains all system software, removing the burden of upgrades and patches from the existing IT operations staff. In this model, the enterprise only focuses on deploying its code to the PaaS machines. The cloud provider is responsible for maintaining operating systems, database software, integration software, and other features under the terms

of a service level agreement (SLA). However, there is still coordination needed between the IT operations staff and the cloud provider to ensure that the organization's code remains current with these operating systems, database software, and any required integration software.

- Software as a Service (SaaS) — under this model, applications are rented. This is typically the most cost-effective of the models because typically the only work involved for the IT operations staff is provisioning users and data. Typically, SaaS applications are most appropriate for non-business-differentiating functions; that is, applications that do not require custom or customized applications to accommodate differentiating business models and rules.

In practice, the differences between these models is not always as crisp as the definitions imply, especially between IaaS and PaaS, but these definitions still serve as a solid basis for understanding the options. Figure 38 illustrates the various Cloud Computing models described above.

Service Lines

Examples

Cloud Computing

Software as a Service (SaaS)
- Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Supply Chain Management (SCM), etc.
- Security, Billing, Document Management
- Collaboration, Business Intelligence

Platform as a Service (PaaS)
- Application Server, Database
- Integration, Middleware
- Application Development Environment

Infrastructure as a Service (SaaS)
- Disaster Recovery, Backup Services
- Storage on Demand, Hosting on Demand
- Virtual Servers, Service Management

FIGURE 38: CLOUD COMPUTING MODELS

In addition, the terms "private cloud" and "hybrid cloud" are commonly used:

- Private cloud — a term that applies to what traditional IT has been doing for many years in on-premises data centers, albeit with a recognition that the "private cloud" on-premises data center should be following industry best practices using virtualization, automated management, and employing a technology stack consistent with what is found in commercial cloud offerings.

- Hybrid Cloud — for numerous reasons, organizations may choose to keep some certain applications on-premises. Examples might include nonstandard systems or systems using or requiring out-of-date software, applications remaining on-premises while waiting to "earn out" before migration to the cloud. Under this model, some applications run in the cloud while others remain on-premises, requiring secure high-speed communications between the environments. Under this model, the cloud can be viewed as an extension of the existing datacenter.

As any organization considers utilizing Cloud Computing, they also need to realize that they are substituting the ability to have absolute control over their inhouse or on-premises environment for the opportunity to maintain the same business application environment at potentially lower costs. However, contractual arrangements that give up control for higher costs are clearly poorly negotiated deals to be avoided, and a key reason for having an underlying strategy.

Figure 39 illustrates the typical tradeoff between cost and control:
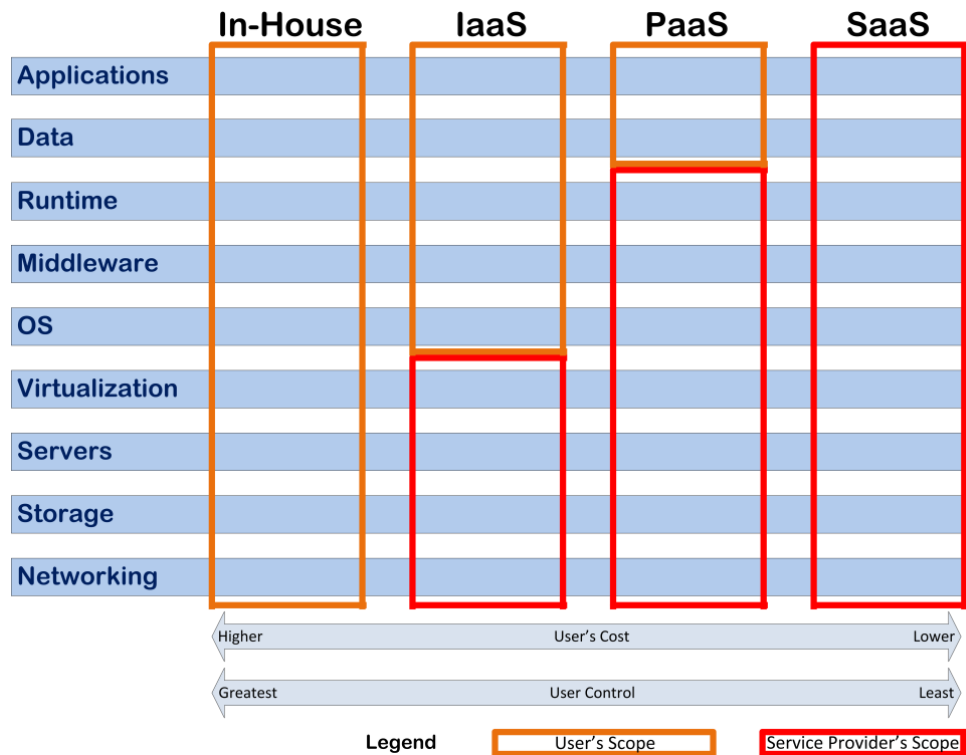
FIGURE 39: CLOUD COMPUTING MODELS—COST VERSUS CONTROL

Within state agencies, the ability for any agency to utilize cloud services strategies varies depending on how information technology is organized within the state, and the extent to which the State CIO and the State CIO's Office have established policies and standards. Given the

recent directive to centralize IT infrastructure within Montana State Government, the recommended cloud strategy must therefore be a collaborative effort between MDT (in terms of being able to articulate its current and future business requirements with respect to new applications) and SITSD to define scalable, cost-effective solutions, addressing the all needs of the state.

E.4 TECHNOLOGY GOVERNANCE

The goal of technology governance is to optimize and leverage IT investments to support accomplishment of business objectives. This is accomplished by following established IT Governance frameworks and best practices. The eVision Partners team recommends that a comprehensive MDT-wide technology governance process be implemented. The specific recommendations within the proposed MDT-wide technology governance framework are outlined below.

E.4.1   Establish Technology Governance (IT-1)

The proposed MDT IT Technology Council would provide governance over all technology initiatives, including technology projects done inside or outside of the MDT Information Services Division. Adopting and implementing this recommendation would provide MDT a forum for the evaluation and ultimate implementation of the enterprise architecture recommendations. Implementing a technology governance process would demonstrate MDT's commitment to enterprise architecture and establish a foothold for expanded technology governance as an important factor in the long-term success of MDT. Technology governance should be considered in the broader sense that considers all aspects of MDT's enterprise architecture: business, applications, data, and technology. This council should be guided by principles that ensure quality, promote good management and planning, stress process improvement, and mitigate agency risk.

Many government agencies (and companies) are seeing the strategic deployment of technology as important as the other strategic initiatives of the business and have established technology governance models. Technology governance provides senior leadership the ability to direct, measure, and evaluate enterprise technology resources to support the achievement of the organization's vision, mission, and strategic goals. Technology governance accomplishes the following:

- Recognizes technology as a strategic part of the organization's success;

- Integrates technology, people, and processes;

- Guides technology investments that generate business value;

- Steers technology investments to mitigate MDT risks;

- Monitors performance of technology resources; and

- Establishes accountability.

It is important to note that Technology Governance is

- Not a replacement for good technology management;

- Not a replacement of technology control structure;

- Not a technology power authority;

- Not a process that pits business groups against each other;

- Nor is it a bureaucracy that impedes processes and production.

Currently, the MDT Division Administrators act as the *de facto* IT Steering Committee to review proposed technology investments. It is recommended that the enhanced MDT Technology Council include a mix of Division Administrators and senior staff members from each division. This will provide for both a policy level viewpoint and more hands-on experience with how proposed technology investments may impact day-to-day operations. The committee should have an executive champion and a committee leader, ideally selected from a division other than the Information Services Division. MDT ISD staff would serve as staff support for the Technology Council.

The research team recommends formal policies and procedures be adopted to guide the committee. We have included in this report a draft MDT Technology Governance Policy and supporting procedures. This draft Technology Governance Policy is included in the Appendix (see H.4 Draft MDT Technology Governance Policy, page H-15). These documents codify MDT's path toward Technology Governance:

- The policies establish the scope of the committee and membership, and empowers the membership to promulgate policies and processes to effectively deliver technology and technology services.

- The procedures define responsibilities and deliverables for the committee.

The research team also recommends that the MDT Technology Council adopt a charter to guide its members in achieving its mission. We have developed and included in the Appendix a draft charter (refer to H.5 MDT Technology Council Draft Charter, on page H-20).

Chief among the responsibilities of the MDT Technology Council would be the establishment of technology deployment plans and a technology procurement and deployment prioritization process built upon the existing procedures to develop the annual IP Plan. Subcommittees of the MDT Technology Council would develop those policies and processes for the approval of the committee.

The new technology investment prioritization process should be transparent to stakeholders. It should include a strong project scoping and screening process for projects prior to being

evaluated to make sure the projects are well thought out. The scoring criteria should also be tightly aligned with MDT's strategic objectives, critical success factors, and business drivers.

The key components in the new MDT technology investment prioritization process include:

- Scoping and screening of candidate projects;

- Evaluating projects for inclusion in a rolling five-year technology plan and the current fiscal year IT budget; and

- Managing scope, schedule, and budget changes during the execution of approved IT projects.

Each of these components is described in more detail below.

E.4.1.1 Scoping and screening of candidate projects

The eVision project team recommends that the front-end scoping and screening consist of two steps:

- The Project Origination Checklist (POC) is prepared by the business owner with support from IT staff describing the business need/requirements and outlining a proposed high-level scope of work to address this business need. It would also include a high-level project timeline and an order-of-magnitude cost estimate. The Division Director responsible for managing the business unit and the manager overseeing the requesting business unit would approve the Project Summary/POC to indicate initial support for the project concept prior to any significant level of resources expended to scope the project in more detail. It is envisioned that any existing forms used today for project requests would be replaced with something following the suggestions of the proposed POC included in the Appendix (page H-23).

- A detailed Project Origination Document (POD) would be prepared by the IT staff in collaboration with the business unit. This POD would provide a detailed scope statement, identify MDT and external resources required to execute the project, and identify proposed strategies for procuring any required software and services and prepared by ISD staff in collaboration with the business unit. It includes a more detailed planning-level schedule and a detailed cost estimate, including identification of future operating cost impacts. It also includes the identification of potential business benefits and a return on investment (ROI) analysis, which would model, at a minimum, a seven-year cost of ownership. The Division Director responsible for the business unit and the manager who oversees the requesting

business unit would approve the POD to indicate their support and concurrence with the proposed technology investment. An example POD is included in the Appendix (page H-25).

Figure 40 illustrates the proposed workflow for the MDT Project Scoping and Screening process.
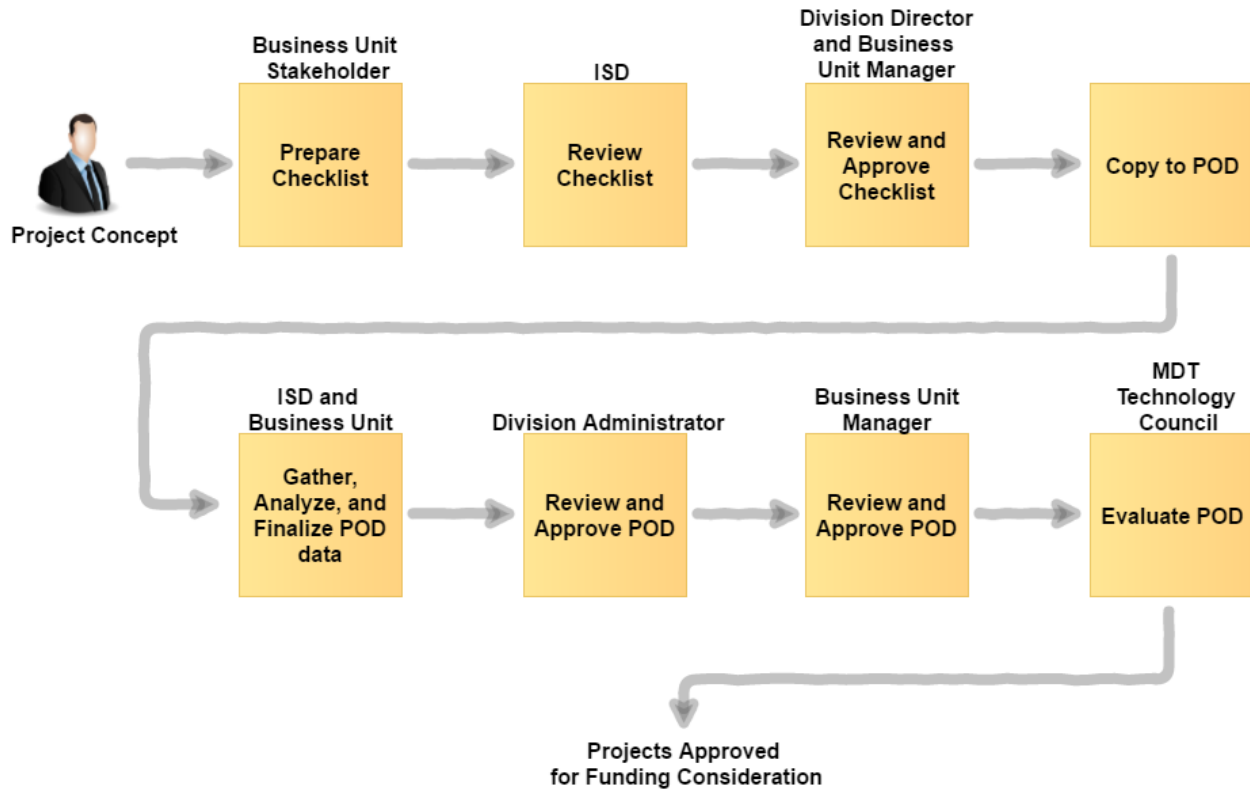
FIGURE 40: PROPOSED TECHNOLOGY PROJECT SCOPING AND SCREENING PROCESS

E.4.1.2 Evaluating projects for inclusion in the rolling five-year technology plan and current fiscal year IT budget

The eVision Partners team recommends that MDT establish a rolling, five-year technology plan as it assumes responsibility for the Enterprise Architecture (EA) created by the eVision Partners project team. Based on this plan, MDT would be able to make ongoing decisions about projects to fund within the MDT budget for each fiscal year within the five-year plan.

The information contained within the suggested Project POC and POD forms should be used to score all proposed projects. The MDT Technology Council would use these project scores as a primary input, but certainly not the sole input to the project prioritization and selection process. The council is expected to weigh various tradeoffs and balance technology expenditures to some extent across MDT business areas when deciding whether to program the proposed project within the five-year technology plan and the current fiscal year budget.

The scoring criteria should be clear and closely tied to how the project will enable MDT to achieve its critical success factors and business drivers. It should also take into account other factors such as how the project might address business risks, the proposed return on investment (ROI), the availability of any external funding, the need for or opportunity to partner with other agencies, and the anticipated overall deliverability of the project within the proposed scope, schedule, and budget. An example of an MDT Technology Investment Decision Model, based upon other similar plans implemented by members of the eVision Partners project team for other clients, is provided in the Appendix (see H.8 Capital Improvement Program Decision-Making Model, on page H-34).

E.4.1.3 Managing scope, schedule, and budget changes during execution of approved IT projects

The eVision Partners team also recommends that MDT implement a technology project change management process in which material changes to scope, schedule, and budget are reviewed by various levels of management based on the size and materiality of the change. The proposed MDT Technology Council would play a significant part in reviewing these change requests and making determinations on how to re-program technology funds as required based on significant project changes, including overruns and under-runs, in total project budget and in fiscal year project authorization.

The research team further recommends that the committee consider beginning by piloting the new technology investment process with at least one new technology request, evaluating current MDT technology initiatives in consideration of the technology investment process and deploying change management strategies to lessen the impacts of this change to current MDT technology projects.

The eVision Partners team believes that the Technology Governance recommendation should be given a high priority and the Technology Council established early in Fiscal Year 2017. A project plan for implementing the recommended governance process is provided in Figure 41. The plan should include members being appointed, formation meetings, charter establishment, policy and procedure review and adoption, committee formation, technology investment process established, and one planning cycle completed.

E.4.1.4 Project Phases

Figure 41 (next page) presents a proposed implementation timeline for the technology governance recommendation.

ID	Task Name	Start	Finish	Duration	2016												2017												2018					
					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	Form MDT IT Governance Committee	7/1/2016	8/11/2016	30d																														
2	Conduct Formation Meetings	8/12/2016	9/1/2016	15d																														
3	Establish Charter	9/2/2016	10/13/2016	30d																														
4	Enact IT Steering Committee Policies and Procedures	7/4/2016	9/23/2016	60d																														
5	Revise and Pilot new Technology Project Request Process	8/15/2016	11/4/2016	60d																														
6	Develop One and Five Year Plans	11/7/2016	2/3/2017	65d																														
7	Conduct IT Steering Committee Meetings	7/1/2016	4/29/2020	999d																														
8	Conduct Change Management Meetings	7/1/2016	4/29/2020	999d																														

FIGURE 41: IMPLEMENTATION TIMELINE FOR ESTABLISH IT GOVERNANCE (IT-1)

E.4.2 Establish Agency Technology Procurement Policy (IT-2)

The eVision Partners team recommends that MDT establish appropriate technology acquisition policies, where the MDT CIO has the responsibility and authority to approve all technology purchases.

Too much flexibility exists in technology procurement, which can have many unintended consequences. Examples of unanticipated prerequisites might be the need for additional network bandwidth, additional storage capacity, additional supporting software, incompatibility with existing software or future software, and/or availability of staff trained to provide technical support. Further, this flexibility also carries the potential issues of acquiring duplicative technology, or technology that does not integrate well into the existing technology environment.

As a best practice, the eVision Partners team recommends all information technology procurements be reviewed and approved by the department's Chief Information Officer (CIO), as the agency's senior technologist and IT thought leader, to ensure all potential issues and dependencies around any proposed IT acquisition are vetted.

Purchasing should become the point of control, to ensure this policy is adhered to, and the appropriate levels of authority and review have been exercised over the acquisition.

E.4.3 Establish Strategy and Framework for Effective Use of IT Resources (IT-3)

The eVision Partners team recommends that MDT develop a strategy and framework for the effective use of IT resources in the agency. This recommendation is also closely tied to E.4.4 Establish Consistent Use of IT standards and Polices (IT-4), which can be found below.

It is an industry best practice that staff with IT titles and/or duties report to the CIO. If these titles and duties are outside of the IT organization, the result is an organization that has, in practice, appointed multiple CIOs, thereby reducing the effectiveness of the titled CIO, as this individual cannot effectively be the technology thought leader and technology leader for the organization.

It is recommended that MDT executive management commission the Human Resources Division to perform a job study on individuals outside of the IT organization and transfer to IT those duties that should be performed in IT as well as to transfer the equivalent headcount or FTEs in order to address the added workload. In general, from a best practices perspective, it is recommended that pure application development resources should be housed within the information technology unit. True business analyst resources may be housed organizationally in the information technology unit, sometimes co-located with the business staff they support, or may be placed organizationally within a business unit with a liaison role back to application

development resources within the information technology organization. IT Project Managers should be housed within the MDT Project Management Office in ISD, or if contracted for externally, should report to the PMO on a matrix-based reporting basis.

E.4.4   Establish Consistent Use of IT standards and Polices (IT-4)

The eVision Partners team recommends that MDT enforce the uniform adherence to IT Standards and Policies on all information technology initiatives throughout the agency. This recommendation is closely tied to E.4.3 Establish Strategy and Framework for Effective Use of IT Resources (IT-3) above.

MDT has established IT Standards and Policies to protect and ensure the agency is implementing technology solutions that meet the needs of the entire organization, including ensuring appropriate security measures are addressed and these solutions are done in a consistent manner addressing the needs of the enterprise rather than being point or area specific. Allowing areas outside of IT to "game the system" and ignore these standards and policies places the agency at risk.

At the same time, it is important that all impacted stakeholders have an opportunity to contribute to the development of standards. There are a number of technically strong, experienced, and knowledgeable resources in areas outside of ISD who must be included in any standards task forces and assist in developing IT standards and procedures in order to make them truly reflective of enterprise requirements.

E.4.5   Establish Effective IT Contract Services Capabilities (IT-5)

Many of the recommendations presented in this proposed MDT Enterprise Architecture represent a significant departure from the way technology projects have been handled in the past by MDT. As MDT continues transitioning from inhouse developed applications and solutions and becomes increasingly dependent on contracted IT solutions and services, this will require a set of strong contract management skills that have always been in high demand and traditionally been possessed by few in IT. Most IT staff do not get the opportunity to obtain, sharpen, or use these skills on a regular or frequent basis. The eVision Partners project team has recognized that MDT does not presently have staff heavily experienced in capturing and documenting business requirements, and constructing effective RFPs to obtain COTS solutions, services, and/or system integrators.

For these reasons, the eVision Partners project team recommends MDT utilize experienced consultants to assist in these efforts as a staff augmentation and advisory service to ensure successful technology projects, until the MDT Information Technology staff gains the experience to be successful on their own. It is suggested that a way to develop this inhouse experience

would be to have MDT Information Technology staff work closely with these consultants on various efforts to facilitate knowledge transfer.

In addition, there is a need for full life-cycle contracts management for IT projects from project initiation through procurement, implementation, and project closeout. It is recommended that MDT implement this end-to-end contracts management capability within ISD, through some combination of internal resourcing and/or outside support for larger project efforts. Initially, we would expect that a part of an ISD staff member's time (25% to 50% of an FTE) should be focused on acting as the IT Contracts Manager. Having some level of specialization in IT contracts provides for separation of duties between project managers who may be working with a contractor on a day-to-day basis on project details; allows a project manager to better focus on managing project scope, schedule and budget; and allows MDT to develop a level of expertise which would not be achieved if various staff members were spending a small amount of their time on contract management type work.

F. STRATEGIC EA IMPLEMENTATION PLAN FOR RECOMMENDATIONS

This section provides an overview of the proposed plan for implementing the MDT Enterprise Architecture program recommendations in this report. It consists of the following:

- Prioritization and order of magnitude cost estimates for each recommendation;

- Proposed work plan for implementation of recommendations;

- Anticipated benefits from the implementation of the Enterprise Architecture program recommendations;

- Risk Management Plan; and

- Organizational Change Management Strategy to guide implementation activities.

F.1 HIGH-LEVEL OVERVIEW OF IMPLEMENTATION SCHEDULE AND WORK PLANS

Based on the relative prioritization of each recommendation, as well as the complexity, associated costs and risk to implement, the eVision Partners team has developed a multi-year implementation plan for the MDT Enterprise Architecture program. This implementation plan is depicted in Figure 42 on the following page.

FY2016 | FY2017 | FY2018 | FY2019 | FY2020 | FY2021 | FY2022 | FY2023

FOUNDATION PROGRAMS

Startup Phase — IT Governance (IT-1, IT-2, IT-3, IT-4, IT-5)

Startup Phase — Data Governance (DA-1, DA-3)

Phased Implementation of Technology Architecture Improvements (TA-1, TA-2, TA-3, TA-4, TA-5)

Reqs Defn | RFP | Implement — Implement Next Generation PPMS (AA-1)

Reqs Defn | RFP | Implement — Implement Next Generation TIS/LRS & Roadway Inventory (AA-3)

Reqs Defn | RFP | Implement Utilities | Implement ROW | Implement Outdoor Advertising — Implement Utilities, ROW, & Outdoor Advertising (AA-4, AA-15)

Reqs Defn | Implement — Implement Resource Management capability in Planisware (AA-5)

Process Reengineering | Solution Design | Reqs Defn | Implement — Reengineer As-Built Process (AA-6)

Define Strategy | Reqs Defn | RFP | Implement — Implement Design Modeling Strategy (AA-7)

Reqs Defn & Project Planning | Implement — AASHTOWare™ Project Construction & Materials (AA-8, AA-9)

Develop Transportation Asset Management Strategy, Policies, and Requirements | Project Planning | RFP | Implement Cross Asset Analysis Toolset
Reqs Defn | RFP | Implement Transportation Assets Warehouse — Implement Enterprise Asset Management Strategy (AA-10)

Complete MMS Implementation
Implement MMS

Reqs Defn | RFP | Implement — Extend SIMS (AA-11)

Reqs Defn | RFP | Implement — Implement Modeling & Analytics for Structures (AA-12)

Develop Policies, Strategy, and Business Requirements | Implement (phased release by asset) — Establish ancillary assets & asset management governance (AA-13)

Project Planning/Prep | Reqs Defn | RFP | Implement — Replace Traveler Info System (AA-14)

Implement SMARTCOP enhancements in incremental releases — Extend and Enhance SMARTCOP (AA-16)

Governance/Strategy Development | Reqs Defn | RFP(s) | Implement mobile technology solutions (multiple projects to cover multiple functional areas) — Implement Internal/External/Client-Facing Mobile Technology (AA-17)

Reqs Defn | RFP | Implement — Implement Enterprise Grants Management Solution (AA-18)

Define Requirements, RFP, and vendor selection | Implement — Financial Suite: (AA-19)

Financial System Revisions | Financial System revisions based on audit | Define Requirements, RFP, and vendor selection | Implement — Financial ERP: (AA-20 & AA-21)

Define Requirements & Strategy | RFP | Vendor Selection | Implement — Implement HR ERP: Talent Mgt, Disc & Grievance Mgt (AA-22, AA-23)

Implement ePart | Enhancements — Complete ePart Implementation (AA-24)

Inventory Forms | Develop Project Work Plan | Execute Work Plan and Retire All Oracle Forms — Retire Oracle Forms (AA-25)

Reqs Defn | RFP | Implement — Implement Case Management System (AA-26)

Select Pilot Area / Reqs Defn | Design Solution | RFP | Implement Pilot, Assess and Evaluate, and continue to implement in multiple / phased releases — Implement Data Warehouse, BI, Analytics (DA-2)

Engineering Reqs Defn | RFP | Implement Engineering Solution
Define Enterprise Requirements for ECM | RFP | Implement (Phased) — Implement ECM (AA-2)

07/15/2016

FIGURE 42: MDT HIGH-LEVEL ENTERPRISE ARCHITECTURE IMPLEMENTATION PLAN

F.2 PRIORITIZATION AND COST ESTIMATES FOR RECOMMENDATIONS

Figure 43 provides both a priority and an order of magnitude cost estimate for each proposed recommendation in the Enterprise Architecture program:

- The cost estimates have been prepared based on the eVision Partners project team's experience with similar projects in other states and/or based on the cost of recent initiatives similar in scope in other states. These costs are laid out to demonstrate the annual spend patterns for each recommendation. These cost estimates are intended only for high-level program level planning and preliminary budgeting purposes only. Each recommendation (or project) should go through an appropriate project scoping and screening processes during which a more detailed cost estimate would be developed.

- The priorities are based both on the anticipated business value to MDT of implementing the recommendation and the relative priority of the recommendation in terms of its role as a building block in the execution of the Enterprise Architecture program. For example, IT Governance is a key element that need to be in place to successfully execute many of the other recommendations, and would have a very high priority to implement.

Transportation Project Delivery

ID	Desc	Estimated Costs	FY2017 Fed/Other	FY2017 MDT	FY2018 Fed/Other	FY2018 MDT	FY2019 Fed/Other	FY2019 MDT	FY2020 Fed/Other	FY2020 MDT	FY2021 Fed/Other	FY2021 MDT	FY2022 Fed/Other	FY2022 MDT	FY2023 Fed/Other	FY2023 MDT	Sub-Totals Fed/Other	Sub-Totals MDT	Total	Internal Labor
AA-1	PPMS	$5m	$2,475,000	$275,000	$1,575,000	$175,000	$450,000	$50,000									$4,500,000	$500,000	$5,000,000	$712,500
AA-3	TIS/LRS	$1m - $2m	$1,440,000	$160,000	$360,000	$40,000											$1,800,000	$200,000	$2,000,000	$190,000
AA-4	ROW	$1.5m					$720,000	$180,000	$480,000	$120,000							$1,200,000	$300,000	$1,500,000	$285,000
AA-5	Planisware®	$1m	$320,000	$80,000	$480,000	$120,000											$800,000	$200,000	$1,000,000	$47,500
AA-6	As-Built	$2m - $2.5m	$160,000	$40,000	$920,000	$230,000	$920,000	$230,000									$2,000,000	$500,000	$2,500,000	$142,500
AA-7	Design Modeling	$2m - $2.5m	$200,000	$50,000	$400,000	$100,000	$800,000	$200,000	$600,000	$150,000							$2,000,000	$500,000	$2,500,000	$190,000
AA-8, AA-9	AASHTOWare™	$1m	$400,000	$100,000	$320,000	$80,000	$80,000	$20,000									$800,000	$200,000	$1,000,000	$1,000,000

Maintenance and Asset Management

ID	Desc	Estimated Costs	FY2017 Fed/Other	FY2017 MDT	FY2018 Fed/Other	FY2018 MDT	FY2019 Fed/Other	FY2019 MDT	FY2020 Fed/Other	FY2020 MDT	FY2021 Fed/Other	FY2021 MDT	FY2022 Fed/Other	FY2022 MDT	FY2023 Fed/Other	FY2023 MDT	Sub-Totals Fed/Other	Sub-Totals MDT	Total	Internal Labor
AA-10	EAM	$2.5m Transportation Asset Whse plus $.25 Asset Analysis Toolset	$180,000	$20,000	$990,000	$110,000	$1,170,000	$130,000	$1,125,000	$125,000	$1,035,000	$115,000					$4,500,000	$500,000	$5,000,000	$500,000
AA-11	SIMS	$1.5m					$600,000	$150,000	$600,000	$150,000							$1,200,000	$300,000	$1,500,000	$190,000
AA-12	Structures	$2m				$400,000				$1,600,000							$0	$2,000,000	$2,000,000	$200,000
AA-13	MMS	$500K		$50,000		$100,000		$100,000		$100,000		$100,000		$50,000			$0	$500,000	$500,000	$500,000

Transportation Operations Management

ID	Desc	Estimated Costs	FY2017 Fed/Other	FY2017 MDT	FY2018 Fed/Other	FY2018 MDT	FY2019 Fed/Other	FY2019 MDT	FY2020 Fed/Other	FY2020 MDT	FY2021 Fed/Other	FY2021 MDT	FY2022 Fed/Other	FY2022 MDT	FY2023 Fed/Other	FY2023 MDT	Sub-Totals Fed/Other	Sub-Totals MDT	Total	Internal Labor
AA-14	Traveler System	$3m - $4m		$0		$800,000		$1,200,000		$2,000,000							$0	$4,000,000	$4,000,000	$570,000
AA-15	Outdoor Adv	$1m										$500,000		$500,000			$0	$1,000,000	$1,000,000	$95,000
AA-16	SMARTCOP	$2m	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000	$200,000					$1,000,000	$1,000,000	$2,000,000	$475,000
AA-24	ePart	$710K		$710,000													$0	$710,000	$710,000	$30,000

Multi-modal and Grants Management

ID	Desc	Estimated Costs	FY2017 Fed/Other	FY2017 MDT	FY2018 Fed/Other	FY2018 MDT	FY2019 Fed/Other	FY2019 MDT	FY2020 Fed/Other	FY2020 MDT	FY2021 Fed/Other	FY2021 MDT	FY2022 Fed/Other	FY2022 MDT	FY2023 Fed/Other	FY2023 MDT	Sub-Totals Fed/Other	Sub-Totals MDT	Total	Internal Labor
AA-18	Grants Mgt	$1m - $1.5m										$675,000		$825,000			$0	$1,500,000	$1,500,000	$150,000

Business Support Services

ID	Desc	Estimated Costs	FY2017 Fed/Other	FY2017 MDT	FY2018 Fed/Other	FY2018 MDT	FY2019 Fed/Other	FY2019 MDT	FY2020 Fed/Other	FY2020 MDT	FY2021 Fed/Other	FY2021 MDT	FY2022 Fed/Other	FY2022 MDT	FY2023 Fed/Other	FY2023 MDT	Sub-Totals Fed/Other	Sub-Totals MDT	Total	Internal Labor
AA-19, AA-20, AA-21	ERP - CARES and AP Replacement	$8m - $10m				$100,000		$400,000		$2,500,000		$3,500,000		$3,500,000			$0	$10,000,000	$10,000,000	$1,500,000
AA-19, AA-22, AA-23	ERP: Talent, Disc & Grievance Mgt	$6m - $8m										$3,000,000		$3,000,000		$2,000,000	$0	$8,000,000	$8,000,000	$1,200,000
AA-26	Case Mgt	$150K						$150,000									$0	$150,000	$150,000	$95,000

Cross-Functional

ID	Desc	Estimated Costs	FY2017 Fed/Other	FY2017 MDT	FY2018 Fed/Other	FY2018 MDT	FY2019 Fed/Other	FY2019 MDT	FY2020 Fed/Other	FY2020 MDT	FY2021 Fed/Other	FY2021 MDT	FY2022 Fed/Other	FY2022 MDT	FY2023 Fed/Other	FY2023 MDT	Sub-Totals Fed/Other	Sub-Totals MDT	Total	Internal Labor
AA-2 & TA-4	ECM	$5m - $6m	$960,000	$240,000		$600,000		$1,500,000		$1,500,000		$400,000	$0	$400,000		$400,000	$960,000	$5,040,000	$6,000,000	$600,000
AA-17 & TA-5	Mobile	$1.8m - $2m	$200,000	$200,000	$175,000	$175,000	$175,000	$175,000	$175,000	$175,000	$275,000	$275,000	$0	$0			$1,000,000	$1,000,000	$2,000,000	$600,000

Information Technology

ID	Desc	Estimated Costs	FY2017 Fed/Other	FY2017 MDT	FY2018 Fed/Other	FY2018 MDT	FY2019 Fed/Other	FY2019 MDT	FY2020 Fed/Other	FY2020 MDT	FY2021 Fed/Other	FY2021 MDT	FY2022 Fed/Other	FY2022 MDT	FY2023 Fed/Other	FY2023 MDT	Sub-Totals Fed/Other	Sub-Totals MDT	Total	Internal Labor
AA-25	Oracle Forms	$1m		$0		$0		$300,000		$300,000		$200,000		$200,000			$0	$1,000,000	$1,000,000	$800,000
DA-1	Data Governance	Startup Consulting Services $200K 1 FTE Ongoing		$195,000		$195,000		$95,000		$95,000		$95,000		$95,000		$95,000	$0	$865,000	$865,000	$665,000
DA-2	DW	$3m - $5m	$175,000	$175,000	$425,000	$425,000	$400,000	$400,000	$400,000	$400,000	$400,000	$400,000	$400,000	$400,000	$300,000	$300,000	$2,500,000	$2,500,000	$5,000,000	$2,550,000
DA-3	Data Svcs	$500K (over 2 years)				$500,000		$500,000									$0	$1,000,000	$1,000,000	$1,000,000
TA-1	Single Sign-on	$3m		$0		$0		$400,000		$400,000		$800,000		$800,000		$600,000	$0	$3,000,000	$3,000,000	$2,850,000
TA-2	DRP	1/4 FTE Ongoing plus $200K support and testing		$23,750		$23,750		$23,750		$23,750		$23,750		$23,750		$23,750	$0	$166,250	$166,250	$166,250
TA-3	Cloud	$200K Start up Costs 1/4 FTE Ongoing		$23,750		$23,750		$23,750		$23,750		$23,750		$23,750		$23,750	$0	$166,250	$166,250	$166,250
TA-4	Mobile	1/4 FTE Ongoing for Tech Arch aspects		$23,750		$23,750		$23,750		$23,750		$23,750		$23,750		$23,750	$0	$166,250	$166,250	$166,250
TA-5	Collaboration	Included in ECM (AA-24)		$0		$0		$0		$0		$0		$0		$0	$0	$0	$0	
IT-1	IT Gov	Startup Consulting Services $100K 1/2 FTE Ongoing		$147,500		$47,500		$47,500		$47,500		$47,500		$47,500		$47,500	$0	$432,500	$432,500	$332,500
IT-2	Procurement	Included in IT-1		$0		$0		$0		$0		$0		$0		$0	$0	$0	$0	
IT-3	EAM	Included in IT-1		$0		$0		$0		$0		$0		$0		$0	$0	$0	$0	
IT-4	Consistency	Included in IT-1		$0		$0		$0		$0		$0		$0		$0	$0	$0	$0	
IT-5	Contract Svcs	Contract Services $175K Annually		$175,000		$175,000		$175,000		$175,000		$175,000		$175,000		$175,000	$0	$1,225,000	$1,225,000	$1,225,000

TOTALS			FY2017 Fed/Other	FY2017 MDT	FY2018 Fed/Other	FY2018 MDT	FY2019 Fed/Other	FY2019 MDT	FY2020 Fed/Other	FY2020 MDT	FY2021 Fed/Other	FY2021 MDT	FY2022 Fed/Other	FY2022 MDT	FY2023 Fed/Other	FY2023 MDT	Sub-Totals Fed/Other	Sub-Totals MDT	Total	Internal Labor
			$6,710,000		$5,845,000		$5,515,000		$3,580,000		$1,910,000		$400,000		$300,000		$24,260,000		$24,260,000	$17,968,750
				$2,988,750		$4,943,750		$10,373,750		$9,508,750		$10,553,750		$6,563,750		$3,688,750		$48,621,250	$48,621,250	$48,621,250
			$9,698,750		$10,788,750		$15,888,750		$13,088,750		$12,463,750		$6,963,750		$3,988,750		$72,881,250		$72,881,250	$72,881,250

FIGURE 43: HIGH-LEVEL COST ESTIMATES FOR RECOMMENDATIONS

F.3 COST/BENEFIT ANALYSIS

This section describes the anticipated business case for the proposed MDT Enterprise Architecture Program. It outlines a number of anticipated benefits of the proposed Enterprise Architecture Program for MDT. It also delineates anticipated benefits associated with a number of the individual project recommendations within the program.

F.3.1   ROI Analysis Assumptions

Based on both the experience of the eVision Partners project team with other state departments of transportation and experience with other organizations, there are a number of potential benefits from the implementation of an Enterprise Architecture program. Specific benefits directly attributable to an Enterprise Architecture program include:

- Structured documentation of an organization's business drivers, which promote improved planning and decision making;

- Improved communication and collaboration including:

  o Communication both within the business organization and between business units and the technology organizations, and

  o Establishment of a standardized vocabulary for individuals to utilize when talking about technology requirements;

- Business-centric architectural views, which:

  o Assist with communicating the complexity of large systems,

  o Assist in understanding interactions between systems, and

  o Facilitate on-ongoing management of complex technology environments;

- A focus on the strategic use of emerging technologies which:

  o Drive implementation of business efficiencies,

  o Drive process standardization, and

  o Improve the ability of the business to meet changing requirements;

- Improved sharing of information across the enterprise by promoting:

  o Consistency, accuracy, and timeliness of information, and

- Integrity, quality, availability, and access to information;

- A structured technology investment process, which:

  - Aids in the identification of benefits, impacts, and life-cycle cost of proposed technology projects,

  - Provides a consistent way to analyze alternatives, risks, and trade-offs, and

  - Provides the prioritization of candidate technology projects based on business value;

- Better leveraging and management of MDT's technology spend as a result of the ability to:

  - Design more quality and flexibility into applications without increasing costs,

  - Achieve economies of scale through sharing services, and

  - Expedite the integration of both legacy and new systems

F.3.2   Benefits from Projects Recommended in the MDT EA Program

In addition to the above benefits attributable to the Enterprise Architecture program, there are additional potential benefit streams from the implementation of the project recommendations contained within the proposed MDT Enterprise Architecture program. Based on the eVision Partners team's experience implementing ERP solutions, program and project management systems, enterprise asset management, construction management, and maintenance management initiatives in other state departments of transportation, the research team expects MDT to achieve many of the following benefit streams:

- Increased efficiency in the delivery of the transportation program:

  - Reductions in the cost to deliver a project through improved program and project management tools including enhanced project budgeting and costing,

  - Improved and more effective cost-effective project programming decisions through enhanced needs identification, project scoping, project prioritization, and selection tools, and

  - Reductions in construction contract change orders, claims, project delays, and overruns through more effective contract management and monitoring tools;

- Improved management of transportation assets and consumable inventory:

- o Improved effectiveness in the use of the agency's maintenance budget through improved life-cycle cost management, as a result of implementation of an integrated transportation asset management solution with life-cycle cost modeling, needs identification, trade-off analysis, and performance-based budgeting capabilities;

- Increased automation of accounting and other support functions:

  - o Opportunity to redirect the time of some accounting and procurement staff through capturing data at the source, and through the use of employee and vendor self-service capabilities, and

  - o Improved contract management capabilities through the consolidation of multiple contract management systems into a single contracts management application that is tightly integrated with SABHRS ERP;

- Reduced information technology costs:

  - o Redirection of some MDT IT staff to supporting more mission specific business applications by leveraging SABHRS, Oracle Taleo and potentially the future statewide grants management solution and other statewide solutions for the department's financial, contract management, human capital management and procurement management system requirements;

- Leveraging modern technologies to better enable increased efficiency and effectiveness throughout the agency:

  - o The ability to more effectively meet MDT business requirements and provide a platform that will be able to more easily address changes to business needs in the future,

  - o Improved customer service to MDT partners and employees,

  - o Standardized reporting capabilities with more timely and accurate data,

  - o Electronic workflow and approval capabilities for many business processes,

  - o Elimination or significant reduction of the number of silo systems,

  - o Accurate capture at the source and secure storage of MDT data,

  - o Self-service functionality for employees, partners and suppliers, and

- o Improved management analytics and performance measurement capabilities through the new Data Warehouse environment.

F.4 RISK MANAGEMENT

The objectives of program/project risk management are to decrease the probability and negative impact of events considered adverse to a successful project outcome. Risk management begins during overall program planning and is executed for each project within the program during planning for that project. It then continues throughout the life cycle of the individual project and the program itself. Assumptions made in the development of a project plan, schedule, or resource allocation are candidates for documenting/identifying as a risk. Factors external to the project may also have an impact on the team's ability to deliver and should be included.

Table 11 (page 161) identifies potential risks to the success of the MDT Enterprise Architecture program and delineates potential mitigation strategies to address these risks. Once created for a project, this list should be regularly reviewed and updated throughout the program/project execution, in order to be successful in managing risk.

There are business, or organizational, risks as well as technical risks, as noted in this section's opening comments:

- Business Risk — Risks in this category could include items such as the need to change existing processes and procedures, the need for supporting legislative changes, the need for organizational change management, and the need to implement new or standardized business processes. Other issues that should be considered:

  - o The level of executive and staff support required for the proposed change;

  - o The agency's demonstrated ability to successfully manage projects of this scope and complexity;

  - o The skills and experience available with the agency to implement the approach;

  - o The number of impacted users;

  - o The amount of required training; and

  - o The length of time the agency has to complete the project.

- Technical Risk — Risks in this category could include items such as the size and scale of the effort required for program implementation, the complexity and degree

of need to integrate this program with other existing systems or other in-motion programs, the need to implement new technology, the technical skills required to implement or support the new system, and skill set gaps within the current staff.

TABLE 11: RISK REGISTER FOR BUSINESS AND ORGANIZATIONAL RISKS

ID	CATG	Description	Internal/ External	Prob- ability (L/M/H)	Impact (L/M/H)	Owner	Strategy (Accept, Avoid, Mitigate, etc.)	Notes
R-1	Business	Need to change existing business process(es) to effectively use new software	Internal	High	Med	MDT Technology Council	Mitigate	• Establish organizational change management program • Engage stakeholders from impacted business units in defining process changes
R-2	Business	Inconsistent business processes and standards across MDT business units could impact drive to standardize business processes	Internal	High	Med	MDT Technology Council	Mitigate	• Establish organizational change management program • Engage stakeholders from impacted business units in defining process changes
R-3	Business	Concern in various business unit(s) regarding apparent loss of previously tailored/custom functionality	Internal	High	Med	MDT Technology Council	Mitigate	• Establish organizational change management program • Engage stakeholders from impacted business units in defining process changes
R-4	Business	Changes in MDT or other agency executive management could impact various programs/projects	External	High	High	MDT Technology Council and MDT ISD PMO	Mitigate	• Immediately brief new management on programs/projects and status • Engage existing Program Steering Committee members to assist in presenting program/project benefits to new management team members • Include career staff in key program roles for continuity
R-5	Business	Governor's Executive Order issued in May 2016 requiring for IT convergence requiring all State agencies to migrate IT infrastructure to SITSD over the next 18 months	External	High	High	MDT CIO and MDT Technology Council	Mitigate	• Review proposed MDT Enterprise Architecture recommendations with SITSD • Collaborate closely on those recommendations deemed to be impacted by the Governor's executive order – for example the cloud strategy (TA-3) and the disaster recovery plan (TA-2) • Evaluate how to integrate existing State technology investments into various recommendations – as an example selection and implementation of an Enterprise Content Management solution (AA-2)
R-6	Business	Delay in obtaining funding for all or part of proposed program/project	External	Med	High	MDT Technology Council	Avoid & Accept	• Actively engage with stakeholders and policy makers to obtain approval(s) • Revisit budgets at each MDT Technology Council meeting; economic factors should be monitored and on agenda when appropriate for discussion • Adjust program schedules as necessary based on timing of funding • Identify activities that could continue in the interim, such as process analysis, requirements gathering, etc., to maintain program momentum

ID	CATG	Description	Internal/ External	Prob- ability (L/M/H)	Impact (L/M/H)	Owner	Strategy (Accept, Avoid, Mitigate, etc.)	Notes
R-7	Business	Funding amount(s) approved is(are) lower than requested amount(s)	External	Med	High	MDT Technology Council	Avoid & Accept	• Actively engage with stakeholders and policy makers to obtain approval(s) • Revisit budgets at each MDT Technology Council meeting; economic factors should be monitored and on agenda when appropriate for discussion • Adjust scope and/or program schedule as necessary based on timing
R-8	Business	Policy issues not resolved in a timely manner	Internal	Med	High	MDT Technology Council	Avoid	• Initiate early discussions • Monitor and track policy issues and resolutions • Ensure management understands required timelines for resolution and cost/schedule impact(s)
R-9	Business	Challenges in obtaining program/project stakeholders to take the enterprise view and/or in reaching consensus on enterprise needs versus the need of specific business units	Internal	Medium	High	MDT Technology Council and MDT ISD PMO	Mitigate	• Employ effective organizational change management measures • Encourage stakeholders to take their "business unit" hat off and put on their "agency" hat for the benefit of the agency and program • Encourage open communication on the reasons "why something won't work for me" • Identify and communicate the benefits of the enterprise/agency viewpoint to team members and stakeholders • Leverage best practices experience of pre-planning and implementation consultants
R-10	Business	Specialized requirements or significant gaps identified in one or more business units within the agency	Internal	Medium	High	MDT ISD PMO and executive sponsors of specific projects	Avoid & Mitigate	• Assess potential for modifying business processes in individual business units or modifying enterprise process slightly • Assess need for additional third-party software and/or minor customizations as a last resort • Encourage active executive sponsorship to help resolve concerns of specific business units
R-11	Business	Staff not able to participate in workshops, requirements gathering, requirements validation, testing, signoffs, etc. within the program/project schedule	Internal	High	High	MDT ISD PMO	Avoid & Mitigate	• Proactively identify key resources and resource constraints during project planning • Re-assign some/all responsibilities of key extended program/project team members • Reprioritize some/all activities assigned to extended team members • Utilize project approach that leverages best practices as the starting point for discussion to better leverage staff time • Leverage best practices experience of pre-planning and implementation consultants

MDT Strategic EA Final Report

ID	CATG	Description	Internal/ External	Prob- ability (L/M/H)	Impact (L/M/H)	Owner	Strategy (Accept, Avoid, Mitigate, etc.)	Notes
R-12	Business	Changes in state priorities that impact program/project funding and/or priority of program/project implementation	External	Medium	High	MDT Technology Council and MDT ISD PMO	Mitigate & Accept	• Keep executive management, Montana State CIO, governor, legislature apprised of program/project and its status along with anticipated benefits • Adjust project scope and/or timelines based on priority changes • Remain focused to the highest extent possible on implementing highest payback areas first in any necessary program/project implementation plan revisions
R-13	Business	Change in the priorities of the state and/or Montana State CIO impacting program/project that drive revisions to their costs and/or timeline(s)	External	Medium	High	MDT Technology Council and MDT ISD PMO and executive sponsors of specific projects	Mitigate & Accept	• Adjust program/project timelines • Attempt to minimize additional costs as a result of impact(s) • Remain focused to the highest extent possible on implementing highest payback areas first in any necessary program/project implementation plan revisions
R-14	Technical	Changes in requirements during implementation	Internal	High	High	MDT Technology Council and MDT ISD PMO and executive sponsors of specific projects	Mitigate	• Involve business units early in developing initial business requirements • Remain actively engaged with business units throughout program/project • Require formal sign-offs by Program Steering Committee on business requirements • Implement a well-defined scope change management process with Program Steering Committee approvals and any other changes that impact budgets/schedules
R-15	Technical	Need to provide training to large number of employees on new system(s)	Internal	Medium	High	MDT ISD PMO and executive sponsors of specific projects	Mitigate	• Employ effective organizational change management measures • Develop training strategy for each program/project component and closely monitor status of training
R-16	Technical	Lack of skills/experience with new technologies being implemented	Internal	Medium	High	MDT ISD PMO and MDT ISD Applications Bureau Chief	Mitigate	• Develop detailed technical training plan once software and other technology is identified as a part of the program/project implementation plan • Include a maintenance option within the systems integrator's agreement to provide application support for specified period following implementation

ID	CATG	Description	Internal/ External	Prob- ability (L/M/H)	Impact (L/M/H)	Owner	Strategy (Accept, Avoid, Mitigate, etc.)	Notes
R-17	Technical	Program/project scope overly large or complex and/or implementation strategy attempts to implement too much at one time	Internal	Medium	High	MDT Technology Council, MDT ISD PMO and executive sponsors of specific projects	Avoid	• Limit scope to identified business requirements • Develop implementation plan carefully linked to business benefits • Link project to business benefits • Program Steering Committee should carefully review scope of implementation plan prior to approving implementation go-ahead • Implement a well-defined scope change management process with Program Steering Committee approvals and any other changes that impact budgets/schedules
R-18	Technical	Vendor proposals/responses exceed cost estimates	External	Medium	High	MDT ISD PMO and executive sponsors of specific projects	Mitigate	• Prepare detailed estimates to the extent possible during development of the business case • Conduct vendor software demonstrations to assess the fit of the vendor solutions and assess the gap-fit to MDT business requirements • Identify significant gaps and impact up front • Benchmark costs incurred by other states who have undertaken similar programs/projects • Request modular estimates of functionality from vendors to support moving forward with reduced functionality
R-19	Technical	Complexity of integrating new COTS solutions with existing legacy applications	Internal	Medium	High	MDT ISD PMO	Avoid	• Identify all major interfaces early in the program/project planning and develop the interface strategy • Eliminate shadow IT solutions and migrate functionality into new COTS solutions to extent possible • Include adequate time in implementation schedule for assessment of interface requirements to put data into formats required by COTS solutions • Ensure early engagement with business and IT owners of systems that need these interfaces
R-20	Technical	Delay in one program/project component could impact remainder of the schedule	Internal	Medium	High	MDT ISD PMO	Avoid	• Establish reasonable schedules for all projects within the programs including schedule contingencies • Plan for multiple project implementation teams to allow balance of deployment work and production support of components already deployed

ID	CATG	Description	Internal/ External	Prob- ability (L/M/H)	Impact (L/M/H)	Owner	Strategy (Accept, Avoid, Mitigate, etc.)	Notes
R-21	Technical	Complexity of converting data from multiple legacy systems into COTS solutions	Internal	Medium	High	MDT ISD PMO	Avoid	• Ensure adequate time is included in schedules for assessment of conversion requirements and design of loading programs to place legacy data in COTS solution
R-22	Technical	Data quality negatively impacting data conversion efforts	Internal	Medium- High	High	MDT ISD PMO and executive sponsors of specific projects	Mitigate	• Identify early potential data quality issues during pre-implementation planning • Build adequate time into the project schedules for data scrubbing • Initiate data scrubbing efforts early • Attempt to scrub data in legacy system before running data through the conversion process • Ensure sufficient involvement is in program/project plan by staff knowledgeable on data
R-23	Technical	Programs/projects are completed late and/or over budget	Internal	Medium	High	MDT ISD PMO	Avoid	• Utilize fixed-price integration contrcts with potential penalties for late delivery • Adhere to project success factors • Ensure adequate milestones are built into program/project schedules to track progress and use early warning systems to detect and mitigate schedule/budget slippages • Monitor project schedules and budgets on a continuous basis
R-24	Technical	Systems integrators provide lesser skilled resources than expected for programs/projects	External	Medium	High	MDT ISD PMO, recommended MDT IT Contracts Manager and business owners for individual projects	Avoid	• Require MDT approvals of project staff in contract • Include in contracts right of dismissal and replacement • Use performance bond or other incentives and disincentives to ensure vendor's performance adheres to contracted schedule

F.5 ORGANIZATIONAL CHANGE MANAGEMENT (OCM)

This sub-section describes eVision Partners project team's recommendations for organizational change management in support of the implementation of the MDT Enterprise Architecture program and accompanying recommendations. This sub-section provides an overview of organizational change management principles and practices, and a description of a typical organizational change management plan. The section also provides organizational change management strategies to be considered with the implementation of an enterprise architecture, as well as strategies to be considered while implementing major project recommendations such as the implementation of the new PPMS or the implementation of an enhanced SABHRS ERP as the agency financial system of record.

Organizational change management (OCM) broadly refers to a framework for managing the impact of business process changes, technology changes or organizational changes on the business. Implementing new technology, new business processes, and new software is challenging, but the people aspect of these large programs/projects is typically even more challenging.

Successfully implementing change in an organization is really about people; change leaders who initiate the effort, staff that manage and support the effort, and ultimately staff affected by the change. That philosophy is especially true in major technology changes where staff members have become accustomed to "their" systems and "their" ways of doing their business. Accepting change is not easy for many people, and for some it is extremely difficult. Any agency's ability to successfully manage change can often be the difference between a project's success and failure.

The effective management of the impact of a change initiative on the organization is integral to successful implementation. Organizational change management activities must span all phases of the project life cycle with dedicated resources assigned. Demonstrating a focus on organizational change management throughout the project can result in achieving acceptance, preferably embracement, of the change throughout the organization. Effective communication to keep staff informed, define staff expectations, and resolve issues can positively affect acceptance of the change.

The need for committed sponsorship cannot be overstated and is critical to the success of a change initiative. The change sponsor's role is to enable the success of the effort. The sponsor enables the success of the effort by communicating why change is needed, defining what the future state will look like, providing the people and other resources the change implementation team will need, empowering staff to move the effort forward, and holding people responsible for

implementing the change. More importantly, the change sponsor removes barriers to the effort's success that cannot be controlled by the change implementation team.

Depending on the effort, the change sponsor could be the leader of an organization or they may be the supervisor of a key business function. The change sponsor is the person in that organization or business area who controls the resources and has the organizational authority to approve the implementation of an identified change. For organization-wide change that affects multiple MDT divisions, bureaus or business units, the sponsor or sponsors should be members of the executive management team.

Also critical to the success of change effort is strong leadership by the person selected to lead the effort. The person should possess good communication and project management skills. These skills are especially important if the implementation team is composed of members who are not part of the business area or normally work with the business area, and for projects where team members are required to contribute to the success of the change implementation effort while at the same time performing their normal work responsibilities. The team leader must be able to clearly communicate the project's objectives, as well as the roles of the team members, their responsibilities, and their accountability. The team leader must monitor performance and address performance issues should they arise and celebrate successes. The team leader should be able to openly communicate with the change sponsor on all matters important to the effort's success.

The change implementation team and management structure are critically important. In cases where significant changes will occur, management structures that exist are often insufficient for successful change. The existing management structure is designed for the normal work of the organization and may have been the cause of the need for change. Further, use of the existing management structure to implement change can be impacted by a reduced priority given to the change implementation. Generally, if the change will be implemented by an existing organization, it will be done while the normal work of the organization remains. That creates a conflict between implementing the change and the delivery schedule of the normal work products.

Successful change management can be accomplished using an established organizational change management plan and requiring that all of the steps of the plan be completed and critical issues addressed. The use of an organizational change management plan can not only guide a change initiative, but also establish the overall importance of the change and its priority to the organization.

F.5.1   Organizational Change Management Plan

Formal organizational change management plans generally include the reason for change; a description of the state of the organization after the change or stated succinctly, a change vision;

change objectives; change details; critical needs; performance management; and an established communication plan:

- Reason for change – It is important to have a clearly defined reason for change. The change sponsors must market that reason so staff members who have been performing functions in a particular way for many years can understand and embrace the change. Staff oftentimes asks, "What is wrong with the way we have always done it?" The reason for change should be supported by data and facts. The proverbial WIIFM ("What's in it for me?") question typically comes into play. The reason for change should be comprehensive enough so that staff members can see their roles/functions in the reason. Through the reasons for change, the sponsor should anticipate the questions that might be asked and provide answer those questions. The reasons for change should also include definitive statements that communicate that the decision to change has been made and all staff members are expected to contribute to the success of the change initiative.

- Vision – "What will our world look like after the change?" The answer to that question should be answered in the vision of the change sponsor. Descriptions of what will be able to be accomplished after the change that cannot currently be done, what cost savings will occur, or what other efficiencies would occur should be stated. Major steps in the change implementation process should be included.

- Change objectives – This section communicates clearly defined change objectives that transition the high-level vision into implementable objectives and milestones. The change sponsors must provide enough detail so the change implementers have a clear understanding of the vision, project objectives, milestones, and expectations to produce the desired future state. The change objectives should be measurable so the change sponsors and team can monitor performance.

- Change details – Details of the change that includes clearly defined tasks with milestones, deliverables, and responsible parties for each task are included in this section. The change implementation team members are named and their defined responsibilities are included. Other team resource requirements are communicated in this section. This is especially required when multiple or complementary change initiatives are ongoing so resources can optimally be allocated. The change implementation team accountability structure should clearly define the expectations of the members.

- Critical needs – Most change efforts have some critical needs or issues that if unaddressed could negatively affect the success of the effort. These needs and issues

should be clearly identified and validated by the implementation team and the change sponsor. It is extremely important that there be consensus on the needs and issues, and that a commitment to address those needs and issues be provided, preferably through formal communication.

- Performance management – Is the change effort on time? Is the change effort on budget? Is the change effort meeting its objectives? These questions are generally addressed through the sound project management of a change effort using clearly defined strategies, tasks, and timelines. More importantly, performance management includes managing the change implementation team's performance against measurable objectives and communicating whether or not the project will meet its overall objectives and vision. Project management can keep the project team on track with the project and keep sponsors informed of the status of the project. Performance management, however, provides the structure through which performance issues are addressed, either through the project team or sponsors. Regular communication that openly discusses project performance is necessary to address and resolve performance issues quickly so they do not impact the overall success of the effort. The project team is responsible to communicate performance and identify issues. The project sponsors must be committed to addressing those performance issues.

- Communication plan – An effective communication plan has several purposes and target audiences. The plan should include regular meetings between the change team leaders and the changes sponsors to communicate the status of efforts, to address things that are going wrong, but just as important, to communicate things that are going right or better than expected. Since most team members will not meet or communicate directly with the change sponsors, the communication plan should provide for regular communication between the team leader and team members to provide overall project status updates, communicate project successes, and share communications that occurred between the team leaders and sponsors. Communicating successes is crucial, especially if project team members are juggling priorities to meet the needs of the change team as well as their normal job functions. The communication plan should also include communication to members of the organization who are not part of the change team but are affected by the change. The communication plan should include the reason for change, the change vision, objectives, and timelines. It should address how they will be impacted and what the organization will do to prepare them for the change, such as transition plans and training.

F.5.2   Enterprise Architecture Change Management Strategies

As noted previously, a key to managing change is in the development and administration of a Change Management Plan. Development of this plan requires that the case for change, the change vision, and change objectives be presented clearly. The development of change details, critical needs, performance management, and communication plans follow.

"Who will be affected by this change?" The answer to that question should guide the development of the change management plan. In the case of an Enterprise Architecture, the people affected by the plan will be the team charged with overseeing the architecture, the team responsible for implementing the architecture, and the business area leaders who will be asked to follow new policies, procedures, and processes developed to support this enterprise architecture.

Chief among those affected by the Enterprise Architecture will be the leadership of business units who will need to ensure their future proposed technology investments align with the Enterprise Architecture (and by extension MDT business objectives) and MDT IT resources whose jobs will likely change to some extent as they have the opportunity to participate on various teams performing projects called for under the Enterprise Architecture and the opportunity to learn and work with new tools and technologies being called for in the Enterprise Architecture plan. The change management plan should place a specific focus on addressing their change needs.

The business area leaders are the leadership foundation of MDT. Once they become committed to the enterprise architecture, and associated policies and procedures, the rest of the organization should follow. If they resist or speak/act negatively towards the Enterprise Architecture, so will their staff. Therefore, it is important to get their buy in of the Enterprise Architecture, as well as to educate them on the new policies and processes and their benefits. It may be necessary to provide support to them in using the new policies and processes. They will need to appreciate and understand that their IT needs can and will still be met while following the Enterprise Architecture's policies and procedures, which support the overall technology needs of MDT. That understanding and support should allay concerns about the policies and procedures being onerous or bureaucratic.

In terms of MDT IT staff, these individuals represent the delivery capacity to carry out the recommendations of the Enterprise Architecture program. As such it is essential that IT staff are educated on the scope and scale of the proposed recommendations and the anticipated benefits of these recommendations as early as possible and that IT staff have receive frequent updates on progress in implementing the various recommendations. Please note that for this purpose we are defining MDT IT staff to include both Information Services Division staff and other staff performing IT-centric roles across MDT.

The research team recommends this report provide the basis for an Enterprise Architecture Change Management Plan. The reason for change has been established throughout this report, as it is a change vision. Change objectives can be developed using the recommendations presented. The change sponsorship can begin with the proposed MDT Technology Governance Council. The draft technology governance policies and procedures provide a basis for the adoption of policies, procedures, and processes to implement the plan.

F.5.3   Project-Specific Change Management Strategies

Significant technology programs/projects will require program or project-specific change management plans. Project specific organizational change management plans should be focused on specific needs determined by the answer to question asked above concerning who will be affected by the change.

A project specific change management plan should target project stakeholders and the project team implementing the initiative. This plan can emphasize the project details, and project team assignments, responsibilities, and accountabilities. It can contain project details and expectations specific to the staff member assigned to support the team by participating in efforts to define requirements, develop "blue-prints," cleanse data, perform systems testing, or function as a subject matter expert. The change management plan should include a communication plan. Most important to that communication plan should be the method of communicating issues and a process for escalating unresolved issues.

The success of any implementation of new technology can be measured in the time it takes the organization to exceed their prior productivity levels. A key to that success is managing change for the people who will be required to abandon old business processes and learn to do their work with new technology. A key element of any project specific plan will be for those MDT staff members who are not part of the project team, but will be users of the resulting new system. The plan can emphasize communication of the project benefits and implementation activities, and focus on training and resources that will be available to help them as they transition to the new technology.

G. WORKS CITED

Eggers, William, and Rob Hamill. 2012. *Five Ways Crowdsourcing Can Transform the Public Sphere.* May 23. http://www.governing.com/columns/mgmt-insights/col-government-crowdsourcing-five-models.html.

Ladley, John. 2012. *Data Governance.* Waltham, MA: Elsevier Inc.

Parsons Brinckerhoff. 2015. *Implementation of Electronic Right of Way Management Systems versus Paper Systems, FHWA-HEP-16-001.* July. http://www.fhwa.dot.gov/real_estate/publications/e-row_management/.

US Department of Transportation, Federal Highway Administration. n.d. *Asset Management.* Accessed May 2016. http://www.fhwa.dot.gov/infrastructure/asstmgmt/tpamb.cfm.

—. 2012. *Moving Ahead for Progress in the 21st Century Act (MAP-21).* July 17. Accessed May 2016. http://www.fhwa.dot.gov/map21/docs/map21_summary_hgwy_provisions.pdf.

Zachman, John A. 1987. "A framework for information systems architecture." *IBM SYSTEMS JOURNAL* 276-292.

H. APPENDICES

The remainder of this document contains various attachments referenced throughout the body of the report. These exhibits are more appropriately located here due to their multi-page content.

H.1 TO-BE ENTERPRISE ARCHITECTURE SCHEMATIC

The schematic on the following page is a high-level overview of the To-Be Enterprise Architecture based on the recommendations and implementation plans presented in this document.
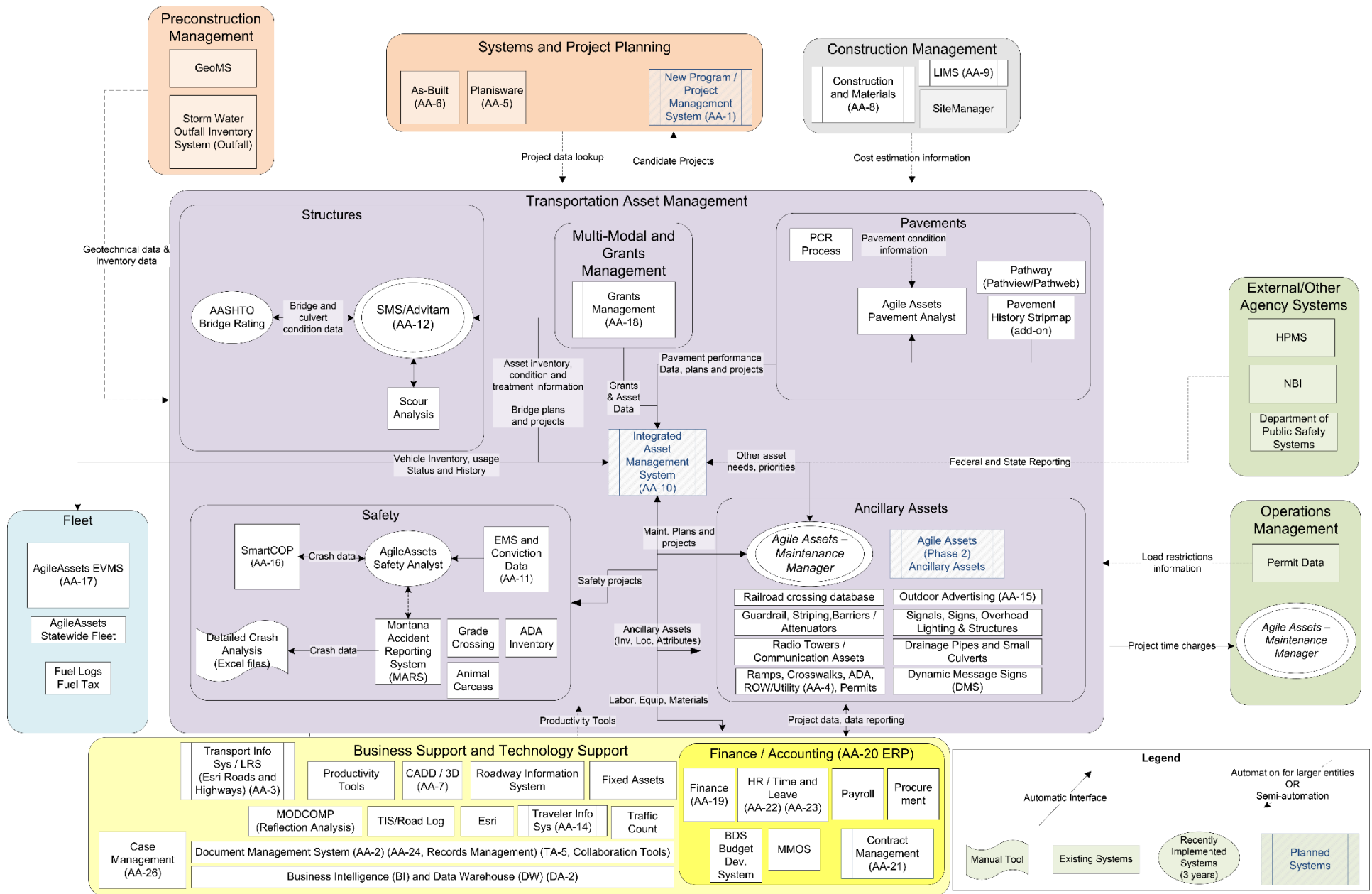
FIGURE 44: MDT ENTERPRISE ARCHITECTURE STUDY "TO-BE" OVERVIEW

H.2 RECOMMENDATIONS

The following pages present the eVision Partners team's detailed recommendations for the MDT Enterprise Architecture.

TABLE 12: MDT STRATEGIC EA RECOMMENDATIONS

ID	Description	Challenge or Opportunity	Recommendation	Priority	Notes
TRANSPORTATION PROJECT DELIVERY					
AA-1	Implement Next Generation PPMS	The current Program and Project Management System (PPMS) has significant functional gaps and lacks clear business ownership	Implement a next generation PPMS based on industry best practice that is tightly integrated with the MDT's Planisware® scheduling application. The new PPMS should also be designed to tightly integrate with MDT's asset management systems. Implementation of this new system should be guided by a governance team comprised of management from all MDT divisions with subject matter experts assigned to the project team from each division	High	Requirements definition initiated – project scope needs to be assessed to confirm solution is being defined so as to fully incorporate industry best practices
AA-3	Implement Next Generation TIS/LRS & Roadway Inventory	MDT is currently defining requirements and planning for implementation of a new Transportation Information System/Location Referencing System and Roadway Inventory application, which is a core foundational element of the MDT applications architecture	Continue with design and implementation of the new Transportation Information System, Location Referencing System and Roadway Inventory application as a foundational of the To-Be MDT Enterprise Architecture	High	Establish multi-disciplinary governance team to guide project efforts
AA-4	Implement ROW and Utility Relocation system	Parcel Acquisition System and Utility Relocation Tracking Application are approaching functional end-of-life	Implement new Right-of-Way Management system and Utility Relocation System using a COTS solution or COTS framework.	Medium	Define requirements and perform initial fit/gap against existing MDT technology solutions (AgileAssets or others) prior to looking at other COTS solutions to evaluate opportunity to leverage and extend existing technology investment
AA-5	Extend Planisware® implementation to support resource management	Planisware® scheduling tool does not currently provide resource management functionality	Extend capabilities of Planisware® to support resource management	Medium	Functionality could be added in future release or upgrade cycle
AA-6	Reengineer As-Built process	Current As-Built process makes limited use of available technologies such as red-lining tools	Re-engineer As-Built process to more effectively utilize available technologies. Re-engineered must consider impact of 3D design and asset management requirements	Medium	
AA-7	Establish and Implement Design Model Strategy	There is no defined strategy for effectively integrated design models with GIS and for integrating design models into MDT's asset management system(s)	Develop design model and GIS integration strategy and begin piloting and phased deployment based on defined strategy	Medium	

ID	Description	Challenge or Opportunity	Recommendation	Priority	Notes
AA-8, AA-9	Implement AASHTOWare™ Project Construction and Materials	There are significant opportunities to build on the implementation of SiteManager to further automate and streamline construction management processes. This includes more advanced mobile capabilities as the use of SiteManager is currently primarily confined to the office or construction trailer MDT did not implement laboratory information management system (LIMS) functionality as part of the deployment of SiteManager	Implement AASHTOWare™ Project Construction and Materials including utilization of mobile technology where possible along with full-range of LIMS functionality	Medium	
MAINTENANCE AND ASSET MANAGEMENT					
AA-10	Define Enterprise Asset Management Strategy	MDT has implemented or is implementing various best in class asset management tools for individual disciplines. However, MDT currently does not have a defined strategy for integrating its individual asset management applications to provide an end-to-end transportation asset management system	Define an asset management systems strategy to provide data integration between individual asset management systems (bridge, pavement, safety and the next generation maintenance management system) to support agency business requirements defined in the MDT transportation asset management plan. As an initial focus, design and establish an Asset Data Warehouse which provides a single point of access to information about transportation assets (through preferably virtual integration of data from core management systems). The asset management systems strategy should include geospatial risk analysis by asset class and corridor type (i.e., terrain type, rural/urban, traffic level, interstate, etc.) to analyze potential risks across the agency's infrastructure network, including alignment of budgets and risk management. In future years, design and develop cross asset analysis tools as business policy and process requirements are defined, as product offerings in this area mature in the marketplace.	High	Developing integration strategy and supporting work plan should move forward near term in conjunction with MDT asset management planning; actual deployment could be phased based on priorities established in asset management plan and funding availability

ID	Description	Challenge or Opportunity	Recommendation	Priority	Notes
AA-11	Extend SIMS functionality	The initial implementation of the Safety Information Management System (SIMS) focused on integrating crash report and highway inventory data and did not include some best-practice elements recommended for a Safety Management System (e.g. EMS run tickets, trauma registry or conviction data)	Implement additional safety management system capabilities with an emphasis on multi-disciplinary data elements such as EMS run tickets, trauma registry information and conviction data	Medium	Move forward based on data sharing agreements with various agencies and funding availability. Implementation plan assumptions will need to be aligned with Traffic Records Strategic Plan.
AA-12	Implement Modeling and Analytics for Structures	The Structures Management System being implemented is focused on bridge inventory and bridge inspection functionality and does not currently address modeling and analytics functionality	Define requirements for modeling and analytics functionality and evaluate capability of Advitam ScanPrint IMS to meet these requirements. If Advitam does not meet requirements, evaluate and select alternative solution.	Medium	
AA-13	Extend MMS to handle ancillary assets	There is no defined management system for ancillary assets	Continue and build on existing efforts through the MMS project to utilize the new AgileAssets MMS to support ancillary assets	Medium	Formalize strategy for each asset class and define timeline for inclusion into AgileAssets as part of current MMS effort or future phase

TRANSPORTATION OPERATIONS MANAGEMENT

ID	Description	Challenge or Opportunity	Recommendation	Priority	Notes
AA-14	Implement new COTS Traveler Information System	Traveler Information System is a home grown solution with known functional gaps	Replace the existing Traveler Information System with a COTS application as the core of the new solution	Medium	Define requirements and perform preliminary fit/gap against available commercial solutions or frameworks as a first step
AA-15	Implement new Outdoor Advertising System	Outdoor Advertising system has both functional gaps and technical limitations	Replace existing Outdoor Advertising application preferably with a COTS solution; evaluate potential for utilizing existing MDT technology (AgileAssets, Advitam, Bentley) to perform this function prior to bringing in another solution	Medium	Define requirements and conduct fit/gap with existing MDT solution components as a first step
AA-16	Continue implementing SMARTCOP enhancements	SmartCOP provides a solid solution to meet the needs of MDT Motor Carrier Enforcement staff	Continue targeted enhancements to SMARTCOP including opportunities to enhance data integration with other agencies	Medium	Implementation plan needs to align with funding as defined in Traffic Records Strategic Plan
AA-17	Implement Mobile Technology support	Increased utilization of mobile technology presents an opportunity to improve the efficiency of various MDT business operations	Evaluate mobile platform alternatives, select solution and integrate with EVMS Implement solution in alignment with enterprise mobile strategy (please refer to TA-4)	Medium	Establish cross-functional working group to define strategy and prepare detailed implementation plan based on strategy
AA-24	ePart Enhancements	A number of priority enhancements are being identified as part of initial implementation of ePart system	Extend ePart implementation to address priority enhancements	Medium	

ID	Description	Challenge or Opportunity	Recommendation	Priority	Notes
MULTI-MODAL AND GRANTS MANAGEMENT					
AA-18	Implement Enterprise Grants Management Solution	MDT has or is implementing multiple grants management solutions. Planning Division is deploying a multi-agency e-Grants solution for all grant programs; Aeronautics has implemented grants management as part of its Aeronautics Suite.	Evaluate the opportunity to implement a single grants management application; this evaluation should include analyzing capabilities of any statewide grants management solution which may be initiated	Medium	
BUSINESS SUPPORT SERVICES					
AA-19	Implement Financial Suite	It is difficult for users to obtain information from the financial system. Likewise, there are currently various off-line and disconnected budgeting and forecasting tools. Taken together, this creates challenges in performing financial analysis and reporting functions	Proceed with implementation of Financial Suite as initial step to provide enhanced budgeting, forecasting, finncial reporting and analysis tools prior to implentation of an ERP. Project should be designed to anticipate future ERP and minimize future re-work when MDT legacy financial systems are replaced with an ERP	High	Project initiated but ramping up slower than originally planned due to funding constraints
AA-20	Implement State's ERP solution as financial system of record for MDT	MDT financial systems are home grown, require a significant effort to maintain and will likely reach functional end-of-life over the next five to seven years	Implement an enterprise resource planning (ERP) application at the agency level or by extending the functionality in the State's SABHRS PeopleSoft application to meet the full range of MDT requirements. This ERP application will provide a highly integrated commercial off-the-shelf (COTS) solution to support financial management, human resource management and procurement functionality	High	Recommend initiating planning work in near term due to long lead time for project and need to prepare project cost estimate to begin to budget project cost in future years. Prepare alternatives analysis to evaluate different potential approaches for proceeding (agency solution, expansion of SABHRS, etc.) and estimated project cost of each alternative. Implement in phases with initial focus on replacing core financials including CARES
AA-21	Implement enterprise contract management system	Multiple contract management systems (Consultant Information System and Contract Tracking System) creates duplicate data entry and potential reconciliation issues	Implement an enterprise-wide contract management system as part of the proposed ERP project	Medium	
AA-22	Implement Talent Management solution	There is no enterprise solution for talent management; instead there are several disconnected State level or MDT applications performing elements of the talent management function	Implement a COTS-based enterprise wide Talent Management solution with an initial focus on an e-Learning that can support all MDT training requirements (employees, local programs, contractors, consultants, etc.)	Medium	Evaluate alternative implementation approaches including. Agency solution or options to build off Oracle Taleo footprint implemented for recruiting at State level as product provides e-Learning and other talent management capabilities

ID	Description	Challenge or Opportunity	Recommendation	Priority	Notes
AA-23	Implement Discipline & Grievance Management solutions	Discipline and Grievance Management System are at the end of life. In addition, MDT is likely not taking advantage of all the capabilities of SABHRS HR, resulting in the need to utilize various off-line systems and paper-based systems	Implement existing or enhanced capabilities within SABHRS HR to meet Discipline, Grievance Management and other HR requirements not currently being met by SABHRS	Medium	Prepare requirements and perform fit/gap analysis against SABHRS functionality
AA-26	Case Management System	There is a need for electronic case management support for MDT Legal Division	Implement COTS-based Case Management Software; integrate solution with new enterprise wide Content Management solution (AA-2)	Medium	Define requirements and conduct software evaluation and selection
CROSS-FUNCTIONAL					
AA-2	Implement Enterprise Content Management (ECM)	Document Management System (DMS) is at end-of-life. Engineering is currently undertaking a requirements effort focused on its business unit specific needs for a document management system. In addition, other areas of MDT are in need of content management (document management, collaboration, records management, etc.) solutions	Define an enterprise wide content management strategy designed to meet all agency requirements and then implement an enterprise wide content management system to meet these requirements. In the interim, proceed with implementation of the new Engineering document management solution to meet immediate business needs. The To-Be solution may involve multiple COTS solution and should leverage existing State investments where appropriate. Include requirements for collaboration tools as defined in TA-5.	High	Establish multi-disciplinary governance team to guide effort Prepare requirements and perform fit/gap with available State solutions as part of evaluating options for proceeding. Continue with implementation of Engineering solution in parallel and integrate into overall MDT solution.
AA-17	Implement Mobile Technology support	Increased utilization of mobile technology presents an opportunity to improve the efficiency of various MDT business operations	Evaluate mobile platform alternatives, select solution and integrate with EVMS Implement solution in alignment with enterprise mobile strategy (please refer to TA-4)	Medium	Establish cross-functional working group to define strategy and prepare detailed implementation plan based on strategy
INFORMATION TECHNOLOGY					
AA-25	Retire all Oracle Forms Applications	No formalized work plan for migrating all Oracle Forms applications not covered in a separate project to a new technical platform	Prepare a work plan and timeline for retiring all Oracle Forms applications either through a specific project initiative or migrating Oracle Forms applications to either COTS applications or a Java based custom application	Medium	Implementation of this plan will allow ISD to sunset Oracle Forms and reduce complexity of its application portfolio over next several years
DA-1	Establish Data Governance Program	There is a need for a greater emphasis on data stewardship and data sharing between and across functional areas.	Establish a data governance initiative to implement industry best practices in data governance, data standards and data stewardship	High	Establish project governance through cross-functional Steering Committee Prepare data governance and data stewardship strategy and detailed action plan for implementation

ID	Description	Challenge or Opportunity	Recommendation	Priority	Notes
DA-2	Implement Data Warehouse, Business Intelligence (BI), and Analytics	Difficulty in accessing information from MDT transaction systems; difficulty in integrating information from multiple systems to perform analysis and reporting	Implement a Data Warehouse (DW) with a set of business intelligence and analytics tools. Successful Business Intelligence (BI) and DW deployments are dependent on an agreed upon definition of fundamentals with respect to the agency's data, which means a formal Data Strategy and a formal Data Governance Strategy. Successfully moving from a "Microsoft Excel® Culture" to a true DW and BI requires an enterprise approach and strategy		Finalize scope definition for first phase of data warehouse Develop data governance and data stewardship strategy as a prerequisite Align DW/BI strategy with ERP strategy
DA-3	Define and implement data services strategy	Sharing data with external partners is difficult – no defined strategy/approach for serving up data to partners	Define and implement data service strategy for partner agencies	Medium	
TA-1	Implement single sign-on	Multiple passwords and sign-ons are required to access various MDT applications.	Implement single sign-on	Medium	Implement approach in conjunction with deployment of new systems and then transition other systems
TA-2	Define and implement Disaster Recovery Planning (DRP) and Strategy	There is a data recovery strategy, but no disaster recovery strategy	Define and implement a disaster recovery strategy and fully test the strategy	Medium	
TA-3	Develop Cloud Strategy	There is currently no clearly defined Cloud strategy. Likewise, there are data security concerns about Cloud-based applications among various stakeholder groups	Develop and implement a single agency-wide cloud strategy	Medium	Establish project governance through cross-functional Steering Committee of business and IT staff and cross-functional work teams; collaborate with State IT in defining strategy
TA-4	Develop Mobile Device or Mobility Strategy	There is currently no mobile device strategy (tablets, phones, Internet of Things (IOT) devices, etc.) Different functional units are making independent product selections and purchasing decisions based on the apparent best fit for their functional areas	Develop and implement a mobile device strategy including determining whether there should be an enterprise mobile platform. Based on strategy, deploy functionality incrementally to various business units (Construction, Maintenance, Motor Carrier, Fleet, etc.) Please refer to AA-17	Medium	Establish project governance through cross-functional Steering Committee of business and IT staff and cross-functional work teams Define enterprise strategy and prepare detailed implementation plan based on strategy Prepare requirements for specific functional areas
TA-5	Implement enterprise collaboration tools	There are currently no enterprise collaboration tools.	Evaluate and implement a set of enterprise collaboration tools potentially in conjunction or aligned with the enterprise content management initiative (please refer to AA-2)	Medium	Define requirements and perform fit/gap with tools already selected by the State

ID	Description	Challenge or Opportunity	Recommendation	Priority	Notes
IT-1	Establish IT Governance	MDT's IT investment prioritization process is not consistently followed. IT investment decisions do not appear to always be made in a coordinated fashion from the perspective of how systems should inter-operate within the overall information technology architecture. Likewise, based on the stakeholder interviews and validation sessions, there is not a clear understanding among stakeholders about the process upon which decisions about which projects will be funded is made.	Implement an IT Steering Committee comprised of a mix of senior level and mid-level managers from all business areas to review and recommend agency IT investments. Implement a project scoring and investment decision process that is aligned with agency business objectives. Develop a project scoping and screening process to ensure a reasonably detailed business case is prepared for a project prior to making a decision to move forward with the project.	High	Establish cross-functional IT Steering Committee as a first step to own Enterprise Architecture design and guide implementation of new investment prioritization process
IT-2	Establish Agency Technology Procurement Policy	There is significant autonomy across the agency in making technology purposes. This can create problems in terms of coordination required between ISD and other MDT business units in ensuring the MDT technical environment is able to support hardware or software purchased by business units	Require approval by the Director of ISD of all proposed technology acquisitions to ensure consistency with MDT standards and ensure appropriate planning for implementation of the proposed technology and its integration with other MDT technology infrastructure Ensure project acquiring technology as been approved through investment process established in IT-1	High	Obtain input from all Division Directors to prepare draft policy statement for approval by Director Communicate rationale for policy agency wide
IT-3	Establish enterprise strategy and framework for effective use of IT resources across agency	There are IT capabilities/resources within various business units, with limited formal coordination between these business units and ISD	Conduct additional evaluation of alternatives to achieve greater coordination and collaboration and maximize overall organizational efficiency	High	Need to identify strategies for creating more alignment (inclusion of Project Managers on all project teams, use of enterprise standards, etc.). Also, need to assess whether it would be more efficient and effective for MDT as a whole if some positions are transitioned within ISD. From a best practices approach, project managers (internal and contract) should either be housed in IT or if housed in a business unit must have a matrixed relationship to the ISD PMO; Application developer positions should generally be housed in the IT organization, while business analyst positions where domain knowledge of the business function is essential may be housed either in the business unit with a matrixed reporting relationship to ISD or in ISD with a matrix reporting relationship to the business unit. Project Managers should also be housed within the MDT Project Management Office in ISD, or if contracted for externally, should report to the PMO on a matrix-based reporting basis.

ID	Description	Challenge or Opportunity	Recommendation	Priority	Notes
IT-4	Establish consistent use of IT standards and polices MDT-wide for all programs/projects with an information technology component	Information technology standards are not consistently followed enterprise wide	Provide education sessions for MDT business units on applicable standards Require compliance with MDT standards in all IT contracts (whether managed by ISD or business unit) Establish a multi-disciplinary team to own and manage updates to standards	Medium	
IT-5	Establish Effective IT Contract services capabilities	Information technology contracts are becoming increasingly complex (Cloud, etc.) and MDT has limited internal experience with highly complicated IT contracts and scopes of work	Establish a retainer contract to obtain services of RFP writers and contract specialists to augment internal skills and experience	Medium	

H.3 INTERVIEW QUESTIONS

FIGURE 45: INTERVIEW QUESTIONS

**Montana Department of Transportation
Strategic Enterprise Architecture Design
Key Stakeholder Interview Questionnaire**

Introduction

eVision Partners, Inc. (eVision) has been engaged by MDT to develop a Strategic Enterprise Architecture Design for the Department. As part of the initiation of this project, eVision is conducting a set of key stakeholder interviews to gain an understanding of the key business drivers within MDT. To help structure these interviews and ensure consistency in data collection, we have developed this brief interview questionnaire to guide our discussion with you.

We will use the questionnaire below to guide these discussions. We encourage the interview participants to review the questionnaire beforehand, if at all possible. Also, please feel free to bring any supporting material to the discussion session that you would like to pass on to the project team.

Please feel free to contact the eVision Project Manager, Robert Cooney (919-605-1590, rcooney@evisionpartners.com) if you have any questions or comments.

Thanks in advance for your assistance with this process.

Stakeholder Questionnaire

1. Please briefly describe your role and responsibilities at MDT?

2. Please explain the key business objectives for your area and how these objectives align with MDT's overall strategic objectives?

3. What do you see as the role of information technology in helping to meet your unit's key business objectives?

P a g e | **1**

Montana Department of Transportation
Strategic Enterprise Architecture Design
Key Stakeholder Interview Questionnaire

4. What information technology initiatives are currently underway within your division or office?

5. From your perspective, what do you see as the key business challenges and opportunities facing MDT department-wide?   In your specific areas of responsibility?

6. From your perspective, what are the key strengths of MDT's current management systems and information technology environment?

7. From your perspective, what are some of the issues/challenges with MDT's current management systems and information technology environment?

8. What specific outcomes from the Enterprise Architecture Design project would make this project a success from your perspective?

9. Are there areas that we have not asked you about that we should have?

10. What other individuals in your areas of responsibility would you suggest we speak to?

H.4 DRAFT MDT TECHNOLOGY GOVERNANCE POLICY

FIGURE 46: DRAFT MDT TECHNOLOGY GOVERNANCE POLICY

MDT★

**State of Montana
Department of Transportation
Technology Governance Policy**

Policy No. POL X.XX.XXX	Subject: **TECHNOLOGY GOVERNANCE**	
Signature: X_____ Michael T. Tooley Director		Effective Date: 7/1/2016

1. PURPOSE

1.1. This policy establishes the Montana Department of Transportation (MDT) Information Technology (IT) Steering Committee to provide technology governance and guide the strategic deployment of technology that enables the optimum delivery of MDT business processes, program and project delivery, operations, and services.

2. DEFINITIONS

2.1. Technology: Software applications and systems, hardware, databases, networks, policies, procedures, etc. that manage the department's information and support the delivery of MDT's programs, projects, services, and operations.

2.2. Technology governance provides senior leadership the ability to direct, measure, and evaluate enterprise technology resources to support the achievement of the organization's vision, mission, and strategic goals. It recognizes technology as a strategic part of the organization's success; it integrates technology, people, and processes; it guides technology investments that generate business value; it steers technology investments to mitigate MDT risks; and it monitors performance of technology resources and establishes accountability.

2.3. Enterprise architecture: A strategic technology plan that aligns with the strategic plan of MDT; integrates the technology needs of MDT; and leverages data, systems, technology infrastructure, and knowledge of staff members to implement technology systems to support the efficient delivery of the programs, operations, and services of MDT.

3. SCOPE (PERSONS AFFECTED)

3.1. This policy applies to all business units of MDT.

4. POLICY

   4.1. Background and Purpose

      4.1.1. The technology demands of MDT have grown more rapidly than could be met by the resources of the MDT Information Services (IS) Division. While there is an existing IS process for technology deployment, divisions in need of technology initiated their own technology development and deployment projects using commercial software providers, university developers, and private information technology consultant developers. The systems implemented have served the immediate needs of the divisions but often have not provided integration with data of the many other systems utilized by MDT. While the divisions were deploying new technology, the backbone applications of the business support functions of MDT continued to use older technology that is becoming harder to support. The lack of technology governance in MDT is believed to have contributed to this situation.

   4.2. IT Steering Committee Mission

      4.2.1. The mission of the IT Steering Committee is to develop policies, procedures, and processes to support the accomplishment of the goals of the committee.

   4.3. IT Steering Committee Goals

      4.3.1. The goals of the committee will be to evaluate and recommend technology investments that generate business value; evaluate technology investments in consideration of enterprise architecture deployment and MDT risk mitigation; and manage the performance of MDT's technology program and technology investments.

   4.4. Technology Investment Plans

      4.4.1. The committee shall establish rolling 5-year and 1-year technology investment plans and update the plans annually.

   4.5. IT Steering Committee Membership and Terms

      4.5.1. The MDT Deputy Director who will serve as the IT Steering Committee's Executive Champion and represent the Director's interest in all technology matters, communicate frequently with the Director on committee actions and activities, and serve to enable the success of the committee.

      4.5.2. Annually, the IT Steering Committee membership shall be appointed by Executive Champion. The Committee membership shall consist of nine (9) members, of which no more than three (3) will be unclassified members. The Committee membership shall include business owners from each of the MDT Divisions, and at least two (2) district representatives. The Division Director of

2

the Information Services Division will have a standing ad hoc position on the Committee. Members will serve three-year terms and may be re-appointed. No Committee member shall serve more than two (2) consecutive terms except for the Division Director of the Information Services Division.

4.5.3. To ensure the ongoing continuity of the IT Steering Committee, the terms of the initial members of the committee will be divided into three groups as follows: three (3) members whose terms will expire on June 30, 2017; three (3) members whose terms will expire on June 30, 2018 and three (3) members whose terms will expire on June 30, 2019. Following this start-up period, terms will continue to be staggered to ensure continuity of the committee.

4.5.4. At the beginning of each fiscal year, the committee membership will elect a chairperson from within their number to serve the IT Steering Committee. The chairperson shall lead the activities of the committee in alignment with the established committee charter. In the conduct of committee matters, the staff of the Information Services Division shall support the chairperson.

4.5.5. The IT Steering Committee may designate any number of ad hoc, non-voting members as may be needed to support the conduct of committee business.

4.6. Authority

4.6.1. The IT Steering Committee is authorized to establish policies and procedures in addition to those included herein to guide technology governance and strategic deployment of technology that enables the optimum delivery of MDT business processes, program and project delivery, operations, and services.

4.6.1.1. The committee will adopt an annual charter to define the mission of the IT Steering Committee; establish objectives; document committee membership and leadership; and document the ratification of the charter by the committee membership;

4.6.1.2. The committee shall create subcommittees to serve the needs of the council. From its membership, the council shall appoint leaders and members to the subcommittees. The committee shall appoint other MDT staff members to the subcommittees in support of their missions. All actions of the subcommittees must be approved by the IT Steering Committee. For approval by the committee, the subcommittees shall develop policies and procedures in support of their missions.

4.6.1.2.1. Standing Committees

4.6.1.2.1.1. Planning – this subcommittee is responsible for the annual development of the one (1) and five (5) year technology investment plans for adoption by the committee

3

4.6.1.2.1.2. Investment – this subcommittee is responsible for reviewing technology investment requests and presenting qualifying investment requests to the entire committee.

4.6.1.2.1.3. Enterprise architecture – this subcommittee is responsible for being the steward of the enterprise architecture and updating the architecture as required.

4.6.1.2.1.4. Security – this subcommittee is responsible for reviewing or establishing data and systems access security governance and conducting risks assessments.

4.6.1.2.1.5. Performance – this subcommittee is responsible for the establishment of technology performance measures and standards, and technology performance management.

4.6.1.2.2. Ad hoc committees

4.6.1.2.2.1. The committee shall, as necessary, appoint ad hoc subcommittees in support of executing its mission.

4.6.1.3. The committee shall conduct regular meetings in conjunction with its execution of its mission and shall publish both meeting agendas and meeting summaries.

4.6.1.3.1. Frequency – the committee shall hold meetings quarterly or more frequently as needed. Subcommittees of the council shall meet as needed to support the subcommittee's mission and committee-established deliverables.

4.6.1.3.2. Agendas – for each meeting, the committee shall establish an agenda. The agenda shall include reports from each of the subcommittees of the committee, discussion, and approval of subcommittee action items and deliverables, and other technology issues added to the agenda by committee members.

4.6.1.3.3. Meeting summaries – the committee shall produce a summary of the actions taken at each committee meeting. Both the committee chairperson and the executive champion shall approve the summary.

5. CLOSING
   5.1. Questions concerning this policy should be directed to the Division Director of the Information Services Division

6. REFERENCES

4

6.1. N/A

7. ADDITIONAL DOCUMENTS
   7.1. N/A

8. KEYWORDS

   REVISION HISTORY

H.5 MDT TECHNOLOGY COUNCIL DRAFT CHARTER

FIGURE 47: MDT TECHNOLOGY COUNCIL DRAFT CHARTER

MDT Information Technology Steering Committee Charter

Purpose of the Charter:

The purpose of this charter is to define the mission of the MDT Information Technology Steering Committee (committee); establish start-up objectives; establish ongoing objectives; identify committee membership and leadership; and document the ratification of the charter by the committee membership.

Mission:

As directed through the MDT Technology Governance Policy, the mission of the IT Steering Committee is to develop policies, procedures, and processes to the to support the accomplishment of the goals of the Committee that include the evaluation and recommendation of technology investments that generate business value; the evaluation of technology investments in consideration of enterprise architecture deployment and agency risk mitigation; and the management of the performance of MDT's technology program and technology investments. The committee will annually produce recommended one-year and five-year technology plans with a more detailed first year budget.

Start-up Objectives:

- Committee Formation – The MDT Director will approve the Technology Governance Policy and the Deputy Director, who serves as the Committee's Executive Champion, will appoint members to the IT Steering Committee. The Committee will define the IT Steering Committee Procedures and will adopt its charter.

- Meetings – The IT Steering Committee will establish a meeting schedule and establish a meeting format and agendas, and appoint responsible parties to deliver its ongoing objectives.

- Policies and Procedures – The IT Steering Committee will approve and implement a technology request and evaluation procedure, as well as a prioritization procedure and processes to develop its technology investment plan.

- Current Project Backlog - The committee will evaluate proposed projects which have been identified and are in the pipeline as of the time of the start-up of the committee and make a recommendation on how to proceed with each project.

- Evaluation of Department Resource Capacity – The committee will provide a recommendation to the administration in terms of whether sufficient resource skills and capacity are available to meet the priority technology needs of the agency.

Ongoing Objectives:

- Implementation of Technology Governance – The agency will embrace technology governance as a strategic part of its business, and will utilize the IT Steering Committee to guide the development of technology plans that implement best value technology investments and mitigate technology risks in an enterprise architecture framework.

- Committees – The IT Steering Committee will establish subcommittees with responsibilities as described in the Technology Governance Policy. The committee will establish subcommittee missions that support the committee, and develop policies, procedures, and practices that aid in the delivery of the committee's deliverables.

- Monitor MDT Strategic Enterprise Architecture Design and Implementation Plan Recommendations – The IT Steering Committee will monitor MDT's progress in implementing the MDT Strategic Enterprise Architecture Design and Implementation Plan recommendations.

- Technology Investment Plans – Annually, the IT Steering Committee will utilize the deliverables of its committees, and recommend a one-year and five-year technology investment plans with a more detailed one-year budget.

- IT Steering Committee Membership Is defined in the MDT Technology Governance Policy.

- Ad-hoc Members – Is defined in the MDT Technology Governance Policy.

- Process Review – The IT Steering Committee will annually review its policies, procedures, and actions and will modify those policies and practices as needed for continuous improvement.

Values:

The IT Steering Committee membership provides a cross functional representation of MDT. In this capacity members will act objectively in the overall best interest of MDT.

IT Steering Committee Membership

The undersigned acknowledge the role and responsibilities of the IT Steering Committee and their individual roles and responsibilities as members of the committee.

IT Steering Committee Executive Champion:	

IT Steering Committee Chairperson:	

IT Steering Committee Members:	

IT Steering Committee Ad Hoc Members:	

H.6 PROJECT ORIGINATION CHECKLIST (POC)

FIGURE 48: PROJECT ORIGINATION CHECKLIST (POC)

MDT IT Steering Committee
Technology Investment Program
Technology Project Origination Checklist (POC)

Project Overview				
Project Name		Planned Starting Fiscal Yr.		
Anticipated Duration		Project Size (Enhancement, Minor, Major)		
Estimated Cost		Basis of Cost Estimate		
Brief Description of Business Opportunity or Challenge				
Proposed Project Scope or Solution				
Brief Summary of Anticipated Business Benefits				
Alternative Solutions Considered (if any)				
Anticipated Project Stakeholders				
Print Name		Department		
Signature				
Date Signed				
Approvals				
First Level Approver		Date Signed		Accept		Reject		

Draft Pending Approval   1

Second Level Approver		Date Signed		Accept		Reject		
Comments								

H-24

H.7 PROJECT ORIGINATION DOCUMENT (POD)

FIGURE 49: PROJECT ORIGINATION DOCUMENT (POD)

MDT Technology Council
Project Origination Document

MDT IT Steering Committee
Technology Investment Program
Technology Project Origination Document (POD)

Project Overview			
General Project Information			
Project Name		Starting Fiscal Year	
Expected Start Date (from Schedule below)		Expected Completion Date (from Schedule below)	
Estimated Project Cost (from Budget below)		Expected Annual Savings (from Benefits below)	
Is this a continuation project?	____ yes ____ no	If yes, project number	

Reason for Initiating Project

Project Scope Definition

Sponsoring Division/Office	
Project Scope	
Expected Deliverables	
Anticipated business benefits	
Is this a proven concept? (explain)	

Draft Pending Approval   1

Alternative Solutions Considered	
Key Stakeholders	

H-26

Project Objectives

Alignment with Department Strategic Plan

Enables Strategic Objectives of Department	

Continuous improvement of service to citizens, stakeholders, and employees

Provide efficient and reliable customer service	
Apply continuous Improvement to ODOT service delivery	

Sustaining technology assets

Maintain technology assets, security & operational capabilities	
Regulatory and Policy Directives	

Regional and other collaboration opportunities

Support regional transportation network	

Risk mitigation

Enhance data integrity	
Provide systems functionality and service delivery	

H-27

Project Objectives (continued)			
Enterprise Deployment			
Agency utilization levels			
Systems integration			
Risk to delivery of technology project (Attach Risk Detail Sheet)			
Implement proven concepts			
Deliver with experienced staff			
Overall Risk Rating from Risk Detail Sheet			
Related Projects			
	1	2	3
Project Name			
Relationship			
Description			

H-28

Resources and Procurement

Resource Requirements

Other Divisions or Offices Required to Participate	
ODOT Staff Experienced w- Technology or Project Type	
Potential Project Management Team Members by Office	

Planned Procurement Strategy

Services, Products, or Materials Needs	
Planned Procurement Approach	
Leverage Existing Contract Vehicles	

H-29

Schedule

Project Schedule (attach detailed schedule)

Project Phase	Start Date	End Date	Comments

Assumptions and Constraints

Assumptions	
Constraints	

Financial

Anticipated Funding and Budget Impact

Targeted Funding Sources	Sources	%	Budget History for Existing Projects	Original Authorized Budget	
	Federal			Current Approved Budget	
	State				
	Other External		Proposed for Funding Transfer from Existing Project	Proposed Transfer	
	Local			Project Number	
	Total				

Federal Funding Status	
Operating Budget Impact	

Estimate of Annualized Business Benefits

	Amount	Basis of Estimate
Increased revenue		
Potential Cost Savings		
Higher Productivity		
Improved Compliance		
Improved Management Efficiency		
Reduced Maintenance		
Other Costs Avoided		
Improved System Security		
Total	$0	

H-31

Financial (continued)

Budget by Phase and Fiscal Year (attach supporting documentation)

Project Phase	Total	Actual	Current	Fiscal Year				
				2016-2017	2017-2018	2018 - 2019	2019 - 2020	2020 - 2021
Total Budget	$0	$0	$0	$0	$0	$0	$0	$0
Net Operating Budget Change	$0							
Budget Change History Narrative								

Return on Investment (ROI) - (attach supporting documents)

Net Present Value (NPV)			Payback Period (years)		

H-32

Approvals								
POD Creator								
Form Status		Date Submitted						
Project Initiator		Action Date		Accept		Reject		
Comments								
Insert first approver		Action Date		Accept		Reject		
Comments								
Insert Second approver		Action Date		Accept		Reject		
Comments								
IT Steering Committee		Action Date		Accept		Reject		
Comments								
Insert final approver		Action Date		Accept		Reject		
Comments								

H-33

H.8 CAPITAL IMPROVEMENT PROGRAM DECISION-MAKING MODEL

This appendix contains a sample Project Prioritization Decision Model (see Figure 50, page H-35), developed by the Vision Partners project team. The intention of this form is to provide an example of the elements that might be included in a technology project prioritization model.

Please note that the example model provided was intended to not only evaluate technology projects but a broader range of other proposed capital improvement projects (construction, systems planning, etc.). As a result, not all criteria will necessarily be applicable to a model intended to evaluate technology projects only.

FIGURE 50: CAPITAL IMPROVEMENT PROGRAMS/PROJECTS FORM

Proposed Objectives/Sub-Objectives for
Evaluating Capital Improvement Programs/Projects

Objective/ Sub-Objective	Rating Scale	Weighting Factor
1. Continuous improvement to customer service – 28%		
Provide safe, secure, and reliable customer service	Safety or security critical: 100% Regulatory: 100% Operation critical: 70% Operation support: 50% Service enhancements: 30% Service expansion per approved regional or other long-range plan: 30% Other service expansion: 0%	15%
Apply continuous improvement to service delivery	Project delivers customer-facing service improvements: 100% Project improves overall efficiency and effectiveness of internal business operations: 50% Project does not provide customer-facing service improvements or substantially improve the efficiency of internal operations: 0%	3%
Mitigate risk to the Authority	Project eliminates the potential for a significant operational disruption, safety, or security issue: 100% Project eliminates the potential for a minor operational disruption: 50% Project does not mitigate the potential for an operational disruption or a safety issue: 0%	10%
2. Sustaining our assets – 29%		
Maintain infrastructure and operational capabilities	Asset or operational process is in a Failed condition: 100% Asset or operational process is in a Substandard condition: 70% Asset or operational process is in an Adequate condition: 30% Asset or operational process is in a Good or Excellent condition: 0% Note: If an asset is being proposed for replacement because of the need to replace another asset on which it is dependent, the asset will receive the lower condition score of either the asset itself or the dependent asset	15%
Address urgent business request	Project addresses an urgent request as approved by the Deputy GM/COO: 100%	4%
Invest in ODOT's human resources	Project promotes staff development and retention: 100%	5%
Improve work place health and safety	Project reduces risk of employee exposure to hazardous materials, eliminates hazardous conditions in the work place, or otherwise improves work place safety: 100%	5%
3. Funding optimization – 9%		
Utilize available Federal funding	Federal grant award executed: 100% Federal grant application notice of award: 80% Federal grant applied for: 30% Federal grant eligible: 10% Authority internal funding only: 0%	5%
Optimize use of external funding sources	Score is percent of project funded by Federal, State, or other non-Authority funds (local partners, etc.)	4%
4. Financial return – 7%		
Provide new or expanded source of revenue	≥ $500K in additional revenue: 100% ≥ $250K and < $500K in additional revenue: 70% > $0 and <$250K in additional revenue: 30% No additional revenue: 0%	2%
Minimize impact on operating budget	Cost savings ≥ $1 million: 100% Cost savings ≥ $500K and < $1 million: 70% Cost savings > $0 and < $500K: 50% Cost neutral: 30% Cost increase < $500K: 5% Cost increase ≥ $500K and < $1 million: 3% Cost increase ≥ $1 million: 1%	4%

<1 of 3>

Objective/ Sub-Objective	Rating Scale	Weighting Factor
Provide a positive return on investment	NPV ≥ $1 million: 100% NPV ≥ $500K and < $1 million: 70% NPV ≥ 0 and < $500K: 50% NPV < 0 and > (-$500K): 30% NPV ≤ (-$500K): 0%	1%
5. Regional and other collaboration opportunities – 4%		
Support regional transportation network	Project results in an expansion of the regional transportation system within the next five years: 100% Project integrates with or supports expansion of non-Authority elements of the regional transportation system within the next five years: 70% Project involves advanced planning or preliminary engineering activities in support of a significant expansion of the regional transportation system included in the approved regional transportation plan: 50% Project involves advanced planning or preliminary engineering activities in support of integration with or supporting expansion of existing non-Authority elements of the regional transportation system per the approved regional transportation plan: 30% Project does not support expansion of the regional transportation network: 0%	2%
Leverage partnership opportunities	Another public sector agency or developer is contributing funding to meet project objectives: 100% Project involves coordination with another public-sector agency or developer who is providing non-cash contributions to meet project objectives: 70% Project does not involve partnership opportunities: 30% Project involves coordination with other public-sector agencies or private partners who are not contributing financial or other resources to meet project objectives: 0%	2%
6. Environmental stewardship and sustainability – 4%		
Reduce release of emissions and contaminants	Project reduces emissions to air, releases to water, or contamination to soil/land: 100%	2%
Improve waste management practices	Project promotes recycling or improves waste management practices: 100%	1%
Promote livable communities	Project incorporates context sensitive design concepts or otherwise enhances local neighborhoods or communities: 100%	1%
7. Project deliverability – 19%		
Implement proven project concepts	Authority has successfully delivered projects of a similar scope/scale: 100% Another transit authority has successfully delivered projects of a similar scope/scale: 30%	4%
Deliver with experienced staff	Authority has internal staff with prior experience with the proposed project technologies and other project elements: 100% Authority has identified external resources with demonstrated prior experience with the proposed project technologies and other project elements: 30%	5%
Leverage available procurement vehicles	Project is able to buy off a GSA or State contract; piggyback off another transit agency contract; or utilize one or more existing Authority master contracts to reduce length of procurement cycle: 100%	7%
Minimize project risk	Project risk rating is low: 100% Project risk rating is medium: 30% Project risk rating is high: 0%	3%
Total:		100%

Program Constraints

The following resource types are proposed to be included in the decision model as program constraints for evaluating candidate projects:

- Total anticipated available funding;
- Total anticipated available funding by funding source/funding type;
- Required track time/track allocation;
- Total hours of Contracts and Procurement staff support per fiscal year;
- Total hours of Technology Applications Development staff support per fiscal year;
- Total hours of Technology Infrastructure and Networking staff support per fiscal year;
- Total hours of Engineering staff support per fiscal year by discipline;
- Total hours of Quality, Safety, and Training staff;
- Service impact (once over weekend, continuous service disruptions, etc.); and
- Special event coordination/limitations.

<3 of 3>

H.9 LISTING OF MONTANA DEPARTMENT OF TRANSPORTATION PARTICIPANTS

FIGURE 51: LIST OF MDT PARTICIPANTS IN THE DEVELOPMENT OF THE MDT EA STRATEGIC PLAN

Name	Division/Bureau/Unit
Aaron Dennis	Engineering Operations
Adam Kraft	Transportation Planning
Amanda Jackson	Bridge
Andrew VanDaele	Facilities
Becky Duke	Data and Statistics Bureau
Bill Semmens	Environmental
Brad Marten	Motor Carrier Services
Brandi Hamilton	Maintenance
Brenda Bokovoy	Accounting Controls
Bryan Miller	Consultant Design
Bryce Larsen	Photogrammetry
Carla Hass	Right of Way
Chad Newman	State Highway Traffic Safety
Cheryl Winship	HR Specialist (Great Falls District)
Chris Hardan	Bridge
Christopher DeVerniero	Transportation Planning
Chuck Granger	Information Services
Damian Krings	Road Design
Dan Bisom	Motor Carrier Services
Dan Kiely	Motor Carrier Services, Licensing and Permitting
Daniel Moore	Motor Carrier Services, Enforcement Bureau
Danielle Bolan	Traffic Geometrics
Dave Hand	District Administrator, Great Falls District
Dave Ohler	Chief Counsel, MDT Legal Services Unit
David Hamer	Accounting Controls
David Hedstrom	Hydraulics
David Hoerning	Right of Way
David Jacobs	Transportation Planning
David Johnson	Bridge
Debbie Alke	Administrator, Aeronautics Division
Dennis Hult	Motor Carrier Services
Diane Myers	Transportation Planning
Don Reidelbach	Right of Way
Don Wark	Transportation Planning
Dorianne Minkoff-Brown	Accounting Controls
Doug McBroom	Maintenance
Duane Williams	Administrator, Motor Carrier Services Division
Ed Ereth	Data and Statistics Bureau
Greg Smerker	Maintenance

Name	Division/Bureau/Unit
Gregory Pizzini	Right of Way
Harlan Davis	Maintenance/Sign Shop
Harold Dramstad	Aeronautics Safety and Education
Ivan Ulberg	Traffic Safety
Jack Dartman	Information Services
Jake Goettle	Construction
James Walthers	Engineering
Janet Kenny	State Highway Traffic Safety
Jason Gilliam	Accounting Controls
Jay Marks	Information Services
Jeania Cereck	Design (Great Falls District)
Jeff Gleason	Equipment
Jeff Jackson	Geotechnical
Jeff Olsen	Bridge
Jeff Sillick	Information Services
Jeff Steeger	Motor Carrier Safety Assistance Program
Jeri Kolberg	Information Services
Jerilee Weibel	Right of Way (Great Falls District)
Jerri Lake	Administration Division
Jim Davies	Pavement Analysis
Jim Skinner	Policy, Programs and Performance
Jodee Alm	Motor Carrier Services
John Althof	Traffic Safety
John Amestoy	Pavement Analysis
John Levick	Information Services
Jonathon Swartz	Maintenance
Joseph Zody	Right of Way
Justun Juelfs	Maintenance
Kathryn Callon	Research
Kathy James	Construction Systems
Kathy Overton	Workforce Planning
Kelly Holbrook	Equipment (Great Falls District)
Ken Wilhelm	Airport/Airways Bureau
Keni Grose	Administrator, Human Resources Division
Kent Barnes	Bridge
Kevin Kauska	Information Services
Kevin Murphy	Workforce Planning
Kim Doherty	Accounting Controls
Kim Janzen	
Kirsten Wrzesinski	Maintenance
Kraig McCleod	Traffic Safety
Larry Flynn	Administrator, Administration Division
Lawrence Urban	Environmental

Name	Division/Bureau/Unit
Leah Kailey	Fiscal Operations
Lesly Tribelhorn	Highways Bureau
Linda Hicks	Fiscal Operations
Lisa Durbin	Construction Administration Services
Lisa Hurley	Fiscal Operations
Luke Cowan	Equipment (Great Falls District)
Lynn Zanto	Administrator, Rail, Transit and Planning Division
Marie Stark	Fiscal Operations
Mark Keeffe	State Highway Traffic Safety
Mary Gayle Padmos	Pavement Analysis
Matthew Needham	Materials
Maureen Culpon	Information Services
Megan Handl	Civil Rights
Megan Serviss	Accounting Controls
Michael Dyrdahl	Engineering Operations
Mike Bousliman	Administrator, Information Services Division
Mike Murolo	Facilities
Mike Warren	Information Services
Miles Wacker	Information Services
Nicole Pallister	Budget and Planning
Patricia McCubbins	Civil Rights
Patrick Hurley	Right of Way
Paul Brown	Right of Way
Paul Jagoda	Construction
Paul Johnson	Transportation Planning
Phillip Inman	Right of Way
Ralph Jones	Surveying
Renae Johnansen	Human Resources
Robert Antonick	Information Services
Robert Heiser	Right of Way
Robert Virts	Occupational Safety and Health
Roche Juneau	Financial Management
Ross (Oak) Metcalfe	Materials
Roy Peterson	Traffic Safety
Ruby Dougherty	Information Services
Ryan Dahlke	Consultant Design
Scott Helm	Geotechnical
Scott Winfield	Accounting Controls
Shawn Bryant	Environmental
Stanley Kuntz	Materials (Great Falls District)
Stephen Prinzing	Engineering (Great Falls District)
Steven Giard	Right of Way/Utilities
Steven Keller	Communications

Name	Division/Bureau/Unit
Susan Sillick	Research
Tara Preston	Accounting Controls
Teresa Yakoweshen	Information Services
Tim Conway	Airport/Airways Bureau
Todd Miller	Information Services
Tony Strainer	Maintenance (Great Falls District)
Tony Strainer	Maintenance (Great Falls District)
Tracey Thennis	Human Resources
Tracy Halubka	Fiscal Operations
Vickie Murphy	Audit Manager
Vonnie Jenkins	Motor Pool
Walt Kertula	Equipment