# Development of Strategic Enterprise Architecture Design for ODOT

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16. Abstract

**In order for the Ohio Department of Transportation (ODOT) to successfully carry out its mission, it is essential to appropriately incorporate and utilize technology. 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. The objective of this research is to develop a strategic enterprise architecture design for ODOT. To accomplish this task, the researcher completed an analysis and documented the `as is' organization wide business processes and supporting information systems architecture at ODOT, and (2) made recommendations for a `to be' future state business process and information system architecture. Based on the analysis, recommendations were provided for appropriate governance mechanisms and change management procedures.**

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We also give special recognition and thanks to our IT Project Manager, Melissa Anverse, for her project guidance and tireless assistance in coordinating the multitude of meetings, workshops, and interviews.

We acknowledge the contributions of our associates, Atul Srivastava of Intueor, Inc., and Dr. David Rose and Howard Wood of Parsons Brinkerhoff, Inc. for their contributions to this project and their assistance during workshops and meetings.

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# I. Introduction

The Ohio Department of Transportation (ODOT) is the lead state-level agency for planning and executing the transportation program for the State of Ohio, including highways, public transit, and aviation. As part of this role, ODOT is responsible for planning, designing, operating, and maintaining the interstate, national highway system and state highway system in Ohio, with counties and cities responsible for constructing and maintaining the local road systems within their jurisdictions. A sister agency, the Ohio Rail Development Commission, has responsibility for rail policy at the state level in Ohio.

ODOT is one of the State of Ohio's largest agencies, with a capital budget of $2.3 billion and an operating budget of $518 million in Fiscal Year 2013. It is divided into 12 district offices throughout the State with numerous county-level offices within each district. ODOT currently has approximately 5,000 employees and has undergone significant down-sizing since the mid-1990s.

ODOT's mission is both diverse and complex. ODOT is responsible for managing the 10$^{th}$ largest roadway system in the United States, consisting of almost 49,000 lane miles (19,256 center-line miles). This includes the fourth largest interstate system in the nation with over 6,700 lane miles and the 2$^{nd}$ largest network of bridges in the United States, with over 43,525 bridges statewide including 14,115 bridges on the State system.

Over 60% of the population in the United States and Canada live within a 1-day drive of Ohio. As a result, ODOT has the 5$^{th}$ highest interstate traffic volume and the 4$^{th}$ largest interstate truck traffic volume. Ohio's footprint in other transportation modes is also quite extensive. It has the 12$^{th}$ largest average daily transit ridership in the nation, with an estimated 500,000 plus transit rides per day on its 62 public transit systems. Ohio also has 163 public-use airports. In addition, Ohio is a key state for intermodal traffic. With 13 intermodal facilities, Ohio ranks 8$^{th}$ nationally for intermodal tons originated and, 7$^{th}$ nationally for intermodal tons terminated. Ohio ranks 1$^{st}$ nationally in concentration of rail lines, 4$^{th}$ with its 5,303 total miles of rail, and 6$^{th}$ with its 36 operating railroads.

Because of the large and complex nature of its mission, it is essential that ODOT effectively utilize information technology to leverage its scarce resources in terms of employees and available funding. However, the current information systems' environment at ODOT, for the most part, is a fragmented collection of standalone or silo systems and processes which meet the needs of specific business areas.

ODOT has a number of systems which, understandably, were not developed in a comprehensive fashion or under one strategic vision. Some systems are old and not well-supported due to the age (and possible obsolescence) of software or people familiar with the systems (such as mainframe systems). Some systems were developed for an individual office or district and not designed to integrate with an overall architecture and some systems simply do not work well. In addition, there is limited data integration, resulting in some information being entered into multiple systems across different business units.

The current information technology environment limits ODOT's capacity to realize efficiencies in core areas such as business process streamlining and systems consolidation. In response, ODOT began taking steps to address this information systems deficit. Within the last three years, ODOT selected and either implemented or is currently implementing a number of industry leading solutions to address specific business requirements, including:

- Kronos for time management;
- Bentley InspectTech for bridge management;
- Deighton dTIMS for pavement management; and
- AgileAssets for fleet management, facilities management, and maintenance management.

ODOT also decommissioned its custom construction management system and replaced it with the AASHTOWare SiteManager™ product, which is used by a number of state departments of transportation. In addition, ODOT is evaluating Esri Roads and Highways product to replace its aging roadway inventory and linear referencing systems. Likewise, ODOT is also interested in implementing an Enterprise Resource Planning (ERP) application to replace its legacy financial management and accounting applications in the near future.

While ODOT is clearly modernizing its technology footprint, the systems replacement efforts initiated to date have been done in response to the individual needs of specific business areas and not necessarily in the context of an overall enterprise-wide information systems strategy/plan. To look at the technology needs of ODOT more holistically, ODOT commissioned this project to develop a strategic enterprise architecture design for ODOT.

The essential objective of an enterprise architecture is to inform, guide, and constrain the technology decisions of the enterprise and ensure technology decisions align with ODOT's business objectives.[1]

ODOT engaged eVision Partners, Inc. and its teaming partners, Parsons Brinckerhoff, Inc. and Intueor, Inc. (research team), to develop the strategic enterprise architecture design. This document is the Final Report for the Development of a Strategic Enterprise Architecture Design for ODOT. This report summarizes the research team project team during Phase I: Baseline Architecture and Phase II: Develop Enterprise Architecture Strategic Plan. The remainder of this report is organized as follows:

- Section II: Research Objectives – This section outlines the primary objectives of the research project for the Development of a Strategic Enterprise Architecture Design for ODOT;

[1] "Federal Chief Information Officer Council Definition of Enterprise Architecture," 1999

- Section III: Description of Research – This section outlines the research team's approach to conducting the project and summarizes the various activities carried out during the research process;
- Section IV: Results/Findings – This section outlines the major results and findings of the project. It includes a summary of interview findings and descriptions of the ODOT As-Is environment by the primary components of the enterprise architecture design: business architecture, applications architecture, data architecture, and technical architecture. It also includes a discussion of the current ODOT information technology governance process and a summary of the best practices briefings conducted during the project;
- Section V: Conclusions and Recommendations – This section outlines the research team's conclusions and recommendations, which are organized by the architectural layers within the ODOT enterprise architecture; and
- Section VI: Implementation Plan for Recommendations – This section outlines a proposed plan for implementing the recommendations from the Enterprise Architecture project. It includes a prioritization of the recommendations, an order of magnitude cost estimate, a high level two-year and five-year work program, anticipated benefits, potential risks to a successful implementation and strategies to mitigate the identified risks, and a change management strategy.

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## II. Research Objectives

The objective of this research was to develop a customized, executable, strategic enterprise architecture design for ODOT, which ODOT can implement through a series of separate follow-on projects. To accomplish this task, ODOT requested the research team to: (1) complete an analysis and document the 'As-Is,' organization-wide, business processes and supporting information systems architecture at ODOT; and (2) make recommendations for a 'To-Be,' future-state, business process and information systems architecture. ODOT also requested that recommendations be given, based on the analysis, for appropriate governance mechanisms and change management procedures.[2]

The following statements from the request for qualifications (RFQ) for the development of a strategic enterprise architecture, clearly define the need for integrated technology to deliver program and project delivery, operations, and services in today's transportation system environment.

> *"In order for the Ohio Department of Transportation (ODOT) to successfully carry out its mission, it is essential to appropriately incorporate and utilize technology. 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 to ensure ODOT's management of the transportation system is efficient and reduce duplication of systems and redundant data, research is needed to develop a strategic enterprise architecture design."*[3]

The RFQ succinctly states the perceived limitations of the current ODOT technology environment to meet the future needs of ODOT. As described, ODOT has a number of systems which were not developed in a comprehensive fashion or under one strategic vision. Some systems are old and not well-supported due to the age of the software or people familiar with the systems. Some systems were developed for an individual office or district and not designed to integrate with an overall architecture, and some systems simply do not work well.

eVision Partners, Inc. and its team members, Parsons Brinckerhoff, Inc. and Intueor, Inc. (research team) accepted the challenge to work with ODOT staff and stakeholders to develop ODOT's strategic enterprise architecture along with a plan meeting the research objectives.

The research objectives comprised development of ODOT's strategic enterprise architecture and supporting implementation strategies to facilitate transitioning to the To-Be architecture, which includes:

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[2] ODOT RFQ Solicitation Number 2013-33, "Development of Strategic Enterprise Architecture Design for ODOT," FY2013

[3] ODOT RFQ Solicitation Number 2013-33, "Development of Strategic Enterprise Architecture Design for ODOT," FY2013

- Developing a proposed information technology governance strategy;
- Recommending an information technology investment prioritization process;
- Identifying any information technology resource skill gaps and recommending approaches to address these gaps;
- Recommending any changes appropriate to the organizational structure or composition of the various business units which provide technology leadership and/or technology focused services in ODOT;
- Developing an organizational change management and communication strategy to guide the further planning and execution of the transition to the To-Be environment;
- Designing ODOT's enterprise architecture, consisting of:
  - Business architecture – which defines the functional structure of ODOT in terms of its business processes and organization and its associated business information needs;
  - Applications architecture, which delineates the capabilities of specific applications used to support ODOT's business functions and how these various applications work together or integrate to support ODOT's enterprise-wide information requirements;
  - Data architecture, which establishes data standards for all of ODOT's systems to support integration and information sharing between these systems; and
  - Technical architecture which describes the technical infrastructure and software technologies, which are shared services and not application specific, and other specific hardware and operating system-level software technologies required to support the various business applications; and
- Designing an implementation plan delineating a timeline and recommended sequencing of a series of projects or initiatives to implement the To-Be enterprise architecture.

As part of preparing the To-Be enterprise architecture design and the supporting implementation plan, the research team collaborated with ODOT stakeholders on a list of key principles and guidelines upon which the plan is based. Some examples include:

- ODOT is not going to abandon all systems at once and completely redevelop its systems environment and so the migration must be staged carefully based on the relative business benefit of different systems replacement efforts;
- ODOT has either recently completed or is currently undertaking several new system implementation projects and upgrades to some of its existing systems. These recent technology investments must be leveraged within the recommended ODOT enterprise architecture. Strategies need to be developed to ensure these new systems will

integrate with other new systems to be implemented in the future and that any potential re-work or interim interfaces between systems can be minimized; and

- There are a number of systems/applications, which need to share data, and if they did, business processes would be streamlined and more efficient; however, there are some systems/applications, which do not necessarily need to share data, and so these systems can be developed on a separate evolutionary path.

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## III. Description of Research

To meet the stated research objectives and deliver an executable Enterprise Architecture Strategic Plan, this project was conducted in two phases. Phase I consisted of a best practices synthesis and a review of ODOT's As-Is technology environment. Phase II included the development and validation of an ODOT enterprise architecture; preparation of a migration plan for implementing the recommended architecture; development of recommendations for a technology governance model; and preparation of an organizational change management strategy to support implementation of ODOT's proposed enterprise architecture.

An enterprise architecture is a strategic technology plan that aligns with the strategic plan of ODOT. The plan integrates the technology needs of ODOT 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 ODOT.

The term "enterprise architecture" was first used in a journal article in 1987 by John Zachmann. As initially defined by Zachmann, enterprise architecture was intended to address two issues:

- System complexity resulting in more and more money being spent on information technology systems; and
- Poor business alignment between information technology and business objectives resulting in it becoming more and more difficult to keep the expensive systems aligned with business needs.

Enterprise architecture addresses these issues by providing an overall blueprint to guide technology investment decisions.

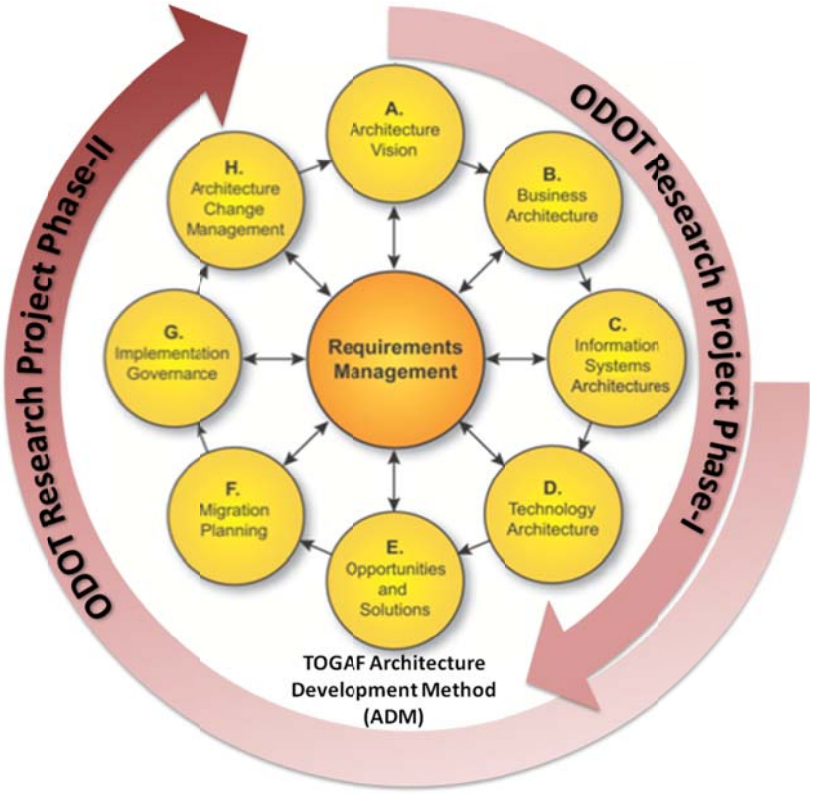
An enterprise architecture:

- 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.[4]

To develop an enterprise architecture for ODOT, 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 was highly collaborative, with frequent opportunities that engaged the research team and key ODOT stakeholders. Figure 1 illustrates how phases of ODOT's Research Project maps to the different phases of TOGAF's ADM.

[4] Federal Chief Information Officer (CIO) Definition of Enterprise Architecture, 1999

**Figure 1: ODOT Research Project Phases Mapped to TOGAF ADM**

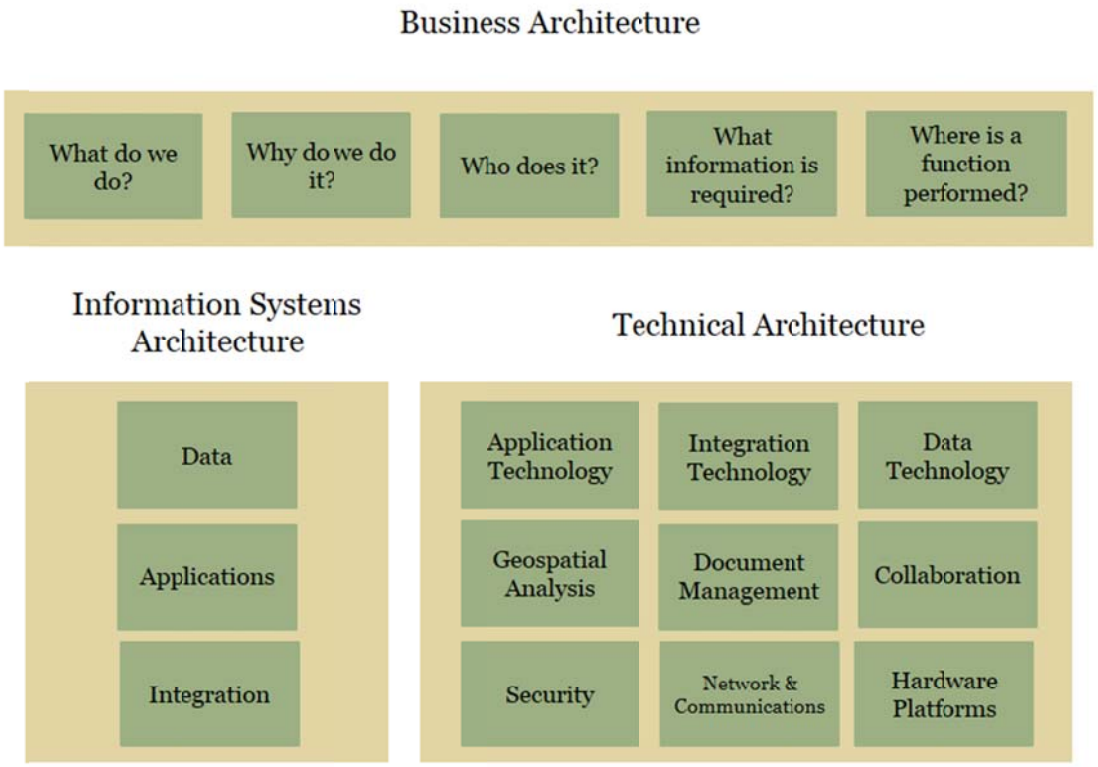



To understand best the technology needs of ODOT, the project team conducted its research utilizing an enterprise architecture design structure that consists of:

- Business architecture, which defines the functional structure of ODOT in terms of its business processes and organization and its associated business information needs;
- Applications architecture, a subset of information systems architecture, which delineates the capabilities of specific applications used to support ODOT's business functions and how these various applications work together or integrate to support ODOT's enterprise-wide information requirements;
- Data architecture, a second subset of information systems architecture, which establishes data standards for all of ODOT's systems to support integration and information sharing between these systems; and
- Technical architecture, which describes the technical infrastructure and specific hardware and software technologies required to support the various business applications.

Figure 2 provides a graphic representation of the enterprise architecture design structure and components.

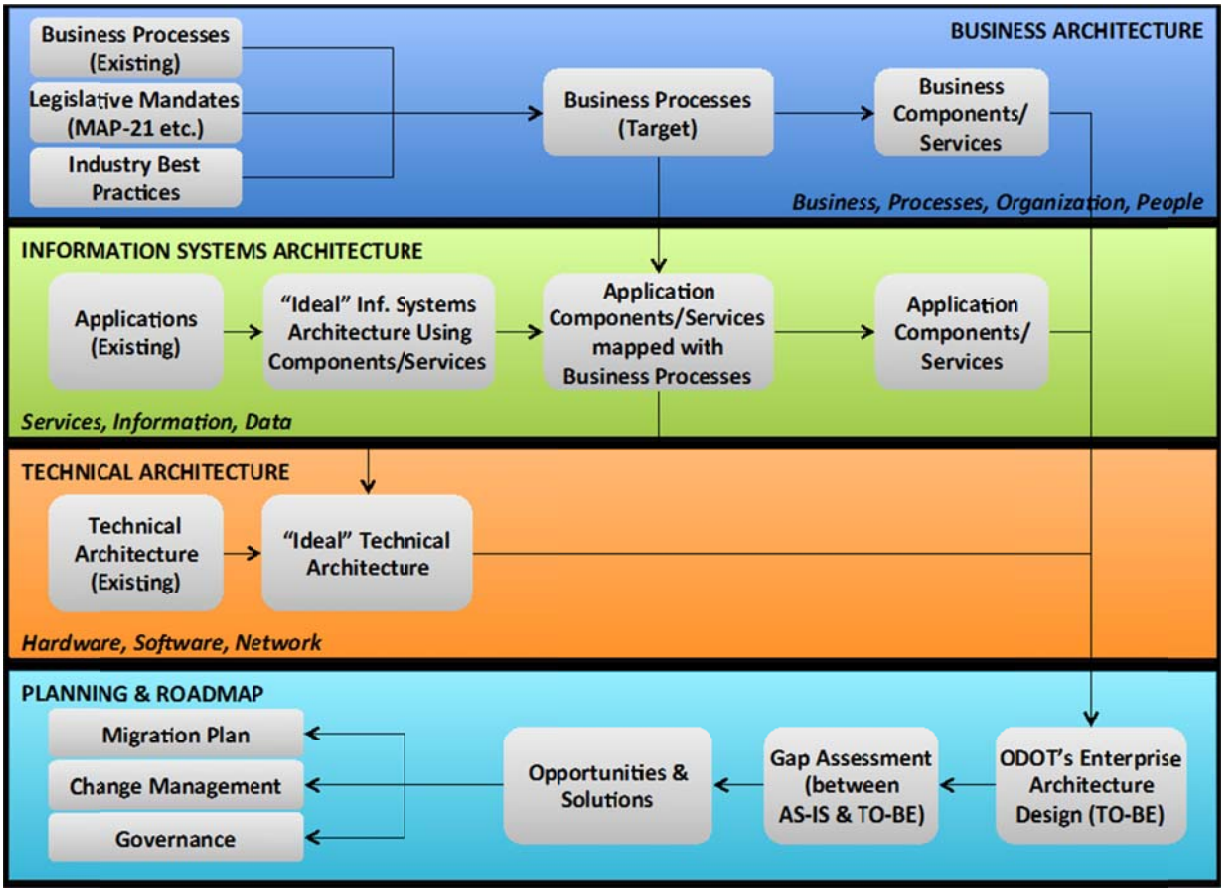
**Figure 2: Enterprise Architecture Design Structure**




In addition, other factors that influence the design of an enterprise architecture, such as ODOT's strategic initiatives, federal and state legislative initiatives and mandates, stakeholder's needs, and Ohio state government needs, are considered in the development.

Figure 3 presents a schematic representation of the factors and interlinking considered in the development of the ODOT enterprise architecture and implementation plan.

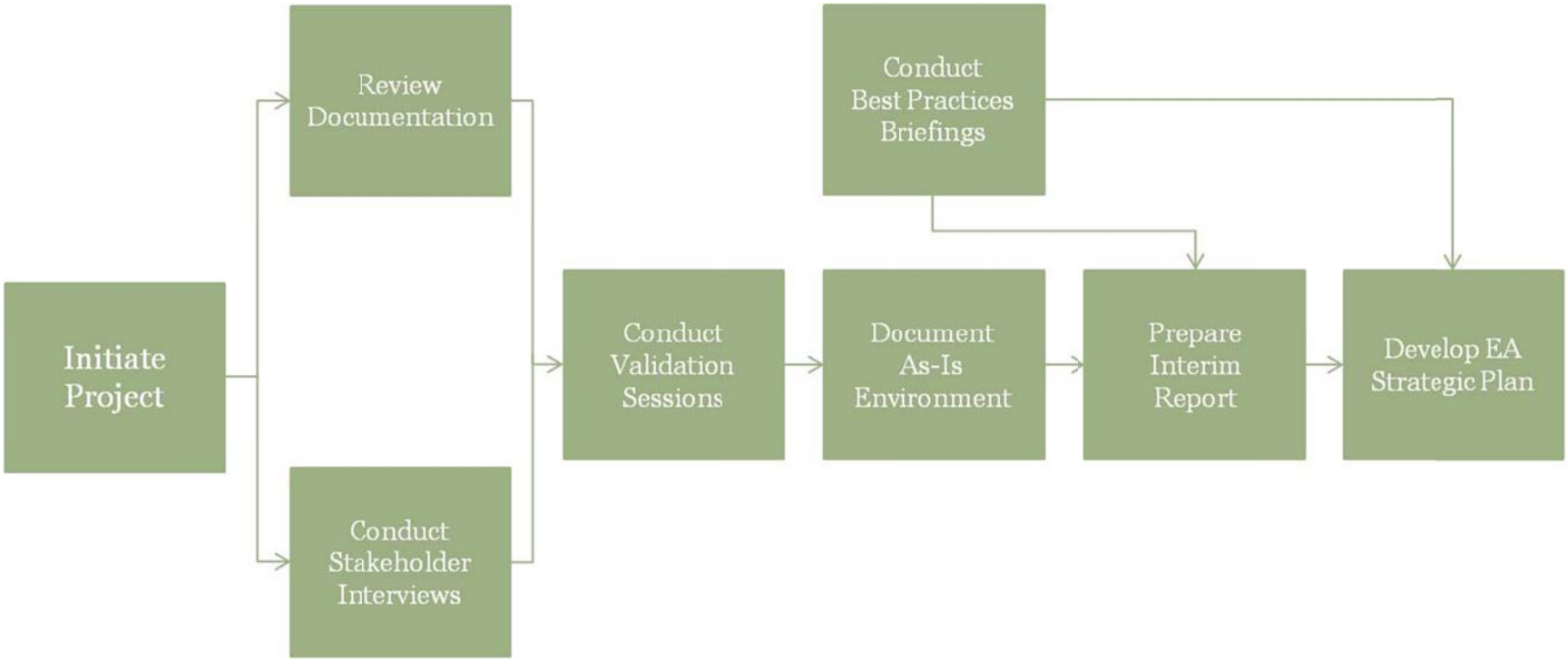
**Figure 3: Project Approach for Enterprise Architecture Framework**




## Methodology and Project Approach – Phase I: Baseline Enterprise Architecture

As stated previously, this project consisted of two phases, Phase I being a best practices synthesis and a review of ODOT's current technology environment and Phase II being the development of ODOT's enterprise architecture strategic plan. Phase I consisted of four tasks: project start-up, best practices synthesis, analysis of the ODOT As-Is environment, and preparation of an interim report. Figure 4 provides an overview of the key activities in Phase I and sequencing of these tasks. Each activity is then described in further detail below.

**Figure 4: Phase I – Baseline Enterprise Architecture Approach Schematic**



### Initiate Project

To initiate the project, the research team met with the Enterprise Architecture Project Steering Committee, consisting of several executive and senior leaders, the sponsoring Office Administrator, ODOT's IT Project Manager, and Ohio Department of Administrative Services (DAS) and Federal Highway Administration (FHWA) representatives. The meeting provided an opportunity to clarify technical issues or concerns with the project, present a project overview, and confirm project methodology and approach. The research team conducted monthly meetings with the steering committee to provide project status updates and obtain steering committee input on the project's direction.

Additionally, a project kick-off meeting was conducted with key stakeholders to explain the project goals and objectives; approach to completing the work; anticipated project timeline; and assistance required from stakeholders and when this assistance would be needed.

### Review Documentation

The research team requested various business area and information systems documentation from ODOT staff. The research team reviewed the documentation provided by ODOT in preparation for stakeholder interviews and/or validation sessions. This documentation was also utilized in the preparation of the As-Is systems model and the Interim Report.

The research team received and reviewed dozens of documents provided either in electronic format or hard copy. The hard copy documents were scanned to enable document sharing among team members. As more ODOT staff members became engaged in the project, more documentation was accumulated.

Some examples of the range and types of documentation reviewed by the research team include:

- ODOT Division of Information Technology (DoIT) table of organization and authorized headcount;
- ODOT Information Systems Application Catalog;
- Transportation Asset Management Plan Recommendations and Data Priorities;
- Appropriation Accounting System Overview;
- ODOT Financial System Integrations between Appropriation Accounting and the Ohio Administrative Knowledge System (OAKS);
- Kronos Implementation Project Statement of Work; and
- Scope of Services for the Implementation of AgileAssets.

### Conduct Stakeholder Interviews

The research team conducted stakeholder interviews with a broad range of ODOT management and staff from various divisions within the central office. The research team also made site visits and conducted interviews with management and staff in two districts: one urban (District 4) and one rural (District 10) selected by the project executive sponsor.

Initially, the research team envisioned interviewing 40 ODOT staff members and stakeholders. That number mushroomed as those interviewed recommended other staff members or external stakeholders to be interviewed to capture fully the technology and business environment at ODOT. In all, more than 100 ODOT staff members and external stakeholders were interviewed in one-on-one or small group interviews that typically lasted one hour.

A standard interview format was used to capture the business functions and objectives of ODOT; challenges to ODOT; technology applications currently being used and those being implemented; strengths and challenges of the current technology environment at ODOT; and measurement of success of this Enterprise Architecture project. A listing of the staff and stakeholders interviewed is included as Appendix 2. The interview questionnaire is included as Appendix 3.

### Conduct Validation Sessions

The research team documented the recurrent and notable themes from the stakeholder interviews, and using the information gathered during the interviews and documentation provided developed listings of technology applications currently in use and those being implemented. The research team then identified and organized the various ODOT business functions into eight major core business processes as illustrated in Figure 5. A ninth area was also established to represent the overall ODOT business environment including the impacts of internal and external influences and initiatives on ODOT that affect the delivery of ODOT programs, operations, and services. Examples of these internal and external influences include ODOT Director's initiatives and ODOT Critical Success Factors; public policy initiatives and impacts, including the impact of the new MAP-21 federal transportation legislation and other potential federal initiatives; external stakeholders; economic development; and economic conditions including transportation financing.

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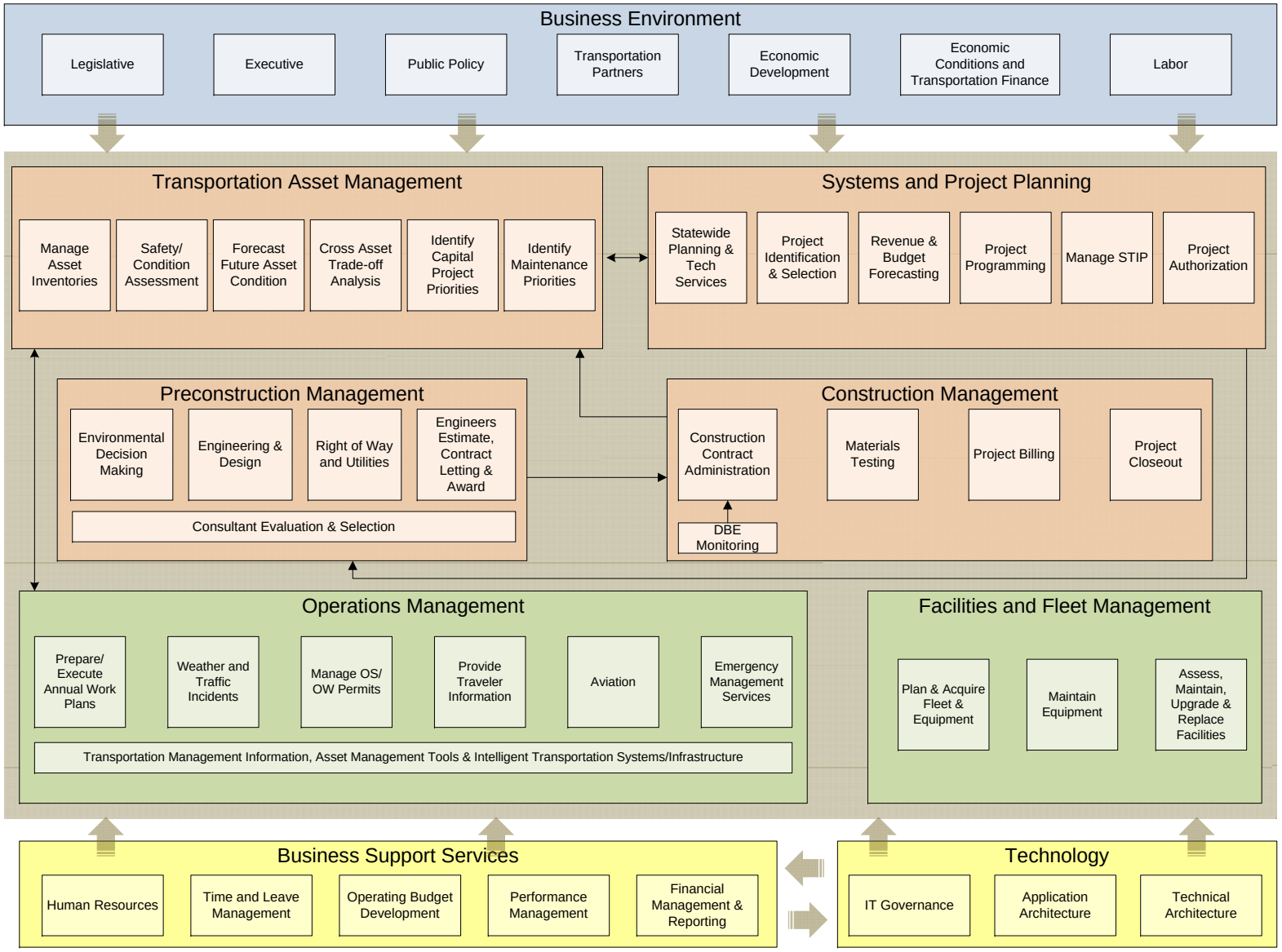
## Figure 5: ODOT Core Business Functions



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A validation workshop was then held for each of the business function areas and the overarching ODOT business environment. The validation workshops, which included cross-functional staff members, validated the documented interview themes, validated the business drivers, and validated and supplemented the listings of applications being used by function. Depending on the scope and complexity of each functional area, these sessions lasted between three and six hours in duration.

During several of the validation workshops, breakout sessions were conducted to understand more fully the technology environment and challenges to future technology implementation. More information on the business functions and business drivers is included in the next section of this report. A listing of the validation workshops conducted and the attendees at each session is included as Appendix 4.

### Document As-Is Environment

Based on the information gathered through the review of systems documentation, stakeholder interviews, and validation sessions, the research team documented the ODOT As-Is environment. The documentation of the As-Is environment was prepared and is presented in this report by enterprise architecture component: business, applications, data, and technology. The definition of the ODOT As-Is environment also includes an overview of the existing ODOT information organization and governance.

### Conduct Best Practices Briefings

The research team, utilizing its prior experience in enterprise architecture development at several state DOTs and literature searches of enterprise architecture best practices at other state DOTs and public sector organizations, conducted a half-day workshop for key ODOT stakeholders to educate them on the best practices in developing and implementing an enterprise architecture. The session included a group discussion on the applicability and potential benefits of these enterprise best practices at ODOT, challenges ODOT will face in implementing enterprise architecture, and strategies to address and mitigate the identified challenges.

Additionally, the research team conducted workshops with key ODOT stakeholders to share basic principles, state of the practice, and recent implementation experience and lessons learned in three specific ODOT business areas. These are expected to be integral in the development of the To-Be enterprise architecture design: transportation asset management, project systems management, and financial management/enterprise resource planning. In these three- to four-hour workshops, the research team also engaged the attendees in discussions on their experiences and provided an opportunity for the research team to discuss various technology deployment options. During some of the workshops, participants were engaged to brainstorm on various technology issues, implementation options, and the technology environment. A listing of best practices is included as Appendix 1.

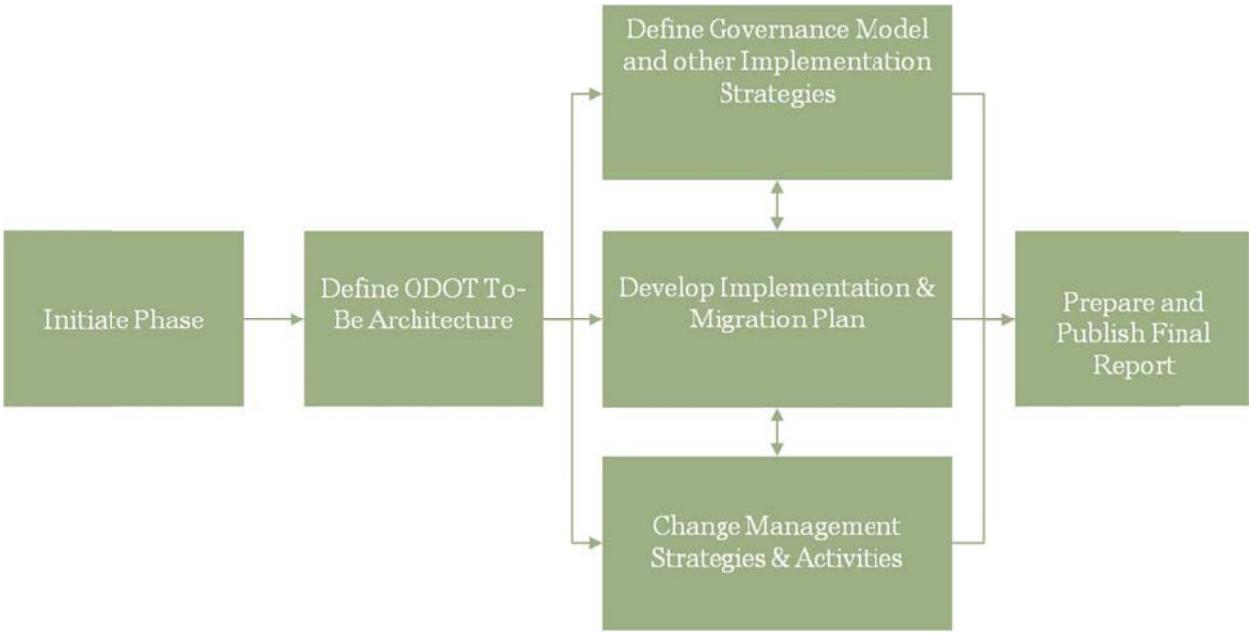
### Prepare Interim Report

The findings during Phase 1 were then documented by the research team in an Interim Report. As part of the development of this report, the research team also identified and documented preliminary recommendations which the research team believed ODOT should consider implementing immediately rather than waiting until completion of the Phase II work.

### Methodology and Project Approach – Phase II: Develop Enterprise Architecture Strategic Plan

As stated previously in this section, this project consisted of two phases, Phase I being a best practices synthesis and a review of ODOT's current technology environment and Phase II being the development of ODOT's enterprise architecture strategic plan. Phase II consisted of five tasks: Phase start-up activities; definition of the ODOT To-Be enterprise architecture; development of a migration plan for transitioning to the proposed To-Be Architecture; definition of a governance model and other strategies to support implementation of the migration plan; and preparation of the Final Report. Figure 6 provides an overview of the key activities in Phase II and sequencing of these tasks. Each activity is then described in further detail.

**Figure 6: Phase II – Develop Enterprise Architecture Strategic Plan Approach Schematic**




**Phase Start-up**

This task included the activities necessary to initiate Phase II. During this task, the research team prepared a detailed outline of the Final Report and provided this outline to the ODOT Project Manager and other appropriate stakeholders for review. The purpose of this outline was to ensure that there was consensus on the scope and content of the Final Report prior to initiating Phase II activities.

**Define ODOT To-Be Architecture**

Using the findings of the As-Is architecture analysis and the current and anticipated ODOT business environment as key inputs, the research team defined the preliminary ODOT To-Be enterprise architecture. The To-Be architecture was then reviewed and validated in a series of workshops with ODOT stakeholders. As opposed to the As-Is analysis, which was accomplished through various functional workshops, these workshops were driven from the enterprise level and involved looking at the systems needs of the department holistically. Validation workshops were centered on broad topic areas.

**Develop Migration Plan**

The research team then developed a draft migration plan for transitioning to the proposed ODOT To-Be enterprise architecture. This plan delineates activities to be accomplished within the next three years, as well as activities to be accomplished over the following two years. As part of preparing this plan, the research team interacted with ODOT stakeholders and used key principles or guidelines in developing the plan including:

- ODOT will not abandon all systems at once, nor completely redevelop its systems environment. The migration plan was staged carefully so as not to disrupt the delivery of ODOT services;
- ODOT recently completed or is currently undertaking several new system implementation projects. Consideration was given on how to best leverage these investments within the overall ODOT enterprise architecture; and
- ODOT has a number of systems/applications that currently do not share data. Consideration was given to data sharing especially in those applications where business areas could be streamlined as a result of data sharing.

**Define Governance Model and Other Implementation Strategies**

In this task, the research team prepared a recommended governance model and proposed organizational change management strategy for implementing the migration plan. These models and plans were provided to ODOT in draft format and then reviewed with key stakeholders.

**Prepare and Publish Final Report**

The research team prepared the draft Final Report and the executive summary and provided the report to ODOT for review. The Final Report packages the various work products from Phase I and Phase II into a single Enterprise Architecture Strategic Plan document. The research team then updated the Final Report based on feedback received from ODOT and upon ODOT's approval will publish the Final Report and Executive Summary following the guidelines of the ODOT Research, Development & Technology Transfer Manual of Procedures.

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## IV. Results/Findings

This section documents eVision Partners team's major results and findings. This section is organized as follows:

Business Architecture – This sub-section describes the existing ODOT business architecture including the overall ODOT business environment and the major internal and external influences on this environment; the major functions of ODOT; the agency's Critical Success Factors; and the major business objectives or business drivers within each functional area.

Applications Architecture – This sub-section describes ODOT's As-Is applications architecture. It consists of an overview of ODOT's key application systems including high-level schematics showing the major systems in use by ODOT and the interrelationships of these systems.

Data Architecture – This sub-section describes ODOT's As-Is data architecture including brief descriptions of the two primary data warehouse environments currently in use at ODOT, Sybase IQ and the Oracle Geospatial data warehouse.

Technical Architecture – This sub-section provides an overview of ODOT's As-Is technical architecture including mainframes, servers, storage, network architecture, telephony, Internet redundancy, enterprise desktop, information technology service desk, and existing shared application services.

Information Technology Organization and Governance – This sub-section describes ODOT's current information technology organization structure and information technology governance practices. A brief discussion of the DAS information technology organization and current DAS information technology initiatives which directly impact ODOT is also included.

Best Practices – This sub-section provides a brief summary of the best practices identified by the research team and presented to ODOT stakeholders in briefings in the following areas: enterprise architecture; transportation asset management; financial management/enterprise resource planning; and program and project management systems.

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## A. Business Architecture

As stated previously, to understand the technology needs of ODOT, the research team conducted its research utilizing an enterprise architecture design structure that consists of business architecture, applications architecture, information systems architecture, and technical architecture. The business architecture defines the functional structure of ODOT in terms of its business processes and organization, and its associated business information needs.

The business of ODOT aligns with its vision, mission, strategic plans, and business plans, and is measured through its critical success factors which include:

- People – work-life index, progress toward optimal structure, workforce injuries, and workforce crashes;
- System Conditions – bridges: general appraisal; pavements: priority, general and urban systems; and maintenance condition ratings;
- Operations – direct labor ratio, travel time reliability index, and snow and ice control;
- Safety – fatalities, serious injuries, and crashes; and
- Capital Program – contract program, ODOT let projects awarded on-time, local let projects awarded on-time, contract program/production costs, complete construction projects on-time, and preventable change orders.

The business architecture is influenced by the key business drivers of ODOT including external and internal factors that affect the business of ODOT and ODOT's business functions and deliverables. The ODOT business and technology environment affects the technology needs of ODOT and its readiness to support an enterprise architecture.

This sub-section identifies the ODOT business functions as categorized for this project; presents the ODOT business environment as developed by the research team in collaboration with members of the ODOT leadership team; and presents the developed and validated business drivers in each of the business functions. In addition, the stakeholder interview findings specific to business architecture are summarized.

### ODOT Business Functions

After numerous meetings and interviews with ODOT staff and utilizing its experience from working with other state departments of transportation, the research team identified six core business functions of ODOT and two business functions that support the overall operation of ODOT.

The core business functions identified are:

- Transportation Asset Management;
- Systems and Project Planning;

- Preconstruction Management;
- Construction Management;
- Operations Management; and
- Facilities and Fleet Management.

The two support business functions identified are:

- Business Support Services; and
- Technology Management.

A ninth area was established to represent the overall ODOT business environment including the impacts of internal and external influences and initiatives on ODOT that affect the delivery of ODOT programs, operations, and services.

Figure 7 presents a schematic representation of the core business functions of ODOT with a high-level workflow between the functions. The schematic demonstrates that the ODOT internal and external business environment influences the whole agency while the support services business functions provide support for the whole agency.

This business functions model was used throughout the project. Validation workshops were conducted in each of the nine identified business areas. In each of the workshops, attendees were asked to validate the business architecture through the validation of the recurrent and notable themes from staff and stakeholder interviews, and the business drivers developed for that business function.

The same validation workshops were used to validate and supplement the technology applications used in the business area and are included in the ODOT applications architecture sub-section later in this report.

### ODOT Business Environment

An overarching business environment affects the operations of ODOT as shown in Table 1. Internal and external business factors that influence ODOT include:

- Legislative, executive, and public policy initiatives and impacts;
- Relationships with transportation partners;
- Economic development initiatives;
- Economic conditions/transportation finance; and
- Labor.

The research team worked with members of ODOT leadership to discuss each of these influence areas and developed the following listings of initiatives, concerns, and issues by category.

**Legislative** – Impacts identified in terms of MAP-21 include: appropriation category modifications; freight corridor provisions; performance measurement requirements; asset management requirements; geospatial data requirements; and proposed enhancements to the National Highway System.

**Executive** – Impacts identified in this category include: ODOT's Critical Success Factors; zero-based budgeting; public/private partnerships; innovative project delivery including the parts management project, SMART Programs, non-interstate service plaza development; the Ohio Turnpike revenue bond initiative; alternative delivery models; central office staff reductions; identifying/managing impacts of the statewide DAS IT Optimization initiative; LEAN - continuous quality improvement initiatives; and the Planning and Engineering Directorate reorganization.

**Public policy** – Influences identified in this category include the potential for significant changes in policy direction and significant turnover in key staff roles as a result of a change in administration; the impact of various ongoing legislative initiatives and issues including speed-limit increases, Department of Public Safety (DPS) funding increases, and Public-Private Partnership (P3) legislation.

**Transportation partners** – The need for accurate and timely information sharing between ODOT and its partners continues to increase. This includes ODOT's delivery partners consisting of, among others, Metropolitan Planning Organizations (MPOs) and Regional Planning Organizations (RPOs), county engineers, general aviation, public transit, and local public agencies (LPAs); Minority Business Enterprise and Disadvantaged Business Enterprise (MBE/DBE) programs; various ODOT partnerships including DPS, Department of Natural Resources (DNR) and DAS among others; Ohio Rail Development Commission; federal resource agencies; and industry partners including the Ohio Contractors Association and American Council of Engineering Companies (ACEC) Ohio.

**Economic development** – Influences in terms of economic development include: the 629 FUND which consists of $15.2 million of funding for projects which is intended to be allocated 100% to job-producing projects, various partnerships established between ODOT and other agencies, and the goal of completing 50 capital projects per year which have an economic development focus. These include intermodal projects and projects that are also linked with ODOT's P3 goals. Other influences in this area are the goal of having 90% of economic development projects delivered prior to the opening of a new plant or facility; a focus on outcome measurement; and the use of economic impact scoring as part of the Transportation Review Advisory Council (TRAC) process.

**Economic conditions and transportation finance** – Influences and impacts in this category include: relatively flat motor fuel revenue growth; relatively flat growth of federal funds under

MAP-21; reduced flexibility in terms of the use of federal funds; and construction cost inflation which, while it continues to increase, is doing so at a much lower rate than ODOT was experiencing four to five years ago.

ODOT policy responses to these influences include delivering the capital program with greater efficiency and effectiveness through the application of various innovative project delivery and project finance techniques. These include zero-based budgeting; extending the service life of assets; using practical design concepts; implementing the Ohio Turnpike revenue bonds program; utilizing public-private and public-public partnerships; exploring opportunities to utilize tolling to advance construction projects; employing new transportation financing options identified by the Ohio Legislature; using sponsorship programs; leveraging assets; and increasing utilization of the State Infrastructure Bank.

**Labor** – In terms of this category, ODOT management and the Ohio Civil Service Employees Association (OCSEA) historically have had a good relationship and the union supports partnering initiatives.

### ODOT Business Drivers and Critical Success Factor 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. Another way to describe a business driver is to ask a different question. From a high-level perspective, "What does the business area do that can be measured for success?"

The research team identified business drivers for the six core business functions of ODOT and the two business support functions. The business drivers associated with each business function were then presented to the attendees of the various validation sessions. Participants were asked to validate, modify, and supplement the business drivers. The process was interactive and in several cases resulted in cross-functional collaboration to finalize the business drivers presented below.

The sub-sections below provide a brief definition of the scope of each of the six core business functions of ODOT and the two business functions that support the overall operation of ODOT. These functions were initially categorized by the research team and then validated with ODOT stakeholders. An inventory of the validated business drivers for each business function is provided.

#### Transportation Asset Management

As defined by the American Association of State Highway and Transportation Officials' (AASHTO) Subcommittee on Asset Management, "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."[5]

The primary goal of transportation asset management is to minimize the 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 ODOT 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 and Statewide Transportation Improvement Program and then through to operations, preservation, and maintenance.

As more fully described in the following section, "Overview of Best Practices," transportation asset management continues to evolve at ODOT. Currently, ODOT manages its major assets through the use of resident systems, applications, and processes to propose system preservation projects for inclusion in ODOT's capital program.

The primary sub-functions considered by the research team in its analysis of this area include:

- Manage asset inventories – This sub-function includes managing, updating, and maintaining accurate asset inventories for pavement, bridge, and various other assets on the State's transportation network;
- Safety/condition assessment – This sub-function includes planning on-going safety/condition assessment processes for key asset types, identifying sources of assessment data, designing assessment processes; preparing field data collection manuals; performing required data collection activities; and storing and managing assessment data;
- Forecast future asset condition – This sub-function involves utilizing various modeling tools and techniques to predict the future condition of assets under a variety of alternative investment strategies;
- Cross-asset trade-off analysis – This sub-function involves macro-level analysis utilizing modeling tools and techniques to predict overall system performance based on the anticipated condition of different asset types at different (varying) levels of investment for each major asset group (pavement, bridge, safety, etc.);

[5] Federal Highway Administration, "Transportation Planning and Asset Management" website: http://www.fhwa.dot.gov/infrastructure/asstmgmt/tpamb.cfm

- Identify capital project priorities – This sub-function includes utilizing output from the modeling and analysis tools for the various asset groups to identify candidate capital projects; and
- Identify maintenance priorities – This sub-function includes utilizing output from the modeling and analysis tools for the various asset groups to identify maintenance management priorities and to assist in establishing the annual maintenance work plan.

Table 1 lists the business drivers for the Transportation Asset Management business function.

**Table 1: Transportation Asset Management Business Drivers**

| Business Drivers – Transportation Asset Management |
|---|
| Embrace Transportation Asset Management for managing ODOT's critical assets and optimizing investment strategies |
| Entrust a Transportation Asset Management Governance body to guide and empower the development of ODOT asset management policies, standards, procedures, and processes |
| Create a Transportation Asset Management data platform to integrate asset inventories |
| Utilize a "Safety First" philosophy in promulgating asset management throughout ODOT |
| Leverage new and existing technologies to ensure the comprehensiveness and quality of asset inventories and condition assessments |
| Develop an integrated asset management process for critical assets that utilizes quality data with technologically advanced management systems |
| Employ level-of-service methodologies and holistic data to guide asset investment strategies |
| Share asset management data with and between ODOT's partner agencies and stakeholders |
| Utilize asset management systems to guide treatments that return the greatest value |

## Systems and Project Planning

Systems and project planning consists of both strategic and long-range planning for future system improvements and more intermediate and short-term planning for specific transportation programs and projects. System planning includes preparation of the State's long-range transportation plan; planning, development and management of other statewide transportation studies; establishment of new transportation programs and the setting of

priorities for existing programs to guide future investment decisions; and development of planning tools to help guide the policies and programs of ODOT and its various divisions. It also includes assessing transportation needs through the analysis of system condition, travel and safety data, and engaging with MPOs, other local public agencies, and communities across Ohio to obtain public input on transportation investments. In addition, it includes the implementation of tools and technologies to support the management of critical transportation asset data and the creation and management of required system reporting such as the FHWA Highway Performance Monitoring System (HPMS). It also includes the management of ODOT's research program.

Project planning includes managing the specific ODOT transportation program areas; project scoping and feasibility studies; initial project cost estimating; project prioritization; preparation of the Statewide Transportation Improvement Program (STIP); selection of specific projects within each program area; preparation of revenue and expenditure forecasts; development of the annual capital program; and the authorization of funding for specific projects with FHWA and other funding partners. It also includes on-going managing and monitoring of the execution of the entire program and each individual program area including making required adjustments to the planned number and mix of projects based on actual project performance.

The primary sub-functions within Systems and Project Planning include:

- Statewide planning and technical services – This sub-function includes preparing the statewide transportation plan; implementing tools and technologies to support the management of asset management data; preparing required system reporting; and managing the research program;
- Project identification and selection – This sub-function involves identifying, prioritizing, and evaluating candidate transportation projects identified through ODOT transportation asset management systems and/or by various stakeholders; preparing scoping studies to further delineate the project concept; and developing initial planning-level cost estimates. It also includes selecting projects within each program area for inclusion in the capital program through ODOT's Transportation Advisory Review Council (TRAC) process;
- Revenue and budget forecasting – This sub-function includes developing annual revenue estimates; preparing the capital budget based on the available revenue; and on-going management and monitoring of ODOT's cash flow forecast;
- Project programming – This sub-function involves the programming of projects based on project selection decisions including identifying and assigning eligible funding to each project. It also includes on-going monitoring of the capital program and implementing any required adjustments to the program based on actual project performance;

- Manage STIP – This sub-function includes preparing the STIP for submission to FHWA and managing any required STIP modifications and revisions during the Federal fiscal year; and
- Project authorization – This sub-function includes requesting authorization for a specific project or project phase from FHWA or another funding partner (Federal Transit Authority, Federal Aviation Authority, local public agency, private funding partner, etc.).

Table 2 lists the business drivers for the Systems and Project Planning business function.

**Table 2: Systems and Project Planning Business Drivers**

| Business Drivers – Systems and Project Planning |
|---|
| Develop/implement stronger statewide planning process |
| Integrate MAP-21 requirements into long-range plan |
| Implement data-driven decision making for project prioritization and selection |
| Integrate estimating at the beginning of planning through construction |
| Improve/standardize scoping-level estimates in the districts |
| Implement a project management culture ODOT-wide through an increased emphasis on PM training ($500^{+}$ staff to be trained over 2 years) |
| Leverage alternative financing strategies |
| • Evaluate tolling as a strategy to expedite project delivery and as an alternative financing strategy |
| • Leverage public/private partnerships |
| • Work collaboratively with the Ohio Turnpike Commission to implement/support Ohio Turnpike financing initiative (House Bill 51) |
| Streamline/automate TRAC processes |
| Implement Key Technology Initiatives |
| • Implement TIMS Phase II |
| • Plan for and implement a replacement for Base Transportation Reporting System (BTRS) |

| Business Drivers – Systems and Project Planning |
|---|
| • Implement enterprise document management solution to support project delivery |
| • Implement enhanced asset management coordination |
| • Conduct an additional study on increased transit services in both urban and rural areas and how to fund it |

**Preconstruction Management**

Preconstruction management consists of the processes and activities to further plan and develop a project concept prior to the initiation of construction. As defined by the research team, preconstruction management includes the environmental decision-making process; preliminary and final engineering and design activities; right-of-way acquisition; utility relocation; preparation of the bid specification package; preparation of the engineers estimate; and conduct and management of the contract letting and award process. It also includes evaluation, selection, and ongoing management of any consultants required to execute preconstruction activities for a project. The primary sub-functions of preconstruction management include:

- Environmental decision making – This sub-function consists of planning for and executing the environmental decision-making process consistent with the National Environmental Policy Act (NEPA). It includes analyzing and assessing the natural and human environmental factors associated with a proposed project; collaborating and coordinating with various resource agency partners relative to the potential environmental impacts of a project; defining and documenting environmental commitments; preparing categorical exclusion (CEs), environmental assessments (EAs), or environmental impact statements (EIS) based on the complexity of the anticipated environmental impacts; and obtaining required permits from various resource agencies prior to the start of construction;
- Engineering and design – This sub-function includes preparing preliminary and final plans including roadway design, pavement design, structural design, geotechnical, hydraulics, and other required design elements. It also includes completion of any required project surveys and management and support of engineering and design tools;
- Right of way and utilities – This sub-function 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. This includes appraising the parcel; negotiating with property owner(s); initiating condemnation proceedings if required; and provisioning of any required relocation services. In addition, this sub-function includes identifying any required utility relocations or railroad impacts and managing these relocation activities;

- Engineers estimate, contract letting, and award – This sub-function includes preparing the bid specification package; preparing the independent ODOT engineers estimate; letting or selling of the proposed project; managing any required addendums during the sale process; receiving bids from potential contractors through the electronic lockbox service used by ODOT; analyzing bids which are received; and determining the lowest responsible and responsive bidder; and
- Consultant evaluation and selection – This sub-function includes identifying the need to utilize an external consultant to support preconstruction activities; requesting letters of interest from potential consultants; receiving letters of interest; evaluating consultant responses including the conduct of interviews; selecting a potential consultant and negotiating a scope of work and proposed fee; receiving and reviewing consultant invoices; and on-going management of the consultant through the duration of a specific contract.

Table 3 lists the business drivers for the Preconstruction Management business function.

**Table 3: Preconstruction Management Business Drivers**

| Business Drivers – Preconstruction Management |
|---|
| Strengthen the estimating process throughout the project life cycle |
| Implement a project management culture department-wide through an increased emphasis on project management training |
| Implement standardized project management tools |
| Provide environmental oversight and guidance to support project delivery and ODOT's operations |
| Streamline/automate required documentation for environmental processes |
| Provide leadership on design policy and standards to ensure statewide consistency |
| Implement improved data collection methods for structures with focus on condition and safety |
| Utilize technology to ensure construction bidding efficiency, accuracy, and fairness |
| Utilize innovative technology to efficiently collect photogrammetric, survey, and GIS data for ODOT |
| Ensure conformance with state and federal regulations regarding real-estate acquisition and utility relocations |

| Business Drivers – Preconstruction Management |
|---|
| Document lessons learned in project delivery to improve future projects |
| Implement improved technologies to provide pavement designs for ODOT projects statewide |
| Assess effectively the condition of pavements and structures to support management systems, capital programming, and design |
| Provide an environment that promotes knowledge management and succession planning |
| Implement processes, methods, and technologies to leverage planning and design data through construction |
| Provide the information to support the issuance of oversize/overweight permits |

**Construction Management**

Construction management consists of the processes and activities to manage a project from contract award to completion. It includes construction contract management; construction inspection and quality assurance activities on the project site; preparation of contractor pay estimates; identification and management of potential contract change orders; and identification and management of potential contractor claims. It also includes the development of materials specifications; and the certification and/or testing of materials utilized on a project to ensure compliance with appropriate specifications. In addition, it includes the monitoring of a contractor's compliance with project DBE goals. Likewise, as defined by the research team, this area also includes the billing of funding partners for their share of project costs and the steps required to proactively closeout projects. The primary sub-functions of construction management include:

- Construction contract administration – This sub-function consists of managing all aspects of the construction contract; monitoring contractor work activities through on-site inspection; preparing progress estimates; managing project change orders; and managing potential contractor claims;
- Materials testing – This sub-function includes providing a materials management environment to ensure the quality of materials and materials processes used in ODOT's construction processes through the establishment of specifications, quality control and quality assurance processes, materials approval methodologies and systems, as well as source and project testing;
- Project billing – This sub-function involves accumulating costs which are eligible for billing to external funding partners and then preparing and submitting bills to FHWA and other funding partners;

- Project closeout – This sub-function involves identifying projects which are eligible for closeout and then completing the closeout process in a timely manner to reallocate any remaining funding, and sharing lessons learned to improve the delivery of future projects; and
- DBE monitoring – This sub-function involves monitoring contractor compliance with DBE goals and commitments throughout a construction project.

Table 4 lists the business drivers for the Construction Management business function.

**Table 4: Construction Management Business Drivers**

| Business Drivers – Construction Management |
|---|
| 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 |
| Delegate the responsibility for federal-aid construction on local public agency contracts through the promulgation of rules, policies, and guidelines; and a system of review that ensures conformance |
| Execute the delivery of projects to minimize the impacts to citizens, contractors, and ODOT 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 small and disadvantaged business enterprises (SDBE) through the SDBE program within ODOT and among stakeholders |
| Provide the technology and systems training necessary to manage construction projects and facilitate the delivery of on-schedule and on-budget projects |
| Utilize alternative project delivery methods to facilitate project delivery and establish and implement policies, specifications, and methods that provide the best value |
| Ensure timely project close-out and capture lessons learned, making them available for future use |

**Operations Management**

Operations management consists of the processes and activities to maintain and operate ODOT's transportation infrastructure. This includes the preparation and execution of annual maintenance work programs; snow and ice removal; routing and sale of oversize/overweight permits; management of the statewide traffic operations center; collection and dissemination of traveler information through various media; management of highway incidents; and required emergency management services coordination with other State agencies. This function also includes the operation of ODOT's aviation program. Likewise, it includes the management of the intelligent transportation systems program and associated infrastructure. The primary sub-functions of operations management include:

- Preparation and execution of annual work plans – This sub-function consists of each county maintenance operation and the various statewide crews preparing annual maintenance work programs; weekly or bi-weekly scheduling of work; performing maintenance work; recording of work performed; and monitoring of actual work performed against the annual work program. It also includes managing and monitoring requests for access permits;
- Weather and traffic incidents – This sub-function includes annual planning for snow and ice removal; preparing for snow and ice removal in advance of a weather event; performing required snow and ice removal; and recording the work performed. Additionally, this sub-function includes managing and coordinating ODOT's response to various incidents including significant crashes, spills, unexpected infrastructure failures, and major emergencies outside the right of way, which may influence the flow of traffic (wildfires, train derailments, etc.);
- Manage oversize/overweight permits – This sub-function includes selling and routing of oversize/overweight permits to ensure the protection of ODOT's transportation infrastructure;
- Traveler information – This sub-function includes managing the consolidated statewide traffic operations center and provisioning traveler information to the public through various mediums;
- Aviation management – This sub-function includes scheduling, operating, and maintaining ODOT-owned aircraft; operating the State's aviation registration program; managing the aviation grants program for general aviation airports; and coordinating statewide efforts for aviation;
- Emergency management services – This sub-function includes planning for and coordinating with other State of Ohio emergency management agencies in terms of ODOT's response and service delivery for a major or declared emergency; and
- Transportation management information, asset management tools, and Intelligent Transportation Systems (ITS) infrastructure – This sub-function includes applying transportation management information and asset management tools to manage the maintenance and operations of highway infrastructure. In addition, it includes

planning, constructing, implementing, and continuous maintaining and managing of the ITS infrastructure to support the dissemination of traveler information.

Table 5 lists the business drivers for the Operations Management business function.

**Table 5: Operations Management Business Drivers**

| Business Drivers – Operations Management |
|---|
| Provide leadership in the maintenance of ODOT infrastructure through the establishment and implementation of policies, procedures, performance measures, and accountability |
| Utilize state-of-the-art techniques, equipment, and forecasting methods to manage snow and ice events to minimize the effects on the motoring public and commerce |
| Use innovative practices, technological advancements, and partnerships to effectively manage traffic and incidents |
| Develop traffic engineering policies and standards (such as the ODOT MUTCD) and performance measures to monitor system performance |
| Support traffic operations through engineering support, signal repair, and sign design and fabrication |
| Serve the State of Ohio and ODOT through the efficient management of flight operations and maintenance of the aircraft fleet |
| Provide statewide leadership for the aviation program in areas that include planning, engineering, grants management, pavement & safety inspections, airspace protection, aircraft registration, and aviation enforcement |
| Coordinate ODOT's emergency preparedness and management systems to ensure that ODOT will perform expeditiously and efficiently to manage emergency events |
| Perform preventative maintenance activities on pavements to lengthen their effective life and perform remedial repairs in a timely and quality manner |
| Ensure the safety of the motoring public through the systematic inspection of traffic systems, correction of deficiencies, and expeditious response to emergent issues |
| Ensure the safety of the motoring public through the systematic inspection of structures (bridges and culverts), correction of deficiencies, and expeditious response to emergent issues |

| Business Drivers – Operations Management |
|---|
| Provide for a safe environment for the ODOT workforce by providing appropriate training, personal protective devices, equipment, facilities, and workforce management |
| Employ latest technologies to effectively provide timely traffic information to the public |
| Process overweight and oversize permits in a timely and efficient manner |
| Leverage efficiencies gained through consolidation of traffic management centers and technology to manage traffic and incidents statewide |

**Facilities and Fleet Management**

Facilities and fleet management consists of planning for, procuring, and acquiring fleet and equipment; maintaining ODOT's fleet and equipment to support daily operations; maintaining and operating ODOT's public-facing and non-public facilities; assessing the condition of ODOT facilities; and planning for the renovation and replacement of facilities. The primary sub-functions within facilities and fleet management include:

- Plan and acquire fleet and equipment – This sub-function consists of annually identifying equipment needs by each district; requesting new equipment through the ODOT truck run; and acquiring and commissioning new equipment. This includes acquiring component parts and the final assembly of new trucks by Ohio Penal Industries (OPI). This sub-function also includes maintaining a comprehensive fleet and equipment inventory;
- Maintaining equipment – This sub-function includes the daily maintenance of fleet and equipment including performing required repair work and scheduled preventive maintenance; and
- Assess, upgrade, replace, and maintain facilities – This sub-function includes performing routine facilities maintenance and repair; maintaining a comprehensive inventory of ODOT facilities and the major systems within these facilities; conducting structured condition assessments of ODOT facilities; and planning, based on condition assessments and the projected life of major components for the upgrade, replacement, and renovation of ODOT facilities and the major systems within each facility. In addition, this sub-function also includes managing facility security and access control.

Table 6 lists the business drivers for the Facilities and Fleet Management business function.

### Table 6: Facilities and Fleet Management Business Drivers

| Business Drivers – Facilities and Fleet Management |
|---|
| Provide leadership through the development of equipment management policies, practices, and guidance that provide a safe, dependable, and efficient equipment fleet |
| Implement strategies to reduce the average age of the ODOT fleet |
| Implement technologies and systems to efficiently manage the ODOT fleet |
| Utilize structured processes and technology to facilitate the acquisition of equipment |
| Facilitate the availability of equipment through proactive coordination with district equipment shops |
| Implement a business outsourcing model for parts management |
| Utilize technology and innovative systems and processes to effectively dispose of retired equipment that best serves the needs of local governments and the public |
| Provide leadership through the development of facilities management policies, practices, and guidance that provide secure, functional, cost-effective facilities that support the needs of ODOT operations |
| Support the replacement, repair, and efficient use of facilities by providing facility construction and design services and space utilization guidance |
| Coordinate facility management statewide through the provision of master planning services, facilities contracts, and coordination of facility managers and supervisors' efforts |
| Implement strategies to reduce the average age of ODOT's operational facilities |
| Develop and implement a statewide security plan for ODOT facilities and support those plans through the use of standards and audits |
| Provide, preserve, and maintain an efficient and workable environment for ODOT staff statewide |
| Develop and direct a Rest Area Program that provides comfort to the motoring public and implement innovative methods to provide best value and revenue generation opportunities |

**Business Support Services**

Business support services include various administrative support, back-office, and management processes which support ODOT's daily operations. These functions include human resource management, time and leave management, operating budget development, performance management, and financial management and reporting. The primary sub-functions within business support services include:

- Human resource management – This sub-function consists of administrating personnel administration; labor relations; employee safety; employee training; and the ODOT LEAN quality improvement program;
- Time and leave management – This sub-function consists of capturing employee time for payroll, processing of employee leave requests, capturing employee leave, and managing employee leave balances;
- Budget development – This sub-function consists of preparing the biennial budget for submission to the Office of Budget and Management and the Ohio Legislature. It also includes proactive monitoring of actual performance versus budget throughout the fiscal year;
- Performance management – This sub-function consists of developing ODOT's critical success factors and other performance measures and the on-going monitoring of organizational performance in terms of the established performance measures; and
- Financial management and reporting – This sub-function consists of the accounting, purchasing, and financial management and reporting functions necessary to support ODOT's daily operations.

Table 7 lists the business drivers for the Business Support Services function.

**Table 7: Business Support Services Business Drivers**

| Business Drivers – Business Support Services |
|---|
| Champion stewardship of ODOT financial resources |
| Lead ODOT in the establishment of accounting and reporting policies, principles, and practices to ensure conformance with governmental accounting standards and regulations |
| Utilize technology, establish cost accounting methods to provide for the analytical evaluation of activity costs |
| Implement budgeting methodologies to manage debt, promote operating budget efficiencies, and maximize the funds available to deliver a robust capital program |

| Business Drivers – Business Support Services |
|---|
| Develop efficiencies in employee time and payroll technologies and practices to minimize human effort, reduce errors, and maximize the reimbursement of qualifying payroll and associated costs |
| Employ methods for expeditious payments to contractors, consultants, and vendors to minimize delays in construction and maintenance activities |
| Partner with the Federal Highway Administration, and other federal partners to effectively obligate and expend all federal funds appropriated to ODOT |
| Employ cash management and forecasting techniques to leverage available fund balances to best operate the system and deliver the capital program |
| Administer and manage the State Infrastructure Bank to facilitate the delivery of local transportation projects |
| Lead ODOT in labor relations and human resource management in ways that demonstrate the value of each employee, and provide appropriate compensation, benefits, meaningful evaluations, and recognition |
| Embrace and promote throughout ODOT knowledge management practices such as training, continuing professional development, and succession planning techniques |
| Establish and promote a culture of safety department-wide |
| Utilize the delegated authority of Ohio civil service to appropriately classify staff and provide challenging career paths that best utilize their talents and skill sets |
| Through the use of audits, protect the interests of Ohio taxpayers by ensuring that funds are appropriately expended |
| Serve as the ODOT records management coordinator and actively champion a statewide records management effort |

## Technology Management

Technology management includes planning for, acquiring, implementing, and then operating and maintaining the technology infrastructure necessary to support ODOT operations. It includes the following sub-functions:

- Information technology governance – This sub-function includes establishing and then managing information technology standards, practices, and processes. It also includes establishing and executing an IT investment process;
- Manage applications architecture – This sub-function includes planning, acquiring, implementing, and maintaining and supporting the various business systems utilized across ODOT; and
- Manage technical architecture – This includes planning for, acquiring, implementing, maintaining, and supporting both common and shared service application software components such as GIS, database management systems, document management or collaboration software, as well as operating system software. It also includes planning for, implementing, and maintaining ODOT's technical infrastructure such as workstations, mobile devices, servers, and the ODOT network.

Table 8 lists the business drivers for the Technology Management business function.

### Table 8: Technology Management Business Drivers

| Business Drivers – Technology Management |
|---|
| Establish a "customer first" philosophy to provide effective and efficient tools, technologies, and services to support ODOT's business functions |
| Enhance relationships between ODOT business groups and external partners to ensure effective data usage through the use and development of enterprise systems |
| Provide leadership in the establishment of technology policies, practices, and guidance that promote strategic technology implementation, procurement, and development |
| Identify, implement, and maintain quality, industry-tested, commercially available software applications that serve the unique and general business needs of ODOT |
| Develop and maintain software applications with internal and external resources that best serve the needs of ODOT when commercially available applications are not available or applicable |
| Protect the integrity and security of ODOT data, and provide the tools and resources to best utilize, maintain, and integrate these data |
| Provide and maintain a reliable and secure technology infrastructure including the data network, servers, desktops, laptops, mobile devices, and telecommunications to meet the diverse needs of the ODOT community |
| Create a system of technology governance to prioritize technology investments that support ODOT's needs, is consistent with the established architecture plan, and is inclusive of all business areas, large and small |
| Enable the effective use of ODOT data through the implementation of user-friendly applications that empower staff, external stakeholders, and the public to utilize data to make informed decisions |
| 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 |
| Challenge business areas to improve business processes in conjunction with technology projects |

As previously stated, in each respective business function validation session the business drivers were presented and discussion took place which resulted in some modifications to the business drivers. In one session, several modifications were recommended which resulted in

the business drivers being modified and sent to the session attendees for a second validation. The research team, therefore, considers the business drivers in each functional area to be validated and an accurate representation of ODOT's business objectives.

**Interview Findings – Business Architecture**

In terms of the business architecture, the following were the common themes in our stakeholder interviews, which were confirmed through discussions in the various validation sessions:

- The importance of utilizing technology as a key enabler for supporting the "right-sizing" of ODOT was clearly understood;
- Many people recognized that technology needs should be considered as ODOT increases its emphasis on innovative project financing and delivery approaches;
- There was consistent awareness that MAP-21 requirements need to be incorporated into the technology plans of ODOT;
- Several people stated concerns about the impacts to ODOT of the statewide information technology optimization effort;
- The opportunity for continuous quality improvement initiatives to accompany technology implementation was recognized as an opportunity and as a concern. As someone put it, "Let's not automate a bad process";
- A recurrent concern was the lack of consistent policy direction and changing priorities often due to changing administrations and the extensive changes to ODOT's leadership team; and
- A lack of consistency between the central office and districts or as one person described it, "12 different ODOTs," was often listed as a concern.

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## B. Applications Architecture

This sub-section includes an overview of ODOT's As-Is and In-Motion applications architecture. It also includes 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 depicts how applications interact with each other and with users. The applications architecture is focused on data consumed and produced by applications rather than on their internal characteristics, such as their programming languages or whether they are custom developed or commercial off-the-shelf applications.

Because of the number of systems initiatives currently in various stages of implementation at ODOT, the research team prepared depictions of both the As-Is applications architecture and the In-Motion applications architecture. The As-Is applications architecture is intended to depict the major systems currently in production and the primary interactions between these systems. The In-Motion applications architecture is intended to depict what the ODOT applications architecture will look like following the implementation of several major information technology projects. These projects include:

- Structures Management System (SMS) being implemented with Bentley's InspectTech application;
- Enterprise Information Management System (EIMS) being implemented utilizing several AgileAssets modules including a new module intended to capture and allocate time charged to ODOT projects;
- A new Capital Project Management System, currently in the requirements definition phase, which will include planned enhancements to the Consultant Selection and Letter of Interest applications as well as project scheduling, document management (potentially to be implemented as the pilot for an enterprise-wide shared services application), and other contracts management functionality;
- A new Real Estate application which is currently in the software selection and evaluation phase of the information technology project life cycle; and
- A new Roadway Information Management System expected to be based on Esri's Roads and Highways application to replace the BTRS and Roadway Inventory applications.

The As-Is and In-Motion applications architecture is depicted from two perspectives:

- Systems view, which shows how the various applications interrelate and share information between themselves through either automated or manual interface points; and

- Business process view, which shows the major applications, utilized by each of the eight business functions and the key data elements which are shared between these business functions. Please note that for the business process view the Business Support and Technology Management functions have been combined into a single function for ease of presentation.

To provide stakeholders with a sense of the complexity of the interrelationships between various application systems while at the same time still making the diagram somewhat user-friendly for the reader, both the systems view and the business process view for the As-Is and In-Motion applications architecture have been depicted for Level 0, meaning that only the most important core ODOT systems and the key or high-level data flows between each of the systems are depicted. Readers are advised that the diagrams are not meant to represent all ODOT systems and interrelationships.

The following diagrams are provided on the pages below:

- Figure 7: As-Is Level 0 Systems View;
- Figure 8: In-Motion Level 0 Systems View;
- Figure 9: As-Is Level 0 Business Process View; and
- Figure 10: In-Motion Level 0 Business Process View.

Appendix 5 includes the Level 1 In-Motion Business Process view schematics for each of the eight functional areas. These diagrams depict the ODOT applications architecture for each business functional area at a lower level of detail than shown in the Level 0 diagrams. Appendix 6 presents a list of ODOT's enterprise-wide application systems, while Appendix 7 contains an additional list of applications maintained by each ODOT district. This inventory was developed through a survey of information technology staff in each district. The survey identified 127 applications or systems currently developed and/or maintained by District IT staff including three applications which are included on the enterprise application inventory in Appendix 7. District 3 and District 9 reported having no applications which they maintain.

ODOT uses a total of 225 systems (not including district-specific applications), of which 208 are owned and maintained by ODOT. The remaining systems are either owned by the State of Ohio (11 systems) or are Federal systems (6 systems) that ODOT uses to send and receive information from FHWA and/or other Federal agencies.

Of the 208 systems owned by ODOT, Operations Management owns the most systems (48), followed by Business Support Services (41), and Transportation Asset Management (28). A complete breakdown is presented in Figure 11. Figure 12 presents a snapshot of all systems owned and used by various functional areas, along with systems that are planned to be retired in those areas and new systems being implemented.

**Figure 7: As-Is Level 0 Systems View**

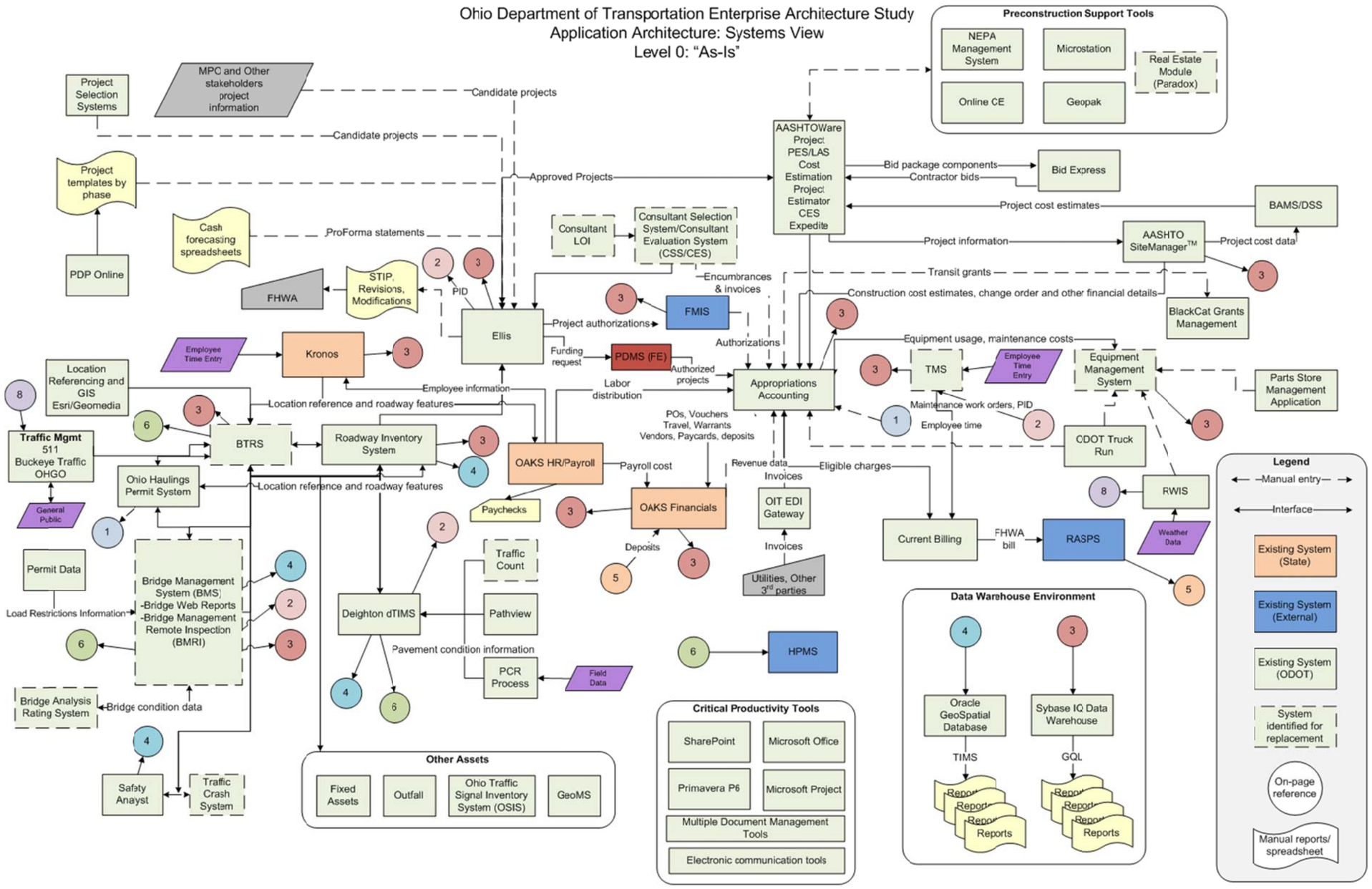


**Figure 8: In-Motion Level 0 Systems View**

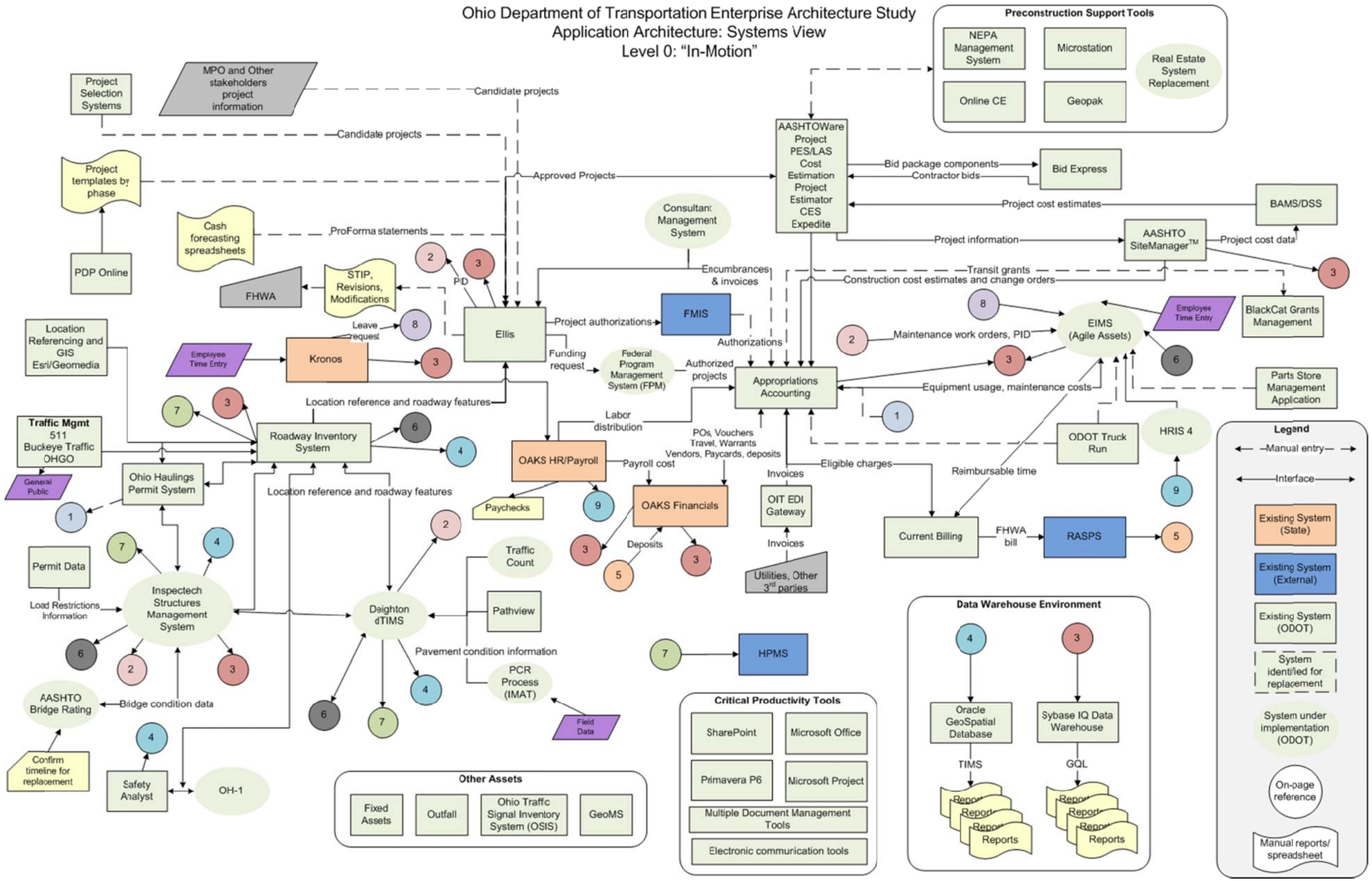


**Figure 9: As-Is Level 0 Business Process View**

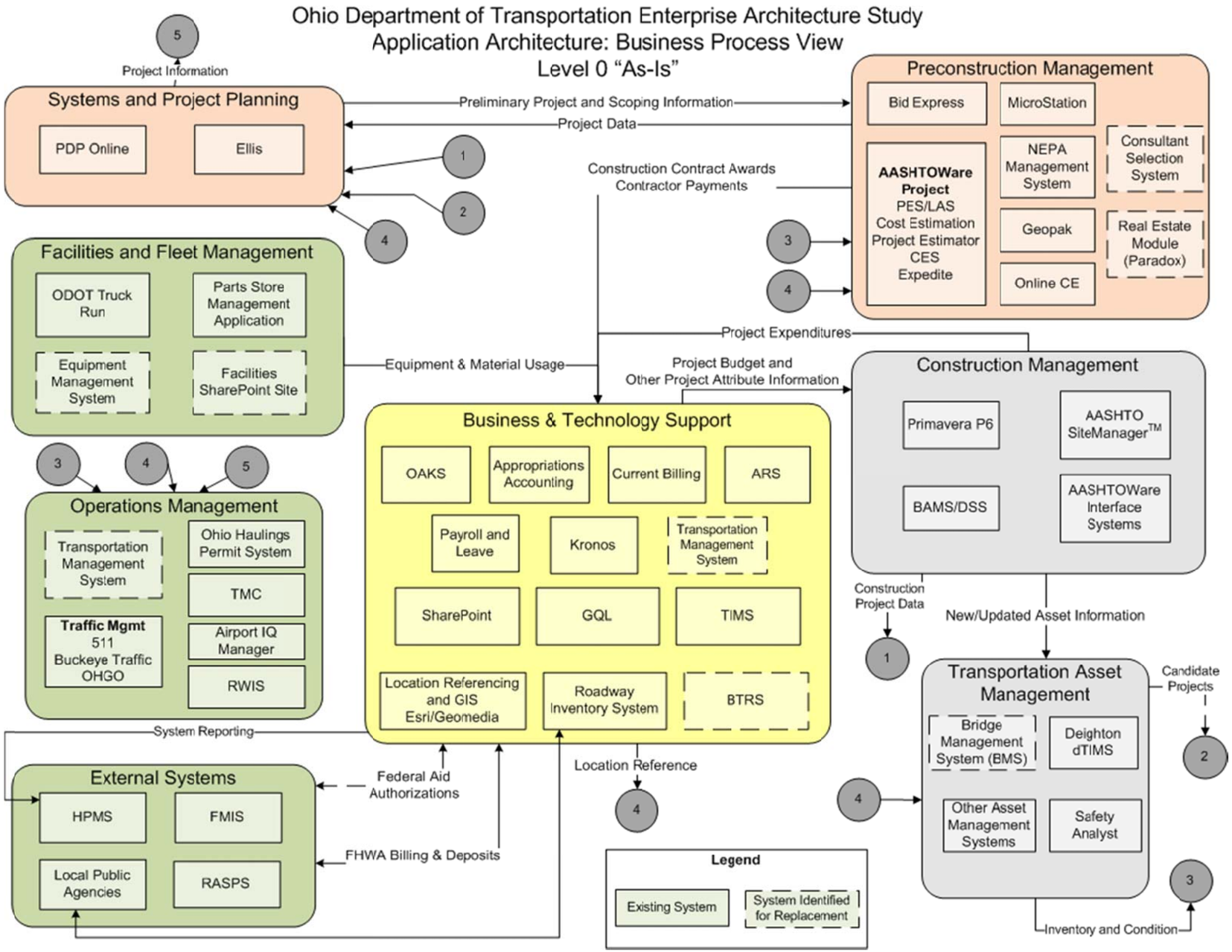


**Figure 10: In-Motion Level 0 Business Process View**

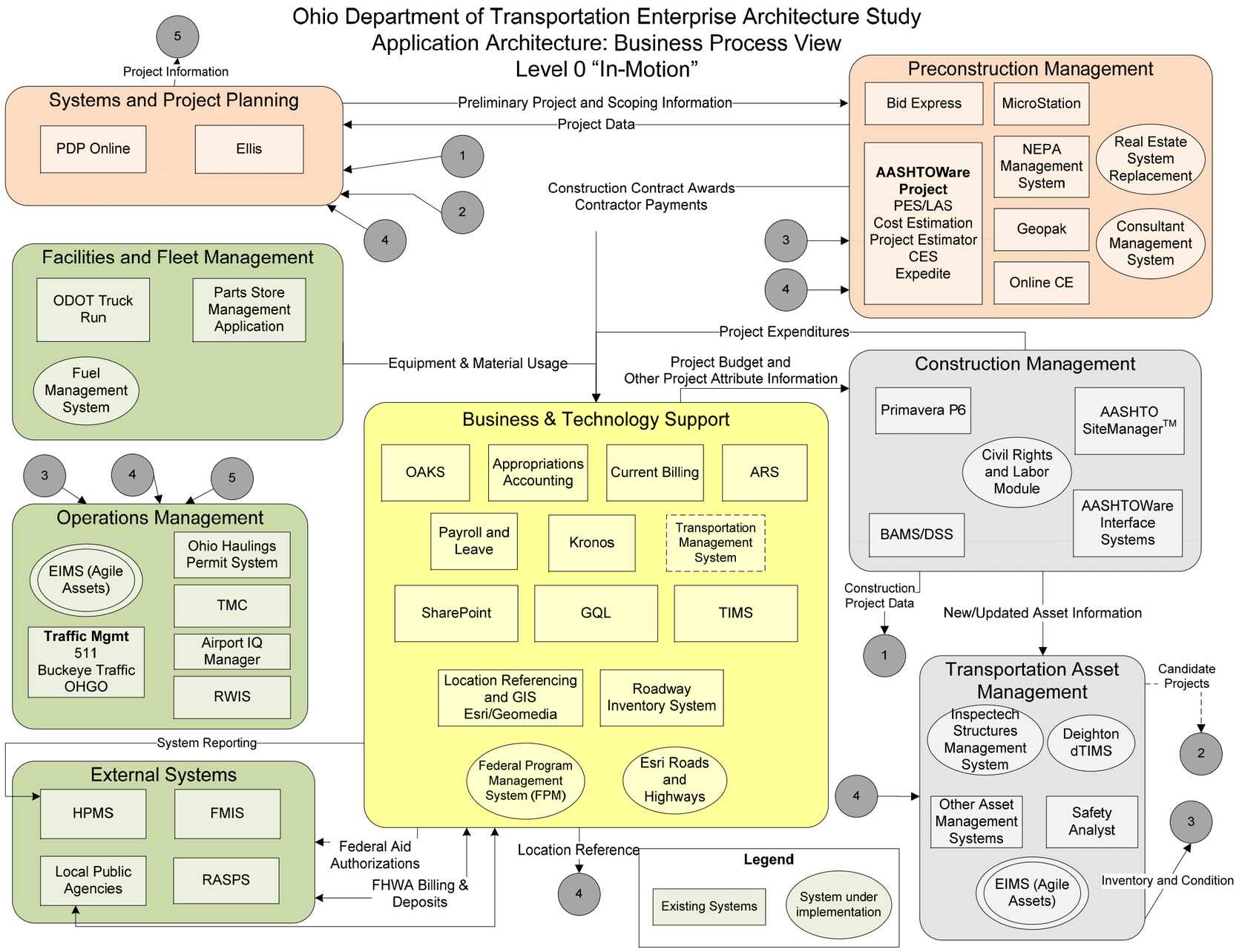


**Figure 11: ODOT Systems and Owners**

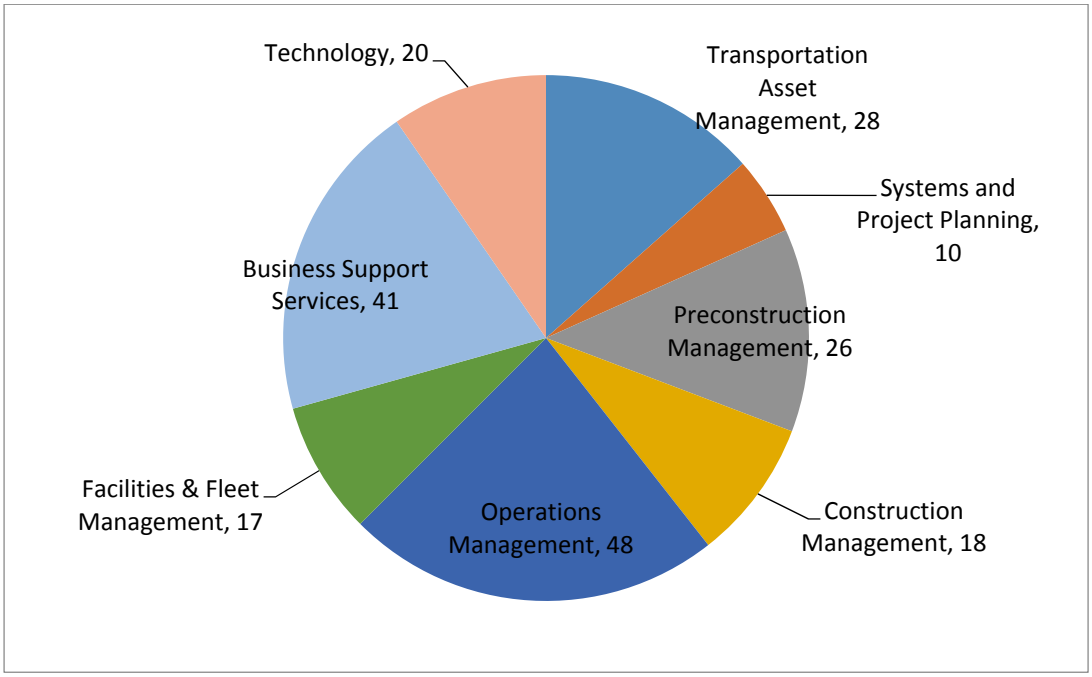
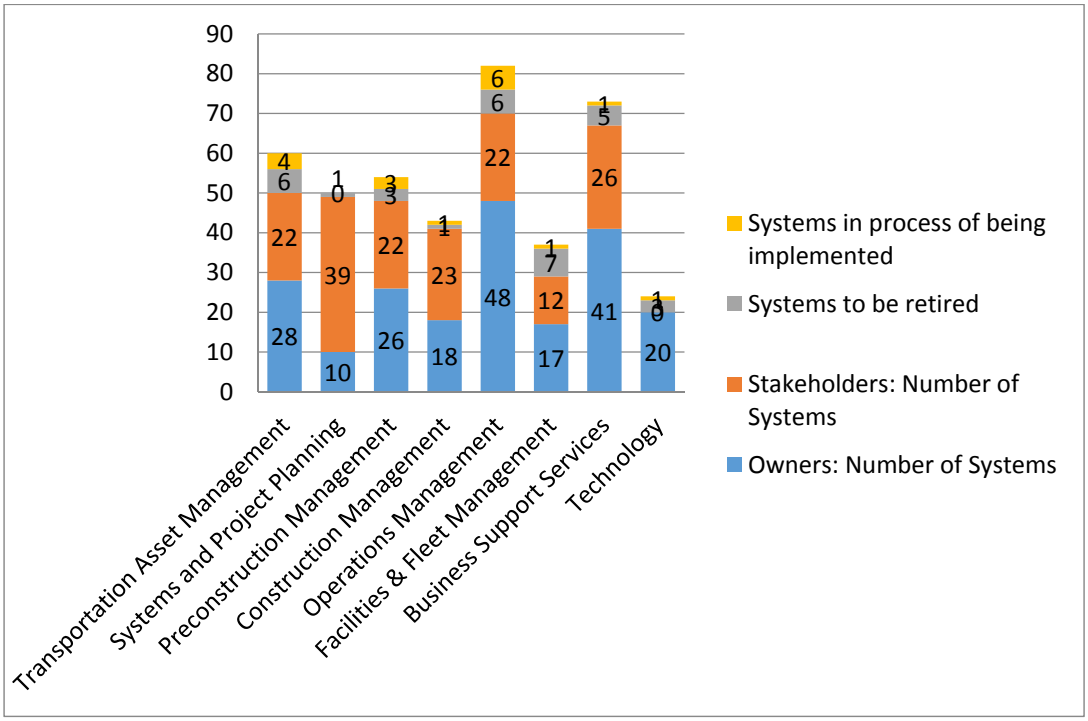



**Figure 12: Summary of Systems by Business Area**



The "top 10" systems, i.e., the systems (including both new and planned systems) the most functional areas use are highlighted in Table 9 below.

**Table 9: Top Ten ODOT Systems in Terms of Use Across Business Functions**

| Application | Nickname | # of Functional Areas Using System |
|---|---|---|
| **Ellis** | Ellis | 6 |
| **Bridge Management System** | BMS | 5 |
| **EIMS/AgileAssets** | EIMS | 5 |
| **InspectTech Structures Management System** | SMS | 5 |
| **Appropriations Accounting** | AA | 4 |
| **Base Highway Transportation Referencing System** | BTRS | 4 |
| **Deighton dTIMS** | dTIMS | 4 |
| **Roadway Inventory Management System** | RIS | 4 |
| **Transportation Information Mapping System** | TIMS | 4 |
| **Transportation Management System** | TMS | 4 |

**Interview Findings – Applications Architecture**

In terms of applications architecture, the following were the common themes in the research teams' stakeholder interviews, which were confirmed through discussions in the various validation sessions:

- It was recognized that ODOT is deploying a number of industry leading products but in some cases these projects are focused on addressing specific business functions and not considering the enterprise perspective;
- There was a stated need to ensure that the business requirements and needs should come before systems are deployed;
- In deploying commercial off-the-shelf products, several people expressed their concerns that they are being overly customized which could hamper software upgrades;

- Several people questioned the lack of integration efforts in deploying some recent technology ODOT-wide such as Kronos, AgileAssets, and Deighton; and
- There was some concern expressed that the fairly recent distribution of the ODOT technology budget to the business areas has exacerbated the problem of silo systems that serve individual business areas.

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## C. Data Architecture

This sub-section includes an overview of ODOT's As-Is data architecture. It also includes a summary of the stakeholder interview findings related to data architecture.

The data architecture component is one of the components of the information systems architecture layer within an enterprise architecture. It describes the data standards for all of ODOT'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.

The As-Is data architecture at ODOT revolves around a data warehouse and several database platforms. The Sybase IQ data warehouse is known generally to end-users as GQL since data is accessed using a reporting tool known as Graphical Query Language (GQL), by Hummingbird.

### Sybase IQ Data Warehouse

The DoIT Database group maintains a Sybase IQ data warehouse primarily used to generate pre-defined, on-demand, and ad hoc reports using GQL. As depicted in the ODOT As-Is applications architecture schematics in Figure 7, the Sybase IQ data warehouse extracts data from most of the major transaction systems and thus it provides a substantial base of information for reporting purposes.

The Database group modifies existing warehouse models and creates new models for new reports as required. Each model has one owner who is responsible for addressing user queries and clarifications.

The Sybase IQ data warehouse database is separate from the transactional database, and is not used to process real-time business transactions. The data warehouse is based on Sybase IQ 12.7, and currently grows at a rate of 5-7 GB per year as new data is added to the warehouse.

The Sybase IQ data warehouse consists of one physical database. Multiple models (or database views) have been defined to provide users with access to tables and columns needed for their reporting requirements. Currently, there are 41 models within the data warehouse with well-defined owners. These model owners are the first points of contact if users have any model/view-related questions or requests.

There are approximately 100 business applications that feed data into the Sybase IQ data warehouse database. These business applications use various databases including Sybase ASE, Oracle, SQL Server, Supra 1 and Supra 2 (mainframe databases), as well as some Microsoft Access databases. The warehouse database data is refreshed on a nightly basis. Approximately 600 programs/scripts are executed to refresh the Sybase IQ data warehouse database. Extract, transform, and load (ETL) programs are used to load data from the Supra 1 and Supra 2 databases while DataStage with data transformation is used to get data from the Sybase, Oracle, and SQL Server databases.

As noted above, ODOT implemented Hummingbird's GQL for its reporting requirements. OpenText acquired Hummingbird in late 2006 and GQL was rebranded as BI-Query.

GQL connects to the Sybase data warehouse database to generate reports. Users use GQL's visual user interface to select tables and columns they want to include in the report. GQL generates the SQL statement and executes it to generate reports based on user selections and how they want to report selected columns.

Users can define and generate new reports using the pre-defined models they are authorized to use. These models are logical views that the data warehouse team defines in the data warehouse database.

If additional information is required for reports that exist in the Sybase warehouse database, the warehouse support team defines a new Sybase model or modifies an existing Sybase model to include additional tables and/or columns.

If additional information does not exist in the warehouse database, the support team:

- Modifies the ETL routines to get the additional information from the source database(s);
- Modifies the data warehouse database schema to add additional tables and/or columns;
- Runs ETL programs to refresh the Sybase IQ data warehouse database; and
- Defines a new model and provides the user with access to this model.

All the reports are defined and generated by the end users. Users need to install a GQL client on their desktop to define and execute GQL reports. There is no Web version of GQL, which creates a user limitation. That is, internal users without GQL installed on their desktops and external users cannot access the data. The current GQL reporting environment supports approximately 26 concurrent users. Users have not reported any performance issues. However, growth of the data warehouse database (5-7 GB per year) might impact its performance in coming years.

### Oracle Geospatial Database & Consolidated Oracle Database

One of ODOT's most significant databases is an Oracle Geospatial database that houses its linear referencing data on a geospatial platform. Both internal and external users can access this geospatial data along with transportation system and project information through ODOT's Transportation Information Mapping System (TIMS) application. TIMS uses a consolidated Oracle database that pulls data from the Oracle geospatial database and several other ODOT databases. TIMS allows users to view data graphically (on a map).

The consolidated Oracle database includes data from about 35 datasets from 11 different data owners (which includes various Ohio agencies). The update cycles for the different datasets

vary from weekly to annually. Examples of the types of data included in the data warehouse are:

- Active projects;
- Roadway inventory;
- Transportation asset management information including pavement condition, bridges, culverts, outfalls, airports, and railroads;
- Safety information including various crash data attributes such as weather, time of day, light conditions, etc.; and
- Traffic counts including average annual daily traffic (AADT) and other traffic attributes.

The Office of Technical Services is currently planning additional enhancements to the Oracle Geospatial database, the consolidated Oracle database, and the TIMS application. In addition, it is anticipated that other applications (for example, the OH-1 Crash Reporting application) will utilize data within the Oracle databases.

**Interview Findings – Data Architecture**

In terms of data architecture, the following were the common themes in the stakeholder interviews, which were confirmed through discussions in the various validation sessions:

- Almost universally interviewees mentioned significant limitations in the sharing of data between applications. As one person put it, ODOT is, "data rich, information poor." The ability to retrieve data and resulting information is very difficult with ODOT's disparate systems; and
- Several users identified the Sybase IQ data warehouse and the GQL reporting engine as a workhorse tool that provides frequent users with a relatively user-friendly and highly flexible reporting tool; however its limitations as an analysis tool was acknowledged. While GQL efficiently allows users to quickly define and generate reports, it does not provide any data analytics or business intelligence (BI) capabilities.

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## D. Technical Architecture

This sub-section includes an overview of ODOT's As-Is technical architecture. The technical architecture layer of an enterprise architecture describes the organization's technical infrastructure. It also includes software technologies that are shared services and not application specific and other specific hardware and operating system-level software technologies required to support the various business applications.

The remainder of this sub-section provides a brief overview of a subset of the components of the ODOT As-Is technical architecture including:

- Mainframe;
- Servers;
- Storage;
- Network operations and telecommunications;
- Enterprise desktop;
- Service desk; and
- Shared or enterprise application software.

It then provides a summary of the interview findings related to the technical architecture.

**Mainframe**

ODOT currently has two IBM Z800 mainframes with storage environments. The production data center is located at the State of Ohio Computing Center (SOCC) and the disaster recovery site is at the ODOT Central Office. Full system backups are performed daily at 9:00 p.m. and restored to the ODOT Central Office location providing for a full recovery from 9:00 p.m. the previous night in the event of a disaster situation.

A number of the systems which run on the mainframe are in the process of being decommissioned including:

- Construction Management System (CMS);
- Bridge Management System (BMS);
- Equipment Management System (EMS); and
- Time Management System (TMS).

However**,** Appropriation Accounting and the Current Billing System need to continue running on the mainframe until the new ODOT financial management system/enterprise resource planning system is implemented. In addition, there are several other applications beyond the financial applications which also still execute on the mainframe.

ODOT's two mainframes will reach an end-of-life status in December 2014. DoIT identified several alternatives for addressing this situation including:

- Migrating to a different mainframe (anticipated to be financially infeasible as the re-licensing cost is estimated to be several million dollars);
- Transitioning to a mainframe environment managed by DAS;
- Utilizing third-party support as an interim solution; and
- Potentially re-hosting the remaining applications on different platforms.

**Servers**

The Unix (AIX) server infrastructure at ODOT hosts several enterprise databases including Oracle, Sybase, and Sybase IQ as well as applications such as Ontime, Ellis, and SiteManager™.

DoIT maintains over 400 Windows servers on physical and virtual hardware platforms. The applications hosted include Buckeye Traffic, SharePoint Portals, SQL servers, web applications such as OHPass for issuing hauling permits, and the Roadway Inventory System (RWIS) used for roadway condition monitoring. Over the past three years, DoIT consolidated Windows servers with VMware virtualization software. This enabled ODOT to attain over 80% virtualization of Windows and Linux servers across ODOT.

As a result of the State's IT Optimization initiative, ODOT, at some point in the future, will no longer be able to purchase its own servers but instead be expected to utilize DAS Office of Information Technology (DAS OIT) computer infrastructure. As the DAS OIT cost for these services become more competitive with ODOT's internal cost, this could present significant cost savings opportunities for ODOT as these items become more of a commodity. In addition, as ODOT technology staff transition to DAS OIT as part of this effort, it will become more and more important for ODOT to rely upon the DAS OIT for infrastructure services. DAS OIT will offer Windows virtualization, AIX virtualization, and mainframe computing services.

**Storage**

DoIT manages a total of 525 TB of enterprise storage. ODOT experienced exponential growth in electronic storage requirements over the past 5 years, with an increase in storage requirements of more than 5,500%. To manage effectively the cost of storage, DoIT implemented a tiered storage approach:

- Tier 1 – High speed\availability\reliability which has the highest cost;
- Tier 2 – Network attached storage (NAS) for large file stores which has a lower cost; and
- Tier 3 – Backup\archiving which has the lowest cost.

Using a tiered storage approach and applying Information Life Cycle Management (ILM) principles, DoIT attempted to optimize the trade-off between storage cost and access requirements:

- DoIT stores the most accessed and the most critical application data on the Tier 1 storage array;
- Tier 1 storage provided 100% uptime since installation over 3 years ago;
- Large file shares and historical information is stored on less expensive NAS arrays; and
- Information not accessed in a specific amount of time or meeting some other criteria are automatically moved to a lower tier of archival storage, thus reducing the cost of storing these data.

This storage architecture strategy allows for scalability for future storage requirements. It also provides for the recovery of all information at ODOT's Central Office in the case of a total loss of the SOCC data center.

ODOT also built a virtual storage network (VSAN) between DAS OIT and ODOT. This VSAN allows ODOT to leverage storage as a commodity, rather than deploying its own storage devices. Currently, ODOT utilizes some Tier 1 storage from DAS OIT and ODOT is planning to deploy the remaining Tier 1 applications to DAS OIT's Tier 2 storage devices.

**Network Operations and Telecommunications**

This sub-section briefly describes highlights of ODOT's As-Is network operations and telecommunications environments. It includes a brief discussion of ODOT's network operations; its Voice over Internet Protocol (VoIP) initiatives; its Internet Redundancy initiative, and implementation of ODOT's Freeway Management System projects.

**Network Operations**

ODOT's wide-area network (WAN) consists of:

- Connectivity to and between various sites in the Columbus area including the SOCC, ODOT Central Office, and 1600 West Broad and Aviation (Don Scott Field);
- Connectivity to and between the 12 district headquarters and over 120 county and outpost locations;
- Over 200 broadband connected project sites and outposts;
- Freeway Management Systems in Cincinnati, Columbus, Dayton, Akron, Toledo, and Cleveland; and
- Management of over 1,000 network devices installed across the state.

Figure 13 provides a visual depiction of the ODOT network.

**Figure 13: ODOT Conceptual Network Diagram**


## Voice-over-Internet Protocol (VoIP)

ODOT utilizes VoIP for telephony which is managed by ODOT internally. The management of VoIP was recently consolidated to provide for centralized management. Prior to consolidation, each district, Central Office, and the SOCC had their own Call Manager (VoIP) server cluster and voicemail server. This was consolidated to one centralized redundant cluster at the SOCC and ODOT Central Office reducing the infrastructure from some 45 servers to 5 servers. As part of this project, District 11 developed a Call Manager administration application allowing each district to only see and manage their own users and devices. DoIT estimates that developing this application internally instead of purchasing Cisco's module for this purpose saved the agency approximately $60,000. In total, DoIT estimates the consolidation effort saved ODOT over $75,000 annually, along with significant savings in power and a reduction in the labor effort to administer and manage what once was 15 separate VoIP clusters.

Because ODOT staff have over more than ten years of experience in designing, installing, and maintaining VoIP telephone services, ODOT leveraged this expertise to offer a hosted VoIP shared service to other, smaller state agencies that may not be able to manage an in-house infrastructure of their own. ODOT's first customer was the Ohio Department of Insurance (DOI), with over 300 phones currently in use.

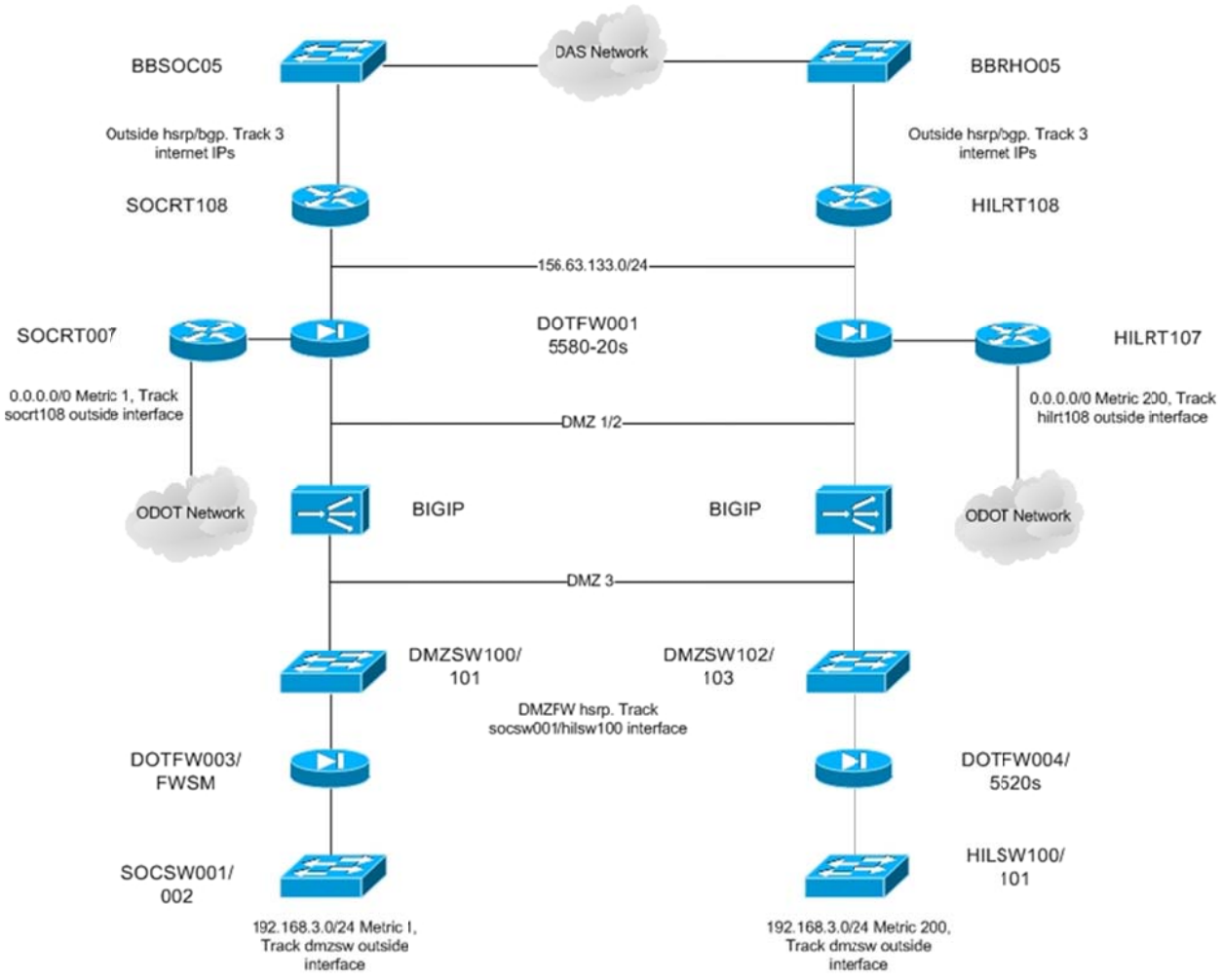
## Internet Redundancy

As a result of a significant winter storm in March 2008, which overloaded ODOT's Buckeye Traffic website, Internet redundancy was implemented resulting in:

- Two fully redundant paths into and out of ODOT to the Internet;
- An infrastructure capable of passing 600Mbps of traffic from the firewalls through the demilitarized zone (DMZ) to the backend web servers; and
- The ability to deliver web applications requiring high performance such as Buckeye Traffic, even if one of the two paths to the Internet is completely down.

Figure 14 depicts ODOT's current Internet connectivity strategy.

**Figure 14: ODOT Internet Connectivity/Redundancy Strategy**




## Freeway Management System Implementations

Currently ODOT has two fully operational freeway management systems (FMS), one in Columbus and one in Cincinnati. The Cleveland\Akron FMS is currently under construction and will have 192 network connected sites with cameras, dynamic message signs (DMS), vehicle detectors, and highway advisory radios. Construction is also underway on the Dayton and

Toledo freeway management systems, with each of these systems adding another 60-80 network connected sites.

**Enterprise Desktop**

Enterprise desktop consists of the administration, security, maintenance, and life-cycle management of more than 5,000 end points across ODOT. These end points include workstations, laptops, thin clients, tablets, handheld devices, mobile devices, and virtual desktops. The enterprise desktop team within DAS OIT also administers and maintains the systems used to manage desktop and laptop computers across the state. These systems provide software and hardware inventory data, enforce ODOT security requirements, configure client settings, and facilitate troubleshooting. These applications include:

- Configuration Manager 2012;
- AirWatch;
- VMware View;
- Microsoft Application Virtualization Servers;
- Group Policy;
- McAfee ePolicy Orchestrator;
- Windows Server Update Services; and
- HP Zero Client provisioning.

**Service Desk**

The DAS OIT Service Desk is the primary vehicle by which ODOT computer users can make day-to-day requests to DoIT. The Service Desk handles requests ranging from information technology account creation, password resets, and access updates to termination for internal and external clients.

Until 2010, the ODOT Central Office and most ODOT districts had their own IT service desks. At that time, DAS OIT consolidated the IT Help Desk operations statewide and established one single phone number to call regardless of a user's location. This number can be responded to by any district or Central Office service desk staff member and ODOT IT staffs from across the state were granted the appropriate security access to help users from outside their location with most common requests. This resulted in a significantly faster response time for users across ODOT. In addition, a customer survey program was implemented to survey ODOT users following the completion of a service desk ticket in order to monitor help-desk performance and address any areas for improvement.

**Enterprise or Shared Application Software Solutions**

There are currently limited shared or enterprise application software solutions across ODOT. The two best examples are:

- The ODOT GIS environment, which is managed by the Office of Technical Services, is available to various users across ODOT. In the research team's stakeholder interviews and validation sessions, however, stakeholders identified there still is a need to further integrate the use of GIS into more of ODOT's future application development initiatives. And, from interviews conducted by the research team in the districts, it is clear that some GIS application development activities are taking place at the district level. It is unclear to the research team that all of these district GIS initiatives are being effectively shared or leveraged ODOT-wide; and
- Microsoft SharePoint which is utilized by a number of offices as a collaboration and document repository tool.

Document management was one area identified, during the interviews and validation sessions, as lacking an enterprise application solution. There are currently several ODOT application systems that incorporate document management capabilities and at least two systems planned to integrate document management capabilities, which are in the requirements or design stage.

**Interview Findings – Technical architecture**

In terms of technical architecture, the following were the common themes in the research team's stakeholder interviews, which were confirmed through discussions in the various validation sessions:

- There was significant concern expressed about both the unknowns and the potential impacts associated with the DAS IT Optimization initiative on ODOT's technical architecture;
- It was pointed out that ODOT has been a historical leader in terms of adopting/deploying technical infrastructure within Ohio state government and the transportation community (an example being VoIP), and therefore ODOT is well-positioned for the deployment of technology recommendations;
- There were mixed opinions in terms of the compatibilities between districts and of the age and condition of the technical infrastructure; and

  There was some concern expressed about network performance to more remote locations, especially regarding the use of the TIMS GIS data warehouse applications and other applications that move large volumes of data from the server to the desktop.

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## E. Information Technology Organization and Governance

This sub-section describes ODOT's current information technology organization structure and information technology governance practices. It includes a brief discussion of the State information technology governance and planning processes managed by DAS. It also includes a brief summary of interviewing findings specific to information technology organization and governance.

**ODOT Information Technology Organization and Governance**

Technology management is a distributed function in ODOT that includes the Division of Information Technology, District IT offices, and several ODOT business areas.

The Division of Information Technology (DoIT) – DoIT is part of the Business and Human Resources Directorate. A Deputy Director leads several IT business areas responsible for applications development, applications support, and management of ODOT's information technology infrastructure.

The Office of Software Production is responsible for building and maintaining enterprise software applications for ODOT, and works closely with the business owners to ensure systems are developed or modified to support their needs. The office is also responsible for recommending and implementing software development standards and best practices. The office consists of three groups: Client/Server Development, Collaboration and Identity Management, and Mainframe Development.

The Database Group is responsible for the integrity, security, and maintenance of the ODOT databases as well as the development and maintenance of the data mining tools and models used in support of ODOT's business needs.

The Infrastructure Management Office is responsible for the creation and support of the ODOT data network, telecommunications, desktops, and servers that make up the ODOT environment.

The Project Management Group works with the other DoIT offices and ODOT districts and divisions to delivery successfully ODOT information technology projects within approved project scopes and stated project estimates and expectations.

The Resource Management Office is responsible for the procurement of IT services, hardware, and software for ODOT. The Resource Management Office also manages software licensing agreements and renewals.

DoIT is staffed by 75 ODOT employees and 30 consultant employees. DoIT has an annual budget of approximately $33 million. The overall technology budget of ODOT is approximately $43 million.

DoIT does not have a Client Services Office but supports the needs of its clients through the Project Management Group, IT Service Desk, and individual support by IT staff members knowledgeable in the systems and services provided by DoIT.

Two statewide initiatives being implemented by DAS, discussed in more detail below, will significantly impact DoIT. The State of Ohio Computing Center (SOCC) Remediation Project is intended to migrate all hardware from agencies into a single environment. The IT Optimization Project will centralize and manage IT services that could be considered enterprise and serve multiple agencies.

District IT Offices – Each ODOT district has an IT office that is part of the Business and Human Resources Office and is typically staffed by three to four ODOT staff members. The IT office provides support services for computer hardware, software, telecommunications, and IT training, including CADD, for District employees. In some districts, the IT office supports the data network and does some application development.

Based on the interviews and validation sessions, the range of staff capabilities varies somewhat between districts. Some districts have done more application development, whereas some districts are principally focused only on desktop and server support.

ODOT Business Areas – Several ODOT divisions have developed technology expertise and responsibility including Planning, Engineering, Traffic Engineering, and Construction Management. In the Planning Division, the Systems Planning and Programming, Estimating, Statewide Planning and Research, and Technical Services offices led or partnered in technology development and deployment initiatives as have the offices of CADD & Mapping Services, Consultant Services, Pavement Engineering, Real Estate, and Structural Engineering in the Engineering Division. Likewise, the Traffic Engineering Division within the Operations directorate has the responsibility for planning, designing, maintaining, and operating the intelligent transportation systems infrastructure and traffic management center. Additionally, the Construction Administration Office led or partnered in technology development and deployment initiatives. In many cases the business areas partnered with DoIT to obtain project management and/or business analyst services for implementation projects. However, in several cases the business area acted independently and deployed the technology themselves.

In addition to the distribution of technology leadership responsibilities, budgets for technology have been distributed from the IT office to the divisions and districts. It appears that the distributed budget may have contributed, to some extent, to an increase in independent technology deployment by the business units.

One consequence of the distributed technology management model in ODOT is the creation of a number of technology silos. Several systems have been deployed that function as standalone systems or have limited data sharing between other systems. In some cases ODOT has or is in the process of deploying what many believe to be “best-of-breed” products but they have been deployed with limited functionality since they were not deployed as enterprise solutions.

Another consequence of the distributed technology management model is the lack of consistency between ODOT divisions and districts in technology deployment. While technology standards and policies are issued, offices may act independently of those policies and standards.

There is currently no technology governance model at ODOT to guide the strategic deployment of technology and regulate and enforce IT standards and policies. An effort was initiated in 2011 to establish an Information Technology Governance Board but the creation of the board was not implemented. A review of the draft charter of the board indicates that the purpose of the board was to select and prioritize the development projects of the IT office and not guide the overall strategic deployment of technology.

**DAS Office of Information Technology**

The DAS Office of Information Technology (DAS OIT) is responsible for establishing information technology policies and standards statewide; overseeing technology life-cycle investment planning for state agencies; and managing privacy and security processes and procedures. It also delivers various statewide information technology and telecommunication services to state government agencies. DAS OIT is divided into the following areas:

- Investment and Governance – supports state agencies in the implementation of ODOT-specific technology programs through the development and maintenance of IT policies, standards, and procedures. This section is also responsible for the statewide information technology investment planning process and recently deployed a new software application for use by agencies in submitting their annual information technology plans. The research team evaluated how best to link a new ODOT information technology governance process with this enhanced statewide IT investment planning process. In addition, Investment and Governance provides contract management, research, and project support services to state agencies;
- Infrastructure Services – manages the information technology infrastructure which is available to state agencies on a shared services basis. This includes mainframe and various UNIX and Windows/Open platforms. It also includes various enterprise shared services. Examples of these shared services include an electronic data interchange (EDI) gateway utilized by ODOT, email servers utilized by ODOT, collaboration tools, and the statewide GIS program which coordinates with the GIS group in ODOT's Office of Technical Services. This section also manages and maintains the Multi-Agency Radio Communications System (MARCS) which is utilized by ODOT, as well as the State Highway Patrol, the Department of Natural Resources and the Ohio Emergency Management Agency among others. The Unified Network Services (UNS) function is a provider of voice and data solutions to state and local governments, functions as the state's Internet service provider, and administers statewide telecommunications contracts. Currently, ODOT manages its own networks and its own VoIP services for telephony;

- Digital Government – coordinates the electronic delivery of government information and services. It manages the Ohio Portal which provides the public with access to state information and services via the Internet including Ohio.gov and the Ohio Business Gateway, which is a multi-agency reporting and payment application for businesses operating in Ohio;
- Ohio Administrative Knowledge System (OAKS) – is the State's enterprise resource planning software application based on the Oracle PeopleSoft platform. It includes human resources, payroll, time and leave, procurement, budgeting, accounting, and asset management functionality. ODOT utilizes OAKS for human resources and payroll functionality. The OAKS PeopleSoft Human Capital Management solution is the human resources system of record for ODOT. ODOT's Kronos time and leave solution interfaces with PeopleSoft Time and Leave which then passes ODOT employee time through to PeopleSoft payroll;

  ODOT did not implement the other available OAKS accounting, budgeting, finance, and procurement functionalities. Because ODOT was not in the initial OAKS implementation scope for financials and procurement, there are a number of key gaps in the OAKS solution that would need to be implemented to support ODOT's operations. These include project management, grants management, contract management, and FHWA billing among others;
- The Office of Information Security and Privacy – plans, implements, and manages statewide information assurance, security, privacy, and risk management initiatives;
- DAS Information Technology Services (ITS) – provides information technology support for DAS internal operations; and
- DAS OIT Shared Solution Office – partners with the Health and Human Services (HHS) Cabinet and the Governor's Office of Health Transformation to assist with the streamlining of various Health and Human Services business functions. Using a shared information technology platform and a set of repeatable application components being deployed through a service-oriented architecture (SOA), the IT Shared Solutions Office is working with business stakeholders to implement integrated consumer access; robust self-service for determination of eligibility and application across the State's HHS programs; and enterprise data integration. It is anticipated that some of the strategies being employed by the DAS OIT Shared Solutions Office may be replicable in terms of implementing shared service business and technology models at ODOT or in implementing other statewide initiatives which could be leveraged by ODOT.

As noted in the discussion of DoIT above, DAS OIT is also currently leading the implementation of two statewide information technology initiatives: IT Optimization and the SOCC Remediation.[6] The SOCC Remediation involves a number of power, computing, and operational

[6] Ohio Department of Administrative Services, "Overview presentation of IT Optimization," May 2013

improvements at the SOCC. The end result of the SOCC Remediation will be a consolidated computing center on the second floor with the required power, cooling, and security capabilities. The SOCC upgrade will result in some ODOT staff currently housed at the SOCC being relocated as only State information technology staff, with the need to have physical access to information technology infrastructure devices, will remain at the SOCC.

The DAS IT Optimization initiative is a significant transformation of how information technology is delivered for the State of Ohio and will likely result in some technology functions currently performed by ODOT (especially infrastructure management and other technical architecture functions) being transitioned to DAS. As a result, the IT Optimization initiative will significantly impact ODOT's technology management strategies and the recommendations for the ODOT To-Be enterprise architecture.

The goal of the DAS IT Optimization initiative is to improve the effectiveness of the services that the State delivers to its citizens and businesses, while at the same time increasing efficiencies and decreasing redundancy and duplication. These goals are very similar to the underlying objectives of ODOT's enterprise architecture initiative. Key objectives of IT optimization include:

- Achieve resource savings through economies of scale and the elimination of duplicative activities;
- Improve the IT business decision-making process;
- Leverage savings to innovate, modernize, and continually upgrade through the reinvestment of funds;
- Provide enhanced solutions delivery;
- Improve security of the State's mission critical systems and constituent information;
- Standardize technology use, procurement, and contracting; and
- Effectively leverage the State's information technology staff, while reducing consultant spend.

The State's IT Transformation strategy will focus on simplifying the State's technology infrastructure to reduce cost and provide a foundation for common enterprise applications and solutions. It is also designed to expand the use of enterprise applications which should help to facilitate better data integration within and between agencies.

The IT Optimization initiative is currently focused on nine functional areas including:

- Network operations;
- Data center operations;
- Enterprise applications;
- Enterprise planning, sourcing, and vendor management;

- Unified communications and infrastructure applications;
- Security;
- Financial management and cost recovery;
- Business relationship management; and
- Workforce transition.

The IT Optimization initiative is projected to generate $150 million in annual savings statewide by:

- Increasing efficiency through:
  - Leveraging the economies of scale and eliminating duplicative activities,
  - Improving the IT business decision-making process,
  - Improving the security of mission critical systems and constituent information,
  - Using information technology professionals more effectively, and
  - Aligning enterprise applications better with business goals; and
- Improving the delivery of information technology services by:
  - Leveraging savings to allow for more innovation, modernization, and system upgrades, and
  - Providing for enhanced solutions delivery by both internal and external staff; and
- Reducing the complexity of the information technology environment by standardizing technology use, procurement, and contracting; and
- Realizing real cost savings by:
  - Reducing consultant spend, and
  - Leveraging economies of scale and eliminating redundant processes.

Because of the close alignment of the IT Optimization initiative and the ODOT Enterprise Architecture project, the research team obtained additional input from DAS OIT during the development and refinement of the recommendations, especially in the areas of applications architecture (potential utilization of an enhanced OAKS application for ODOT) and technical architecture.

### Interview Findings – Information Technology Organization and Governance

In terms of information technology organization and governance, the following were the common themes in our stakeholder interviews, which were confirmed through discussions in the various validation sessions:

- There was considerable concern expressed about the lack of a structured IT investment decision-making process; however, at the same time, there were also concerns raised that ODOT must be careful not to create an IT investment process which is so structured so as to reduce ODOT's flexibility to quickly react to changing business needs;
- Multiple centers of technology leadership were clearly identified through the interviews which could continue to create technology silos;
- The need for improved coordination between IT and business units was stated several times;
- Several people identified knowledge management as a critical issue since legacy systems are still providing fundamental functions for ODOT and the staff capable of maintaining those systems are eligible or becoming eligible to retire. Coupled with the increased use of outside consultants due to IT staff reductions there is concern that there will be very little ODOT staff knowledge of the technology systems in use and the interrelationships between those systems; and
- There was concern expressed about the district information technology staff's responsibilities and talents, and how to best utilize that staff statewide considering the role changes that could be mandated with the statewide IT Optimization project.

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## F. Overview of Best Practices

The research team conducted one half-day workshop for key ODOT stakeholders to educate them on the best practices in developing and implementing an enterprise architecture. In addition, the research team conducted three workshops with key ODOT stakeholders to share basic principles, state of the practice, and recent implementation experience and lessons learned in three specific ODOT business areas which are expected to be integral in the development of the To-Be enterprise architecture design: transportation asset management, project systems management, and financial management/enterprise resource planning. The sessions were conducted from an ODOT-wide enterprise perspective. In each of the workshops the attendees were engaged in discussions on their experiences and brainstormed various technology, implementation, and environmental issues. The sub-sections below briefly summarize each of the four workshops.

**Enterprise Architecture Best Practices**

The purpose of the Enterprise Architecture Best Practices session was to introduce ODOT staff to enterprise architecture concepts and provide an overview of what other state departments of transportation and other public sector organizations are doing in terms of developing strategic enterprise architecture designs. In addition, a facilitated group discussion was conducted on opportunities and challenges that ODOT will need to address in implementing an enterprise architecture.

The definition of enterprise architecture and the components of enterprise architecture as presented in this report were introduced, including information technology governance as an enabling strategy for enterprise architecture and a brief history of the development of enterprise architecture was presented. Examples of other enterprise architecture projects at state departments of transportation (Kansas, Texas, and Washington), in the Federal Government, and at the State of Michigan were utilized to help explain the various components of an enterprise architecture.

Figure 15 illustrates a business architecture deliverable from the State of Michigan's enterprise architecture project.[7] In this example, the State of Michigan mapped business drivers within its Public Service Architecture to specific application systems and technical architecture initiatives. Please note that the State of Michigan utilized the nomenclature Public Services Architecture for the business architecture layer since the State of Michigan team saw their state's mission as being that of providing services to the public as opposed to the more traditional definition of a business.

[7] Appendix H, "State of Michigan Enterprise Architecture Plan," 2007, available at www.michigan.gov/documents/dit/2007_EA_Strategic_Approach_206296_7.pdf

**Figure 15: Business Architecture Deliverable from the State of Michigan's Enterprise Architecture Project**

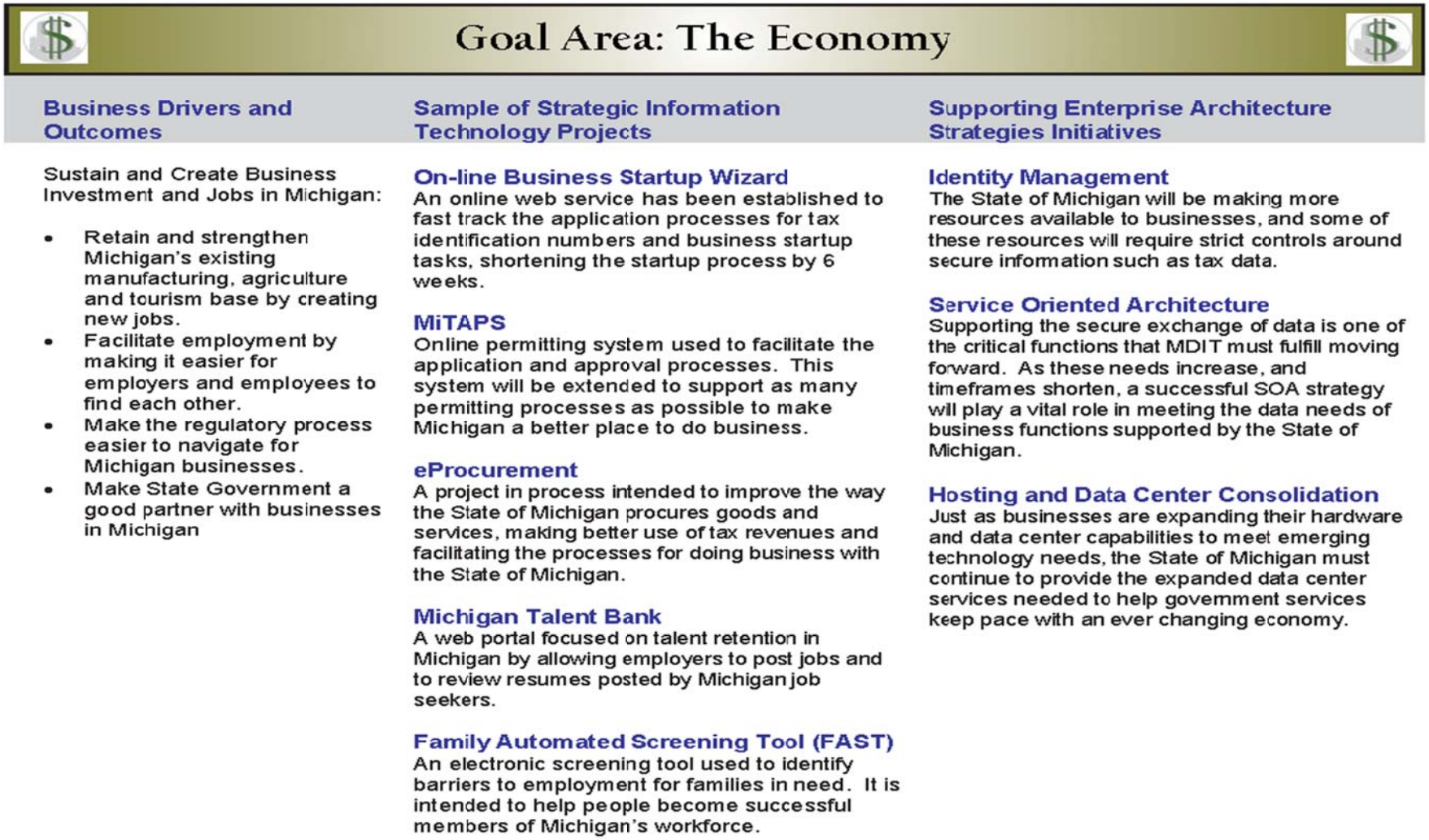


Figure 16 through Figure 19 illustrate several examples of information systems architecture work products from work completed 2003-2005 at the Kansas Department of Transportation (KDOT).[8] Figure 16 depicts KDOT's overall architecture, while Figure 17 shows the types of work products produced during their enterprise architecture design. Figure 18 shows KDOT's high-level data model and Figure 19 depicts KDOT's data integration with partners.

[8] All KDOT diagrams are from the presentation "Enterprise Architecture at The State of Kansas and the Kansas Department of Transportation" by Bill Rothman, January 2005

Figure 16: KDOT's Overall Architecture

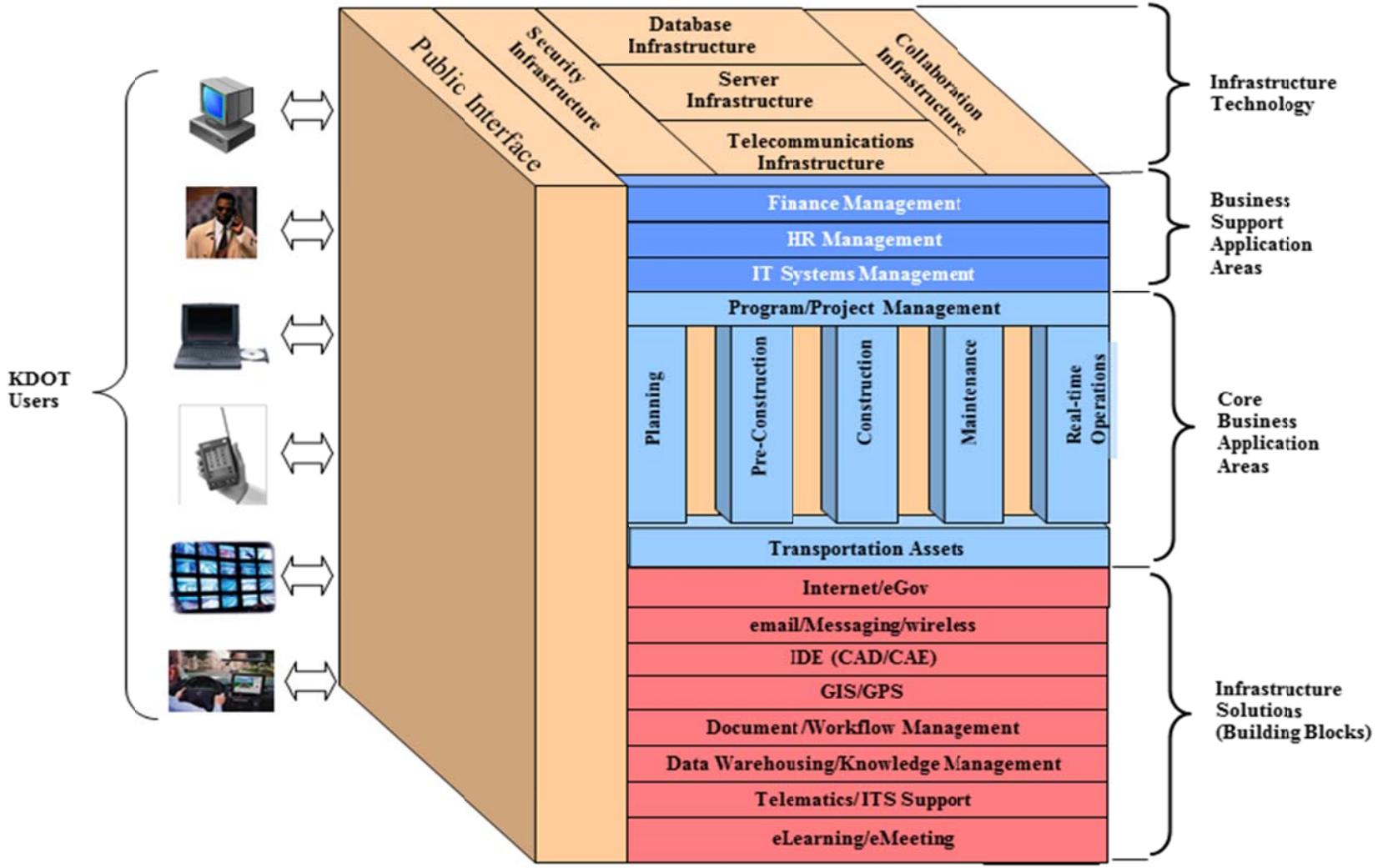


**Figure 17: Types of Work Products Produced During KDOT's Enterprise Architecture Design**

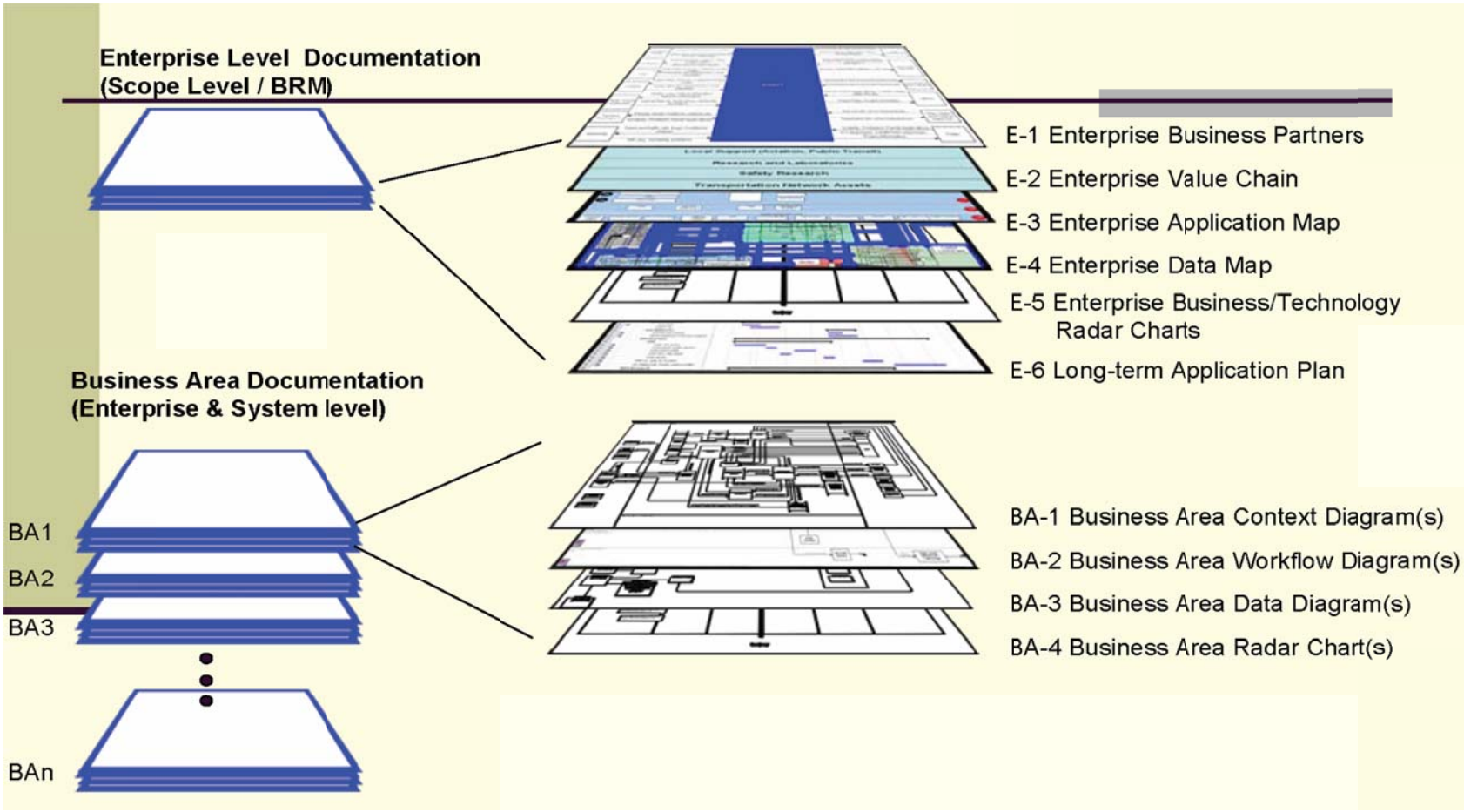


**Figure 18: KDOT's High-Level Data Model**

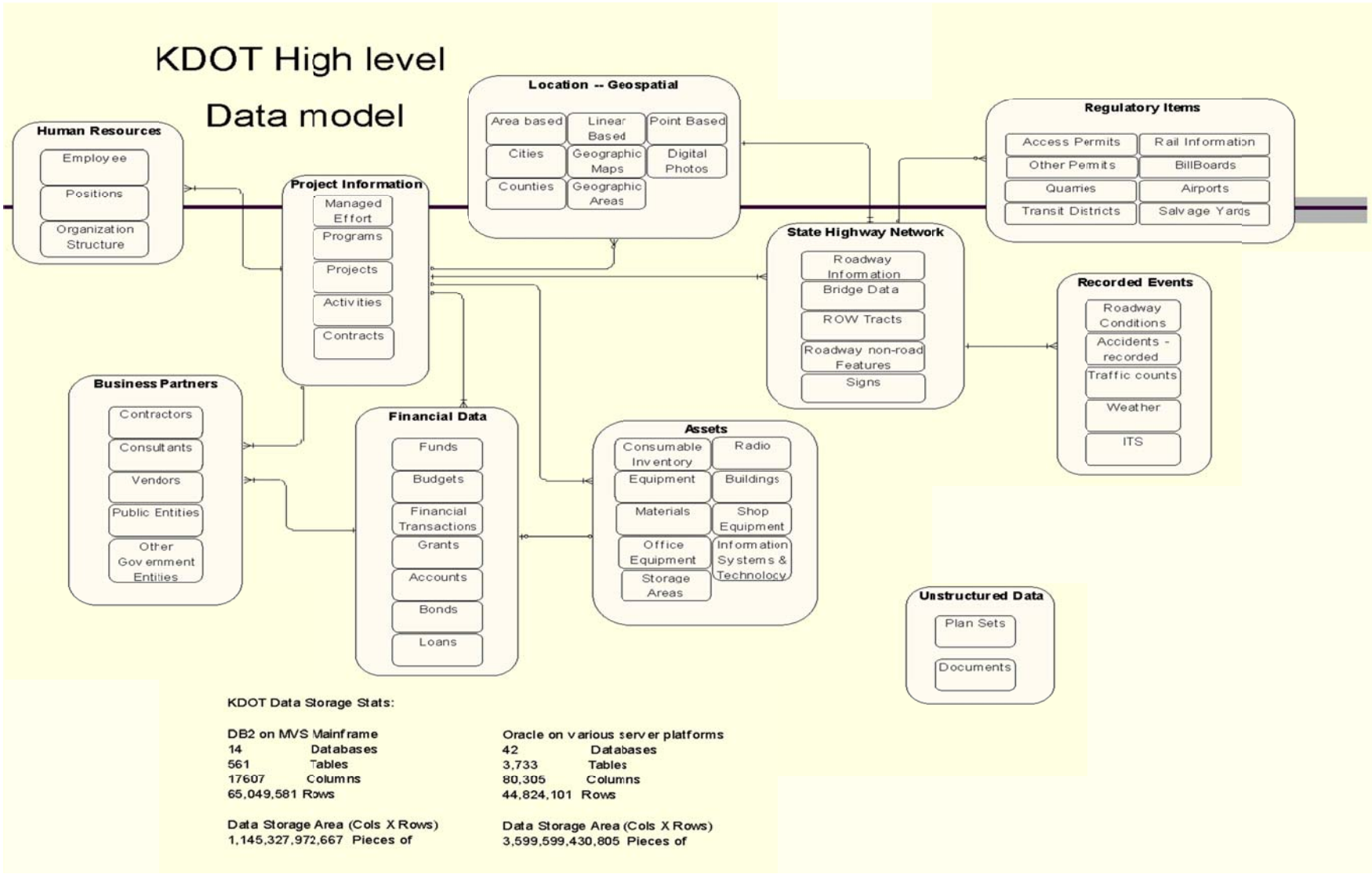
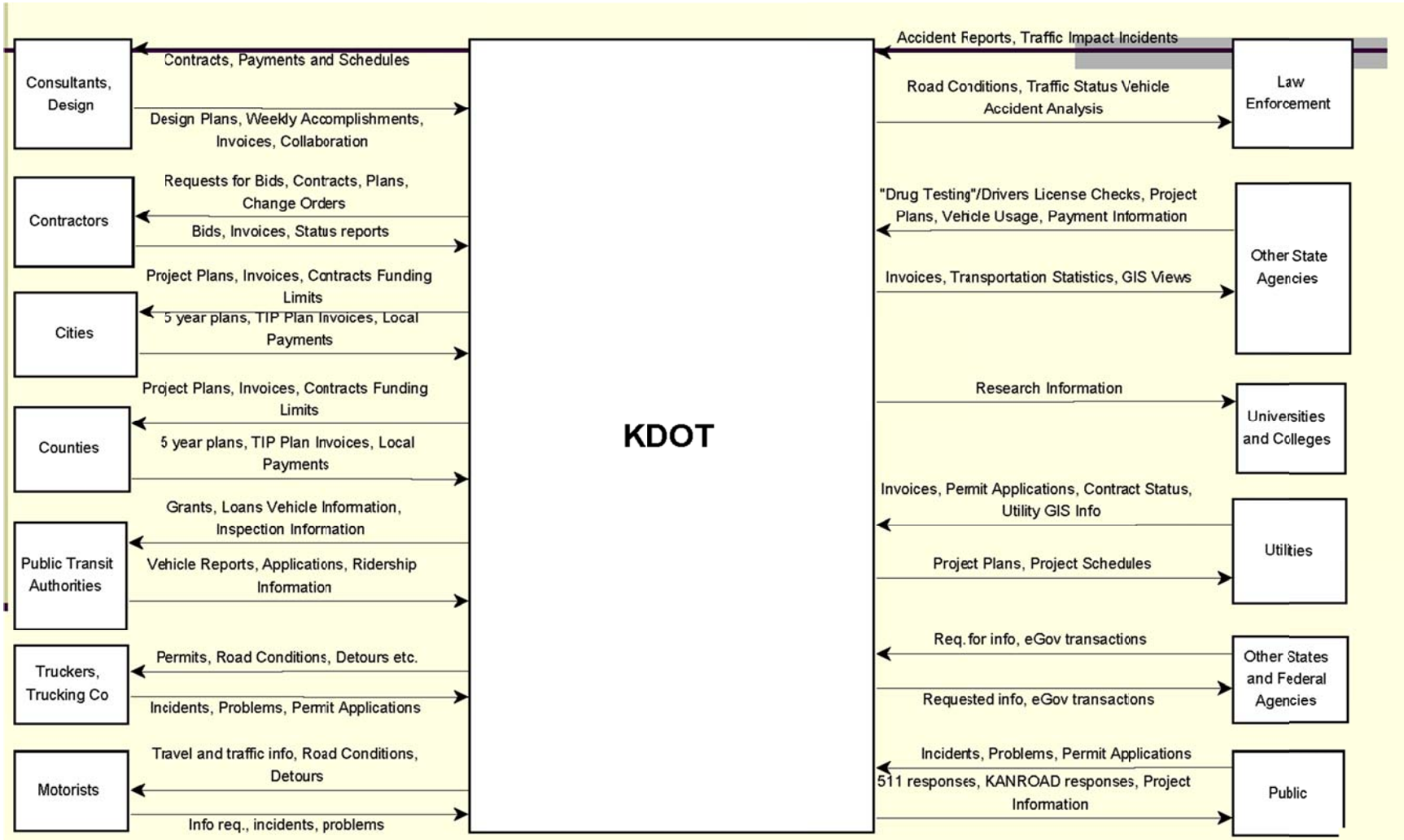


**Figure 19: KDOT's Data Integration with Partners**



Potential benefits from the development of an enterprise architecture based on both the experience of the research team and other organizations were highlighted. These potential benefits include:

- Better planning and decision making through an understanding of an organization's business drivers;
- Improved communication and collaboration – both within the business organizations and between business units and information technology – through the use of a standard vocabulary;
- Business-centric architectural views which:
  - Help to communicate the complexity of large systems,
  - Depict interaction between systems, and
  - Facilitate on-ongoing management of complex environments; and
- A focus on the strategic use of emerging technologies to:
  - Drive implementation of business efficiencies,
  - Drive process standardization, and
  - Enable businesses to meet changing requirements; and
- Improved sharing of information across the enterprise which leads to:
  - Data consistency, accuracy, timeliness, integrity, quality, availability, and accessibility; and
- Implementation of a structured technology investment process to:
  - Identify benefits, impacts, and life-cycle cost,
  - Analyze in a consistent way alternatives, risks, and trade-offs, and
  - Prioritize candidate projects based on business value; and
- Better leveraging of technology spend by:
  - Building more quality and flexibility into applications without increasing cost,
  - Achieving economies of scale through sharing services,
  - Expediting integration of legacy, migration, and new systems, and
  - Ensuring legal and regulatory compliance.

Likewise, potential barriers to implementation of an enterprise architecture were also presented. Figure 20 presents these potential barriers to the implementation of an enterprise architecture, along with potential mitigation strategies.

**Figure 20: Potential Barriers to Implementation of an Enterprise Architecture**

| | |
|---|---|
| Lack of clear executive sponsorship | • Early engagement of executive management |
| Changes in leadership | • Early wins to demonstrate business value<br>• Build champions at all management levels |
| Lack of key business and technology champions | • Engage early through governance team |
| Challenges in obtaining organizational buy-in | • Develop champions at all staff levels<br>• Organizational change and communication plan |
| Budgetary and human resource constraints | • Right-size plan based on available funding and human resources |
| Implementation plan too ambitious | • Phased deployment plan |
| Initiative unable to gain momentum | • Early wins to demonstrate business value |

Building off the barriers to implementation experienced by other organizations, the research team led a facilitated group discussion with ODOT staff to discuss ODOT-specific enterprise architecture opportunities and implementation challenges. Some of the opportunities and challenges raised by ODOT participants during this work session were considered during development of the recommendations:

- The need for developing a strategy to mitigate the impact of changes in executive leadership including ways of positioning the ODOT CIO as a "technocrat" position, while at the same time balancing this with the need to ensure that the CIO has proper visibility to executive management and executive team priorities;
- Identifying opportunities to break down barriers between DoIT and business units including the potential of embedding business analysts within other divisions with a cross-matrix reporting relationship to both information technology and the business. It was also stressed by the workshop participants that these business analysts need to be employees who can develop an understanding of the business and who would typically be available to ODOT for more than just one project;
- The need to establish an Enterprise Architecture function to own, maintain, and carry forward the To-Be enterprise architecture design and the other deliverables of this project;
- How to leverage the increasing sophistication of business users in terms of their knowledge of information technology and their capability to build system solutions on their own. Some of the ideas identified by the group included:

  - Ensuring there is early engagement of information technology by the business unit,
  - Ensuring that business subject matter experts are active participants on project teams, and
  - How to best manage ODOT's "technical debt," essentially how to reduce the amount of time required to develop new silo systems or patch work solutions because of material gaps in existing core systems; and
- The need for a structured approach for managing the current backlog of information technology projects during the implementation of any information technology investment process; and
- The potential establishment of a multi-year program of information technology projects (similar to the STIP for transportation projects) with the annual budget then developed based on this multi-year program of projects.

### Transportation Asset Management

The objectives of the Transportation Asset Management best practices workshop was to provide a general introduction to transportation asset management (TAM) best practices to ODOT staff with less familiarity with TAM; to compare the state-of-the practice in asset management with current and planned ODOT practices; and to identify key transportation asset management requirements which should be carried forward into the design of ODOT's To-Be enterprise architecture.

AASHTO defines asset management as "a strategic and systematic process of operating, maintaining, upgrading, and expanding physical assets effectively throughout their life cycle."[9] During the workshop, specifically for those attendees unfamiliar with transportation asset management, the research team shared many of the principles of transportation asset management as described in the AASHTO Transportation Asset Management Guide. The research team emphasized the key benefit of asset management, which is to reduce the overall life-cycle costs of all assets and the infrastructure network as a whole.

Key features in asset management include managing across the whole life cycle of the asset, making decisions based on data, using risk-based programming, and utilizing integrated and cross-asset programming and trade-off analyses.

During the best practices workshop, the research team discussed the infrastructure management life cycle, asset management tiers, and maturity levels.

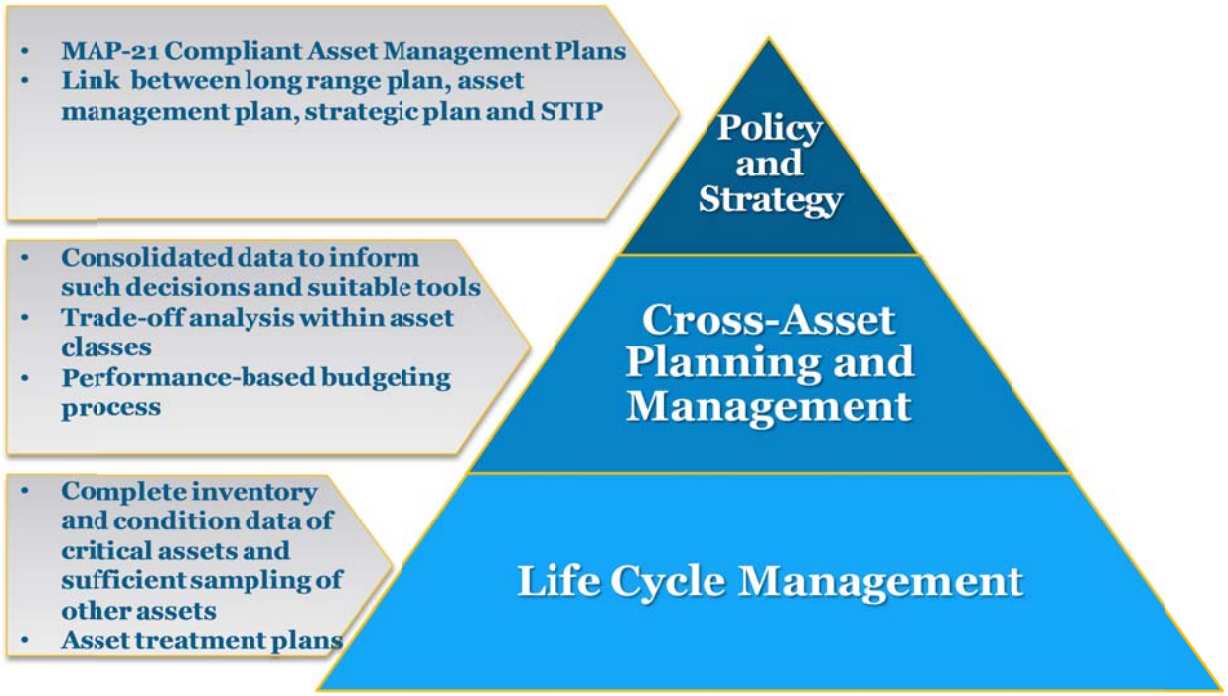
[9] http://tam.transportation.org/Pages/default.aspx

Asset management activities can generally be separated into three tiers:

- Policy and strategy, which drives an organization's asset management policies and practices;
- Cross-asset planning and management, which helps an agency prioritize among assets and asset classes based on their risk analysis and risk tolerance; and
- Life-cycle management, which provides the basis of all asset management through an inventory of assets as well as asset treatment plans.

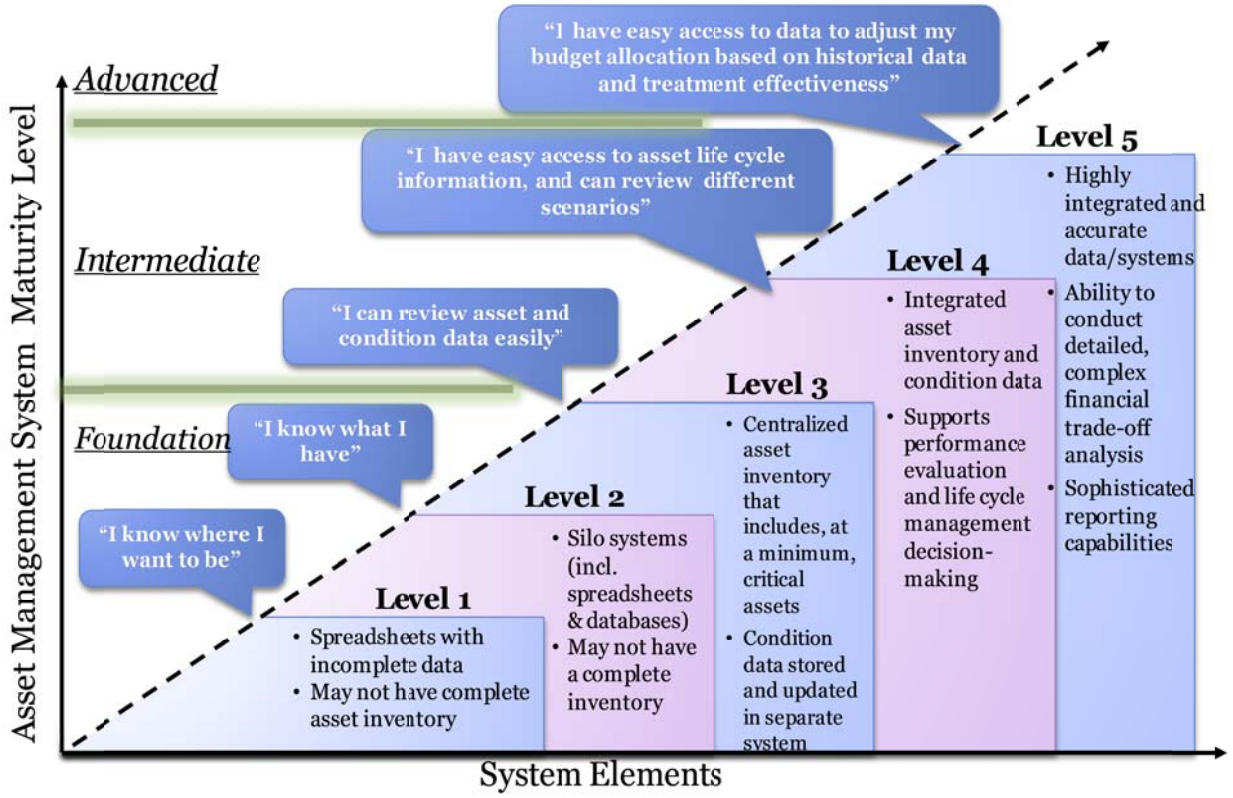
These tiers, along with the key documents/data that aid each tier, are presented in Figure 21.

**Figure 21: Asset Management Tiers and Documents/Data**




The research team developed an asset management maturity model to educate various agencies on different levels of maturity, and they presented these levels to ODOT to initiate a discussion on ODOT's current level of maturity and their goals/vision. The maturity levels are presented in Figure 22.

**Figure 22: Asset Management Maturity Levels**




The research team shared technology requirements in the form of enterprise, engineering, and asset management systems. The asset management processes of managing asset inventories, performing condition assessments, forecasting future conditions, performing cross-asset trade-off analyses, and identifying capital project and maintenance priorities were discussed during the workshop. Additionally, the research team shared with the attendees some asset management practices being implemented in other state DOTs.

As stated previously, ODOT manages its major assets through the use of resident systems, applications, and processes to propose system preservation projects for inclusion in ODOT's capital program.

Transportation asset management continues to evolve at ODOT. Early in 2011, the ODOT Transportation Asset Management Committee issued a series of recommendations to implement asset management in ODOT. In 2012, after a series of workshops and self-assessment surveys of ODOT's current management practices in transportation asset management, ODOT issued the report "Transportation Asset Management Plan Recommendations and Data Priorities."

After various TAM concepts were presented, workshop attendees were asked to compare the differences between the "state-of-the practices" in asset management and the current asset management practices in ODOT for each of the six asset management process components so

as to guide the development of the enterprise architecture. Major technology considerations identified by the workshop participants for inclusion in the To-Be design are:

- Importance of initiating and implementing the modernization of BTRS and Roadway Inventory (likely through replacement of these functions by Esri Roads and Highways) early in the implementation timeline since these are foundational applications which numerous other applications rely on for roadway inventory and location reference information;
- There is a need to define and obtain consensus on the "systems of record" for all tiered asset inventories and condition assessments;
- There is a need to implement technologies that will enable the use of automated inspection and data collection; and
- There is a future requirement to support cross-asset trade-off analysis.

### Financial Management and Enterprise Resource Planning

During the workshop the research team shared with the attendees the fundamental components of an enterprise resource planning (ERP) application and provided examples of ERPs implemented in other state DOTs with case studies of two of the states, Louisiana and West Virginia. Key lessons learned from successful ERP implementations were also shared. Additionally, the workshop included two discussion sessions on potential ERP implementation models for ODOT and the challenges that ODOT might face in an ERP implementation.

Enterprise resource planning can be described as a comprehensive suite of commercially available, integrated modules that provide end-to-end support for agency-wide or statewide administrative functions. Typical components of an ERP for a state department of transportation include financial management, funds management, human resources/payroll, and procurement and logistics, with all of these functions integrated within a business intelligence/data warehouse environment.

There are four common providers of ERP software to state governments namely, Oracle PeopleSoft, SAP, CGI Advantage, and Infor. OAKS, the State of Ohio's ERP, utilizes an Oracle PeopleSoft platform. ERPs implemented at state DOTs across the country have used three of the four ERP solutions. Two implementation models have typically been used by state DOTs:

- A DOT-specific ERP which interfaces to the statewide financial management or ERP system; or
- An ERP as part of a statewide ERP system.

The research team shared with the workshop participants the information on state DOT ERP implementations shown in Table 10 and Table 11.

**Table 10: State DOT ERP Implementations with PeopleSoft**

| State | Implementation Model | Implementation Date |
|---|---|---|
| Virginia | Agency – statewide rollout to follow | 1999 (upgrade 2011) |
| Wyoming | Agency | 2007 |
| Indiana | Statewide – separate copies for major agencies | 2008 |
| Tennessee | Statewide | 2008 |
| Kansas | Statewide | 2010 |
| Texas | Agency – based on statewide template | On-going |

**Table 11: State DOT ERP Implementations with SAP and CGI**

| State | Primary Software | Implementation Model | Implementation Date |
|---|---|---|---|
| North Carolina | SAP | Agency | 2003 |
| Colorado | | Agency | 2008 |
| Louisiana | | Statewide | 2010 |
| California | CGI | Agency | 2010 |
| West Virginia | | Statewide | On-going |

Based on the research team's experience with the implementation of ERPs at three state departments of transportation, key lessons learned for successful ERP implementations were presented including:

- Active leadership support from a project sponsor and the executive team;
- Identifying and using business process champions and users from the beginning of the project to the end;
- Creating a change management plan that includes effective communication and actions to lessen the organizational impacts;
- Committing the necessary resources to implement the ERP as well as backfill voids that are created;

- Preparing for the inevitable change in scope and budget;
- Being nimble so as to adjust the implementation as needed to produce the desired end results;
- Preparing to utilize subject matter experts as resources for the system development and advocates of its use;
- Committing the internal resources from each business area to clean data that will populate the ERP;
- Empowering staff to freely collaborate, share information, and make decisions when required;
- Training staff before implementation and after; and
- Partnering with FHWA early and throughout the process to ensure successful certification.

During the workshop a discussion session was conducted to consider two possible ERP implementation options for ODOT. The first option would be to modify OAKS as necessary to provide the systems and functionality needed by ODOT with interfaces to transportation-specific systems. The second implementation option would require that ODOT procure an ERP software solution and interface that system as necessary with OAKS and other transportation specific systems.

The discussions on the different implementation options concentrated on two major themes: cost and control. Regarding costs, it was acknowledged that the implementation of an ERP system is very costly. The software is expensive, as are costs associated with building interfaces. Since the State of Ohio through DAS already owns PeopleSoft/OAKS, ODOT could theoretically partner with DAS to modify and extend OAKS as necessary to provide for ODOT's needs which should be less expensive than procuring an ERP software, and costs associated with several interfaces would be eliminated.

Regarding control, the workshop attendees were concerned that as a client of DAS, ODOT's needs might not be met, or if those needs were met would they be in a timely manner, so often necessary in a rapidly changing environment like the business of ODOT. The role of ODOT would change from an owner to a client which was disconcerting to several attendees. Attendees were also concerned about the potential OAKS modification costs and user chargeback fees that might be associated with an increased usage of OAKS. The participants also acknowledged limited knowledge of the current capabilities of OAKS at ODOT and the exact scope of the effort which would be required to enhance OAKS to support fully ODOT's requirements.

The second discussion session focused on the potential ERP implementation challenges at ODOT. A significant concern was the resources or lack thereof necessary to implement successfully an ERP, namely funding and staff. Another concern of the workshop attendees was timing. They shared that with the possibility of an administration change in ODOT in less than

two years. ODOT should consider the merits of initiating a costly project that would span the potential administration change in the event that a different administration might want to proceed in a different direction. The attendees also expressed some concern about the current implementation of several systems at ODOT that could become redundant with some of the functionality of an ERP.

### Program and Project Management Systems

The objectives of the Program and Project Management Systems best practices workshop was to provide an overview of the state of the practice in program and project management systems and provide some examples of recent state department of transportation experiences with the implementation of these types of systems. In addition, there was a facilitated group discussion on important considerations in terms of the future development of program and project management systems at ODOT. As part of formulating the To-Be enterprise architecture design, the research team utilized input from this discussion.

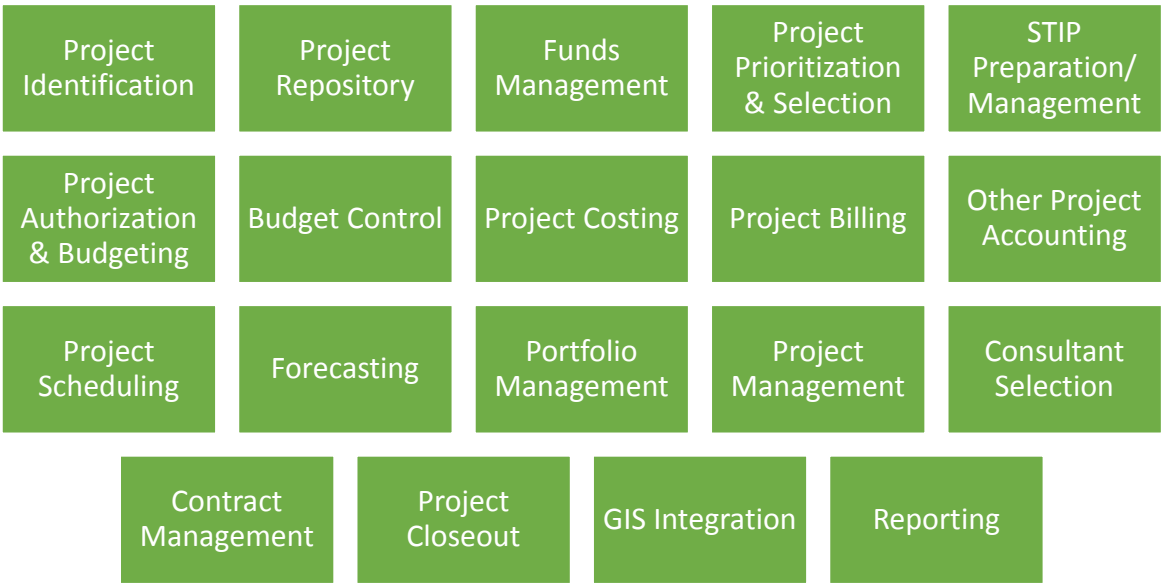
The general capabilities of program and project management systems for state departments of transportation were presented at the workshop. Examples of some of these capabilities include:

- Project definition and tracking from initial project request to project closeout;
- Unique project identification including the capability to assign a project number and maintain project-related descriptive phase and category information;
- Configurable multi-level work break-down structure or WBS (for example project, phase, task, activity, sub-activity, line item, category);
- Creation/maintenance of budget and schedule templates for each major project type and the ability to utilize these templates to create new projects or to start a new project by copying the structure from an existing project;
- Project hierarchies with sub-projects linked to a primary project and roll-up reporting for a related project;
- Establishment of project budgets and the tracking of budget change history;
- Tracking and controlling revenues and expenditures against the established project budget;
- Recording expenditures against all WBS levels or to the lowest WBS level;
- Recording project cost information including budgets, pre-encumbrances, encumbrances, expenditures, anticipated revenues, and receivables;
- Drill-down capabilities to allow a user to go from a summary level snapshot to source transactions;
- Extensive workflow management capabilities;

- Partner self-service capabilities such as candidate project identification by MPOs and other local partners, consultant invoice submissions, construction contractor submittals, construction test results, etc.; and
- Integration with document management systems to facilitate creation of a project repository.

Likewise, more detailed requirements for program and project management systems were also presented and discussed for each of the functional areas outlined in Figure 23.

**Figure 23: Key Program and Project Management System Components**




Examples from program and project management systems from several state departments of transportation were also presented. This included a discussion of the scope of the West Virginia Department of Transportation's (WVDOT) Capital Program Management System (CPMS) application which is being developed as part of a statewide ERP effort. The WVDOT CPMS will incorporate most of the key capabilities identified above and is designed to provide a solution for tracking transportation projects from initial definition through project programming, preparation of the STIP, initiation of all project phases, and monitoring and execution of the project through construction completion and closeout. Figure 24 illustrates the intended scope of the WVDOT CPMS and depicts the relationships between CPMS and other WVDOT systems.

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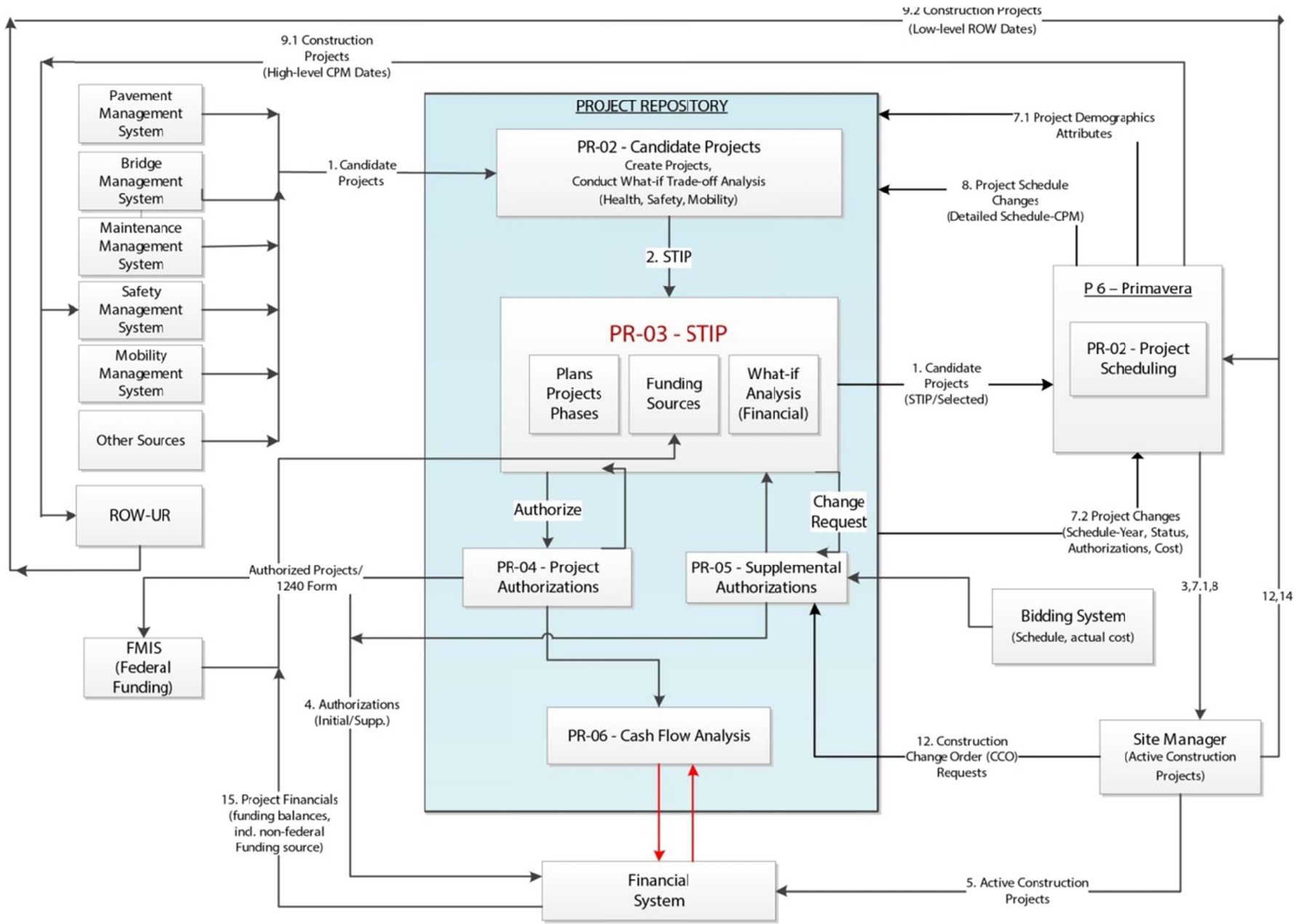
**Figure 24: Scope of WVDOT CPMS Application**



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In terms of the discussion of program and project management system opportunities at ODOT, the following items were noted:

- There is a need to integrate the program and project management functionality currently provided by the Applied Research Management System (ARMS) application for the research program into any future enterprise program management system. Similarly, any new program and project management system should support all types of projects, including non-traditional capital projects. Ellis does not currently support non-traditional capital projects;
- A new program and project management system should fully support design-build and other alternative project delivery methods;
- The program and project management system must be able to link to Pre-PID project documents such as safety studies (essentially documents related to the project but were developed before a specific project was uniquely identified as a project); and
- A number of system capabilities were highlighted by workshop participants as very important:
  - Management of a standard vendor list,
  - Electronic submission of consultant and contractor documents,
  - Integration with enterprise document management,
  - Creation, maintenance, and monitoring of project budgets including maintaining budget history; currently, offline methods are used for this function, and
  - Implementing paperless processes throughout the system to the extent practical; and
- Providing the capability to notify users when they have an action to take within the system; and
- Providing the ability to export data easily to other systems.

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# V. Conclusions and Recommendations

During the ODOT Enterprise Architecture project the eVision Partners team gathered information from ODOT staff members and external stakeholders through direct interviews, validation sessions, best practice workshops, and documentation reviews. The results and findings presented in the foregoing section of this report directly relate to the information gathered from staff and stakeholders. The results and findings were presented in an expanded format that included information based on the researcher's general experiences in working with other state DOTs, and specifically on the researcher's experiences in developing enterprise architectures for other state DOTs and their experiences in ERP implementations. This section of the report provides the research team's conclusions and recommendations drawn from those results and findings. The conclusions and recommendations are presented together in the same format used throughout the report and categorized by architecture.

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## A. Overarching Conclusions and Recommendations

Based on the recurrent and notable themes during the staff and stakeholder interviews, and the discussions in the various validation sessions and best practice workshops, it is the conclusion of the research team that ODOT is positioned to implement an enterprise architecture with full understanding that resource and timing issues must first be addressed. Almost universally, staff members recognize the need to move forward with a best value, integrated technology environment that serves the needs of the whole agency. They recognize that in the future, systems should be deployed in an enterprise manner and not to address specific business issues. They also recognize the limitations of many of the current technology systems, the issues associated with the lack of system integration, and the less than optimum utilization of the capabilities of various application software solutions in some recent deployments.

From an overall perspective, the research team recommends ODOT pursue the core strategies outlined below by architecture layer over the five-year planning window defined for the Enterprise Architecture project.

**Business Architecture**

In terms of the business architecture layer, the research team recommends ODOT implement the following strategies/initiatives:

- Implement a Technology Council consisting of policymakers and senior-level staff to provide enterprise-level technology governance. This includes establishing policies and procedures related to technology projects and providing overall strategic direction on technology investments and deployment;
- Establish a technology investment prioritization process that is closely aligned with ODOT's strategic objectives, critical success factors, and supporting business drivers;
- Re-align technology staffing to better support planning and deployment of technology investments including:
  - Creating additional business analyst positions to be filled by ODOT employees and embedded in the business,
  - Transferring positions within business units whose primary focus is applications development for DoIT,
  - Establishing an Enterprise Architecture team within DoIT to drive implementation of the recommendations from this research project and maintain ODOT's enterprise architecture going forward, and
  - Leveraging District IT staff by integrating them more widely into key roles on enterprise IT projects.

## Applications Architecture

In terms of the applications architecture layer, the research team recommends ODOT implement the following strategies/initiatives:

- Implement OAKS Plus ERP, an enhanced version of the State of Ohio's PeopleSoft ERP system, with additional modules and extensions as required to meet ODOT's business requirements. OAKS Plus ERP will serve as ODOT's primary financial, procurement, and human resource management system. This proposed implementation project will:
  - Replace Appropriations Accounting and various other ODOT-specific accounting and financial management applications,
  - Improve the timeliness of access to human resource data for use in other ODOT systems and retire, to the extent possible, ODOT-specific human resource applications, and
  - Evaluate the replacement of the AgileAssets timekeeping module developed for ODOT within EIMS with an enhanced deployment of Kronos to allow for a single point of employee time capture and allocation to projects in an industry leading time and leave management system; and
- Continue ODOT's recent direction of adopting industry leading off-the-shelf software solutions to the extent possible versus custom developing applications. This includes:
  - Completing implementation of EIMS/AgileAssets, InspectTech SMS, and Deighton dTIMS and initiating follow-on projects to further expand and enhance utilization of these products,
  - Implementing the planned Roadway Information Management System utilizing the Esri Roads and Highways platform and tightly integrating this application with EIMS/AgileAssets, Deighton dTIMS, and SMS, and
  - Implementing the planning and analytical components needed to have a fully functional bridge management system through an off-the-shelf solution such as AASHTOWare PONTIS; and
- Design and implement a new Capital Program Management System (CPMS) to replace Ellis which is tightly integrated with the OAKS Plus ERP environment. Requirements for this application should be developed in parallel with OAKS Plus ERP. ODOT should then evaluate various solution options for meeting these requirements, leveraging existing technologies such as PeopleSoft, Oracle Primavera, and the OAKS CI project management application implemented under Oracle's Skire Unifier toolset and used by the Ohio Facilities Construction Commission. The potential for re-platforming the existing Ellis application to an Oracle database environment and enhancing its functionality should also be evaluated as an option;

- Implement a Capital Project Delivery System which is tightly integrated with both the new CPMS and OAKS Plus ERP using a combination of one or more off-the-shelf solutions to meet the requirements for an upgraded and enhanced consultant contract selection and management system. This system should be implemented in phases with an upgrade of the capabilities of the existing Consultant Contract Selection System implemented in the first phase, followed by a second phase focused on project management, document management, and collaboration tools. In defining the solution for this proposed system, ODOT should also evaluate the capability to leverage either PeopleSoft modules or the OAKS CI application. In addition, the project document management and collaboration capabilities developed in the second phase should leverage and utilize the recommended enterprise document management system (please refer to the recommendation below under Technical Architecture);
- Design and implement an enterprise-wide asset management system which provides a common enterprise view of all major assets on the ODOT network. Existing products, such as Deighton dTIMS and EIMS/AgileAssets, should be evaluated to meet the requirements of this functionality; and
- Implement in the longer term a cross-asset trade-off solution, as an extension of the enterprise-wide asset management system, when the product offerings available for this purpose in the marketplace become more mature. In the interim, ODOT should focus on defining the business policies and supporting business processes for cross-asset trade-off decision making. Once the business model is defined, ODOT can then develop requirements and select a solution which will be configured and implemented to support the desired business process.

**Data Architecture**

In terms of the data architecture layer, the research team recommends ODOT transition from the existing GQL and geospatial data warehouse environment to a more robust BI environment. ODOT should define requirements; evaluate, select, and implement an industry leading BI environment; and integrate this environment with OAKS Plus ERP and other core ODOT applications. The new BI toolset should provide the following types of capabilities:

- End-user reporting and query tools;
- Online analytical processing tools to support multi-dimensional analysis;
- Management dashboards and other graphical presentation tools;
- Data mining tools; and
- Performance management and measurement tools.

## Technical Architecture

In terms of the technical architecture layer, the research team recommends ODOT implement the following strategies/initiatives:

- Transition responsibility for managing most technology infrastructure to DAS through the State's IT Optimization project;
- Establish a mainframe replacement project to migrate all remaining applications off the mainframe which are not included in the scope of the OAKS Plus ERP project or another ongoing project to allow for de-commissioning of the ODOT mainframe environment;
- Define requirements for an enterprise document management system; evaluate, select, and deploy an enterprise document management system; and integrate this new enterprise document management system with OAKS Plus ERP, CPMS, the Capital Project Delivery System, and other core ODOT applications; and
- Implement enhanced partner self-service capabilities across ODOT business units and management systems.

The key conclusions and related recommendations are presented in more detail by architecture layer in the sub-sections below.

## B. Conclusions and Recommendations: Business Architecture

It is the conclusion of the research team that the ODOT leadership is positioning ODOT for the successful implementation of an enterprise architecture. This project was initiated by members of the executive team which indicates an understanding of many of the technology issues in ODOT. Members of the executive team have been actively engaged in the project. However, the research team concluded that in order for ODOT to be successful in implementing an enterprise architecture, certain issues need to be addressed. These issues are as follows:

- A lack of single-point ownership of technology in ODOT has enabled the creation of the technology silos that currently exist within ODOT. Several areas of technology excellence exist within ODOT but no single entity is authorized to ensure enterprise technology deployment that considers all of ODOT's functions;
- ODOT does not have a technology strategic plan that aligns with the strategic plan of ODOT and could survive a potential change in the ODOT administration. A technology strategic plan should be a long-term plan that always considers enterprise technology deployments, uses best value solutions, is based on ODOT's business needs, and is flexible enough to accommodate a new administration's initiatives without discarding the plan;
- There appears to have been very little process improvement or process reengineering prior to implementing some recent technology. Processes should be examined before a technology project is initiated or the technology will simply automate a bad process and entrench that bad process into ODOT. An opportunity exists to begin immediately to examine processes that utilize systems that are targeted for replacement. Leveraging efficiency groups like LEAN or reengineering consultants could ultimately produce better technology environments;
- It appears that little planning has been done to address the resource needs for an ultimate ERP implementation that is integral to an enterprise architecture. ERP implementation efforts are very costly. With the State of Ohio's two-year budget cycle, ODOT is not positioned for funding an ERP immediately. ODOT could start the process of developing system definitions and requirements, which is a fairly long process, while it budgets for an ERP implementation. Additionally, ERP implementations are very labor intensive and will require ODOT staff, subject matter experts, and other staff members to be fully engaged in the implementation. With the current staffing reductions being implemented at ODOT, ODOT will need to consider how to provide those necessary resources; and
- It is the understanding of the research team that the technology budget of ODOT was once consolidated in the IT Division budget. For several reasons, parts of that budget were distributed to the business areas which initiated independent technology deployments. The technology budget distribution appears to have exacerbated the problem of technology silos.

The research team concluded that these issues could be broadly categorized as issues associated with technology governance and the various ODOT technology organizations for which details and recommendations follow.

### Technology Governance

In the course of the project it quickly became apparent that ODOT faced the same technology challenges that other state transportation agencies faced. The technology demands of ODOT, especially in the engineering business areas, have grown much more rapidly than could be met by the resources of DoIT. Consequently, the business areas in need of technology initiated their own technology development and deployment projects using commercial software providers, university developers, and IT consultant developers. As stated previously, the systems implemented served the immediate needs of the business area but often did not allow other business areas to access these data or integrate with data owned by other systems. The end result is that ODOT has or is in the process of deploying what many believe to be industry leading products but they deployed with limited functionality since they were not deployed as enterprise solutions. Additionally, while the business areas were and are deploying new technology, the backbone applications of the business support functions of ODOT continue to use older technology that is becoming harder and harder to maintain for several reasons.

The lack of technology governance in ODOT was a recurrent theme as the research team interviewed staff members and stakeholders. A major concern voiced by interviewees was the lack of consistent technology policy direction and changing priorities often due to changing administrations and the extensive changes to ODOT's leadership team. A lack of consistency between the ODOT Central Office and districts or as one person described it, "12 different ODOTs," was often listed as a concern. Several people questioned the lack of integration efforts in deploying some recent ODOT-wide technology such as Kronos, AgileAssets, Deighton, etc. Numerous document management efforts were mentioned in business groups in addition to ODOT's document management task group.

Almost universally, interviewees mentioned significant limitations in the sharing of data between applications. As one person put it, ODOT is, "Data rich, information poor." The ability to retrieve data and resulting information is very difficult with ODOT's disparate systems. There was also an expressed concern about the lack of a structured IT investment decision-making process. Likewise, multiple centers of technology leadership were clearly identified through the interviews which could continue to lead to technology silos and inefficiencies. The need for improved coordination between IT and business units was stated several times.

The Enterprise Architecture project will produce a recommendation for an enterprise architecture and an implementation plan but that is only the beginning. In order to implement the plan, detailed systems requirements need to be developed, budgets funded, and human resources committed. The implementation of the plan must be guided along. Decisions will need to be made regarding the best investment strategies. The plan and implementation will need to be monitored to ensure that business areas are not "doing their own thing."

**Recommendation Business Architecture – 1.1: ODOT Technology Governance**

The research team recommends that an ODOT-wide technology governance process be implemented. This proposed ODOT Technology Council will provide governance over all technology initiatives. Adopting and implementing this recommendation would provide ODOT a forum for the evaluation and ultimate implementation of the enterprise architecture recommendations. Implementing a technology governance process would demonstrate ODOT's commitment to enterprise architecture and establish a foothold for expanded technology governance as an important factor in the long-term success of ODOT. Technology governance should be considered in a broad sense that considers all layers of the technology architecture; business, applications, data, and technical. The council should be guided by principles that ensure quality, promote good management and planning, stress process improvement, and mitigate agency risk.

Many 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. It 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 ODOT risks; and monitors performance of technology resources; and establishes accountability.

It is important to note that technology governance is not a replacement for good technology management; a replacement of technology control structure; a technology power authority; a process that pits business groups against each other; or a bureaucracy that impedes processes and production.

It is recommended that the Technology Council include a mixture of executive leadership and classified senior staff members to ensure continuity during an administration change. The council should have an executive champion and a council leader, ideally selected from a business area. Council membership should include executive management, ODOT technology business area leaders, ODOT IT leaders, ODOT major business area leaders, audit, and stakeholders.

The research team recommends that policies and procedures be adopted to guide the council and has developed a draft ODOT Technology Governance Policy and a draft ODOT Technology Governance Procedure, included as Appendix 9 and Appendix 10. The documents, or ODOT documents with similar intent, codify ODOT's path toward technology governance. The policy establishes the scope of the council 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 council.

Chief among the responsibilities of the Technology Council is the establishment of technology deployment plans and a technology procurement and deployment prioritization process.

Committees of the Technology Council would develop those policies and processes for the approval of the council.

The 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 ODOT's strategic objectives, critical success factors, and business drivers.

The key components in the ODOT technology investment prioritization process include:

- Scoping and screening of candidate projects;
- Evaluating projects for inclusion in the 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 below.

**Scoping and screening of candidate projects**

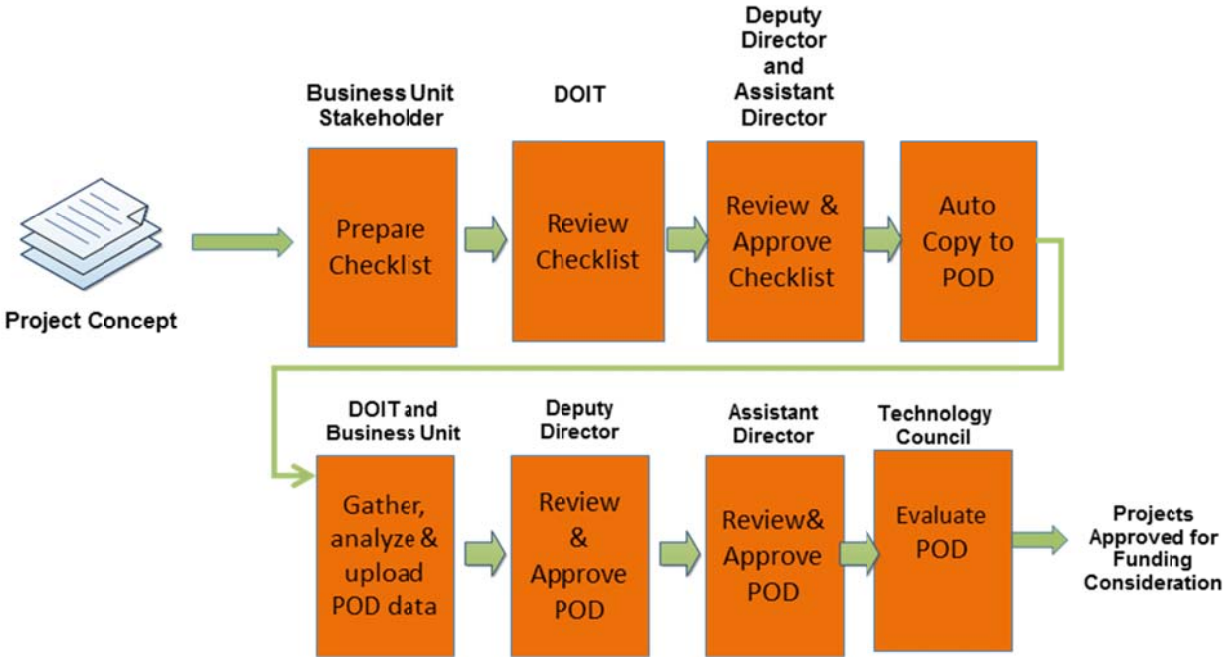
The research team recommends that the front-end scoping and screening consist of two steps:

1. A brief project origination checklist (POC) prepared by the business owner with support from DoIT staff. The POC would describe the business need/requirements and outline a proposed high-level scope of work to address the business need. It would also include a high-level project timeline and an order-of-magnitude cost estimate. The Division Deputy Director responsible for managing the business unit and the Assistant Director who oversees the requesting business unit will be asked to sign-off on the POC to indicate initial support for the project concept prior to any significant level of resources being expended to scope the project in more detail.

2. A more detailed project origination document (POD) would then be prepared by DoIT staff in collaboration with the business unit. This POD would provide a detailed scope statement, identify ODOT and external resources required to execute the project and identify proposed strategies for procuring any required software and services. 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 models, at a minimum, a seven-year cost of ownership. The Division Deputy Director responsible for managing the business unit and the Assistant Director who oversees the requesting business unit would be asked to sign-off on the POD to indicate concurrence with the proposed IT investment.

Figure 25 illustrates the proposed workflow for the scoping and screening process.

**Figure 25: Proposed Technology Project Scoping and Screening Process**




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

The research team recommends that ODOT establish a rolling, five-year technology plan and then based on this plan make final decisions about which projects to fund in the technology budget for each fiscal year.

The information contained within the POC and POD is used to score all projects. The Technology Council would use these project scores as a primary input, but certainly not the only input. The council is expected to weigh various trade-offs and balance technology expenditures to some extent across ODOT business areas when deciding whether or not to program the proposed project within the five-year technology plan and the current fiscal year technology budget.

The scoring criteria should be clear and closely tied to how the project will enable ODOT 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 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 investment prioritization decision model implemented by members of the research team for a large transit agency is provided in Appendix 10 as an example of the type of decision model that could be implemented at ODOT. Please note that the example model provided is intended to not only evaluate technology projects but a range of other proposed capital improvement projects (construction, systems planning, etc.) so not all criteria is necessarily applicable to a model intended to evaluate technology projects only.

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

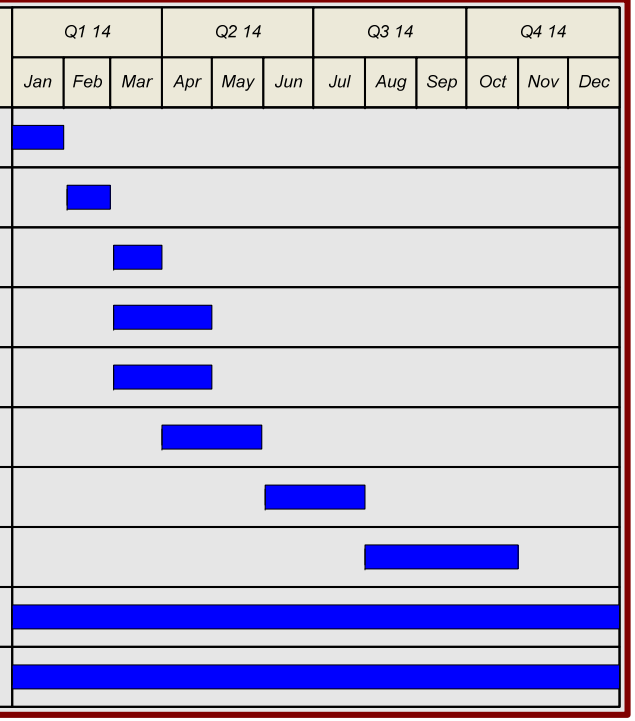
The research team also recommends that ODOT implement a technology project change management process in which material changes to scope, schedule, and budget are reviewed by various levels of management based on the size and materiality of the change. The proposed ODOT Technology Council would play a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

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

The researchers recommend that the technology governance issue be given a high priority and that the Technology Council be fully functional by December 2014, using a project plan similar to that shown in Figure 26. 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.

## Figure 26: Technology Governance Project Plan

| ID | Task Name | Start | Finish | Duration |
|---|---|---|---|---|
| 1 | Form ODOT technology council | 1/1/2014 | 1/31/2014 | 4.6w |
| 2 | Conduct formation meetings | 2/3/2014 | 2/28/2014 | 4w |
| 3 | Establish charter | 3/3/2014 | 3/31/2014 | 4.2w |
| 4 | Enact technology council policies and procedures | 3/3/2014 | 4/30/2014 | 8.6w |
| 5 | Establish and adopt technology investment policy | 3/3/2014 | 4/30/2014 | 8.6w |
| 6 | Pilot technology project request | 4/1/2014 | 5/30/2014 | 8.8w |
| 7 | Solicit annual technology projects | 6/2/2014 | 7/31/2014 | 8.8w |
| 8 | Develop one and five year plans | 8/1/2014 | 10/31/2014 | 13.2w |
| 9 | Conduct council meetings | 1/1/2014 | 12/31/2014 | 52.2w |
| 10 | Conduct change management activities | 1/1/2014 | 12/31/2014 | 52.2w |



## IT Organization

The challenges in the IT organization can be classified as leadership, staffing, client services, and distributed responsibility for technology, and are described as follows:

- Recent changes and vacancies in the DoIT Division Deputy Director/Chief Information Officer (CIO) position resulted in a lack of leadership. Fortunately, that leadership void was filled through the appointment of a new CIO. In the interim, ODOT used its very capable staff to maintain the systems and infrastructure that currently exists while moving forward with planned initiatives, other business of the IT Division, and significant initiatives such as the Enterprise Architecture project and major system deployments;
- The IT Division is being challenged to reduce staff. While the number of ODOT staff members decrease there has been a corresponding increase in the number of consultant and contract employees utilized at ODOT. It is concluded that, as a result, the IT services delivered to the ODOT business areas to support technology implementation have lessened. Consultants are being retained to be project business analysts and project managers for technology enhancements or deployments. Often, they arrive at ODOT with no or limited knowledge of the business areas within the scope of the project. While the project is underway, they often become the most knowledgeable person on the enhanced or new system. After the project, their departure from ODOT can be problematic since much of the knowledge they gained departs with them. IT staff tasked with maintaining those systems are consequently at a disadvantage since little residential knowledge exists within ODOT;
- It appears that there is, at best, limited IT Division client advocacy in ODOT. Client services is a shared responsibility in the IT Division, divided amongst the Project Management Office through its business analysts and project managers who work with the business areas to implement technology projects, the Infrastructure Management Office through the IT service desk team, and the Software Production Office through its staff members that support the various systems and interfaces developed by ODOT and the users of the systems. ODOT should consider embracing client advocacy as it is being deployed in other state DOTs wherein IT staff members, who maintain their IT Division identity, are embedded into the business areas to understand the business so as to advocate for the best technology solutions for the client. The embedded staff member can become a resource to the business areas and potentially serve as a business analyst or project manager; and
- As described earlier in this report, technology centers and organizations exist outside of the IT Division within ODOT, namely in the districts and in some business areas. This contributed to the development of technology silos and the lack of consistency statewide. The research team concluded that ODOT should consider consolidating some of the technology functions at the central office and establish better coordination and accountability with the district offices.

**Recommendation Business Architecture – 1.2: ODOT IT Transformation**

The research team recommends that ODOT adopt a series of organizational recommendations to improve the ability of ODOT to efficiently and effectively deliver technology projects and manage technology components within the business.

**Division of Information Technology Recommendations**

DoIT should develop business plans to focus on ODOT core business functions and be redesigned and right-sized in consideration of the following additional recommendations. Right-sizing is defined as an examination of staff needed to perform core business functions and a redeployment of excess staff to understaffed areas:

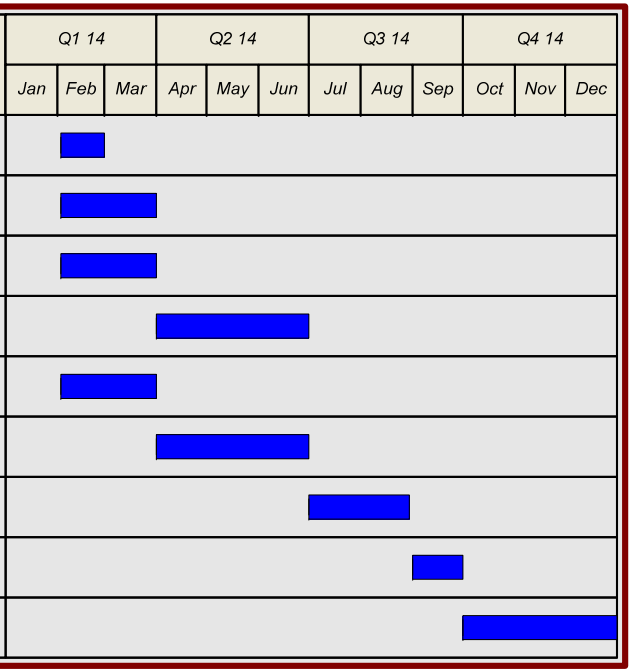
- DoIT should become a customer-centric organization and expand its customer services to include client advocacy and consider the embedment of staff in the ODOT business areas to learn their technology needs and serve as a liaison between the business areas and DoIT;
- DoIT should rationalize its outsourcing model to focus outsourcing efforts on the services that can best be outsourced with minimum impact to client services and create potential increased value to ODOT overall. The current model of outsourcing technology deployment business analysis and project management functions is flawed. Fundamentally, the DoIT Project Management methodology is an excellent method to deliver technology but the extended use of consultants as business analysts and project managers creates a knowledge void for DoIT staff. Consultants often times know more about ODOT systems than the DoIT staff. That same issue is experienced in other business areas of DoIT. The research team is generally in favor of outsourcing efforts but suggests that those efforts be concentrated on generic IT services and not services unique to ODOT;
- DoIT should create an Enterprise Architecture Office to become the steward of the enterprise architecture, provide for annual enterprise architecture plan revisions, be a change management advocate for enterprise architecture deployment, encourage process improvement to accompany technology deployment, and support the ODOT Technology Council on enterprise technology deployment;
- ODOT should freeze further DoIT staff reductions until the business models of DoIT can be redeveloped and rationalized. Under the current DoIT business model, consultants are retained as staff augmentation support or in project-specific roles to fill the voids created by ODOT staff reductions, since the services and functions required of DoIT remain. With this business model there may be a reduction in ODOT staff but there is virtually no net staff reduction. Freezing further staff reductions at this time would allow time for the redevelopment of DoIT business plans and for the DAS IT Optimization initiative that should lead more shared services to evolve; and

- DoIT should embrace its role as the ODOT technology leader and proactively coordinate the delivery of technology through its ODOT partners in the districts and business areas, and with DAS IT.

It is recommended that these DoIT organizational recommendations be considered a high priority and that business, reorganization, and right-sizing plans be implemented within one year utilizing a project plan similar to that shown in Figure 27. The project plan should include a team composed of IT staff and clients, examine the current services delivered by DoIT, and consider the impacts of the DAS IT Optimization initiative, alternate outsourcing models, the enterprise architecture plan, and other recommendations presented herein.

## Figure 27: Division of Information Technology Recommendations Project Plan

| ID | Task Name | Start | Finish | Duration |
|---|---|---|---|---|
| 1 | Form reorganization team | 2/3/2014 | 2/28/2014 | 4w |
| 2 | Review current business plans/identify services delivered | 2/3/2014 | 3/31/2014 | 8.2w |
| 3 | Review business cases for DAS IT optimization project | 2/3/2014 | 3/31/2014 | 8.2w |
| 4 | Review current and examine alternate outsourcing models | 4/1/2014 | 6/30/2014 | 13w |
| 5 | Review role and need for enterprise architecture office | 2/3/2014 | 3/31/2014 | 8.2w |
| 6 | Establish client advocate office and roles | 4/1/2014 | 6/30/2014 | 13w |
| 7 | Develop DoIT business plans | 7/1/2014 | 8/29/2014 | 8.8w |
| 8 | Develop DoIT reorganization plan | 9/1/2014 | 9/30/2014 | 4.4w |
| 9 | Implement reorganization plan | 10/1/2014 | 12/31/2014 | 13.2w |



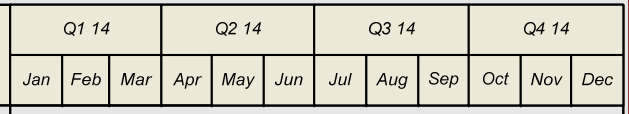
**Business Area Technology Centers and District IT Office Recommendations**

The development and deployment of all ODOT technology should be coordinated by DoIT through its policies and procedures, and those established by the ODOT Technology Council. The technology staff in the business areas whose predominant function is the development or maintenance of technology systems should be transferred to DoIT. Development activities in the districts and business areas by staff members whose functions are not predominantly technology system development or maintenance should follow the technology development protocols established by the DoIT Project Management Office and the ODOT Technology Council. Business areas are encouraged to be expert users of the systems and applications of their business areas, and stewards of data accuracy and collection.

It is recommended that that these business area technology centers and district IT office recommendations be considered a high priority and be completed by July 2014, utilizing a project plan similar to that shown in Figure 28. The project plan should include the development and promulgation of technology development policies, procedures, and development standards; identification of development staff in each of the business areas; and the development of on-going development activities statewide.

## Figure 28: Business Area Technology Centers and District IT Office Recommendations Project Plan

| ID | Task Name | Start | Finish | Duration |
|---|---|---|---|---|
| 1 | Assign recommendation leader | 2/3/2014 | 2/3/2014 | .2w |
| 2 | Identify business area staff with a predominant role for technology system development and maintenance | 3/3/2014 | 4/30/2014 | 8.6w |
| 3 | Develop plans to reassign staff to DoIT | 5/1/2014 | 6/30/2014 | 8.6w |
| 4 | Implement plan | 7/1/2014 | 7/31/2014 | 4.6w |
| 5 | DoIT to promulgate technology development policies, procedures, and development standards | 2/3/2014 | 6/30/2014 | 21.2w |



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## C. Conclusions and Recommendations: Applications Architecture

The research team, based on the validation sessions conducted with various stakeholders, identified various systems in use, systems marked for retirement, and systems under implementation. Furthermore, the research team identified basic strengths and weaknesses of ODOT's core systems. The following conclusions are based on this understanding and the research team's analysis of the systems and their interactions.

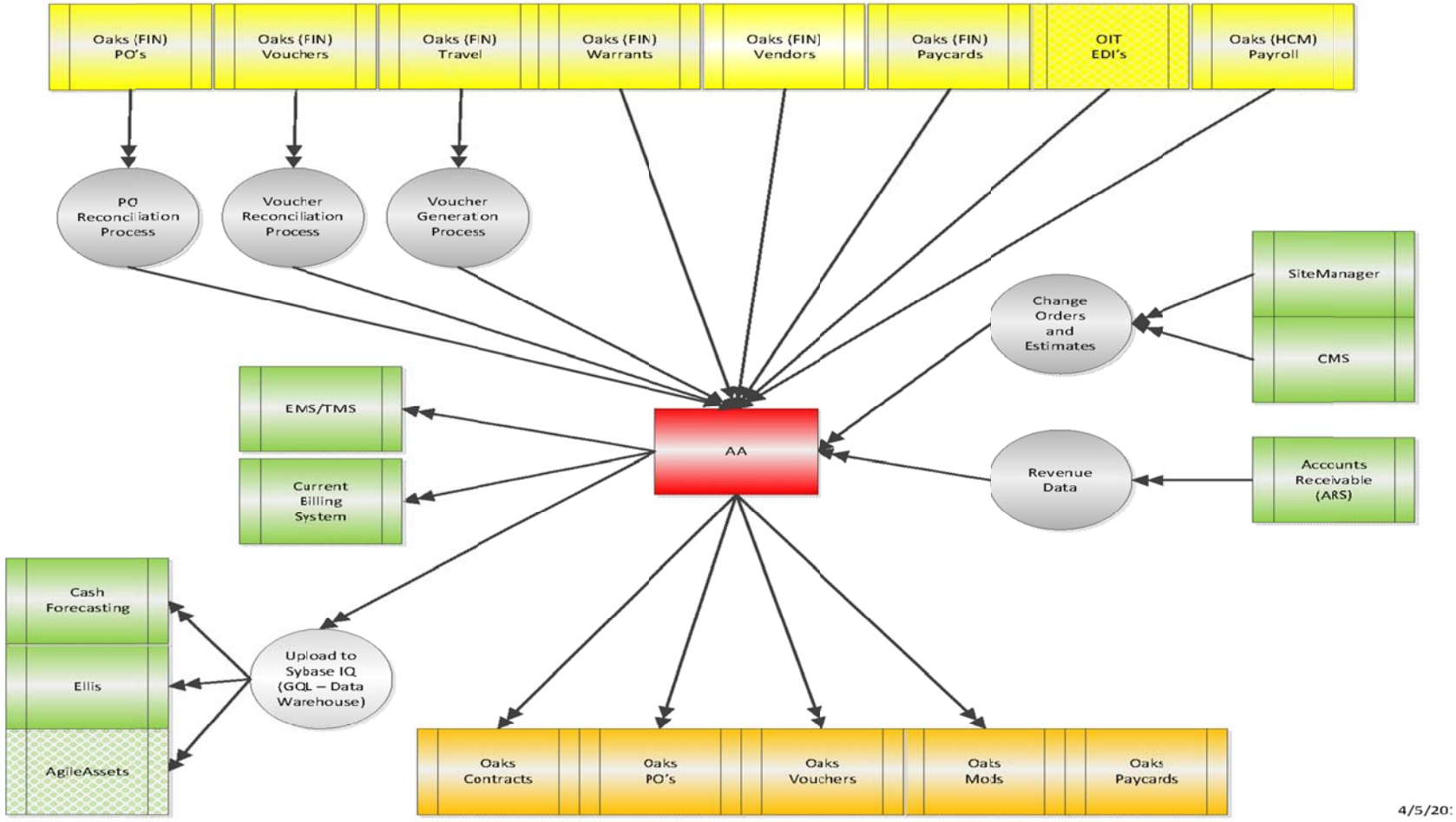
ODOT has many systems that have been in place and use for a long time. While some of these systems continue to meet their intended goals, there are others that do not meet today's ODOT requirements and need more maintenance than before. Two key examples are Ellis, which is continually being updated to meet ODOT's requirements and Appropriations Accounting, which is a mainframe system that is difficult to maintain and does not tightly integrate with ODOT's other systems or the State of Ohio's system of record, OAKS. It is the conclusion of the research team that both Appropriations Accounting and Ellis are at end-of-life and should be replaced as soon as possible.

ODOT recently selected new systems for various functions. The research team believes that the selected systems are "best of breed" – that is, these systems are the market leaders and provide a robust set of capabilities. It is the opinion of the research team that these systems have been and are being implemented with limited interactions and integration between various systems. This can significantly limit the benefits ODOT receives through these systems both in terms of data to make more informed decisions and to reduce duplicate data entry tasks with corresponding inaccuracies.

The primary example is ODOT's implementation of EIMS/AgileAssets. AgileAssets is a well-established application in the highway asset management sector. ODOT's implementation of AgileAssets does not tightly integrate with existing applications, such as Kronos, as has been done by other state departments of transportation in their implementations. As a result, end users need to enter their actual time worked in multiple systems at varying levels of detail. This further requires reconciliation efforts between systems. Furthermore, it is the research team's experience that such systems provide the most benefits when they are well-integrated with ODOT's other asset management systems (Deighton dTIMS and InspecTech SMS in ODOT's case). This does not seem to be the case with ODOT's AgileAssets implementation.

The State of Ohio's system of record is OAKS which is based on an Oracle PeopleSoft platform. ODOT currently uses OAKS for its Human Resource functions. Several other business functions, such as payroll and payments, are executed through OAKS which requires extensive interfaces between OAKS and ODOT's Appropriation Accounting application that must be maintained. Figure 29, provided by the ODOT Finance Division, depicts the interfaces that currently exist between the ODOT Appropriation Accounting system and OAKS.

## Figure 29: Appropriation Accounting Interfaces with OAKS



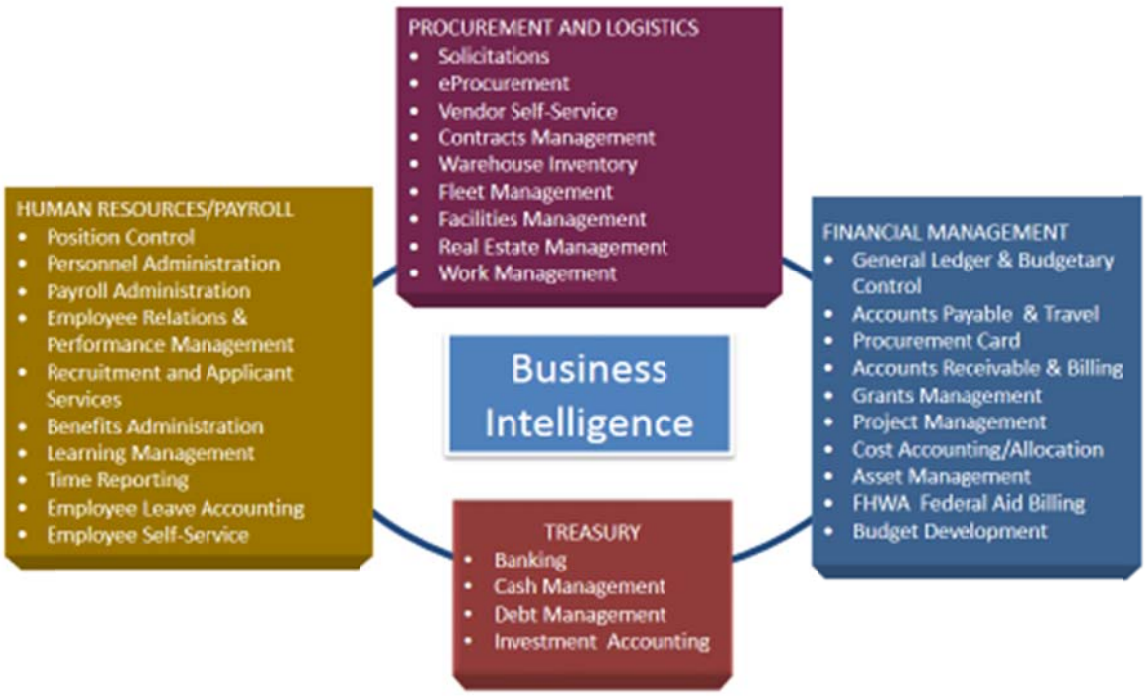
**Recommendation Applications Architecture – 2.1: Enterprise Resource Planning Implementation**

It is the conclusion of the research team that ODOT should implement an enhanced version of the State's existing OAKS system which includes additional PeopleSoft modules and other software enhancements to meet ODOT's core business requirements. The research team understands that OAKS will require a significant expansion of functionality to support ODOT in the areas of project management, grant management (unless this is met through BlackCat), contract management, and FHWA billing, at a minimum. However, the research team believes that utilizing an enhanced OAKS system, hereafter called OAKS Plus, to support ODOT could provide potentially significant cost benefits to ODOT since:

- The State already owns the software (even if the software needs to be updated, savings should still occur);
- The development and maintenance of interfaces would be drastically reduced;
- Costs associated with ERP requirements and specifications should lessen since the software provider is known and specifications would be written to align with that software;
- Implementation cost could be reduced since major ERP implementers would be proposing on the implementation of a known ERP solution rather than having each of the major implementers pairing off with the different ERP solution providers; and
- Some IT resources currently focused on supporting internal ODOT financial systems could be redeployed to other ODOT application systems and business areas as responsibility for ODOT's financial systems are taken on by a statewide shared services function.

Additionally, it is the conclusion of the research team that ODOT should use the non-financial functionality of OAKS to the maximum extent possible, such as human resource management, to replace ODOT-specific systems and interfaces. Figure 30 depicts typical components of an ERP. The implementation plan for the deployment of an ERP at ODOT should consider all of the existing functionality of OAKS, as well as the potential for implementing other PeopleSoft ERP modules that may be available as part of the recommended OAKS Plus system, which utilizes more of the capabilities of the PeopleSoft platform.

**Figure 30: Typical Enterprise Resource Planning Components**




- It is an additional conclusion of the research team that the recent and soon-to-be deployed timekeeping and payroll processes, including payroll cost accounting processes, be reexamined in consideration of the expanded functionality of an ERP and the capability of other systems already deployed by ODOT.
- Consistent with the conclusions stated above it is the recommendation of the research team that ODOT implement an enterprise planning system and that the enterprise planning system be built upon OAKS, the State of Ohio's PeopleSoft-based ERP.

As previously stated in the Best Practices section of this report, an ERP can be described as a comprehensive suite of commercially-available integrated modules that provide end-to-end support for ODOT-wide or statewide administrative functions. Typical components of an ERP for a state department of transportation include financial management, funds management, human resources/payroll, and procurement and logistics, with all of these functions integrated within a business intelligence/data warehouse environment. Coupled with additional systems and functionality based on further recommendations to be presented later in this and subsequent sections of this report it is envisioned that an ODOT/OAKS Plus system could conceptually be depicted as shown in Figure 31.

**Figure 31: Conceptual Model of ODOT/OAKS Plus**


Chief considerations in this recommendation include the major ODOT business functionalities that must be considered during the implementation, as well as principles and guidelines to adopt for a successful implementation.

Financial – Implementation of the ERP must ensure that all of the functionality of Appropriations Accounting be replaced as well as the functionality of the other satellite systems that support Appropriations Accounting and the business processes of ODOT. The system must integrate all financial processes and eliminate all financial interfaces. The system must provide for direct linkages to the Federal Highway Administration systems for project authorizations and modifications, project billing, and program approval. The current OAKS system should be enhanced to provide the aforementioned FHWA linkages, as well as grants management, project management, and contracts management.

Human Resources – Implementation of the ERP must maintain the functionality of the current ODOT processes and eliminate all HR-related interfaces and uploads. Implementation of the ERP should replace standalone HR-related systems and include the interconnectivity to third-party systems that will remain and are required for human capital management. It should also provide for faster access (real-time to the extent possible) to updates of employee data for use in other ODOT systems.

Timekeeping rationalization – Directly related to the financial and HR functionality described above is the rationalization of the soon-to-be deployed timekeeping practices of ODOT that utilize Kronos and AgileAssets for cost accounting. It is recommended that the process be redesigned to continue use of Kronos and the timekeeping functionality of AgileAssets work-order systems, but redesign the cost-accounting functionality to capture both time and allocation of this time for capital projects in Kronos. Employee time will then be interfaced from Kronos to OAKS Plus for payroll processing, labor distribution, and to support project billing requirements.

Logistics – Implementation of the ERP system must include other modules that support the business functions of ODOT. The system must include an enterprise procurement or supplier resource management system. It should include inventory and warehouse management. Considerations should also be given to developing mobile solutions, as well as other functionality available through the OAKS Plus system.

Interconnectivity with other systems – It is imperative that implementation of the ERP system provide interconnectivity with other ODOT systems, such as the new CPMS, EIMS/AgileAssets, Deighton dTIMS, InspectTech SMS, and the future roadway information management system.

Principles and Guidelines – Implementation of an ERP should include the establishment of principles and guidelines to support successful deployment. The research team strongly recommends including in those principles and guidelines leadership and project management, process improvement, and change management strategies.

Leadership and project management – It is the opinion of the research team that an ERP implementation cannot be successful without the active engagement and support of executive and senior management. It is recommended that an executive and senior-level ERP steering committee be formed with an executive sponsor and committee chair person named. It is recommended that an ERP project team be formed as soon as possible to assume ownership of this recommendation and manage the project. The project team should engage the business areas of ODOT in the project since the more that business owners are engaged in the project the more likely the ERP implementation will be successful.

Process improvement – ODOT should adopt the principle that all business processes be reviewed prior to the development of system requirements to support that business. ODOT should be open to transferring responsibilities from office to office in support of process improvement, as well as system functionality. ODOT should engage its LEAN office or other process improvement resources in this effort.

Change Management Strategies – ODOT should deploy change management strategies throughout the project to engage staff in the project's development, communicate project activities, prepare staff for potentially dramatic changes to their work systems and processes, and potentially utilize staff for systems testing, data cleanup, and training programs.

It is recommended that ODOT partner with DAS OIT to develop a solutions approach for deploying OAKS Plus. As described in the Best Practices section of this report, there are two primary options for implementing an OAKS Plus ERP.

The recommended option is for DAS OIT to enhance the current OAKS system to address identified gaps in functionality. The solution approach would minimize interfaces, should reduce licensing costs, optimize the existing technical infrastructure, and allow for the newly implemented functionality to be used by other state agencies.

The alternate option includes deploying an ODOT-only instance of OAKS/PeopleSoft for financials and procurement that would be cloned from the state baseline environment. ODOT would then deploy additional PeopleSoft modules, customizations, and interfaces necessary for business functionality. This non-preferred option may be suggested by DAS OIT if it is determined that the volume of transactions of ODOT would place an overwhelming burden on the OAKS environment and its supporting infrastructure. The solution may alleviate impacts to other state agencies but could result in higher licensing, infrastructure, and operational costs.

The researchers recommend that the ERP implementation include several phases as described below:

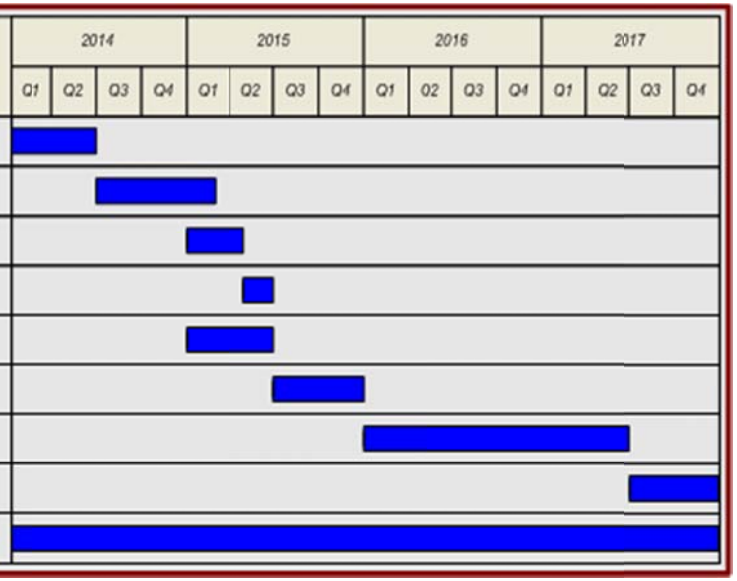
- Project pre-planning – This six-month phase would initiate the ERP implementation effort. An ODOT/OAKS Plus Steering Committee would be formed, chartered, and an executive champion appointed. The project team would be formed and chartered. Change management activities would begin. The most important responsibility of the project team during this phase is to develop an RFP and select a consultant to assist the team to develop the systems requirements, perform the fit-gap analysis, and develop an RFP for a systems integrator as described in the next three phases;
- Requirements definition – During this nine-month phase, detailed systems and interface requirements would be developed. The requirements would be written to guide an integrator's delivery of a system that will meet the business needs of ODOT and provide the interconnectivity needed for ODOT's other systems;
- Fit-gap analysis – This four-month phase would compare the detailed systems and interface requirements to the functionality that currently exists in OAKS and what additional PeopleSoft modules or third-party systems need to be deployed to meet the required functionality;
- Solution approach – During this two-month phase, the ODOT/OAKS Plus team would analyze the available solution approaches for deploying the system and selecting the best solution for both DAS OIT and ODOT;
- Prepare systems integrator Request for Proposals (RFP) – During this six-month phase, the project team would use the detailed requirements, fit-gap analysis, and the solutions approach selected to develop an RFP to solicit proposals for implementation of the ERP;

- Select systems integrator – This six-month phase would include the solicitation of proposals from systems integrators, evaluation of the submitted proposals, and selection and contracting of the ERP integrators;
- Systems implementation activities – During this two-year phase, the integrator would work with the software providers, DAS OIT, and ODOT to deliver OAKS Plus as contracted. The ODOT/OAKS Plus team and ODOT staff members will be required to support the effort throughout this phase by participating in blue-print sessions, systems validation sessions, data cleansing activities; and systems testing, training, and deployment support; and
- Post production support – During this phase, which begins when the new system becomes functional, serves to support ODOT's use of the system, correct operational issues, provide for unforeseen functionality needs, etc.

It is recommended that the ERP implementation be given a high priority for ODOT and be implemented in July 2017, utilizing a project plan similar to that shown in Figure 32. The plan includes all of the above described phases as well as project management activities throughout the project.

## Figure 32: Enterprise Resource Planning Implementation Project Plan

| ID | Task Name | Start | Finish | Duration |
|---|---|---|---|---|
| 1 | Project Pre-Planning | 1/6/2014 | 6/30/2014 | 126d |
| 2 | Requirements Definition including CPMS | 7/1/2014 | 2/27/2015 | 174d |
| 3 | OAKS Fit/Gap | 1/1/2015 | 4/30/2015 | 86d |
| 4 | Confirm Solution Approach | 5/1/2015 | 6/30/2015 | 43d |
| 5 | Prepare Systems Integrator RFP | 1/1/2015 | 6/30/2015 | 129d |
| 6 | Select Systems Integrator Partner | 7/1/2015 | 12/31/2015 | 132d |
| 7 | Implementation | 1/1/2016 | 6/30/2017 | 391d |
| 8 | Initial Production Support | 7/3/2017 | 12/29/2017 | 130d |
| 9 | Manage Program | 1/6/2014 | 12/29/2017 | 1040d |



**Recommendation Applications Architecture – 2.2: Capital Program Management System (CPMS)**

Ellis, ODOT's current program and project management system, lacks many of the capabilities considered to be best practices in department of transportation program and project management systems, as identified in Section IV.F of this report. Some of the key gaps include:

- No automated interfaces with ODOT asset management systems to populate the system with potential candidate projects;
- No partner self-service capability to allow MPOs and other local agencies to enter candidate projects;
- No what-if analysis capabilities to model various system funding scenarios when preparing the STIP or the ODOT capital budget;
- No what-if analysis capabilities for local partners to utilize when developing their TIPs;
- Limited capital budgeting/forecasting and cash-flow management capabilities necessitating the use of off-system worksheets for this function;
- Limited interface points between Ellis and Appropriation Accounting; and
- Other limitations in the extent of capabilities available in Ellis which led to the need to develop other applications such as Federal Program Management for interactions with FMIS and ARMS to support management of the ODOT Research program.

In addition to the identified functional gaps, at least one key resource with extensive knowledge of the system is likely to leave state service in the next few years, increasing the overall business risk of Ellis to ODOT.

The research team recommends a project be initiated to replace Ellis with a Capital Program Management System (CPMS) due to the number of functional gaps within Ellis. The CPMS as envisioned will be highly integrated with ODOT's asset management systems, the new Roadway Information Management System, and OAKS Plus ERP, and serve as the control center for planning and managing ODOT's capital program.

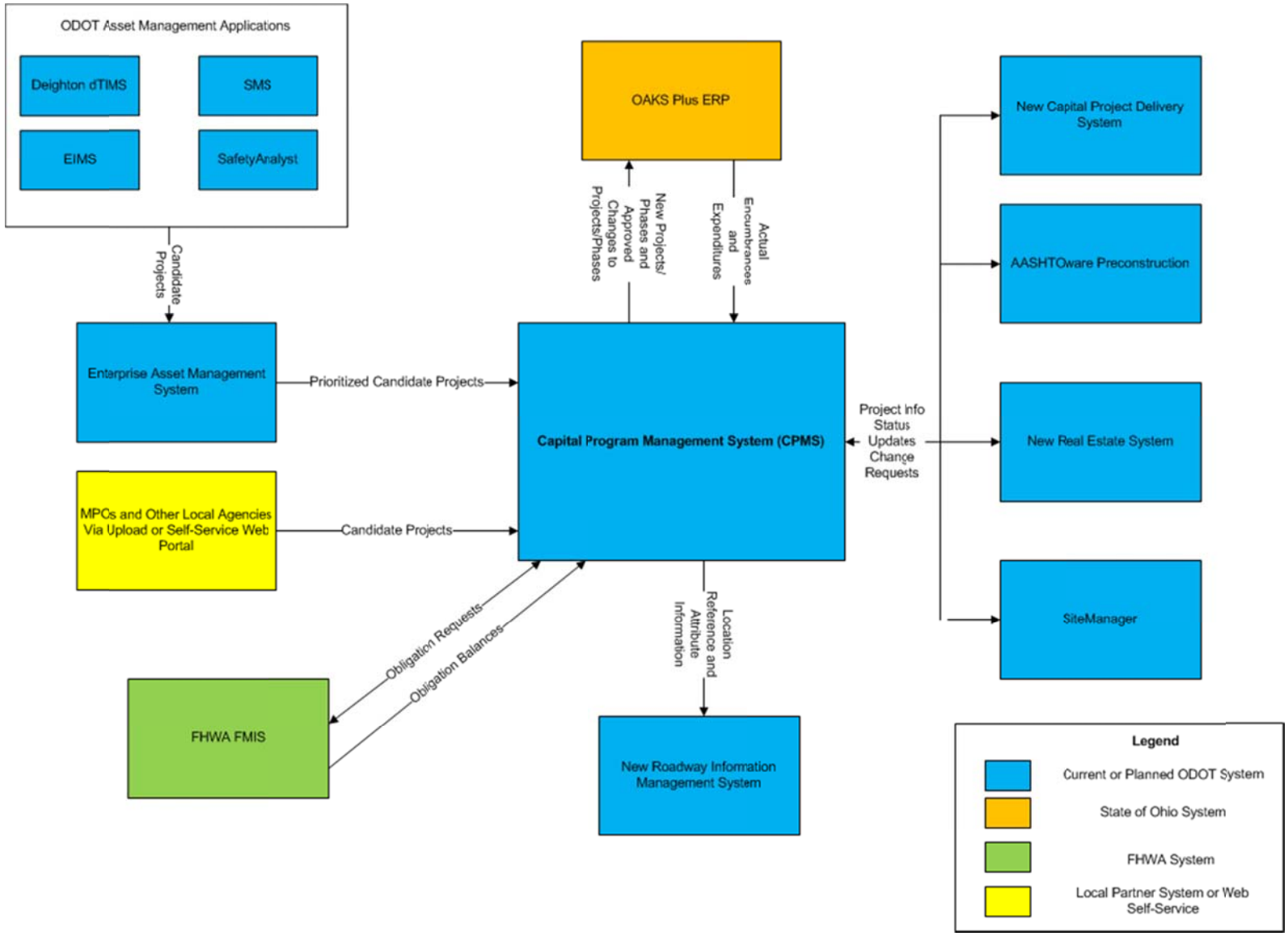
Candidate projects would be identified in ODOT's asset management systems or through other sources and interfaced into CPMS. Projects would be initially scoped in CPMS and the STIP and ODOT's annual construction program would be built and managed through CPMS. Project phases would be authorized with FHWA's FMIS application through CPMS and then initiated in OAKS Plus Financials to support project budgeting and project costing. Project change requests (scope, schedule, and budget) would be submitted as needed and evaluated and managed within CPMS. The management of the detailed execution of individual projects and project phases would be performed in the proposed Capital Project Delivery System described below.

Table 12 outlines some of the proposed capabilities within CPMS. Figure 33 depicts some of the key interactions between CPMS and other ODOT and partner systems.

**Table 12: Representative CPMS Functional Capabilities**

| CPMS Functional Capabilities | |
|---|---|
| Identification of candidate projects | Evaluation of budget scenarios and other what-if analysis |
| Scoping and screening of candidate projects | Cash-flow forecasting |
| Evaluation and prioritization of candidate projects | Portfolio management |
| Federal funds management | Tracking of project budget performance by phase |
| STIP preparation and management | Tracking of project schedule performance against key milestone dates |
| Evaluation of budget scenarios and other what-if analysis | Portfolio management |
| Project authorization and budgeting | Performance management for delivery of the capital program |
| Project change requests | Management reporting and analysis of the capital program |

## Figure 33: CPMS Interface Diagram



It is highly recommended that the requirements for CPMS be gathered in parallel with the requirements for the ERP because of the tight integration planned between OAKS Plus ERP and CPMS. Following the requirements gathering process, a fit-gap analysis would be conducted to evaluate proposed solution elements for CPMS. Potential solutions should be evaluated to determine if they can be utilized in all or parts of the proposed CPMS, including:

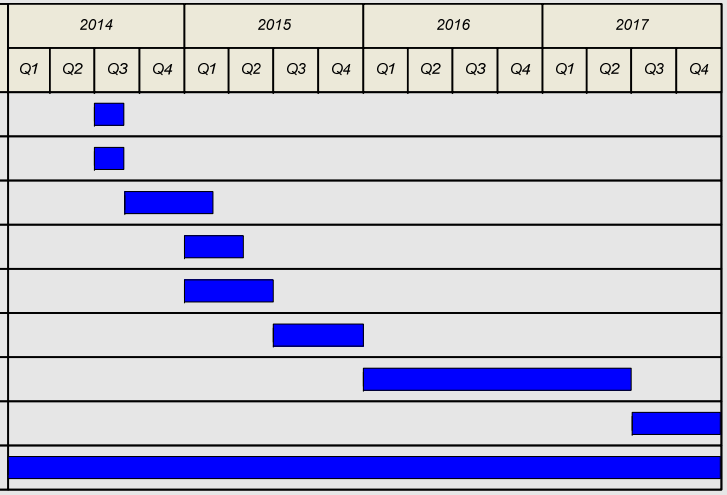
- Oracle PeopleSoft Project Costing;
- Oracle PeopleSoft Performance Budgeting and/or Oracle's Hyperion planning and analysis tools for budgeting and STIP development;
- Oracle Primavera for portfolio management requirements;
- OAKS CI Project Management application implemented under Oracle's Skire Unifier toolset and used by the Ohio Facilities Construction Commission for capital program and project management; and
- The potential for re-platforming the existing Ellis application to an Oracle database environment and then enhancing the system's functionality.

Although not recommended by the research team, ODOT could decide to delay the implementation of CMPS until after the implementation of the OAKS Plus ERP. In doing so ODOT would likely incur significantly higher overall implementation costs since interfaces between Ellis and OAKS Plus would need to be created for the OAKS Plus project only to be replaced with new CPMS/OAKS Plus interfaces during the CPMS deployment project. Additionally, the new functionality provided by an integrated CPMS/OAKS Plus system would be unavailable and would limit some of the functionality provided by the OAKS Plus system.

Figure 34 provides a proposed timeline for the envisioned CPMS project.

## Figure 34: CPMS Implementation Project Plan

| ID | Task Name | Start | Finish | Duration |
|---|---|---|---|---|
| 1 | Project Initiation | 7/1/2014 | 8/29/2014 | 44d |
| 2 | Finalize Project Scope | 7/1/2014 | 8/29/2014 | 44d |
| 3 | Requirements Definition in conjunction with ERP | 9/1/2014 | 2/27/2015 | 130d |
| 4 | Solution Design | 1/1/2015 | 4/30/2015 | 86d |
| 5 | Prepare Systems Integrator RFP | 1/1/2015 | 6/30/2015 | 129d |
| 6 | Select Systems Integrator Partner | 7/1/2015 | 12/31/2015 | 132d |
| 7 | Implementation | 1/1/2016 | 6/30/2017 | 391d |
| 8 | Initial Production Support | 7/3/2017 | 12/29/2017 | 130d |
| 9 | Manage Program | 1/6/2014 | 12/29/2017 | 1040d |



**Recommendation Applications Architecture – 2.3: Capital Project Delivery System**

ODOT recently initiated an effort to replace its existing Consultant Service/Consultant Evaluation System. ODOT intends to expand the scope of this current system beyond the consultant selection process and management of consultant contracts to a more fully functional project management system. ODOT staff, local partners, and consultants would utilize the project management system to manage the day-to-day execution of the planning, environmental, and design phases of work for an ODOT construction project. The system also has the potential to play a role in the right-of-way acquisition and utility relocation processes and be responsible for selection and management of consultant inspection resources during the Construction phase of work. Additional capabilities envisioned for this new system include integrated document management, project collaboration tools, and project scheduling tools.

The research team supports ODOT's planned replacement of this system. In conjunction with the recommended CPMS, a new Capital Project Delivery system will help to address gaps in ODOT's project management system capabilities in comparison to best practices. The primary responsibilities of the new Capital Project Delivery system will include contract management, consultant evaluation, project scheduling, a common project repository, robust document management capabilities, and project team collaboration tools.

The research team recommends that ODOT implement a Capital Project Delivery System which is tightly integrated with both the new CPMS and OAKS Plus ERP using a combination of one or more off-the-shelf solutions to meet the requirements for an upgraded and enhanced consultant contract selection and management system.

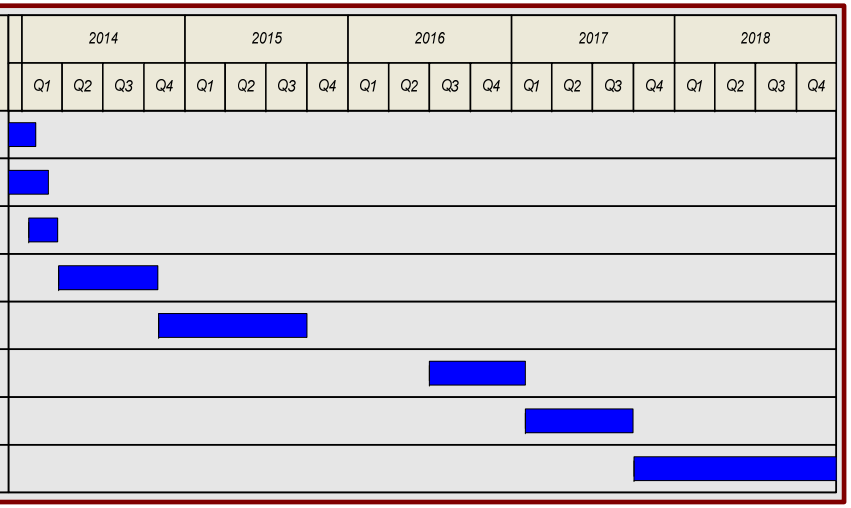
The research team recommends implementation of this system in phases with an upgrade of the capabilities of the existing Consultant Contract Selection System implemented in the first phase, followed by a second phase focused on project management, document management, and collaboration tools. In defining the solution for this proposed system, ODOT should evaluate the capability to leverage either PeopleSoft modules or the OAKS CI application. In addition, the project document management and collaboration capabilities developed in the second phase of the Capital Project Delivery System should leverage and utilize the recommended enterprise document management system, which is further described as part of the Technical Architecture recommendations below.

In addition, because the Capital Project Delivery system is currently in the requirements stage, the research team believes this proposed system may be an appropriate project to utilize to pilot the proposed technology project scoping and screening process.

Figure 35 provides a proposed timeline for the envisioned Capital Project Delivery System implementation.

## Figure 35: Capital Project Delivery Implementation Project Plan

| ID | Task Name | Start | Finish | Duration |
|---|---|---|---|---|
| 1 | Complete Phase 1 Requirements | 12/2/2013 | 1/31/2014 | 45d |
| 2 | Complete Scoping/Screening Process for Phase 1 project | 12/2/2013 | 2/28/2014 | 65d |
| 3 | Conduct Fit/Gap Analysis and Define Phase 1 Solution | 1/16/2014 | 3/21/2014 | 47d |
| 4 | Prepare RFP and Select Solution and Integrator for Phase 1 | 3/24/2014 | 10/31/2014 | 160d |
| 5 | Implement Phase 1 | 11/3/2014 | 9/30/2015 | 238d |
| 6 | Finalize Requirements and Complete Planning for Phase 2 | 7/1/2016 | 1/31/2017 | 153d |
| 7 | Prepare RFP and Select Solution and Integrator for Phase 2 | 2/1/2017 | 9/29/2017 | 173d |
| 8 | Implement Phase 2 | 10/2/2017 | 12/31/2018 | 326d |



**Recommendation Applications Architecture – 2.4: Roadway Information Management System**

ODOT recently initiated a new Roadway Information Management System to replace the existing BTRS and Roadway Inventory applications. The research team believes this project is a fundamental building block within the proposed ODOT enterprise architecture and concurs with ODOT's planned direction in this regard.

ODOT's GIS efforts initiated in the late 1970s and early 1980s evolved from a system allowing users to overlay and display crash data on layers such as pavement conditions and traffic volumes into a tool supporting many of ODOT's business areas.

Implemented in 2000, BTRS is currently the foundation of GIS at ODOT and serves as the official log of all highway locations. By updating location data to each subsystem, BTRS provides common location data that allows for the linkage of roadway, bridge, culvert, traffic, crash, and other information from various legacy systems in a data warehouse repository. This information is used to produce GIS maps, planning reports, and production reports. The roadway information system acts as a database on various physical and administrative data related to the roadway networks.

A new roadway information system is the next logical step in the evolution of the use of GIS at ODOT. The new Roadway Information Management System will provide the next generation of mapping tools and new or more enhanced capabilities in the following areas:

- Managing location referencing, including integrating data from various coordinate systems;
- Updating and integrating local transportation systems and attributes;
- Keeping roadway information up-to-date based on changes in different systems;
- Integrating enterprise data with additional analysis and reporting capabilities to make more informed decisions; and
- Maintaining temporality (change history).

Based on the research team's recent experience in other states, the research team recommends that this functionality be implemented by Esri's Roads and Highways application, with tight integration with the various asset management applications utilized by ODOT including EIMS/AgileAssets, InspectTech SMS, and Deighton dTIMS. Since the process of selecting an integration partner is underway at the time of this report, we strongly encourage ODOT to consider Esri Roads and Highways as the recommended solution since Esri, AgileAssets, and Deighton are already working together to integrate their solutions in other states and ODOT will be able to leverage this work.

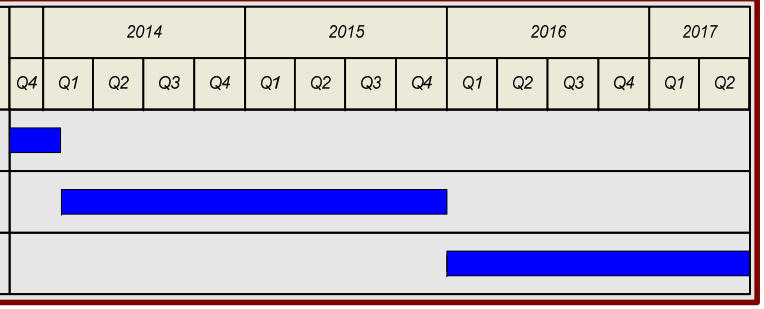
The three primary factors that will most ensure the success of this implementation are:

- Establishing a well-defined scope that includes straight-line diagramming, strip mapping, and HPMS modernization before finalizing the selection of a vendor for implementation;
- Ensuring the scope includes ties to various other systems, including systems that are "in-motion" and those planned to be implemented over the next few years (including OAKS Plus and additional phases of EIMS/AgileAssets, InspectTech SMS, and Deighton dTIMS); and
- Requiring the implementation team to work closely with other ODOT project teams to ensure working connections/interfaces with the numerous other ODOT systems which will heavily depend on the Roadway Information Management System for location reference information.

Figure 36 presents a high-level schedule for a roadway information management system implementation. This schedule is based on the completion of vendor selection and initiation of the design phase by February 1, 2014.

## Figure 36: Roadway Information Management System Implementation Plan

| ID | Task Name | Start | Finish | Duration |
|---|---|---|---|---|
| 1 | Vendor selection completion and design phase initiation | 11/1/2013 | 1/31/2014 | 13.2w |
| 2 | System implementation and testing | 2/3/2014 | 12/31/2015 | 99.8w |
| 3 | System modifications for other system interfaces, production support | 1/1/2016 | 6/30/2017 | 78.2w |



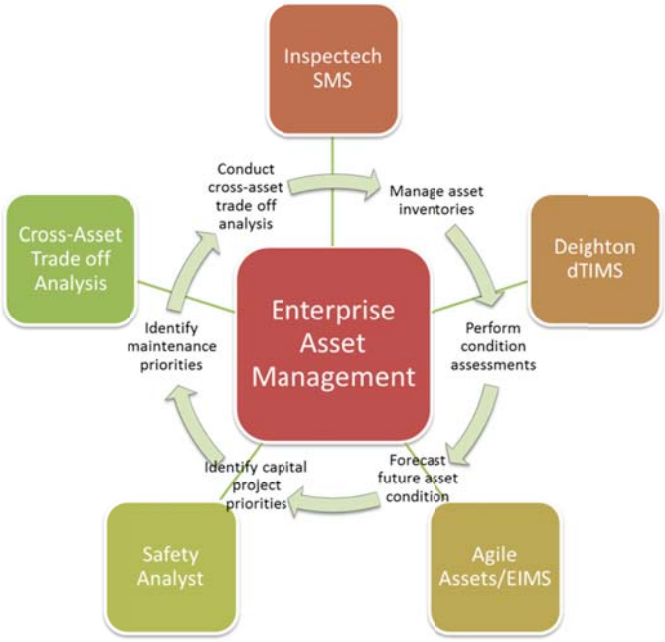
**Recommendation Applications Architecture – 2.5: Continue enhancements to asset management tools and develop an enterprise asset management system**

As previously stated in the Results and Findings section of this report, the primary goal of transportation asset management is to minimize the 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 ODOT 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, and then through to operations, preservation, and maintenance.

The report's Overview of Best Practices sub-section describes that transportation asset management continues to evolve at ODOT. Early in 2011, the ODOT Transportation Asset Management Committee issued a series of recommendations to implement asset management in ODOT. In 2012, after a series of workshops and self-assessment surveys of ODOT current management practices, ODOT issued the report "Transportation Asset Management Plan Recommendations and Data Priorities."

The research team recommends that ODOT continue in its development of transportation asset management policies, procedures, and plans. Technology deployment assists in the implementation of those policies, procedures, and plans.

The project team recommends that ODOT continue enhancements to its key asset management tools (Deighton dTIMS, InspectTech SMS, and EIMS/AgileAssets) and more closely integrate them to develop an enterprise asset management system that allows ODOT to effectively prioritize future capital and maintenance investments within various asset classes and across those asset classes. The additional capabilities ODOT will gain through system enhancements and integration will include the ability to:




- Forecast future asset condition;
- Identify capital project priorities;
- Identify maintenance priorities; and
- Conduct cross-asset trade-off analysis.

ODOT currently uses Deighton dTIMS for managing its pavement assets, SafetyAnalyst for managing and evaluating safety-related projects, and is in the process of implementing InspectTech SMS for inventorying bridges and culverts, and EIMS/AgileAssets for managing guardrails, non-overhead signs, and lands/buildings. The research team believes these systems, along with modifications or additional system(s) for cross-asset trade-off analysis will provide ODOT with an enterprise asset management system to allow ODOT the most benefits from these state-of-the art systems.

This recommendation consists of the following steps:

- Implementing EIMS/AgileAssets phase 2 to include all ODOT assets that are not included in the current phase, Deighton dTIMS, or InspectTech SMS;
- Implementing InspectTech SMS phase 2 to improve the bridge and culvert management system;
- Implementing Deighton dTIMS phase 2 and institutionalizing it as ODOT's enterprise pavement management system;
- Integrating systems to create an enterprise asset management system; and
- Implementing cross-asset trade-off analysis capabilities.

**Implement EIMS/AgileAssets Phase 2**

The current phase of EIMS/AgileAssets includes guardrails, non-overhead signs, and lands/buildings. The research team recommends that a second phase of EIMS/AgileAssets be conducted once the current phase is completed to include assets that are not included in the current phase or are pavements, bridges, or culverts. ODOT will be able to track all asset classes better after EIMS/AgileAssets phase 2, and will eventually be able to evaluate needs across all asset classes and effectively prioritize these needs.

**Implement InspectTech SMS Phase 2**

The current phase of InspectTech SMS will provide ODOT with a comprehensive inventory of all bridges, and ultimately, all culverts. An inventory management system for structures is essential. The deployment should continue to provide the ODOT structures inventory unless a thorough analysis is performed that clearly demonstrates that current deployment issues are irreconcilable and another solution would better provide an inventory management system. That said, the current phase does not include structures management capabilities that utilizes the structures inventory data to predict future bridge conditions or the ability to prioritize among different projects. These structures management capabilities are essential for ODOT to prioritize projects in a fiscally constrained environment and move to an enterprise asset management system. Phase 2 would require ODOT to evaluate the functionality of AASHTO's PONTIS structures management software or possibly Deighton dTIMS to provide all of ODOT's desired structures management capabilities and implementing the selected solution, integrating it with the structures inventory data provided through InspectTech SMS.

**Implement Deighton dTIMS phase 2 and institutionalize it as ODOT's enterprise pavement management system**

ODOT currently uses Deighton dTIMS as its pavement management system, and is in the process of implementing condition forecasting capabilities in the system. That said, Deighton dTIMS is currently not used extensively by ODOT staff. The research team recommends that ODOT institutionalize Deighton dTIMS to be used consistently across ODOT. The research team also recommends that ODOT evaluate opportunities to simplify or replace current custom components or peripheral systems used to pre-process data through third-party tools or potential incorporation of more data scrubbing in outsourced pavement data collection contracts.

**Integrate systems to create an enterprise asset management system**

The research team recommends that ODOT prepare a detailed set of requirements for an enterprise asset management system in parallel to the phase 2 implementations of EIMS/AgileAssets, InspectTech SMS, and Deighton dTIMS, and conduct a fit-gap analysis against the capabilities provided by these three systems. This will allow ODOT to determine a plan for integrating the systems effectively, using the elements of each system that will best meet ODOT's requirements.

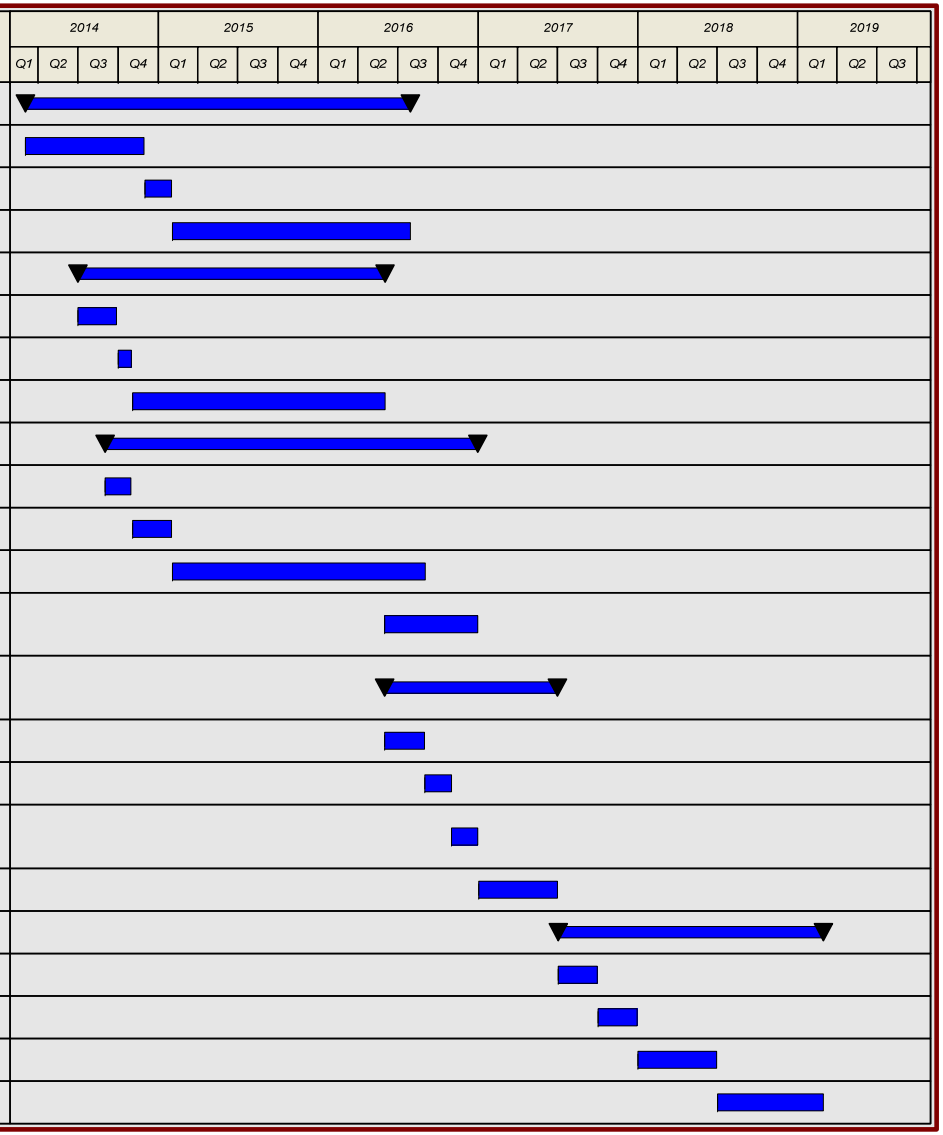
**Implement cross-asset trade-off analysis capabilities**

Cross-asset trade-off analysis is still evolving as an industry practice, and the available tools are evolving accordingly. The project team therefore recommends that ODOT evaluate available tools (including Deighton dTIMS and AgileAssets) to determine their cross-asset trade-off analysis capabilities close to the completion of previous steps (system phase 2 implementations). This will allow ODOT to accurately evaluate the capabilities of various systems and determine the best system for such analysis capabilities. ODOT should then undergo an implementation of a new cross-asset trade-off analysis system (or an upgrade of an existing system to add such capabilities) to reach a state-of-the art enterprise asset management system.

Figure 37 presents a high-level schedule for an Asset Management System Implementation.

## Figure 37: Asset Management System Implementation Plan

| ID | Task Name | Start | Finish | Duration |
|---|---|---|---|---|
| 1 | **Implement EIMS Phase 2** | **3/3/2014** | **7/29/2016** | **126w** |
| 2 | Define requirements and scope for phase 2 | 3/3/2014 | 11/28/2014 | 39w |
| 3 | Prepare detailed, resource-loaded schedule | 12/1/2014 | 1/30/2015 | 9w |
| 4 | Implement system and conduct testing | 2/2/2015 | 7/29/2016 | 78w |
| 5 | **Implement Inspectech SMS Phase 2** | **7/1/2014** | **6/1/2016** | **100.4w** |
| 6 | Define requirements and scope for phase 2 | 7/1/2014 | 9/26/2014 | 12.8w |
| 7 | Prepare detailed, resource-loaded schedule | 10/1/2014 | 10/30/2014 | 4.4w |
| 8 | Implement system and conduct testing | 11/3/2014 | 6/1/2016 | 82.6w |
| 9 | **Implement dTIMS Phase 2** | **9/1/2014** | **12/30/2016** | **122w** |
| 10 | Define requirements and scope for phase 2 | 9/1/2014 | 10/29/2014 | 8.6w |
| 11 | Prepare detailed, resource-loaded schedule | 11/3/2014 | 1/30/2015 | 13w |
| 12 | Implement system and conduct testing | 2/2/2015 | 9/1/2016 | 82.8w |
| 13 | Change management, including institutionalizing use of dTIMS across all districts | 6/1/2016 | 12/30/2016 | 30.6w |
| 14 | **Integrate Systems to Create an Enterprise Asset Management System** | **6/1/2016** | **6/30/2017** | **56.6w** |
| 15 | Define requirements for EAM system | 6/1/2016 | 8/30/2016 | 13w |
| 16 | Conduct fit/gap analysis against existing systems | 9/1/2016 | 10/31/2016 | 8.6w |
| 17 | Prepare plan to integrate systems, define systems of record, and required data flows | 11/1/2016 | 12/30/2016 | 8.8w |
| 18 | Undergo system integrations and testing | 1/2/2017 | 6/30/2017 | 26w |
| 19 | **Implement Cross-Asset Trade off Analysis Capabilities** | **7/3/2017** | **2/28/2019** | **86.8w** |
| 20 | Define requirements for cross-asset trade off analysis | 7/3/2017 | 9/29/2017 | 13w |
| 21 | Conduct fit/gap analysis against available systems | 10/2/2017 | 12/29/2017 | 13w |
| 22 | Prepare RFP and select vendor for implementation | 1/1/2018 | 6/29/2018 | 26w |
| 23 | Undergo system implementation and testing | 7/2/2018 | 2/28/2019 | 34.8w |



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### To-Be Applications Architecture

Implementation of the five key systems recommendations described in this sub-section will significantly transform ODOT's To-Be Applications Architecture. As the research team did for the As-Is Applications Architecture, the team provides two views of the To-Be Applications Architecture below. Both the systems view and the business process view for the Level 0 To-Be Architecture at two different points in time, July 2017 and July 2019, are depicted. As these are the Level 0 diagrams, please note they depict only the most important core ODOT systems and the key or high-level data flows between each of the systems. Readers are advised that the diagrams are not meant to represent all ODOT systems and interrelationships.

The following diagrams are provided on the pages below:

- Figure 38: To-Be Level 0 Systems View for July 2017;
- Figure 39: To-Be Level 0 Systems View for July 2019;
- Figure 40: To-Be Level 0 Business Process View for July 2017; and
- Figure 41: To-Be Level 0 Business Process View for July 2019.

Appendix 11 contains more detailed Level 1 Business Process schematics for each of the business areas from a July 2017 perspective. Appendix 12 contains more detailed Business Process schematics for each of the business areas from a July 2019 perspective.

Appendix 13 contains an inventory of the existing systems utilized on an enterprise basis with a specific recommendation for the future direction of each system. These recommendations include:

- **Keep** – Continue utilizing the system within the five-year planning window of the Enterprise Architecture project;
- **Enhance** – Continue utilizing the system within the five-year planning window of the Enterprise Architecture project and consider enhancing or extending the system to deploy additional capabilities within the software or to support additional ODOT business functionality;
- **Retire** – Retire the system within the five-year planning window, with potential strategies for retiring the system identified in the Notes/Comments column of the table; and
- **Evaluate** – Evaluate the system for potential retirement or modified usage within the five-year planning window, with potential strategies ODOT should evaluate identified in the Notes/Comments column of the table.

Based on the research team's analysis of the 236 ODOT and Partner-owned systems maintained in the application inventory, the research team made the following recommendations:

- Keep – 117;
- Enhance – 9;
- Retire – 64; and
- Evaluate – 36.

**Figure 38: To-Be Level 0 Systems View for July 2017**

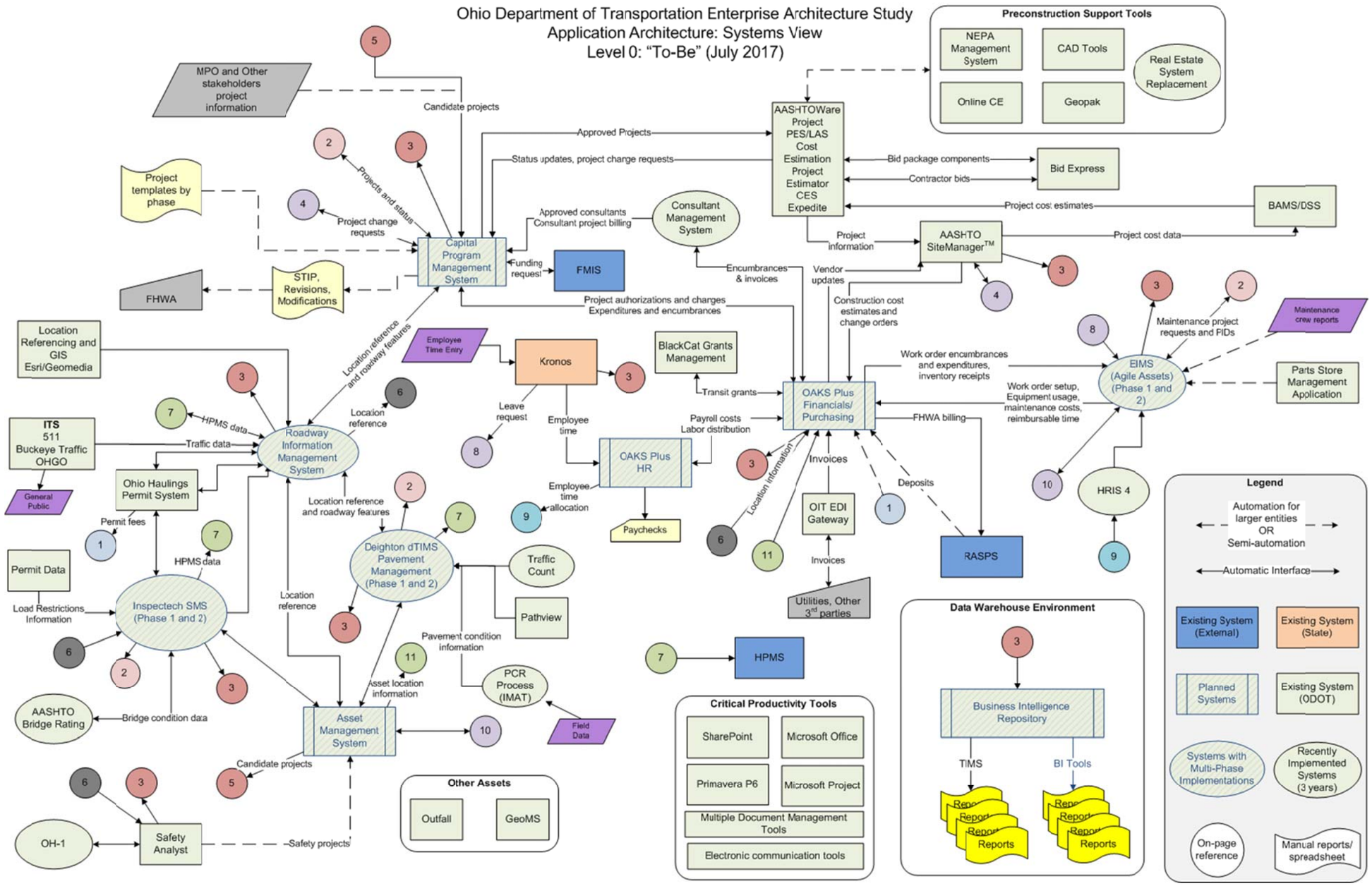


**Figure 39: To-Be Level 0 Systems View for July 2019**

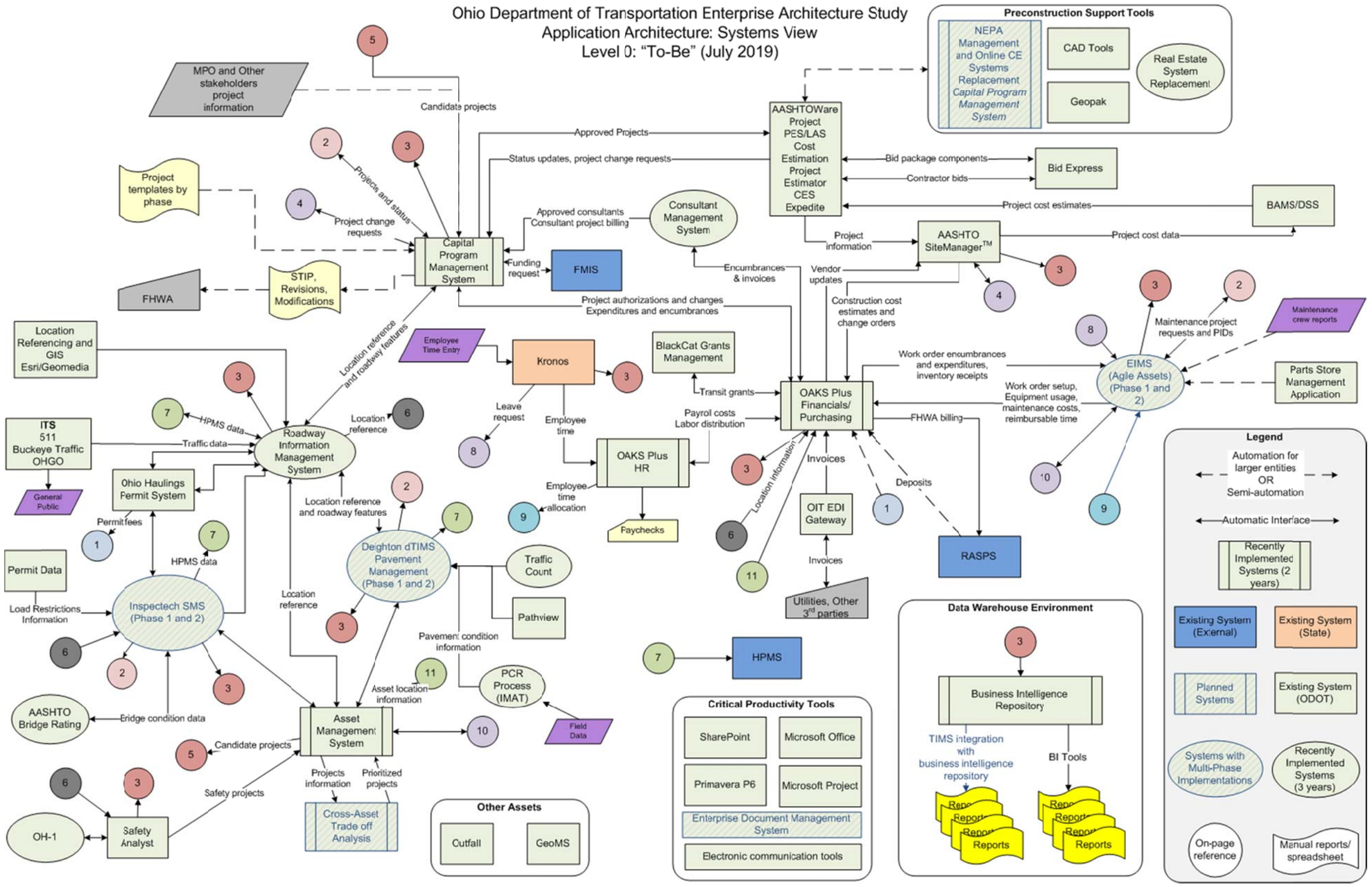
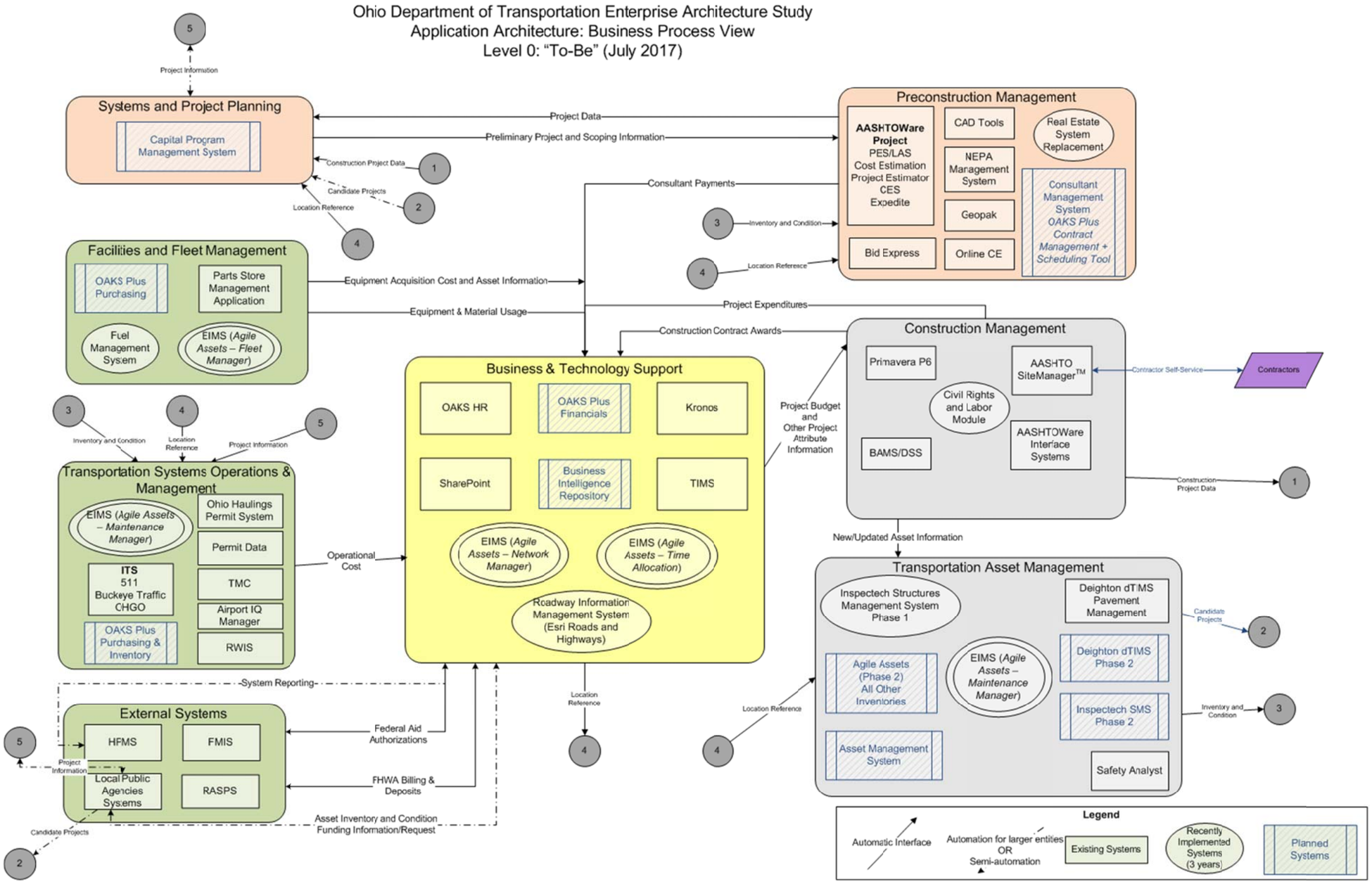
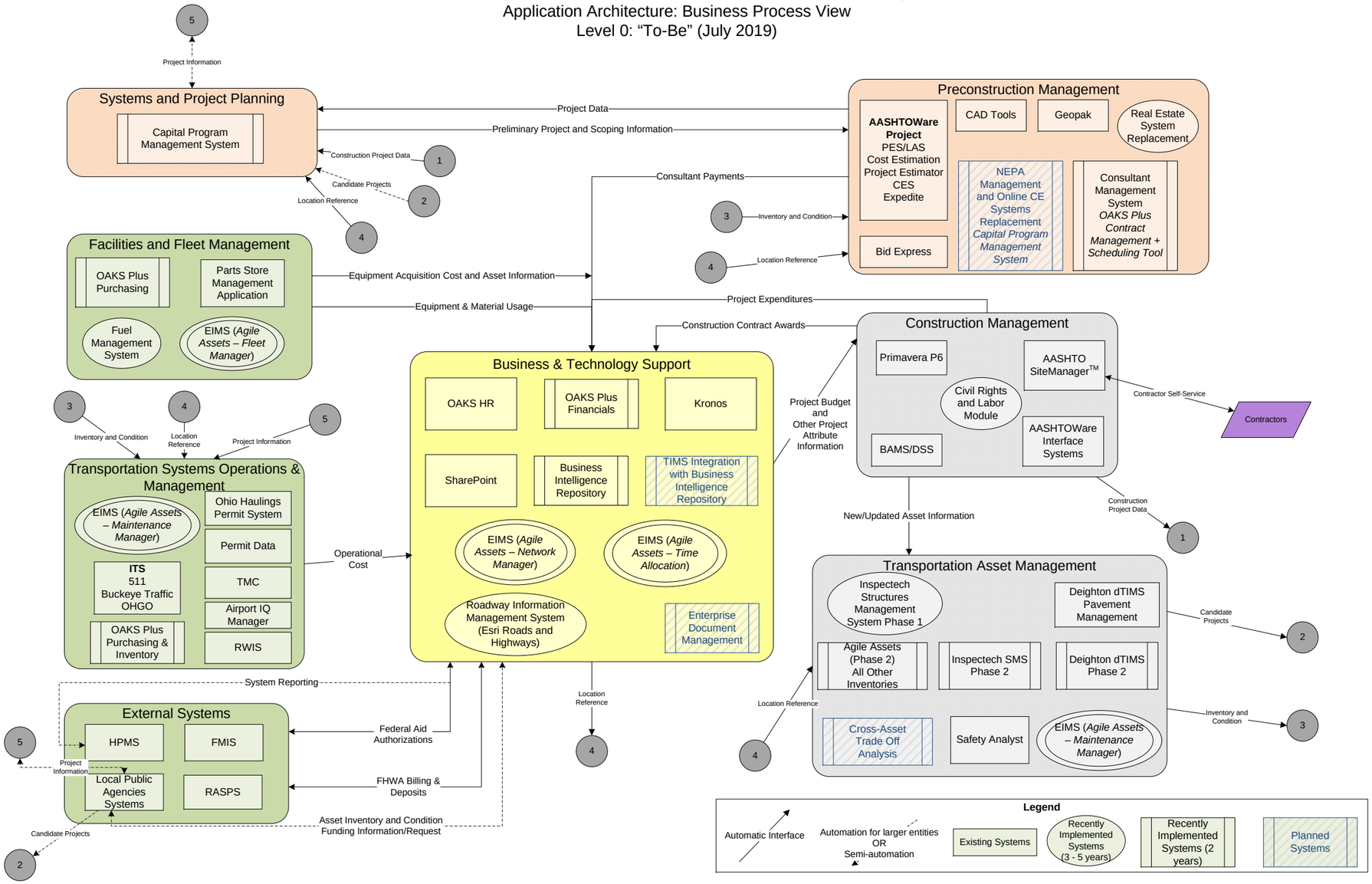


**Figure 40: To-Be Level 0 Business Process View for July 2017**



## Figure 41: To-Be Level 0 Business Process View for July 2019



## D. Conclusions and Recommendations: Data Architecture

The eVision Partners team concludes that ODOT does a good job in gathering information in various business functions and storing this information. The biggest limitation in this respect is ODOT's ability to consolidate these data to inform and support its decisions. Some staff members characterized the organization as being "data rich and information poor." The research team agrees with this assessment and believes that ODOT can achieve significantly better decision-making and decision-support capabilities by integrating available data.

Integrating data is generally achieved by some combination of two alternatives:

- Linking/integrating different system data sources so data can flow from one system to another electronically through an interface. This allows one system to dynamically use data stored in another system; and
- Extracting data from various systems into a central data warehouse, which then "translates" these data into a common language or platform, thus allowing users to holistically review and analyze these data.

As described in the Data Architecture section of this report, ODOT does have a robust data warehouse to store data but it has limitations on being able to extract these data. The Sybase IQ data warehouse and associated GQL reporting tool, while functioning as a productive reporting environment, has no analytical or business intelligence capabilities. It is the conclusion of the research team that ODOT is in need of a robust data warehouse with business intelligence capabilities that allows a wide range of users to access these data to perform business analytics so as to make more informed decisions.

**Recommendation Data Architecture – 3.1: Business Intelligence (BI) Repository**

The research team recommends ODOT transition from the existing GQL and geospatial data warehouse environment to a more robust, fully geospatially enabled BI environment. ODOT should define BI environment requirements and evaluate, select, and implement a BI environment, integrating this environment with OAKS Plus ERP and other core ODOT applications. The new BI toolset should provide the following types of capabilities:

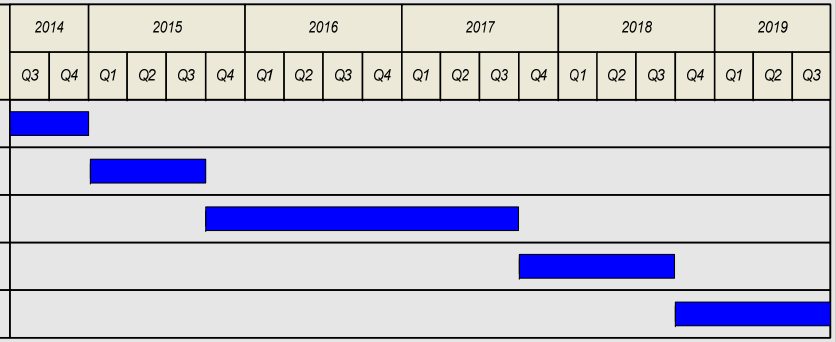
- End-user reporting and query tools;
- Online analytical processing tools to support multi-dimensional analysis;
- Management dashboards and other graphical presentation tools;
- Data mining tools; and
- Performance management and measurement tools.

Base requirements for the BI environment should be developed in parallel with the requirements gathering for OAKS Plus ERP. The BI capabilities can then be developed in stages. The first phase will begin with the OAKS Plus ERP and CPMS implementations in the summer of

2017. The next phases would continue the deployment of additional capabilities throughout 2018 and 2019 and would be dependent on timing of the deployment of additional asset management capabilities and other technologies. The proposed high-level work plan for the BI environment implementation is provided in Figure 42.

## Figure 42: Business Intelligence Environment Implementation Work Plan

| ID | Task Name | Start | Finish | Duration |
|---|---|---|---|---|
| 1 | Define Business Intelligence Requirements | 7/1/2014 | 12/31/2014 | 132d |
| 2 | Evaluate and Select Business Intelligence Tools | 1/5/2015 | 9/30/2015 | 193d |
| 3 | Implement BI Wave 1: OAKS Plus ERP and CPMS | 10/1/2015 | 9/29/2017 | 522d |
| 4 | Implement BI Wave 2: Enterprise Asset Management | 10/2/2017 | 9/28/2018 | 260d |
| 5 | Implement BI Wave 3: Other Functionality | 10/1/2018 | 9/30/2019 | 261d |



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## E. Conclusions and Recommendations: Technical Architecture

Over the years ODOT has been a leader in deploying leading-edge technical infrastructure within the Ohio government. The state CIO, for example, commended ODOT for being a leader in the implementation of VoIP a few years ago. While ODOT is to be commended for those efforts it is the conclusion of the research team that three significant issues are likely to impact ODOT from a technical architecture perspective in the very near future, namely the ODOT mainframe reaching an end-of-life status and the DAS IT Optimization and SOCC remediation projects.

**Recommendation Technical Architecture – 4.1: Mainframe System Replacement**

As described previously, ODOT currently has two IBM mainframes with storage environments. A number of applications still run in these environments, including two applications critical to ODOT, Appropriation Accounting and the Current Billing systems. These applications, at a minimum, will continue to run on the mainframe until OAKS Plus ERP is implemented. ODOT is planning to migrate the mainframes into the DAS data center and will engage third parties as required for support as an interim solution. However, the research team advocates proceeding more quickly with plans for the replacement of Appropriation Accounting and the Current Billing systems with an ERP solution. The research team's OAKS Plus ERP recommendation reflects a July 1, 2017 implementation date. In addition, the research team recommends establishment of a work team immediately to address migrating the remaining applications off the ODOT mainframes which are going to end-of-life status in December 2014.

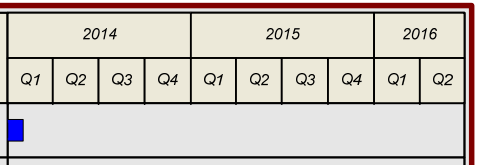
The mainframe systems retirement team would:

- Identify mainframe systems that would retire with Appropriations Accounting and the implementation of an ERP:
  - Prepare systems description, functions, and interface documentation, and
  - Communicate with the ERP requirements team to ensure the functionality is included in the ERP deployment; and
- Identify mainframe systems that would not retire concurrent with Appropriations Accounting and the implementation of an ERP:
  - Prepare systems description, function, and interface documentation, and
  - Identify alternative platforms or solutions to provide the functionality; and
- Develop and implement plans to remove the systems from the mainframe.

The research team recommends that the mainframe systems retirement issue be given a high priority and that the solutions be implemented to coincide with the implementation of the ERP. For those mainframe systems not associated with the ERP, it is recommended that solutions be developed and implemented by December 2015, using a project plan similar to that shown in Figure 43. The plan includes team selection and formation, preparation of system functionality and interfaces, identification of alternate solutions, implementation plans, and procurement and deployment of solutions.

## Figure 43: Mainframe Systems Retirement Team Project Plan

| ID | Task Name | Start | Finish | Duration |
|---|---|---|---|---|
| 1 | Team selection and formation | 1/1/2014 | 1/31/2014 | 4.6w |
| 2 | Validate listing of mainframe systems | 2/3/2014 | 2/28/2014 | 4w |
| 3 | **Identify mainframe systems associated with Appropriations Accounting** | **2/3/2014** | **6/30/2014** | **21.2w** |
| 4 | Prepare systems description, functions and interface documentation | 2/3/2014 | 6/30/2014 | 21.2w |
| 5 | **Identify mainframe systems not associated with Appropriations Accounting** | **2/3/2014** | **6/30/2014** | **21.2w** |
| 6 | Prepare systems description, functions and interface documentation | 2/3/2014 | 6/30/2014 | 21.2w |
| 7 | Identify alternative platforms or solutions to provide the functionality | 1/1/2015 | 12/31/2015 | 52.2w |
| 8 | Develop and implement plans to remove the systems from the mainframe | 1/1/2015 | 12/31/2015 | 52.2w |
| 9 | Procure and implement solutions | 1/1/2015 | 12/31/2015 | 52.2w |



## Recommendation Technical Architecture – 4.2: IT Optimization

As detailed in the IT Organization and Governance section above, DAS OIT is leading the implementation of two statewide information technology initiatives: IT Optimization and the SOCC Remediation. The SOCC Remediation includes a number of power, computing, operational improvements, and consolidation efforts at the SOCC which will result in the relocation of ODOT staff currently operating at the SOCC. The IT Optimization initiative is a significant transformation of how information technology is delivered for the State of Ohio and will likely result in some technology functions currently performed by ODOT being transitioned to DAS. ODOT staff members are currently engaged in these efforts. It is the conclusion of the research team that ODOT should seize these DAS OIT efforts as an opportunity to not only partner with DAS OIT in these efforts but to also nurture relationships up and down the ODOT and DAS organizations that could potentially benefit the ultimate implementation of an enterprise architecture.

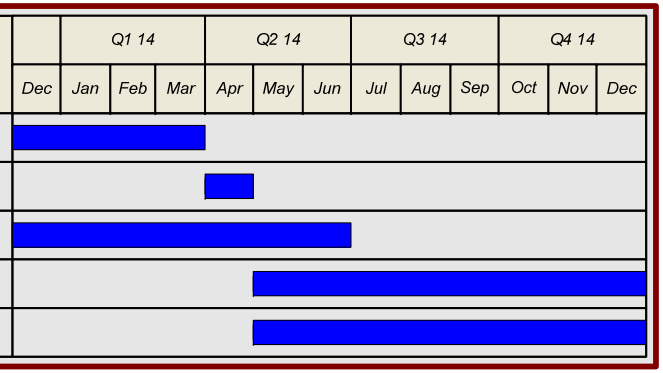
In addition, the research team believes that the IT Optimization initiative will provide ODOT executive management an opportunity to determine how to best optimize the use of its information technology headcount as the responsibility for most technical infrastructure components (and consequently some ODOT IT staff) shifts to DAS, allowing ODOT to focus more IT staff time on ODOT-specific applications which directly support ODOT business objectives.

ODOT is scheduled to move its current network and server environment from the ODOT managed area on the third floor of the SOCC to a DAS-managed area on the second floor of the SOCC in April 2014. The research team recommends that this move be done as a “lift and shift” with the equipment moved but responsibility for management remaining with ODOT for a transition period. This approach will reduce the overall business risk for both agencies by allowing additional time to establish what the specific responsibilities of DAS and ODOT will be and to develop clear service-level agreements between DAS and ODOT. The goal should be to complete the transition to DAS management likely from the operating system out (but the specific scope of DAS responsibilities still needs to be confirmed) by the end of December 2014.

Figure 44 provides an overview of an implementation plan for the IT Optimization initiatives.

## Figure 44: IT Optimization Plan

| ID | Task Name | Start | Finish | Duration |
|---|---|---|---|---|
| 1 | Plan Migration from Third Floor of SOCC | 12/2/2013 | 3/31/2014 | 86d |
| 2 | Move Equipment to Second Floor of SOCC | 4/1/2014 | 4/30/2014 | 22d |
| 3 | Define Go-Forward Business Plan and Supporting SLAs with DAS | 12/2/2013 | 6/30/2014 | 151d |
| 4 | Complete turnover to DAS management | 5/1/2014 | 12/31/2014 | 175d |
| 5 | Implement changes in DOIT organization and staffing | 5/1/2014 | 12/31/2014 | 175d |



**Recommendation Technical Architecture – 4.3: Partner Self-Service**

In numerous places in this report it is documented that there exists significant limitations on data and information sharing between the technology systems and staffs of ODOT. During the course of this project, the research team observed limited or no data sharing between ODOT and its transportation partners such as FHWA, MPOs, county engineers, contractors, consultants, and vendors. Some current systems provide "view only" access to data. In at least one system, county engineers are permitted to upload information but the full functionality of the system is prohibited. Some limited file sharing occurs with transportation partners through file transfer protocol sites. The research team found no ODOT or Ohio policies or statutes that would prohibit expanded secure access to ODOT systems as appropriate. It appears that the business areas of ODOT make the decisions regarding access to systems, or the technology staffs do not provide customer-friendly solutions to enable systems access or data transfers.

The research team has knowledge of other state departments of transportation that allow secured access to its systems. Contractors, given secured access to their projects, can prepare month estimates and proposed change orders within SiteManager, and track the work flow and approval of that estimate or change order. Consultants, with secured access for their projects, can access electronic plan rooms to post plans for review and approval, and retrieve marked up plan sheets. Vendors, including consultants and contractors, have secured access to ERP systems to review payment information. FHWA, granted broader access to the agency's ERP and other systems, get project authorization and modification requests, and project billings, but also dive into the transportation agency's systems for detailed information that supports the requests and billings. This increased access provides for the expedient transfer of information to the transportation partners. It also allows the agency to, in effect, outsource some of its administrative demands, and concentrate those resources on other core business functions.

The research team recommends that ODOT adopt a philosophy and policy for providing secured self-service access to its systems whenever it is in the best interest of ODOT and its transportation partners. Self-service access should be provided in a user-friendly manner that supports the expanded use of self-service and results in the increased number of transportation partners that self-serve. It is envisioned that this philosophy would be adopted by the ODOT Technology Council and would factor into the deployment of the enterprise architecture.

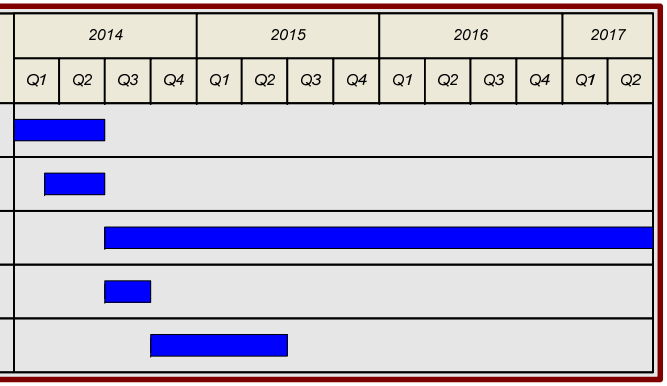
The research team recommends that ODOT, using the secured self-service access philosophy and policy adopted by the Technology Council, immediately begin to review its current systems to determine where increases in self-service access for transportation partners would be possible. For systems where self-service access is possible, project details should be developed and submitted for approval in accordance with the procedures of the Technology Council. Approved projects would proceed with the implementation of the self-service access.

It is recommended that this partner self-service be given a medium priority and that the recommendation be deployed with two timelines: the first being the adoption of the self-service philosophy and policy of the Technology Council, coupled with the provision of self-service functionality to accompany the ERP deployment in July 2017; and the second being self-

service access implemented on current systems where possible by July 1, 2015. A project plan, similar to that shown in Figure 45 below, that includes the adoption of a self-service philosophy, implementation of self-service functionality to accompany the ERP, evaluation of self-service capabilities of current systems, development of self-service project plans and submittal, and implementation of the self-service solutions should be considered.

## Figure 45: Partner Self-Service Recommendations Project Plan

| ID | Task Name | Start | Finish | Duration |
|---|---|---|---|---|
| 1 | Adopt self-service philosophy | 1/1/2014 | 6/30/2014 | 25.8w |
| 2 | Evaluate self-service capabilities of current systems | 3/3/2014 | 6/30/2014 | 17.2w |
| 3 | Implement self-service with ERP | 7/1/2014 | 6/30/2017 | 156.8w |
| 4 | Develop and submit plans | 7/1/2014 | 9/30/2014 | 13.2w |
| 5 | Implement self-service solutions | 10/1/2014 | 6/30/2015 | 39w |



**Recommendation Technical Architecture – 4.4: Enterprise Document Management**

Document management is defined as the electronic storage of document images. It is mentioned several times in this report in the Results/Findings section, as well as in this Conclusions and Recommendation section. Several document management initiatives are currently underway in ODOT. These document management initiatives are generally part of the deployment of a new system or upgrade of an existing system, and are being deployed to serve the needs of the business area deploying the technology or upgrade. The need for one document management technology solution to serve the universal needs of ODOT clearly exists. However, the research team recommends that ODOT consider document management in a much broader sense than technology.

Enterprise document management includes the policies, procedures, and processes for document retention, storage, retrieval, and preservation. It includes all ODOT documentation including paper documents, digital copies of paper documents, and electronic documents that are not printed, such as electronic files, data reports, and communication documents, such as email. A technology solution is needed to support the ODOT enterprise document management policies, procedures, and processes.

It is the recommendation of the research team that ODOT implement enterprise document management and that the recommendation be given a medium priority and be completed within a five-year time frame.

The recommendation priority and time frame are not based on the importance or need for enterprise document management in ODOT. Rather, the priority and time frame are based on the magnitude of effort to accomplish this implementation, which with a shorter time frame, would be occurring at the same time that ODOT would be implementing several other major recommendations presented in this report.

Additionally, the implementation of enterprise document management, that predominantly requires the electronic storage of documents, requires a significant cultural shift of the staff that has heretofore relied on paper documents or the electronic document management system used by their business area. The implementation of other major recommendations in this report will likewise require significant cultural shifts of the staff. The research team recognizes that there may be limits to the number of changes that the staff can absorb at the same time.

The research team recommends that ODOT continue in its current direction of deploying document management that serves the business areas, as well as utilizing the document management capabilities of services currently provided by DoIT until enterprise document management is deployed in ODOT.

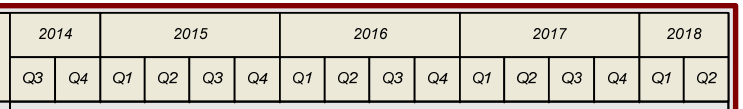
It is recommended that activities for deploying enterprise document management in ODOT begin in fiscal year 2014-2015 and be implemented by the end of fiscal year 2017-2018 using a

project plan similar to that shown in Figure 46. The plan includes the following items as well as project management and change management activities throughout the life of the project:

- Creating, chartering, and forming a team;
- Developing an RFP to solicit, select, and contract with a consultant specializing in document management to assist the team in performing the following tasks:
  - Inventorying all ODOT documents including paper and electronic storage, and storage systems;
  - Reviewing current ODOT and State of Ohio document management policies and statutes;
  - Developing and implementing ODOT enterprise document management policies, procedures, and processes;
  - Developing an RFP to solicit, select, and contract the implementation of a document management technology solution;
  - Implementing the solution;
  - Providing post production support; and
  - Conducting staff training.

## Figure 46: Enterprise Document Management Recommendations Project Plan

| ID | Task Name | Start | Finish | Duration |
|---|---|---|---|---|
| 1 | Create team, chartering and formation | 7/1/2014 | 12/31/2014 | 26.4w |
| 2 | Develop RFP to solicit, select, and contract a document management consultant | 1/1/2015 | 6/30/2015 | 25.8w |
| 3 | Inventory all ODOT documents including paper and electronic storage | 7/1/2015 | 6/30/2016 | 52.4w |
| 4 | Review current ODOT and State of Ohio document policies and statutes | 7/1/2015 | 6/30/2016 | 52.4w |
| 5 | Develop and implement ODOT enterprise document management policies, procedures, and processes | 10/1/2015 | 6/30/2016 | 39.2w |
| 6 | Develop an RFP to solicit, select, and contract the implementation of a document management technology solution | 6/30/2016 | 12/30/2016 | 26.4w |
| 7 | Implement solution | 1/2/2017 | 3/30/2018 | 65w |
| 8 | Conduct staff training | 1/1/2018 | 3/30/2018 | 13w |
| 9 | Post production support | 4/2/2018 | 6/29/2018 | 13w |
| 10 | Project management and change management activities | 7/1/2014 | 6/29/2018 | 208.8w |



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# VI. Implementation Plan for Recommendations

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

- Prioritization of recommendations;
- Order-of-magnitude cost estimate;
- Proposed work plan for implementation of recommendations;
- Anticipated benefits from the implementation of the Enterprise Architecture program recommendations at ODOT;
- Risk management plan; and
- Organizational change management strategy to guide implementation activities.

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## A. Prioritization of Recommendations

Table 13 outlines the research team's prioritization of each of the ODOT Enterprise Architecture program recommendations. These priorities are based both on the anticipated business value to ODOT of implementing the recommendation and the relative priority of the recommendation in terms of its role as a building block to execution of the Enterprise Architecture program. For example, technology governance and the re-alignment of some ODOT information technology staff are key elements that need to be in place to execute other recommendations. Likewise, the new Roadway Information Management System is a core application that is utilized by many ODOT applications for location referencing and attribute information.

**Table 13: Prioritization of Enterprise Architecture Recommendations**

| # | Area | Recommendation | Priority | Start | Finish |
|---|---|---|---|---|---|
| 1.1 | Business Architecture | Technology governance structure including a technology investment prioritization process | High | 1/1/14 | 12/31/14 |
| 1.2 | | Transformation of ODOT technology staffing | High | 2/3/14 | 12/31/14 |
| 2.1 | Applications Architecture | OAKS Plus ERP | High | 1/6/14 | 12/29/17 |
| 2.2 | | Capital Program Management System | High | 7/1/14 | 12/29/17 |
| 2.3 | | Capital Project Delivery System – Phase 1 | High | 12/2/13 | 9/30/15 |
| 2.3 | | Capital Project Delivery System – Phase 2 | Medium | 7/1/16 | 12/31/18 |
| 2.4 | Applications Architecture | Roadway Information Management System | High | 11/1/13 | 12/31/15 |
| 2.5 | | Continue enhancements to asset management tools and develop an enterprise asset management system | Medium | 3/3/14 | 2/28/19 |
| 3.1 | Data Architecture | BI environment | Medium | 7/1/14 | 9/30/19 |

| # | Area | Recommendation | Priority | Start | Finish |
|---|---|---|---|---|---|
| 4.1 | Technical Architecture | Capital mainframe replacement project | High | 1/1/14 | 12/31/15 |
| 4.2 | | IT Optimization | High | 12/2/13 | 12/31/14 |
| 4.3 | | Partner self-service | Medium | 1/1/14 | 6/30/15 |
| 4.4 | | Enterprise Document Management System | Medium | 7/1/14 | 6/29/18 |

## B. Order of Magnitude Cost Estimate

Table 14 provides an order of magnitude cost estimate for each proposed recommendation in the Enterprise Architecture program. These cost estimates have been prepared based on the research team's experience with similar projects in other states and/or based on the cost of recent initiatives similar in scope in other states. This cost estimate is intended to be used for high-level program level planning and budgeting purposes only. Each recommended project will be expected to go through the proposed project scoping and screening process during which a more detailed cost estimate will be prepared.

**Table 14: Order of Magnitude Cost Estimates for Enterprise Architecture Recommendations**

| # | Area | Recommendation | Estimated Cost | Estimating Basis |
|---|---|---|---|---|
| 1.1 | Business Architecture | Technology governance structure including a technology investment prioritization process | $75,000 - $100,000 | • Limited external implementation support<br>• Development of scoping and screening tools |
| 1.2 | | Transformation of ODOT technology staffing | $25,000 - $50,000 | • Limited external implementation support |
| 2.1 | Applications Architecture | OAKS Plus ERP | $20MM - $22MM | • Prior team experience<br>• Cost of recent ERP implementation projects, especially those for state DOTs only or where state DOT was the pilot for a statewide project<br>• Cost estimate includes requirements definition and other pre-planning activities, the RFP process, and implementation services |

| # | Area | Recommendation | Estimated Cost | Estimating Basis |
|---|---|---|---|---|
| 2.2 | | Capital Program Management System | $6MM - $8MM | • Prior team experience<br>• Cost estimate includes requirements definition and other pre-planning activities, the RFP process, and implementation services |
| 2.3 | | Capital Project Delivery System – Phase 1 | $2MM - $3MM | • Prior team experience |
| 2.3 | | Capital Project Delivery System – Phase 2 | $2MM - $3MM | • Prior team experience |
| 2.4 | | Roadway Information Management System | $3MM - $4MM | • Prior team experience |
| 2.5 | | Continue enhancements to asset management tools and develop an enterprise asset management system | $7MM - $9MM | • Prior team experience<br>• Cost estimate includes requirements definition and other pre-planning activities, the RFP process, and implementation services |
| 3.1 | Data Architecture | BI environment | $3MM - $5MM | • Prior team experience |
| 4.1 | Technical Architecture | Mainframe systems replacement project | $2MM - $3MM | • Cost estimate includes cost of replacing systems that are not part of the OAKS Plus ERP project |

| # | Area | Recommendation | Estimated Cost | Estimating Basis |
|---|---|---|---|---|
| 4.2 | | IT Optimization | $300,000 - $400,000 | • Cost estimate includes cost of equipment move and any other external support to plan and manage migration and transition of responsibility from ODOT to DAS |
| 4.3 | | Partner self-service | $1MM - $2MM | • Prior team experience |
| 4.4 | | Enterprise Document Management System | $2MM - $3MM | • Prior team experience<br>• Cost estimate includes requirements definition and other pre-planning activities, the RFP process, and implementation services |

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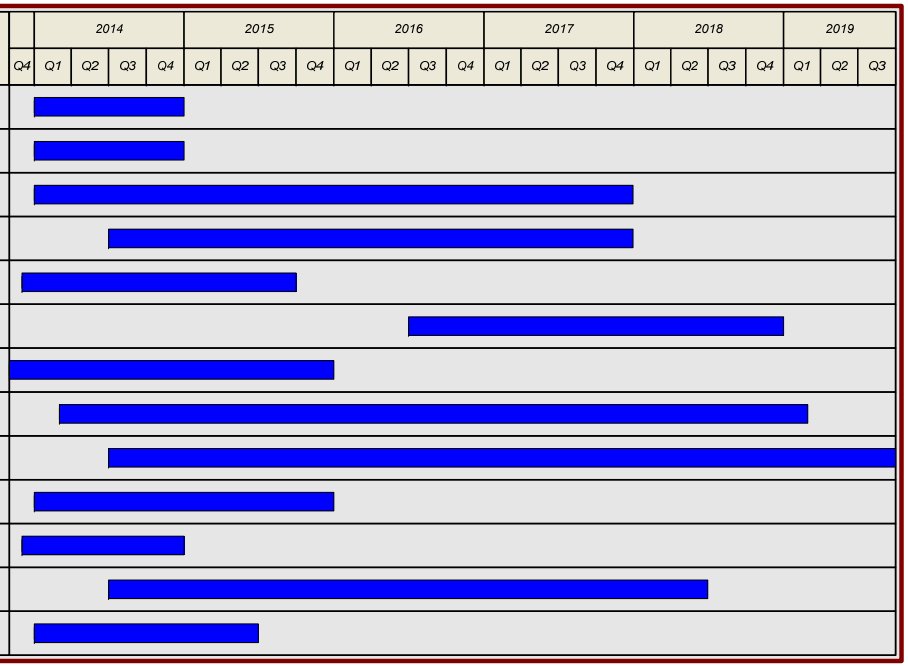
## C. Proposed Implementation Work Plan

Based on the relative prioritization of each recommendation, as well as the complexity, cost and risk to implement, the research team developed a multi-year implementation plan for the ODOT Enterprise Architecture program. As requested by ODOT, the research team segmented this plan into a short-term plan that outlines milestones which can be accomplished over the next two years and a longer-term plan for completing all recommendations within the Enterprise Architecture program. Figure 47 provides a high-level work plan for the entire ODOT Enterprise Architecture program. Figure 48 outlines the short-term work plan for the next two years.

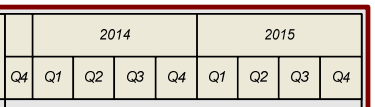
## Figure 47: ODOT Enterprise Architecture Overall Work Plan

| ID | Task Name | Start | Finish | Duration |
|---|---|---|---|---|
| 1 | 1.1 Technology Governance Structure | 1/1/2014 | 12/31/2014 | 52.2w |
| 2 | 1.2 Transformation of ODOT Technology Staffing | 1/1/2014 | 12/31/2014 | 52.2w |
| 3 | 2.1 OAKS Plus ERP | 1/1/2014 | 12/29/2017 | 208.6w |
| 4 | 2.2 Capital Program Management System (CPMS) | 7/1/2014 | 12/29/2017 | 182.8w |
| 5 | 2,3 Capital Project Delivery System – Phase 1 | 12/2/2013 | 9/30/2015 | 95.6w |
| 6 | 2.3 Capital Project Delivery System – Phase 2 | 7/1/2016 | 12/31/2018 | 130.4w |
| 7 | 2.4 Roadway Information Management System | 11/1/2013 | 12/31/2015 | 113w |
| 8 | 2.5 Enterprise Asset Management System | 3/3/2014 | 2/28/2019 | 260.8w |
| 9 | 3.1 Business Intelligence Environment | 7/1/2014 | 9/30/2019 | 274w |
| 10 | 4.1 Mainframe Replacement Project | 1/1/2014 | 12/31/2015 | 104.4w |
| 11 | 4.2 IT Optimization | 12/2/2013 | 12/31/2014 | 56.6w |
| 12 | 4.3 Enterprise Document Management | 7/1/2014 | 6/29/2018 | 208.8w |
| 13 | 4.4 Partner Self-Service | 1/1/2014 | 6/30/2015 | 78w |



## Figure 48: ODOT Enterprise Architecture Two-Year Work Plan

| ID | Task Name | Start | Finish | Duration |
|---|---|---|---|---|
| 1 | 1.1 Technology Governance Structure | 1/1/2014 | 12/31/2014 | 52.2w |
| 2 | 1.2 Transformation of ODOT Technology Staffing | 1/1/2014 | 12/31/2014 | 52.2w |
| 3 | **2.1 OAKS Plus ERP – Pre-Implementation** | **1/6/2014** | **12/31/2015** | **103.8w** |
| 4 | Pre-planning and requirements definition | 1/6/2014 | 2/27/2015 | 60w |
| 5 | OAKS Fit/Gap and Solution Design | 1/1/2015 | 6/30/2015 | 25.8w |
| 6 | RFP Preparation and Integrator Selection | 1/1/2015 | 12/31/2015 | 52.2w |
| 7 | **2.2 CPMS – Pre-Implementation** | **7/1/2014** | **12/31/2015** | **78.6w** |
| 8 | Pre-planning and requirements definition in conjunction with ERP | 7/1/2014 | 2/27/2015 | 34.8w |
| 9 | Solution Design | 1/1/2015 | 4/30/2015 | 17.2w |
| 10 | RFP Preparation and Integrator Selection | 1/1/2015 | 12/31/2015 | 52.2w |
| 11 | 2,3 Capital Project Delivery System – Phase 1 | 12/2/2013 | 9/30/2015 | 95.6w |
| 12 | 2.4 Roadway Information Management System | 11/1/2013 | 12/31/2015 | 113w |
| 13 | **2.5 Enterprise Asset Management System – Enhance existing tools** | **1/1/2014** | **12/31/2015** | **104.4w** |
| 14 | Implement enhanced capabilities in existing asset mgmt tools | 1/1/2014 | 12/31/2015 | 104.4w |
| 15 | **3.1 Business Intelligence Environment – Pre-Implementation** | **7/1/2014** | **9/30/2015** | **65.4w** |
| 16 | Requirements Definiton and Tools Selection | 7/1/2014 | 9/30/2015 | 65.4w |
| 17 | 4.1 Mainframe Replacement Project | 1/1/2014 | 12/31/2015 | 104.4w |
| 18 | 4.2 IT Optimization | 12/2/2013 | 12/31/2014 | 56.6w |
| 19 | **4.3 Enterprise Document Management - Start-up** | **7/1/2014** | **12/31/2015** | **78.6w** |
| 20 | Pre-planning and requirements definition | 7/1/2014 | 12/31/2014 | 26.4w |
| 21 | RFP and Consultant Selection | 1/1/2015 | 6/30/2015 | 25.8w |
| 22 | Begin document inventory | 7/1/2015 | 12/31/2015 | 26.4w |
| 23 | 4.4 Partner Self-Service | 1/1/2014 | 6/30/2015 | 78w |



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## D. Anticipated Benefits from Implementation

Based on both the experience of the research team with other state departments of transportation and the experience of other organizations, there are a number of potential benefits from the implementation of an Enterprise Architecture program. These benefits relate both to the implementation of the Enterprise Architecture program itself as well as benefits from specific project initiatives included within the Enterprise Architecture program recommendations.

**Benefits from Implementation of an Enterprise Architecture program**

The specific benefits directly attributable to an Enterprise Architecture program include:

- Structured documentation of an organization's business drivers which promote better planning and decision making;
- Improved communication and collaboration. This includes communication both within the business organization and between business units and the technology organizations. It also includes establishment of a standardized vocabulary for individuals to utilize when talking about technology requirements;
- Business-centric architectural views which:
  - Help to communicate the complexity of large systems,
  - Depict interaction between systems, and
  - Facilitate on-ongoing management of complex environments; and
- A focus on the strategic use of emerging technologies which:
  - Drives implementation of business efficiencies,
  - Drives process standardization, and
  - Better enables the business to meet changing requirements; and
- Improved sharing of information across the enterprise by promoting both:
  - Consistency, accuracy, and timeliness of information, and
  - Integrity, quality, availability, and access to information; and
- Structured technology investment process which:
  - Identifies benefits, impacts, and life-cycle cost of proposed technology projects,
  - Analyzes in a consistent way alternatives, risks, and trade-offs, and
  - Prioritizes candidate projects based on business value; and

- Better leveraging of technology spend by:
  - Building more quality and flexibility into applications without increasing cost,
  - Achieving economies of scale through sharing services, and
  - Expediting integration of both legacy and new systems.

**Benefits from Projects Recommended Through the Enterprise Architecture program**

In addition to benefits attributable to the Enterprise Architecture program directly, there are also potential benefit streams from the implementation of the project recommendations contained within the Enterprise Architecture program. Based on the research team's experience implementing ERP, program and project management, and enterprise asset management initiatives in other state departments of transportation, the research team would expect ODOT to achieve many of the following benefit streams:

- Increased efficiency in the delivery of the transportation program:
  - Reduction in the cost to deliver a project through improved program and project management tools including enhanced project budgeting and costing,
  - More cost-effective project programming decisions through enhanced needs identification, project scoping, project prioritization, and selection tools, and
  - Reduction in construction contract change orders, claims, project delays, and overruns through more effective contract management and monitoring tools; and
- Improved management of assets and consumable inventory:
  - More effective use of the existing 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, and
  - Reduced spend on consumable inventory by reducing inventory turns and more frequently negotiating volume discounts; and
- Automation, streamlining, and consolidation of accounting and other support functions:
  - Opportunity to redirect the time of some accounting, timekeeping, payroll, and procurement staff through capturing data at the source, and through the use of employee and vendor self-service capabilities; and
- Enhanced billing and revenue collection practices:
  - Ability to improve collection rates for accounts receivable through enhanced billing, collection, and monitoring, and
  - Ability to offset receivables from and payables to local jurisdictions and other entities through the use of common identifiers and enhanced collection management capabilities; and

- Enhanced procurement practices:
  - Ability to take discounts on vendor payments through enhanced accounts payable management capabilities; and
- Reduced information technology costs:
  - Decommissioning of the ODOT mainframe environment, and
  - Redirection of some ODOT information technology staff to supporting programmatic business applications by leveraging the OAKS Plus ERP as the department's financial and procurement management system and through the potential elimination of approximately 100+ systems/applications within the ODOT application portfolio; and
- Leveraging modern technologies to better enable increased efficiency and effectiveness throughout ODOT:
  - More effectively meeting current ODOT business requirements and providing a platform for more easily addressing changes in ODOT's business needs in the future,
  - Improved customer service to ODOT partners and employees,
  - Implementing standardized reporting capabilities with timely and accurate data,
  - Implementing electronic workflow and approval capabilities for many ODOT business functions,
  - Eliminating or significantly reducing the number of silo systems within ODOT,
  - Accurately capturing and securely storing ODOT data,
  - Incorporating self-service functionality for employees, partners and suppliers, and
  - Providing improved performance measurement capabilities through the new BI environment.

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## E. Risk Management Plan

The research team recommends that ODOT implement a proactive risk management plan in support of the implementation of the recommendations from the ODOT Enterprise Architecture program.

The objectives of project risk management are to decrease the probability and impact of events adverse to the project. Risk management begins during overall program planning and then is initiated 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. Any assumptions made in the development of a plan, schedule, or resource allocation should be considered for documentation 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 15 identifies potential risks to the success of the ODOT Enterprise Architecture program and delineates potential mitigation strategies to address these risks. This list should be regularly reviewed and updated throughout program execution.

**Table 15: Critical Potential Implementation Risks and Proposed Strategies to Mitigate**

| Risk Description | Risk Response Strategy and Notes |
|---|---|
| Need to change existing business process to effectively proposed software solutions | • Establish organizational change management program<br>• Engage stakeholders from various business units in defining process changes |
| Inconsistent processes and standards across ODOT business units could impact drive to standardize business processes | • Establish organizational change management program<br>• Engage stakeholders from various agencies in defining process changes |
| Concern in various ODOT business units about apparent loss of tailored functionality | • Encourage early involvement by key business units<br>• Ensure Change Management and Communication Plan emphasizes benefits of enterprise solution<br>• Ensure consistent and ongoing senior management support |

| Risk Description | Risk Response Strategy and Notes |
|---|---|
| Changes in ODOT executive management can impact program execution | • Immediately brief new management on program objectives and status<br>• Implement Technology Council to manage program with a mix of executive-level policymakers and senior-level career staff<br>• Engage continuing Technology Council members to assist in presenting program benefits to new management team members<br>• Include career staff in key roles responsible for managing program execution for continuity |
| Delay in obtaining funding for all or part of proposed program effort | • Actively engage with stakeholders and policymakers to obtain approval<br>• Revisit budgets regularly; economic factors should be on agenda for discussion at Technology Council meetings where appropriate<br>• Adjust program schedule as necessary based on timing of funding<br>• Identify activities that could continue in the interim (process analysis, etc.) to maintain momentum |
| Less funding than requested is approved for the program effort | • Actively engage with stakeholders and policymakers to obtain approval<br>• Revisit budgets regularly; economic factors should be on agenda at Technology Council for discussion where appropriate<br>• Adjust scope and/or program schedule as necessary based on timing of funding |
| Challenges in aligning ODOT Enterprise Architecture program schedule with OAKS Roadmap | • Initiate early discussions with the OAKS team and continue dialogue throughout planning process<br>• ODOT should participate in requirements and fit-gap process for planned PeopleSoft upgrades |

| Risk Description | Risk Response Strategy and Notes |
|---|---|
| Policy issues not resolved in a timely manner | • Initiate early discussions<br>• Monitor and track resolution<br>• Ensure management understands required timeline for resolution and cost/schedule impact of not resolving |
| Difficulty in getting project stakeholders to take an enterprise view and/or in reaching consensus on enterprise needs versus needs of specific agencies | • Encourage stakeholders to take "business unit" hat off and put "ODOT" hat on during project activities<br>• Encourage team members to explain "why something can't work for me"<br>• Identify and communicate benefits of enterprise solution to team members |
| Specialized requirements or significant gaps identified in one or more business units within ODOT | • Assess potential for modifying business processes in individual business units or modifying enterprise process slightly<br>• Assess need for additional third-party software and/or minor customizations as a last resort<br>• Encourage active executive sponsorship to help resolve concerns of specific business unit managers |
| Desired business benefits not achieved | • Adhere to requirements, involve stakeholders and tie scope decisions to performance measures and anticipated benefits to ensure success<br>• Incorporate business process training and mentoring into the work plan |
| Staff not being able to participate in workshops or review deliverables within schedule | • Utilize a project approach that leverages best practices as a starting point for discussions to better leverage staff time<br>• Proactively identify resource constraints and escalate in a timely manor<br>• Re-assign some responsibilities of key extended team members<br>• Reprioritize some activities assigned to extended team members |

| Risk Description | Risk Response Strategy and Notes |
|---|---|
| Project scope too large or complex and/or implementation strategy attempts to implement too much at one time | • Establish implementation plan, carefully developed and linked to business benefits<br>• Link project scope to business benefits<br>• Careful review by ODOT Technology Council of requirements and implementation plan before approving implementation go-ahead<br>• Develop scope change process that requires demonstrated link to targeted business benefits and program steering committee approval of any proposed scope changes |
| Availability of ODOT, OAKS, and other DAS resources (business and technical) to support implementation | • Develop detailed estimates of resource requirements as early as possible as part of pre-implementation planning<br>• Develop an implementation strategy and work plan that is in sync with availability of State resources<br>• Obtain specific commitment of resources from ODOT and other agency management prior to start of implementation |
| Delay in implementation of one project component within the overall program could impact the remainder of the schedule and affect stakeholder confidence | • Establish reasonable schedule for all projects within the program including schedule contingency<br>• Plan for multiple project implementation teams to allow for balance of deployment work and production support of components already deployed |
| Need to provide large number of employees with training on various new system functions | • Initiate organizational change management program from start of program<br>• Develop training strategy for each project component early and monitor status of training effort closely |

| Risk Description | Risk Response Strategy and Notes |
|---|---|
| Complexity of integrating new ERP with existing legacy applications | • Develop interface strategy that utilizes same layout and format used today where possible<br>• Ensure early engagement of business and IT owners of these other systems |
| Complexity of converting data from Appropriations Accounting and multiple ODOT shadow systems into new OAKS Plus ERP solution | • Ensure adequate time is included in the OAKS Plus ERP project schedule for assessment of conversion requirements and design of load routines from existing ODOT systems to put data into standard formats required by PeopleSoft |

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# VII. Change Management Strategy

This sub-section describes eVision Partners team's recommended approach to organizational change management in support of the implementation of the ODOT Enterprise Architecture program. 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.

A senior state transportation official, after the successful implementation of major technology changes at the agency, said, "At the end of the day, the technology part of the project was easy. It was the people part of the project that was hard."

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 very accustomed to "their" systems and ways of doing their business. Accepting change is not easy for many people. For some people accepting change is very hard. An agency's ability to successfully manage change can often be the difference in whether or not the effort is successful.

In this section the research team provides an overview of change management principles and practices, and a description of a typical change management plan. The section also provides 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 enterprise resource planning and capital program management.

## Overview

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 life cycle and have dedicated resources assigned to it. Demonstrating a focus on organizational change management throughout the project can result in achieving an acceptance or preferably an embracement of the change throughout the organization. Effective communication to keep staff informed, define staff expectations, and resolve issues can positively impact acceptance of the change.

The need for committed sponsorship cannot be overstated and is absolutely 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 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 several offices and business areas, the sponsor or sponsors should be members of the executive level of the organization. If the change is to affect multiple offices of an organization or multiple organizations, often executive sponsorship teams with members representing the different offices or organizations are utilized. An executive sponsor or sponsors are usually appointed to coordinate the team's efforts.

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 system is designed for the normal work of the organization and may have been the cause of the need for change. Also, 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 of the work 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 change management plan and requiring that all of the steps of the plan be complete and critical issues addressed. The use of a change management plan can not only guide a change initiative, but establish the overall importance of the change and its priority to the organization.

### 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 – A clearly defined reason for change must be communicated. The change sponsors must market that reason so staff members who have been performing functions in a particular way for many years can embrace the reason for change. Often staff members will be quick to ask, "What is wrong with the way that we currently do it?" Whenever possible, the reason for change should be supported by data and facts. The proverbial WIIFM question will come up, "What's in it for me?" The reason for change should be comprehensive enough so that staff members can see their functions in the reason. Through the reasons for change, the sponsor should consider what questions might be asked and 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 can be done after the change that cannot currently be done, what cost savings will occur, or 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 best 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 validate 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 hopefully doing 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. The importance of communicating successes cannot be overstated, especially if the 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 who will be impacted 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.

### Enterprise Architecture Change Management Strategies

As stated in the previous section, a key to managing change is the development of a change management plan. Development of the plan requires that the case for change, the change vision, and change objectives be clearly presented. 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 the architecture.

Chief among those affected by the enterprise architecture will be the business area leaders who will no longer be allowed to "do their own thing." The change management plan should place a specific focus on addressing their change needs. These business area leaders are the leadership foundation of the organization. Once they become committed to the enterprise architecture, and associated policies and procedures, the rest of the organization will follow. If they resist or act negatively to the enterprise architecture, so will their staffs. It is important to not only convince them of the need for the enterprise architecture, but to train them on the new policies and processes. It may be necessary to provide support to them in using the new

policies and processes. In doing so, they may understand that their needs can be met while following the enterprise architecture's policies and procedures, which support the overall technology needs of ODOT. That support should allay concerns about the policies and procedures being onerous and bureaucratic.

It is the recommendation of the research team that this report provide the basis for an enterprise architecture change management plan. The reason for change is established throughout the report, as is a change vision. Change objectives can be developed using the recommendations presented. The change sponsorship can begin with the Enterprise Architecture Steering Committee and transition to the ODOT Technology Council once established. The draft technology governance policies and procedures can form the basis for the adoption of policies, procedures, and processes to implement the plan. The IT organizational recommendations can provide resources to support the implementation of the enterprise architecture, and support the business areas in adopting and using the established enterprise architecture policies and procedures.

### Project-Specific Change Management Strategies

Significant technology projects, such as the implementation of an ERP or the development of a capital program management system, require project-specific change management plans. The reason for the change and project vision and objectives should be clearly and consistently presented. However, the remaining elements of the plan should be focused on specific needs determined by the answer to question asked above concerning who will be affected by the change. It may be in the best interest of the organization to develop separate change management plans to support the needs of the people affected by the plan.

A plan can be developed to target the project team and staff expected to support them. 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 an implementation of a new technology can be measured in the time that it takes for an organization to exceed their normal productivity levels. Key to that success is managing the change for the people who will be required to abandon their old methods of doing their work while learning to do their work with a new technology. A separate plan can be developed for those staff members who are not part of the project team. 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.

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# Appendices

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# Appendix 1: Best Practices Workshops and Attendees

### Transportation Asset Management and Maintenance Management – July 16, 2013

| | | |
|---|---|---|
| Scott Phinney | Dave Blackstone | David Humphrey |
| Drew Williams | Brian Schleppi | Matt Larch |
| Daniel Barr | Wendy Flowers | Steve Taliaferro |
| Mike Orndorf | Tim Keller | Ellen Hall |
| Dave Gardner | Thomas Lyden | |

### Financial Management/Enterprise Resource Planning – July 17, 2013

| | | |
|---|---|---|
| Mike Cope | Matt Downs | Mark Jackson |
| Jim Snyder | Adam Makuley | Helen Kelly |
| Jana Cassidy | Chrystal Beacom | Katie Wood |

### Enterprise Architecture – July 29, 2013

| | | |
|---|---|---|
| Scott Phinney | Jayne Barker | Rachel Lewis |
| Drew Williams | Brian Schleppi | Jack Kerstetter |
| Lynn Wenrick | Lori Best | Katie Wood |
| Dave Blackstone | Tracy Bryniarski | Matt Larch |
| Charles Ash | Tina Collins | |

### Program and Project Management Systems – July 29, 2013

| | | |
|---|---|---|
| Scott Phinney | Gary Angles | Natasha Turner |
| Tim McDonald | Justin Hickey | Tim Pritchard |
| Drew Williams | James Young | Jacqueline Annarino |
| Adam Makuley | Tina Collins | Matt Kouskouris |
| Lynn Wenrick | Lyle Flower | |
| Lisa Zigmund | Daniel Balsley | |

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## Appendix 2: Staff and Stakeholders Interviewed

| | | |
|---|---|---|
| Jim Barna | Michael Cope | Tim McDonald |
| Greg Murphy | Scott Phinney | Michael Flynn |
| Michael Cope | James Burns | Mark Jackson |
| Scott Phinney | Michael Orndorf | Dave Reich |
| Tim McDonald | Dave Gardner | Dave Ray |
| Michael Flynn | Dave Blackstone | Anthony Urankar |
| Carolyn Chavanne | Charles Ash | Helen Kelly |
| Steve Williams | Jayne Barker | Tracy Bryniarski |
| Jana Cassidy | Lisa Jones | Tim Hill |
| Matt Downs | Brian Schleppi | Amjad Waheed |
| Adam Makuley | Scott Fulks | Tina Collins |
| Bobby Johnson | Cynthia Lee | Rachel Lewis |
| Rich Winning | Joe Phillips | Gary Fetherolf |
| David Coyle | Bette Mendenhall | Chuck Price |
| Mike Bussa | Lisa Zigmund | Jack Kerstetter |
| Mark Gnatowski | Gary Angles | John Maynard |
| Lynn Wenrick | Mia Woodard | Katie Wood |
| Daniel Barr | Brian Brown | Thomas Lyden |
| Tyler Bircher | Jennifer Townley | David Humphrey |
| Adam Makuley | Ellen Hall | Dave Miller |
| Bobby Johnson | Chrystal Beacom | Jim Riley |
| Rich Winning | Wendy Flowers | Lyle Flower |
| David Coyle | Jeff Hisem | Nick Nicholson |
| Mike Bussa | James Young | Chris Merklin |
| Mark Gnatowski | Megan O'Callaghan | Jill Jones |
| Lynn Wenrick | Lori Best | Tony Goddard |
| Daniel Barr | James Burns | Mark Jackson |
| Tyler Bircher | Michael Orndorf | Dave Reich |

| | | |
|---|---|---|
| Stephen Masters | Dave Gardner | Dave Ray |
| Daniel Balsley | Debra Bateman | Andrea Stevenson |
| Daveen Goodman | Shannon Slavin | Victoria Beale |
| Carol Schubert | Marcia Disinger | Melissa Ayers |
| Denae Kotheimer | John MacAdam | Mike Bline |
| Debra Bateman | Patrick Piccininni | Bette Mendenhall |
| Shannon Slavin | Aisha Powell | Cynthia Lee |

**Ohio Rail Development Commission**

| |
|---|
| Matt Dietrich |

**Ohio Department of Administrative Services**

| | | |
|---|---|---|
| Katrina Flory | Joe Phillips | Stu Davis |
| Darlene Wells | | |

## Appendix 3: Interview Questionnaire

### Ohio Department of Transportation
### Strategic Enterprise Architecture Design
### Key Stakeholder Interview Questionnaire

eVision Partners, Inc. (eVision) has been engaged by ODOT to develop a Strategic Enterprise Architecture Design for ODOT. 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 ODOT. To help structure these interviews and ensure consistency in data collection, we have developed this brief interview questionnaire to guide our discussion with you.

Thanks in advance for your assistance with this process.

1. Please briefly describe your role and responsibilities at ODOT?

2. Please explain the key business objectives for your area and how these objectives align with ODOT's overall critical success factors?

3. What do you see as the role of information technology in helping to meet your division or office's key business objectives?

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 ODOT department-wide? In your specific areas of responsibility?

6. From your perspective, what are the key strengths of ODOT's current management systems and information technology environment?

7. From your perspective, what are some of the issues/challenges with ODOT's current management systems and information technology environment?

8. What specific outcomes from the Enterprise Architecture study 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?

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# Appendix 4: Validation Workshops and Attendees

**Systems and Project Planning – June 17, 2013**

| | | |
|---|---|---|
| Scott Phinney | Brian Schleppi | Mike Orndorf |
| Drew Williams | Justin Hickey | |
| Dave Blackstone | Jana Cassidy | |

**Preconstruction Management – June 18, 2013**

| | | |
|---|---|---|
| Tina Collins | Matt Kouskourds | Amjad Waheed |
| Rachel Lewis | Lyle Flower | Doug Buskirk |
| John Maynard | Chris Merklin | Jack Kerstetter |

**Business Support Services – June 21, 2013**

| | | |
|---|---|---|
| Jim Snyder | Scott Fulks | Katie Wood |
| Alana Haberman | Cynthia Lee | Daveen Goodman |
| Jana Cassidy | Joe Phillips | Stephanie Fuller |
| Matt Downs | Brian Brown | Deb Bateman |
| Adam Makuley | Crystal Beacom | Shannon Slavin |
| Bobby Johnson | Steve Williams | Marcia Disinger |
| Mike Bussa | John Worley | |

**Transportation Asset Management – June 24, 2013**

| | | |
|---|---|---|
| Drew Williams | Dave Ray | Jill Jones |
| Dave Gardner | Dave Miller | Mike Orndorf |
| Dave Blackstone | Stephen Taliaferro | Wendy Flowers |
| Brian Schleppi | Jana Edmunds | Mike Loeffler |

**Operations Management – June 25, 2013**

| | | |
|---|---|---|
| Tim Farley | Thomas Lyden | Lynn Wenrick |
| Darcy Stitt | Sonya Simpson | |

**Construction Management – July 10, 2013**

| | | |
|---|---|---|
| Cary Betzing | Jeff Wigdahl | Tina Collins |
| Adam Makuley | Jeff Chandler | |
| Lisa Zigmund | Clint Bishop | |

**Technology Management – July 11, 2013**

| | | |
|---|---|---|
| Kevin Betzing | Charles Ash | Lori Best |
| Drew Williams | Jayne Barker | Tracy Bryniarski |
| Lynn Wenrick | Brian Schleppi | Katie Wood |
| Michael Orndorf | Crystal Beacom | Matt Larch |
| Dave Blackstone | Wendy Flowers | Jill Jones |

**Business Environment – July 12, 2013**

| | | |
|---|---|---|
| Jim Barna | Rich Winning | James Young |
| Mike Cope | James Riley | Mike Orndorf |
| Scott Phinney | Jennifer Townley | |

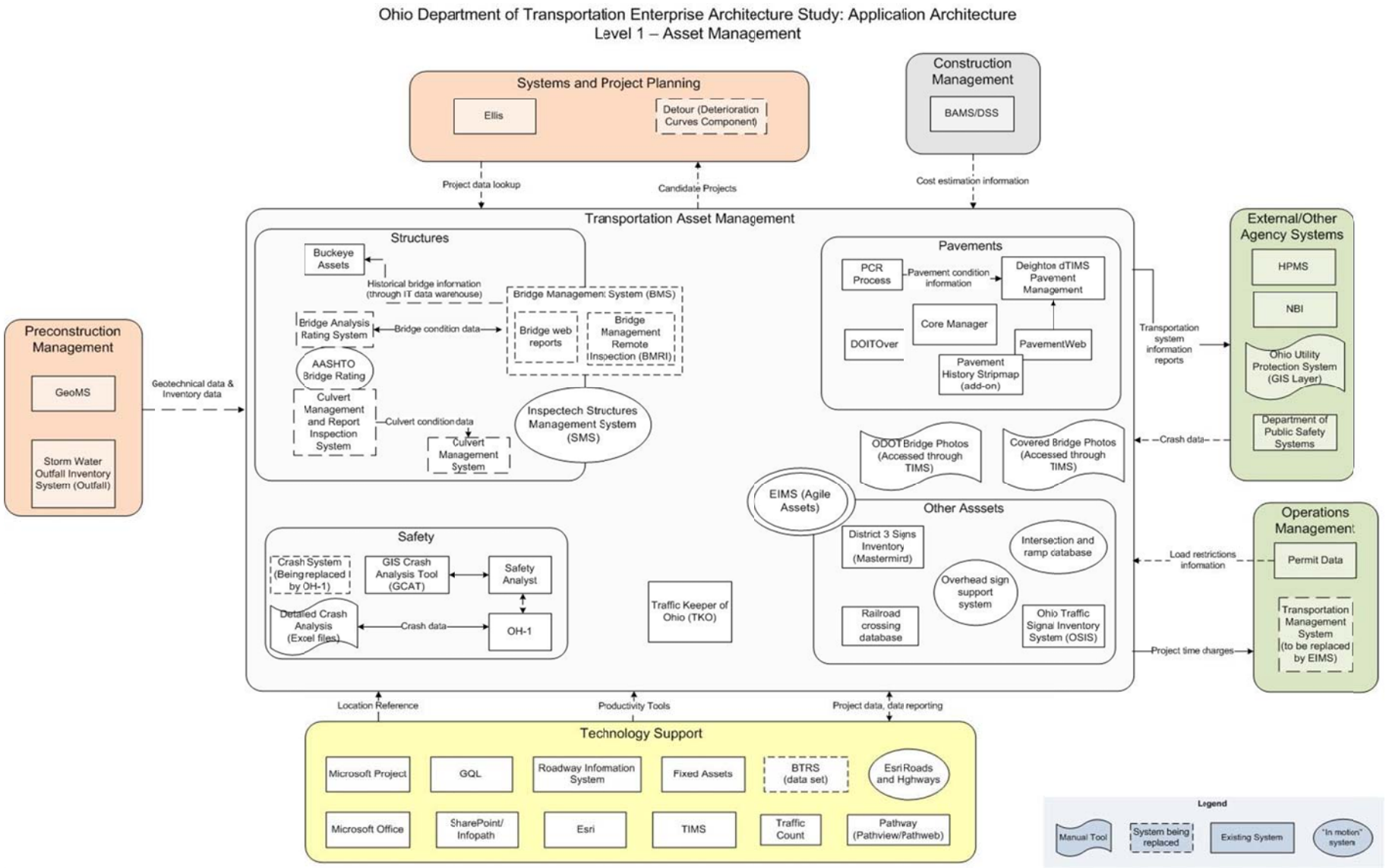
**Facilities and Fleet Management – July 15, 2013**

| | | |
|---|---|---|
| David Coyle | Daniel Barr | Ellen Hall |
| Mark Gnatowski | Tyler Bircher | |

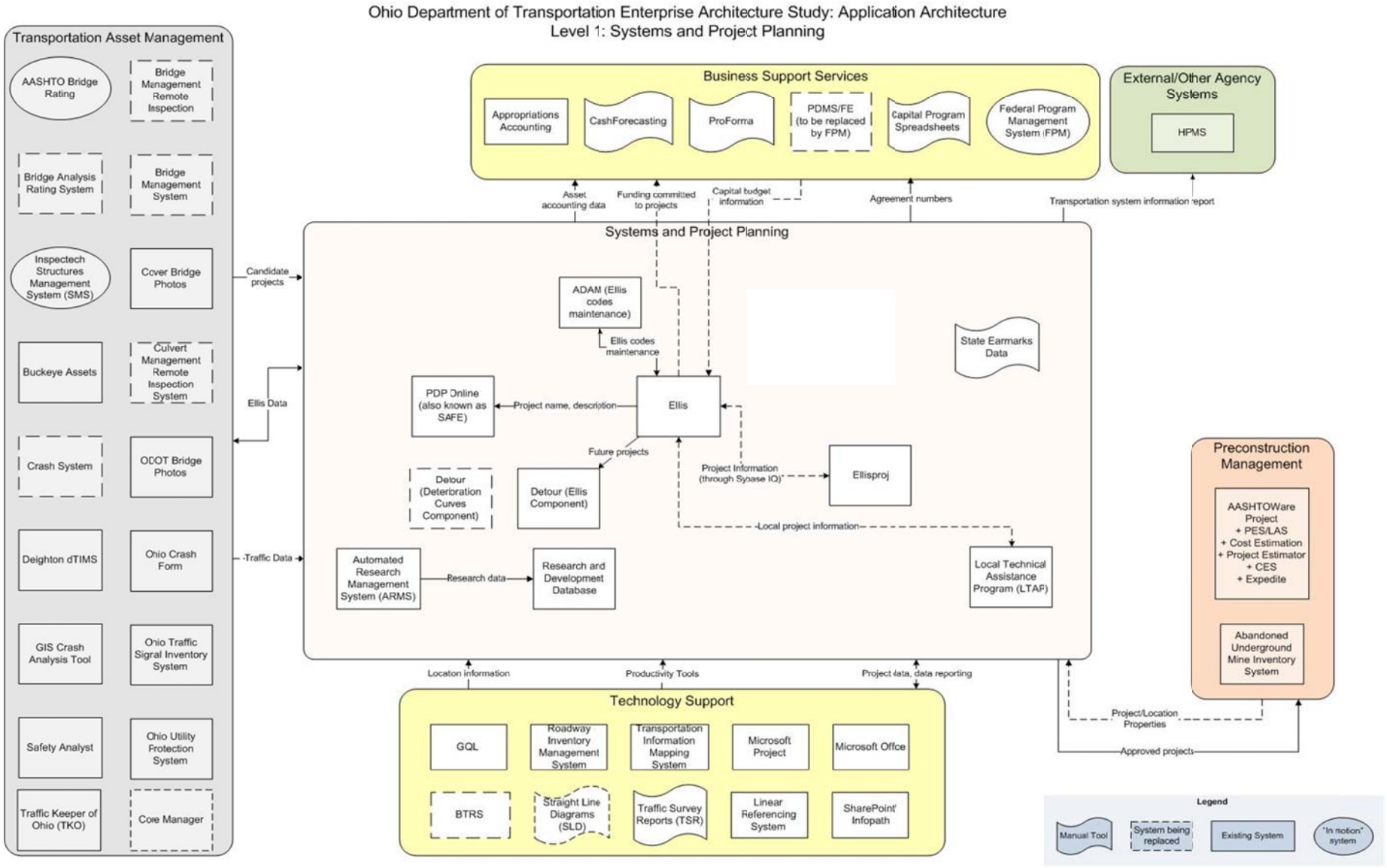
## Appendix 5: Level 1 As-Is Business Process View Diagrams

This appendix includes the Level 1 In-Motion Business Process view schematics for each of the functional areas. These diagrams depict the ODOT applications architecture for each business functional area based on the anticipated completion of various information technology systems implementation projects which are currently in progress (for example EIMS/AgileAssets and InspectTech SMS).

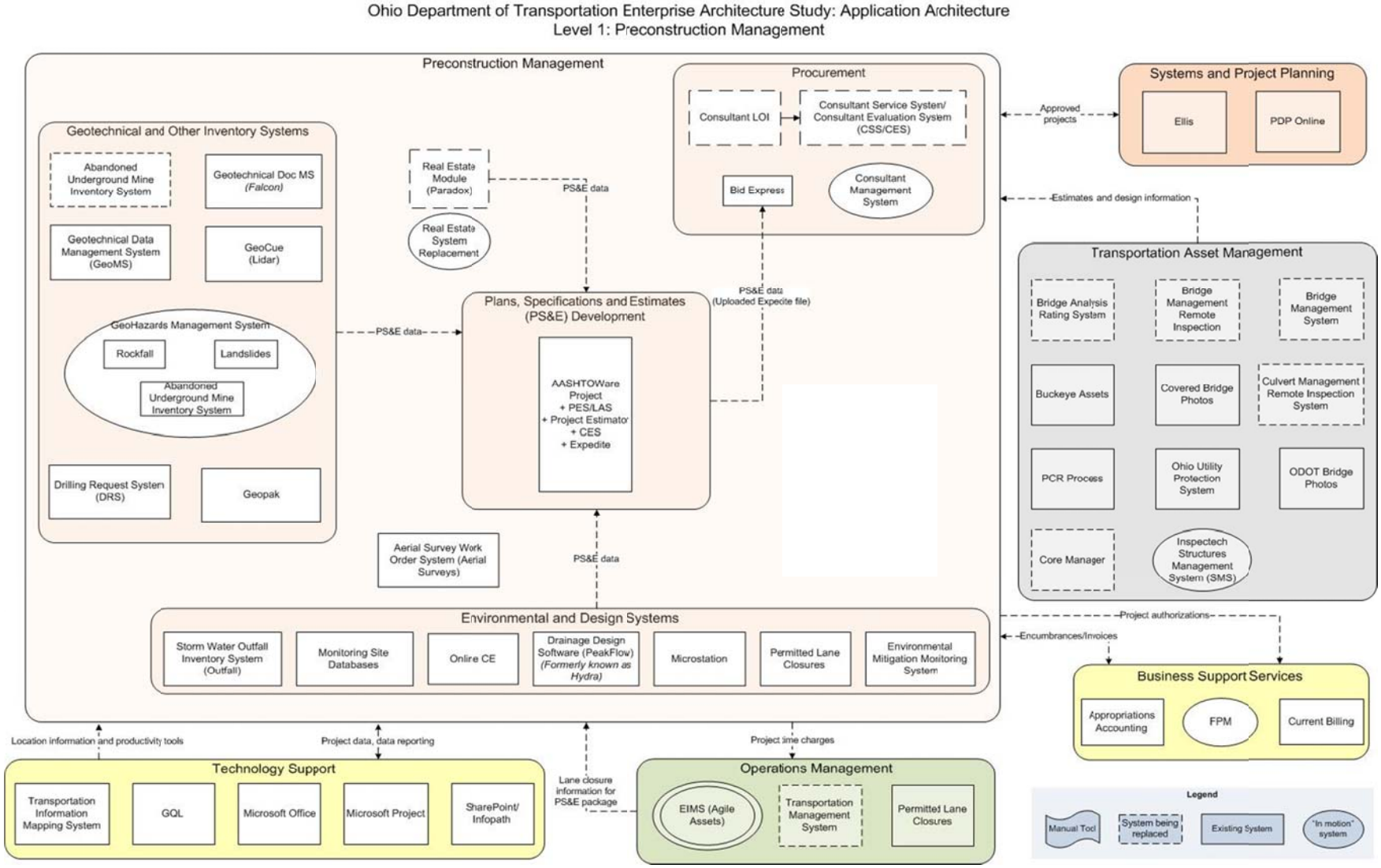
## Figure 49: Asset Management As-Is Business Process View



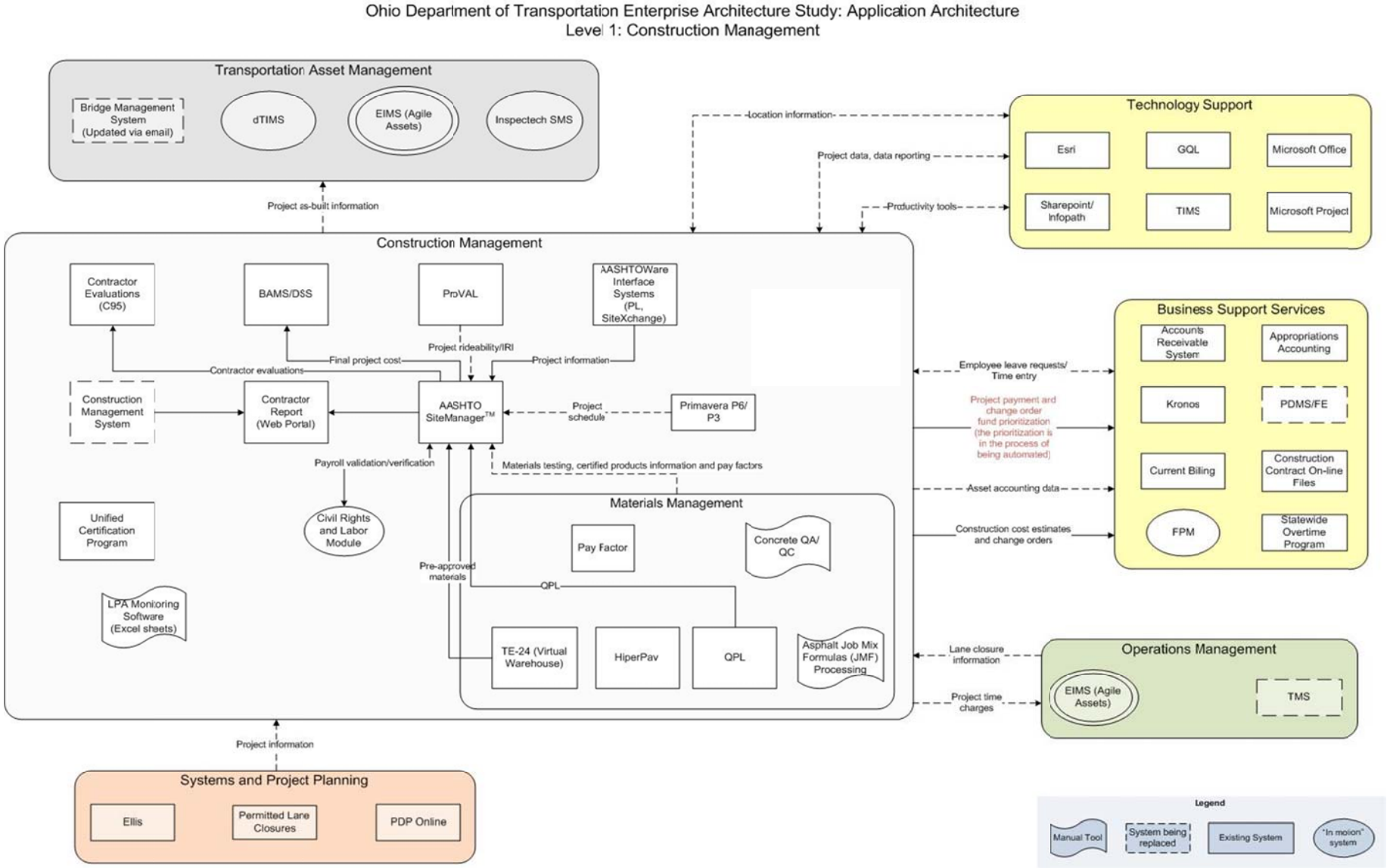
## Figure 50: Systems and Project Planning As-Is Business Process View



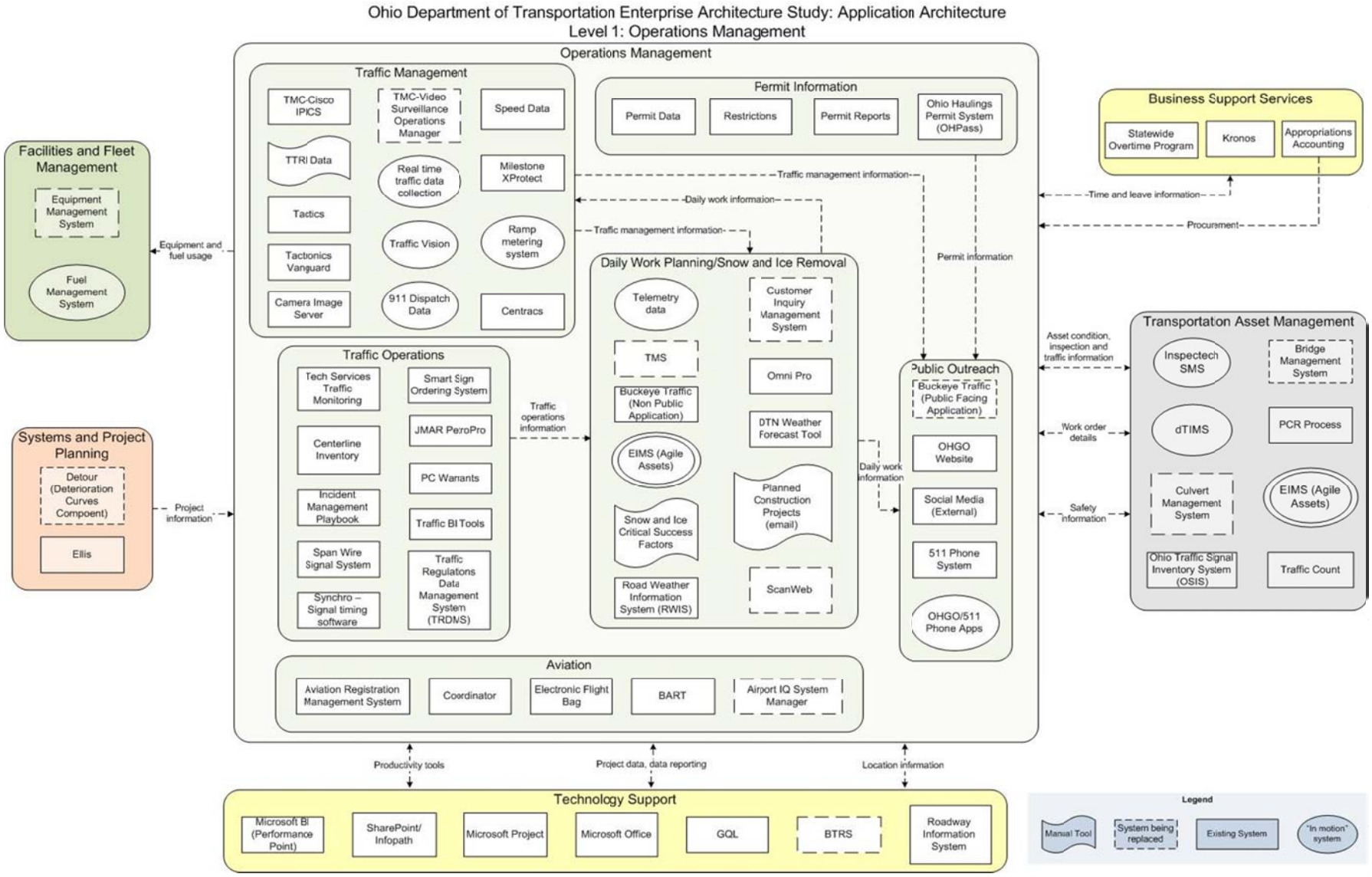
## Figure 51: Preconstruction Management As-Is Business Process View



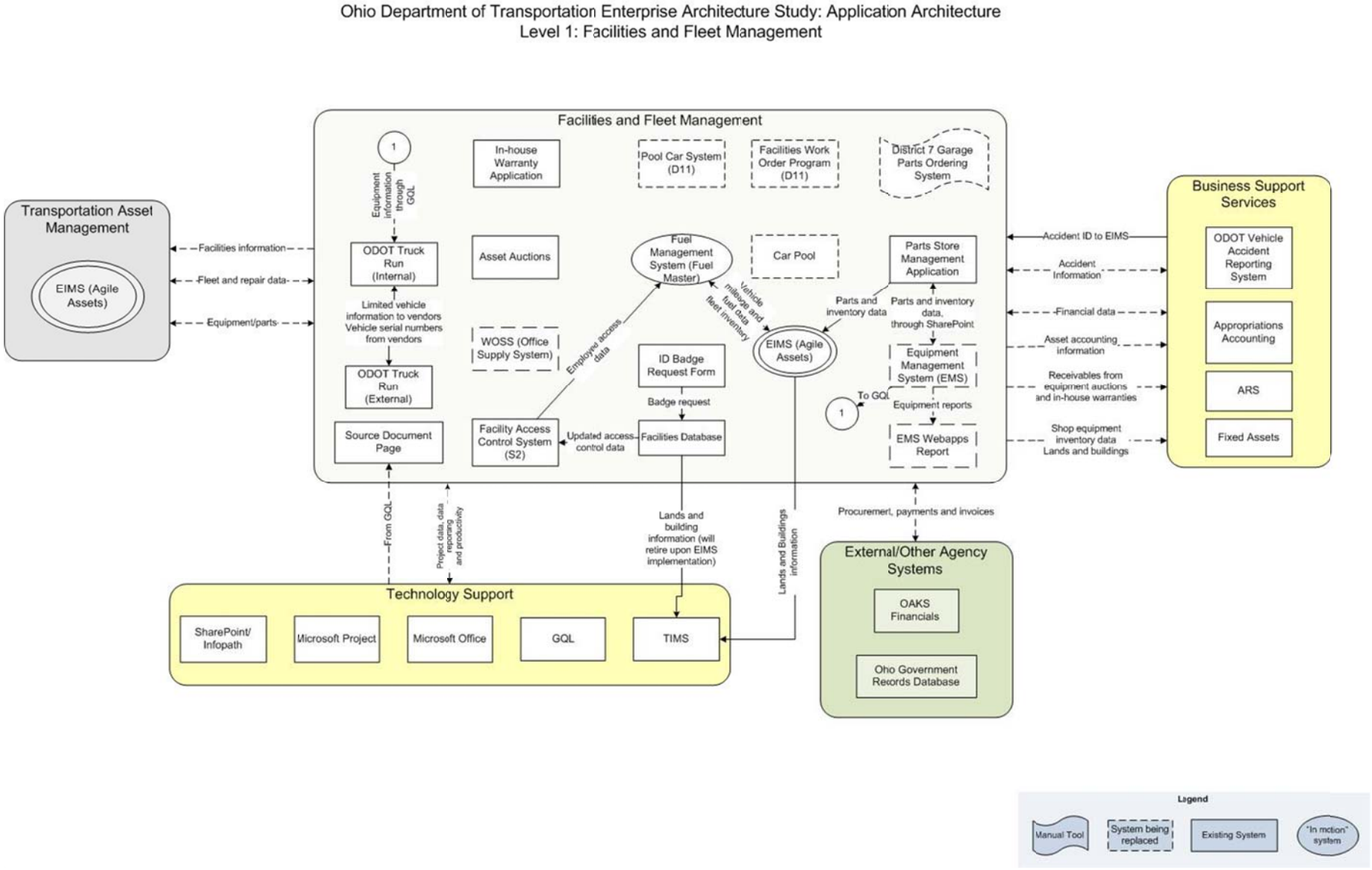
## Figure 52: Construction Management As-Is Business Process View



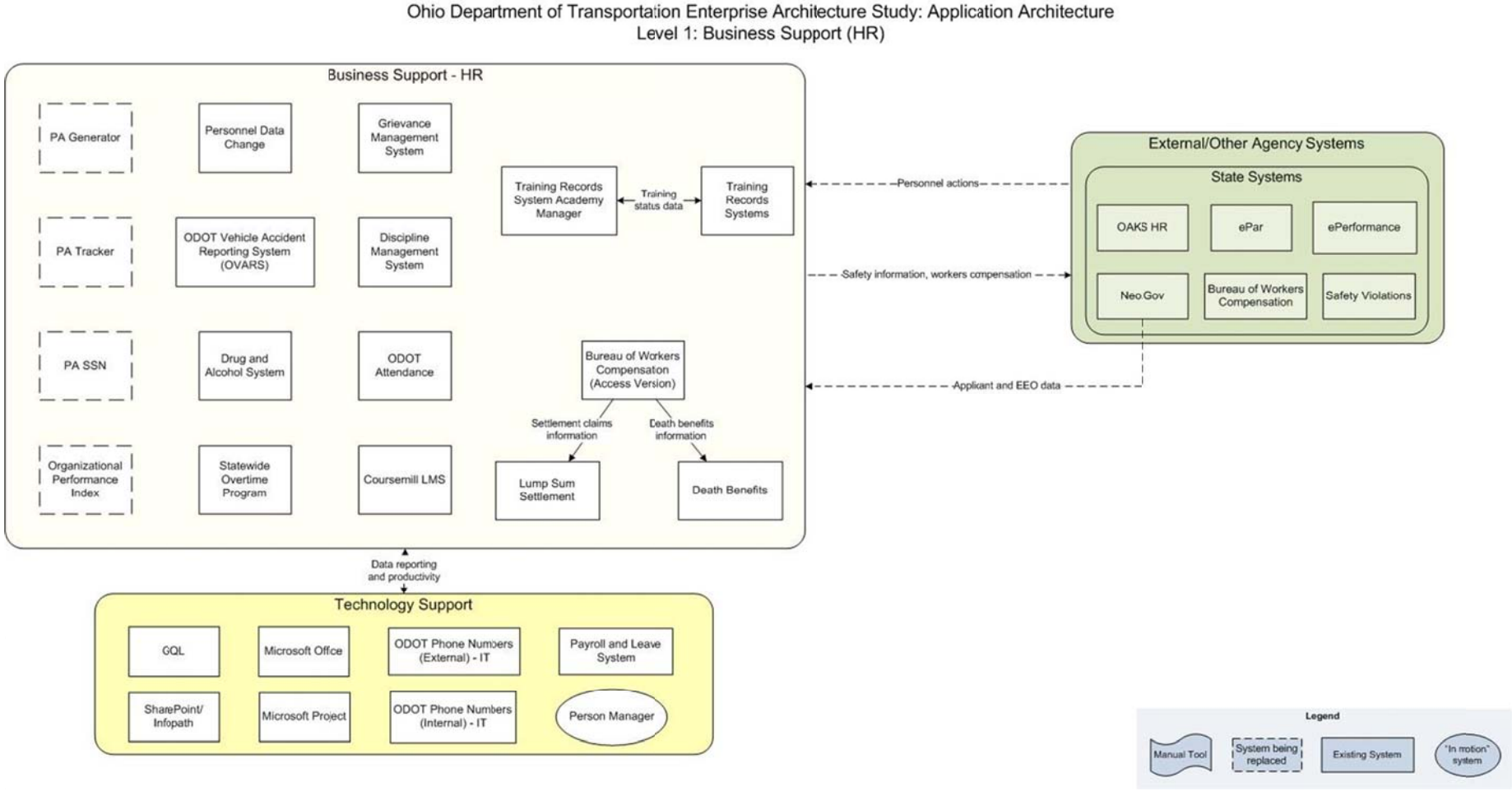
## Figure 53: Operations Management As-Is Business Process View



## Figure 54: Facilities and Fleet Management As-Is Business Process View



## Figure 55: Business Support – Human Resources As-Is Business Process View



## Figure 56: Business Support – Financials As-Is Business Process View

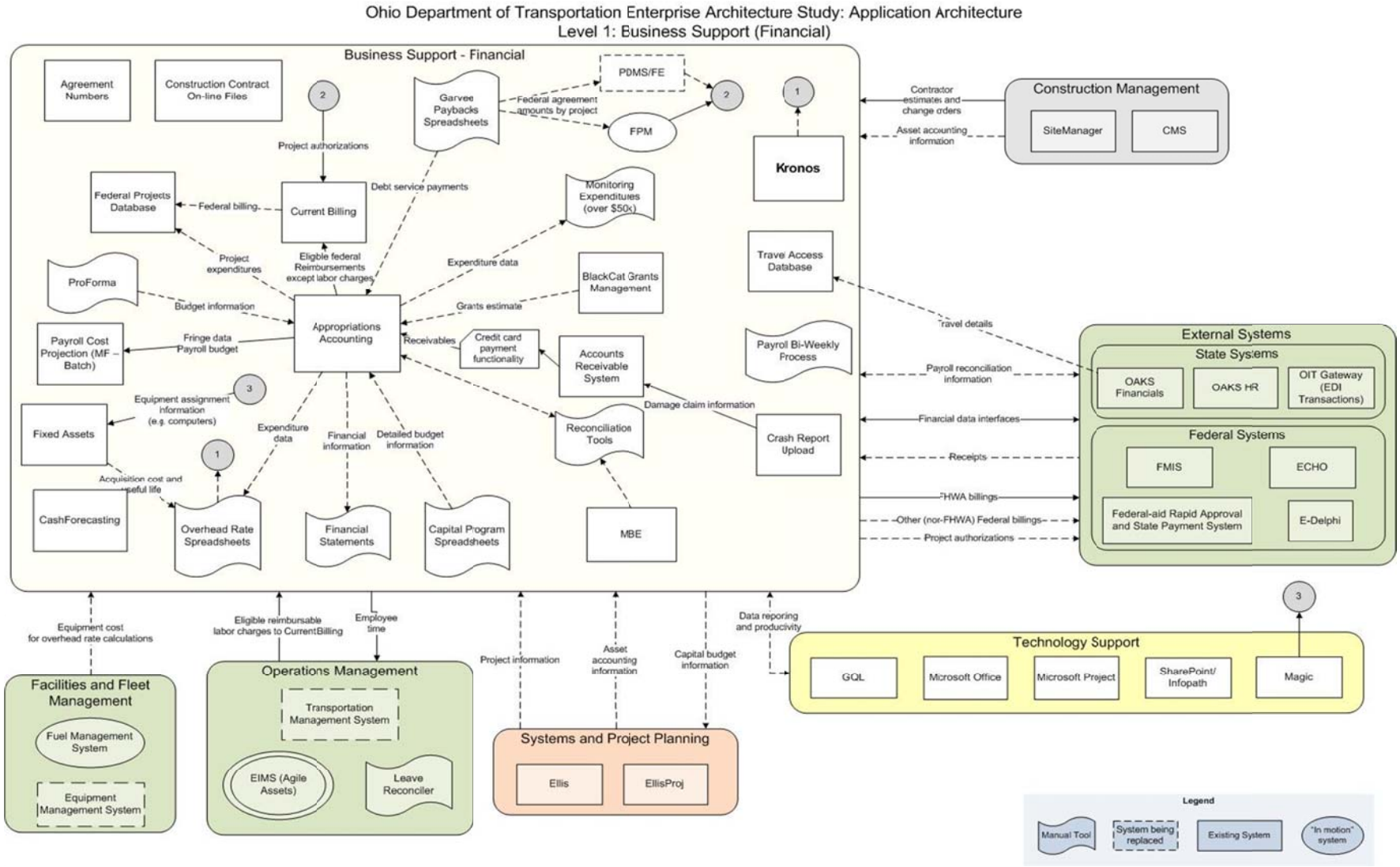
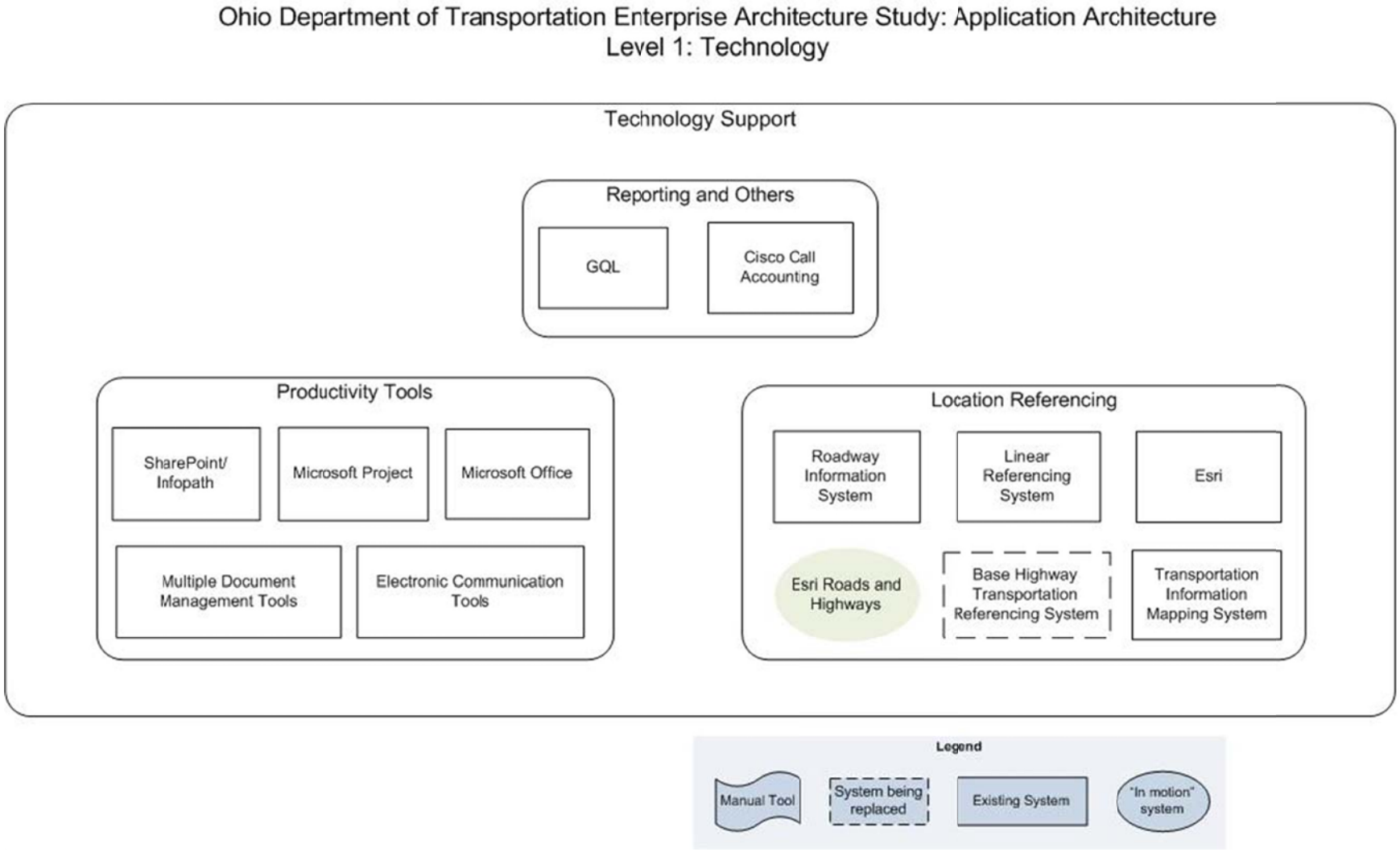


**Figure 57: Technology As-Is Process View**



# Appendix 6: ODOT Enterprise-Wide Application Systems

## Introduction

This appendix presents a listing of all applications that are used by ODOT on an enterprise-wide basis, as determined from the team's validation sessions. The listing identifies the owners of the systems (functional area responsible for the system) and the stakeholders (functional areas that use the system on a regular basis).

The research team also identified systems that are either marked for replacement or are in the process of being replaced, as well as systems that are currently being implemented. These systems are color coded in Table 16, which shows a complete listing of the system. The legend is as follows:

| ***LEGEND*** |
|---|
| *O = Owner of the System* |
| *S = Stakeholder/User of the System* |
| *System in process of being implemented* |
| *System in process of being retired* |

## Table 16: System Listing/System Inventory

| Application | Nickname | Transportation Asset Management | Systems and Project Planning | Preconstruction Management | Construction Management | Operations Management | Facilities & Fleet Management | Business Support Services | Technology |
|---|---|---|---|---|---|---|---|---|---|
| 511 Phone System | | | | | | O | | | |
| 911 Dispatch Data | | | | | | O | | | |
| AASHTO Bridge Rating | | O | S | | | | | | |
| AASHTO SiteManager | | | | | O | | | S | |
| AASHTOWare Interface Systems | | | | | O | | | | |
| AASHTOWare Project | | | S | O | | | | | |
| Abandoned Underground Mine Inventory System | AUMIRA | | S | O | | | | | |
| Accounts Receivable System | ARS | | | | S | | S | O | |
| Aerial Survey Work Order System | | | | O | | | | | |
| Agreement Numbers | | | | | | | | O | |
| Airport IQ System Manager | | | | | | O | | | |
| Appropriations Accounting | AA | | S | S | S | S | S | O | |
| Asphalt Job Mix Formulas (JMF) Processing | | | | | O | | | | |
| Asset Auctions | | | | | | | O | | |
| Automated Research Management System | ARMS | | O | | | | | | |
| Aviation Registration Management System | | | | | | O | | | |
| BAMS/DSS | | S | | | O | | | | |
| Base Highway Transportation Referencing System | BTRS | S | S | | | S | | | O |
| Bid Express | | | | O | | | | | |
| BlackCat Grants Management | | | | | | | | O | |
| Bridge Analysis Rating System | BARS | O | S | S | | | | | |
| Bridge Management Remote Inspection | BMRI | O | S | S | | | | | |
| Bridge Management System | BMS | O | S | S | S | S | | | |
| Buckeye Assets | | O | S | S | | | | | |
| Buckeye Traffic – Non-Public Application | | | | | | O | | | |
| Buckeye Traffic - Public-Facing Application | | | | | | O | | | |
| Bureau of Workers Compensation | | | | | | | | S | |
| Camera Image Server | | | | | | O | | | |

| Application | Nickname | Transportation Asset Management | Systems and Project Planning | Preconstruction Management | Construction Management | Operations Management | Facilities & Fleet Management | Business Support Services | Technology |
|---|---|---|---|---|---|---|---|---|---|
| Capital program spreadsheets | | | S | | | | | O | |
| Car Pool | | | | | | | O | | |
| CashForecasting | | | S | | | | | O | |
| Centerline Inventory (Mastermind) | | | | | | O | | | |
| Centracs | | | | | | O | | | |
| Cisco Call Accounting | | | | | | | | | O |
| Civil Rights and Labor Module | CRLM | | | | O | | | | |
| Concrete QA/QC | | | | | O | | | | |
| Construction contract on-line files | | | | | S | | | O | |
| Construction Management System | CMS | | | | O | | | S | |
| Consultant LOI | | | | O | | | | | |
| Capital Project Delivery System | | | | O | | | | | |
| Consultant Service System/ Consultant Evaluation System | CSS/CES | | | O | | | | | |
| Contractor Evaluations | C95 | | | | O | | | | |
| Contractor Report | | | | | O | | | | |
| Coordinator | | | | | | O | | | |
| Core Manager | | O | S | S | | | | | |
| CourseMill LMS | | | | | | | | O | |
| Covered Bridge Photos | | O | S | S | | | | | |
| Crash Report Upload | | | | | | | | O | |
| Crash System | | O | S | | | | | | |
| Credit Card Payment Functionality | | | | | | | | O | |
| Culvert Design and Storm Sewer Design | Hydra | | | O | | | | | |
| Culvert Management Remote Inspection System | CMRI | O | S | S | | | | | |
| Culvert Management System | | O | | | | S | | | |
| Current Billing | CBS | | | S | S | | | O | |
| Customer Inquiry Management System | CIMS | | | | | O | | | |
| Death Benefits | | | | | | | | O | |
| Deighton dTIMS | dTIMS | O | S | | S | S | | | |
| Detailed Crash Analysis | | O | | | | | | | |

| Application | Nickname | Transportation Asset Management | Systems and Project Planning | Preconstruction Management | Construction Management | Operations Management | Facilities & Fleet Management | Business Support Services | Technology |
|---|---|---|---|---|---|---|---|---|---|
| Detour (Deterioration Curves Component) | Detour | S | O | | | S | | | |
| Detour (Ellis Component) | | S | O | | | | | | |
| Discipline Management System | DMS | | | | | | | O | |
| District 3 Signs Inventory | Mastermind | O | | | | | | | |
| District/Garage Parts Ordering System | | | | | | | O | | |
| Drainage Design Software | PeakFlow | | | O | | | | | |
| Drilling Request System | DRS | | | O | | | | | |
| Drug and Alcohol System | | | | | | | | O | |
| DTN Weather Forecast Tool | | | | | | O | | | |
| ECHO | | | | | | | | S | |
| E-Delphi | | | | | | | | S | |
| Electronic Flight Bags | | | | | | O | | | |
| Ellis | | S | O | S | S | S | | S | |
| Ellis Codes Maintenance | ADAM | | O | | | | | | |
| EllisProj | | | O | | | | | S | |
| EMS Webapps Report | | | | | | | O | | |
| Enterprise Information Management System (AgileAssets) | EIMS/ AgileAssets | O | | S | S | S | S | S | |
| Environmental Mitigation Monitoring System | | | | O | | | | | |
| ePar | | | | | | | | S | |
| ePerformance | | | | | | | | S | |
| Equipment Management System | EMS | | | | | S | O | S | |
| Esri | | S | | | S | | | | O |
| Esri Roads and Highways | | S | | | | | | | O |
| Facilities Database | | | | | | | O | | |
| Facilities Work Order Program | | | | | | | O | | |
| Facility Access Control System | | | | | | | O | | |
| Federal Program Management System | FPM | | S | | S | | | O | |
| Federal Projects Database | | | | | | | | O | |
| Federal-aid Rapid Approval and State Payment System | RASPS | | | | | | | S | |

| Application | Nickname | Transportation Asset Management | Systems and Project Planning | Preconstruction Management | Construction Management | Operations Management | Facilities & Fleet Management | Business Support Services | Technology |
|---|---|---|---|---|---|---|---|---|---|
| Financial Statements | | | | | | | | O | |
| Fiscal Management Information System | FMIS | | | | S | | | S | |
| Fixed Assets | | S | | | | | S | O | |
| Flight Operations Manager | BART | | | | | O | | | |
| Fuel Management System | | | | | | S | O | S | |
| Garvee paybacks spreadsheets | | | | | | | | O | |
| GeoCue | | | | O | | | | | |
| GeoHazards Management System | | | | O | | | | | |
| GeoMS | | S | | O | | | | | |
| Geopak | | | | O | | | | | |
| Geotechnical Doc MS | | | | O | | | | | |
| GIS Crash Analysis Tool | GCAT | O | S | | | | | | |
| GQL | | S | S | S | S | S | S | S | O |
| Grievance Management System | GMS | | | | | | | O | |
| HiperPav | | | | | O | | | | |
| HPMS | | S | S | | | | | | |
| ID Badge Request Form | | | | | | | O | | |
| Incident Management Playbook | Playbook | | | | | O | | | |
| In-House Warranty Application | | | | | | | O | | |
| InspectTech Structures Management System | SMS | O | S | S | S | S | | | |
| Intersection and Ramp Database | | O | | | | | | | |
| JMAR PetroPro | JMAR | | | | | O | | | |
| Kronos | | | | | S | S | | O | |
| Leave Reconciler | | | | | | O | | S | |
| Linear Referencing System | LRS | | S | | | | | | O |
| Local Technical Assistance Program | LTAP | | O | | | | | | |
| LPA Monitoring Software | | | | | O | | | | |
| Lump Sum Settlement | | | | | | | | O | |
| Magic | | | | | | | | S | O |
| MBE | | | | | | | | O | |

| Application | Nickname | Transportation Asset Management | Systems and Project Planning | Preconstruction Management | Construction Management | Operations Management | Facilities & Fleet Management | Business Support Services | Technology |
|---|---|---|---|---|---|---|---|---|---|
| Microsoft Business Intelligence (Performance Point) | | | | | | | | | O |
| Microsoft Office | | S | S | S | S | S | S | S | O |
| Microsoft Project | | S | S | S | S | S | S | S | O |
| Microstation | | | | O | | | | | |
| Milestone XProtect 5.0b | Milestone | | | | | O | | | |
| Monitoring Expenditures over $50k | | | | | | | | O | |
| Monitoring Site Databases | | | | O | | | | | |
| National Bridge Inventory | NBI | S | | | | | | | |
| Neo.Gov | | | | | | | | | |
| NEPA Management System | NEPA | | | O | | | | | |
| OAKS Financials | | | | | | | S | S | |
| OAKS HR | | | | | | | | S | |
| ODOT Attendance | | | | | | | | O | |
| ODOT Bridge Photos | | O | S | S | | | | | |
| ODOT Phone Numbers (External) - IT | | | | | | | | | O |
| ODOT Phone Numbers (Internal) - IT | | | | | | | | | O |
| ODOT Truck Run (External) | | | | | | | O | | |
| ODOT Truck Run (Internal) | | | | | | | O | | |
| ODOT Vehicle Accident Reporting System | OVARS | | | | | | S | O | |
| Office Supply System | WOSS | | | | | | O | | |
| OHGO Website | OHGO | | | | | O | | | |
| OHGO/511 Phone Apps | | | | | | O | | | |
| Ohio Bureau of Workers Compensation | Wcomp | | | | | | | S | |
| Ohio Crash Form | OH-1 | O | S | | | | | | |
| Ohio Government Records Database | | | | | | | S | | |
| Ohio Haulings Permit System | OHPass | | | | | O | | | |
| Ohio Traffic Signal Inventory System | OSIS | O | S | | | S | | | |
| Ohio Utility Protection System | OUPS | S | S | S | | | | | |
| OIT Gateway (EDI Transactions) | | | | | | | | S | |
| Omni Pro | | | | | | O | | | |

| Application | Nickname | Transportation Asset Management | Systems and Project Planning | Preconstruction Management | Construction Management | Operations Management | Facilities & Fleet Management | Business Support Services | Technology |
|---|---|---|---|---|---|---|---|---|---|
| Online CE | | | | O | | | | | |
| Organizational Performance Index | | | | | | | | O | |
| Overhead rate spreadsheets | | | | | | | | O | |
| Overhead Sign Support System | | O | | | | | | | |
| PA Generator | | | | | | | | O | |
| PA SSN | | | | | | | | O | |
| PA Tracker | | | | | | | | O | |
| Parts Store Management Application | | | | | | | O | | |
| Pathway (Pathview/Pathweb) | | S | | | | | | | O |
| Pavement Design Tool | DoITOver | O | | | | | | | |
| Pavement History Stripmap | | O | S | | | | | | |
| Pavement Web | | O | S | | | | | | |
| Payroll and Leave System | | | | | | | | | O |
| Payroll Bi-Weekly Process | | | | | | | | O | |
| Payroll Cost Projection (MF-Batch) | | | | | | | | O | |
| PC Warrants | | | | | | O | | | |
| PCR Process | | O | | S | | S | | | |
| PDMS/FE | PDMS/FE | | S | | S | | | O | |
| PDP Online | SAFE | | O | S | S | | | | |
| Permit Data | | S | | | | O | | | |
| Permit Reports | | | | | | O | | | |
| Permitted Lane Closures | | | | O | S | | | | |
| Person Manager | | | | | | | | | |
| Personnel Data Change | | | | | | | | O | |
| Planned Construction Projects | | | | | | O | | | |
| Pool Car System | | | | | | | O | | |
| Primavera P6 | | | | | O | | | | |
| ProForma | | | S | | | | | O | |
| ProVAL | | | | | O | | | | |
| Qualified Products List | QPL | | | | O | | | | |

| Application | Nickname | Transportation Asset Management | Systems and Project Planning | Preconstruction Management | Construction Management | Operations Management | Facilities & Fleet Management | Business Support Services | Technology |
|---|---|---|---|---|---|---|---|---|---|
| Railroad Crossing Database | | O | | | | | | | |
| Ramp Metering System | | | | | | O | | | |
| Real Estate Document Management System | | | | O | | | | | |
| Real Estate Module | Paradox | | | O | | | | | |
| Real Estate System Replacement | | | | O | | | | | |
| Real Time Data Collection | | | | | | O | | | |
| Reconciliation tools | | | | | | | | O | |
| Remediation Cost Database Application | RCDA | | | O | | | | | |
| Research and Development Database | | | O | | | | | | |
| Restrictions | | | | | | O | | | |
| Road Weather Information System | RWIS | | | | | O | | | |
| Roadway Information System | RIS | S | S | | | S | | | O |
| SafetyAnalyst | | O | S | | | | | | |
| Safety Violations | VSSR | | | | | | | S | |
| ScanWeb | | | | | | O | | | |
| SharePoint/Infopath | | S | S | S | S | S | S | S | O |
| Smart Sign Ordering System | | | | | | O | | | |
| Snow and Ice Critical Success Factors | | | | | | O | | | |
| Social Media | | | | | | O | | | |
| Source Document Page | | | | | | | O | | |
| Span Wire Signal System | SWSS | | | | | O | | | |
| Speed Data | | | | | | O | | | |
| State Earmarks Data | | | O | | | | | | |
| Statewide Overtime Program | Overtime Roster | | | | S | S | | O | |
| Storm Water Outfall Inventory System | Outfall | S | | O | | | | | |
| Straight Line Diagrams | SLD | | S | | | | | | O |
| Synchro Signal Timing Software | | | | | | O | | | |
| Tactics | | | | | | O | | | |
| Tactronics Vanguard | | | | | | O | | | |

| Application | Nickname | Transportation Asset Management | Systems and Project Planning | Preconstruction Management | Construction Management | Operations Management | Facilities & Fleet Management | Business Support Services | Technology |
|---|---|---|---|---|---|---|---|---|---|
| TE-24 | | | | | O | | | | |
| Tech Services Traffic Monitoring | | | | | | O | | | |
| Telemetry Data | | | | | | O | | | |
| Test Results System | | | | | O | | | | |
| TMC Video Surveillance Operations Manager | | | | | | O | | | |
| TMC-Cisco IPICS | | | | | | O | | | |
| Traffic BI Tools | | | | | | O | | | |
| Traffic Count | | S | | | | S | | | O |
| Traffic Keeper of Ohio | TKO | O | S | | | S | | | |
| Traffic Regulations Data Management System | TRDMS | | | | | O | | | |
| Traffic Survey Reports | TSR | | S | | | | | | O |
| Traffic Vision | | | | | | O | | | |
| Training Records System | | | | | | | | O | |
| Training Records System Academy Manager | | | | | | | | O | |
| Transportation Information Mapping System | TIMS | | S | S | S | | S | | O |
| Transportation Management System | TMS | S | | S | S | O | | S | |
| Travel Access Database | | | | | | | | O | |
| TTRI Data | | | | | | O | | | |
| Unified Certification Program | | | | | O | | | | |
| Web Portal | | | | | O | | | | |

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## Appendix 7: Inventory of Applications Maintained by ODOT Districts

This appendix presents a listing of all applications that are currently maintained by ODOT districts. This inventory was developed through a survey of information technology staff in each district during October 2013.

## Table 17: ODOT Strategic Enterprise Architecture Design
## Systems and Applications Developed or Deployed by Districts

| System Name | Nickname | District Owner | Description | Business Function | Primary Business Owner | Used By Other Districts? |
|---|---|---|---|---|---|---|
| 10ths Program | | D11 | Program to calculate hours worked based on clock-in and clock-out times | Operations Management | Counties | |
| Accident | | D02 | Used by accounting to calculate charges accidents | Business Support Services | Accounting | |
| Accident Reporting Records | | D06 | | Business Support Services | Finance | |
| Account Lookup | | D11 | Allows IT and HR staff to lookup user information such as mainframe ID, BALS ID, OAKS and AD information | Technology | IT | D05, CEN, D07, D03 |
| Active Directory User Creator | ADUC | D11 | Application to create user accounts and “W” drive shares. The application has been replaced. | Technology | IT | Previously used by Central Office |
| AD Security Group Query | | D06 | | Technology | DSM | |
| Adopt-A-Highway | | D02 | Tracks adopted highway sections and organization information | Other | Highway | D08 |
| Adopt-a-Highway | | D06 | | Operations Management | Highway Management | |
| ARRA | | D06 | | Business Support Services | Construction | |
| Asset Management Service | | D02 | Tracks District assets and GIS information | Transportation Asset Management | GIS | |

| System Name | Nickname | District Owner | Description | Business Function | Primary Business Owner | Used By Other Districts? |
|---|---|---|---|---|---|---|
| Auxiliary Pavement Markings | | D11 | A simple database application that keeps track of auxiliary pavement markings. The database is then used to create GIS maps for production. | Transportation Asset Management | P&E | |
| BackupExec | | All Districts except D02 and D10 | Backup system | Technology | IT | D01, D04 |
| BarCode Labeler | BarCode Labeler | D05 | Used to create Barcode labels for EMS inventory items | Business Support Services | Roadway | |
| BWC Wage Statements | BWCWS | D12 | Prints BWC Wage Statements for Safety Department | Business Support Services | Israel Ciptak | |
| CIMS - Customer Inventory Management System | | D06 | | Operations Management | Customer Service | |
| Cisco Call Accounting | Call Accounting | D11 | Statewide system used to view phone records for Cisco VoIP phones | Technology | IT | D01, D02, D03, D04, D05, D06, D07, D08, D09, D10, D11, D12, CEN |
| Closure and Restriction | | D06 | | Operations Management | Construction | |
| Construction RFL Notification | | D06 | | Construction Management | Construction | |
| County Accident Program | | D02 | Used by counties to calculate charges accidents | Business Support Services | County Garages | |

| System Name | Nickname | District Owner | Description | Business Function | Primary Business Owner | Used By Other Districts? |
|---|---|---|---|---|---|---|
| County Culvert Database | | D11 | A simple database application that keeps track of auxiliary pavement markings. The database is then used to create GIS maps for production. | Transportation Asset Management | P&E | D04 |
| County Kiosk | | D06 | | Operations Management | Highway Management | |
| Create a Card | | D06 | | Business Support Services | D06 | |
| Credit Card Override | | D06 | | Business Support Services | Finance | |
| D06 Facilities Maintenance Request | | D06 | | Facilities and Fleet Management | BHR | |
| D06 Location Slider | | D06 | | Transportation Asset Management | Highway Management | |
| Daily Events Calendar | | D12 | Hub for garages to post their daily activities for PIO to publish | Systems and Project Planning | Amanda Lee | |
| Detours | | D02 | Post Detour information and Route Map on the Internet | Other | Permits Dept. | |
| District 5 News | D5 News | D05 | Used to display / communicate D5 updates on ODOT's Intranet | Business Support Services | IT | |
| District 5 Phone App | Phone Directory | D05 | Used for publishing D5 employee phone (desk and cell) numbers | Business Support Services | Finance | |
| District 5 Yearbook | Yearbook | D05 | Used for publishing badge images | Business Support Services | Facilities | |
| District Accident Billing Work Orders | WO Billing | D05 | Used for Accident Work Order / Billing (Guardrail Ding & Dent) | Business Support Services | Highway | |

| System Name | Nickname | District Owner | Description | Business Function | Primary Business Owner | Used By Other Districts? |
|---|---|---|---|---|---|---|
| District CFO App | Construction Field Office | D05 | Used to track CFO project information (remote office) | Business Support Services | Construction | |
| District Checkout System | Checkout | D05 | Used for reserving Laptops | Business Support Services | IT | |
| District Complaint Tracker | Complaint | D05 | Used for tracking public customer complaints (CIMS alternative) | Business Support Services | Highway | |
| District Culvert / Bridge Work Orders | Culvert/ Bridge WO | D05 | Used to track Culvert and Bridge work orders | Business Support Services | Highway | |
| District EIMS/AgileAssets System | EIMS/ AgileAssets | D05 | Used for Employee Information and Yearbook entries | Business Support Services | Personnel | |
| District IT Kbase | Kbase | D05 | Used for documenting IT-related information | Business Support Services | IT | |
| District Kiosk | | D06 | | Business Support Services | DDD | |
| District Road Repair App | Road Repair | D05 | Used for documenting Road Repairs needed | Other | Highway | |
| Drainage | | D02 | Tracks Inspection and Repairs needed on Culverts | Systems and Project Planning | Roadway Services | |
| Drug Test Authorization Form | County OT Program | D11 | Replaced | Business Support Services | Administration | None - Replaced |
| Employee Last Logon Query | | D06 | | Technology | DSM | |
| Employee Relocation form | | D06 | | Business Support Services | Construction | |
| Employee Work Schedule | Work Schedule | D05 | Used to track / display Employee's work schedule | Business Support Services | B&HR | |
| EMS Webapps D08 Reports | | D08 | EMS/TMS District information | Operations Management | Mike Brown | D08 |

| System Name | Nickname | District Owner | Description | Business Function | Primary Business Owner | Used By Other Districts? |
|---|---|---|---|---|---|---|
| Equipment Disposal/Equipment Number Request | | D06 | | Facilities and Fleet Management | Highway Management | |
| Facilities Work Order Program | | D11 | A database system which allows employees to submit Facilities work orders and assist Facilities to track them. | Facilities and Fleet Management | Facilities | D01 |
| Facilities equipment location application | | D06 | | Facilities and Fleet Management | BHR | |
| Facilities Event Calendar | | D12 | Hub for Facilities to track and plan their daily work | Facilities and Fleet Management | Dave Whiteley | |
| Facilities Request | | D12 | Place for employees to enter requests for Facility work | Facilities and Fleet Management | Dave Whiteley | |
| File bulk Re-namer | | D06 | | Technology | Production | |
| Final Inspection form | | D06 | | Construction Management | Construction | |
| Findbear.exe Used to convert items into bearings | | D06 | | Operations Management | Production | |
| Fleet Report | | D12 | Repository to list available equipment | Facilities and Fleet Management | | |
| Garage Parts Ordering System | | D07 | Parts ordering application | Facilities and Fleet Management | | |

| System Name | Nickname | District Owner | Description | Business Function | Primary Business Owner | Used By Other Districts? |
|---|---|---|---|---|---|---|
| GIS to DGN | | D11 | A simple application that allows Microstation users to place cells based on latitude/longitude coordinates or places cells at county/route/sections. | Systems and Project Planning | P&E | |
| Guardrail Work Order | | D06 | | Operations Management | Highway Management | |
| Health and Safety Issues | | D06 | | Business Support Services | Safety | |
| IM viewer Program used to facilitate the transfer of Item Master Data into General | | D06 | | Operations Management | Production | |
| Innovation ODOT | | D06 | | Business Support Services | BHR/D06 | |
| IT Work Order Tracking System | | D12 | IT Ticketing System | Technology | Freddy Caraballo | |
| Job Site Safety Survey | | D06 | | Construction Management | Highway Management | |
| Lack of Usage Justification | | D06 | | Business Support Services | Highway Management | |
| Lat/Long Converter | | D11 | An application that allows users to lookup County/Route/Section, State Plane Coordinates, or Latitude/Longitude for locations on ODOT's system | Systems and Project Planning | P&E | |
| Lat\Long finder | | D06 | | Transportation Asset Management | Production | |

| System Name | Nickname | District Owner | Description | Business Function | Primary Business Owner | Used By Other Districts? |
|---|---|---|---|---|---|---|
| Leave Reconciler | | D11 | Program to reconcile Leave and Hours Worked between OAKS, TMS, and Kronos | Business Support Services | Accounting/Payroll | |
| LPA Report | | D06 | | Construction Management | Construction | |
| Magic Ticket Daily Reminder | | D11 | Sends daily e-mails about Magic Tickets and Access Request forms to supervisors and form approvers | Technology | IT | |
| Maintenance management system | | D06 | | Operations Management | Traffic | |
| Material Ordering System (Under development) | MOS | D12 | | Operations Management | Lori Roman | |
| Motor Pool Calendar | | D12 | Scheduling of Motor Pool Vehicles | Facilities and Fleet Management | Dan Moncol | |
| Motor Pool Reservation | | D06 | | Facilities and Fleet Management | Garage/D06 | |
| Near Miss | | D06 | | Business Support Services | BHR | |
| NetBackup and Symantec OpsCenter Analytics | | D02 | Backup system for D02. ODOT is not using Backup Exec. | Technology | IT | |
| NetFiler | | D11 | Defunct - replaced by D11 Netwatch | Technology | IT | |
| Netwatch | | D11 | An application that allows Network Administrators to view open files on a server | Technology | IT | |
| NewsFlash | | D06 | | Business Support Services | DSM | |

| System Name | Nickname | District Owner | Description | Business Function | Primary Business Owner | Used By Other Districts? |
|---|---|---|---|---|---|---|
| ODOT Backup (Virtual) | | D11 | System to backup VMware virtual machines without having to buy backup licenses or VMware host licenses or a SAN | Technology | IT | D01 |
| ODOT Desktop Reconciler | IDARE | D11 | System to ensure computers are in inventory, computrace, and active directory | Technology | IT | CEN |
| ODOT-Surveyor (Under development) | | D12 | Updated, internal survey system | Business Support Services | John Wesp | |
| Online Store/Traffic Sign Program | | D11 | System to order signs from the district traffic department | Operations Management | HIGHWAY MANAGEMENT | |
| Open Bridge Work Orders | | D12 | Shows open bridge work orders (Rarely used) | Transportation Asset Management | District | |
| Oracle Primavera Contract Manager | Primavera CM | D12 | Construction Contract Management | Construction Management | Tom Hyland | |
| Parts Ordering | | D12 | Tracks ordering of non-Mancon parts | Facilities and Fleet Management | Tom Vanek | |
| Password Challenge Response | | D11 | Defunct – no longer used | Technology | IT | |
| Pavement Marking Request | | D06 | | Operations Management | Highway Management | |
| Permits | | D06 | | Operations Management | Permits | |
| Permits Database | | D07 | Used for tracking Right of Way Permits | Operations Management | Wayne Callahan | |
| Permits Program | | D08 | Database for Right of Way Use Permits | Operations Management | Tom Makris | D08 |

| System Name | Nickname | District Owner | Description | Business Function | Primary Business Owner | Used By Other Districts? |
|---|---|---|---|---|---|---|
| Permits Utility Program | Permits | D05 | Used for creating Right of Way Permits | Other | P&E | |
| Personnel Action Notification | | D06 | | Business Support Services | BHR | |
| Plan Index | | D06 | | Technology | Production | |
| Plan Index Database | | D07 | Used for referencing Design Plans | Systems and Project Planning | Greg Collier | |
| PO Tracker | | D12 | Tracks available amounts in PO's | Business Support Services | Steve Henry | |
| Pool Car System | | D11 | Tracks pool car and IT loaner resource usage and allows users to schedule equipment | Facilities and Fleet Management | Garage/Production | |
| Pothole Report | | D06 | | Operations Management | Highway Management | |
| Power form | | D06 | | Operations Management | Traffic | |
| Pre-Con Meeting Notes | | D06 | | Construction Management | Highway | |
| Production Equipment Reservations | | D12 | Place for Production to schedule their shared assets | Other | Lou Hazapis | |
| Project Submission Wizard | | D11 | Used by the production department to submit plan packages to central office. Ensures folder standards are followed and proper e-mail templates are used. | Systems and Project Planning | P&E | |
| Quick Tray | D5 Tray | D05 | Used to organize and produce quick shortcuts to items | Business Support Services | IT | |
| Reconciliation Report | | D12 | Used to reconcile employees' hours | Business Support Services | District | |

| System Name | Nickname | District Owner | Description | Business Function | Primary Business Owner | Used By Other Districts? |
|---|---|---|---|---|---|---|
| Right of Way Permits | | D02 | Tracks Right Of Way Permits | Preconstruction Management | Permits Dept. | |
| Road Sign Inventory | | D12 | Lists all Road Signs in the district (Not maintained) | Transportation Asset Management | Travis Bonnett | |
| Safety DB | | D12 | Tracks Accidents and Injuries and created reports | Business Support Services | Israel Ciptak | |
| Safety Supplies Request | | D12 | Tracks all orders for Safety Equipment | Business Support Services | Israel Ciptak | |
| Sign Order Request | | D06 | | Operations Management | Highway Management | |
| SirForm – software installation request form auto filler | | D06 | | Technology | DSM | |
| SnowFlake/Auxiliary Callout | | D06 | | Operations Management | Highway Management | |
| Software Inventory | | D06 | | Technology | DSM | |
| StateSigns | | D02 | Tracks Sign inventory, condition, and replacement date | Systems and Project Planning | Traffic | D03, D12 |
| Survey Admin | | D12 | Internal survey system | Business Support Services | Ed Thomas | |
| Survey Project Tracking Database | | D02 | Tracks survey projects to completion | Systems and Project Planning | Survey | |
| Team Member of the Month Nomination | | D06 | Submit nominations for team member of the month | Business Support Services | Administration | |
| Team Member of the Quarter Survey | | D06 | Online survey for team member of the quarter | Business Support Services | Administration | |
| Traffic Electrical maintenance work order | | D06 | | Operations Management | Traffic | |

| System Name | Nickname | District Owner | Description | Business Function | Primary Business Owner | Used By Other Districts? |
|---|---|---|---|---|---|---|
| Traffic ITS main sheet | | D06 | | Operations Management | Traffic | |
| Training Calendar | | D12 | Lists all upcoming classes for employees of District 12 | Other | Barb Gibbons | |
| Training Schedule Query | | D06 | | Business Support Services | D06 | |
| Transfer Program | | D02 | Tracks employee transfers | Business Support Services | Highway | |
| Trouble Ticket System | TTS | D12 | Tracks asset deficiencies | Transportation Asset Management | Howard Huebner | |
| Utility Program | | D11 | Tracks utility bills. Allows us to get billing/usage data. | Business Support Services | Accounting | |
| Utilities | | D12 | Utility electronic paycard system | Business Support Services | Dennis Hill | |
| Utility Relocation Program | | D08 | Tracking tool for relocated utilities | Operations Management | Suzanne Enders/Stefan Spinosa | D08 |
| Visual Salt Balance Tracker | VSBT | D12 | Track Salt Balance | Operations Management | Howard Huebner | |
| Web Plan Index | | D11 | A database application that allows users to quickly search for and view project plans in production. | Systems and Project Planning | P&E | |
| WebEM44 | | D12 | Vehicle problem reporting | Facilities and Fleet Management | Dan Moncol | |

# Appendix 8: Technology Governance

Approved:

Policy No. XX-XXX(P)
Effective: (Month) (day), (year)
Responsible Division:

_____
Jerry Wray
Director

**TECHNOLOGY GOVERNANCE**

**POLICY STATEMENT:**

This policy establishes the Ohio Department of Transportation (ODOT) Technology Council to provide technology governance and guide the strategic deployment of technology that enables the optimum delivery of ODOT business processes, program and project delivery, operations, and services.

The ODOT Technology Council shall promulgate policies, procedures, and processes to guide technology investments that generate business value; evaluate technology investments in consideration of enterprise architecture deployment and ODOT risk mitigation; and manage the performance of technology resources. The ODOT Technology Council shall establish a five (5) year technology plan and update the plan annually.

The Technology Council membership shall be appointed by the Director. The council membership shall consist of five (5) senior unclassified members and five (5) senior classified members. Any number of ad hoc, non-voting members may be appointed to the committee to contribute to its success. From the council membership, the Director shall appoint an executive champion and the council chairperson. The Director of the ODOT Division of Information Technology will have a standing position on the council. Council members shall act in the best interest of ODOT and avoid parochialism in support of their business areas.

**AUTHORITY:**

Ohio Revised Code 5501.02 and 5501.03

**SCOPE:**

All Districts, Divisions, and Offices of the Ohio Department of Transportation

**BACKGROUND AND PURPOSE:**

The technology demands of ODOT have grown more rapidly than could be met by the resources of the ODOT Division of Information Technology. Since there was no structured investment strategy for technology investments, business areas in need of technology

initiated their own technology development and deployment projects using commercial software providers, university developers, and IT consultant developers. The systems implemented have served the immediate needs of the business area but often have not provided integration with data of the many other systems utilized by ODOT. While the business areas were deploying new technology, the backbone applications of the business support functions of ODOT continue to use older technology that is becoming harder to support. The lack of technology governance in ODOT is believed to have contributed to this situation.

**DEFINITIONS:**

Enterprise architecture: A strategic technology plan that aligns with the strategic plan of ODOT; integrates the technology needs of ODOT; 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 ODOT.

Technology: Software applications and systems, hardware, databases, networks, policies, procedures, etc. that support the delivery of ODOT's programs, projects, services, and operations.

Technology governance: 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 ODOT risks; and it monitors performance of technology resources and establishes accountability. Technology governance is not a replacement for good technology management; a replacement of technology control structure; a technology power authority; a process that pits business groups against each other; or a bureaucracy that impedes processes and production.

**TRAINING:**

Training is not mandated for implementation of this policy or the statutes identified as the authority for this function. However, training on the policies and procedures implemented by the ODOT Technology Council may be required.

**FISCAL ANALYSIS:**

Implementation of this policy will have no fiscal impact on ODOT.

## Appendix 9: Technology Council Procedures

Procedure No. XX-XXX(SP)
Effective: (Month) (day), (year)
Responsible Division:

_____
Respective Division Deputy Director(s)

**ODOT TECHNOLOGY COUNCIL PROCEDURES**

**PROCEDURAL STATEMENT**:

This document codifies the procedures of the ODOT Technology Council, charged with providing technology governance and guiding the strategic deployment of technology, that enables the optimum delivery of ODOT business processes, program and project delivery, operations, and services.

I. Membership

A. The Director shall appoint Technology Council membership and shall consist of five (5) senior unclassified members and five (5) senior classified members. The Director of the ODOT Division of Information Technology will have a standing position on the council. The term of a council member shall be three (3) years. No council member shall serve more than two (2) consecutive terms except for the Director of the ODOT Division of Information Technology. The terms shall be staggered to promote continuity.

B. Annually, the Director shall appoint council membership in the form of a memorandum.

C. The recommended council membership shall include business owners from each of the ODOT directorates in addition to the Director of the Division of Information Technology, and at least two (2) district representatives. The only staff member from the Division of Information Technology shall be its Director. Annually, the council executive champion shall make council membership and leadership recommendations to the Director.

D. The council may appoint any number of ad hoc, non-voting members to contribute to its success.

II. Leadership

The Director shall appoint an executive champion and council chairperson from the council membership.

A. The executive champion shall represent the Director's interest in all technology matters, communicate frequently with the Director on council actions and activities, and serve to enable the success of the council.
B. The council chairperson shall lead the activities of the council in alignment with the established council charter. In the conduct of council matters, the staff of the Division of Information Technology shall support the chairperson.

III. Council Charter

Annually, the council shall adopt a charter which defines the mission of the Technology Council, sets one (1) year objectives, sets long-term objectives, and lists committee membership. The council executive champion, chairperson, and members shall sign the charter.

IV. Committees

The council shall create committees to serve the needs of the council. From its membership, the council shall appoint leaders and members to the committees. The council shall appoint other ODOT staff members to the committees in support of the mission of the committee. All actions of the committees must be approved by the council. For approval by the council, the committees shall develop policies and procedures in support of their missions. The council shall publish the approved policies and procedures.

A. Standing committees

1. Planning – this committee is responsible for the annual development of one (1) and five (5) year technology plans for adoption by the council.

2. Investment – this committee is responsible for reviewing technology investment requests and presenting qualifying investment requests to the entire council.

3. Enterprise architecture – this committee is responsible for being the steward of the enterprise architecture and updating the architecture as required.

4. Security – this committee is responsible for reviewing or establishing data and systems access security governance and conducting risks assessments.

5. Performance – this committee is responsible for the establishment of technology performance measures and standards, and technology performance management.

B. Ad hoc committees – the council may appoint ad hoc committees to serve the needs of the council.

V. Meetings

A. Frequency – the council shall hold meetings quarterly or more frequently as needed. Committees of the council shall meet as needed to support the committee's mission and council-established deliverables.

B. Agendas – for each meeting, the council shall establish an agenda. The agenda shall include reports from each of the committees of the council, discussion, and approval of committee action items and deliverables, and other technology issues added to the agenda by council members.

C. Meeting summaries – the council shall produce a summary of the actions taken at each council meeting. Both the council chairperson and the executive champion shall approve the summary.

**AUTHORITY:**

Ohio Revised Code 5501.02 and 5501.03

**REFERENCES:**

ODOT Policy No. XX-XXX(P) – Technology Governance

**SCOPE:**

All Districts, Divisions, and Offices of the Ohio Department of Transportation

**BACKGROUND AND PURPOSE:**

The technology demands of ODOT have grown more rapidly than could be met by the resources of the ODOT Division of Information Technology. Since there was no structured investment strategy for technology investments, business areas in need of technology initiated their own technology development and deployment projects using commercial software providers, university developers, and IT consultant developers. The systems implemented have served the immediate needs of the business area but often have not provided integration with data of the many other systems utilized by ODOT. While the

business areas were deploying new technology, the backbone applications of the business support functions of ODOT continue to use older technology that is becoming harder to support. The lack of technology governance in ODOT is believed to have contributed to this situation.

**DEFINITIONS:**

Enterprise architecture: A strategic technology plan that aligns with the strategic plan of ODOT; integrates the technology needs of ODOT; 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 ODOT.

Technology: Software applications and systems, hardware, databases, networks, policies, procedures, etc. that support the delivery of ODOT's programs, projects, services, and operations.

Technology governance: 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 ODOT risks; and it monitors performance of technology resources and establishes accountability. Technology governance is not a replacement for good technology management; a replacement of technology control structure; a technology power authority; a process that pits business groups against each other; or a bureaucracy that impedes processes and production.

**TRAINING:**

Training on the Technology Council developed procedures is required by all staff members utilizing those procedures.

**FISCAL ANALYSIS:**

Implementation of this policy will have no fiscal impact on the department.

## Appendix 10: Authority Capital Improvement Program Decision-Making Model

This appendix contains a sample project prioritization decision model that members of the research team developed for a major transit agency. It is intended to provide ODOT with an example of what elements might be included in a technology project prioritization model. Please note that the example model provided is intended to not only evaluate technology projects but a range of other proposed capital improvement projects (construction, systems planning, etc.) so not all criteria will necessarily be applicable to a model intended to evaluate technology projects only.

### Table 18: Proposed Objectives/Sub-Objectives for Evaluating Authority CIP Projects

**Goal: Prioritize CIP projects for optimal allocation of Authority resources in support of the Authority's mission and vision**

| 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%<br><br>Regulatory: 100%<br><br>Operation critical: 70%<br><br>Operation support: 50%<br><br>Service enhancements: 30%<br><br>Service expansion per approved regional or other long-range plan: 30%<br><br>Other service expansion: 0% | 15% |
| Apply continuous improvement to service delivery | Project delivers customer-facing service improvements: 100%<br><br>Project improves overall efficiency and effectiveness of internal business operations: 50%<br><br>Project does not provide customer-facing service improvements or substantially improve the efficiency of internal operations: 0% | 3% |

| Objective/ Sub-Objective | Rating Scale | Weighting Factor |
|---|---|---|
| Mitigate risk to the Authority | Project eliminates the potential for a significant operational disruption, safety, or security issue: 100%<br><br>Project eliminates the potential for a minor operational disruption: 50%<br><br>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%<br><br>Asset or operational process is in a Substandard condition: 70%<br><br>Asset or operational process is in an Adequate condition: 30%<br><br>Asset or operational process is in a Good or Excellent condition: 0%<br><br>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% |

| Objective/ Sub-Objective | Rating Scale | Weighting Factor |
|---|---|---|
| 3. Funding optimization – 9% | | |
| Utilize available Federal funding | Federal grant award executed: 100%<br><br>Federal grant application notice of award: 80%<br><br>Federal grant applied for: 30%<br><br>Federal grant eligible: 10%<br><br>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%<br><br>≥ $250K and < $500K in additional revenue: 70%<br><br>> $0 and <$250K in additional revenue: 30%<br><br>No additional revenue: 0% | 2% |
| Minimize impact on operating budget | Cost savings ≥ $1 million: 100%<br><br>Cost savings ≥ $500K and < $1 million: 70%<br>Cost savings > $0 and < $500K: 50%<br>Cost neutral: 30%<br>Cost increase < $500K: 5%<br><br>Cost increase ≥ $500K and < $1 million: 3%<br>Cost increase ≥ $1 million: 1% | 4% |

| Objective/ Sub-Objective | Rating Scale | Weighting Factor |
|---|---|---|
| Provide a positive return on investment | NPV ≥ $1 million: 100%<br><br>NPV ≥ $500K and < $1 million: 70%<br><br>NPV ≥ 0 and < $500K: 50%<br><br>NPV < 0 and > (-$500K): 30%<br><br>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%<br><br>Project integrates with or supports expansion of non-Authority elements of the regional transportation system within the next five years: 70%<br><br>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%<br><br>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%<br><br>Project does not support expansion of the regional transportation network: 0% | 2% |

| Objective/ Sub-Objective | Rating Scale | Weighting Factor |
|---|---|---|
| Leverage partnership opportunities | Another public sector agency or developer is contributing funding to meet project objectives: 100%<br><br>Project involves coordination with another public-sector agency or developer who is providing non-cash contributions to meet project objectives: 70%<br><br>Project does not involve partnership opportunities: 30%<br><br>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%<br><br>Another transit authority has successfully delivered projects of a similar scope/scale: 30% | 4% |

| Objective/ Sub-Objective | Rating Scale | Weighting Factor |
|---|---|---|
| Deliver with experienced staff | Authority has internal staff with prior experience with the proposed project technologies and other project elements: 100%<br><br>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%<br><br>Project risk rating is medium: 30%<br><br>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.

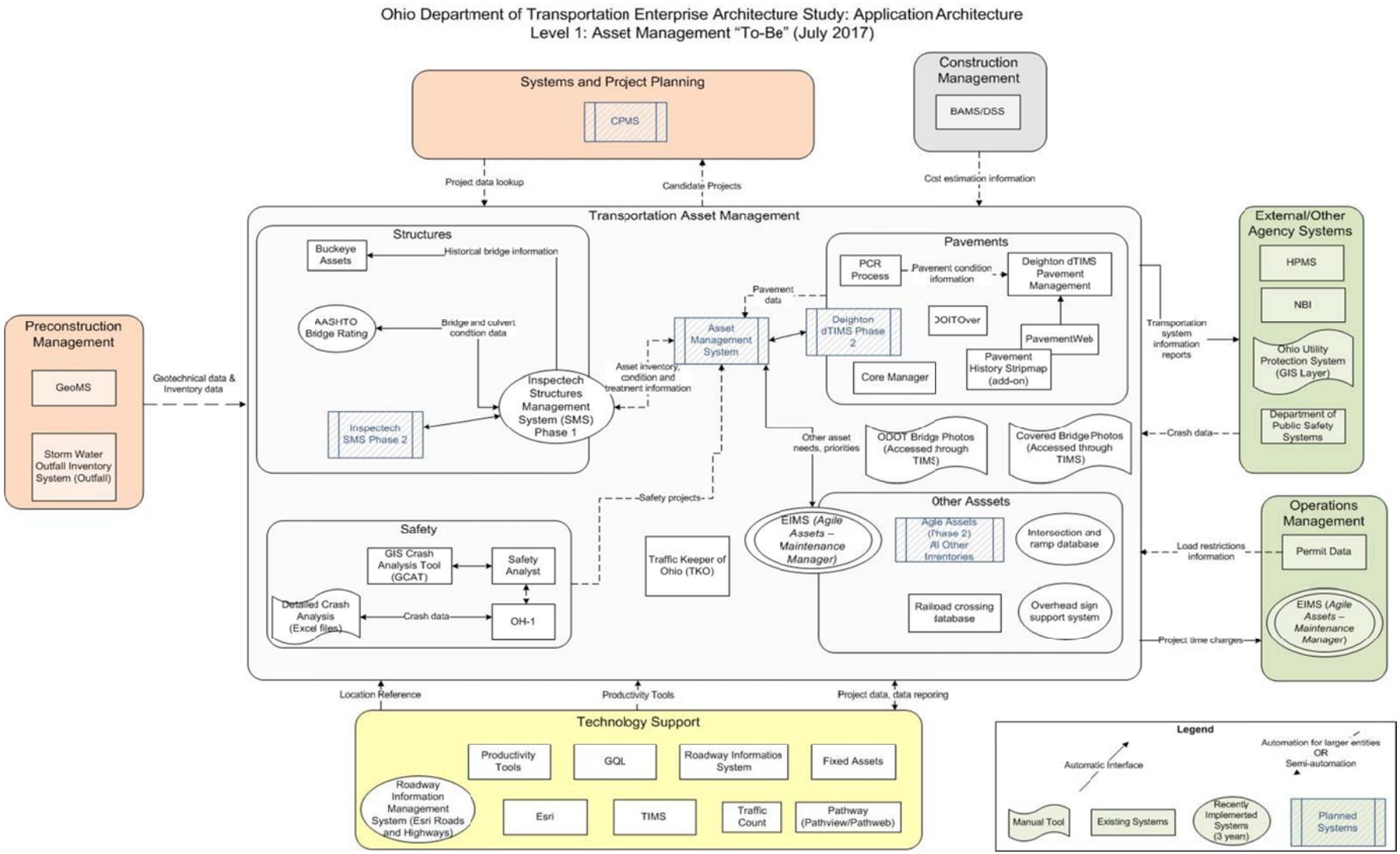
## Appendix 11: Level 1 To-Be Business Process View Diagrams (July 2017)

This appendix includes the Level 1 To-Be Business Process view schematics for each of the functional areas except technology management for which schematics were not developed since those systems were included in the other schematics:

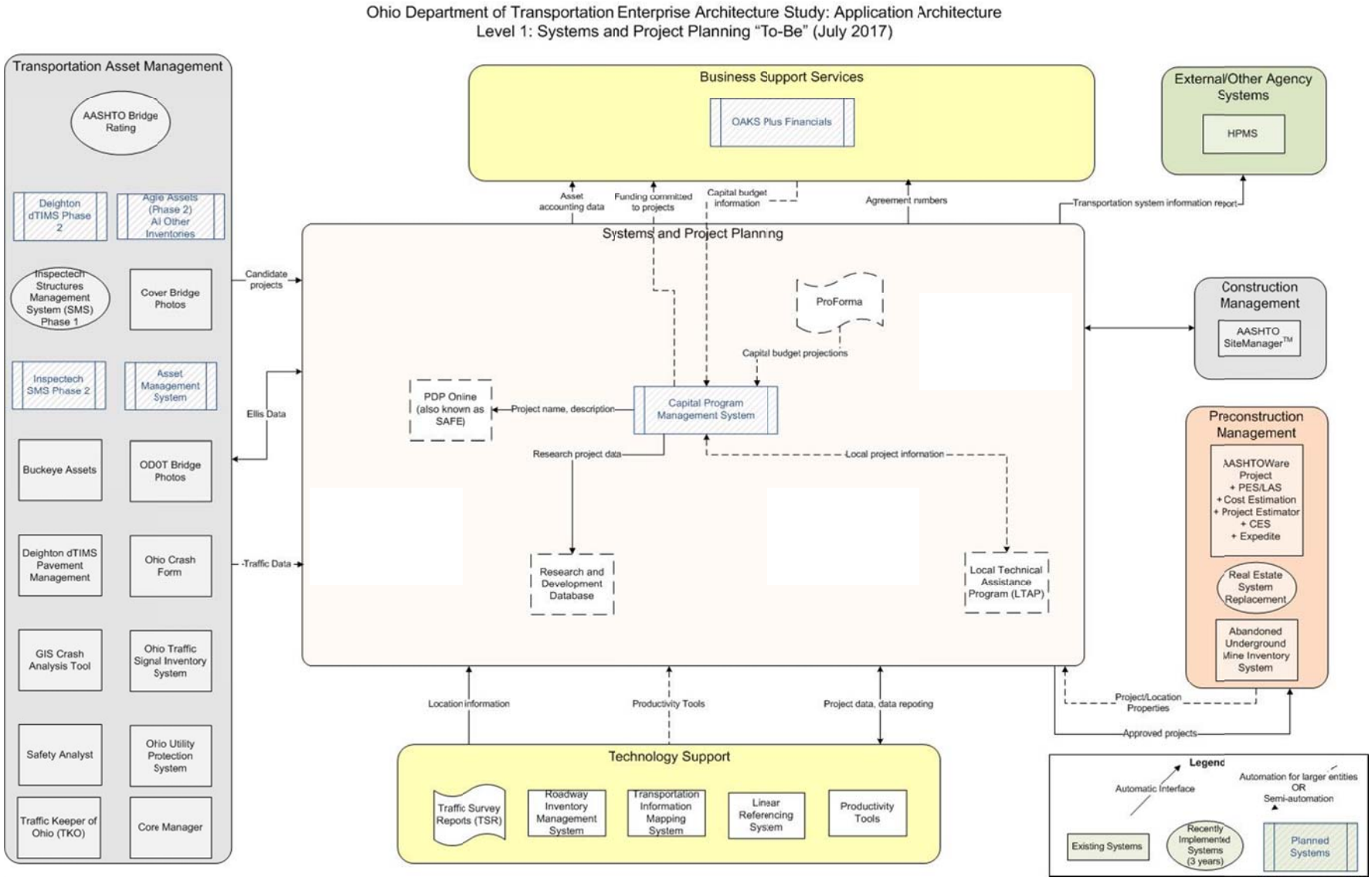
- Figure 65: Transportation Asset Management To-Be Business Process View;
- Figure 66: Systems and Project Planning To-Be Business Process View (2019);
- Figure 67: Preconstruction Management To-Be Business Process View;
- Figure 68: Construction Management To-Be Business Process View;
- Figure 69: Transportation Asset Management To-Be Business Process View;
- Figure 70: Facilities and Fleet Management To-Be Business Process View; and
- Figure 71: Business Support Services To-Be Business Process View.

These diagrams depict the anticipated ODOT applications architecture for each business functional area based on the implementation of the recommendations from the Enterprise Architecture project as of July 2017.

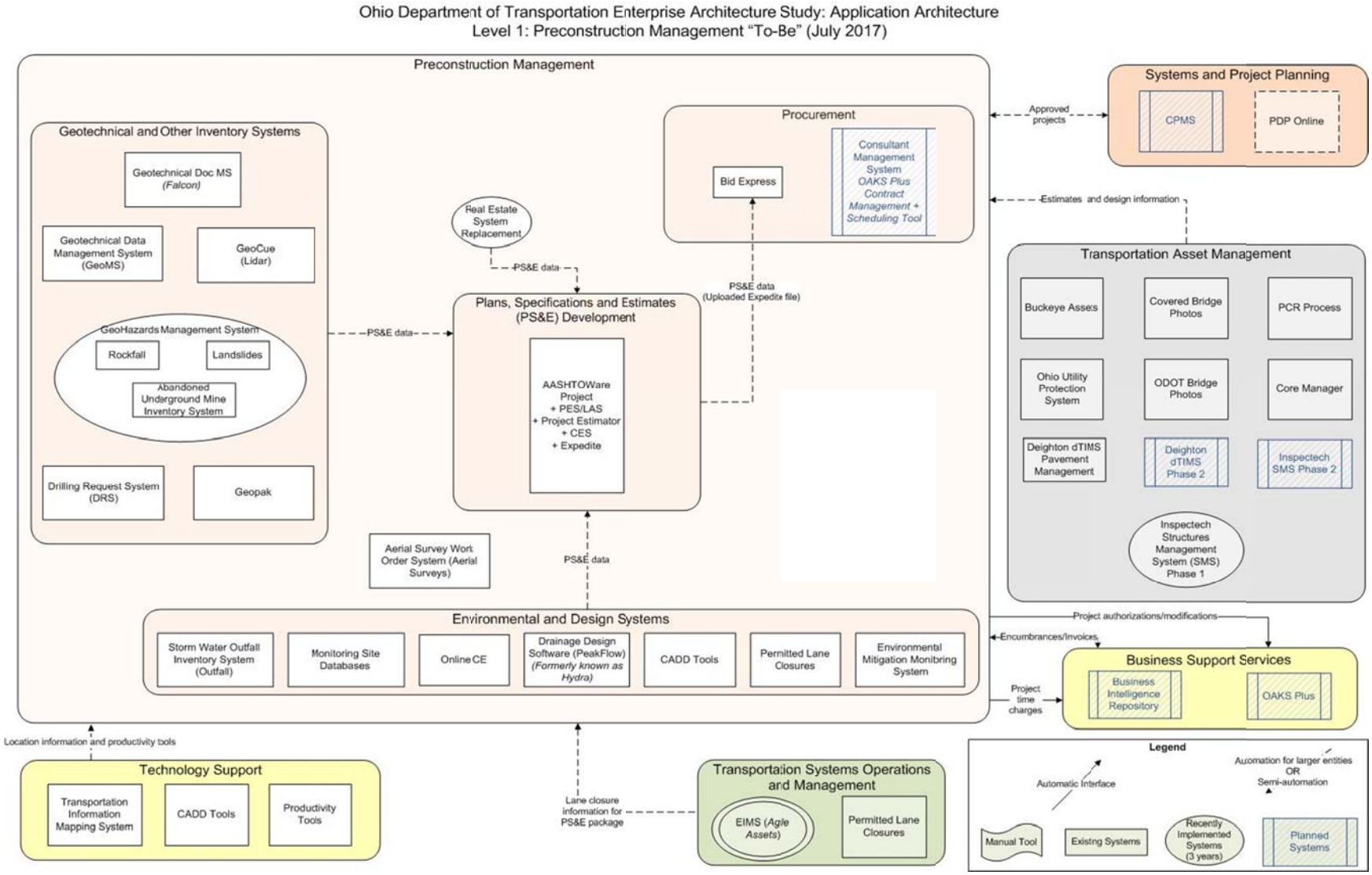
## Figure 58: Transportation Asset Management To-Be Business Process View (2017)



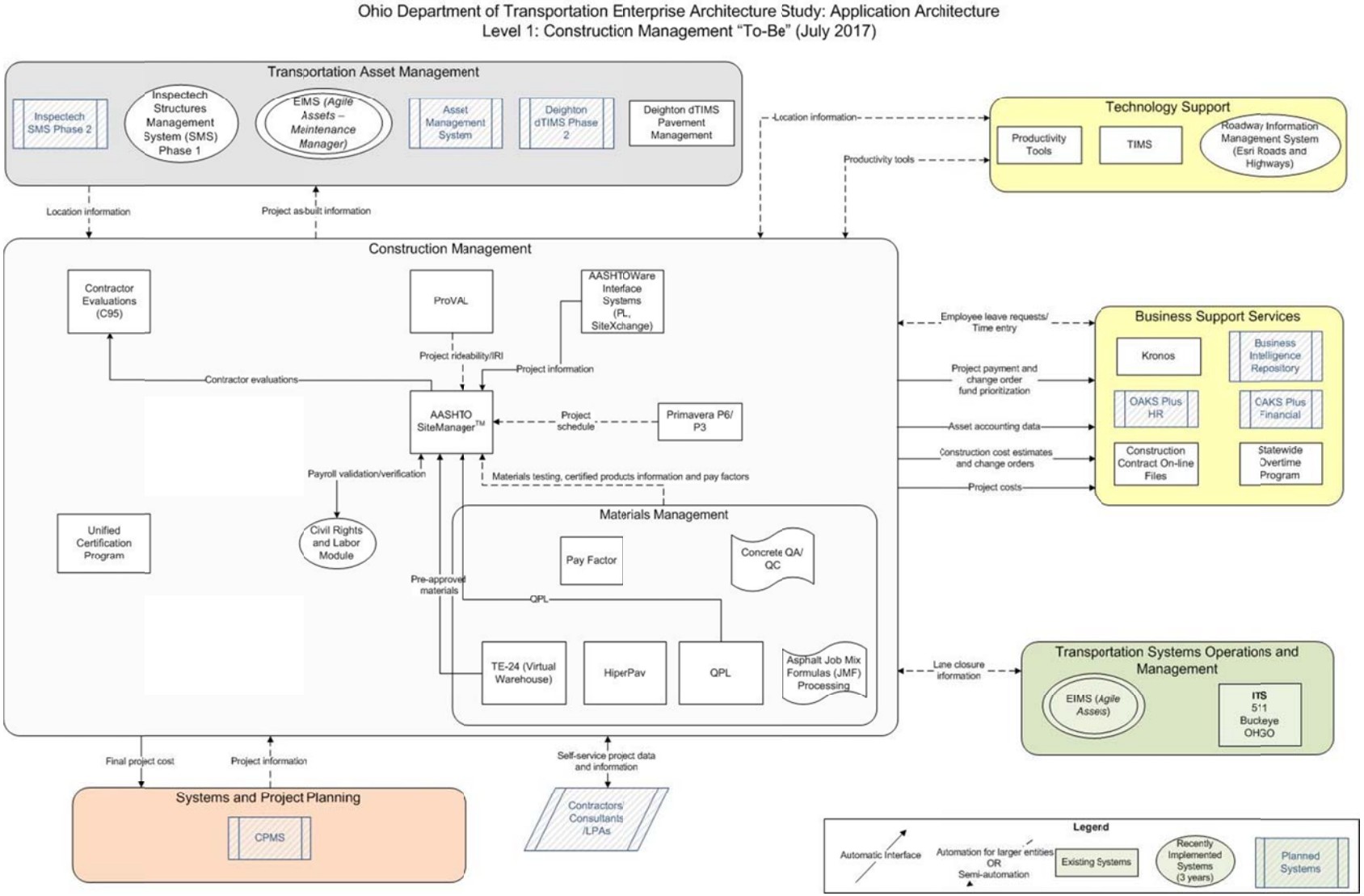
## Figure 59: Systems and Project Planning To-Be Business Process View (2017)



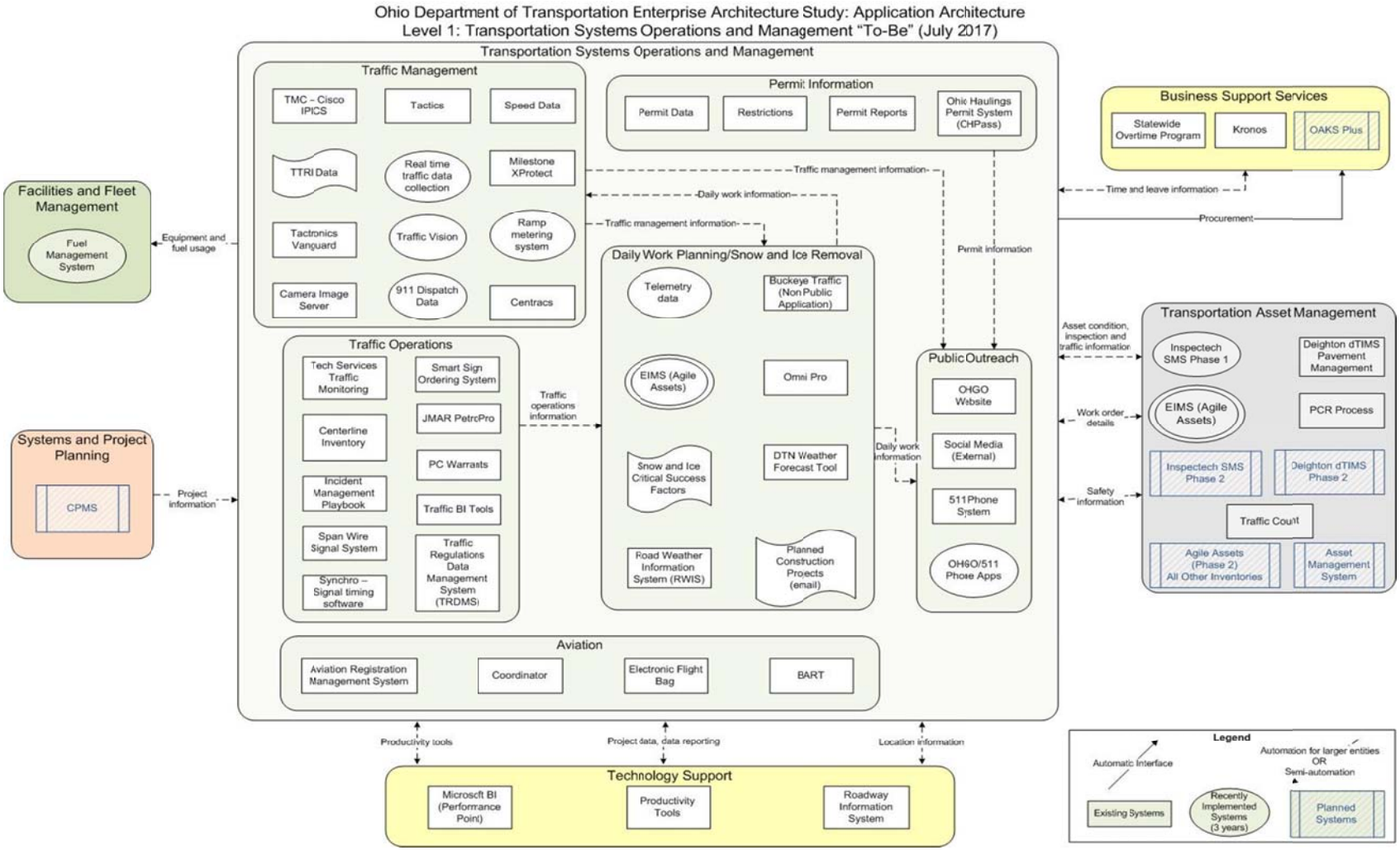
## Figure 60: Preconstruction Management To-Be Business Process View (2017)



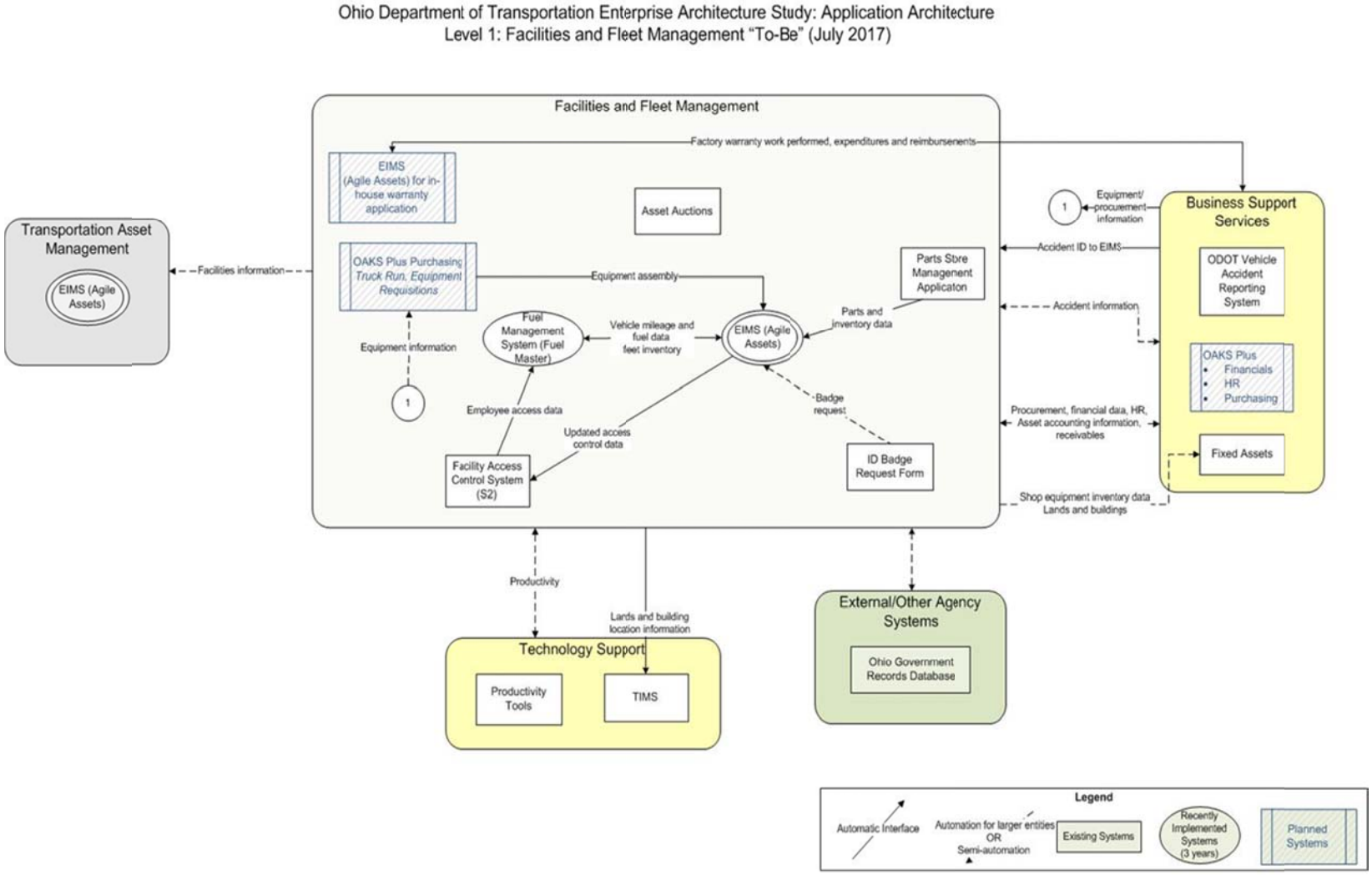
## Figure 61: Construction Management To-Be Business Process View (2017)



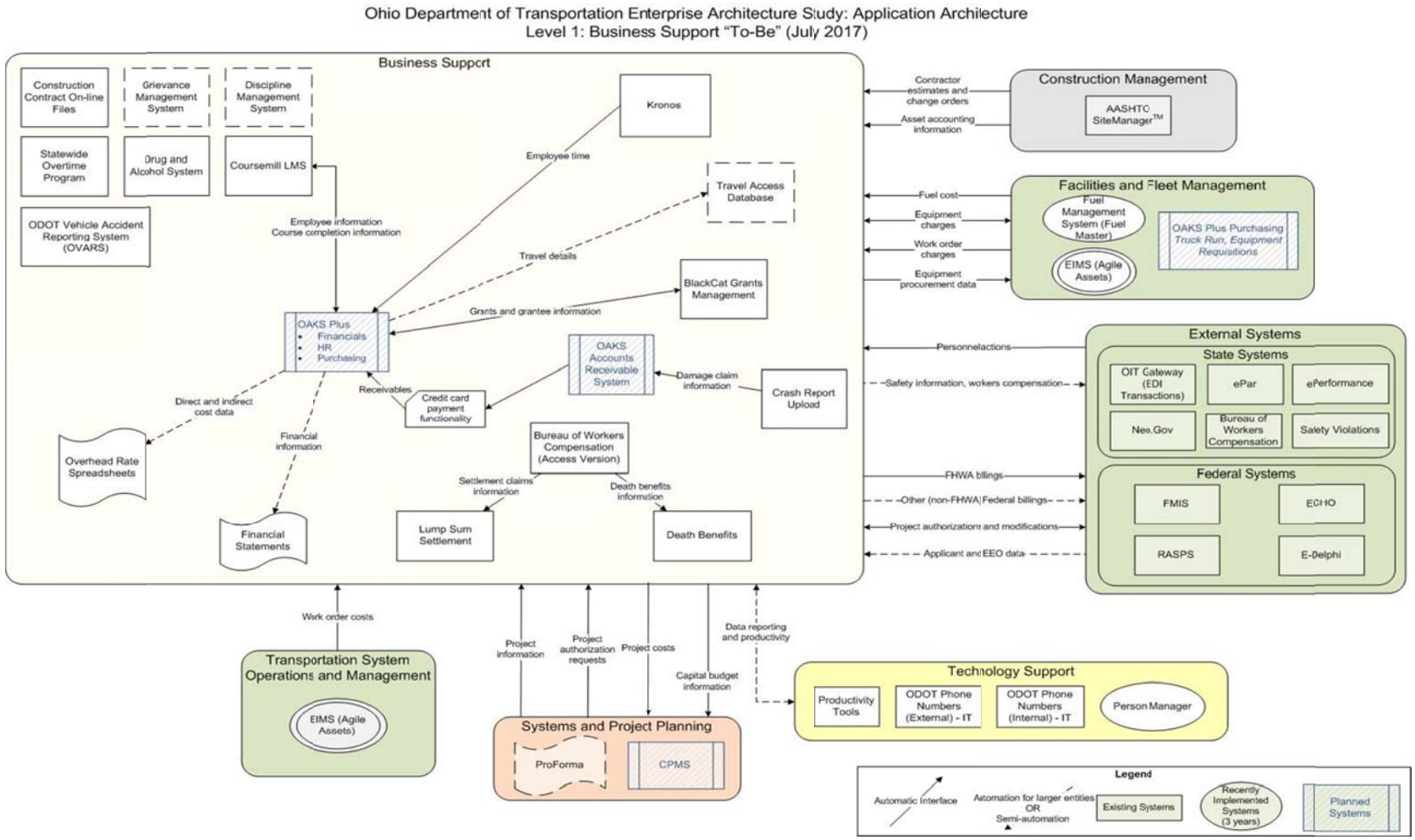
## Figure 62: Transportation Asses Management To-Be Business Process View (2017)



## Figure 63: Facilities and Fleet Management To-Be Process View (2017)



## Figure 64: Business Support Services To-Be Business Process View (2017)



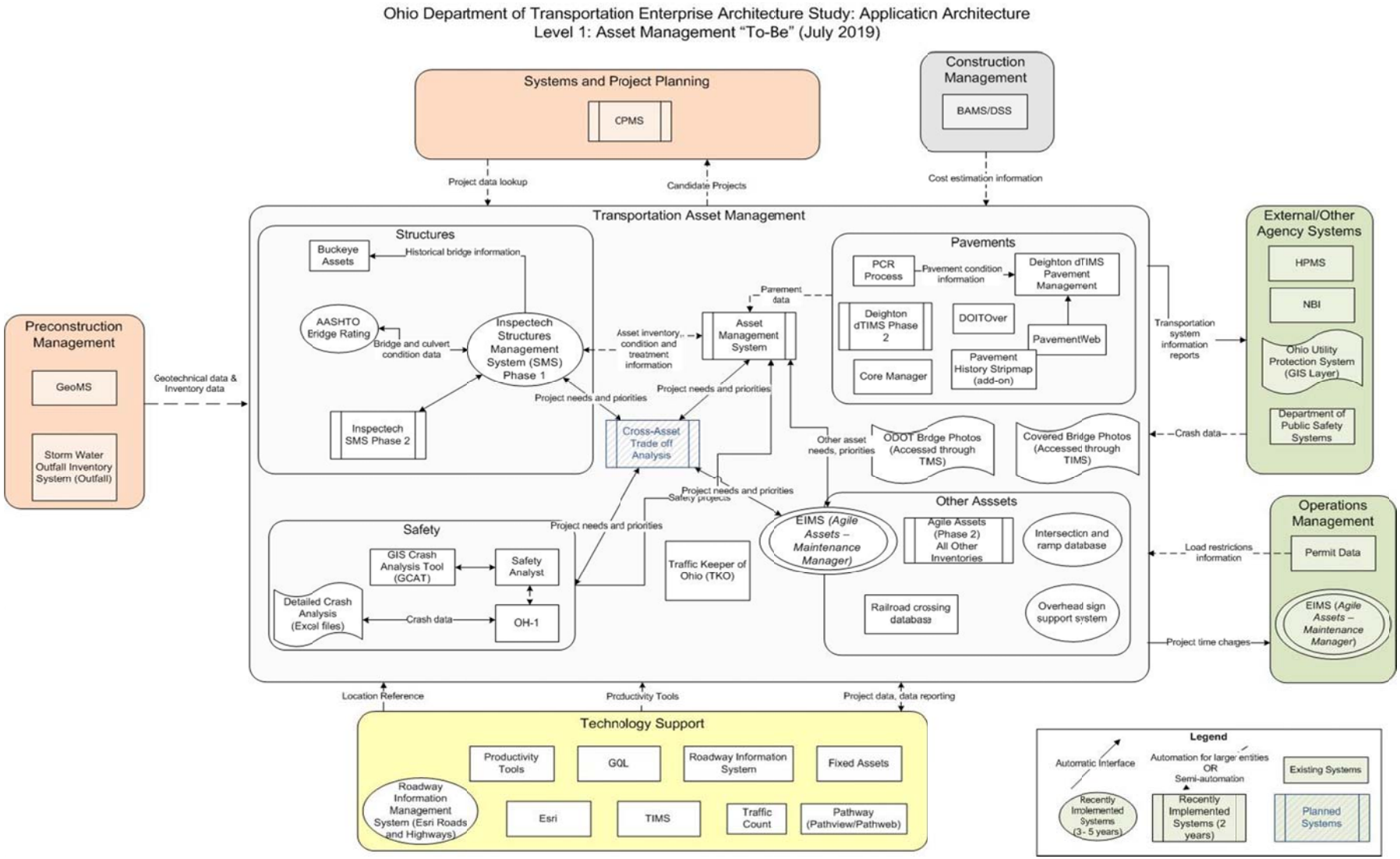
## Appendix 12: Level 1 To-Be Business Process View Diagrams (July 2019)

This appendix includes the Level 1 To-Be Business Process view schematics for each of the functional areas except technology management for which schematics were not developed since those systems were included in the other schematics:

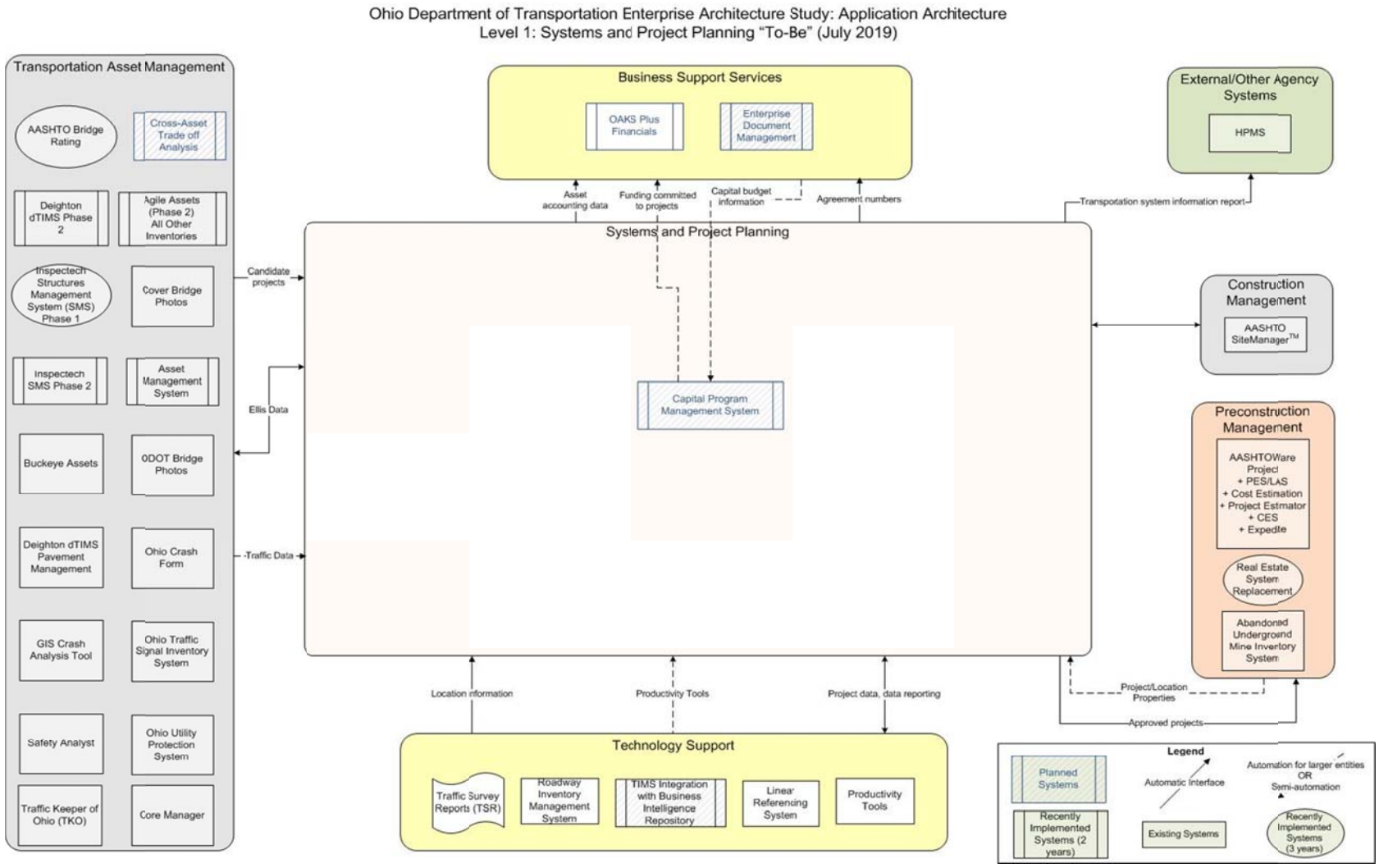
- Figure 65: Transportation Asset Management To-Be Business Process View;
- Figure 66: Systems and Project Planning To-Be Business Process View;
- Figure 67: Preconstruction To-Be Business Process View;
- Figure 68: Construction Management To-Be Business Process View;
- Figure 69 Transportation Asset Management To-Be Business Process View;
- Figure 70: Facilities and Fleet Management To-Be Business Process View; and
- Figure 71: Business Support Services To-Be Business Process View.

These diagrams depict the anticipated ODOT applications architecture for each business functional area based on the implementation of the recommendations from the Enterprise Architecture project as of July 2019, except technology management for which schematics were not developed since those systems were included in the other schematics.

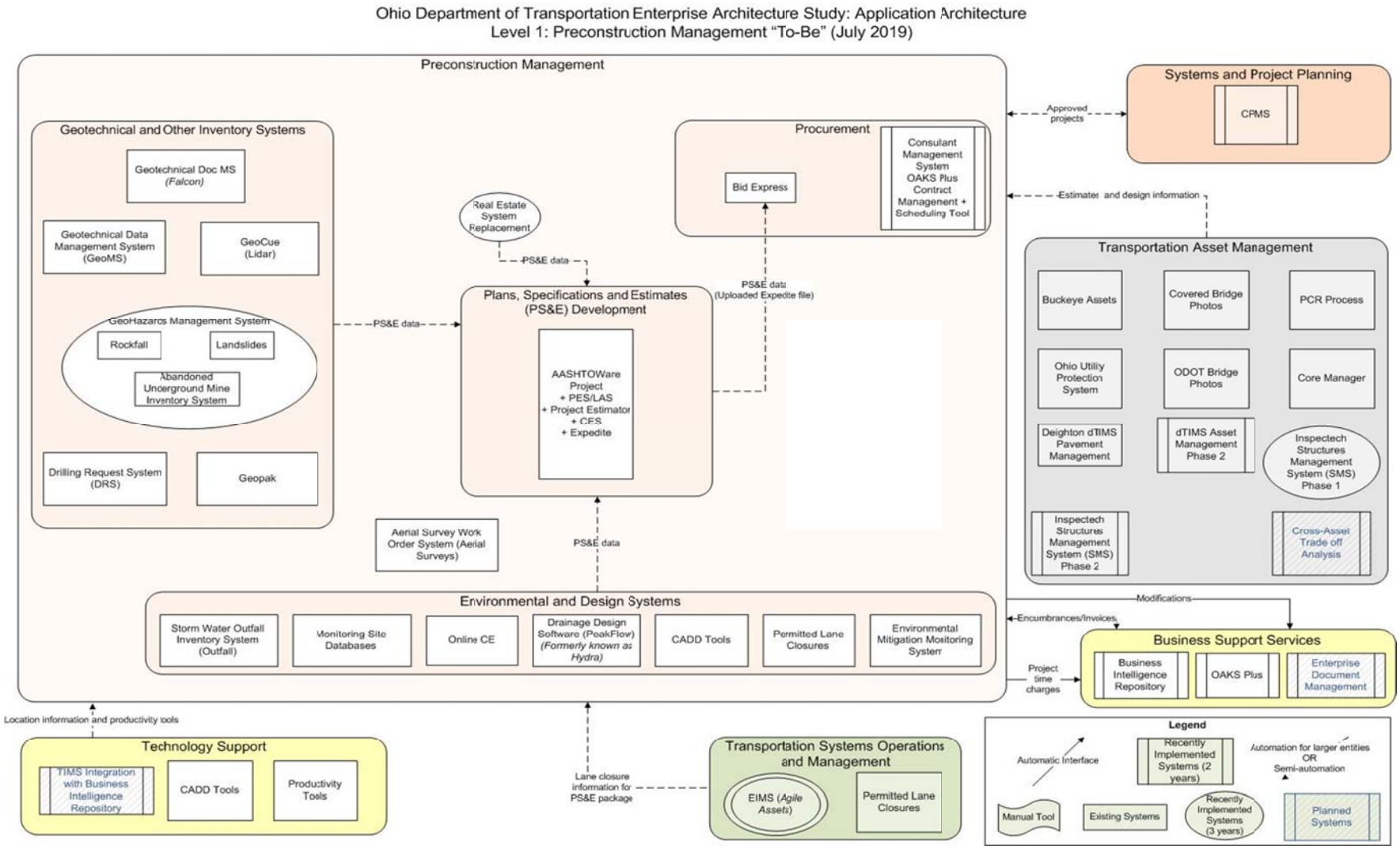
## Figure 65: Transportation Asset Management To-Be Business Process View (2019)



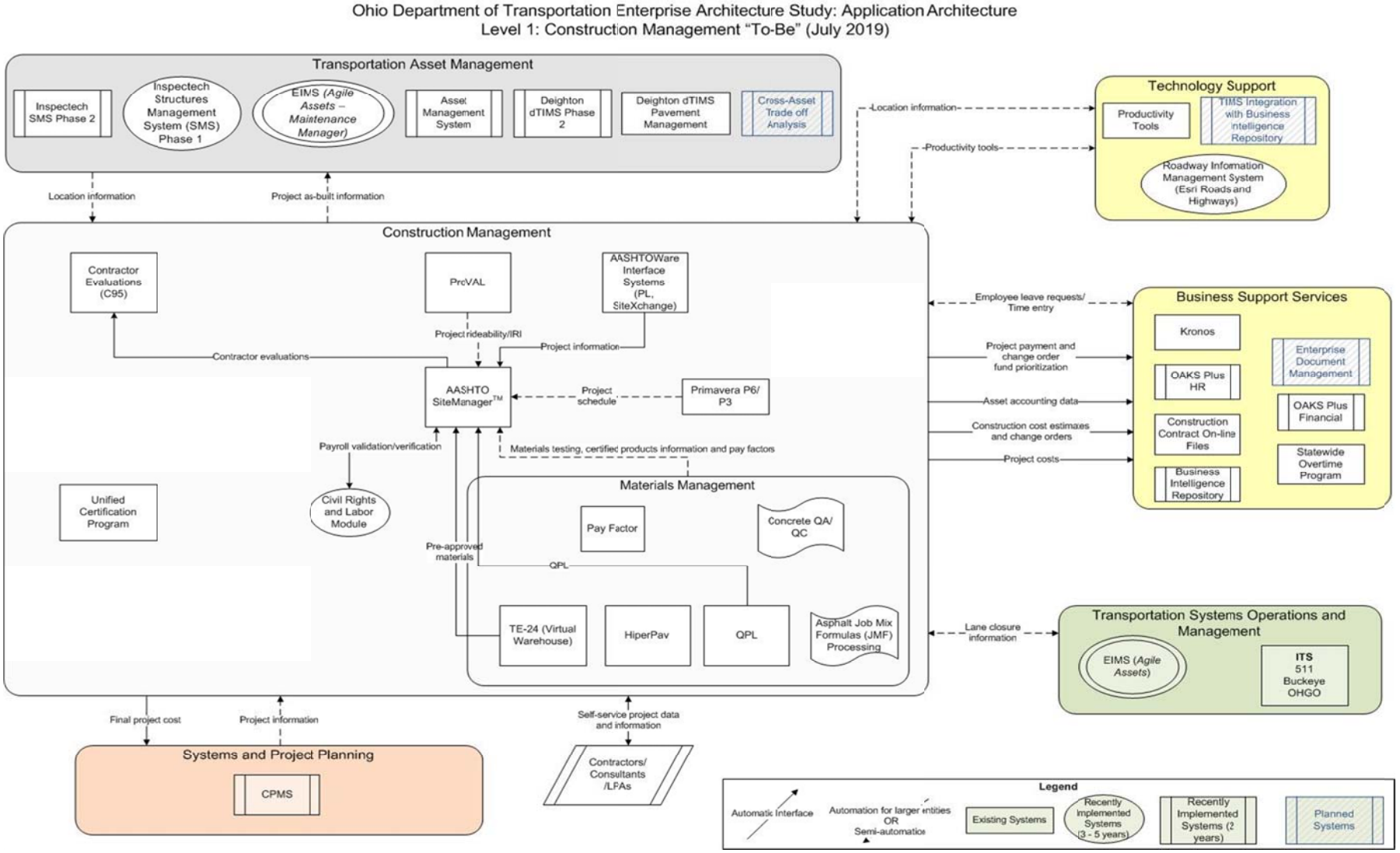
## Figure 66: Systems and Project Planning To-Be Business Process View (2019)



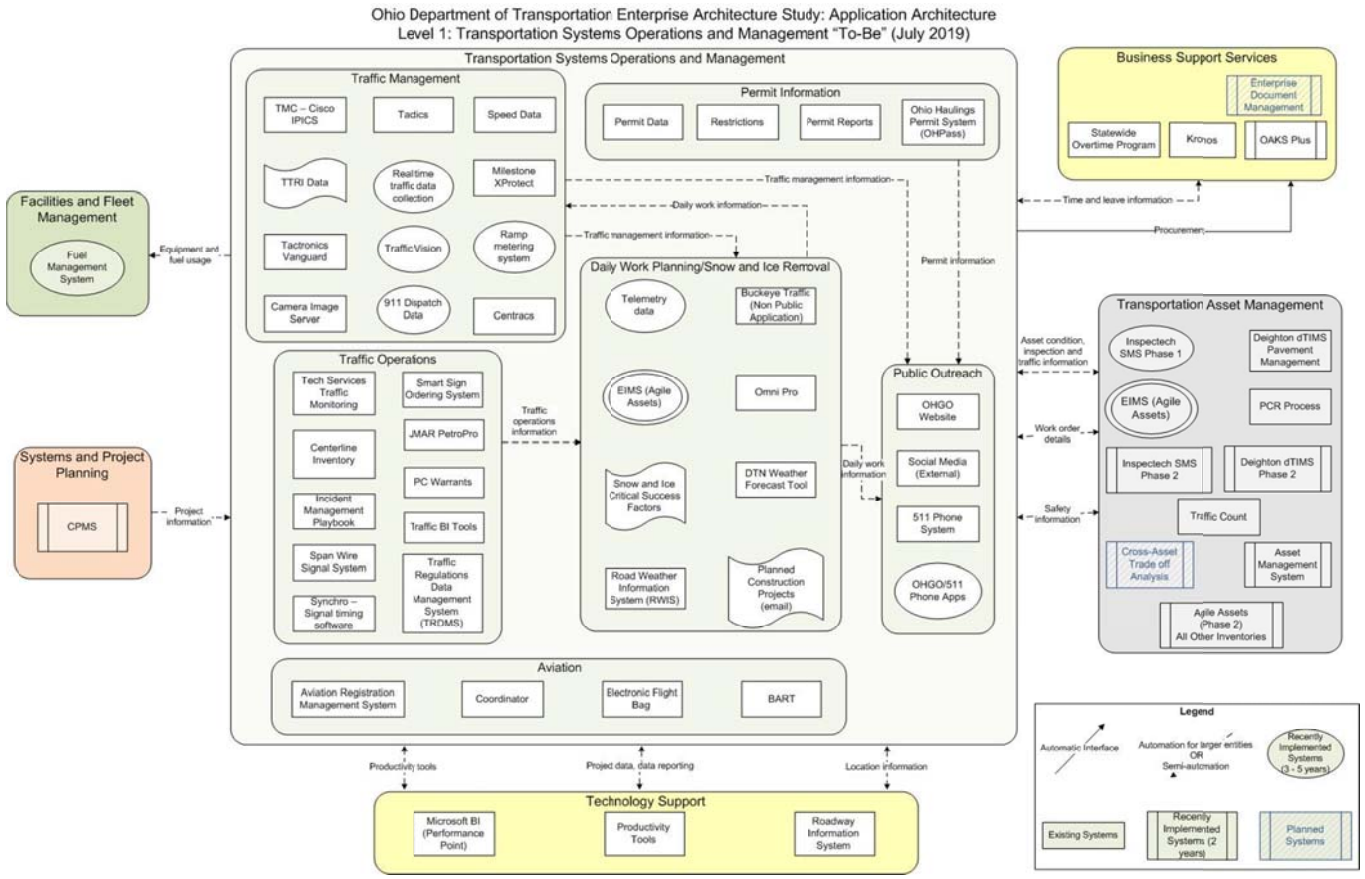
## Figure 67: Preconstruction Management To-Be Business Process View (2019)



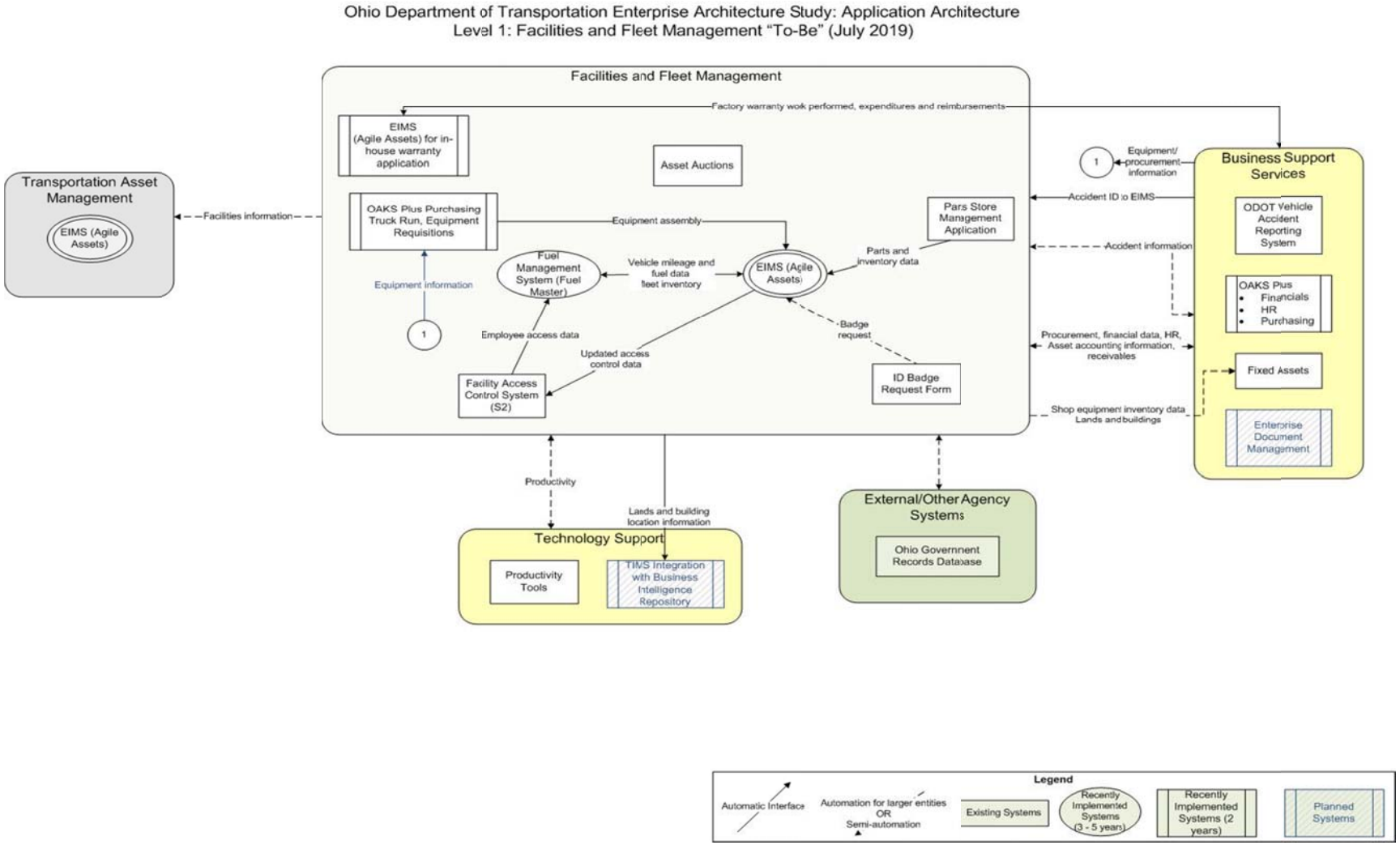
## Figure 68: Construction Management To-Be Business Process View (2019)



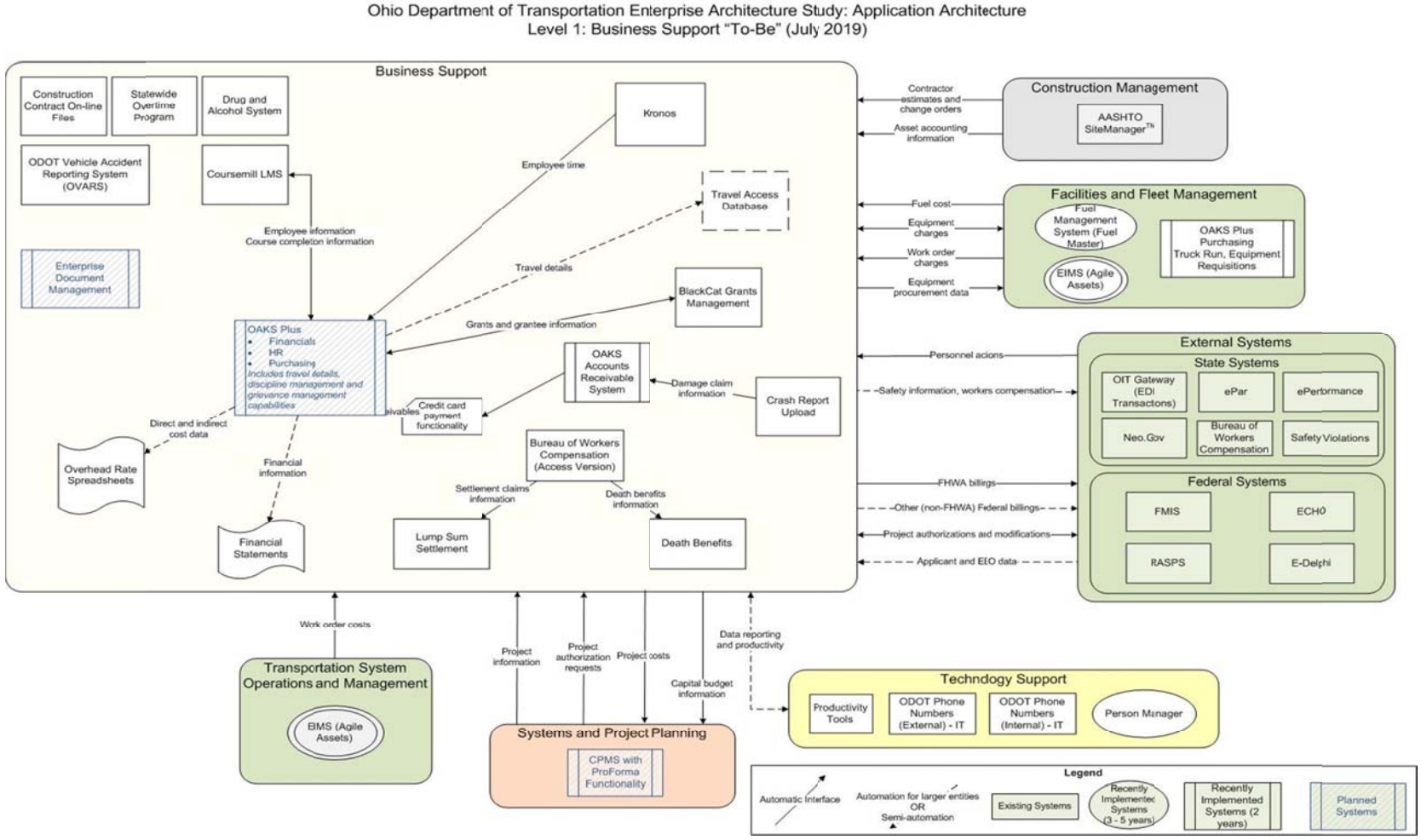
## Figure 69: Transportation Asset Management To-Be Business Process View (2019)



## Figure 70: Facilities and Fleet Management To-Be Business Process View (2019)



## Figure 71: Business Support Services To-Be Business Process View (2019)



## Appendix 13: Application Portfolio Inventory Recommendations

This appendix presents a listing of all enterprise-wide applications that are currently used by ODOT or which are in various stages of implementation as determined from the research team's validation sessions. For each system, the research team provides a recommendation in Table 19 in terms of the future direction of the application.

- **Keep** – Continue utilizing the system within the five-year planning window of the Enterprise Architecture project;
- **Enhance** – Continue utilizing the system within the five-year planning window of the Enterprise Architecture project and consider enhancing or extending the system to deploy additional capabilities within the software or to support additional ODOT business functionality;
- **Retire** – Retire the system within the five-year planning window, with potential strategies for retiring the system identified in the Notes/Comments column of the table; and
- **Evaluate** - Evaluate the system for potential retirement or modified usage within the five-year planning window, with potential strategies which should be evaluated by ODOT identified in the Notes/Comments column of the table.

Additionally, the names of any systems either currently being retired or currently being implemented are color coded as follows:

| ***LEGEND*** |
|---|
| *System in process of being implemented* |
| *System in process of being retired* |

## Table 19: Inventory Recommendations for ODOT's Enterprise-Wide Applications

| Application | Nickname | Recommended Direction | Notes/Comments |
|---|---|---|---|
| 511 Phone System | | Keep | |
| 911 Dispatch Data | | Keep | |
| AASHTO Bridge Rating | | Keep | System currently being deployed |
| AASHTO SiteManager | | Enhance | Implement additional contractor self-service functions |
| AASHTOWare Interface Systems | | Keep | |
| AASHTOWare Project | | Keep | Continue to maintain currency on upgrades as AASHTO migrates to fully web-based product set |
| Abandoned Underground Mine Inventory System | AUMIRA | Retire | |
| Accounts Receivable System | ARS | Retire | Replace with OAKS Plus Accounts Receivable |
| Aerial Survey Work Order System | | Evaluate | Evaluate potential to replace with either work order functionality in PeopleSoft or future Capital Project Management System |
| Agreement Numbers | | Retire | Replace as part of CPMS initiative |
| Airport IQ System Manager | | Retire | |
| Appropriations Accounting | AA | Retire | Replace with OAKS Plus Financials |
| Asphalt Job Mix Formulas (JMF) Processing | | Keep | |
| Asset Auctions | | Keep | |
| Automated Research Management System | ARMS | Retire | Replace with combination of functionality in CPMS, Capital Project Delivery System initiative and OAKS Plus Purchasing |
| Aviation Registration Management System | | Keep | |
| BAMS/DSS | | Keep | |
| Base Highway Transportation Referencing System | BTRS | Retire | Replace through Roadway Information Management System initiative |
| Bid Express | | Keep | |
| BlackCat Grants Management | | Enhance | Develop interfaces with OAKS Plus Financials; evaluate potential use of system for other DOT grants programs. Potential also to be adapted by other state agencies for their grants management needs. |

| Application | Nickname | Recommended Direction | Notes/Comments |
|---|---|---|---|
| Bridge Analysis Rating System | BARS | Retire | Replace all functionality and complete decommissioning through SMS Phase 2 initiative |
| Bridge Management Remote Inspection | BMRI | Retire | Replace all functionality and complete decommissioning through SMS initiative |
| Bridge Management System | BMS | Retire | Replace all functionality and decommission through current SMS and proposed SMS Phase 2 initiative |
| Buckeye Assets | | Keep | |
| Buckeye Traffic - Non Public Application | | Keep | |
| Buckeye Traffic - Public Facing Application | | Retire | Replace with OHGO |
| Bureau of Workers Compensation | | Keep | |
| Camera Image Server | | Keep | |
| Capital program spreadsheets | | Retire | Replace with functionality in CPMS and/or OAKS Plus Financials |
| Car Pool | | Retire | Replace with EIMS/AgileAssets |
| CashForecasting | | Retire | Replace with functionality in CPMS and OAKS Plus Financials |
| Centerline Inventory (Mastermind) | | Keep | |
| Centracs | | Keep | |
| Cisco Call Accounting | | Keep | |
| Civil Rights and Labor Module | CRLM | Keep | System currently being deployed |
| Concrete QA/QC | | Keep | |
| Construction contract on-line files | | Keep | |
| Construction Management System | CMS | Retire | Complete decommissioning of system. As part of main replacement effort any projects still using CMS should be moved to SiteManager. |
| Consultant LOI | | Retire | Replace through Capital Project Delivery System initiative |

| Application | Nickname | Recommended Direction | Notes/Comments |
|---|---|---|---|
| Capital Project Delivery System | | Keep | Under development – to be completed through proposed Capital Project Delivery System initiative – OAKS CI and OAKS Plus Financials. Purchasing functionality to be evaluated as part of the potential solution. |
| Consultant Service System/Consultant Evaluation System | CSS/CES | Retire | Replace through Capital Project Delivery System initiative |
| Contractor Evaluations | C95 | Evaluate | Evaluate potential to perform this function through OAKS Plus Purchasing or OAKS CI |
| Contractor Report | | Keep | |
| Coordinator | | Keep | |
| Core Manager | | Keep | |
| CourseMill LMS | | Keep | Interface with OAKS Plus Human Resources |
| Covered Bridge Photos | | Keep | |
| Crash Report Upload | | Keep | |
| Crash System | | Retire | Complete retirement and decommissioning through replacement with SafetyAnalyst |
| Credit Card Payment Functionality | | Evaluate | Evaluate opportunity to replace with PeopleSoft functionality |
| Culvert Design and Storm Sewer Design | Hydra | Keep | |
| Culvert Management Remote Inspection System | CMRI | Retire | Replace with SMS through proposed SMS Phase 2 initiative |
| Culvert Management System | | Retire | Replace with SMS through proposed SMS Phase 2 initiative |
| Current Billing | CBS | Retire | Replace with OAKS Plus Financials PeopleSoft Billing module |
| Customer Inquiry Management System | CIMS | Retire | Currently being replaced with EIMS/AgileAssets |
| Death Benefits | | Evaluate | Evaluate whether functionality can be met with PeopleSoft modules |
| Deighton dTIMS | dTIMS | Enhance | Utilize additional capabilities of Deighton as appropriate; institutionalize use of system ODOT-wide |

| Application | Nickname | Recommended Direction | Notes/Comments |
|---|---|---|---|
| Detailed Crash Analysis | | Evaluate | Evaluate opportunities to utilize SafetyAnalyst or other enterprise tools to perform functionality |
| Detour (Deterioration Curves Component) | Detour | Retire | Replace with dTIMS |
| Detour (Ellis Component) | | Retire | Replace with CPMS |
| Discipline Management System | DMS | Evaluate | Evaluate whether functionality can be met with PeopleSoft modules |
| District 3 Signs Inventory | Mastermind | Retire | Replace with EIMS/AgileAssets |
| District/Garage Parts Ordering System | | Retire | Replace with OAKS Plus Procurement with integration to inventory in EIMS/AgileAssets |
| Drainage Design Software | PeakFlow | Keep | |
| Drilling Request System | DRS | Evaluate | Evaluate capability to replace by work request functionality in PeopleSoft or AgileAssets and/or new Capital Project Delivery System |
| Drug and Alcohol System | | Keep | |
| DTN Weather Forecast Tool | | Keep | |
| ECHO | | Keep | Evaluate potential for electronic interfaces with OAKS Plus Financials |
| E-Delphi | | Keep | Evaluate potential for electronic interfaces with OAKS Plus Financials |
| Electronic Flight Bags | | Keep | |
| Ellis | | Retire | Replace with CPMS |
| Ellis Codes Maintenance | ADAM | Retire | Replace with CPMS |
| EllisProj | | Retire | Replace with CPMS |
| EMS Webapps Report | | Retire | Replace with EIMS/AgileAssets |
| Enterprise Information Management System (AgileAssets) | EIMS | Enhance | Institutionalize initial phase and deploy incremental functionality; utilize as tool for maintaining additional asset types |
| Environmental Mitigation Monitoring System | | Keep | |
| ePar | | Keep | |
| ePerformance | | Keep | |

| Application | Nickname | Recommended Direction | Notes/Comments |
|---|---|---|---|
| Equipment Management System | EMS | Retire | Replace with EIMS/AgileAssets |
| Esri | | Keep | |
| Esri Roads and Highways | | Keep | Implement through Roadway Information Management System project |
| Facilities Database | | Retire | Replace with EIMS/AgileAssets |
| Facilities Work Order Program | | Retire | Replace with work order functionality in EIMS/AgileAssets |
| Facility Access Control System | | Keep | |
| Federal Program Management System | FPM | Retire | Replace with combination of functionality in CPMS and OAKS Plus Financials |
| Federal Projects Database | | Retire | Replace with combination of functionality in CPMS and OAKS Plus Financials |
| Federal-aid Rapid Approval and State Payment System | RASPS | Keep | |
| Financial Statements | | Retire | Replace with OAKS Plus Financials |
| Fiscal Management Information System | FMIS | Keep | Opportunities for additional electronic interfaces/increased data exchange with CPMS |
| Fixed Assets | | Retire | Replace with OAKS Plus Financials |
| Flight Operations Manager | BART | Keep | |
| Fuel Management System | | Keep | |
| Garvee paybacks spreadsheets | | Evaluate | Evaluate potential to replace with OAKS Plus Accounts Receivable functionality |
| GeoCue | | Keep | |
| GeoHazards Management System | | Keep | |
| GeoMS | | Keep | |
| Geopak | | Keep | |
| Geotechnical Doc MS | | Keep | |
| GIS Crash Analysis Tool | GCAT | Keep | |
| GQL | | Retire | Replace with new Business Intelligence toolset |
| Grievance Management System | GMS | Evaluate | Evaluate whether functionality can be met through PeopleSoft |

| Application | Nickname | Recommended Direction | Notes/Comments |
|---|---|---|---|
| HiperPav | | Keep | |
| HPMS | | Keep | |
| ID Badge Request Form | | Keep | |
| Incident Management Playbook | Playbook | Keep | |
| In-House Warranty Application | | Retire | Replace with a combination of OAKS Plus Financials and EIMS/AgileAssets functionality |
| InspectTech Structures Management System | SMS | Enhance | Deploy additional functionality within InspectTech software and implement full bridge management capability through SMS or additional tools |
| Intersection and Ramp Database | | Keep | |
| JMAR PetroPro | JMAR | Keep | |
| Kronos | | Enhance | Extend configuration of Kronos to utilize as primary time capture tool including for allocating time worked to capital projects |
| Leave Reconciler | | Retire | Replace through OAKS Plus Human Resources initiative |
| Linear Referencing System | LRS | Retire | Retire as part of implementation of new Roadway Information Management System |
| Local Technical Assistance Program | LTAP | Keep | |
| LPA Monitoring Software | | Keep | |
| Lump Sum Settlement | | Keep | |
| Magic | | Retire | Replace with asset management capability in OAKS Plus Financials |
| MBE | | Retire | Retire as part of OAKS Plus Financials |
| Microsoft Business Intelligence (Performance Point) | | Retire | Replace with new Business Intelligence toolset |
| Microsoft Office | | Keep | |
| Microsoft Project | | Keep | Evaluate potential for greater use as scheduling tool for small to medium projects as part of Capital Project Delivery System initiative |
| Microstation | | Keep | |
| Milestone XProtect 5.0b | Milestone | Keep | |
| Monitoring Expenditures over $50k | | Retire | Retire as part of OAKS Plus Financials |

| Application | Nickname | Recommended Direction | Notes/Comments |
|---|---|---|---|
| Monitoring Site Databases | | Keep | |
| National Bridge Inventory | NBI | Keep | |
| Neo.Gov | | Keep | |
| NEPA Management System | NEPA | Evaluate | Evaluate for replacement as part of a second phase of CPMS |
| OAKS Financials | | Enhance | Add additional capabilities to meet ODOT requirements and deploy as ODOT-wide financial management solution |
| OAKS HR | | Enhance | Add additional capabilities to more fully meet operational level ODOT HR requirements |
| ODOT Attendance | | Retire | Replaced by capabilities already deployed in Kronos |
| ODOT Bridge Photos | | Keep | |
| ODOT Phone Numbers (External) - IT | | Evaluate | Evaluate whether functionality can be met through reports/extracts from PeopleSoft HR |
| ODOT Phone Numbers (Internal) - IT | | Evaluate | Evaluate whether functionality can be met through reports/extracts from PeopleSoft HR |
| ODOT Truck Run (External) | | Retire | Replace with a combination of OAKS Plus Purchasing and EIMS/AgileAssets functionality |
| ODOT Truck Run (Internal) | | Retire | Replace with OAKS Plus Purchasing functionality |
| ODOT Vehicle Accident Reporting System | OVARS | Evaluate | Evaluate whether functionality can be provided through either AgileAssets Fleet and/or PeopleSoft HR functionality |
| Office Supply System | WOSS | Retire | Replace with OAKS Plus Purchasing functionality |
| OHGO Website | OHGO | Keep | |
| OHGO/511 Phone Apps | | Keep | |
| Ohio Bureau of Workers Compensation | Wcomp | Keep | |
| Ohio Crash Form | OH-1 | Keep | |
| Ohio Government Records Database | | Keep | |
| Ohio Haulings Permit System | OHPass | Keep | Evaluate business value of electronic interface to OAKS Plus Financials |

| Application | Nickname | Recommended Direction | Notes/Comments |
|---|---|---|---|
| Ohio Traffic Signal Inventory System | OSIS | Evaluate | Evaluate potential use of AgileAssets Traffic Signal Inventory module |
| Ohio Utility Protection System | OUPS | Keep | |
| OIT Gateway (EDI Transactions) | | Keep | |
| Omni Pro | | Evaluate | Evaluate potential to utilize EIMS/AgileAssets to provide functionality |
| Online CE | | Evaluate | Evaluate for replacement as part of a second phase of CPMS |
| Organizational Performance Index | | Retire | Not currently utilized; replace with analytics and reports through business intelligence tool as requirements for functionality identified |
| Overhead rate spreadsheets | | Evaluate | Evaluate for potential replacement through OAKS Plus Financials |
| Overhead Sign Support System | | Keep | |
| PA Generator | | Retire | Replace with OAKS Plus Human Resources |
| PA SSN | | Retire | Replace with OAKS Plus Human Resources |
| PA Tracker | | Retire | Replace with OAKS Plus Human Resources |
| Parts Store Management Application | | Keep | Evaluate additional automated interfaces with EIMS/AgileAssets |
| Pathway (Pathview/Pathweb) | | Keep | |
| Pavement Design Tool | DoITOver | Keep | |
| Pavement History Stripmap | | Keep | |
| Pavement Web | | Keep | |
| Payroll and Leave System | | Evaluate | Evaluate for replacement as part of OAKS Plus Human Resources initiative |
| Payroll Bi-Weekly Process | | Evaluate | Evaluate opportunities for streamlining as part of OAKS Plus Human Resources initiative |
| Payroll Cost Projection (MF-Batch) | | Retire | Retire as part of implementation of OAKS Plus |
| PC Warrants | | Evaluate | Evaluate potential for EIMS/AgileAssets to provide this functionality |
| PCR Process | | Keep | |

| Application | Nickname | Recommended Direction | Notes/Comments |
|---|---|---|---|
| PDMS/FE | PDMS/FE | Retire | Decommission as part of CPMS; data should be converted to CPMS or to data warehouse and system fully decommissioned |
| PDP Online | SAFE | Evaluate | Evaluate for replacement as part of CPMS |
| Permit Data | | Keep | |
| Permit Reports | | Keep | |
| Permitted Lane Closures | | Keep | |
| Person Manager | | Keep | Evaluate approach and timing for integration to OAKS Human Resources Plus |
| Personnel Data Change | | Evaluate | Evaluate for replacement as part of OAKS Plus Human Resources |
| Planned Construction Projects | | Retire | Replace with CPMS functionality |
| Pool Car System | | Retire | Replace with EIMS/AgileAssets functionality |
| Primavera P6 | | Keep | Potential to utilize as scheduling tool for larger projects as part of Capital Project Delivery System |
| ProForma | | Evaluate | Potential to replace with functionality in OAKS Plus Financials PeopleSoft modules and CPMS |
| ProVAL | | Keep | |
| Qualified Products List | QPL | Keep | |
| Railroad Crossing Database | | Evaluate | Evaluate opportunity to utilize EIMS/AgileAssets for this functionality; interface with new CPMS |
| Ramp Metering System | | Keep | |
| Real Estate Document Management System | | Retire | Replace with functionality in new Real Estate module and functionality to be provided in Enterprise Document Management System |
| Real Estate Module | Paradox | Retire | Replace through new Real System project now underway |
| Real Estate System Replacement | | Keep | Evaluate opportunities for automated interfaces with CPMS and OAKS Plus Financials |
| Real Time Data Collection | | Keep | |
| Reconciliation tools | | Retire | Retire through implementation of OAKS Plus |
| Remediation Cost Database Application | RCDA | Retire | System already retired per validation sessions |

| Application | Nickname | Recommended Direction | Notes/Comments |
|---|---|---|---|
| Research and Development Database | | Evaluate | Evaluate opportunities to replace functionality through CPMS and new Enterprise Document Management System initiative; also potential to remain and interface with CPMS |
| Restrictions | | Keep | |
| Road Weather Information System | RWIS | Keep | |
| Roadway Information System | RIS | Keep | |
| SafetyAnalyst | | Keep | Continue to extend use of system throughout ODOT |
| Safety Violations | VSSR | Evaluate | Evaluate opportunity to replace with PeopleSoft functionality |
| ScanWeb | | Keep | |
| SharePoint/Infopath | | Keep | |
| Smart Sign Ordering System | | Evaluate | Evaluate potential to provide functionality through PeopleSoft order management or AgileAssets work request functionality |
| Snow and Ice Critical Success Factors | | Evaluate | Evaluate potential to implement through reports/analytics in new business intelligence (BI) toolset |
| Social Media | | Keep | |
| Source Document Page | | Retire | Replace with OAKS Plus Financials and Purchasing functionality |
| Span Wire Signal System | SWSS | Keep | |
| Speed Data | | Keep | |
| State Earmarks Data | | Evaluate | Potential to meet functionality through CPMS |
| Statewide Overtime Program | Overtime Roster | Keep | |
| Storm Water Outfall Inventory System | Outfall | Keep | |
| Straight Line Diagrams | SLD | Evaluate | Evaluate opportunity to replace through Roadway Information Management System project |
| Synchro Signal Timing Software | | Keep | |
| Tactics | | Keep | |
| Tactronics Vanguard | | Keep | |

| Application | Nickname | Recommended Direction | Notes/Comments |
|---|---|---|---|
| TE-24 | | Keep | |
| Tech Services Traffic Monitoring | | Keep | |
| Telemetry Data | | Keep | |
| Test Results System | | Keep | |
| TMC Video Surveillance Operations Manager | | Retire | System in the process of being retired |
| TMC-Cisco IPICS | | Keep | |
| Traffic BI Tools | | Keep | |
| Traffic Count | | Keep | |
| Traffic Keeper of Ohio | TKO | Keep | |
| Traffic Regulations Data Management System | TRDMS | Evaluate | Evaluate potential to utilize EIMS/AgileAssets to provide functionality |
| Traffic Survey Reports | TSR | Keep | |
| Traffic Vision | | Keep | |
| Training Records System | | Evaluate | Evaluate potential to replace with PeopleSoft functionality through OAKS Plus HR initiative |
| Training Records System Academy Manager | | Evaluate | Evaluate potential to replace with PeopleSoft functionality through OAKS Plus HR initiative |
| Transportation Information Mapping System | TIMS | Enhance | |
| Transportation Management System | TMS | Retire | Replace with EIMS/AgileAssets |
| Travel Access Database | | Evaluate | Evaluate opportunity to replace with PeopleSoft Time and Expense functionality, direct use of OAKS Cognos BI environment, or import of data into ODOT BI environment |
| TTRI Data | | Keep | |
| Unified Certification Program | | Evaluate | Evaluate potential to utilize OAKS Plus Purchasing functionality |
| Web Portal | | Evaluate | Evaluate replacement with PeopleSoft Financials functionality |