Alaska Department of Transportation & Public Facilities

TRANSPORTATION ASSET MANAGEMENT INFORMATION SYSTEM (TAMIS)
Federal Project Number 000S793(A)

Prepared By:
Cambridge Systematics, Inc.
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October 2015
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This document is a compilation of all tasks in the Transportation Asset Management Information Systems (TAMIS) project for the Alaska Department of Transportation and Public Facilities (DOT&PF). The goal of the TAMIS research was to provide the backbone for the Asset Management program for ADOT&PF. This project documented and analyzed relevant research and requirements, conducted an assessment of existing business practices and information, data systems, and tools, developed a framework and common vision, conducted a gap analysis as an overall risk management and assessment program and developed recommendations. This research project’s goals were to improve data management for the organization and create a system that all staff can easily use and for the State of Alaska to maintain. The research discusses how to strengthen the ability of data programs to support core business functions of the agency, improve data quality, consider protect data an agency asset and limit risks associated with data and information loss or inaccuracy.

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### SI* (MODERN METRIC) CONVERSION FACTORS

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#### ILLUMINATION

| fc | foot-candles | 10.76 | lux | lx |
| fl | foot-Lamberts | 3.426 | candela/m\(^2\) | cd/m\(^2\) |

#### FORCE and PRESSURE or STRESS

| lbf | poundforce | 4.45 | newtons | N |
| lbf/in\(^2\) | poundforce per square inch | 6.89 | kilopascals | kPa |

### APPROXIMATE CONVERSIONS FROM SI UNITS

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#### TEMPERATURE (exact degrees)

| \( ^\circ C \) | Celsius | \( 1.8C+32 \) | Fahrenheit | \( ^\circ F \) |

#### ILLUMINATION

| lx | lux | 0.0929 | foot-candles | fc |
| cd/m\(^2\) | candela/m\(^2\) | 0.2919 | foot-Lamberts | fl |

#### FORCE and PRESSURE or STRESS

| N | newtons | 0.225 | poundforce | lbf |
| kPa | kilopascals | 0.145 | poundforce per square inch | lbf/in\(^2\) |

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.
(Revised March 2003)*
Transportation Asset Management Information System (TAMIS)

prepared for

Alaska Department of Transportation and Public Facilities

prepared by

Cambridge Systematics, Inc.
Transportation Asset Management Information System (TAMIS)

Compilation of all Tasks

prepared for
Alaska Department of Transportation and Public Facilities

prepared by
Cambridge Systematics, Inc.
1566 Village Square Boulevard, Suite 2
Tallahassee, FL 32309

date
October 7, 2015
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Overview

This document is a compilation of all tasks in the Transportation Asset Management Information Systems (TAMIS) project for the Alaska Department of Transportation and Public Facilities (DOT&PF).

The following lists all task reports, provides a brief description, and date of publication.


2. **Federal Requirements and Associated Research**: June 2013 - Provides research and analysis of Federal requirements and associated research related to the development of a TAMIS.

3. **Other State’s Best Practices**: July 2013 - Documents research of best practices applicable to Alaska DOT&PF with respect to asset management planning, data integration/management, and governance.

4. **TAMIS Vision and Components**: July 2013 - The Vision and Components report was the deliverable of Task 4 Stakeholder Coordination. A TAMIS stakeholder team was developed and a workshop was held to develop the Vision and Components for TAMIS.

5. **TAMIS Data Systems Evaluation**: December 2013 - This report is the result of identification, assessment, and documentation of ADOT&PF’s existing asset management information systems and data.

6. **TAMIS Framework**: December 2013 - Establishes the desired framework of TAMIS for ADOT&PF following Section 8.1 of the AASHTO Asset Management (AM) Guide

7. **TAMIS Gap Analysis**: March 2014 - Compares existing data and information systems with the desired framework for the TAMIS in order to develop an action plan to address gaps.

8. **System Model Alternatives**: March 2014 - Documents research of available models for ADOT&PF TAMIS.

9. **TAMIS Implementation Plan and Summary of Research Recommendations**: September 2015 - Provides an Implementation Plan for TAMIS based on a detailed analysis and prioritization of recommendations from all tasks in the project.

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10. **TAMIS Communication Plan**: September 2013 - Documents the Communication plan for the Alaska DOT&PF TAMIS project.

11. **TAMIS Data Business Plan**: July 2015 - The Data Business Plan (DBP) establishes business rules and data quality expectations for TAMIS data systems to guide enterprise improvements to data and information practices.

12. **TAMIS Proof of Concept Report**: June 2015 - This report documents the development, functionality, recommendations, and lessons learned for the Proof of Concept which is a tool that could support asset management data analysis and improved decision-making if a TAMIS is at Alaska DOT&PF.

13. **Data Governance Manual**: June 2015 - The Data Governance Manual defines a data governance framework, describes roles and responsibilities, identifies and explains the supporting policies and procedures, and lists standards to follow for effective data management that will support TAMIS and enterprise systems at Alaska DOT&PF.

**Data and Information System Catalog (DISC) Report**: September 2015 - Documents the Data and Information System Catalog (DISC) development, functionality, and recommendations.
Transportation Asset Management Information Systems (TAMIS) and Data Research Project

Work Plan

prepared for

Alaska Department of Transportation & Public Facilities

prepared by

Cambridge Systematics, Inc.
1.0 Introduction

This proposed work plan will support the development of the Transportation Asset Management Information System (TAMIS). The goal of the TAMIS will be to provide the backbone for the Asset Management program for ADOT&PF. The program will ultimately support the FHWA State Transportation Improvement Program (STIP) and Long Range Transportation Plan development activities of the Program Development Office.

The objectives of this project are to:

1. Document and analyze relevant research and requirements for TAMIS;
2. Conduct an assessment of existing business practices and information, data systems, and tools related to TAMIS;
3. Develop a framework of the TAMIS, including a common vision;
4. Conduct a gap analysis as an overall risk management and assessment program; and
5. Develop recommendations in the form of a work plan.

This project will result in improved data management for TAMIS that will:

- Create a system that all ADOT&PF employees can easily use and for the State of Alaska to maintain;
- Strengthen the ability of data programs to support core business functions of the agency;
- Improve data quality throughout the organization;
- Protect data as an asset of the agency; and
- Limit risks associated with loss of data and information.

The following section describes in detail the twelve project tasks.
2.0 Work Tasks

The project activities will be closely coordinated with the ongoing development of a Transportation Asset Management Plan (TAMP) within currently underway within ADOT&PF. This project is organized into twelve tasks as shown below.

The result will be a research product that will review, document, and assess all current data and information systems related to asset management within ADOT&PF, build on MAP-21 and upcoming performance management requirements, draw from all relevant national AASHTO,
FHWA and NCHRP research efforts, assess the state of Information Systems and Data to support TAMIS within ADOT&PF, take advantage of successes and lessons learned in other states, research options for a TAM Information and Data System and make specific recommendations for ADOT&PF regarding the data integration required and the optimum system.

The successful completion of all project tasks in a timely manner will require close coordination between the ADOT&PF and the CS Project Team, in the review and revision of all project materials.

Materials will be transmitted electronically to ADOT&PF, via email or using the CS FTP server, or other methods approved by ADOT&PF.

**TASK 1. PROJECT MANAGEMENT AND WORK PLAN**

**Objective**

The objective is to develop a detailed work plan and coordinate with ADOT&PF Asset Management Office.

**Description of Work**

The first step in Task 1 is to hold a teleconference to kickoff the meeting. The purpose of this meeting is to review the project objectives, work plan, schedule and expected deliverables. The Work Plan will include potential risks and constraints of project management. It will also include a detailed schedule and clearly identify the “early win” task deliverables. Based on feedback received at this meeting, we will revise the work plan and schedule as needed and submit the updated versions to ADOT&PF.

The remainder of Task 1 will involve coordinating with ADOT&PF regarding deliverables and project status. This includes monthly project teleconference meetings with the ADOT&PF project manager to review progress, discuss any issues that may have arisen, and review work over the next month.

**Deliverables**

- Schedule, preparation and attendance at on-site kickoff meeting.
- Draft and final project work plans.
- Monthly detailed progress reports.
- Monthly progress teleconferences
TASK 2. DOCUMENT AND ASSESS ALL FEDERAL REQUIREMENTS AND ASSOCIATED RESEARCH

Objective

The objective of this task is to research, compile and analyze all Federal requirements and associated research related to the development of an Asset Management Information System.

Description of Work

1. Compile and provide a summary of all relevant national requirements and research. These include:
   - MAP-21,
   - AASHTO Transportation Asset Management Guide,
   - NCHRP 666 Target-Setting Methods and Data Management to Support Performance-Based Resource Allocation by Transportation Agencies and NCHRP 706
   - NCHRP 8-87 Best Practices in GIS-Based Asset Management (in progress),
   - NCHRP 20-74 Developing an Asset Management Framework,
   - NCHRP Report 545, Analytical Tools for Asset Management,
   - NCHRP 20-90 Improving the Management of Information at State DOTs,
   - NCHRP 8-36, Task 100 Transportation Data Self Assessment Guide,
   - ACRP Report 19 – Developing an Airport Performance-Measurement System,
   - ACRP Report 69 – Asset and Infrastructure Management for Airports – Primer and Guidebook
   - FAA Advisory Circulars on Airport Pavement Management
   - ACRP Report 19 - Developing

For example, according to MAP 21:

- FHWA will set minimum condition thresholds for pavements and bridges by March 2014. (Minimum condition for bridges is 10 percent of deck area classified as structurally deficient.) If states fall below them they must reallocate money to address the deficiencies.
- FHWA will define the process for developing a Transporations Asset Management Plan (TAMP) by March 2014. The TAMP will include:
  » Inventory and condition of pavements and bridges
  » Objectives and performance measures
  » Lifecycle cost and risk management analysis
» Financial plan
- States must develop a TAMP for the NHS by the beginning of the second fiscal year after the process has been defined.
- FHWA will certify the process used by each state to develop the TAMP.
- States have until September 2014 to provide more detailed (element-level) bridge data.
- FHWA will conduct a risk assessment of bridges in the U.S. to prioritize them for work.

In addition, MAP-21
- Establishes a new program, “the National Highway Performance Program” for addressing national goals on the NHS. This is the largest program.
- Identifies 7 national goals areas, and potential measures for each.
- Money will not be allocated based on targets, but if states underperform for 2 reporting periods they must describe the actions necessary to achieve them.
- According to MAP-21, Statewide and regional plans must use a performance-based approach to decision making that support the national goals. Measures and targets must be considered when developing policies, programs and investment priorities. Plans must include measures, targets, and a performance report comparing actual performance to target values.
- All of these will impact the need for and approach to the TAMIS project in Alaska.
- Others will be identified though research by interviewing FHWA Asset Management office and TRB committee Chairs.
- Future relevant initiatives such as the development of performance measures by the newly formed FHWA Office of Performance Management will also be monitored and tracked.

2. Assess potential impact of all relevant requirements and research on Alaska’s TAMIS.

3. Report on recommendations

Deliverable
Research report documenting all relevant Federal requirements and initiatives and their potential impact on the Alaska TAMIS.

TASK 3 - RESEARCH OTHER STATE BEST PRACTICES

Objective
The objective of this task is to research and document best practices applicable to Alaska DOT&PF with respect to asset management planning and data integration/management and governance.
Description of Work

1. Interview (by phone) representatives from several State DOTs who have conducted successful Asset Management (AM) or AM related Data Integration plans. These may include: the Arizona DOT, Colorado DOT, Massachusetts Highway Department, New Mexico DOT, Pennsylvania DOT, Vermont Agency of Transportation, Utah DOT and Virginia Department of Rail and Public Transit. Another good example may be Minnesota DOT’s aggressive pavement Preservation Program.

Topics to be covered include: Data Business Plans, data integration for Asset Management, Systems in use for Asset Management and data integration, risk assessment, tradeoff analysis, technology components of a TAMIS (database, links to geospatial features, application software, and interfaces) and organizational challenges/lessons learned (such as data governance).

An outline and interview guide will be approved by ADOT&PF prior to the interviews.

Following are examples of TAM efforts that may be relevant for this effort:

- The New Mexico DOT established a phased TAM implementation, as illustrated below, and is working to implement the actions defined in the plan.

- In the area of Risk Management, Georgia DOT is conducting a risk assessment of its Interstate Highway System to use the results to prioritize preservation projects.

- Successful Data Business Plans have been developed in Virginia, California, Florida, Colorado, and Alaska.

- Tradeoff tools/analysis frameworks are being developed in several states including Georgia, Massachusetts, Pennsylvania, California, Montana, New Jersey, Ontario Canada DOTs; and the Atlanta, Detroit, and Indianapolis MPOs.

2. Document lessons learned and best practices to be applied to ADOT&PF.
Deliverables

- Outline of Interview Guide
- Final and draft Interview Guide.
- Summary table describing results of best practice review (by State)
- Memorandum summarizing best practices and lessons learned related to information systems and data integration and AM planning as applicable to ADOT&PF TAMIS.

**TASK 4 – STAKEHOLDER COORDINATION**

**Objective**

The objective of this task is to establish a TAMIS Stakeholder Task Team and coordinate with the team throughout the project. This task also includes workshops and detailed interviews with all stakeholders. One of the workshops will be a “vision” workshop where the high level definition, vision and data components of the TAMIS will be discussed.

**Description of Work**

1. Work with ADOT&PF Asset Management Office to identify a “Stakeholder Task Team”. The Task Team will be comprised of all data owners associated with the TAMIS. At a minimum, members will include representatives from the pavement, program development, bridge, maintenance, Information Technology (IT), Program Development and Asset Management offices.

2. Schedule and hold regular meetings (teleconferences or webinars) with the Team to keep them apprised of progress. We will work with ADOT&PF to schedule these meetings, identify participants, develop agendas and other meeting materials, assist with facilitation, and document the results of each meeting. The meeting summaries will document highlights from the discussions, identify potential implications for subsequent activities, and recommend approaches for addressing outstanding issues.

3. Schedule and conduct targeted interviews with members of the Task Team and others as deemed appropriate. The interviews will be to elicit their perspectives on asset management, data and information integration and relationships to other ongoing efforts. The interviews will focus on the following areas:
   - Current and planned policies and initiatives that support asset management and data integration related to asset management;
   - Existing management systems, databases, and other IT tools that can be used to support asset management.
   - Specific questions related to data quality, timeliness, and integration.
- A draft list of interview questions will be prepared by the consultant and approved by ADOT&PF prior to holding the interviews.

4. Schedule and facilitate a half-day (in-person) vision workshop presenting the findings developed in Tasks 2 and 3 and facilitating an open forum for discussion. A high level vision and list of components/data will be presented and discussed at the meeting as well. The general scope of the TAMIS will be agreed upon with the stakeholders. This includes general modal scope (e.g. TAMIS will cover roadways only), data elements and data bases to be included and high level business processes. The vision workshop will also be an important activity to inform Task 10 - Project Communications Plan.

**Deliverables**

- Draft and final list of TAMIS Stakeholder Task Team.
- Draft and Final Stakeholder interview guide.
- Participation in meetings in March 6-8 to conduct some interviews
- Schedule, preparation and facilitation of half-day workshop.
- Workshop summary.
- Draft Vision and Components Document
- Task Team Teleconferences (Monthly)
- The following materials for each meeting:
  - Draft and final agenda and meeting materials (typically in the form of handouts and/or PowerPoint presentation slides) emailed at least one week prior to the scheduled meeting;
  - Facilitation of the meeting;
  - Memorandum summarizing highlights from the meeting.

**TASK 5 – EVALUATE CURRENT SYSTEMS AND EXTENT OF INTEGRATION (EXISTING CONDITION)**

**Objective**

The objective of this task is to identify, assess, and document all existing (and planned) data systems related to Asset Management. The task will require considerable time and coordination by data owners/stewards. The task will use the results of the recent IRIS list of systems.
Description of Work

1. Document Data Systems and Data Quality Attributes - Based on the vision and components established in Task 4, each of the data systems will be documented in terms of data components, quality components. The following data quality attributes will be assessed:

   - **Accuracy** – The measure or degree of agreement between a data value or set of values and a source assumed to be correct.

   - **Completeness** (also referred to as availability) – The degree to which data values are present in the attributes (e.g., volume and speed are attributes of traffic) that require them. Completeness is typically described in terms of percentages or number of data values.

   - **Validity** – The degree to which data values satisfy acceptance requirements of the validation criteria or fall within the respective domain of acceptable values. Data validity can be expressed in numerous ways. One common way is to indicate the percentage of data values that either pass or fail data validity checks.

   - **Timeliness** – The degree to which data values or a set of values are provided at the time required or specified. Timeliness can be expressed in absolute or relative terms.

   - **Coverage** – The degree to which data values in a sample accurately represent the whole of that which is to be measured. As with other measures, coverage can be expressed in absolute or relative units.

   - **Accessibility** (also referred to as usability) – The relative ease with which data can be retrieved and manipulated by data consumers to meet their needs. Accessibility can be expressed in qualitative or quantitative terms.

These data quality attributes will be used to evaluate the data to be included in TAMIS.

An excellent starting place for this assessment of current conditions will be the Concept of Operations for the Data Business Plan prepared for the ADOT&PF Program Development office in 2005. The Concept of Operations defined, at a high level, how the Data Business plan system works, as well as all interfacing systems and people. It was developed from stakeholder interviews and through research of the relationships among the various agencies and stakeholders, both within and external to ADOT&PF. The core business processes related to data within the ADOT&PF Program Development Division and the three regional Planning functions (Northern, Central, and Southeast). Eight major data systems were identified: Accident Reporting; Bridge Management System (BMS); Maintenance Management System (MMS); Pavement Management System (PMS); Road Weather Information System (RWIS); Temperature Data Probe (TDP); Traffic; and Traveler Information (CARS/511). Use Case diagrams were used to describe the functionality of a system and users of the system. With the advent of the Concept of Operations for the new crash and Traffic data systems (2011), the five core business areas were redefined as follows: a) Highway Safety, b) Road Weather Information System (RWIS), c) Traffic Data System (TDS), d) Transportation Asset Management, e) Traveler Information Systems (511). The Use Cases for traffic and crash data systems were updates for the Concept of Operations for the systems. There are two implementing technologies that are
critical to the success of these five business areas: Geographic Information System (GIS) and Information Technology (IT).

The Concept of Operations has the following three high-level objectives:

- Document the physical infrastructure of existing data programs;
- Identify how data management programs fit into ADOT&PF’s missions and responsibilities; and
- Provide expectations regarding needs and vision of future data programs.

Following is an example of a Use Case.

![Use Case Diagram]

The Use Cases will be updated for each of the data systems identified to be part of the TAMIS.

In addition to the Use Cases, the following types of information will be documented for each data system: data program type, systems integrated, update cycle of data, performance measures established, targets established, key business process supported, key stakeholders, system improvement schedule, maintenance and ongoing costs.
The Alaska Aviation System Plan (AASP) Facility Information Directory (FID) will also be one of the databases to be considered in this task.

Specific conversations will also be held regarding the IRIS project to capture best practices and ensure timeliness regarding the two projects.

Conversations will also be held with Stakeholders regarding organizational challenges/successes faced with data integration and collaboration.

The purpose of this documentation and analysis will be to compare it with the TAMIS desired system framework (to be identified in Task 6). The gap analysis will take place in Task 7.

**Deliverable**

- Documented report to summarize the task
- Summary table of results by data system
- Updated Concept of Operations for Data Business Plan

**TASK 6 – DEVELOP ADOT&PF TAMIS FRAMEWORK (DESIRED CONDITION)**

**Objective**

This task will establish the framework of TAMIS for ADOT&PF. The task will follow Section 8.1 of the AASHTO AM Guide.

**Description of Work**

1. **Definition and Components of TAMIS** – According to the AM Guide, a TAMIS is a collection of hardware, software, data, and processes that support asset management business processes. Cambridge Systematics, Inc. will propose a customized definition for ADOT&PF’s TAMIS. This will be a more detailed description based on the vision developed in Task 4. The specific components of the TAMIS will be proposed using the AM Guide Section 8.1.2 and Figure 8-1 in particular. The scope of the TAMIS in terms of functionality/business processes, stakeholders, data and associated supporting databases, geospatial elements, software, interfaces and data collection systems will also be identified. Table 8-1 will be used as a guide for identifying the data elements.

2. The Definition and Components will be presented in draft form to the stakeholders and finalized after feedback from them.

3. **Framework** – A framework including key integration points will be developed in coordination with ADOT&PF and stakeholders. Figure 8-2 and Table 8-2 of the AM Guide will be used as templates. Section 8.2.2.2 – Develop an Architectural Vision will also be
followed. A Roadway Asset Hierarchy such as the example in Table 8-4 will also be developed and vetted with stakeholders.

4. TAMIS Task Team meetings will be held to review the definition, components and framework.

**Deliverables**

- Definition and Components Document
- Data Catalog
- TAMIS Framework

**Task 7 – TAMIS Gap Analysis**

**Objective**

The objective of this task is to compare existing data and information systems with the desired framework for the TAMIS in order to develop an action plan to address gaps.

**Description of Work**

1. Conduct a maturity assessment per Section 8.4.1 of the AM Guide. We will propose ADOT&PF maturity level with respect to the use of information systems and data for asset management (initial, awakening, structures, proficient or best practice). Recommendations for moving to the next level of maturity will be suggested and discussed with stakeholders.

2. Compare existing to desired state – Identify gaps between existing conditions (in Task 5) and Framework (Task 6). Gaps will be identified in the following categories:
   - System – Such as Data systems (collection, storage, maintenance), data quality, data integration, data analysis, data elements, analytic tools,
   - Technical – Such as software, hardware, interfaces, IT compatibility, Business Intelligence (BI) tools, network issues
   - Institutional – Such as business processes, geospatial elements, data management, resource availability (costs). One of the considerations here will be ADOT&PF people resources because implementation of change is affected by perception of how change affects staff.

3. One desired outcome of the project is to examine linkages between two critical components that are closely related to Asset Management: highway safety and road system performance (HPMS). The following references and resources will be referenced:
Resources

Fatality Analysis Reporting System

"Why Your Agency Should Consider Asset management Systems for Roadway Safety (FHWA-HRT-05-077)

FHWA - Highway Safety and Asset Management

Asset Management and Safety Peer Exchange (FHWA-HIF-12-005)

Highway Safety Improvement Program (HSIP)

Highway Performance Monitoring System (HPMS)

References

Model Inventory of Roadway Elements (MIRE)

MIRE Data Dictionary Version 1.0


Roadway Safety Data Partnership (RDSP)

Crash Data Improvement Program (CDIP)

Strategic Highway Safety Plan (SHSP)

NHTSA Traffic Records Assessment

NHTSA Model Performance Measures for State Traffic Records Systems

Traffic Records Coordinating Committee

Highway Safety Improvement Program Manual

Manual on Uniform Traffic Control Devices (MUTCD - 2009)

AASHTO Transportation Asset Management Guide – A Focus on Implementation (Jan 2011)

HPMS Field Manual
Deliverables

- Summary of maturity level for ADOT&PF related to Information systems and data
- Detailed identification and description of gaps

**TASK 8 – RESEARCH TAMIS SYSTEM MODEL ALTERNATIVES**

Objective

The objective of this task is to research available models for ADOT&PF TAMIS.

Description of Work

1. Based on AASHTO AM Guide Section 8.2.3 – Alternative Models for TAMIS Implementation, model figures (8-3 (Fully Integrated), 8-4 (Asset Management Planning Tool with Data Feeds) and 8-5 (Separate Management System with Interfaces) will be reviewed and a desired model developed based on earlier tasks.

2. Potential vendor solutions will be researched and reviewed for applicability to Alaska. Advantages and disadvantages of each in terms of cost, compatibility and ability to meet business needs for Asset Management will be compiled. Commercial Off the Shelf (COTS) and internally developed solutions will be included.

Deliverables

- Recommended Model for TAMIS
- Comparison of Vendor COTS and internal solutions

**TASK 9 – RESEARCH RECOMMENDATIONS FOR TAMIS**

Objective

This scope of work is designed to focus on the data and information integration components of the TAMIS in accordance with Chapter 8 of the AASHTO AM Guide. This task involves the development of an Action Plan to consider all other elements of the AM Plan for ADOT&PF. It will also summarize all research accomplished.

Description of Work

1. The work plan will provide a set of recommendations for incorporating asset management concepts throughout the agency. It will provide a road map for ADOT&PF to use as it moves
forward and addresses critical process and system issues related to systems and data to support asset management.

The work plan will consider all components in Chapter 8 of the AASHTO AM Guide as (including Sections 8.2.2.4 (Resource Requirements) and 8.2.2.5 (Plan for Incremental Improvements)) and all research accomplished in earlier tasks.

The work plan will also include requirements for the TAMIS report to be a living document – it needs to be updated at least annually to take into account changes in data and information systems. It will also include performance measures to measure the success of implementation of TAMIS.

**Deliverables**

- Detailed summary report of all research, lessons learned and application to ADOT&PF
- Summary of all Stakeholder involvement processes and outcomes
- Detailed Action/Implementation Plan for TAMIS

**TASK 10 – DEVELOP AND CONDUCT A PROJECT COMMUNICATION PLAN**

**Objective**

To encourage collaboration and a shared ownership of the research project by key decision makers.

To ensure the results of this research project are shared with all appropriate audiences including the State’s ETS, executive branch and legislative branch in order to ensure a highly implementable product.

**Description of Work**

A central component of this task will be to develop a Project Communication Plan that identifies target audiences, key messages, specific collateral materials to present the research to key audiences, and appropriate media for sharing the research. As part of the development of a Project Communication Plan, several steps will be taken:

- NCHRP Report 610 “Communicating the Value of Transportation Research” will be reviewed to determine key national themes of relevance that should be incorporated in the project communication plan.

- More contextual local input will be solicited in conjunction with activities of Task 4 – Stakeholder Coordination. The Stakeholder Task Team will be queried for names of key decision makers and executives whose support is paramount to the success of this research.
Transportation Asset Management Information Systems (TAMIS) and Data Research Project
Work Plan

In addition, output from the ½ day vision workshop will be central to developing key messages that appeal to target audiences.

- Executives and decision makers will be interviewed to assess their understanding of data and information management and to hone key messages that communicate the benefits of TAMIS and the value of the research.

Following development of the Project Communication Plan, a project collaboration website will be developed to allow stakeholders to review meeting summaries, draft reports and schedules, and to be involved to the extent that their interest permits. This website will be maintained throughout the course of the research project and will be handed over to Alaska DOT&PF at the completion of the project.

When the research recommendations for TAMIS are synthesized into an Action Plan (Task 9), project communication materials will be developed. These collateral materials will make the “business case” for TAMIS and identify the benefits of enhanced data and information management for the target audience. It is anticipated that the best approach to “make the case” will be short and easy-to-read material, available in both printed and web versions. Specifically, this might be a brochure highlighting benefits or a one-page fact sheet profiling the research and its value to the reader.

**Deliverables**

- Project Communication Plan
- Project Website – established and maintained at beginning of project – can also function as a collaboration site for TAMDIT
- Conduct of Plan, including stakeholder coordination and interviews
- Communication materials to roll out research, such as a brochure and/or fact sheet.

**TASK 11 – DATA BUSINESS PLAN FOR TAMIS**

**Objective**

To prepare a Data Business Plan including a Data Governance framework for the TAMIS

**Description of Work**

1. Draft and Final Data Business Plan

A draft data business plan will be developed based on the results of the TAMIS research. The DBP will be designed to implement the TAMIS Framework and model alternative.

Section 8.4.2 of the AASHTO AM Guide documents the importance of Data Business Planning and Governance. Many of the components have been partially developed in the Data Business
Plan developed for the Program Development office in 2005 and many components were updated in 2011.

This task will follow the sample outline in Table 8-3. Data Standards per Section 8.4.2.3 will also be established.

A data assessment chart such as the one in Figure 8-6 will also be populated.

Evaluation matrices for each data program within the TAMIS (see Fig 8-7) will also be developed.

A Data Governance maturity exercise per NCHRP 666 will be accomplished. A maturity model developed to document levels of maturity related to the development and application of data developed based on NCHRP 666 will be used. The criteria (people/processes, technology/tools and institutional/governance) are described in more detail below:

- People/processes – Refers to the willingness, understanding, and commitment of people within the agency to embrace data management. It also refers to processes that may be in place to assure employees understand and appreciate the value of data management.

- Technology/tools – Refers to the use of tools and techniques designed to assist the agency (ADOT&PF) managing, integrating, analyzing, and reporting data.

- Institutional/governance – Refers to the institutional structure within an agency to ensure consistent management of data programs.

The levels are somewhat generic in nature and are described as: 0 – Ad Hoc; 1 – Aware; 2 – Planning; 3 – Defined; 4 – Managed; 5 – Integrated; and 6 – Continuously Improving.

The following will be used to assess the level of data management maturity.

<table>
<thead>
<tr>
<th>Level</th>
<th>0 – Ad Hoc</th>
<th>1 - Aware</th>
<th>2 - Planning</th>
<th>3 - Defined</th>
<th>4 - Managed</th>
<th>5 – Integrated</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Technology/Tools</td>
<td>No tools in place</td>
<td>Planning for tools to support data management in some offices</td>
<td>Planning for tools to support data management across agency or for a specific office</td>
<td>Implemented some tools to support data management but not widespread across agency</td>
<td>Widespread implementation of tools to support data management but not integrated</td>
<td>Integrated, widespread implementation of tools to support data management and performance measurement</td>
</tr>
<tr>
<td>B. People/Awareness</td>
<td>Not aware of need for improved data management</td>
<td>Aware of need for improved data management / No action has been taken</td>
<td>Aware of need for improved data management / Some steps have been made within agency to improve technology or institutional setting to support data management in at least one office</td>
<td>Aware of need for improved data management / Improvements are underway to improve both technology and institutional setting to support data management in more than one office</td>
<td>Aware of need for improved data management / Improvements are underway to improve both technology and institutional processes are in place to support data management for performance measures</td>
<td>Aware of need for improved data management / Technology and institutional processes are in place to support data management for performance measures</td>
</tr>
</tbody>
</table>
An additional reference for this task will be ADOT&PF’s Roadway Safety Data Partnership Report which breaks down the maturity for each of NHTSA’s six performance metrics.

2. Implementation of the Data Business Plan
This task will implement the research and results recommended in Tasks 6, 7, 8 and 9.

**Deliverables**

- Draft Outline of Data Business Plan for Asset Management
- Draft Data Business Plan for Asset Management
- Final Data Business Plan for Asset Management
- Implementation of Data Business Plan for Asset Management

**TASK 12 – PILOT TAMIS APPLICATION**

**Objective**
To demonstrate concepts of data management on a subset of asset data and information systems.

**Description of Work**
This task will be defined during the development of TAMIS. A test set of information systems within ADOT&PF will be selected to demonstrate the recommendations in the TAMIS plan.

**Deliverables**

1. Proposed Pilot Description
2. Completed Pilot and documentation.
3.0 Risks of Project

There are several risks associated with completing the TAMIS project successfully. Success will be measured by completing deliverables on time and archiving full cooperation with all stakeholders. The following are some of the risks with contingency plans to overcome them.

<table>
<thead>
<tr>
<th>Risk</th>
<th>Contingency</th>
</tr>
</thead>
</table>
| 1 Pavement Section acquires new AM system prior to TAMIS recommendations | a) Rearrange schedule to perform evaluation of options earlier  
b) Concentrate on meeting needs of Pavement group through close coordination – ensure they are involved with Visioning  
c) Be flexible and build in changes/new systems as they are implemented |
| 2 TAMIS becomes too big/complicated and not practical to implement    | a) Break it into manageable tasks, deliverables  
b) Coordinate closely with stakeholders |
| 3 TAMIS is seen as an extra burden to staff, and therefore they don't want to use it | a) Demonstrate value of integrated data and TAMIS during and after interviews  
b) Use examples from other states |
| 4 TAMIS is driven and/or constrained too much by IT considerations and doesn't effectively support the AM business needs | a) Follow IT processes and keep them in close coordination  
b) Consider adding them to a smaller management team (not only on the Stakeholder team) |
| 5 DOT staff get AM fatigue because of all of the various efforts vying for their attention | a) Ensure meetings/products are meaningful, timely and relevant |
| 6 Timing of Rule Making for Map 21 may cause a delay                  | a) Keep track of rule making, but do not wait for it |
| 7 Availability of Stakeholders to participate in all interviews      | a) Limit meetings and plan ahead for scheduling |
4.0 Schedule

Our proposed schedule indicates our commitment to completing all work identified in tasks one through twelve by August 24, 2014.

![Schedule Table]

5.0 Staffing Plan

Anita Vandervalk, Project Manager
Steve Decker, Principal In Charge
Joe Guerre, Deputy Project Manager
Elizabeth Sanford, Communications Specialist
Dena Snyder, Data Specialist
Kim Hajek, Data Specialist
Lisa Smith, Project Coordinator
Nathan Higgins, Research Technician
Beth Wemple, Senior Planner
Bruce Spear, Senior GIS Specialist
Kevin Howard, Systems Integrator
Sam VanHecke, Planner
Krista Jeanotte, Senior Planner
Erika Ferri, Production
Transportation Asset Management Information Systems and Data Research Project

Task 2 - Federal Requirements and Associated Research

final report

prepared for

Alaska DOT & Public Facilities

prepared by

Cambridge Systematics, Inc.

June 2013
Final report

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date
June 2013
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1.0 Introduction

The Alaska Department of Transportation and Public Facilities (ADOT&PF) has recently initiated a research effort focused on a Transportation Asset Management Information System (TAMIS). In this context, a TAMIS is a set of business processes and integration tools that, taken collectively, will ensure that information is available to support asset management decisions throughout the agency. This research effort will address all current data and information systems related to asset management within ADOT&PF, and will consider MAP-21 requirements, draw from relevant national research efforts, and take advantage of successes and lessons learned in other states.

The objective of this report is to summarize Federal requirements and associated research related to the development of a TAMIS. The research team focused on the recently authorized MAP-21 transportation bill, and the latest federal research initiatives that are shaping asset management and supporting the development of data support needs and opportunities. The report covers federal requirements and other themes emerging from national research. It summarizes the documents in brief and describes their applicability to TAMIS development. Finally, it presents recommendations, and a list of documents reviewed for this research project.
2.0 Federal Requirements and Associated Research

2.1 MAP-21 REQUIREMENTS

Historically, asset management has been a critical, but under-represented element of the transportation planning process. Based on the simple, but powerful premise that agencies should consider the full life-cycle cost of their investment choices and manage their assets accordingly, the field of asset management has grown and become prevalent in transportation agencies throughout the world. In the U.S., many State Departments of Transportation (DOTs) have begun to implement asset management principles, helped along through research and capacity building by the American Association of State Highway and Transportation Officials (AASHTO), the Federal Highway Administration (FHWA) and the Transportation Research Board (TRB), among others.

Moving Ahead for Progress in the 21st Century (MAP-21), which was signed into law in July 2012, establishes a performance-based highway program to provide a means to more efficient investment of Federal transportation funds. The requirements of MAP-21 are clearly stated, yet there is significant detail that will be added through FHWA’s rule-making process.

The summary of MAP-21 requirements in this literature review focus on three areas of impact for a TAMIS project: (1) required elements of transportation asset management plan (TAMP) development, (2) national performance measures related to asset management, and (3) minimum condition thresholds. These areas have broad-reaching impacts and the legislative requirements should be considered in researching information for a TAMIS.

For additional detail on the individual modal impacts of MAP-21 requirements and its historical significance, see the Legislation, Codes, and Policies section of the ADOT&PF Enterprise Transportation Asset Management Synthesis and Work Plan (February 2013 draft).

Transportation Asset Management Plans

MAP-21 legislation requires State DOTs to develop a Transportation Asset Management Plan (TAMP) that contains at a minimum:

1. A summary listing of the pavement and bridge assets on the National Highway System in the State, including a description of the condition of those assets;
2. Asset management objectives and measures;
3. Performance gap identification;
4. Life cycle cost and risk management analysis;
5. A financial plan; and
6. Investment strategies.

FHWA is charged with a rule-making process that will add greater detail to the required elements of a TAMP. FHWA is required to define the process for developing TAMPs by early 2014.

MAP-21 requires that states develop a TAMP for the NHS by the beginning of the second fiscal year after the process has been defined. FHWA will certify the process used by each state to develop the TAMP.

Separately, states have until September 2014 to provide more detailed (element-level) bridge data as part of their National Bridge Inventory (NBI) data submission.

In addition, FHWA has started a project to support the development of pilot TAMPs in New York, Louisiana, and Minnesota. As part of this project a generic Work Plan was released that provides direction on TAMP development (http://www.fhwa.dot.gov/asset/tamp/workplan.pdf).

The section below provides a brief summary of each required MAP-21 TAMP element and describes how a TAMIS could support the MAP-21 requirements.

**Asset Inventory and Condition**

Compiling, maintaining, and monitoring data on the number and condition of assets is the foundation for effective asset management programs. It provides context for subsequent steps in the asset management process such as setting performance targets, allocating resources and monitoring progress towards stated objectives.

Supporting asset inventory and condition data is a key role for a successful TAMIS. At a minimum, a TAMIS could fulfill the requirements of MAP-21, which requires inventory and condition data for NHS pavements and bridges. Looking ahead to the future, TAMIS could go beyond this requirement to include data on non-NHS roadways and other priority assets, beyond pavements and bridges.

**Objectives and Measures**

Goals, as used in asset management, are desired outcomes expressed as policy. For example, an agency’s goal may be to improve the conditions of the existing highway system. Objectives are more explicit statements of what an agency hopes to achieve. Objectives often incorporate a performance measure and a specific value (i.e. target) of that measure that the agency wants to achieve. For
example, an objective could be to maintain all interstate pavements above a specified pavement rating. A TAMIS could support tracking progress towards objectives by providing access to target condition levels and historic condition data.

**Performance Gap Identification**

A comprehensive performance gap element of the asset management planning process would define short-term and long-term asset management planning horizons, describe traffic growth and demand on the system, present an analysis of future funding levels versus condition scenarios, and illustrate the performance gap between existing condition levels and future condition levels.

As with the earlier elements, this analysis could be supported with a TAMIS that addresses current condition data. Projected condition data for different funding levels are also of particular value for performance gap identification, since this information can support the target setting process. MAP-21 also requires that a TAMP address non-condition related highway needs. A TAMIS could support this requirement by addressing deficiencies and planned projects that are not tied to asset condition.

**Life Cycle Management and Risk Management**

Life cycle management is characterized as “maintaining existing system performance at a constant desired level while minimizing resource consumption and externalities over the long term.” Life cycle management is a long-term strategy for managing assets with an aim to minimize whole life costs while maximizing system performance and public safety. Using life cycle management can prolong an asset’s useful life while maintaining performance.

Life cycle management could be supported by a TAMIS that provides condition and usage data necessary to analyze remaining service life, develop deterioration curves, and recommend treatments.

Risk management involves systematically identifying, analyzing, assessing, and managing the risks that threaten the ability to achieve organizational objectives. “Risk” is a broad term and could be related to any number of events, such as performance failure, weather events, cost controls, the selection of suboptimal preservation projects, regulatory delays, construction delays, etc.

Risk management could be supported by a TAMIS that provides condition and usage data that can be used to understand the likelihood and consequences of performance failures. Risk management can also be supported by data related to project and program delivery, such as cost estimates and actual costs, and

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1 “Supplement to the AASHTO Transportation Asset Management Guide: Volume 2-A Focus on Implementation”
projects schedules and actual completion dates. In addition, risk is often influenced by external factors. Therefore data on neighboring floodplains, potential rockslide/avalanche terrain, and other external events could further support detailed risk management.

Financial Planning

Financial planning enables agencies to compare current and future needs to anticipated revenue levels, and allocate existing funds. Financial planning could be supported by a TAMIS that accounts for historic funding levels, future revenue projections, and information regarding the relationship between future performance and funding.

Investment Strategies

MAP-21 does not clearly define the term “investment strategies”. Potential types of strategies may include work strategies and condition thresholds for applying them, a list of assets that are prioritized for investment, and mitigation strategies that are derived from the risk assessment. Since investment strategies could derive from many of the other TAMP elements listed above, it is likely that a TAMP could support investment strategies by addressing the types of data and information already covered.

Performance Measures

MAP-21 requires a set of national transportation performance measures. It also requires DOTs and Metropolitan Planning Organizations (MPOs) to establish targets for these measures. The legislation organizes the measures by national goal areas. Specific measures for each national goal area are being developed by FHWA. MAP-21 calls for national performance measures in the following goals areas:

- Safety;
- Infrastructure Condition;
- Congestion Reduction;
- System Reliability;
- Freight Movement and Economic Vitality;
- Environmental Sustainability; and

Reduced Project Delivery Delays is also identified as a goal area in MAP-21, but a national performance measure is not required for it. MAP-21 also requires statewide and regional plans to use a performance-based approach to decision making that support the national goals. Measures and targets must be considered when developing policies, programs, and investment priorities.
Plans must include measures, targets, and a performance report comparing actual performance to target values.

MAP-21 includes the establishment of a new program, “the National Highway Performance Program” for addressing national goals on the NHS. This is a large funding program. Money will not be allocated based on performance levels, but if states underperform for two reporting periods they must describe the actions necessary to achieve the desired performance levels.

When considering the Infrastructure Condition goal area, the asset management planning process has many elements in common with a performance-based planning process. Therefore a TAMIS that provides access to the types of data and information discussed in the previous section could also help to support these broader requirements. However, given the similarities in the asset management and performance-based planning, the TAMIS could eventually be expanded to address all of the national goal areas and performance measures.

**Minimum Condition Thresholds**

Closely related to the performance management provisions in MAP-21, the legislation dictates that FHWA set minimum condition thresholds for pavements and bridges by March 2014. For example, MAP-21 defines the minimum condition for bridges as 10 percent of deck area on bridges are classified as structurally deficient. If states fall below these thresholds they must reallocate money to address the deficiencies.

This requirement strengthens the need for a TAMIS to account for at least a subset of the national performance measures, current condition levels of those measures, and the national thresholds for them.

### 2.2 SUMMARY OF ASSOCIATED RESEARCH

This section summarizes the sources reviewed and potential lessons that could be applied to supporting development of a TAMIS for ADOT&PF. The sources are ordered by topic area as follows: studies providing general asset management guidance, guidance in specific areas such as risk assessment and life cycle cost analysis, tools and data management, asset management guidance for airport resources, transit, and guidance specific to GIS systems. Most studies are from 2010-2013.

**AASHTO Transportation Asset Management Guide – A Focus on Implementation**

This guide, published in 2011, focuses on the process of asset management implementation. The report covers the asset management planning process; processes, tools and data to support asset management; and case studies to illustrate these topics. The guide provides a wide range of examples, many of
which may be useful for development of a TAMIS for ADOT&PF. Of particular relevance to the TAMIS effort, is the section on asset management system integration. The integration section describes a range of models for integrating asset management data:

- A fully integrated, self-contained TAMIS;
- A set of centralized asset management planning tools with feeds from source systems; and
- Separate management systems that interface directly with one another.

These and other potential models will be evaluated for development of the TAMIS framework. The guide also provides guidance on data standards for asset management and a data maturity model, both of which could help to inform the TAMIS effort.

**NCHRP Synthesis 439: Use of Transportation Asset Management Principles in State Highway Agencies**

This report summarizes the state of the practice in DOT asset management based on two surveys. These surveys included participants from 43 agencies and the following topic areas:

- General Asset Management Practices – agency mandate and asset management group composition;
- Asset Management and Data – inventory, condition assessment, and data needs;
- Asset Management Activities – asset management process and anticipated growth in the next two to five years; and
- Asset Management Process and support activities – the use of asset management principles, the integration of transportation asset management plans (TAMP), and asset management’s influence on decision-making.

Based on these survey results, the synthesis:

- Analyzed the impact of having an internal or external mandate on implementing asset management practices:
- Analyzed the importance of having an asset management group;
- Conducted an in-depth analysis of five TAMP examples provided by agencies; and
- Assessed training and outreach activities for advancing asset management practice.

The in-depth analysis of the TAMP examples provides detail key asset assumptions and information that are used as a part of the life-cycle management plan, such as asset description, performance and service levels,
service expansion needs, asset value, risk, and data reliability. Similar information for Alaska could be incorporated into TAMIS, allowing stakeholders to implement life-cycle management plans. In addition, the results of the surveys could help ADOT&PF to learn from other agencies, especially when facing similar asset management implementation barriers.

**NCHRP 632: An Asset-Management Framework for the Interstate Highway System**

The objective of the original research project, NCHRP Project 20-74, was to develop a practical framework for applying asset management principles and practices to managing Interstate Highway System (IHS) investments. This report (NCHRP 632) documents the results of Project 20-74 and includes a detailed list of the IHS infrastructure assets, for which a DOT would ideally collect inventory and performance data. It recommends performance measures for these assets and recommends a risk management strategy. Five basic tool types which support asset management are discussed: investment analysis, management systems, needs and project evaluation, risk assessment, and results monitoring. A list of available tools is also provided.

As part of the TAMIS project, it may be valuable to review the data tools and needs identified in NCHRP 20-74 to ensure that the necessary data to support IHS asset management decision-making is available. As ADOT&PF expands the scope of asset management beyond the IHS and highway mode, it will be important to review data and tools from a more comprehensive perspective. The list of challenges related to the IHS may also be valuable for consideration by ADOT&PF. These challenges include a need for disaggregated data, a need for high quality data, and the challenge of having multiple data analysis systems in place.

**NCHRP 545: Analytical Tools for Asset Management**

This report presents two tools developed to support tradeoff analysis for transportation asset management: AssetManager NT and Asset Manager PT. The report summarizes a typical DOT’s asset management analysis needs. The report notes that for successful tool implementation and use, agencies must have a well-defined asset management business process that depends on good quality information and analysis results and tools specifically tailored to answering the right questions.

ADOT&PF has a multimodal focus on asset management, which may place significant emphasis on tradeoff analysis when making performance driven funding decisions. As such, the data needs of AssetManager NT (network trade-off) and PT (program level trade-off) may be valuable to review during the TAMIS Framework Development Task. The structure of current condition data on assets should be sufficient to allow modeling tools (such as Pontis or dTIMS) to predict life cycle or replacement costs.
NCHRP 713: Estimating Life Expectancies of Highway Assets (Volumes I & II)

This report provides a methodology for estimating the life expectancies of major types of highway system assets, in a form useful to state DOTs and others, for use in life cycle cost analyses that support management decision making. Volume 1 is a guidebook for applying the methodology in DOT asset management policies and programs. Volume 2 describes the technical issues and data needs associated with estimating asset life expectancies and the practices used in a number of fields—such as the energy and financial industries—to make such estimates. The reports include several practical tips for life cycle analysis, such as establishing a clear definition for “end of life” as part of the analysis framework.

Accurately predicting the life cycle of various transportation assets is important to a mature asset management process. This report demonstrates the importance of condition and performance data to support life cycle prediction. The report recommends considering the data needs relative to the asset management maturity level of the organization. As ADOT&PF is generally described as being at the Awakening phase of transportation asset management (Enterprise TAM Synthesis and Work Plan, 2013), the organization may want to focus on successful data collection that demonstrates a proof-of-concept for life cycle analysis. If ADOT&PF were to pursue developing sets of complete data to support life cycle analysis on a wide range of assets, they may find it difficult to maintain momentum. By taking on data collection to support a small sample of life cycle analysis, the value of data could be demonstrated and provide momentum for the larger effort.

An important step within life cycle analysis is the development of the foundation tools for computing life expectancy for all the asset types within the scope of the plan. ADOT&PF may want to consider where existing data and planned data improvements can be valuable foundation tool inputs.

NCHRP 708: A Guidebook for Sustainability Performance Measurement for Transportation Agencies

This report provides transportation agencies with an approach to identify and apply sustainability-related performance measures. It covers the principles of sustainability and includes a reference compendium of performance measures. Some of the challenges in sustainability performance measurement deal with data resources and include: difficulty measuring progress towards goals; difficulty understanding tradeoffs; difficulty measuring project level impacts; and inconsistent data across jurisdictions. One of the best practices includes linking sustainability to targets, which is one of many places where this process would overlap with the asset management process. Several sustainability rating systems are introduced including FHWA’s Sustainable Highways self-

As part of the TAMIS project, ADOT&PF will be laying the groundwork to support current and future performance measures. ADOT&PF may benefit from consideration of new sustainability performance measures or linkage to existing sustainability policies that can be supported by enhanced data collection processes.

**NCHRP Report 736: Resource Allocation Logic Framework to Meet Highway Asset Preservation**

This report presents a logic framework for allocating highway asset preservation funds to the right mix of investments given policy, funding, organizational, and other legislative and programmatic constraints. The report begins with research on the state of the practice for preservation resource allocation and describes the context of these allocation decision-making processes in various state DOTs. Based on this research, the report defined a logic framework and a resource allocation computational model. The logic framework and demonstration model were applied and tested in two state DOT case studies. From the results of these two case studies, this report developed a MS Excel-based model that allow users to specify preservation program activities grouping, inventory performance and deterioration rates, project priorities and performance goals.

The report presents the context of preservation resource allocation decision-making in state DOTs, including how the agencies determine the appropriate objectives and the process constraints. In particular, the case studies provide examples of challenges for state DOTs in applying the resource allocation framework, such as funding constraints and missing assumptions on inventory condition and deterioration rates. For these challenges, the framework offers alternative steps that used historical input assumptions of comparative measures. TAMIS could adopt this concept by incorporating comparable data that could be used in the case of missing assumptions.

The excel computation model for resource allocation is also available for download from the report’s website. The model outlines typical asset activity groups and units of measure which could be used to spec out TAMIS data needs for stakeholders facing similar resource allocation problems. Furthermore, the computation model could be used as an example application in developing TAMIS as a data source for similar tools.

**NCHRP Report 742: Communicating the Value of Preservation: A Playbook**

This report presents a set of strategies for using effective market research to communicate the value of highway maintenance and preservation to agency leadership, elected officials, and the public. The report describes four building blocks for effective communications:
- Audience Identification: how to identify your target audience, and assess their interests and motivation to determine effective strategies.

- Message Design: how to translate technical information about preservation into concise and compelling messages for the target audience.

- Message Delivery: how to communicate messages via three major avenues – traditional, one on one, and the internet.

- Market Research: describes market research practice used by state DOTs to gather feedback during various phases of a communication campaign.

The four building blocks in this report can help the TAMIS project in the development of a communication plan. This plan can employ the playbook’s guidelines on audience identification and use stakeholder market research to develop effective asset and data management messages. The report also provides message design examples in the forms of presentations, brochures, fact sheets, press releases, and websites. These examples could help in designing concise collateral materials that communicate the benefits of highway maintenance and preservation to different stakeholders. Based on some of the message delivery techniques outlined in this report, TAMIS could provide canned reports that target the desired audience segments.


The Public Available Specification (PAS) was published for the purpose of creating asset management industry standards that are consistent with the International Organization for Standardization (ISO) format. The document describes seven components of an asset management system: (1) general requirements, (2) asset management policy, (3) asset management strategy, objectives, and plans, (4) asset management enablers and controls, (5) implementation of an asset management plan, (6) performance assessment and improvement, and (7) management review.

The PAS provides high-level steps for organizations to establish, implement, and maintain processes to monitor and measure systems performance. The guidance in this document could help in developing conversations with stakeholders about possible performance assessments, and identifying critical data gaps.

NCHRP 658: Guidebook on Risk Analysis Tools and Management Practices to Control Transportation Project Costs

This report provides guidance to state DOTs for using specific, practical, and risk-related management practices and analysis tools for managing and controlling transportation project costs. It contains a toolbox for agencies to use in selecting appropriate strategies, methods, and tools to apply in meeting cost-estimation and cost-control objectives. The report defines a framework for managing project risks built on five steps: 1) risk identification, 2) risk
assessment/analysis, 3) risk mitigation and planning, 4) risk allocation, and 5) risk monitoring and control.

This report demonstrates the importance of incorporating risk management into project planning. It also makes the case for careful cost estimations for projects, maintaining data to support cost estimates (which could be addressed by a TAMIS), and promoting use of risk analysis in decision making.

**NCHRP 666: Target-Setting Methods and Data Management to Support Performance-Based Resource Allocation by Transportation Agencies**

This research examined how performance measures and targets and their underlying data and information systems can be used for decision making at transportation agencies. Specifically, the types of decisions include resource allocations for operations, asset management, capital investment, planning, and policy development. Targets represent the desired end state of performance measures, and NCHRP 666 explains the target selection process and discusses approaches for establishing targets. The report presents best practices in managing data and information systems that are used to develop targets. The practices described in the report include data management, data stewardship, data sharing, data programs assessment, and use of technology.

This research illustrates the importance of how data management programs are used for managing data and information systems. Data management programs can be established through the use of data business plans. In fact, the Program Development Division (now Division of Program Development) of ADOT&PF implemented a Data Business Plan as a result of the Concept of Operations for a Data Business Plan that was developed in 2005. NCHRP 666 identifies several of the institutional and technological challenges that impact implementation of data management programs. The report presented methods for addressing those challenges as part of the recommended best practices. These best practices include, but are not limited to the use of a data governance framework in establishing a data management program and an evaluation matrix to determine a level of maturity in data management at the agency.

A data governance framework and maturity matrix will be developed as part of the TAMIS research project. The project will also recommend data stewardship roles for support of TAMIS and will document how data sharing of asset data currently is handled at ADOT&PF and what improvements are needed as part of the development of TAMIS. This will be done as part of the data programs assessment phase of the project. The assessment will include an examination of the technology used to share and integrate asset management data and will offer possible solutions to improve data sharing and integration through the use of new technology.
NCHRP 154: Target-Setting Methods and Data Management to Support Performance-Based Resource Allocation by Transportation Agencies (Volume III: Case Studies)

This report summarizes the case studies that were used in the development of NCHRP 666. It includes 19 case studies and a summary of federal performance management initiatives. The case studies cover a mix of public and private sector agencies and include several international and multinational organizations.

The report is a valuable tool in demonstrating the need for data to underpin a wide variety of strategic decision-making processes. There are several general data guidelines that are noted as reasons for success by multiple organizations. These include making data widely available, closely linking data to specific performance goals, regularly monitoring data, and using data to promote transparency (usually internal in the case of the private sector and external for the public sector).

NCHRP 706: Uses of Risk Management and Data Management to Support Target-Setting for Performance-Based Resource Allocation by Transportation Agencies

NCHRP Report 706 was completed as a supplement to NCHRP Report 666. It describes how risk management and data management may be used by transportation agencies to support management target-setting for performance based resource allocation. This report is comprised of two primers. The first primer describes a process for transportation agencies to systematically assess and address risks and provides examples from case studies, to illustrate how state DOTs are using risk management to support funding decisions. The second primer addresses information technology issues and challenges regarding data sharing, and integration. It is the content of the second primer that is the most applicable to the development of TAMIS, which is intended to recommend a framework of business processes and data integration tools to support the transformation of asset related data into information for purposes of making asset management decisions. This primer presents challenges and offers solutions to address those challenges identified by state transportation agencies in sharing and integration of data.

A portion of the research documented in the second primer of Report 706 is based on interviews with the ADOT&PF Division of Program Development as well as several other state DOTs. The additional recommendations from several other transportation agencies for handling the institutional and technological challenges regarding data sharing and integration should be considered during the development of TAMIS. Some of these challenges include:

- Establish common location referencing - ADOT&PF is making excellent progress in addressing this need through the development of the Spatially Integrated Roadway Information System (SIRIS). Further research will be
conducted as part of the TAMIS project to determine the appropriate level of accuracy of the location referencing data needed for TAMIS in order to meet the individual needs of the current asset management programs.

- Use of silo systems – This issue potentially impacts the development of TAMIS framework, since the evaluation of what types of data are needed for asset management decisions, as well as who maintains this data at ADOT&PF needs to be identified. Not all of the asset management related systems reside in one location (division/office), therefore, TAMIS will need to recommend tools for acquiring the needed data across existing ‘silos’ of data systems.

- Identify roles of IT office and business units for data stewardship – The development of TAMIS requires close coordination between the IT office and the business offices responsible for the maintenance of the multiple asset related management systems currently in place at ADOT&PF. The newly formed Asset Management Office would be the likely office responsible for identification and outreach to potential data stewards for the asset related data systems.

- Need to identify best approaches for integration of new technology tools – The TAMIS research project will identify an appropriate set of technology tools and business processes that can support the TAMIS framework. These recommendations should be reviewed by the IT office and the Asset Management Office to provide feedback to the research team. The recommended platform and IT components may include, at some point, a request for an exception to use non-standard IT tools to support TAMIS, where appropriate.

**NCHRP 20-90: Improving Management of Transportation Information**

The NCHRP 20-90 Project was conducted to investigate the methods, tools and practices that can be used to improve management of transportation information at state DOTs. The research included assessments in three areas related to the management of transportation information:

- Assess the current state of DOT policies and practices regarding governance of transportation information and the practices used to capture, manage, store (preserve), and deliver/disseminate (retrieve) such information in a way that is easily accessible to information users.

- Assess current practices from other fields that may be adapted for improving DOT management of transportation information, such as guidance for file formats, naming conventions, and information preservation strategies.

- Assess the current state of practice regarding standardization of terminology and categorization schemes for transportation information.
The information gathered from this research was used to develop a Guidance document for use by state DOT information managers. The Guidance document presents comprehensive and detailed guidance for each of the phases of what is described as the Information Management Life Cycle including capture, manage, store, archive/preserve, and deliver/disseminate information. Strategies and actions for governing transportation data and information activities are also presented in the Guidance.

The development of a framework for TAMIS could include an investigation into each phase of the Information Management Life Cycle as documented in NCHRP 20-90. The methods and technology tools currently used to capture, manage, store, and retrieve/disseminate asset data and information for the separate asset management systems at ADOT&PF will need to be evaluated to determine how these processes and tools may be utilized with newer methods and tools as part of the TAMIS framework.

Recommendations are presented in 20-90 pertaining to the storage of data and information in knowledge management systems as well as the use of indexing, categorization schemes, and taxonomies for managing data and information. Similar categorization schemes and taxonomies may be developed as part of TAMIS framework to establish the best framework for managing the multiple types of assets contained within the system, including pavement, bridge, and weather station data. NCHRP 20-90 also includes recommendations on the types of tools and technologies that can be used to store and retrieve data and information. This includes not only traditional types of storage medium including digital data in WORD, and Excel formats, and geospatial data on maps, but, also the potential use of the cloud for storing large datasets and the use of social media for delivery and dissemination of data. Many of these options and others will be explored during the research for TAMIS.

NCHRP 8-36, Task 100: Transportation Data Self Assessment Guide

The research in NCHRP 8-36, Task 100 was intended to help agencies assess the alignment of their data programs with strategic agency needs, and evaluate the adequacy and effectiveness of existing data management processes. The research results included a data self assessment tool that can be used within the context of agency data management practices. The framework for the self-assessment includes three components: (1) preparation for the assessment, (2) conducting the assessment and determining gaps in data needed to support business functions of the agency, and (3) analyzing the results of the assessment and developing a management plan to prioritize and address the needs of the agency regarding data and information systems.

The data self-assessment tool as recommended in NCHRP 8-36, Task 100 could be used to evaluate the recommended TAMIS framework, in accordance with good data management practices. In particular, the tool can be used to assess
how effective the existing asset management related data systems are for supporting asset management decisions at ADOT&PF.

One of the key components of data management best practices as identified in NCHRP 8-36 is the issue of data quality. As part of the development of a TAMIS framework, it is imperative that the framework and the data systems used to support TAMIS meet the criteria for data quality in accordance with the following data quality criteria: accuracy, consistency, reliability, completeness, timeliness, integrity, currency, and confidentiality. Each of these criteria has been identified in the Project Work Plan for TAMIS and will be included as part of the assessment process in Task 5 – Evaluate Current Systems and Extent of Integration.

Part of the data self-assessment tool also includes establishing maturity targets (for the subject program such as TAMIS) to initially and continually evaluate its effectiveness in meeting agency needs regarding asset data and information. A similar maturity scale will be developed for TAMIS that can be easily re-evaluated on at least an annual basis to determine its effectiveness in supporting asset management decisions at ADOT&PF.

FHWA HQ assisted ADOT&PF with a self-assessment using previous guidance. The results of this self-assessment are contained in a May 2010 report ADOT&PF Transportation Asset Management Assessment (http://www.dot.state.ak.us/stwddes/asset_mgmt/assets/tam_assessment_final.pdf).

**NCHRP 703: Guide for Pavement-Type Selection**

This report includes practical, logical, and transparent processes for conducting systematic evaluations of pavement alternatives and for making decisions on pavement-type selection. It includes decision-making processes for pavement type selection by agencies as well as allowing contractors to select pavement type. The report provides detail on frameworks for life cycle cost analysis and performance trend analysis for pavements.

The framework for pavement life cycle cost analysis provides detail on necessary pavement condition data and life cycle assumptions. It may provide some insight related to the development of the TAMIS framework, into necessary data collection items for pavement life cycle analysis to support asset management, including both economic and non-economic factors.

**NCHRP 750: Strategic Issues Facing Transportation (Volume 1)**

This report is intended to provide decision makers with a critical analysis of the driving forces behind high-impact economic and social changes, as well as sourcing patterns that may affect the U.S. freight transportation system. Four future scenarios were developed as part of the research project, as well as a detailed methodology for planners to follow to conduct their own scenario planning workshops.
This research has limited applicability to TAMIS, though there may be potential for ADOT&PF to integrate scenario planning into asset management, potentially linked with a risk assessment. The data needs for scenario planning are relatively limited.

**ACRP Report 19: Developing an Airport Performance Measurement System**

Airport Cooperative Research Program (ACRP) Report 19 was designed to provide guidance on developing and implementing an effective performance measurement system for airports with a wide range of available resources. This guidebook has three parts:

- **Part 1**: General introduction to the theory and practice of effective performance measurement system for airports. This section also describes the major performance measurement system frameworks in practice.

- **Part 2**: A six-step process for developing a well-defined performance management system starting with the assessment of the airport’s environment. This assessment confirms the alignment of an airport’s strategic elements with its long-term and short-term objectives, and is used to determine performance measures and targets. Based on the results of these measures and targets, the process initiates a new performance-measurement system cycle, allowing an airport the flexibility to determine appropriate measures in performance management.

- **Part 3**: Airport case studies on performance management systems to reflect outcomes and benefits of common performance measures, the roles of measure results in the decision-making process, and factors that prevent airports from implementing a performance measurement system.

The six-step process in ACRP Report 19 could help in assessing and identifying data that support development of performance measures and targets that are consistent with ADOT&PF’s Strategic Plan and the Statewide Alaska Airport System Plan. While the ADOT&PF does not have a comprehensive airport assets inventory, the process could help identify potential gaps in data elements, analytical tools, business processes and data management that will need to be addressed to reach the next level of asset management maturity. In particular, the process highlights performance reports and measures that could meet TAMIS stakeholders’ needs. The data requirement for these reports and measures could be included in the TAMIS framework.

The case studies in ACRP Report 19 range in different airport sizes and available resources. These examples can inform ADOT&PF on how data collection procedure, performance measures, standards and targets, as well as monitoring and reporting differ by airport size and governance. When gathering and comparing inventories and conditions across different types of airports, ADOT&PF could use these case studies when considering the comparability of performance measures.
ACRP Report 69: Asset and Infrastructure Management for Airports – Primer and Guidebook

The first part of the ACRP Report 69 provides a primer that describes the integration of asset management processes, practices, and tools across the airport organization, and how this systems approach to management and decision-making can deliver benefits. The second part of the report is on assessing and driving meaningful improvements to existing asset management plans, developing and implementing a new airport asset management plan. This guidebook provides:

- Directions for assessing asset management maturity, and guidance on determining and implementing an appropriate asset management framework;
- Case studies showing service level measures integrated into the airport master planning process;
- Guidance of asset management plans and how to develop the asset strategy;
- Guidance on decision support tools, functionality requirements for maintenance management and asset accounting;
- Best practices in asset planning and delivery, operations and maintenance, and renewal and decommissioning;
- Guidance for monitoring and managing performance to achieve organizational objectives; and
- Guidance on improving business processes, procedures, data, and information in the Asset Management Implementation Phase where organizational strategies are continuously adjusted based on changing context.

The report offers an airport asset management plan with methods that determine asset life cycle, replacement costs, and the risk exposure of critical assets. In particular, the guidebook provides an example spreadsheet that can be used to conduct an asset risk assessment and a method for determining optimal investment and funding strategies. This example could help in identifying the asset inventory information needed to support the methods outlined in the airport asset management plan, including risk assessment, life cycle analysis, and replacement costs calculation.

The guidebook highlights various decision support tools and information systems that are based on stakeholders’ desired level of data and the availability of information in an airport’s asset management systems. A FAA pilot inventory and condition survey of 20 Alaska airports is currently underway that will inventory additional assets such as state-owned building, visual aids, vehicles, and drainage features. While this is an initial step in airport asset inventory, the TAMIS effort could build on this survey by identifying additional information of
interest to the stakeholders, and the additional data needs for the decision support tools discussed in the guidebook.

This report also emphasizes consistent monitoring of asset management plan implementation to identify where performance measure gaps have been closed and new gaps have formed. The guidebook offers examples of periodic asset management maturity assessment or gap analysis. These examples could guide the TAMIS framework in developing periodic gap analysis by comparing existing performance measures and information systems at a given time with a desired asset management framework adjusted to the changing environment.

**FAA Advisory Circular on Airport Pavement Management**

This advisory circular summarizes the concept of airport pavement management system (APMS) and how cost-effectiveness solutions are identified with information in the APMS. An APMS has two essential components: (1) database elements such as pavement structure, maintenance history, traffic, and pavement condition data; and (2) system capabilities such as predicting future conditions, determining maintenance and repair plans, and maintenance budget requirements. The advisory circular discusses existing pavement management software and how they can generate standard reports that aid in the pavement management decision-making process.

ADOT&PF’s could build on its existing APMS by developing additional reporting functionalities as described in the advisory circular. The TAMIS framework could incorporate the APMS and its expanded reporting capabilities to give TAMIS stakeholders access to airport pavement conditions in decision making. To incorporate these reporting functionalities, the ADOT&PF could conduct a gap analysis identifying the necessary database elements.

**FTA Report No. 0027: Asset Management Guide**

This guide is a resource for agencies developing transit asset management practices, tools, and procedures for improving investment decisions. It includes the following components:

- A transit management framework with three categories of businesses processes: (1) asset management vision and direction, (2) life cycle management, and (3) cross-asset planning and management. Within each category, the report presents implementation activities and peer examples.

- The state of the practice in asset management information systems and components of a highly functional system.

- Guidance for assessing an agency’s asset management maturity and implementation steps for advancing maturity.

In addition, a supplementary guide describes the fundamental information and steps for developing an agency’s asset class-specific life cycle management plan. This guide is a useful tool to support the development of the TAMIS framework,
which will need to consider a life cycle management plan as part of the business processes within the framework.

**NCHRP 695: Guide for Implementing a Geospatially Enabled Enterprise-wide Information Management System for Transportation Agency Real Estate Offices**

This report is a guide for implementing a geospatially enabled enterprise-wide information management system for right-of-way offices. It is intended to support state highway agencies responsible for the acquisition, management, and disposal of real estate for right-of-way.

This research can add value to the TAMIS project in two ways. First, it identifies several keys to successful implementation of enterprise information systems. These include guidance in building support, assessing requirements and capabilities, and identifying a valid starting point based on systems needs and maturity. The research also details some of the ROW data use cases that could be reviewed by ADOT&PF for potential incorporation into the TAMIS. If there are valid ROW analysis uses for a TAMIS, additional data could be considered within the system to support the analyses.

**NCHRP 8-87: Best Practices in GIS-Based Asset Management (in progress)**

This ongoing research project has the objectives of (1) developing guidance for how DOTs and other transportation agencies can enhance their asset-management capabilities through effective adoption of GIS technologies and (2) encouraging more extensive adoption of GIS technologies by conducting pilot demonstrations and workshops on implementation of GIS-based asset management.

As noted in the NCHRP 8-87 research statement, GIS technologies are powerful and still evolving tools that DOTs can use to support asset-management decision making. GIS enables or enhances agencies’ capabilities, for example, to integrate transportation and non-transportation data; improve the cost-effectiveness of data acquisition and updating; integrate condition assessment and resource-allocation analysis within and across asset classes and program areas; schedule asset-inspection and repair work; and conduct spatial analyses for decision making. These tools are advancing rapidly through improvements in hardware and software for computation, location measurement, condition assessment and monitoring, and data management protocols.

Building an effective GIS program to support asset management will be critical to long range success. The ADOT&PF TAM Assessment (2010) notes that the data group has been transitioning from the legacy database system (Highway Analysis System) to an enterprise geo-database environment. The group is working to provide capabilities of mapping asset locations/conditions and proposed and previous project limits/information and other pertinent
information in serving wider customers. The Alaska Enterprise Asset Management Plan notes that funding has been identified to expand and permanently host the Geographic Data Integration Page. It appears ADOT&PF is making positive steps in GIS program development. It may be worthwhile to revisit this NCHRP 8-87 research project upon its completion (scheduled for July 2014) to see if any of the recommendations are applicable to Alaska.
3.0 Conclusions

In addition to the items described in Section 2 for each resource document, the research team has identified the following cross-cutting themes that should be considered during development of the TAMP:

- The federal requirements advanced by MAP-21 include development of a transportation asset management plan for NHS pavements and bridges. It is recommended that the TAMIS address the data and systems required to meet these requirements. Looking beyond NHS pavements and bridges, the MAP-21 requirements provide a model for considering the expansion of the TAMIS to other modes and other parts of the highway system.

- Several research documents present models for assessing the maturity of an agency’s business practices and IT environment. These approaches are helpful in understanding the current situation relative to the ideal situation, and provide a basis for establishing a future vision. It is recommended that the TAMP be designed to support current practices, and be flexible and scalable to evolve as ADOT&PF’s practices evolve.

- The research illustrates the significant benefits of use cases in terms of clearly communicating potential functionality, creating buy-in from future end users, and generating organizational momentum for implementation. In addition to working with stakeholders throughout the design process, many of the resource documents discuss the importance of considering the eventual communication of the results of the asset management process. Thinking ahead about what the outcomes of the asset management process could look like and how they should be communicated (what, when, why, and to whom) can provide context to the TAMIS design process.

- A key to success noted in several recent research efforts is thinking holistically rather than by asset group. ADOT&PF has adopted a more multimodal approach to transportation management than many of its peers and this is reflected in the development strategies in place for the TAMIS. It is recommended that this approach be continued by first considering mode-neutral requirements for asset management, and then exploring implementation details for each asset group.

- Overall, the literature review reinforced the direction of the TAMIS work plan, and illustrated that several of the key steps planned in later stages of this study hold significant value. No structural changes are recommended for the TAMIS work plan.
4.0 References


FHWA. Alaska Department of Transportation & Public Facilities Transportation Asset Management Assessment, 2010.


NCHRP. Project 8-87: Best Practices in GIS-Based Asset Management (in progress)


Final report

Transportation Asset Management Information Systems and Data Research Project

Task 3 - Other State Best Practices

prepared for
Alaska DOT & Public Facilities

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date
July 2013
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1.0 Introduction

The Alaska Department of Transportation and Public Facilities (ADOT&PF) has recently initiated a research effort focused on a Transportation Asset Management Information System (TAMIS). In this context, a TAMIS is a set of business processes and integration tools that, taken collectively, will ensure that information is available to support asset management decisions throughout the agency. This research effort will address all current data and information systems related to asset management within ADOT&PF, consider MAP-21 requirements, draw from relevant national research efforts, and take advantage of successes and lessons learned in other states.

The objective of this report is to research and document best practices applicable to ADOT&PF with respect to asset management planning, data integration, data management, and governance. As part of this review, the research team investigated and synthesized related practices at 10 state departments of transportation (DOTs). Most of the state case studies covered multiple topic areas. Table 1.1 summarizes the agencies and topic areas covered in the review. It also lists the sections in this report in which each topic area is addressed.

Table 1.1 Agencies and Topics

<table>
<thead>
<tr>
<th>Topic Area (section of report)</th>
<th>CO</th>
<th>GA</th>
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2.0 Development and Implementation of an Asset Management Program

This Section presents the Wyoming, New Mexico and Georgia DOTs’ experience developing and implementing a transportation asset management program.

2.1 WYOMING DOT

Wyoming DOT (WYDOT) has followed a steady model of asset management implementation. Their focus is on the development of “centers of excellence” within asset groups, and on encouraging data and analysis maturity in their data management practices. WYDOT selected a single asset group (pavement) and developed the asset management capabilities to the level where it could be used as an example for all other asset groups. This included developing current condition reporting, being able to reliably predict future condition levels based on investment levels, and generating project needs.

From WYDOT’s perspective, one of the primary goals of asset management is to bring planners and project programmers together. This inevitably leads to overlaps with performance-based planning. WYDOT has benefitted from the assignment of an asset manager with significant experience at the DOT. Their asset management lead brings experience as a District Engineer. Many asset management decisions are made at the district level. Therefore, this choice of lead greatly aided in developing confidence and trust in the asset management process used at WYDOT and ensuring that project and engineering level concerns are addressed.

WYDOT did not use an implementation plan to direct their asset management efforts. This approach afforded them the opportunity to gradually develop their asset management level of maturity. This was an effective approach at the time, but, given the urgency MAP-21 has placed on developing asset management plans, they would not necessarily recommend that approach to other states. An implementation plan may have facilitated more rapid maturity in asset management.

WYDOT has experienced several challenges during its asset management implementation efforts, including:

- Transparency in decision making has been difficult to promote;
• Asset management groups are sometimes not comfortable with sharing results tied to expectations for performance;

• It took a long time for required data resources to develop. In many cases, data was available to document current conditions, but it took longer for everyone to be comfortable with predictions for future conditions; and

• It has also been a significant challenge to incorporate safety data into asset management. Coordination between different asset groups is encouraged as part of project work (i.e., replacing guard rails while resurfacing), but these can have unpredictable effects on the costs of projects, especially when making safety improvements.

WYDOT was able to build on their data collection programs, which have been in place for a long time. There were some areas that needed expanded data collection, but in most cases they were able to use current collection mechanisms. In building data resources for asset management, WYDOT found that integration with GIS was essential. They noted that agencies should keep the project visualization needs in mind when thinking through their data needs, since many groups, including legislators, would like to use maps for decision-making.

WYDOT has focused on developing a comprehensive database that allows for queries across multiple asset groups. The database is Oracle-based with a business enterprise software module interface. For example, one query capability they are interested in having is linking snow-related crashes with presence of snow barriers. WYDOT has found success in this database model. They do not think that the data management of each asset group can occur in a centralized database, but the centralized database can be used to extract data from other systems and allow for analysis.

WYDOT took significant steps in the development of their asset management program by including future pavement and bridge condition scenarios in the Wyoming Connects Long Range Transportation Plan. These three scenarios (illustrated in Figure 2.1) helped to integrate pavement needs into the agency’s broader system performance program. A snapshot of the performance outcomes is shown in Figure 2.2.
The process of developing future pavement and bridge condition scenarios clearly defined a large need for investment to prevent deterioration. This method was an effective approach, as it did encourage legislators to find funding to address the issue. Now, however, WYDOT is tasked to generate results with the money delivered.

Another area of interest for WYDOT is corridor level planning. Wyoming assessed corridor level needs for 16 State Significant Corridors, shown in Figure 2.3. WYDOT would like to continue to develop their corridor level assessment capabilities, because it believes corridor level investments are an effective way of making responsible funding decisions.
Moving forward, WYDOT would like to see more transparency in the resource allocating process, more integration of safety performance measurement and assets, strong ties between asset management and performance-based planning, and the tracking of additional assets. Integrating safety hardware as an asset group and as a planning priority is another target area, as well as incorporating safety benefit-cost analysis at the project assessment level.
Lessons Learned

- The asset management champion should have experience making program and project level asset management decisions within an agency;
- Agencies should anticipate that asset management maturity will take a long time to develop; and
- A good example from a single asset group should be developed and used as a model for others to follow; and
- When using asset management to prioritize projects, it is better to provide a range of recommended projects, as opposed to recommending a single project. WYDOT frequently looks for a candidate project list from their asset groups, covering a three-year period (the example given was for 2016-2018). This allows District Engineers and others the flexibility to select projects based on other on-the-ground or political elements, while still closely matching their asset preservation needs.

2.2 NEW MEXICO DOT

The New Mexico DOT (NMDOT) has recently formed a new division to address their asset management needs. The Division of Strategic Planning and Asset Management was formed on April 1, 2013. The DOT is currently identifying their asset management functions, inventorying data systems, and determining staff needs and opportunities.

NMDOT has faced several challenges in their previous asset management implementation efforts. For example, data organization has proved challenging. There have been some problems with their collection and packaging of Highway Performance Monitoring System (HPMS) data. NMDOT has also had difficulty in integrating data into a single, reliable platform. They are in a major evaluation period to consider what platforms to use in the future.

NMDOT would like to see better data resources developed as part of a comprehensive asset management program. These would include easy to access roadway data that integrates with a linear referencing system (LRS) and are easy to use and extract. They are currently looking for an enterprise level system to serve their LRS and roadway data needs.

To improve data resources, one of New Mexico’s core focus areas moving forward is the implementation of a revised pavement management system (PMS). The current PMS (Agile Assets) is being regularly loaded with data at the statewide level, but Districts are not using this pavement data for project decisions because they do not trust the data quality. Now NMDOT is looking at improving its Pavement Serviceability Rating (PSR) and making changes in data collection to get better quality control. NMDOT uses PONTIS for their bridge management needs, with no plans to migrate away from PONTIS in the near future.
**Lessons Learned**

- With previous systems initiatives, NMDOT had difficulties with data systems that require an individual to possess IT-level skills to access and use the application systems. This created a significant burden for the non-IT-level users and made data updating and management a burden. NMDOT recommends that DOTs interested in enhancing their data systems, make sure that they are widely accessible to promote their use and to develop trust in the product.

### 2.3 Georgia DOT

The Georgia Department of Transportation (GDOT) began moving towards asset management practices in the fall of 2009. Prior to this, a “worst-first” approach had been used in infrastructure maintenance, which can result in a crisis-oriented organization. The main catalyst for the push towards asset management is GDOT’s strong desire to make the most efficient use of agency resources. Significant budgetary constraints and growing infrastructure investment needs highlighted the importance of understanding the performance impacts of funding allocations and major decision making. Implementing asset management requires quality data and information that supports all of GDOT’s data systems, business processes, and divisions.

GDOT established a Transportation Asset Management (TAM) Task Force in 2011 in an effort to formalize GDOT’s commitment to asset management. The group included representatives from each of the divisions critical to TAM implementation and was first charged with completing an Asset Management Self-Assessment Survey that helped to identify areas of high concern with respect to maintenance. Key findings from the self-assessment included several areas of focus for GDOT: developing a performance-based approach to resource allocation, developing life cycle approaches to evaluating investment benefits and costs, and improving data accessibility and integration.

GDOT recently developed an Asset Management Implementation Plan to provide a blueprint for further advancement of asset management. The Plan delivers objectives, strategies, and action items. The objectives define four main categories that explain the desired outcomes of GDOT’s asset management program, with strategies specifying work steps for the Plan (summarized in Table 2.1).
Table 2.1 Summary of GDOT Asset Management Implementation Plan Objectives and Strategies

<table>
<thead>
<tr>
<th>OBJECTIVES</th>
<th>STRATEGIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Develop a comprehensive asset inventory with performance measurement</td>
<td>1.1 Identify critical assets for performance measurement and inventory</td>
</tr>
<tr>
<td></td>
<td>1.2 Identify ability to support performance measures with existing data and tools</td>
</tr>
<tr>
<td></td>
<td>1.3 Identify shortcomings and update data collection tools as necessary</td>
</tr>
<tr>
<td></td>
<td>1.4 Integrate assets and performance measures into GDOT enterprise information systems</td>
</tr>
<tr>
<td>2. Consistently manage asset data</td>
<td>2.1 Ensure compliance to State and Federal standards such as the Congressional District Balancing Law or financial reporting (GASB)</td>
</tr>
<tr>
<td></td>
<td>2.2 Ensure application of GDOT data standards and governance principles</td>
</tr>
<tr>
<td>3. Ensure data-driven investment decisions</td>
<td>3.1 Clearly establish data-driven resource allocation</td>
</tr>
<tr>
<td></td>
<td>3.2 Develop asset condition prediction models where possible</td>
</tr>
<tr>
<td>4. Institutionalize asset management within agency and state</td>
<td>4.1 Ensure efficient employee transitioning into asset management practice to influence agency culture</td>
</tr>
<tr>
<td></td>
<td>4.2 Monitor asset management use as a business process throughout agency</td>
</tr>
<tr>
<td></td>
<td>4.3 Improve external understanding of how GDOT uses asset management to allocate resources and improve integration with cities and counties (i.e., use of GDOT information by cities and counties, and availability of city/county data to GDOT)</td>
</tr>
</tbody>
</table>

Lessons Learned

- GDOT’s approach helped to formalize their commitment to asset management (through implementation of the TAM Task Force); and focus on critical asset management needs (identified through a self-assessment survey).
3.0 Risk Assessment

This Section focuses on risk management efforts in Minnesota, Georgia, and Colorado. Risk assessment and management involves systematically identifying, analyzing, assessing, and managing the risks that threaten the ability to achieve organizational objectives. “Risk” is a broad term and could be related to any number of events, such as performance failure, weather events, cost controls, the selection of suboptimal preservation projects, regulatory delays, and construction delays.

MAP-21 keeps enterprise risk management at the forefront of asset management. One of the goals of MAP-21 is to enable agencies to understand the relationship between asset management decisions and risks facing the agency and the transportation network.

3.1 Colorado DOT

The Colorado Department of Transportation (CDOT) has made the advancement of their risk assessment practice a key component of asset management. Until recently, each work unit was responsible for managing risks for their area or risk management was done by the Finance Office if the risk was budget related. Local agencies typically dealt with risks in their area (i.e. rock slides, etc.). CDOT did not address risks related to project delivery for assets on a statewide basis. There was a mix of over-mitigated and under-mitigated risks related to financial, man-made, environmental, safety, and other issues.

CDOT was forced to deal with a significant event a few years ago when the cost of asphalt for surface treatment increased greatly, impacting the preservation work they could do within a fixed budget. They had to come up with funds to handle the spike in the cost of asphalt, to address this need. In the future, CDOT is planning to better prepare themselves for such events and mitigate risks.

Now, CDOT is working to determine the risks at the program level and translate those risks into project level impacts. They are developing a matrix of probabilities and consequences to support risk management. One person is designated as the contact for a particular asset and is expected to be the primary expert in determining the probability of risks related to that asset (e.g., bridge engineer for bridge failures; rock-fall engineer has to estimate probability of rock falls). CDOT has determined that the probability of risks needs to be determined at the project level and the consequence/cost analysis done at a broader level. For the consequence/analysis phase, they are depending upon their statewide experts. For example, the Chief Financial Officer’s office would need to look at how to handle unexpected price increases. By dividing risk assessment responsibilities this way, CDOT believes it can predict reliable project level risks.
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and then be prepared with an action plan to address risks on a broader scale when events occur.

CDOT is taking steps to incorporate risk management into lifecycle cost analysis. The default method for handling assets is on a lifecycle cost basis, which focuses on keeping assets operating at a specified minimum performance level for a least cost approach. However, using this approach, one has to consider the risk in this method of operation. Assets at a minimum performance level may be at greater risk and their failure may greatly inflate costs.

CDOT regularly addresses five asset groups (pavements, bridges, maintenance, fleet equipment, and ITS equipment) in their asset management process. They will go from five asset categories to nine by adding rock-falls, buildings, tunnels, and culverts. They will leverage the work already done for rock-fall mitigation to help with management of the other assets. Pavement will move from being managed by an existing surface life approach to a drivability approach.

Lessons Learned

- Determining risks at the program level helps CDOT to identify impacts at the project level. Using a matrix of probabilities and consequences helps them to manage risks and (potential and actual) impacts to projects.
- Lessons learned in managing assets in one area (e.g. rock-fall mitigation) will be used to facilitate management of assets in other areas.
- The data requirements for risk assessment vary greatly depending on the nature of the risk being analyzed. In some cases, the data needed to fully analyze a particular risk can be very significant. Options for dealing with this issue include using a qualitative approaches and prioritizing risks for quantitative analysis.

3.2 GEORGIA DOT

In addition to its broad asset management implementation efforts, GDOT is also currently engaged in an Interstate Highway System (IHS) Risk Assessment. This effort has the goal of developing a process for making decisions regarding the preservation of the IHS in Georgia. The process will combine asset management techniques with risk management concepts. The first phase of the project developed a risk profile for the IHS. As part of the second phase of the project, GDOT is developing guidance on funding levels and preservation strategies for the IHS.
The risk assessment framework developed by GDOT (see Figure 3.1) is a key mechanism for identifying the assets carrying the greatest risk. The assets which fall in the red sections will be high priorities for preservation activities. The framework consists of two dimensions:

- **Condition priority.** This dimension reflects the *likelihood* of performance failure. As an asset deteriorates, it becomes more likely that it will require significant work. Bridges and pavements on the IHS were assigned a condition score on a scale of 0 to 1. A higher score indicates a higher likelihood of failure, and therefore a higher priority in terms of condition.

- **Economic impact priority.** This dimension reflects the *consequences* of performance failure. If an asset fails and requires significant work, the people and goods using that asset will be impacted. IHS corridors were assigned an economic impact score on a scale of 0 to 100. A higher score indicates higher consequences of failure, and therefore a higher priority in terms of economic impact.

**Figure 3.1 Risk Assessment Framework**

By combining these two dimensions, each bridge and pavement section on the IHS was categorized as a high, medium, or low preservation priority. For example, assets falling in the red portion of Figure 3.1 have a relatively high possibility of falling into poor condition and there are relatively high consequences if the asset deteriorates. Therefore, these assets are high priorities for preservation activities. The opposite is true in the green portion of Figure 3.1. Assets in this area have a lower likelihood of falling into poor condition and/or lower consequences of deterioration. Therefore, they are lower priorities for preservation.
This framework supports GDOT’s efforts to move away from a worst-first strategy for preservation and maintenance activities and move towards a most-at-risk-first strategy.

GDOT also evaluated external threats to the transportation system, including earthquakes, floods, hurricanes, tornados, and winter storms. For each of these risks, the IHS was broken into tiers based on the relative frequency or intensity of the event. The results of the external risk assessment are intended to inform subsequent planning, programming, and operations efforts.

Lessons Learned

- Use of a risk assessment framework is helping GDOT to identify the assets in most need of repair by shifting the focus to the most-at-risk assets instead of worst-condition assets when determining investment priorities.

3.3 MINNESOTA DOT

The Minnesota DOT (MnDOT) is active in asset management. MnDOT developed a Data Business Plan in 2011 which recommended more asset management planning. MnDOT’s 20-Year Multimodal Transportation Plan (2012) included asset management as a key strategy moving forward, and MAP-21 is giving the organization additional impetus to grow their asset management expertise.

MnDOT noted that typically pavement and bridge assets lead the way in a DOT’s capital expenditures, but DOTs include all aspects of the transportation system. MnDOT sees asset management as the mechanism for tying all of these needs together. To address its broader asset management needs, MnDOT has implemented asset management approaches for managing data on pavements, bridges, signs, hydraulic structures, lane markings and other department assets.

MnDOT is one of the three pilot states (along with New York and Louisiana) that is in the process of developing a transportation asset management plan (TAMP). They are evaluating the best approach for meeting the requirements of MAP-21, but are also including other assets beyond the NHS.

Risk assessment will be a part of their TAMP. They are beginning to use risk analysis management as part of their overall planning process. MnDOT is already using a risk-based approach to managing assets such as culverts. They consider risk management to be the next evolution beyond performance management. The staff (especially engineers) is already making risk assessments on a daily basis, by asking questions like “what does it take to have this asset close to like-new condition?”. Risk management will help the agency to reconsider its current practice in some areas of expecting a like-new condition on everything.

They are investigating the appropriate data needed to make business decisions. Risk assessment activities have progressed with the appointment of a Chief Risk
Officer and the current effort to develop an Asset Management Plan in accordance with the recommendation in their Data Business Plan.

Integrating risk management with asset management is new territory for MnDOT. The concept they want to explore is targeting the conditions of the assets. FHWA has helped in this regard, by identifying assets related to the NHS as a top priority. MnDOT is reviewing the condition and performance of assets, lifecycle costs (for other areas in addition to pavement modeling), and variance from prescribed targets based on performance measures. This analysis will help in the investment planning and maintenance planning phases for assets.

MnDOT’s maintenance engineers proactively develop an inventory of centerline culverts for the state. To build on this existing work, MnDOT wants to be more sophisticated in setting priorities for investments, especially for culverts, and with regard to MAP-21 requirements.

MnDOT notes that the challenge is not in risk management - it is in change management. It can be a challenge to get managers used to managing risks as part of their routine business procedures. Managers need a formalized, standardized way to manage risks across MnDOT.

MnDOT recently gained some support for risk management when there was an executive-level interest in justifying investments in better roads for Minnesota. An investment in pavement was needed to bring pavements back to an acceptable condition. MnDOT needed to determine what variance from established targets for pavement condition was acceptable. The decision-makers began to understand that there is a new way of thinking about managing pavement assets within a variance level that is acceptable. Several decision-makers have become supporters of better risk management as a result.

**Lessons Learned**

- MnDOT’s asset management plan was a result of recommendations made in their Data Business Plan, which included an evaluation of data systems and information needs in the Department (including those systems that support asset management).

- Challenges encountered regarding asset management are primarily related to change management (i.e., changing existing business processes), not to risk management processes. Executive level support is needed to address these type(s) of challenges.
4.0 Trade-Off Analysis

Trade-off analysis is an important area of asset management that can support financial planning and tie investments to performance goals. In trade-off analysis, agencies look at the impacts of distributing funding to different program areas (for example: bridge maintenance, pavement maintenance, safety improvements, and capacity improvements). Trade-off analysis often includes the assessment of several different funding scenarios to give decision-makers a clear understanding of how best to invest their funds to get the best possible performance out of their transportation assets.

This section highlights asset management efforts in North Carolina and revisits practices in Colorado and Georgia.

4.1 North Carolina DOT

The North Carolina Department of Transportation (NCDOT) has made development of trade-off analysis capacity a key goal related to asset management. The Agency uses AgileAssets software that incorporates modules for a Pavement Management System (PMS), Bridge Management System (BMS), and Maintenance Management System (MMS). Their goal is to do investment scenario analysis within each module. The isolated analysis is currently underway in pavement, but not bridge or maintenance. They are working with the system vendor to make adjustments that, once complete, should be able to run scenarios to facilitate trade-off analysis across these different asset classes. NCDOT's current step is to get the analysis capability working within each module, then look into combining the results. NCDOT is looking to accomplish this within the next three to six months.

NCDOT wants the capacity to predict maintenance outcomes, reported in level of service (LOS), for a given investment amount. They would also like the capacity to provide their system with an LOS target and then learn what the cost would be to achieve that target. When doing a condition analysis, they want to understand how the conditions impact other assets such as shoulders and signs.

NCDOT views trade-off analysis as a valuable tool to understand how policy decisions impact future conditions. For example, legislators sometimes make policy decisions, such as dictating that large funds be applied to bridge replacements and rehabilitations, and NCDOT is challenged to provide an explanation for how these policies will impact overall system performance.

They are planning to begin trade-off analysis at the statewide level and then implement it effectively down at the division level. They hope to provide information to the legislature to demonstrate the implications of policy decisions.
and what could be accomplished with greater flexibility to spend money as needed without restrictions.

**Lessons Learned**

- NCDOT believes that anyone undertaking trade-off analysis needs to determine what analysis factors they want to consider as well as how the factors will be included in the process. NCDOT uses a single weighted index but are looking to expand to include other indices (mobility, safety, other assets like facilities and ports).
- NCDOT also recognizes that agencies need to have buy-in from different organizational groups and will need to overcome difficulties in getting groups to think long-range and embrace a planning mentality.

### 4.2 Colorado DOT

Colorado DOT (CDOT) is evaluating the expansion of trade-off capabilities. About four years ago, CDOT worked with a consultant in the development of an Excel-based trade-off analysis tool for three areas: bridge, surface-treatment and maintenance service level. The tool relied on data from the agency’s Systems Application and Products (SAP) system. The results of this effort were not as effective as CDOT had hoped, so they looked into an alternative that would utilize both SAP (which supports financial planning systems) and a system from Deighton. They developed a blueprint to manage five assets groups (pavements, bridges, maintenance, fleet equipment, and ITS equipment) that can be used as a prototype for managing other assets. The trade-off tool gives the ability to show decision-makers the impact of their funding decisions on a 50-year timeframe.

CDOT built the capability to better automate their management of data so that they did not have to re-collect data and they could better display their data through a dashboard system. They can determine if they want to make decisions on the fly or based on snapshots in time that depict three alternatives, with staff recommendations for the alternatives. The new system allowed them to build deterioration curves. Since optimization requires one to compare “apples to apples” for all assets, the decision-makers want to have input in determining how/where to move funds to manage assets and not leave it solely to computer software. In contrast to the NCDOT, which is working towards an optimization approach to tradeoff analysis, CDOT is working to provide program-level information side by side to support the budgeting process.

**Lessons Learned**

- Phase II of CDOT’s asset management plan will incorporate five assets into a single system for high-level program analysis. It will be necessary to identify the ratio of staff hours to consultant hours that are needed to support asset management. This ratio needs to be at least one-to-one for consultant-
to-staff according to CDOT’s recommendation. Staff hours will need to be dedicated to this integration project.

- CDOT advised that there are three components needed to maintain a State DOT: people, processes, and technology. It should be recognized that technology cannot solve the needs in the other two areas. For instance, CDOT acknowledges that they need to do a better job of addressing the staffing and resource needs for the agency.

- CDOT recommends using a holistic approach for managing assets. If a culvert fails, the pavement will fail as well. All of the data needed to support asset management should be linked together in a geospatial environment to support analysis and decision making for asset management.

- CDOT believes that tradeoff analysis should enable decision makers to use their judgment and that it should not be based on a mathematical function that seeks to find an optimal solution between competing needs. Once projects are optimized within a program area, decision makers should weigh the alternatives and identify the preferred allocation across program areas.

### 4.3 Georgia DOT

GDOT recognizes that resource allocation is an essential role of any transportation agency. Decisions on where and how to direct limited funds to best meet agency objectives is a persistent challenge. For example, a common issue is to determine how much funding should be allocated to preserving existing assets versus expanding the system. GDOT is developing an innovative, yet practical approach that enables agencies to explore trade-off decisions.

GDOT has developed a trade-off tool, which uses an online dashboard that combines analysis from individual tools to demonstrate anticipated performance levels, given funding allocation to different project areas. The tool extracts results from multiple analysis sources and presents them all in an easy-to-understand format. The outcome of these efforts is a series of program-level funding and performance targets, such as those required by MAP-21. These targets are also a fundamental element of a comprehensive transportation asset management plan.

This tool was developed as part of the GDOT Transportation Asset Management and Strategic Plan project being led by the GDOT office of Organizational Performance Management. It is also directly related to an effort by GDOT to develop an Interstate System Risk Assessment Study. The risk assessment study is examining trade-offs of investment in highway capacity, pavement, and bridge for interstates and will be expanding that analysis to the state National Highway System (NHSA). It complements this effort (which examines tradeoffs across the entire State transportation system needs for the three areas above plus system operations and safety) by focusing on a portion of the State’s transportation network (the Interstates and NHS) that are of particular importance due to their...
use. These uses include supporting Georgia’s economy, as well as Federal requirements for performance reporting that apply to those facilities.

The GDOT tool, developed by Cambridge Systematics and called Optics, is shown in Figure 4.1. The tool allows for scenario analysis where users can allocate different funding levels in the areas of pavement, capacity, safety, bridge, and operations and view the anticipated resulting performance.

**Figure 4.1  Tradeoff Tool Results Dashboard**

For this trade-off tool to be developed, GDOT had to define the set of programs for analysis, select a performance measure for each program, establish the relationship between future performance and funding level for each measure, estimate the total amount of money to be divided among the programs, and develop preliminary allocation scenarios.

The tool is intended to assist in the funding allocation process, support project recommendations, and provide guidance for future GDOT planning efforts, such as the next update of the Statewide Transportation Plan.

**Lessons Learned**

- Development of trade-off analysis tools can help DOTs evaluate where to allocate resources to meet performance needs.
- Dashboards are an effective tool for drawing results from multiple source systems and displaying them in a way that supports tradeoff decisions.
5.0 Data Integration

Data integration is one of the primary capabilities needed for the successful development of a transportation asset management system. This capability is required because many of the traditional assets maintained by a state DOT do not reside in a single enterprise database. There are many Business Intelligence (BI) tools available (such as those used in a Geographic Information System (GIS)), which can be used to integrate multiple datasets, based on a common linear referencing system. This section presents data integration practices in Utah, Ohio, and Colorado, in support of their data management programs.

5.1 Utah DOT

The Utah Department of Transportation (UDOT) recognizes the importance of data integration efforts in supporting business decisions, including those decisions pertaining to asset management. They also indicated that teaming together and pooling resources provides an excellent opportunity to have better data (e.g., collection of guardrail inventory data, collected by one group, available for use by other applications). In fact, a data collection project was initiated that provided the ability to collect all of the assets needed to the accuracy level needed, in a geospatial format, and then allowed correlation of that data to fatalities. Now that the data is improved in quality and is in a format available for more widespread use (via GIS), everyone sees that they can utilize the data even more so than in the past. Each group has a better understanding of what can be gained in their business area by contributing to an integrated data source.

In order to ensure that data continues to be available for business decisions, the department conducted a gap analysis in 2002 to evaluate their data and information needs. This analysis resulted in establishing a steering committee to oversee data related decisions in the department. The committee is comprised of the Deputy Director and his direct reports. The committee identified as a priority the need to collect repeatable data, and to forecast future conditions based on available budgets. They also indicated that a better job of organizing and displaying data was needed. This resulted in setting a strategic direction for the bridge and pavement areas in the department. The committee continues to have an impact on data decisions being made, like the need to have a common Linear Referencing System (LRS). In the area of pavement management, they are working together in the department to obtain the needed data. Initially, each region had their own group of data collectors, but, as a result of the steering committee actions they are using the following approach for collecting pavement data and using it to formulate recommendations for pavement management:

- Collect on a two-year cycle, attributes collected are quite extensive;
• Aggregate to one-tenth mile sections;
• Divide these sections into segments with history of when each was built;
• Run data through the Pavement Management System with optimization tools to indicate the best result/most cost effective solutions for pavement management;
• Run scenarios based on different funding levels to identify scenarios that will happen in the future; and
• Make recommendations to the Regions on what projects should be done, based on the scenarios that are run.

UDOT did identify as a shortcoming the fact that they do not have a document to define the requirements for collecting and providing data. They traditionally also did not have a central focus on GIS until last year. Prior to that time, each area in the department had its own GIS expert. To address this need, they hired two staff to help formalize governance procedures and to develop policies regarding GIS.

Lessons Learned

• At times, UDOT has observed a reluctance to share data, among some areas of the department. Culturally, it can be challenging to get everyone to work together. UDOT has overcome this challenge by demonstrating how technology can be used to foster a good cooperative working relationship. UDOT utilized consultants to demonstrate the types of technology available that could benefit everyone in the department. This included the use of vendors like ESRI and data collectors to provide demonstrations to the staff regarding the advantages of data sharing and integration.

• Senior leadership is needed for asset management – it needs to be driven from the top.

• It was helpful to get all of the contractors (software vendors) in the same room to get them to work together to come up with solutions. This helped to overcome consultant silos as well as those existing in the department. The best example was with the development of UPLAN and ESRI. They want to replicate this success in other areas.

• They would like to see a roadmap for asset management being used in Utah, similar to the one being used in Alaska with TAMIS.

• Documented policies regarding the collection and use of data, as well as governance through some type of steering committee group are very beneficial in supporting and strengthening data management practices, including data integration efforts at the DOT.
5.2 Ohio DOT

This example, from the Ohio Department of Transportation (ODOT), demonstrates how data integration is supported at the department through the use of the Base Transportation Referencing System (BTRS). Standard procedures require any business area wanting to provide data at the enterprise level to register their data with the BTRS. Development of the BTRS also supports the integration of data (using a common LRS) with the department’s enterprise database. Data standards and formats exist for the data that is linked to the BTRS. They are also in the process of converting all data to a geospatial environment, especially with the impetus of FHWA’s All Roads Network (ARNOLD). This effort will be critical in forming the foundation for their asset management system. ODOT reported that the funding mechanism for the states to develop and submit their network is 100% funding (SPR funds through 2015).

Technology plays an important role in encouraging data integration at ODOT. They use business intelligence tools like dashboards for their pavement and bridge data. This capability encourages other areas to develop similar dashboards for their data too. ODOT has not experienced a lot of issues with data integrity, because they are learning by example, using the management of pavement and bridge data as examples for managing other assets.

ODOT, like many other DOTs, experienced data integration challenges. The main data challenge had to with the fact that data was in silos in different business areas of the department. They now have business owners providing legacy data to the enterprise database. Since these new sources of data have become available, they now consider themselves “data rich”.

Although ODOT is making great progress in data integration efforts, some challenges still remain. These are identified as follows:

Silos - They are still dealing with issues related to silos, because some business owners have a silo mentality and are only concerned with data for their business area. They are including business owners in an Asset Management Leadership team to gain their buy-in and support for widespread use of a particular business area’s data, not just for its use within a specific area.

IT support – Continued participation of the IT department is needed to support all business areas. The IT department just initiated an enterprise architecture research project and are interviewing all of the business owners to find out what they need regarding IT support. By next spring (2014), they should have the components of what they need for the development of an IT Strategic Plan.

Executive level support – It was extremely important to get the necessary support from the top management regarding data management practices including data integration initiatives.

Finally, ODOT’s goal is to have a central repository, for which there is one authoritative source of information for everyone. About 80% of the analysis they
do is based on ad-hoc queries, so the data structure must exist to be able to support those types of queries. The plan is to migrate data to a geospatial environment and make it available for ad-hoc queries, which will make the Business Intelligence (BI) applications (apps) much easier to use. ODOT wants to provide a one-stop shop for BI on an open architecture system and they are using a collective, collaborative, and holistic approach to achieve this goal.

**Lessons Learned**

- Do not go it alone – make it a collaborative effort, complete with communication. Structure your oversight committee in a business-like manner, with a chair, co-chair, and document meeting minutes. This facilitates an environment of open communication and dialog.
- Do not try to do everything at one time.
- Identify champions within the organization to support the work of the group.
- Bring in a neutral third party to gain buy-in from everyone.
- Management at the top level has to be supportive – it is necessary to have something that catches their attention. In the case of ODOT, their data integration initiatives are tied to the Department’s Strategic Plan.

### 5.3 COLORADO DOT

The Colorado DOT (CDOT) case study provides another example of how data management practices (including data integration) are improved through the use of automation. Automation has helped CDOT eliminate duplicate data collection practices, and provide better display capabilities for data, through use of a dashboard system. This system allows them to make business decisions “on the fly” or based on snapshots in time, which depict three alternatives, with staff recommendations regarding each alternative.

CDOT encountered some challenges in incorporating data integration efforts into their asset management approach. For instance, there were seven different maintenance superintendents using different ways to collect data for the SAP system. There was no agreement on how to collect the data for SAP. To address the need for collecting and using asset data at an enterprise level, CDOT established a Transportation Asset Management Task Force group, which includes Maintenance & Operations (M&O) and Traffic safety staff. One of CDOT’s enterprise data managers was able to identify data integration points for SAP and identified Extract Transform Load (ETL) tools needed to integrate the SAP data at the enterprise level.

CDOT also experienced the loss of institutional knowledge. In 2008, they had an exodus of institutional knowledge when the IT staff was moved to its own agency (OIT) (outside of CDOT). At that time, CDOT lost about 75% of the staff that understood business requirements for the department. This made it even
more critical that CDOT’s Information Management Branch continue in its role to maintain and manage the enterprise level data on behalf of the department. The staff in that branch are required to have business analysis skills, so that they can translate business needs into technical solutions to support the department. The OIT is now used more or less as consultant services.

CDOT still has some uncoordinated data collection activities that need to be addressed to avoid duplication of efforts. Communication is seen as the key to resolving this issue. Communication needs to be a top priority, using as many methods as possible including newsletters, email, meetings, and the internet to achieve improved coordinated data collection activities.

The Information Management Branch is also planning to conduct a tour of the five regions in the state (as outreach) to discuss the data and information needs in the regions. This will include meetings with Pavement Managers, M&O Managers and others. They want to demonstrate that they are being attentive to the needs of the regions by delivering the technology tools that are needed and this will ultimately gain buy-in to support development of tools and applications to meet business needs. The exchange of information must include the middle managers as they are the ones that delegate the work to the front-line staff. Staff in the Information Management Branch also recommend that the number of new committees be limited, and to use existing committees and members of the committees to support new technology solutions.

Overall, asset management has impacted how/when/where they collect data at CDOT. For instance, they have staff review bridge photos to determine what bridges will need to be replaced. If fleet equipment is used for the first, second, and third shifts, the SAP system will “red-flag” what equipment is undergoing maintenance, which allows decisions to be made about whether the equipment should be replaced. CDOT indicated that there is a lot of additional data that is needed to make decisions that should have been made available 20 years ago, but, they are working to collect that data now.

The decision was also made that document management should be addressed under data governance, using knowledge management governance. They now have a transportation asset management knowledge management governance framework. They use four tools to support this framework: MS Sharepoint, Project Wise, Plone (web-content management system), and SAP.

In the future, they plan to continue telling ‘data stories’ to explain how the data can be translated into information that can inform decisions. One of the things they did to facilitate this effort was to hire a statistician who can look at data and explain what the data is telling them.

**Lessons Learned**

Colorado DOT lessons learned were summarized in Section 4.2.
6.0 IT Policy, Practice and Data Governance for TAMIS

IT Policies, Practices, and Data Governance are essential components for strengthening data management practices in any organization. The agencies with advanced levels of maturity in these areas are successfully managing their data and information systems to meet their business needs. One of the best examples of incorporation of all of these components is presented in this section with an example from Michigan.

6.1 MICHIGAN DOT

The Michigan DOT (MDOT) has successfully combined IT policies, practices, and governance to guide the management of their data and information at the department. They identified a key objective for strengthening data management practices and this was to develop a data management plan where Information Technology (IT) requests are managed, such that core functions of the department receive equal treatment on development of application systems to support business needs. Data governance is used to support this effort.

For instance, in the maintenance area, MDOT prioritizes maintenance activities and uses their governance structure to look at what projects are needed. There is a Steering Committee comprised of executive managers who make decisions about what gets done. They are able to keep up with project progress and stay informed using a governance approach.

In fact, Information Technology (IT) governance functions very well at MDOT. The governance effort began back in the 1980’s, when they developed a governance structure that allowed them to get to know each other in the various business units and to discuss their individual business needs. This governance structure has successfully guided them ever since, in the management of their data programs to meet business needs.

To facilitate the continued development of IT policies, practices and data governance, they are also developing a data dictionary (or data catalog) and identifying who can update what data and when. They have some basic data definitions identified for location referencing, including the use of latitude/longitude as the basis for linear referencing. This is the same linear referencing system that is used for federal reporting.

MDOT did experience some challenges, however, in establishing their data management practices. These challenges are described in the following paragraphs:
Most of the IT staff is experienced in doing smaller systems enhancements. As a result of this experience level and background, they had to outsource their work for IT development. It took six months to one year to develop staff capable of maintaining their systems. It appears that the corporate attention span is about 2 ½ to 3 years. After that time staff must be retrained on what is needed.

It is a challenge to come up with ways to develop business requirements. There are so many needs that it is hard to come up with methods to document those requirements. The IT staff tends to concentrate on avoiding risks, instead of other requirements that may be needed, so, it is helpful to incorporate IT into the process early (when developing data systems) and clearly tell them what is needed regarding business requirements (focusing on one thing at a time).

While MDOT recognizes that they can produce a lot of data, it is not used enough. There is so much information available that could be used to make better decisions and better use of the money that they have, if they know what data they have and how to use it.

They are learning how to use some of the new analysis tools that have become available over the last fifteen years, which provides a genuine opportunity for staff and encourages them to advance in their careers.

**Lessons Learned**

- **Organizational lessons** - Staff are willing to work together, but there has to be an element of trust. Most of the staff work in silos and governance is the mechanism that they can use to break the silos and help the organization and the business units become stronger.

- **Technology lessons** - Encourage use of new technology. For example MDOT is using new technology to support their business needs, by installing readers on android phones as means to capture International Roughness Index (IRI) data. The University of Michigan is taking this data and comparing it with what is needed to meet HPMS reporting requirements for pavement data.

- **Business process lessons**
  - Consider the use of crowdsourcing (“practice of obtaining needed services, ideas, or content by soliciting contributions from a large group of people and especially from the online community rather than from traditional employees or suppliers” – online Miriam Webster Dictionary)
  - When assistance is needed from the IT office or division, know what the goals and objectives are regarding their help; this makes it easier to obtain IT assistance and participation.
  - When planning a project, identify the key objectives of the project and structure it to keep participants happy by identifying feedback points built into the project to provide ongoing project status.
- It is important to demonstrate that implementing smaller pieces of a system, which provides business value, is critical. It is important to know what needs to be achieved, and that there is a vision and a plan to achieve the goals, with progress points to document what is being achieved. It is similar to using commercials and marketing techniques.
7.0 Data Business Plans

Data Business Plans are being used more and more at state DOTs to provide a foundation for the management of data systems that support core business functions of the department. During the last ten years the following states have developed some form of a data business plan in various divisions or offices of their agencies to manage their data as assets: Alaska, Virginia, Minnesota, Colorado, and there is an ongoing initiative at the U.S. DOT Office of Operations to implement a Data Business Plan. This section presents examples from Virginia, and Minnesota.

7.1 VIRGINIA DOT

The Virginia Department of Transportation (VDOT) has focused its data business planning efforts on the Maintenance and Operations area. They began data business planning in 2008, by completing a quick assessment of their needs and asking the following questions:

- Do they have the data to support informed decision making?
- What are the stumbling blocks that keep you from meeting your strategic planning needs?
- What data do you have?
- What do you need?
- What are the recommendations to address those needs?

Based on the results of this assessment, VDOT determined that they did not have the data or the IT assistance necessary to meet their needs. Therefore, VDOT decided to develop a Data Business Plan (DBP) to address their needs. The initial focus of the DBP was as a strategic planning exercise. They did not have a lot of information to start out with, only anecdotal comments received from senior and mid-level managers. Once they started developing the DBP, they started collecting the data that was needed. They surveyed 300 people regarding their data and information needs and followed up with two workshops to gather more information on the state of their data environment. They now have a list of action items, as identified in their DBP, and are trying to implement those action items.

One of the most important components of the data business planning effort at VDOT was the establishment of Communities of Interest (COIs) for an initial category of data, ITS assets. The COI is comprised of a group of people who use ITS assets data on a regular basis. The use of the COIs allows that group to become more involved “in the weeds” regarding what is needed and to identify
what are the uses of a particular type of data. The response received from business area representatives on the COI is positive. They see the DBP as a good initiative but want to know, “when are you going to get something implemented”? They do however, have a cooperative and enthusiastic attitude about their participation on the COI. Their objective is to determine where do they get that type of data today? Does it meet their needs? What are the gaps? What do they need from this data for informed decision-making?

The COI produced a document referred to as a Statement of Information Needs, which documents what the data needs are for ITS assets, and which will eventually include a data dictionary that contains the minimum data elements needed. While there is a need to activate more COIs for other types of data, they are time consuming to initiate, but very productive once they are up and running.

VDOT also recognized the need to define roles and responsibilities for data management and to assign people to those roles. For instance, there is a data steward for the Maintenance & Operations program who has a data architect that works directly for him in his business unit, instead of the IT Office. Their approach to getting systems implemented (to support M&O) is to use BI tools to identify source systems that the needed data comes from, to identify what database tables the data comes from and goes to, and to build the database on a local machine as a prototype model. This prototype is then given to the IT Office with the request for them to develop the system for the M&O business area. Tools including MSharepoint and SQL database are to build their prototype. To support this type of approach, VDOT M&O staff advocate training staff in using the tools to build prototypes. The business users are more sophisticated now and know how to use these types of tools.

The next logical step is to incorporate data business planning into asset management at the agency. There are some challenges that have been encountered at VDOT in this effort, as described in the following paragraphs:

Educating senior management and getting them to understand what is Asset Management and why it is data intensive is a challenge. Management understands the general concepts of asset management, but, when trying to get them to change business processes or allocate resources to support that type of program, they are reluctant to do so. It is obvious that data custodians are needed to help support the DBP, but management is reluctant to do this.

There is also turnover at the executive level, typically every 2-3 years, so they have to move quickly if they want to get things accomplished. There is now a requirement by law, in the Commonwealth of Virginia, to adopt an Asset Management Approach at the DOT. However, there is no consensus among all Commissioners of what should be in the Asset Management program.

**Lesson Learned**

- Do not try to do too much at one time.
• Concentrate on a small area and drill down to that area. Use the COIs for this effort - this will result in honest discussions among the participants in the COIs. These include data providers and data users. It is good to hear people describe why and what they need and what are the requirements for data and information.

• Use a good balance of people (from different offices) in the COIs.

• Involve senior level management in the DBP approach. One example is in the structure and bridge maintenance area. The division that did the analysis for what was needed did not report to the area that was responsible for allocation for allocation of funds. They approached senior management to get a COI set up to discuss the needs related to structure and bridge maintenance and allocation of funds for this effort. They needed to decide how to package the request to present it to others higher up the chain. Typically, the senior managers may be involved at the beginning and conclusion of projects, with mid-level managers more involved in the meetings or presentation of findings from the workgroups. It is critical to have senior level involvement for recommendations that may span several business areas.

• Data custodians need to be identified as well as data managers.

• Determine if what is needed is to be built is data marts or software systems.

• Commitment from executive managers is needed to support system development.

### 7.2 MINNESOTA DOT

The Minnesota DOT (MnDOT) implemented their Data Business Plan (DBP) in February 2011. This plan identified the development of an Asset Management Plan as one of several recommendations for moving the department forward in the management of its critical assets including data. MnDOT wants to become more sophisticated in their approach to setting priorities for investments, especially with regard to managing assets, like culverts, and with consideration for MAP-21 requirements.

They are continuing with the recommendations outlined in the DBP to develop an Asset Management Plan. MnDOT has determined that pavement and bridge management will NOT be addressed first in the AM Plan, because those areas are in pretty good shape as far as the data is concerned. The first asset to be implemented will be the traffic engineering assets (as part of a potential COTS solution). This will include signals and lighting; then drainage, guardrail and other less discussed assets will also be included. This additional domain of data (others less discussed) will have a group responsible for making investment decisions for those assets as well.
MnDOT, like the other DOTs also experienced challenges in the incorporation of data business planning into their Asset Management approach. Some of these challenges are described in the following paragraphs.

**IT Consolidation** - MnDOT had not yet undergone the IT consolidation at the time of the development of the Data Business Plan (2011). Since that time, the IT staff are now located at another agency. This may result in MnDOT getting push-back from this external IT agency at some point, which now has to consider managing information systems, based on efficiency at the statewide level, not just for MnDOT.

**Additional challenges** as they move forward with their Data Business Planning will be to determine:

- What is the quality of the data being collected and used
  - If there is sufficient quality control for the data
  - How does the Department ensure that the data is accurate
  - How is data assessed from a business perspective, i.e., is 60% accuracy good enough for making business decisions? The domain stewards are starting to get engaged in these processes.

**Lessons Learned**

- **Managers and Data Domain Stewards work together** - To oversee the implementation of recommendations from their DBP, MnDOT has merged their data governance control with an internal control task force, comprised of high-level managers, and data domain stewards (for nine data domains). The domain stewards assess the current health of the data systems for which they are responsible. Any request for a new system in the area of the domain steward’s responsibility has to go to the domain steward for approval, before it goes to the Division Director for consideration.

- **Priority of needs regarding assets has been determined** - pavement management and bridge management are established, MnDOT will concentrate on other critical need areas (traffic engineering assets) first as part of their asset management program.

- **Potential COTS solutions** - will be evaluated to support their asset management needs.
8.0 Cross-Cutting Themes

In addition to the lessons described above that were offered by each agency, the study team identified the following cross-cutting themes:

- Many of the case studies presented above represent efforts to proactively address the data and analytical capabilities required to support improved asset management. In many cases, agencies went through some type of assessment process to identify their needs and prioritize them, and are now working to address the highest priorities. Several agencies spoke about their implementation work as a multi-year, sustained effort.

- Several agencies talked about the transition from data to information. All of the agencies are using data that are housed in multiple source systems. Most of them spoke about quality and access issues related to providing the data to decision makers in a way that supports decisions. This represents a cultural shift from collecting and storing data to process and using it.

- Turning data into information requires connecting decision makers who use information to the agency staff who collect and process the data. This is a two-way conversation. Decision makers need to know what is available and what is possible, and data stewards need to know what information is important and what level of quality/confidence is required.

- In terms of management system capabilities, several agencies mentioned the need to improve confidence in results. Two main categories of improvements were mentioned: 1) improving the quality of data that is collected during inspections and input into the management systems, and 2) improving the parameters (e.g., unit costs and/or deterioration curves) used by the management systems to process the raw data.

- Multiple agencies spoke about drilling into one program area in detail, and then holding up the results as an example of what could be done in other areas. Examples include Wyoming’s emphasis on pavement data and analysis, and Colorado’s retaining wall risk assessment.

- The case studies illustrate that there is no single, correct way to integrate multiple systems for asset management. For example, North Carolina is working to pull various assets and programs into a single system (AgileAssets) so that cross-asset analysis can be performed. Colorado also is working to pull multiple assets into a single system (Detighton), but will not be looking at cross-asset analysis. Georgia developed a dashboard that pulls data and results from various tools and combines them in a way that supports tradeoff analysis. Michigan, Utah, and New Mexico discussed using GIS as a basis for pulling data from multiple sources together for decision makers.
A. State DOT Interview Guide

The following set of questions were used to guide the interviews with the state DOTs. The following topic areas were inserted at the appropriate place in the question, depending upon who was being interviewed and what topic was being represented by the interview:

- Development and Implementation of a TAM Program
- Risk Assessment
- Trade-Off Analysis
- Data Integration
- IT Policy, Practice and Data Governance
- Data Business Plans

**Interview Questions:**

1. What are your plans for meeting the MAP 21 requirements for a Transportation Asset Management Plan (TAMP)?
2. What were your key objectives in the area of [TOPIC AREA] as relates to asset management?
3. What are the key steps you took to develop [TOPIC AREA] capacity within your organization?
4. What are/were the challenges in incorporating [TOPIC AREA] into your asset management approach?
5. How did data support your development of [TOPIC AREA]? What data challenges did you encounter?
6. Moving forward, how would you like to see [TOPIC AREA] evolve?
7. What are some of the lessons learned in the development of [TOPIC AREA]?
Transportation Asset Management Information Systems and Data Research Project

Task 4 - Vision and Components

final report

prepared for

Alaska DOT & Public Facilities

prepared by

Cambridge Systematics, Inc.
Transportation Asset Management Information Systems and Data Research Project

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1.0 Introduction

The Alaska Department of Transportation and Public Facilities (ADOT&PF) has initiated a research effort focused on a Transportation Asset Management Information System (TAMIS). The objective of this report is to document the vision, components, and guiding principles for development and implementation of Alaska’s TAMIS.

2.0 Vision, Goals and Objectives

2.1 Vision

ADOT&PF’s vision for Transportation Asset Management (TAM) is to provide a long term, systematic approach to cost-effectively sustain our infrastructure. Systematic approach is further defined as a continuous collaborative improvement process.

In general, a TAMIS is a collection of hardware, software, data, and processes that support asset management business processes.

Alaska’s TAMIS is the collection, synthesis and maintenance of data from multiple sources. It will include a set of business processes (technical and institutional), and integration tool(s) to ensure that Alaska’s key asset information is available to support transportation asset management (TAM). It will encompass existing and proposed data in designated data systems. Identification of these data will be part of the TAMIS development process.

2.2 Goal

The goal for Alaska’s TAMIS is, “A TAMIS that meets needs of stakeholders by integrating data and establishing institutional methods to ensure that integration results in improved decision making for TAM.” The overall TAM motto “Start Simple, Grow Smart, Show Continuous Improvement” which also applies to the TAMIS.

2.3 Objective

The TAMIS objective is, “Transformation of data into information to fulfill the needs of TAM in Alaska.” Business processes and tools will be recommended for transforming asset data into information needed for asset management.
2.4 STRATEGIES

Strategies for developing Alaska’s TAMIS include the following:

- Document and analyze relevant research and requirements for the Transportation Asset Management Information System (TAMIS)
- Conduct an assessment of existing business practices and information/data systems/tools related to TAMIS
- Develop a framework for TAMIS, including a common vision
- Conduct a gap analysis (as an overall risk management/assessment program)
- Develop recommendations in the form of a work plan

3.0 Components

Figure 3.1 depicts the three primary components of Alaska’s TAMIS: 1) Data Sources; 2) TAMIS; and 3) Asset Management Decisions. The framework will continue to evolve to include key data integration points, architectural vision, and roadway asset hierarchy.
3.1 **DATA SOURCES**

The following data sources may provide data on programs and assets for TAMIS:

- Airport Information System
- EMS – Equipment Management System
- FMMS – Facilities Maintenance Management System
- Geotechnical Assets
- MMS – Maintenance Management System
- MRS – Management Reporting System
- PETS (part of COGNOS) – Performance Economic Tracking System
- PMS – Pavement Management System
- PONTIS (BrM 5.1 – 2014) – Bridge Management System
- RWIS – Road Weather Information System
- SIRIS – Spatially Integrated Roadway Information System
  - Roadway Data System
  - Crash (new in 2013)
  - Traffic (new in 2014)
- Traveler Information – 511
- Other data systems (to be determined)

### 3.2 TAMIS

The business processes in TAMIS include: (1) technical (e.g., data quality, IT compatibility), (2) institutional (e.g., data governance and management), and (3) integration tools (e.g., geospatial component, BI tools, interfaces, analysis tools, and software and hardware). The following questions will be used to inform the business process rules for TAMIS:

- What needs to be in place?
- What documentation is needed?
- What institutional policies and governance are needed for TAMIS?
- What data standards are needed?
- Are there going to be owners of the data who are accountable for the accuracy of the data?
- Is there a main data guru function?
- The timeliness of data is also critical if it is needed for annual decision making processes. At what point does the data need to be available for use?

### 3.3 ASSET MANAGEMENT DECISIONS

Alaska’s TAMIS will support asset management decisions that lead to desired outcomes, promote wise investment of resources, and promote credibility and transparency of investment decisions. The following types of asset management decisions may be supported:
1. Programming – Conducting tradeoff analysis in order to allocate funds to program areas, and establish performance targets
2. Strategy – Evaluating activities within asset groups (e.g. preventative maintenance)
3. Project – Prioritizing assets and/or projects
4. Project Development – Designing projects and evaluating project alternatives (e.g., conducting life cycle cost analysis)
5. Policy – Evaluating AM policy issues (e.g., understanding the implications of increasing truck weight limits)

4.0 Guiding Principles

The TAMIS research effort will consider all current data and information systems related to asset management within ADOT&PF, address MAP-21 requirements, draw from relevant national research efforts, and take advantage of successes and lessons learned in other states. The following guiding principles will be incorporated into the development and implementation of Alaska’s TAMIS:

- TAMIS will address the data and systems required to meet the asset management requirements in MAP-21.
- TAMIS will be designed to support Alaska’s current level of asset management maturity but will be flexible and scalable for future expansion.
- TAMIS development will focus on generating early results and use cases that demonstrate value.
- TAMIS development will first consider asset-neutral requirements for asset management, and then explore implementation details for each asset group. The goal will be to think holistically rather than by asset group.

The research team will consider the following cross-cutting themes and lessons learned from the analysis of best practices by other states throughout the research effort:

- Several agencies mentioned the need for a cultural shift from collecting and storing data to processing and using it (i.e., from data to information).
- Ensure that data is accessible and if it is used by decision-makers.
- Establish a close connection between the data side and business side of the agency.
- Start with one area (i.e. pavement) in the implementation phase of asset management and build on that success.

- No one single answer is available for the systems integration phase, but, enterprise databases and linear referencing systems can be important tools for use in systems integration.

- Making data visible can help an agency improve data quality and ensure that information is provided when needed.

Alaska’s TAMIS will include the following functionality:

- TAMIS should function as a one-stop shop – do not need to ask several people for data, data should be standardized, and include a data dictionary.

- TAMIS should address data quality and MAP 21 performance monitoring requirements.

- TAMIS should guide users through the decision-making process using supporting data systems.

- Regarding the use of data sources for TAMIS, the data owners may not be users of TAMIS. Decision-makers may be using the data while other staff are responsible for providing the integrated data and information to the decision-makers. Decision-makers are those who are making funding decisions.

The following additional issues related to functionality will be considered as TAMIS is developed:

- Could/should the TAMIS enable integration of other systems (systems beyond those identified as needed for asset management)?

- Which assets should be addressed by TAMIS? (This is related to the ownership issue described above.)

- Which decisions could/should be supported by TAMIS? (This should be addressed by the TAM steering committee.)
ADOT&PF Transportation Asset Management Information Systems (TAMIS) and Data Research Project

TAMIS Data Systems Evaluation

prepared for

Alaska DOT & Public Facilities

prepared by

Cambridge Systematics, Inc.
report

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1.0 Introduction and Overview

The Alaska Department of Transportation and Public Facilities (ADOT&PF) has initiated a research effort that will support the development of the Transportation Asset Management Information System (TAMIS). The goal of the TAMIS will be to provide the backbone for the Asset Management program for ADOT&PF. The program will ultimately support the FHWA State Transportation Improvement Program (STIP) and Long Range Transportation Plan development activities of the Program Development Office.

This report is the primary deliverable for Task 5 of the research effort: Evaluate Current Systems and Extent of Integration (Existing Condition). The objective of this task was to identify, assess, and document all existing (and planned) data systems related to Asset Management.

1.1 TAMIS Vision, Goals, Objectives

Vision

ADOT&PF’s vision for Transportation Asset Management (TAM) is to provide a long term, systematic approach to cost-effectively sustain its infrastructure. The systematic approach is further defined as a continuous collaborative improvement process.

In general, a TAMIS is a collection of hardware, software, data, and processes that support asset management business processes.

Alaska’s TAMIS is the collection, synthesis and maintenance of data from multiple sources. It will include a set of business processes (technical and institutional), and integration tool(s) to ensure that Alaska’s key asset information is available to support transportation asset management (TAM). It will encompass existing and proposed data in designated data systems. Identification of these data is part of the TAMIS development process.

Goal

The goal for Alaska’s TAMIS is, “A TAMIS that meets needs of stakeholders by integrating data and establishing institutional methods to ensure that integration results in improved decision making for TAM.” The overall TAM motto, “Start Simple, Grow Smart, Show Continuous Improvement,” also applies to the TAMIS.
Objective

The TAMIS objective is, “Transformation of data into information to fulfill the needs of TAM in Alaska.” As part of this project, business processes and tools will be recommended for transforming asset data into information needed for asset management.

Strategies

Strategies for developing Alaska’s TAMIS are to be addressed through the research project tasks shown in Table 1.1. This report is a primary deliverable for Task 5, Evaluate Current Systems and Extent of Integration (Existing Condition).

Table 1.1  TAMIS Project Tasks

<table>
<thead>
<tr>
<th>Task ID</th>
<th>Task Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task 1</td>
<td>Project Management and Work Plan</td>
</tr>
<tr>
<td>Task 2</td>
<td>Document and Assess all Federal Requirements and Associated Research</td>
</tr>
<tr>
<td>Task 3</td>
<td>Research Other State Best Practices</td>
</tr>
<tr>
<td>Task 4</td>
<td>Stakeholder Coordination</td>
</tr>
<tr>
<td>Task 5</td>
<td>Evaluate Current Systems and Extent of Integration (Existing Condition)</td>
</tr>
<tr>
<td>Task 6</td>
<td>Develop ADOT&amp;PF TAMIS Framework (Desired Condition)</td>
</tr>
<tr>
<td>Task 7</td>
<td>TAMIS Gap Analysis</td>
</tr>
<tr>
<td>Task 8</td>
<td>Research TAMIS System Model Alternatives</td>
</tr>
<tr>
<td>Task 9</td>
<td>Research Recommendations for TAMIS</td>
</tr>
<tr>
<td>Task 10</td>
<td>Develop and Conduct a Project Communication Plan</td>
</tr>
<tr>
<td>Task 11</td>
<td>Data Business Plan for TAMIS</td>
</tr>
<tr>
<td>Task 12</td>
<td>Pilot TAMIS Implementation</td>
</tr>
</tbody>
</table>

Source: TAMIS Project Work Plan (April 2013)

1.2 TAMIS FRAMEWORK

Figure 1.1 depicts the three primary components of Alaska’s TAMIS: 1) Data Sources; 2) TAMIS; and 3) Asset Management Decisions. The framework is from the TAMIS Vision and Components document and includes key data integration points, architectural vision, and roadway asset hierarchy.
1.3 Task 5 Methodology

The process for completing Task 5 of the TAMIS project began with development of a detailed work plan for this task. Task 5 is one of the largest tasks in the project as it involves identification and evaluation of over 50 data systems that could potentially be used to support TAMIS. A series of interviews was conducted over a two month period with the data owners of these systems. Additionally, a short survey was sent to a select group of data owners to determine if the system was considered to be “in” or “out” of the TAMIS framework as depicted in Figure 1.1.

The detailed work steps conducted to complete Task 5 include the following:
• Identification of the key data sets that are needed to support TAMIS and additional datasets that may support TAMIS (based on the March 2013 data inventory list from the TAMDIT group).

• Development of list of interviewees in coordination with ADOT&PF (refer to Appendix A).

• Development of interview questions (refer to Appendix B) to determine:
  o Whether data systems are in or out of TAMIS
  o Data integration points with TAMIS
  o Use Cases (this information will be used to develop the Data Business Plan and Concept of Operations for TAMIS)

• Evaluation of information obtained during interviews and in survey responses. Additional documentation such as user manuals, data dictionaries and training manuals were also collected and reviewed for relevance to TAMIS. Based on this compilation of information, the following steps were completed to identify and evaluate the data systems that support TAMIS.
  o Identification of asset management decisions at ADOT&PF
  o Identification of data systems and data sets used to support asset management at the enterprise level (Tier 1) or asset management for a specific business area (Tier 2). Other data systems that support a business area but are not related to asset management are considered to be Tier 3 applications.
  o Evaluation of the data systems and data sets as documented in Section 3. The evaluation includes assessing the quality of data according to a set of quality criteria (i.e., accurate, complete, timely, valid, coverage, accessible), availability of documentation for the system and identifying the storage medium for the data system, which has an impact on the ability to integrate data from each system.
  o Identification of data integration points for the Tier 1 and Tier 2 applications. These integration points are identified in Section 4 of this report.
  o Discussion of technical and institutional challenges with data integration (in a virtual context). Several of the interviewees identified technical and institutional issues that may impact the use of data for asset management at the enterprise level. The issues (defined in more detail in Section 5) range from challenges with integration of data from legacy systems, which were designed to serve a specific business area (‘silos’ systems), to more institutional challenges such as the need for policies and procedures to direct management of enterprise applications and
to address the need for additional resources to support development and maintenance of new applications.

- Development of recommendations for addressing technical and institutional challenges. The recommendations for moving forward with the development of the TAMIS framework includes utilizing improved business processes and technology such as Business Intelligence (BI) tools. The recommendations are summarized in Section 6 and include the following topics:
  - Discussion of recommended Policies and Procedures to support TAMIS.
  - Discussion of Data and Information Systems Governance to support the Department and the TAMIS framework.

1.4 DOCUMENT ORGANIZATION

The remainder of this document is organized as follows:

Section 2 – ADOT&PF Asset Management Decisions
Section 3 – TAMIS Data Systems
Section 4 – Data Integration Points
Section 5 – System Documentation
Section 6 – Data Integration Issues
Section 7 – Next Steps
Appendix A – Interviewee List
Appendix B – Interview Questions
Appendix C – Data Catalog
Appendix D – Interview Summaries
Appendix E – References
2.0 ADOT&PF Asset Management Decisions

Asset management is a comprehensive process for maintaining, preserving, repairing, rehabilitating, and replacing the existing transportation assets. A significant number of strategic and tactical decisions made by ADOT&PF could fall under the umbrella of asset management. These decisions are represented in the bottom box of the TAMIS framework in Figure 1.1. The overall objective of the TAMIS is to turn data into information that can be used to support asset management decisions. Therefore, in order to develop and implement a practical TAMIS, ADOT&PF must decide which types of decisions TAMIS will support.

This section defines the types of asset management decisions that ADOT&PF currently makes and/or will have to make to meet the requirements of MAP-21. The decisions are presented in the form of questions, organized around the Transportation Asset Management Plan (TAMP) elements required by MAP-21.

- **Asset inventory**
  - What assets should ADOT&PF include in its asset management program? (This is a fundamental question for ADOT&PF’s asset management program. The answer to this question will influence the answers to all subsequent questions.)

- DOT&PF will need to answer the following questions for each asset included in its asset management program:
  - **Asset condition**
    - What performance measures should be used to summarize the condition of ADOT&PF’s assets?
    - How should these measures be calculated?
  - **Asset management objectives**
    - What are the objectives of ADOT&PF’s asset management program?
  - **Performance gap assessment**
    - What short-term performance targets should ADOT&PF establish?
    - What long-term performance targets should ADOT&PF establish?
  - **Life cycle cost considerations**
    - What types of preservation and preventive maintenance treatments should be considered for each asset?
    - What is the ideal timing for these treatments?
» How much do they typically cost?
» How can ADOT&PF design a project to ensure that it minimizes life-cycle costs?

- Risk management
  - What risks could impact ADOT&F’s achieving its asset management objectives?
  - What risks could impact each individual program? The bridge program? The pavement program? Etc.
  - Which assets are the most vulnerable to external and environmental risks?
  - What is the likelihood of these risks occurring?
  - What are the consequences if they occur?
  - What are ADOT&PF’s priority risks?
  - How should the priority risks be mitigated?

- Financial plan
  - How should ADOT&PF allocate funds between its asset management programs and other priorities?
  - How should ADOT&PF allocate funds between the various asset management program areas (e.g., pavement versus bridge)?
  - How should ADOT&PF allocate funds to the Regions?

- Investment strategies
  - What are ADOT&PF’s priority assets?
  - What candidate projects should be considered?
  - How should ADOT&PF prioritize candidate projects and select projects for the capital program?
  - Should the scope of candidate projects be enhanced to address other issues along the project location? If so, which issues should be addressed?
  - How should the maintenance program influence the capital program?
  - How should the capital program influence the maintenance program?
  - Should ADOT&PF increase truck weight limits, or implement other types of policies that impact asset conditions?
  - What risk mitigation strategies should be funded and implemented?
3.0 TAMIS Data Systems

This section examines the data systems that are potential sources of information to support TAMIS. These data systems were identified by various sources including the ADOT&PF TAM office, Transportation Asset Management Data Integration Team (TAMDIT) group, and several data business owners.

A systematic approach was used to determine the relevance and degree of importance (Tier level) of each data system with respect to its ability to support enterprise asset management at ADOT&PF. A more detailed explanation of the evaluation approach follows in the next sections; however, at a minimum, the systems were initially evaluated to determine if they were considered to be “in” or “out” of TAMIS according to a specific set of criteria.

Once a data system was determined to be “in” the TAMIS framework, the system was evaluated to determine a level of importance (or Tier level) for the system with respect to TAMIS. The Tier level schema does not reflect on the importance of the system to meet the general business needs for a certain business area, rather only for use of the system for enterprise asset management.

After the Tier level evaluation was completed, only those data systems determined to be a Tier 1 or Tier 2 system were evaluated for data integration points with TAMIS. This is because those are the systems that can most directly impact and support asset management decisions for the Department.

3.1 Data System Categories

The first step in the data systems evaluation process was to determine if a data system was “in” or “out” of the TAMIS framework. A set of survey questions was used (refer to Appendix B) to evaluate the data systems. The criteria covered by the survey questions included the following:

- Does the system collect data in real-time or on a periodic basis?
- Can the system be used to support TAM performance measures?
- Is the system used statewide/systemwide or only in certain geographic regions?
- Does the system contain useful inventory data (that can be used to make asset management decisions)?
- Is the system supported by adequate resources?
- Are there plans to retire or replace the system?

Each of these criteria helped to formulate the decision of whether or not a data system is a viable source of information for enterprise asset management. For
example, data collected in real-time (with no archival mechanism) would not necessarily be useful for enterprise asset management. Enterprise asset management should have the capability to evaluate input from multiple data systems with data sets with a temporal component (at the very least they are valid for a specific period of time, such as monthly, quarterly, annually).

Once a data set was determined to be “in” the TAMIS framework, an evaluation was made on the Tier level of importance of the data for enterprise asset management. The Tier level definitions used are the following:

**Tier 1** – A critical, core system that supports enterprise asset management decisions.

**Tier 1** - A critical core system that supports enterprise asset management although the system itself is NOT an asset management system (e.g., RDS).

**Tier 2** – A system that supports business area asset management decisions and interacts with other data systems.

**Tier 3** – A system that supports business area, not directly related to asset management.

Table 3.1 summarizes the evaluation of the data sets in terms of whether they are “in/out” of TAMIS and their Tier level.

Of the 52 data sets evaluated, 26 were found to be “in” TAMIS and 26 were found to be “out” of TAMIS. Of the systems that are in TAMIS, there are 9 Tier 1 systems, one Tier 1* system, 13 Tier 2 systems, and 3 Tier 3 systems. The system designated as Tier 1* is critical to supporting TAMIS, since it is primarily the source of the Department’s Linear Referencing System (LRS) and the enterprise geodatabase (GIS). Many of the asset management systems that comprise the TAMIS framework require some kind of location referencing system for the assets. The location information is needed to facilitate the maintenance and operations of those assets.
Table 3.1   ADOT&PF Data Systems

<table>
<thead>
<tr>
<th>Major Asset Class/Subclass</th>
<th>Data Systems</th>
<th>Purpose</th>
<th>Criteria for “In/Out of TAMIS”</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Real-time or periodic update?</td>
</tr>
<tr>
<td>HIGHWAYS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bridge</td>
<td>PONTIS (BrM 5.1 – 2014)</td>
<td>Inventory of bridge identification, location, characteristics, and condition ratings for state and federal reporting.</td>
<td>24 month inspection cycle; data entered into system within 90 days of inspection</td>
</tr>
<tr>
<td>Construction</td>
<td>Bid Tab</td>
<td>Stores and retrieves data on active and archived bid costs for various pay items and units of those items to help improve the accuracy of capital improvement project.</td>
<td>Data is updated in real-time</td>
</tr>
<tr>
<td>Construction</td>
<td>Construction Data</td>
<td>Purpose is to a) maintain a status of Periodic as needed.</td>
<td>No</td>
</tr>
<tr>
<td>Major Asset Class/Subclass</td>
<td>Data Systems</td>
<td>Purpose</td>
<td>Criteria for “In/Out of TAMIS”</td>
</tr>
<tr>
<td>----------------------------</td>
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</tr>
<tr>
<td>Management (CDM)</td>
<td>Data Systems</td>
<td>the projects that have a competitively bid contract, b) be able to analyze how construction contracts have changed from the time of contract award to the final contract, and c) as a regional management tool for staffing purposes (work load).</td>
<td>Real-time or periodic update? Supports TAM perf measures? Supports statewide or regional system? Contains useful inventory data? Supported by adequate resources? Plans for retirement of system? In/Out of TAMIS? Tier¹</td>
</tr>
<tr>
<td>Construction</td>
<td>Navigator</td>
<td>Traveler information system for construction related activities and expected impacts. Used as activity/tool for Title VI tracking / reporting to FHWA.</td>
<td>Weekly No, although it is used as tool for tracking &amp; reporting Title VI impacts to FHWA Regional – Central, Northern regions only No Yes No, although the system may be merged with 511 Out N/A</td>
</tr>
<tr>
<td>Construction</td>
<td>Site Manager</td>
<td>Used to 1) produce contract progress payments to</td>
<td>Real-time No Regional – fully implemented No – data elements include bid Yes, supported by InfoTech via Planned updated in 2015 to web- Out N/A</td>
</tr>
<tr>
<td>Major Asset Class/Subclass</td>
<td>Data Systems</td>
<td>Purpose</td>
<td>Criteria for “In/Out of TAMIS”</td>
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<tr>
<td>Facilities</td>
<td>ADA Inventory</td>
<td>ADA Inventory is being conducted as part of a transition plan for ADOT&amp;PF pedestrian facilities within its ROW.</td>
<td>Real-time or periodic update? Supports TAM perf measures? Supports statewide or regional system? Supports useful inventory data? Supports by adequate resources? Plans for retirement of system? In/Out of TAMIS? Tier¹</td>
</tr>
<tr>
<td>Facilities</td>
<td>Facilities</td>
<td>Maintains Work Order information and needs for repairs and</td>
<td>Real-time or periodic update? Supports statewide or regional system? Supports useful inventory data? Supports by adequate resources? Plans for retirement of system? In/Out of TAMIS? Tier¹</td>
</tr>
<tr>
<td>Facilities Maintenance</td>
<td>Maintenance</td>
<td></td>
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</tr>
</tbody>
</table>

¹ Tier 1 – Critical for managing enterprise assets designated as ADA type assets.
<table>
<thead>
<tr>
<th>Major Asset Class/Subclass</th>
<th>Data Systems</th>
<th>Purpose</th>
<th>Real-time or periodic update?</th>
<th>Supports TAM performance measures?</th>
<th>Statewide or regional system?</th>
<th>Contains useful inventory data?</th>
<th>Supported by adequate resources?</th>
<th>Plans for retirement of system?</th>
<th>In/Out of TAMIS?</th>
<th>Tier</th>
</tr>
</thead>
<tbody>
<tr>
<td>System (FMMS)</td>
<td></td>
<td></td>
<td>supplies are ordered, work order generated, etc.)</td>
<td>purchases for work orders.</td>
<td>in SE Region yet, but will be on-line for that region soon. There are different data collection activities in the regions, and these activities are not tied to the FMMS system.</td>
<td>and materials for maintenance and service to building facilities.</td>
<td>developed as part of TAMIS to facilitate tracking and sharing of information on buildings.</td>
<td>No, but data could be used for planning and design so staff can see where there are gaps in materials sites along specific corridors and where they are lacking materials.</td>
<td>Statewide</td>
<td>No</td>
</tr>
<tr>
<td>Geotechnical Material Sites Inventory</td>
<td>Includes site inventory and inspection data for all material sites (e.g., quarries, borrow pits, etc.), as well as associated documentation.</td>
<td>Periodic updates will be performed by regional ADOT&amp;PF staff when they go to them for projects.</td>
<td>No, but data could be used for planning and design so staff can see where there are gaps in materials sites along specific corridors and where they are lacking materials.</td>
<td>Yes – includes site name, location, permit number, status, and owner.</td>
<td>No</td>
<td>need additional funding to develop geodatabase for geotechnical assets. There is also a need to educate users on the tool.</td>
<td>No</td>
<td>In</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Major Asset Class/Subclass</td>
<td>Data Systems</td>
<td>Purpose</td>
<td>Criteria for “In/Out of TAMIS”</td>
<td>In/Out of TAMIS?</td>
<td>Tier</td>
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</tr>
<tr>
<td>Geotechnical</td>
<td>Unstable Slope Inventory</td>
<td>Inventory of the Top 200 unstable rock and soil slopes around the state</td>
<td>Periodic – ratings are done by trained observers (geologists or engineers with knowledge of slope issues)</td>
<td>No, but supports asset management decision making.</td>
<td>In</td>
<td>2</td>
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<tr>
<td></td>
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<td></td>
<td>Supports TAM perf measures?</td>
<td>Yes – Location, height of slope, kind of rock, potential hazard, description of slope, and risk rating</td>
<td>No</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>Statewide or regional system?</td>
<td>Statewide – Top 200 unstable slopes</td>
<td>No</td>
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<td>Contains useful inventory data?</td>
<td>No – Doesn’t include a database, but a data dictionary in spreadsheet format. Data elements include location, physical characteristics, height, design type, and material.</td>
<td>No</td>
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<td>Supported by adequate resources?</td>
<td>Supported by adequate resources?</td>
<td>No</td>
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<td>Plans for retirement of system?</td>
<td>Plans for retirement of system?</td>
<td>No</td>
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<tr>
<td>Geotechnical</td>
<td>Retaining Walls Inventory</td>
<td>A data dictionary and retaining walls inventory is in development.</td>
<td>Periodic – For the initial inventory, construction personnel are mining as-builts to gather information and enter it into the spreadsheet. Re-rating or condition surveying of walls will occur every 5 to 10 years.</td>
<td>No, but supports asset management decision making.</td>
<td>No</td>
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<td>Supports TAM perf measures?</td>
<td>Supports TAM perf measures?</td>
<td>No</td>
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<td>Statewide or regional system?</td>
<td>Statewide or regional system?</td>
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<td>Contains useful inventory data?</td>
<td>Contains useful inventory data?</td>
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<td>Supported by adequate resources?</td>
<td>Supported by adequate resources?</td>
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<td>Plans for retirement of system?</td>
<td>Plans for retirement of system?</td>
<td>No</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>In/Out of TAMIS?</td>
<td>In/Out of TAMIS?</td>
<td>In - This is low risk area for TAM.</td>
<td>2</td>
<td></td>
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</tr>
<tr>
<td>Major Asset Class/Subclass</td>
<td>Data Systems</td>
<td>Purpose</td>
<td>Criteria for “In/Out of TAMIS”</td>
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<tr>
<td>Geotechnical</td>
<td>Statewide Asset Location Log (SALLy)</td>
<td>Webpage/database that was developed to allow M&amp;O staff to enter incident reports and other data about specific geologic occurrences (rock falls, landslides, etc.).</td>
<td>Real-time or periodic update?</td>
<td>Supports TAM perf measures?</td>
<td>Statewide or regional system?</td>
<td>Contains useful inventory data?</td>
<td>Supported by adequate resources?</td>
<td>Plans for retirement of system?</td>
<td>In/Out of TAMIS?</td>
<td>Tier¹</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Periodic updates by M&amp;O and others</td>
<td>No</td>
<td>Yes, but data is localized to a specific Region and supports work in the M&amp;O business area for that region</td>
<td>Unknown</td>
<td>The future of the SALLy webpage/data base is not settled at this time.</td>
<td>Unknown</td>
<td>Out</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

³ Tier: 1 - Initial Tier
<table>
<thead>
<tr>
<th>Major Asset Class/Subclass</th>
<th>Data Systems</th>
<th>Purpose</th>
<th>Real-time or periodic update?</th>
<th>Supports TAM perf measures?</th>
<th>Statewide or regional system?</th>
<th>Contains useful inventory data?</th>
<th>Supported by adequate resources?</th>
<th>Plans for retirement of system?</th>
<th>In/Out of TAMIS?</th>
<th>Tier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td>Maintenance Management System (MMS)</td>
<td>Provides tools to manage the planning, scheduling, reporting, and analyzing of maintenance actions. Provides information for managing special programs, administrative and financial tasks, contracts and project work.</td>
<td>Daily data input</td>
<td>Yes, MMS contains data to perform QA checks on roads and status of the overall system, and to evaluate future M&amp;O funding for maintenance projects, helps determine highest priority needs.</td>
<td>Statewide, however regional management only uses system to extract data and reports – Data entry occurs at station level and fills data points for regions.</td>
<td>Yes. Regional access is available and custom/ad hoc reports available upon request.</td>
<td>Yes.</td>
<td>Future plans include replacement of the MMS system with a more user-friendly system. Data quality in the current system also needs to be improved in the new system.</td>
<td>In 1</td>
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<tr>
<td>Maintenance</td>
<td>MMS Inventories: Sign, Culvert, Guardrail, Quality Assurance Program</td>
<td>Sign inventory – available as tables in MMS, but not user friendly; Culvert and Guardrail inventories – no</td>
<td>Periodic</td>
<td>Yes</td>
<td>Statewide</td>
<td>Yes, the sign, culvert, guardrail inventories are critical for asset management</td>
<td>Inventories for guardrail and culverts not being done at this time and sign inventory is not user-friendly, but all</td>
<td>Future plans include integration of the inventories data into the MMS system</td>
<td>In 1</td>
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<td>Major Asset Class/Subclass</td>
<td>Data Systems</td>
<td>Purpose</td>
<td>Criteria for “In/Out of TAMIS”</td>
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<td>Inventory</td>
<td>Data Systems</td>
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<td>Real-time or periodic update?</td>
<td>Supports TAM perf measures?</td>
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<tr>
<td>Maintenance</td>
<td>Station Profiles</td>
<td>Contains inventory information for maintenance stations and airports that is used for making management decisions based on personnel assignments and operating costs per station.</td>
<td>Periodic. Data updated annually or more frequently depending on source (AKSAS, Geodatabase, Airport Layout Plan, PONTIS, MMS) or manager request. This system has been inactive for over 5 years and is currently being</td>
<td>No</td>
<td>Statewide – there are 84 maintenance stations/airports</td>
<td>Station data includes information on highways, facilities (including airport hangers, offices, warehouses, and garages), personnel, lane-miles (including airport runways), and bridges for roadways within the station boundaries.</td>
<td>Yes</td>
<td>No. MMS gives centerline miles, but station profiles gives lane miles.</td>
<td>Out – is not the primary source of data, pulls data from other systems</td>
<td>N/A</td>
</tr>
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<tr>
<td>Pavement</td>
<td>Pavement Management System (PMS)</td>
<td>System used to document pavement conditions and to minimize cost of pavement maintenance and rehabilitation projects while maintaining a specified level of performance. Data extracts are used to provide data for use with HPMS and by Design engineers, Materials engineers, Planners, and M&amp;O staff.</td>
<td>Periodic – pavement data collected annually, while additional data elements (friction data, rolling weight deflectometer data) collected every 3-4 years.</td>
<td>Yes – pavement condition ratings</td>
<td>Statewide</td>
<td>Yes, IRI, PSR data for pavement sections on statewide basis and some of the data required for annual HPMS submittal</td>
<td>Yes, but have to rely on data collected by off-site contractor, which is provided to the Department annually.</td>
<td>Plans for replacement of existing system are underway.</td>
<td>In</td>
<td>1</td>
</tr>
<tr>
<td>Property Management</td>
<td>eParcels</td>
<td>Data entry and reporting system for tracking right-of-way parcels acquisition and expenditures related to obtaining right-of-way for federally funded</td>
<td>Periodic</td>
<td>No</td>
<td>Statewide</td>
<td>No - Contains ownership information for parcels acquired or about to be acquired for projects,</td>
<td>Yes – system is supported by a programmer</td>
<td>No plans for retirement or replacement.</td>
<td>Out</td>
<td>N/A</td>
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<tr>
<td>Right of Way</td>
<td>ePermits</td>
<td>Online Permit application system that allows for submission of various signs, construction activities, and events that occur within State-owned rights of way. Does not currently accept online payments.</td>
<td>Real-time. Public users can submit applications, and ROW staff add data and review applications daily.</td>
<td>No, although it is part of the record of which answers the question, “What is on this highway between mileposts x and y?”</td>
<td>Statewide, although it only tracks permit applications and granted permits since the inception of the system. Previous permits that were done on paper are not captured in the system.</td>
<td>Serves as a record of permit applications received and a record of driveways and other objects in the ROW. ePermits is also a workflow/review system for applications currently being processed.</td>
<td>Yes – system is supported by a programmer who handles minor improvements and fixes, user administration, and resolving data problems that can’t be addressed through the user interface.</td>
<td>No plans for retirement or replacement.</td>
<td>Out</td>
<td>N/A</td>
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<tr>
<td>Right of Way (needs link to ROW Data)</td>
<td>Right of Way (ROW) Data</td>
<td>Provide ROW information (existing)</td>
<td>Periodic updates</td>
<td>No</td>
<td>Statewide, although there is no data system in</td>
<td>No, they don’t have</td>
<td>No</td>
<td>Out</td>
<td>N/A</td>
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<td>GIS)</td>
<td>Pertinent to Planning</td>
<td>ROW location, width, utilities permits, driveway permits, encroachment permits, etc.) to the Department to support planning &amp; design.</td>
<td>(surveys, title analysis) conducted as projects require realignment of the roadway and acquisition of ROW. are portions of the state that haven’t been mapped yet.</td>
<td>Statewide or regional system?</td>
<td>Supports by adequate resources?</td>
<td>Plans for retirement of system?</td>
<td>N/A</td>
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<tr>
<td>Roadway</td>
<td>Highway Performance Monitoring System (HPMS)</td>
<td>Support aggregated reporting to FHWA on the extent, condition, performance, use, and operating characteristics of public roadways in the State.</td>
<td>Annual updates due by June 15th of the year following the data year.</td>
<td>Statewide</td>
<td>Yes – capacity related performance measures</td>
<td>Yes</td>
<td>No</td>
<td>In/Out of TAMIS?</td>
<td>Tier¹</td>
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<tr>
<td>Roadway</td>
<td>Roadway Data System (RDS) – Enterprise Linear Referencing System (LRS) –</td>
<td>RDS is used to support HPMS and other business needs in the Department related to use of location</td>
<td>Periodic – data is updated as needed</td>
<td>Statewide</td>
<td>Yes, RDS primarily includes location and road feature data for</td>
<td>Yes – staff are responsible for maintaining different data elements</td>
<td>RDS is part of SIRIS. SIRIS consists of three components: the Roadway</td>
<td>N/A</td>
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</table>

¹ Tier: Tier 1 – While RDS is not an asset mgmt system, it is a critical element for planning.
<table>
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<tbody>
<tr>
<td>Roadway</td>
<td>Traffic Server (new in 2014) – component of SIRIS</td>
<td>Traffic Server will be the primary source of traffic data after the transition from HAS is complete.</td>
<td>Annually and will include historical, current and projected traffic data</td>
<td>Yes – capacity related performance measures</td>
<td>Statewide</td>
</tr>
<tr>
<td>Roadway</td>
<td>Traveler Information (511) – RIDE</td>
<td>Traveler information system that provide information on driving and weather conditions in the</td>
<td>Real-time</td>
<td>No</td>
<td>Statewide</td>
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</tbody>
</table>
### Roadway

#### Weigh in Motion (WIM) Data Port

- **Purpose:** WIM site sensors measure truck weight and axle configurations of trucks at highway speeds. WIM sites provide pavement life data in support of Alaska’s PMS and FHWA’s LTPP Program.

- **Real-time or periodic update?:** Real-time

- **Supports TAM perf measures?:** Yes – support pavement performance and weight restriction decisions

- **Statewide or regional system?:** Statewide (limited) – WIM stations located on main highways and strategically opened/closed.

- **Contains useful inventory data?:** Yes – WIM data could be used for pavement deterioration models

- **Supported by adequate resources?:** Yes

- **Plans for retirement of system?:** Currently, WIM Dataport acts as a central data repository. It polls data from the WIM sites, and runs QA and QC procedures. The WIM data is then shared through the HAS Highway Dataport (HDP). The HDP will be replaced in 2014 by the new Roadway Information Portal (RIP). Additionally, the new Alaska Traffic Server (new traffic

- **Tier:** 2

- **In/Out of TAMIS?:** In
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<th>Plans for retirement of system?</th>
<th>In/Out of TAMIS?</th>
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<tr>
<td>Safety</td>
<td>Crash Data Entry System &amp; Crash Reporting and Analysis System for Safer Highways (CRASH)</td>
<td>Crash Data Entry System – accepts electronic and manual crash reports and stores data into Oracle database (DB). The crash data processors use it to geolocate a crash in RDS and to validate crash data, but not in real-time.</td>
<td>Regular updates (e.g., within x days following a crash)</td>
<td>Supports TAM perf measures</td>
<td>Yes – supports safety related performance measures</td>
<td>No – provides crash characteristics data at crash locations</td>
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</table>

Data system will integrate data from the WIM Dataport. Traffic reports and data analysis will be done in Traffic Server side, not through the HDP or its replacement, RIP. So, partial retirement of WIM Dataport is very likely.
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<th>In/Out of TAMIS?</th>
<th>Tier&lt;sup&gt;1&lt;/sup&gt;</th>
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<tbody>
<tr>
<td>Transit</td>
<td>Grant Management &amp; Program Administration System (GMPAS)</td>
<td>GMPAS is used to manage grants from the FTA and other funding sources in support of transit operations in Alaska. Governor’s Community and Public</td>
<td>the data and save it to the Oracle DB. Crash data is automatically saved to HAS. Crash – Used by traffic and safety engineers to analyze crashes, produce crash rates, sliding spots, etc. and produce reports. Traffic AADTs will be integrated from the new Traffic Server application.</td>
<td>Real-time or periodic update?</td>
<td>Supports TAM perf measures?</td>
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<td>Transit</td>
<td>Transit and Rail</td>
<td>Database for tracking transit assets and supporting transit asset management decisions as required by FTA Section 5339.</td>
<td>Periodic – updated as needed and certified annually as a condition of funding</td>
<td>Not used for enterprise asset mgmt – is used to track assets in the transit area (i.e., inventory and condition of transit vehicles); it</td>
<td>Statewide</td>
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<td>Major Asset Class/Subclass</td>
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<tr>
<td><strong>Weather</strong></td>
<td>Road Weather Information System (RWIS)</td>
<td>System of atmospheric sensors, pavement sensors, temperature data probes, and cameras to provide information on road and driving conditions to support winter weather maintenance activities and weight restriction decisions.</td>
<td><strong>Real-time or periodic update?</strong>&lt;br&gt;also supports FTA Section 5339 funds.</td>
<td><strong>In/Out of TAMIS?</strong></td>
<td><strong>Tier</strong>&lt;br&gt;Transit business area</td>
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<td>Road weather observations updated at 10- to 20-minute intervals. Temperature probe data is packaged into a 24-hr file for further review.</td>
<td><strong>Supports TAM perf measures?</strong>&lt;br&gt;Supports winter weather maintenance and weight restriction decisions.</td>
<td><strong>Statewide or regional system?</strong>&lt;br&gt;Statewide</td>
<td><strong>Contains useful inventory data?</strong>&lt;br&gt;Useful data for TAMIS is surface temperature and sub-probe data</td>
</tr>
<tr>
<td><strong>AVIATION</strong></td>
<td>Airport – Administration</td>
<td>Maintains information on airport personnel, procurement (stock requests), inventory, and employee time.</td>
<td>Periodic - Daily</td>
<td><strong>No</strong>&lt;br&gt;Statewide</td>
<td><strong>No – contains information on airport personnel, procurement, inventory, and employee</strong></td>
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<tr>
<td>Airport Information System</td>
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<td><strong>Airport – Facilities</strong></td>
<td>Alaska Aviation System Plan (AASP)</td>
<td>Used to track the aviation facilities inventory data and inspection data for several Alaska airports. Data is used to publish the Alaska Aviation System Plan.</td>
<td>Real-time or periodic update?</td>
<td>Supports TAM perf measures?</td>
<td>Supports by adequate resources?</td>
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<td>Periodic – Most data updated on annual cycle, but some data pulled from FAA airport master records on 45-day cycle</td>
<td>Could be used to associate aviation forecasts at the aviation facilities to make capital funding decisions. Pictures of failing infrastructure are also used as part of decision-making tools.</td>
<td>Statewide, but current application is being hosted by consultant services</td>
</tr>
<tr>
<td><strong>Airport - Facilities</strong></td>
<td>Airport and Highway Pavement Management System</td>
<td>Used to track the aviation facilities inventory data and inspection data for several Alaska airports. Data is</td>
<td>Periodic</td>
<td>Pavement condition reports for airports helps determine pavement</td>
<td>Pavement condition at airports</td>
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<tr>
<td>Major Asset Class/Subclass</td>
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<td>Purpose</td>
<td>Real-time or periodic update?</td>
<td>Supports TAM performance measures?</td>
<td>Statewide or regional system?</td>
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<tr>
<td><strong>Airport - Equipment</strong></td>
<td>Passur</td>
<td>A data feed that tracks commercial aircraft activity at ANC and FAI airports.</td>
<td>Periodic - daily</td>
<td>Passur does NOT serve as support for decision-making regarding capacity issues due to accuracy rate and reliability of information</td>
<td>Regional – used only in CR (ANC) and NR (FAI) airports</td>
</tr>
<tr>
<td><strong>Airport – Property Management</strong></td>
<td>eLeasing</td>
<td>Tracks applications for airport land use permits and allows customers to apply and pay for their lease online.</td>
<td>Periodic - Daily updates</td>
<td>No</td>
<td>Statewide system for rural airports</td>
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<tr>
<td>Airport - Property Management</td>
<td>PROPworks</td>
<td>PROPworks system is a planned airport accounting revenue subsidiary ledger and property management system that will be implemented in 2014.</td>
<td>System does not exist yet. No, and it has relatively low utility by itself with respect to TAM decision making. Planned to be statewide. System will be used by TSAIS, FIA, and all rural airports. System does not exist yet. No – Tracks aggregated information about aircraft usage at all rural airports.</td>
<td>No</td>
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**MARINE HIGHWAY**

| Marine Highway | Asset Management Operating System (AMOS) | AMOS is a shipboard-focused program used to track maintenance requirements for all machinery used onboard the ships. | Periodic – information is tracked on an hourly, weekly, or every 300 hour basis, depending on the piece of equipment. No | Access and update privileges for AMOS are very restrictive – only Chief Engineers and Master Engineers aboard ship can update data No – only inventory is related to machinery and parts needed aboard ship Yes, although updates are needed to make the system easier to use. Not retirement, but system enhancement | Yes, although updates are needed to make the system easier to use. Not retirement, but system enhancement | Out | N/A |

<p>| Marine Highway | ATLAS | AMHS personnel management tool used to track | Periodic – updated | No – it is not used to support | Yes | No | Out | N/A |</p>
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<tbody>
<tr>
<td>Marine Highway</td>
<td>Fleet Condition Survey</td>
<td>Identifies deferred maintenance needs and mandatory upgrades for the 11 vessels in the AMHS fleet</td>
<td>Real-time or periodic update?</td>
<td>Supports TAM perf measures?</td>
<td>Statewide or regional system?</td>
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<td>needed</td>
<td>decisions outside of AMHS</td>
<td>Statewide – covers entire AMHS vessel fleet</td>
</tr>
<tr>
<td>Marine Highway</td>
<td>Reservations Management System Ver 3 (RMSIII)</td>
<td>Online system that allows the public to book reservations on AMHS vessels and to ticket the appropriate</td>
<td>Real-time or periodic update?</td>
<td>Supports TAM perf measures?</td>
<td>Statewide or regional system?</td>
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<td>Portions are updated in real-time (e.g., those involved in the travel portion) and</td>
<td>No – the system is used internally to forecast passenger loads and to</td>
<td>Statewide – covers the entire AMHS route.</td>
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<tr>
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<tr>
<td>Marine Highway Ship</td>
<td>Ship</td>
<td>Database system that is used for annual maintenance/overhaul planning for ferries</td>
<td>Periodic as needs are identified</td>
<td>No</td>
<td>System is vessel specific (to each ship)</td>
</tr>
<tr>
<td>Marine Highway Shore</td>
<td>Condition</td>
<td>Inspection reports on the condition of dock structures, bridges, associated floats, and loading ramps.</td>
<td>Periodic – facilities are inventoried every 2 years</td>
<td>Yes - Bridge inspection data is entered into PONTIS</td>
<td>SE Region produces report used statewide - Shore condition report is generated in SE Region and covers all marine</td>
</tr>
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¹ Tier: 1 = Real-time or periodic update; 2 = Periodic
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<tbody>
<tr>
<td>Marine Highway</td>
<td>Terminal Maintenance Requests (TMRs)</td>
<td>Spreadsheet of maintenance needs and work for ferry terminals</td>
<td>Periodic as needs are identified – system does not use a database – it uses Excel spreadsheets.</td>
<td>Regional – system used to forecast maintenance budget needs for ferry terminal facilities</td>
<td>Out</td>
</tr>
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<td></td>
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<td></td>
<td>No – not used for TAM performance measures, but is used to forecast project needs for a 3-yr period and some of the projects are part of the STIP.</td>
<td>System does NOT use a database – TMRs are used to log and track maintenance work</td>
<td>No – there are limited resources currently available to maintain the TMR spreadsheet and to keep up with scheduling crews and fixing equipment.</td>
</tr>
</tbody>
</table>

**MEASUREMENT STANDARDS / COMMERCIAL VEHICLE ENFORCEMENT (MS/CVE)**

<p>| Measurement Standards | LIBRA | Measurement devices database that tracks registration, inspection, and compliance | Periodic – data is updated in real-time but the information is not always accurate | No – system does not have travel forecasting or budget forecasting | Statewide | No, contains data on where measure and weight devices are located | Yes – IT staff handles extraction of data from Libra and integration | No – but future plans include developing a possible link to the IRIS system | Out | N/A |</p>
<table>
<thead>
<tr>
<th>Major Asset Class/Subclass</th>
<th>Data Systems</th>
<th>Purpose</th>
<th>Criteria for “In/Out of TAMIS”</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Data Systems</td>
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<td>Tier1</td>
</tr>
<tr>
<td>Information for commercial weighting and measuring devices in the state.</td>
<td>retained in the Libra database</td>
<td>capabilities but the data can be used for these purposes by other applications like Peachtree.</td>
<td>statewide and the compliance rates for the devices. However, reports can be generated to determine if more equipment is needed to support the fishing industry by calculating the money needed to travel to where the fishing is located; data can also be used for analysis related to airport expansion into Peachtree.</td>
</tr>
<tr>
<td>Major Asset Class/Subclass</td>
<td>Data Systems</td>
<td>Purpose</td>
<td>Real-time or periodic update?</td>
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</tr>
<tr>
<td>Measurement Standards</td>
<td>Metrology Laboratory System (MetLab)</td>
<td>The MetLab is responsible for certifying equipment used for measures and weights throughout the state. The Metrology Laboratory has custody of, and is responsible for the state standards of mass, volume, and frequency</td>
<td>Periodic – Data is updated almost daily</td>
</tr>
</tbody>
</table>

¹ Tier: 1
### Major Asset Class/Subclass

<table>
<thead>
<tr>
<th>Purpose</th>
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<tbody>
<tr>
<td>Data Systems</td>
</tr>
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</table>

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<tr>
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<th>In/Out of TAMIS?</th>
<th>Tier</th>
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<tbody>
<tr>
<td><strong>Permits</strong></td>
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</tr>
<tr>
<td><strong>Local Permits (LP)</strong></td>
<td>Real-time – system updated as permits are issued</td>
<td>No – it is used for issuing permits to overweight vehicles. However, some of the data about weight of vehicle and routes traveled may be useful for pavement deterioration assessment.</td>
<td>System is used statewide but issuing of permits is restricted to 5 staff at the Anchorage office and there is an online permit system also used by the public for permits within certain limits.</td>
<td>System does NOT contain inventory data, it uses bridge condition data to help determine routing decisions for overweight vehicles.</td>
<td>Yes, 5 staff at Anchorage office issue permits statewide.</td>
<td>No – they are in a maintain phase at this time, with short-term needs for updates and feature enhancements done as needed.</td>
<td>In – provides a source for oversize/overweight data for pavement deterioration assessment</td>
</tr>
</tbody>
</table>

#### State Equipment Fleet

<table>
<thead>
<tr>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Management System (EMS)</td>
</tr>
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</table>

| Equipment | Monthly updates as they become available | No – does not support TAM performance measures | Statewide – covers the State Equipment Fleet | Yes – data includes equipment number, year/ make/ model, location of equipment, owner, and Federal | Yes, although they stated a need for resources to develop a user’s manual and make it available on everyone’s | No, although EMS will be replaced in the next 2-3 years. | In – supports enterprise asset management of state equipment fleet | 1 |

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**ADOT&PF Transportation Asset Management Information Systems (TAMIS) and Data Research Project**

**3-28**

**Cambridge Systematics, Inc.**
<table>
<thead>
<tr>
<th>Major Asset Class/Subclass</th>
<th>Data Systems</th>
<th>Purpose</th>
<th>Criteria for “In/Out of TAMIS”</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Equipment Fleet</td>
<td>Equipment Management System – FileMaker Pro (FMP)</td>
<td>FMP houses financial information associated with the equipment purchasing process. When the purchasing process ends, the information is housed in EMS. Periodic updates as they become available</td>
<td>Real-time or periodic update?</td>
</tr>
<tr>
<td>State Equipment Fleet</td>
<td>Equipment Management System – FileMaker Pro (FMP)</td>
<td>FMP houses financial information associated with the equipment purchasing process. When the purchasing process ends, the information is housed in EMS. Periodic updates as they become available</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**ADMINISTRATIVE SERVICES**

<table>
<thead>
<tr>
<th>Major Asset Class/Subclass</th>
<th>Data Systems</th>
<th>Purpose</th>
<th>Criteria for “In/Out of TAMIS”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative Services</td>
<td>BuySpeed Online (BSO)</td>
<td>BSO is a purchasing database / application used for processing requisitions, solicitations, All functionality is real-time</td>
<td>Real-time or periodic update?</td>
</tr>
<tr>
<td>Administrative Services</td>
<td>BuySpeed Online (BSO)</td>
<td>BSO is a purchasing database / application used for processing requisitions, solicitations, All functionality is real-time</td>
<td>No</td>
</tr>
</tbody>
</table>

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<sup>1</sup> Tier: Tier 1 (Out – This system will be replaced by IRIS in 2015, N/A – Not Applicable, N/A – Not Available, BuySpeed Online will be retired once IRIS is implemented, BSO will be retained for historical lookup for a period of time.)
<table>
<thead>
<tr>
<th>Major Asset Class/Subclass</th>
<th>Data Systems</th>
<th>Purpose</th>
<th>Criteria for “In/Out of TAMIS”</th>
<th>In/Out of TAMIS?</th>
<th>Tier¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Real-time or periodic update?</td>
<td>Supports TAM perf measures?</td>
<td>Supports by adequate resources?</td>
</tr>
<tr>
<td>Federal Aid Agreement Management (FAAM)</td>
<td>eDOCS</td>
<td>eDOCS is a document management system that is used as a repository to store all types of documents such as surveys, plats, memos, financial documents, ROW documents, as-built plans, satellite images, etc</td>
<td>Periodic as needed</td>
<td>No, but could be used as a resource for storing backup documentation for performance measures</td>
<td>Used on a voluntary basis at the statewide level, and usage varies by region</td>
</tr>
<tr>
<td>Integrated</td>
<td></td>
<td>Used to prepare the Federal-Aid Agreement document for FHWA and to satisfy Federal-Aid requirements.</td>
<td>Periodic as needed</td>
<td>No, data in FAAM is a result of TAM decisions</td>
<td>Neither – limited to use by HQ Federal-Aid Agreement Team</td>
</tr>
<tr>
<td>Major Asset Class/Subclass</td>
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<td>Tier¹</td>
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<td></td>
<td>Resource Information System (IRIS)</td>
<td>procurement and HR management enterprise system that will contain all requisitions, purchase orders, and information about what is being purchased. Phase I (Financial) of IRIS will be implemented in July 2015. Phase II (HR) will be implemented January 2016.</td>
<td>Financial information from IRIS could be used to conduct financial analyses such as calculating fixed asset values with depreciation.</td>
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<tr>
<td></td>
<td>Management Reporting System (MRS)</td>
<td>Used to track all capital projects. Data includes project names, locations, contractor names, STIP, obligation estimates, obligation transactions, costs of contracts, and project status.</td>
<td>Periodic – data is updated daily.</td>
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<td>Financial info from MRS could be used to support trade-off analysis and return on investment as part of TAM. System is being used to document</td>
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<td>Regions enter Project level data &amp; HQ also has a project control role and the obligation of funds</td>
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<td>There is project location info descriptions in the system, but NO use of lat/long for location. Construction and contract managers enter data into</td>
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<td>Yes, at both Regional and HQ level.</td>
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<tr>
<td>Performance Electronic Tracking System (PETS)</td>
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<td>Tier¹</td>
</tr>
</tbody>
</table>

¹ Notes:
Tier 1: A critical, core system that supports enterprise asset management decisions
Tier 1*: A critical core system that supports enterprise asset management although the system itself is NOT an asset management system (e.g., RDS, GIS)

Tier 2: A system that supports business area asset management decisions and interacts with other data systems

Tier 3: A system that supports business area, not directly related to asset management
3.2 DATA SYSTEMS EVALUATION

Once the initial evaluation of the data systems was completed according to the criteria identified in Section 3.1, the next steps in determining potential data integration points to support TAMIS decisions involved:

» Evaluating the system interfaces (either automated or manual) with other systems
» Determining the quality of the data in the source system
» Identifying the database environment (if one exists) for storing the data
» Identifying the documentation available for the data system and
» Documenting the user community for the data system.

This evaluation revealed that many of the data systems were designed and implemented to meet certain needs for a specific business area in the Department. However, since many of these ‘silo’ systems share common database platforms (e.g., Oracle or MS Access), it is feasible to use these systems in the future for decision making purposes across multiple assets.

Additionally, because most of the data systems include a transportation asset’s physical location as a common attribute, an enterprise-wide Geographic Information System (GIS) with a core set of geospatial databases, represents a key technology for integrating data across these data systems. The critical components for an enterprise GIS, including a common roadway centerline and linear referencing system (LRS), already exist within the RDS and other geospatial databases managed by ADOT&PF’s Transportation Geographic Information Section (TGIS).

Table 3.2 illustrates the more detailed evaluation of the data systems determined to be “in” TAMIS. The major Asset Type is identified by header rows within the table, such as Highways, Aviation, Alaska Marine Highway System, etc. The table summarizes the following information for each data system:

- Name of Data System
- Tier Level of System – Tier classification as defined in Section 3.1.
- Data Owner – Primary office(s) responsible for maintaining data in system
- Description/Business Purpose – Identifies what the data is used for at the Department
- System Interfaces – Describes the automated and manual interfaces with internal and external data systems (e.g., several of the systems had some kind of interface with the Alaska Statewide Accounting System (AKSAS))
• Data Quality – Identifies the quality of the data sets in accordance with the following criteria:
  – **Accuracy** – The measure of degree of agreement between a data value or sets of values and a source assumed to be correct.
  – **Timeliness** – The degree to which data values or a set of values are provided at the time required or specified.
  – **Completeness** – The degree to which the data values are present in the attributes (data fields) that require them.
  – **Validity** – The degree to which data values satisfy acceptance requirements of the validation criteria or fall within the respective domain of acceptable values.
  – **Coverage** – The degree to which data values in a sample accurately represent the whole of that which is to be measured.
  – **Accessibility** – The relative ease with which data can be retrieved and manipulated by data consumers to meet their needs.

Systems with adequate data quality attributes to support the business area are indicated with a solid filled circle (●), while those with inadequate data quality attributes are indicated with a hollow circle (○).

• Data Storage – Identifies the platform used for storing the data set. Many of the data systems use either Oracle or Access databases and also use Excel for producing reports.

• Documentation – A check mark identifies the types of documentation currently available (✓) or in progress (✓*) for the data system. Types of documentation include data dictionaries, user manuals, or other (e.g., training materials or Concept of Operations documents with detailed Use Cases).

• Users – Identifies the primary users of the system, both internal and external to the Department.

The quality of the data is basically good for most of the data systems. Unfortunately, some of the Tier 1 and Tier 2 applications do not have the data quality needed to support the business area, much less the TAMIS framework. In some cases, these data systems are under consideration for replacement in the near future.

Many of the data systems have some form of documentation available in the form of user manuals and data dictionaries. The data dictionaries, in particular, are valuable for evaluating the potential for data integration across systems.
Table 3.2  Analysis of Data Source Systems for TAMIS

<table>
<thead>
<tr>
<th>Data System</th>
<th>Tier</th>
<th>Data Owner</th>
<th>Description/Business Purpose</th>
<th>System Interfaces</th>
<th>Data Quality</th>
<th>Data Storage</th>
<th>Documentation</th>
<th>Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGHWAYS</td>
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</tr>
<tr>
<td>PONTIS (BrM 5.1 – 2014)</td>
<td>1</td>
<td>Bridge Section</td>
<td>Pontis is used to assist in managing highway bridges and other structures. Pontis stores bridge inspection and inventory data, based on the U.S. Federal Highway Administration (FHWA) National Bridge Inventory System (NBIS) coding guidelines. In addition, the system stores condition data for each of a bridge’s structural elements.</td>
<td>1. MS Access Program for maintaining data (rail height, asphalt thickness, hydraulic information) that is not covered in Pontis. 2. Data from Pontis is used by MSCVE permitting office – this is NOT an automated link.</td>
<td>● ● ● ● ● ●</td>
<td>Oracle</td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>ADA Inventory</td>
<td>1</td>
<td>DOT&amp;PF Office of Civil Rights</td>
<td>ADA Inventory is being conducted as part of a transition plan for ADOT&amp;PF pedestrian facilities within its ROW.</td>
<td>The ADA Inventory is using an interactive GIS mapping program. This will allow for updated information to be imputed directly into the map (onto the feature) when information becomes available.</td>
<td>● ● ● ● ● ●</td>
<td>Geographic information system</td>
<td>✔</td>
<td>Current users are Office of Civil Rights. When the transition plan is complete, it will be made available to users in Planning.</td>
</tr>
<tr>
<td>Data System</td>
<td>Tier</td>
<td>Data Owner</td>
<td>Description/Business Purpose</td>
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</tr>
<tr>
<td>Material Sites Inventory</td>
<td>2</td>
<td>Statewide Materials</td>
<td>Includes site inventory and inspection data for all material sites (e.g., quarries, borrow sites, etc.), as well as associated documentation.</td>
<td>1. ROW section files, Materials section files for all materials sites (manual review to populate initial database)</td>
<td>● ● ● ● ● ●</td>
<td>PDF versions of reports, summary spreadsheets, and quantity charts. Data is being populated into a geodatabase.</td>
<td></td>
<td>PD&amp;E, and Construction</td>
</tr>
<tr>
<td>Unstable Slope Inventory</td>
<td>2</td>
<td>Statewide Materials</td>
<td>Inventory of the Top 200 unstable rock and soil slopes around the state</td>
<td>1. Using RoadLog to pull milepoint and lat/long coordinates for each site.</td>
<td>● ● ● ● ○ ●</td>
<td>MS Access database that resides on contractor server</td>
<td></td>
<td>Regional Planning &amp; Design Staff</td>
</tr>
<tr>
<td>Retaining Walls Inventory</td>
<td>2</td>
<td>Statewide Materials</td>
<td>A data dictionary and retaining walls inventory is in development.</td>
<td>1. As-builts used to mine drawings for retaining walls data (manual review to populate initial inventory)</td>
<td>- - - - - -</td>
<td>Data dictionary in spreadsheet format. No database</td>
<td>**</td>
<td>M&amp;O staff</td>
</tr>
<tr>
<td>Data System</td>
<td>Tier</td>
<td>Data Owner</td>
<td>Description/Business Purpose</td>
<td>System Interfaces</td>
<td>Data Quality1</td>
<td>Data Storage</td>
<td>Documentation2</td>
<td>Users</td>
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</tr>
<tr>
<td>Maintenance Management System (MMS)</td>
<td>1</td>
<td>M&amp;O</td>
<td>Provides tools to manage the planning, scheduling, reporting and analysis of maintenance actions. Provides information for managing special programs, administrative and financial tasks, contracts and project work.</td>
<td>Uses manually controlled export/import. No direct (automated) system interface. Information is used from: 1.Pontis 2.Pavement Mgmt System 3. AKSAS 4. ALDER 5. EMS 6. RDS (once transitioned from HAS)</td>
<td>□ □ □ □ □ □</td>
<td>Oracle</td>
<td>✓ ✓</td>
<td>M&amp;O staff in Regions and HQ</td>
</tr>
<tr>
<td>MMS Inventories: Sign, Culvert, Guardrail, Quality Assurance Program Inventory</td>
<td>1</td>
<td>M&amp;O</td>
<td>Sign inventory – available as tables in MMS , but not user friendly  Culvert and Guardrail inventories – no data collection yet for these inventories  Quality Assurance Program - part of MMS</td>
<td>MMS tables for Sign Inventory and Q/A Program  - - - - - -  - - - - - -</td>
<td>□ □ □ □ □ □</td>
<td>Tables that are part of the MMS system, but data is extracted using COTS software separate from MMS</td>
<td>✓</td>
<td>M&amp;O staff in Regions</td>
</tr>
<tr>
<td>Pavement Mgmt System</td>
<td>1</td>
<td>Pavement Management</td>
<td>System used to document pavement conditions and to  No other automated system interfaces – extracts of</td>
<td>Data collected by</td>
<td>□ □ □ □ □ □</td>
<td>✓</td>
<td>AST</td>
<td>HPMS staff, Design</td>
</tr>
<tr>
<td>Data System</td>
<td>Tier</td>
<td>Data Owner</td>
<td>Description/Business Purpose</td>
<td>System Interfaces</td>
<td>Data Quality¹</td>
<td>Data Storage</td>
<td>Documentation²</td>
<td>Users</td>
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</tr>
<tr>
<td>Roadway Data System (RDS) – Enterprise Linear Referencing System (LRS)</td>
<td>1*</td>
<td>Program Development Division – Transportation Information Group</td>
<td>RDS is used to support HPMS and other business needs in the Department related to use of location and roadway feature data. It can also be used to support safety, bridge, and pavement management areas since it includes bridge locations, bridge number, pavement type, etc. It also contains information on airport locations, AMHS ports and harbor locations, and eagles’ nests.</td>
<td>Automated interfaces exist between CRASH and RDS for location referencing. The Traffic Server will also include automated interfaces as well as others in the future. Data extracts are also provided to several other systems as needed, including HPMS, ADA Inventory, bridge management and pavement management.</td>
<td>✔ ✔ ✔ ✔</td>
<td>Oracle</td>
<td>✔ ✔</td>
<td>Current: HPMS, CRASH, 511 Future: Traffic, MMS, PMS, CRASH, SIRIS (RDS integrated into SIRIS)</td>
</tr>
</tbody>
</table>

¹ Data Quality: Accurate, Complete, Timely, Valid, Coverage, Accessible

² Documentation: Data Dictionary, User Manual, Other, None

<table>
<thead>
<tr>
<th>Data System</th>
<th>Tier</th>
<th>Data Owner</th>
<th>Description/Business Purpose</th>
<th>System Interfaces</th>
<th>Data Quality</th>
<th>Data Storage</th>
<th>Documentation</th>
<th>Users</th>
</tr>
</thead>
</table>
| Traffic Server           | 2    | Program Development Division – Transportation Information Group | Traffic Server will be the primary source of traffic data after the transition from HAS is complete.                                                                                                                     | 1. Export data to HPMS  
2. Import/export data from/to HAS (until HAS is decommissioned)  
3. Import data from PEEK software used by regions for volume data collection.  
4. Import and store WIM data.  
5. Interface with GIS-LRS and CRASH as part of SIRIS  
6. Interface with PMS for pavement condition data.  
7. Interface with PONTIS/BrM for bridge condition data | • • • • • • | Current system includes a mainframe, Oracle database, and GIS database. Future data storage will depend on Transmetric America solution.                                                                 | ✓             | ADOT&PF Planning, Highway Safety, local government agencies, law enforcement, FHWA |
| Weigh in Motion (WIM) Data Port | 2    | Program Development Division – Transportation Information Group | WIM site sensors measure truck weight and axle configurations of trucks at highway speeds. WIM sites provide pavement life data in support of Alaska’s PMS and FHWA’s LTPP Program.                                          | 1. Export data to Vehicle Travel Information System (VTRIS) and FHWA reporting  
2. Export weight data to HAS (until HAS is decommissioned).  
3. Export weight data to Traffic Server. | • • • • • | Current system is Highway Data Port Oracle database.                                                                                                                     | ✓ ✓           | Program Development staff, MS/CVE staff                                   |
<table>
<thead>
<tr>
<th>Data System</th>
<th>Tier</th>
<th>Data Owner</th>
<th>Description/Business Purpose</th>
<th>System Interfaces</th>
<th>Data Quality</th>
<th>Data Storage</th>
<th>Documentation</th>
<th>Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crash Data Entry System &amp; Crash Reporting and Analysis System for Safer Highways (CRASH)</td>
<td>3</td>
<td>Program Development Division – Transportation Information Group</td>
<td>CRASH will be the primary source of crash characteristics data after the transition from HAS is complete.</td>
<td>1. Import/export data from/to HAS (until HAS is decommissioned).&lt;br&gt;2. TDS will receive data from DMV Crash Data Repository&lt;br&gt;3. Interface with GIS-LRS and Traffic Server as part of SIRIS</td>
<td>● ● ● ● ●</td>
<td>Future system will include Oracle database and ArcGIS server.</td>
<td>Data Dictionary, User Manual</td>
<td>MS/CVE, Regional M&amp;O, Highway Safety Office, Planning, Design &amp; Engineering Services, Regional Traffic &amp; Safety, Alaska Injury Prevention Center, FARS, local agencies</td>
</tr>
<tr>
<td>Grant Management &amp; Program Administration System (GMPAS)</td>
<td>2</td>
<td>Program Development Division – Transit Planning</td>
<td>GMPAS is used to manage grants from the FTA and other funding sources in support of transit operations in Alaska. Governor’s Community and Public Transportation Advisory Board also uses data for decision-making. System is new and is being implemented in phases. Three main</td>
<td>No automated links, but uses data extracts from AKSAS (will use IRIS in the future)</td>
<td>● ● ● ● ●</td>
<td>System is hosted externally by Panther International – database and servers are external to ADOT&amp;PF</td>
<td>Data Dictionary, User Manual</td>
<td>Transit Planners, FTA, Alaska Mental Health Trust Authority</td>
</tr>
</tbody>
</table>
## Data System Description/Business Purpose

<table>
<thead>
<tr>
<th>Data System</th>
<th>Tier</th>
<th>Data Owner</th>
<th>System Interfaces</th>
<th>Data Quality</th>
<th>Data Storage</th>
<th>Documentation</th>
<th>Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit and Rail</td>
<td>2</td>
<td>Program Development Division – Transit Planning</td>
<td>Transit and Rail operations are supported by the Grant Management &amp; Program Application System (GMPAS) [see below]. See GMPAS</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>See GMPAS</td>
</tr>
<tr>
<td>Road Weather Information System (RWIS)</td>
<td>2</td>
<td>Program Development Division</td>
<td>RWIS is a comprehensive road weather information system for atmospheric observations, surface conditions, temperature data probe reports, and camera images to support M&amp;O maintenance activities and weight restriction decisions. Other non-DOT environmental information is also available. A formal automated quality assurance and health of the network program for RWIS has not been implemented yet by the Transportation Information Group (TIG). Access to RWIS information is available through the external website at roadweather.alaska.gov</td>
<td>● ● ● ● ○ ●</td>
<td>● ● ● ● ● ○</td>
<td>✓</td>
<td>* M&amp;O</td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>* Planners</td>
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<td></td>
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<td></td>
<td>* Local transport authorities</td>
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<td></td>
<td></td>
<td></td>
<td>* Numerous External DOT&amp;PF agencies (i.e. DOA Risk Mgmt)</td>
</tr>
</tbody>
</table>

### AVIATION

- Road Weather Information System (RWIS)
  - Program Development Division
  - Description/Business Purpose: Road Weather Information System (RWIS)
  - Business Purpose: Supports atmospheric observations, surface conditions, temperature data probe reports, and camera images for M&O maintenance activities and weight restriction decisions. Other non-DOT environmental information is also available. A formal automated quality assurance and health of the network program for RWIS has not been implemented yet by the Transportation Information Group (TIG). Access to RWIS information is available through the external website at roadweather.alaska.gov.
  - System Interfaces: See GMPAS
  - Data Quality: ● ● ● ● ○ ●
  - Data Storage: ● ● ● ● ● ○
  - Documentation: ✓
  - Users: * M&O

- **AVIATION**
<table>
<thead>
<tr>
<th>Data System</th>
<th>Tier</th>
<th>Data Owner</th>
<th>Description/Business Purpose</th>
<th>System Interfaces</th>
<th>Data Quality</th>
<th>Data Storage</th>
<th>Documentation</th>
<th>Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alaska Aviation System Plan (AASP)</td>
<td>2</td>
<td>Aviation Planners,</td>
<td>Used to track the aviation facilities inventory data and inspection data for several Alaska airports. Data is used to publish the Alaska Aviation System Plan.</td>
<td>eDOCS, Airport Improvement Program (AIP)</td>
<td>● ○ ○ ● ●</td>
<td>Access, Excel</td>
<td>✓</td>
<td>Publisher of AASP</td>
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</tr>
<tr>
<td>Airport and Highway PMS systems</td>
<td>2</td>
<td>Pavement managers</td>
<td>Used to track the aviation facilities inventory data and inspection data for several Alaska airports. Data is used to publish the Alaska Aviation System Plan. Data dictionary includes data on DOT&amp;PF owned airports including paved/unpaved areas at the airport.</td>
<td>eDOCS, Airport Improvement Program (AIP)</td>
<td>● ○ ○ ● ●</td>
<td>Access, Excel</td>
<td>✓</td>
<td>Publisher of AASP</td>
</tr>
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<tr>
<td>MARINE HIGHWAY</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Fleet Condition Survey</td>
<td>2</td>
<td>AMHS</td>
<td>Identifies deferred maintenance needs and mandatory upgrades for the 11 vessels in the AMHS fleet</td>
<td>No connection to other data systems. The goal is to get Ship Maintenance Requests integrated into FCS.</td>
<td>● ● ● ● ● ●</td>
<td>Access</td>
<td>✓</td>
<td>Senior vessel construction manager, marine engineering manager</td>
</tr>
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</tr>
<tr>
<td>Shore Condition Survey</td>
<td>2</td>
<td>AMHS</td>
<td>Used to document inspection of shore facilities every 2 years and inspections of bridges as</td>
<td>Pontis</td>
<td>● ● ● ● ● ●</td>
<td>Data not stored in database, but</td>
<td>✓</td>
<td>AMHS Port Captains and</td>
</tr>
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<tr>
<td>Data System</td>
<td>Tier</td>
<td>Data Owner</td>
<td>Description/Business Purpose</td>
<td>System Interfaces</td>
<td>Data Quality¹</td>
<td>Data Storage</td>
<td>Documentation²</td>
<td>Users</td>
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</tr>
<tr>
<td>T&amp;EOBR</td>
<td>2</td>
<td>M&amp;O - Statewide Equipment Fleet</td>
<td>EMS is used to identify vehicles and equipment in the State Equipment Fleet, track costs, bill customers, maintain inventory, calculate rates, and store historical information about equipment. This tracking also provides cost information for budgeting and forecasting.</td>
<td>1. AKBAS for billing and financial information 2. Interface with MMS for assets, FUR and IFUR rates 3. Export AKBAS IDs and cost per unit information to T&amp;E system to bill Feds for reimbursement</td>
<td>● ● ● ● ●</td>
<td>Unix server in Juneau, APPX software &amp; APPX-IO database management system</td>
<td>✓</td>
<td>M&amp;O staff, Design &amp; Construction, AMHS, all Executive Branch agencies</td>
</tr>
<tr>
<td>MEASUREMENT STANDARDS / COMMERCIAL VEHICLE ENFORCEMENT (MS/CVE)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Local Permits (LP)</td>
<td>2</td>
<td>Local Permits Office - Anchorage</td>
<td>Commercial vehicle permit database that stores overweight/over dimension permit information for large commercial vehicles.</td>
<td>1. AKBAS to determine if an overweight load can travel safely over a bridge 2. State DOT ArcGIS Server</td>
<td>● ● ● ● ●</td>
<td>LP database is stored in SQL server.</td>
<td>✓</td>
<td>Motor carriers, public (public can self-issue permits within certain limits)</td>
</tr>
<tr>
<td>STATE EQUIPMENT FLEET</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

¹ Data Quality: Accurate, Complete, Timely, Valid, Coverage, Accessible
² Documentation: Data Dictionary, User Manual, Other, None

Shore Condition Report uses MS Word and Excel
Terminal Mgrs. Cities and municipalities
<table>
<thead>
<tr>
<th>Data System</th>
<th>Tier</th>
<th>Data Owner</th>
<th>Description/Business Purpose</th>
<th>System Interfaces</th>
<th>Data Quality¹</th>
<th>Data Storage</th>
<th>Documentation²</th>
<th>Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADMINISTRATIVE SERVICES</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>eDOCS</td>
<td>3</td>
<td>Administrative Services Division</td>
<td>eDOCS is a document management system that is used as a repository to store all types of documents such as surveys, plats, memos, financial documents, ROW documents, as-built plans, satellite images, etc.</td>
<td>eDOCS search is integrated with the following applications: TAM Library in Transportation Asset Management Confluence Site, Material Site Portal, Aviation System Plan, Parks Highway Corridor Map, and Site Manager Attachments</td>
<td>●</td>
<td>●</td>
<td></td>
<td>✓ Project and Contracts, Aviation, Geotechnical, Stormwater Pollution Prevention, Utility, MSCVE, Site Manager, PETs, Radiation Safety, Planning, TAM, Administration</td>
</tr>
<tr>
<td>Federal Aid Agreement Management (FAAM)</td>
<td>3</td>
<td>HQ – Fed-Aid Team</td>
<td>Used to prepare the Federal-Aid Agreement document for FHWA and to satisfy Federal-Aid requirements.</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>✓ HQ – Fed-Aid Team</td>
</tr>
<tr>
<td>Integrated Resource Information System (2015)</td>
<td>1</td>
<td>Administrative Services Division</td>
<td>An executive branch financial procurement and HR management enterprise system that will contain all</td>
<td>IRIS will interface with EMS, MMS, MRS, eParcels, Rural Airport Badging System, Airport Information System.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>✓ Accounting clerks, admin assistants,</td>
</tr>
<tr>
<td>Data System</td>
<td>Tier</td>
<td>Data Owner</td>
<td>Description/Business Purpose</td>
<td>System Interfaces</td>
<td>Data Quality¹</td>
<td>Data Storage</td>
<td>Documentation²</td>
<td>Users</td>
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<td>-----------------------------------------------------------------------------</td>
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<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Management Reporting System (MRS)</td>
<td>1</td>
<td>Regional Project Controls, HQ Project Controls and Obligation Mgr.; HQ Admin Services owns the hw/sw; staff in contracts and construction also update data in MRS</td>
<td>requisitions, purchase orders, and information about what is being purchased. IRIS will be implemented in 2015.</td>
<td>Used to track all capital projects. Includes project names, locations and contractor names, costs of contracts, etc.</td>
<td>Aksamas (via PCIS). There is no current interface directly from Aksamas, although analysis is underway to retire PCIS and to obtain the information directly from Aksamas. Also, there is no AKPAY (payroll) interface.</td>
<td>• • • • •</td>
<td>Oracle</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>Performance Electronic Tracking System</td>
<td>1</td>
<td>Administrative Services Division</td>
<td>PETS is used to track key performance indicators across ADOT&amp;PF.</td>
<td>eDOCS used to store backup documentation</td>
<td>• • • • • •</td>
<td>Cognos, eDOCS</td>
<td>✓</td>
<td>Aviation, Safety, AMHS,</td>
</tr>
<tr>
<td>Data System</td>
<td>Tier</td>
<td>Data Owner</td>
<td>Description/Business Purpose</td>
<td>System Interfaces</td>
<td>Data Quality¹</td>
<td>Data Storage</td>
<td>Documentation²</td>
<td>Users</td>
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<td>(PETS)</td>
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</tr>
</tbody>
</table>

**NOTES:**

¹ **Data Quality:**
- ● Adequate data quality attribute to support the business area
- ○ Inadequate data quality attribute to support the business area

² **Documentation**
- ✓: Documentation type exists
- ✓*: Development of documentation type is in progress
4.0 Data Integration Points

This section examines the data integration points that are needed to support cross-asset decision making at the enterprise level at ADOT&PF. The AASHTO Asset Management Guide provides example key integration points to support Transportation Asset Management (TAM) systems (Table 4.1). Based on this Guide, data integration points specific to ADOT&PF data systems are identified in Table 4.2. Only the Tier 1 and Tier 2 systems are shown in Table 4.2, since they are most likely to support asset management decisions from an enterprise perspective.

4.1 AASHTO Asset Management Guide

Example Key Integration Points for a TAMIS include those identified in Table 4.1 (from the AASHTO Asset Management Guide, Chapter 8), with some of the potential Alaska data systems identified in the ADOT&PF System column of the table. The first two columns are from the AASHTO Guide. The first two rows of the table list the systems that provide the Linear Referencing System (LRS) and geospatial data layers used for location. Location information is a basic need in comparing assets from disparate systems, which are often based on different segment lengths (e.g., pavement segments, maintenance segments, HPMS sections, etc.). The geospatial environment provides the capability to analyze different segment lengths (and their associated roadway data attributes) through the use of an integrated basemap. The purpose for integration of data from each system in support of TAMIS is identified in the last column of the table.

There are many more data integration points that can be used to support TAMIS at ADOT&PF. Those points are identified in Table 4.2. Table 4.1 below is basically presented to illustrate some of the types of data integration points that typically are used to support a TAM system, based on the AASHTO Guide. Table 4.2 represents the comprehensive list of data integration points specific to ADOT&PF data systems.

<table>
<thead>
<tr>
<th>Data Type(s)</th>
<th>Systems Integrated</th>
<th>ADOT&amp;PF System</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Network and Linear Referencing</td>
<td>Enterprise GIS, Enterprise LRS</td>
<td>RDS (SIRIS)</td>
<td>Integrate TAMIS and other geospatial data; keep TAMIS location referencing in synch with enterprise LRS over time.</td>
</tr>
<tr>
<td>Data Type(s)</td>
<td>Systems Integrated</td>
<td>ADOT&amp;PF System</td>
<td>Purpose</td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>-------------------------------------</td>
<td>------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Geospatial Data Layers</td>
<td>Enterprise GIS</td>
<td>Enterprise GIS</td>
<td>Utilize geospatial data within the TAMIS; provide map interface for field data collection.</td>
</tr>
<tr>
<td>Functional Classification, Highway System</td>
<td>Highway Inventory</td>
<td>RDS (SIRIS)</td>
<td>Provide TAMIS with highway designation data for use in treatment assignment, prioritization and analysis.</td>
</tr>
<tr>
<td>Asset Inventory</td>
<td>Across specialized inventories for single assets or asset groupings</td>
<td>PMS, PONTIS, MMS, etc.</td>
<td>Assess needs and develop work programs reflecting multiple assets in a corridor; filter data based on pavement type or bridge locations; consolidate information for HPMS reporting; consolidate information for financial reporting.</td>
</tr>
<tr>
<td>Asset Condition and Performance</td>
<td>Executive Information, Enterprise Reporting, Performance Management</td>
<td>COGNOS – Exec Info Mgmt., Enterprise Rept. PETS – Perf Mgmt</td>
<td>Display asset performance data on enterprise performance reports or dashboards, consolidate multiple performance indicators for internal or external reporting.</td>
</tr>
<tr>
<td>Identifiers and Codes for Assets, Activities, Accounts, Projects, and Administrative Units</td>
<td>Financial, Enterprise Master Data</td>
<td>MMS, FAAM</td>
<td>Keep TAMIS coding in synch with other systems, avoid need for duplicate data maintenance as code changes occur.</td>
</tr>
<tr>
<td>Employees</td>
<td>Human Resources</td>
<td>IRIS, MMS</td>
<td>Select staff resources for assignment to maintenance work activities (for TAMIS including maintenance management functions).</td>
</tr>
<tr>
<td>Data Type(s)</td>
<td>Systems Integrated</td>
<td>ADOT&amp;PF System</td>
<td>Purpose</td>
</tr>
<tr>
<td>------------------------------</td>
<td>--------------------------------------</td>
<td>----------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Vehicles/Equipment</td>
<td>Fleet and Equipment Management</td>
<td>EMS, MMS</td>
<td>Select equipment resources for assignment to maintenance work activities (for TAMIS including maintenance management functions).</td>
</tr>
<tr>
<td>Materials</td>
<td>Materials or Inventory Management</td>
<td>EMS, SALLY, PMS, PONTIS</td>
<td>Select materials for assignment to maintenance work activities based on available stocks (for TAMIS including maintenance management functions).</td>
</tr>
<tr>
<td>Resource Utilization</td>
<td>Financial, Human Resource</td>
<td>MMS, IRIS</td>
<td>Obtain cost transactions associated with work orders in order to track maintenance costs by asset and location.</td>
</tr>
<tr>
<td>Project Budgets and Actual Costs</td>
<td>Financial, Capital Programming</td>
<td>FAAM, MRS, IRIS</td>
<td>Provide planning-level cost estimates from TAMIS to financial or capital programming systems. Obtain current cost estimates from financial systems for integration into TAMIS work plans or for tracking historical asset maintenance and rehabilitation costs.</td>
</tr>
<tr>
<td>Treatment Recommendations</td>
<td>Programming and Contracting</td>
<td>Site Manager, Bid Tab, STIP</td>
<td>Provide TAMIS recommendations to be further developed for contracting and scheduling. This would be for programs like Site Manager, Bid Tab and the STIP.</td>
</tr>
<tr>
<td>Data Type(s)</td>
<td>Systems Integrated</td>
<td>ADOT&amp;PF System</td>
<td>Purpose</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------------------------------</td>
<td>----------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Work Requests</td>
<td>Call Center</td>
<td>AMHS</td>
<td>Route asset maintenance work requests to the TAMIS (for TAMIS including maintenance management functions) and provide completion status. ADOT&amp;PF has a call center for AMHS, but no other known call centers at this time.</td>
</tr>
<tr>
<td>Multiple</td>
<td>Data Warehouse/Business Intelligence</td>
<td>COGNOS</td>
<td>Make information from the TAMIS available via enterprise reporting or business intelligence tools.</td>
</tr>
</tbody>
</table>

Source: Columns 1 and 2 adapted from AASHTO Asset Management Guide, Chapter 8

### 4.2 TAMIS Data Integration Points

The determination of data integration points needed for TAMIS is a result of the series of interviews that were conducted regarding the data sources for TAMIS, as well as a review of the ‘data level’ type documentation provided by the data owners. This includes, but is not limited to, data dictionaries and user manuals for several of the systems.

Figure 4.1 illustrates the dependence on location data and other key data (such as Structure-Id for bridge data, or pavement Segment-Id for pavement data) as a point of integration for asset management. The diagram shows how asset management decisions are supported by business processes, which in turn rely on data support systems that can be accessed through on-line queries. The location-based queries (QLOC) can utilize the existing GIS system for geospatial data layers and the RDS component of the SIRIS system for linear referencing purposes. The queries that are not location-based (QOTL) rely on data integration points that are identified by something other than location. Examples of this are structure-id (bridges), pavement segment-id, and maintenance section-id.
Figure 4.1 TAMIS Structure and Data Integration Points

![Diagram of TAMIS Structure and Data Integration Points]

- Asset Management Decisions
- Asset Management Business Processes within Governance Structure
- Asset Management Related Queries
  - Queries - Location Based (QLOC)
  - Queries - Other Than Location Based (QOTL)
- Integration Processes and Rules

- ADA Inventory
- Airport & Highway PMS
- Alaska Aviation System Plan
- Crash
- eDOCS
- EMS
- Federal Aid Agreement Management (FAAM)
- Geotechnical Assets (Materials sites, unstable slopes, retaining walls)
- Grant Management and Program Administration System (GMPAS)
- IRIS (2014)
- Local Permits (LP)
- Management Reporting System (MRS)
- Marine Highway Fleet Condition Survey (FCS)
- MMS
- MMS Inventories: Sign, Culvert, Guardrail, Quality Assurance
- PETS
- PMS
- PONTIS (BIM 5.1)
- Road Weather Information System (RWIS)
- Roadway Data System (RDS)
- Shore Condition Survey
- Traffic Server
- Transit and Rail
- Weigh In Motion Data Port
Table 4.2 identifies the potential integration points for data from the source systems which can be used to support TAMIS. The data are identified as either Primary or Secondary types of data. The Primary data would be the data that is typically considered to be primary key data in a database table, allowing access to all other data in the table through the primary key. The Secondary types of data are those data that would be extracted from database tables for use in cross-asset analysis. If a data dictionary or user manual was provided for the data system then the actual data field name is used in Table 4.2, otherwise, the type of data is listed instead of a specific data name (e.g., Region Project Level data, Project Control data (HQ), Federal Obligation data, etc.).
## Table 4.2  TAMIS Data Integration Points by System (Tiers 1 and 2 only)

<table>
<thead>
<tr>
<th>Major Asset Class/Subclass</th>
<th>Data Systems</th>
<th>Tier</th>
<th>Data Integration Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGHWAYS</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Bridge                     | PONTIS (BrM 5.1 – 2014) | 1    | **Primary:** Location, Structure ID  
**Secondary:** Approach rail, bank protection, debris, approach fill, seismic retrofit, wingwall, utility, traffic impact, bridge condition, load rating, clearances (vert, horiz), geometry, scour, ice or debris buildup, fatigue |
| Facilities                 | ADA Inventory | 1 – Critical for managing enterprise assets designated as ADA type assets | **Primary:** Project Number (ID), ROW location  
**Secondary:** Pedestrian facilities |
| Geotechnical               | Material Sites Inventory | 2    | **Primary:** Location of Materials Sites  
**Secondary:** Permit status, Quantity and Quality of Materials |
| Geotechnical               | Unstable Slope Inventory | 2    | **Primary:** Location of Unstable Slopes (milepoint and lat/long)  
**Secondary:** Slope hazard and risk ratings, height of the slope, kind of rock on the slope, potential hazard (e.g., rock slide, land slide), a physical engineering description of the slope, and risk related items that have to do with site distance, line of site, and the length of the slope (i.e., how long vehicles are exposed in the hazard zone). |
| Geotechnical               | Retaining Walls Inventory | 2    | **Primary:** Location of Retaining Walls  
**Secondary:** Retaining wall physical characteristics, height, design type, and material (e.g., modular, concrete wall, etc.) |
<table>
<thead>
<tr>
<th>Major Asset Class/Subclass</th>
<th>Data Systems</th>
<th>Tier</th>
<th>Data Integration Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td>Maintenance Management System (MMS)</td>
<td>1</td>
<td>Primary: Material ID number, MMS Project Number (ID), Roadway Name, Project Summary (this is the Project Name), Project Manager Name, Project begin/end termini, Region, Organization Unit, Road CDS information (comes from HAS), Milepoint, Lane mile, M&amp;O station, Station routes Secondary: Material Source type (Direct Purchase (DP) Materials number, Stockpile (SP) number), Stockpile name, Material Cost (Planning Cost), Road, Milepost, Pit name (all three used for aggregate stockpiles), Unit Cost, Capacity, Recommended Quantity, Reorder Point, Vendor Name, Bill of Lading number, Allotment (funding amount), Authorized charges: Labor, Authorized charges: Equipment, Authorized charges: Material, Authority to Proceed, Work Begin, Work End Secondary includes items managed in MMS: Aggregates, asphalts, blades, brushes (sweeper), chemicals, culverts (pipe &amp; bands), cutting edges, guardrail (rail &amp; posts, end sections, crash attenuator), labor SEF, lumber, paint, signals &amp; luminaries, signs (signs, posts &amp; markers)</td>
</tr>
<tr>
<td>Maintenance</td>
<td>MMS Inventories</td>
<td>1</td>
<td>Note: The MMS Inventories data exists in tables that are external to MMS and access to them or integration of their data is done through COTS software, external to MMS. Inventories for guardrail and culverts has not yet begun (as of Sept 2013). Primary: Inventory type (signs, culverts, guardrails), location of inventory item Secondary: condition of inventory item, guardrail (rail &amp; posts, end sections, crash attenuator), signs (signs, posts &amp; markers)</td>
</tr>
<tr>
<td>Pavement</td>
<td>Pavement Management System (PMS)</td>
<td>1</td>
<td>Primary: Location, Pavement Section ID Secondary: IRI (Roughness), rutting, frost heave, cracking, surface distress, spring bearing capacity</td>
</tr>
<tr>
<td>Roadway</td>
<td>Roadway Data System (RDS) – Enterprise Linear Referencing System (LRS) – component of Spatially Integrated Roadway</td>
<td>1*</td>
<td>Primary: Route CDS information (Route name, Route number), milepost signs, bridge location, bridge number, airport locations, AMHS ports and harbor locations, intersections, STIP related data fields: Unique Project ID (Need_Id), Proj_Type (1=STIP, 2= Needs List, 3=10-year construction plan), Areawide_STIP Secondary: NHS data, AHS data, SHS (State Highway System) data, Functional Class, DOT Region Boundaries, Borough Boundaries, Rural/Urban area, Pavement data, Speed Limit zones,</td>
</tr>
</tbody>
</table>

*While RDS is not an asset mgmt system, it is a critical core system to provide location data for enterprise asset mgmt.
<table>
<thead>
<tr>
<th>Major Asset Class/Subclass</th>
<th>Data Systems</th>
<th>Tier</th>
<th>Data Integration Points</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inventory System (SIRIS)</td>
<td></td>
<td>National Truck Route network, Road Surface, Number of Through Lanes, Traffic Direction, Maintenance responsibility, Environmental sites, ADOT&amp;PF Maintenance Districts, ADOT&amp;PF Maintenance Stations</td>
</tr>
</tbody>
</table>
| Roadway                   | Traffic Server (new in 2014) – component of SIRIS | 2    | Primary: Location, Traffic Segment ID  
Secondary: Volume, Classification, Weigh Station data, Speed                                                                                                           |
| Roadway                   | Weigh in Motion (WIM) Data Port        | 2    | Note: According to the ADOT&PF Traffic Data System ConOps (March 2012), “Due to the nature of the confidential data, it (WIM data) is only available to authorized users within DOT&PF.”  
Primary: Weigh station location  
Secondary: Traffic, speed, and weight data (for Highway Data Port (HDP))                                                                 |
| Transit                   | Grant Management & Program Administration System (GMPAS) | 2 – while system does not support enterprise asset mgmt, it does support asset mgmt & funding for the Transit business area | Primary: (transit) vehicle ID, vehicle type, FTA Grant Category (e.g., 5311, 5310), Grant ID number, Grant type  
Secondary: (transit) vehicle age, vehicle condition, ridership (number of riders), mileage, operating cost, expenditures to date, funding data (dollars/ride) |
| Transit                   | Transit and Rail                      | 2 – while system does not support enterprise asset mgmt, it does support asset mgmt for the Transit business area | Primary: (transit) vehicle ID, vehicle type, FTA Grant Category (e.g., 5311, 5310), Grant ID number, Grant type  
Secondary: (transit) vehicle age, vehicle condition, ridership (number of riders), mileage, operating cost, expenditures to date, funding data (dollars/ride) |
| Weather                   | Road Weather Information System (RWIS) | 2    | Primary: Environmental Sensor Station (ESS)  
Secondary: Pavement Temperature, Temperature Data Probe (TDP), Relative Humidity (RH), Air Temperature, Dew Point (note: calculated from Relative Humidity and Temperature), Precipitation Occurrence, Precipitation Accumulation, Remote Processing Unit, Snow Depth, Station Pressure, Subsurface Temperature, Surface Temperature, Wind Speed, Wind Direction, Wind Speed Maximum, Wind Direction of Maximum Speed, Surface Grip, Surface State, and |
<table>
<thead>
<tr>
<th>Major Asset Class/Subclass</th>
<th>Data Systems</th>
<th>Tier</th>
<th>Data Integration Points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AVIATION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Airport – Facilities       | Alaska Aviation System Plan (AASP) | 2    | Primary: UCID – Unique Community ID, UAID – Unique Airport ID, URID – Unique Runway ID, UREID – Unique Runway End ID  
Secondary: DOTRoadMaintenance, RoadAccessStatus, RoadAccess, FerryService, FerryFrequency, OtherModes, AltCargoTransportation, StateRegion, FacilityStatus, FederalGrantObligation, MaintenanceProvider, FullDOTOwnership, SnowRemovalEquipment (SRE), SREBuilding, UnmetDemandLeaseLots, UnmetDemandTiedowns, UseableTiedowns, UnmetDemandFloatplaneParking, UseableFloatplaneParking, UnmetDemandAutoParking, PassengerShelter, PublicToiletAvailable, ARFFEquipment, ARFFBuilding, DOTMaintenanceEquipment, WxStation |
| Airport - Facilities       | Airport and Highway PMS systems | 2    | Primary: UAID – Unique Airport ID, URID – Unique Runway ID  
Secondary: PrimarySurfacesOnProperty, FullDOTOwnership, RunwayExtrapolatedAvePCI, ExpectedRwyReplacementDate, PrimaryRwyTaxiwayExists, AreaPavedRwy, AreaUnpavedRwy, AreaPavedTwy, AreaUnpavedTwy, AreaPavedApron, AreaUnpavedApron, TaxiwayExtrapolatedAvePCI, ExpectedTwyReplacementDate, ApronExtrapolitatedAvePCI, ExpectedApronReplacementDate, CompositeAirportAveragePCI |
| **MARINE HIGHWAY**         |              |      |                         |
| Marine Highway             | Fleet Condition Survey | 2    | Primary: Type of Mandatory upgrades, Priority Rank (of maintenance item), grid-based location of item on vessel  
Secondary: Item cost (for equipment, machinery, etc.), pictures and diagrams associated with items |
| Marine Highway             | Shore Condition Survey | 2    | Primary: Bridge (Structure ID), location of AMHS terminals, location of dock structures  
Secondary: Bridge inspection data, Fracture critical inspection data, types of AMHS shoreside structures, types of AMHS shoreside facilities, date shoreside facilities were built, condition of |
<table>
<thead>
<tr>
<th>Major Asset Class/ Subclass</th>
<th>Data Systems</th>
<th>Tier</th>
<th>Data Integration Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEASUREMENT STANDARDS/ COMMERCIAL VEHICLE ENFORCEMENT (MS/CVE)</td>
<td></td>
<td></td>
<td>shoreside facilities, condition of shoreside structures</td>
</tr>
<tr>
<td>Permits</td>
<td>Local Permits (LP)</td>
<td>2</td>
<td>Primary: Origin and Destination Location (addressed based), route begin and end points, LP number</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Secondary: Dimensional data (length, width, height, weight, number of axles on hauling vehicle)</td>
</tr>
<tr>
<td>STATE EQUIPMENT FLEET</td>
<td>Equipment Management System (EMS)</td>
<td>1</td>
<td>Primary: Location (city description) of equipment, equipment number</td>
</tr>
<tr>
<td>State Equipment Fleet</td>
<td></td>
<td></td>
<td>Secondary: Equipment year, make, model, owner of equipment, FUR rate (developed each year), reliability ratio (P&amp;P 11.04.012), condition assessment (P&amp;P 11.05.020), maintenance schedule (recommended by mfr.), utilization (miles and hours used), life cycle cost (economic life per P&amp;P 11.05.001)</td>
</tr>
<tr>
<td>ADMINISTRATIVE SERVICES / OTHER</td>
<td>Integrated Resource Information System (IRIS)</td>
<td>1</td>
<td>TBD: It is likely that multiple data integration points will provide information for TAMIS, most of them related to financial information, based on TAMIS interviews with data business owners. Analysis of systems to be integrated or used with IRIS is still underway. IRIS system scheduled to implement in 2015.</td>
</tr>
<tr>
<td></td>
<td>Management Reporting System (MRS)</td>
<td>1</td>
<td>Primary: Project control section, Project number (ID), AKSAS (Project) Number, Federal Project Number, Borough/Census Area, CDS Route, Functional Class</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Secondary: Project Name, Project Phase Number, Contract Number, Contractor ID, Associated Airports, Region Project Level data, Project control data (HQ), Federal obligation data (HQ), project location descriptions, unique bridge ID (also in BMS and NBI), milestone dates, engineers assigned to bridge, project status (from Project managers), design status, construction status, highway, region, House District, Need category, Mode, Federal Cost to Complete, MPO, Primary Type of Work, Secondary Type of Work, Sponsor Type, Need ID, Priority (HQ use only),</td>
</tr>
</tbody>
</table>
There are 174 database tables that comprise the MRS Oracle database. Each table has its own set of data that is stored depending upon the type of data. The list of Secondary data fields above are a representative set of the data that is used for asset management.

<table>
<thead>
<tr>
<th>Major Asset Class/Subclass</th>
<th>Data Systems</th>
<th>Tier</th>
<th>Data Integration Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Electronic Tracking System (PETS)</td>
<td>1</td>
<td>Primary: Name of Key Performance Indicator (KPI), Performance Measures Owner&lt;br&gt;Secondary: Target KPI, Actual KPI, Variance, Variance %, Time Period</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**

*Primary* indicates main integration point for the system’s use for TAMIS.

*Secondary* indicates the type of data that can be extracted from the Source data system to support asset management decisions.

Table 4.3 lists the asset classes and measures that were identified in Paul Thompson’s report *Enterprise Transportation Asset Management, Synthesis and Work Plan Final Report (5-31-13)*. These are the data that are typically used for Condition and Performance Monitoring and therefore also important for decision-making at higher levels in ADOT&PF. A comparison of this table with the data integration points in Table 4.2 reveals that many of the data elements listed as “Secondary” elements are also important for Condition and Performance Monitoring (e.g., IRI, bridge condition, bridge scour, etc.) and thus are important for asset management.
### Table 4.3  Condition and Performance Monitoring Data

<table>
<thead>
<tr>
<th>Asset class and measure</th>
<th>Description</th>
<th>Performance concerns</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pavement</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roughness (IRI)</td>
<td>Short-wave due to wear, potholes</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Rutting</td>
<td>Studded tires or weak structure</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Frost heave</td>
<td>Long-wave due to freeze/thaw</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Cracking</td>
<td>Alligator, longitudinal, or transverse</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Surface distress</td>
<td>Ravelling, slid, other surface defects</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Spring seating capacity</td>
<td>Ability to carry heavy wheel loads</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>Bridges</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bridge condition</td>
<td>Element inspections</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Load rating</td>
<td>Strength to carry heavy vehicles</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Clearedances - vert, horiz</td>
<td>Limits use by trucks</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Geometry</td>
<td>Narrowness or alignment</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Scour</td>
<td>Loss of foundation support</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Ice or debris buildup</td>
<td>Damaging pressure on structure</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Fatigue</td>
<td>Cracking due to negative loading</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>Buildings</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition assessment</td>
<td>Level of service by building system</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Functional adequacy</td>
<td>Meeting the needs of building users</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>Vehicles and equipment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reliability ratio</td>
<td>Defined in P&amp;P 11.04.012</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Condition assessment</td>
<td>For replacement, P&amp;P 11.05.020</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Maintenance schedule</td>
<td>Compliance with P&amp;R recommendations</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Utilization</td>
<td>Miles and hours used</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Life cycle cost</td>
<td>Economic life per P&amp;P 11.05.001</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>Modal specific assets</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Airport specific assets</td>
<td>Condition, availability, function</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Marine specific assets</td>
<td>Condition, availability</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Transit specific assets</td>
<td>Condition, utilization, age</td>
<td>2</td>
<td>2-3</td>
</tr>
<tr>
<td><strong>Other assets</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slope stability</td>
<td>Movement that could accelerate</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Entrenchment movement</td>
<td>Freeset/flow or water movement</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Retaining walls</td>
<td>Element condition</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Scour</td>
<td>Due to water or ice flow</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Device visibility</td>
<td>Reflectivity</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Material sites</td>
<td>Availability and condition</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Rockfall protection</td>
<td>Element condition</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Culverts, drainage</td>
<td>Element condition, blockage</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Presence where required</td>
<td>Main safety equipment</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Standards adherence</td>
<td>Main safety equipment</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Electrical function</td>
<td>Reliability of traffic signals, lighting</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Non-bridge structures</td>
<td>Element condition</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Collision damage</td>
<td>To roadside features</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Fences, landscaping</td>
<td>Element condition</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

Notes:
1. Federal rule-making may specify pavement condition indicators for MAP-21 compliance
2. Airport assets not otherwise listed: especially jetways, windcones, tie-downs, deicing stations, off-road equipment
3. Marine, seaplace, and harbor assets not otherwise listed: especially ferry vessels, float slips, and breakwaters
4. Related to asset funding and procurement of buses, maintenance facilities, transit centers, etc.
5. Signs, pavement markings, traffic signals. Sign inventory nearly complete statewide.
6. Barriers, guiderails, sign supports, mast arms, high-mast light poles, sidewalks, curbs, soundwalls
7. Priority and readiness: 1=highest, 2=medium, 3=lower

Source: Enterprise Transportation Asset Management, Synthesis and Work Plan Final Report (5-31-13)
5.0 System Documentation

The process of researching and collecting information about the data systems resulted in the development of a Data Catalog that summarizes the available documentation for each of the data systems that are “in” TAMIS. The data catalog is provided in Appendix C. The documents listed in the Data Catalog are available on the following FTP site:

User name: 8800tamis
Password: Asset8800

It is recommended that the Data catalog be completed and maintained over time in ADOT&PF’s eDOCS system.

6.0 Data Integration Issues

Table 6.1 describes current technical and institutional issues related to integrating and sharing data for TAM decision making that were identified during stakeholder interviews.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Challenges</td>
<td></td>
</tr>
<tr>
<td>Date Integration</td>
<td>Difficulty integrating disparate data sources across ADOT&amp;PF departments due to differences in spatial location, segment identification, data formats, temporal resolution.</td>
</tr>
<tr>
<td>Data Quality/Validation</td>
<td>Inconsistent data quality assurance techniques and different sources of data. Duplicative data in multiple data systems. Completeness of data is an issue (e.g., GIS mapping of ROW data for planning, airport facilities).</td>
</tr>
<tr>
<td>Data Access</td>
<td>Data is stored in varying locations and database formats. Some groups (e.g., ROW) do not have a retention schedule for their files, so they have a large amount of hard copy files that are not currently stored in eDOCS.</td>
</tr>
<tr>
<td>Data Reports</td>
<td>Ability to generate multiple, customizable reports to support TAM decision making. Data aggregation needs to be driven/determined by each application. Existing customization features need to be maintained.</td>
</tr>
<tr>
<td>Replacement of legacy data systems</td>
<td>Several data systems are scheduled to be replaced or updated within the next several years (e.g., pavement, Highway Analysis System). Additionally, replacement systems will offer new functionality (e.g., IRIS, SIRIS, GIS). Data format of Asset IDs or location codes could be different once these new</td>
</tr>
</tbody>
</table>
Ultimately, IRIS inbound interfaces will be required to be in XML. However, that does not mean that the State agency’s interface file is in XML format. Regarding the outbound interface, the Asset/PO data passed from IRIS to EMS may or may not occur depending upon ongoing discussions between IRIS group and SEF. The DOA IRIS team (Div. of Finance staff and contractors) are responsible to create any outbound interfaces, and they will provide them in any requested format (XML, CSV, etc.).

Stove pipe data systems are preventing use of a common key to geolocate asset data. The pavement and highway groups are currently using different linear referencing systems. Currently, there is no accurate Coordinate Data System in the pavement database to allow the data to be synched with the roadway linear network. This will be explored as part of the Roads & Highways pilot project in Fall 2014. Location referencing for some data systems does not match up to the roadway network well, while other data systems do not include data fields for location referencing.

Post processing
Requires considerable effort to post-process data for use in decision making and performance measure reporting.

IT Infrastructure
IT infrastructure/servers need to be in place to support enterprise wide TAM solution.

<table>
<thead>
<tr>
<th><strong>Institutional Challenges</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Funding and Resources</strong></td>
</tr>
<tr>
<td>In-house capability to develop the analytical tools to process, integrate, and utilize the available data. Funding and resources for data updates are also an issue for some data systems (e.g., AASP). Within the organization, some groups don’t have access to GIS mapping staff, which makes it difficult to maintain this type of data.</td>
</tr>
<tr>
<td><strong>Data Ownership</strong></td>
</tr>
<tr>
<td>Who “owns” data once it has been processed or shared. Some databases such as AASP are consultant-housed and do not reside on ADOT&amp;PF servers.</td>
</tr>
<tr>
<td><strong>Data Stewardship</strong></td>
</tr>
<tr>
<td>People have a need for data, but may not be willing to become the data steward and be directed to keep data updated going forward (e.g., data collection for Eagle’s Nests, ROW data for planning)</td>
</tr>
<tr>
<td><strong>Data Management &amp; Governance</strong></td>
</tr>
<tr>
<td>Roles and responsibilities for quality, access, data updates, and distribution of data are not always clear. Trust issues between data owners and Information Technology (IT) functions can also occur. There are also firewall, turf, and data silo concerns.</td>
</tr>
<tr>
<td><strong>Data Privacy/Security</strong></td>
</tr>
<tr>
<td>Sharing of some data elements (e.g., bridge condition, crash data) may be limited due to data privacy/security concerns.</td>
</tr>
<tr>
<td><strong>Use of Proprietary Data &amp; Technology</strong></td>
</tr>
<tr>
<td>Legacy laws may establish agencies authority over data/IT.</td>
</tr>
</tbody>
</table>
7.0 Next Steps

This report summarizes the research, documentation and evaluation of the data systems and associated data relevant for enterprise asset management at ADOT&PF. The interviews, information collected and resulting analysis in this Task will be important for future tasks as follows:

- The identification of data integration points in this task will be critical for determining the desired condition in Task 6 and for conducting the gap analysis in Task 7.
- The interviews will be used to establish desired condition in Task 6.
- The analysis and documentation will serve to support Use Cases, Concept of Operations and Data Business Plan in Task 11.

The next steps for the TAMIS project will be to conduct several tasks simultaneously:

- **Task 6 – Develop ADOT&PF TAMIS Framework (Desired Condition).** Much of the research for Task 6 has been accomplished. CS will document a desired framework and complete the data catalog started in Task 5. The desired framework and results of Task 6 will be vetted and validated with the TAMIS Team during the meeting on December 10.

- **Task 7 – TAMIS Gap Analysis.** This research will occur once Tasks 5 and 6 have been approved by the TAMIS Team.

- **Task 8 – Research TAMIS System Model Alternatives.** This research will continue to support development of the desired framework in Task 6

- **Task 10 – Develop and Conduct a Project Communications Plan.** The plan has been developed and will continue to be implemented as the project progresses.

- **Task 11 – Data Business Plan for TAMIS.** Once key data systems have been agreed to, detailed use cases will be developed.

- **Task 12 – Pilot TAMIS Application.** This work will also continue.
A. Interviewee List

The interviewee list is shown in Table A.1 and was developed in coordination with ADOT&PF.
## Table A.1 Interviewee List

<table>
<thead>
<tr>
<th>Major Asset Class/Subclass</th>
<th>Data Systems</th>
<th>Interviewees</th>
<th>Title</th>
<th>Email</th>
<th>Interview Date</th>
<th>Interview Type</th>
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<tbody>
<tr>
<td>Highways</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bridge</td>
<td>PONTIS (BrM 5.1 – 2014)</td>
<td>Michael Knapp, John Orbistondo, Larry Owen</td>
<td>Michael (Stwd Hydraulics Engineer), John (Engineering Assistant), Larry (Bridge Management Engineer)</td>
<td><a href="mailto:Michael.knapp@alaska.gov">Michael.knapp@alaska.gov</a> <a href="mailto:john.orbistondo@alaska.gov">john.orbistondo@alaska.gov</a> <a href="mailto:larry.owen@alaska.gov">larry.owen@alaska.gov</a></td>
<td>8/27/2013</td>
<td>Detailed</td>
</tr>
<tr>
<td>Construction</td>
<td>Bid Tab</td>
<td>Barbara L. Tanner (Northern Region)</td>
<td></td>
<td><a href="mailto:Barbara.tanner@alaska.gov">Barbara.tanner@alaska.gov</a></td>
<td>8/16/2013</td>
<td>In/Out</td>
</tr>
<tr>
<td>Construction</td>
<td>Construction Data Management (CDM)</td>
<td>Phil Kvapil, Shelley Potter</td>
<td>Phil - Info Sys Analyst Programmer (NR) Engineering assistant NR Construction</td>
<td><a href="mailto:Phil.kvapil@alaska.gov">Phil.kvapil@alaska.gov</a> <a href="mailto:shelley.potter@alaska.gov">shelley.potter@alaska.gov</a></td>
<td>8/16/2013</td>
<td>In/Out</td>
</tr>
<tr>
<td>Construction</td>
<td>Navigator</td>
<td>Mike Cray</td>
<td>Central Region Construction Manager (manages Navigator for Central and Northern region)</td>
<td><a href="mailto:mike.cray@alaska.gov">mike.cray@alaska.gov</a></td>
<td>10/3/2013</td>
<td>In/Out</td>
</tr>
<tr>
<td>Construction</td>
<td>Site Manager</td>
<td>Jaclyn Elmes Supervisor Andrew Schultz Frank Ganley</td>
<td>Site Manager System Manager Andrew (Engineer) Frank (Construction Section - Northern Region)</td>
<td><a href="mailto:Jaclyn.elmes@alaska.gov">Jaclyn.elmes@alaska.gov</a> <a href="mailto:andrew.schultz@alaska.gov">andrew.schultz@alaska.gov</a> <a href="mailto:frank.ganley@alaska.gov">frank.ganley@alaska.gov</a></td>
<td>8/16/2013</td>
<td>In/Out</td>
</tr>
<tr>
<td>Facilities</td>
<td>ADA Inventory</td>
<td>James Bauman, Talena</td>
<td>James (Civ Rights &amp; Compl)</td>
<td><a href="mailto:james.bauman@alaska.gov">james.bauman@alaska.gov</a></td>
<td>8/16/2013</td>
<td>In/Out</td>
</tr>
<tr>
<td>Major Asset Class/Subclass</td>
<td>Data Systems</td>
<td>Interviewees</td>
<td>Title</td>
<td>Email</td>
<td>Interview Date</td>
<td>Interview Type</td>
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<td>----------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Facilities</td>
<td>Facilities Maintenance Management System (FMMS)</td>
<td>Peter Kristeller, Adam Zenger, Steve Meierotto, Al Gilbert, Steve Rice, Paula Hess</td>
<td>Analyst/Programmer IV, Stwd Div of Admin Services, Steve (Building Maintenance Manager Northern Region), Al (Central Region Building Manager), Adam (SER Building Manager)</td>
<td><a href="mailto:peter.kristeller@alaska.gov">peter.kristeller@alaska.gov</a>, <a href="mailto:adam.zenger@alaska.gov">adam.zenger@alaska.gov</a>, <a href="mailto:stephen.meierotto@alaska.gov">stephen.meierotto@alaska.gov</a>, <a href="mailto:al.gilbert@alaska.gov">al.gilbert@alaska.gov</a>, <a href="mailto:steve.rice@alaska.gov">steve.rice@alaska.gov</a>, <a href="mailto:paula.hess@alaska.gov">paula.hess@alaska.gov</a></td>
<td>9/4/2013</td>
<td>Detailed</td>
</tr>
<tr>
<td>Geotechnical</td>
<td>Material Sites Inventory</td>
<td>Dave Stanley</td>
<td>Chief Engineering Geologist</td>
<td><a href="mailto:Dave.stanley@alaska.gov">Dave.stanley@alaska.gov</a></td>
<td>8/30/2013</td>
<td>Detailed</td>
</tr>
<tr>
<td>Geotechnical</td>
<td>Unstable Slope Inventory</td>
<td>Dave Stanley</td>
<td>Chief Engineering Geologist</td>
<td><a href="mailto:Dave.stanley@alaska.gov">Dave.stanley@alaska.gov</a></td>
<td>8/30/2013</td>
<td>Detailed</td>
</tr>
<tr>
<td>Geotechnical</td>
<td>Retaining Walls Inventory</td>
<td>Dave Stanley</td>
<td>Chief Engineering Geologist</td>
<td><a href="mailto:Dave.stanley@alaska.gov">Dave.stanley@alaska.gov</a></td>
<td>8/30/2013</td>
<td>Detailed</td>
</tr>
<tr>
<td>Geotechnical</td>
<td>Statewide Asset Location Log (SALLY)</td>
<td>Mitch McDonald</td>
<td>Regional Engineering Geologist - Southeast Region</td>
<td><a href="mailto:Mitch.mcdonald@alaska.gov">Mitch.mcdonald@alaska.gov</a></td>
<td>10/25/13</td>
<td>In/Out</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Maintenance Management System (MMS)</td>
<td>Steve Potter, Scott Gray, Todd Van Hove, Regional QA people North - Henry Cole, Central - Burrell Nickeson, SE - Greg Patz, Ocie Adams, Mike Chambers, Dan Breeden</td>
<td>Steve (M&amp;O Mgr - NR), Scott (M&amp;O Spec - SE), Todd (CR M&amp;O Mgr), Greg (SER M&amp;O Mgr), Ocie (M&amp;O Specialist AND Special Pgmts Mgr), Mike (Publication Specialist), Dan (Special Pgmts Mgr), Steve (Data processing Manager)</td>
<td><a href="mailto:steve.potter@alaska.gov">steve.potter@alaska.gov</a>, <a href="mailto:scott.gray@alaska.gov">scott.gray@alaska.gov</a>, <a href="mailto:todd.vanhove@alaska.gov">todd.vanhove@alaska.gov</a>, <a href="mailto:henry.cole@alaska.gov">henry.cole@alaska.gov</a>, <a href="mailto:burrell.nickeson@alaska.gov">burrell.nickeson@alaska.gov</a>, <a href="mailto:greg.patz@alaska.gov">greg.patz@alaska.gov</a>, <a href="mailto:ocie.adams@alaska.gov">ocie.adams@alaska.gov</a>, <a href="mailto:mike.chambers@alaska.gov">mike.chambers@alaska.gov</a>, <a href="mailto:dan.breeden@alaska.gov">dan.breeden@alaska.gov</a>, <a href="mailto:steve.rice@alaska.gov">steve.rice@alaska.gov</a></td>
<td>9/3/2013, 9/9/2013</td>
<td>Detailed</td>
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<tr>
<td>Major Asset Class/Subclass</td>
<td>Data Systems</td>
<td>Interviewees</td>
<td>Title</td>
<td>Email</td>
<td>Interview Date</td>
<td>Interview Type</td>
</tr>
<tr>
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<tr>
<td>Maintenance</td>
<td>MMS Inventories: Sign, Culvert, Guardrail, Quality Assurance Program Inventory</td>
<td>Regional M&amp;O Data Mgrs - Greg Patz (Southeast), Jason Sakalaskas &amp; Henry Cole (North), Todd Van Hove &amp; Burrell Nickeson (Central)</td>
<td>Same as above</td>
<td><a href="mailto:jason.sakalaskas@alaska.gov">jason.sakalaskas@alaska.gov</a></td>
<td>9/3/2013</td>
<td>Detailed</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Station Profiles</td>
<td>Ocie Adams</td>
<td>M&amp;O Specialist and Special Programs Mgr</td>
<td><a href="mailto:ocie.adams@alaska.gov">ocie.adams@alaska.gov</a></td>
<td>8/30/2013</td>
<td>Detailed</td>
</tr>
<tr>
<td>Pavement</td>
<td>Pavement Management System (PMS)</td>
<td>Jim Horn, Drew Pavey, June Finkbiner, Steve Rice</td>
<td>Jim (Statewide M&amp;O Pavement Engineer), Drew and June (CR Materials Engineering Tech/GIS Support)</td>
<td><a href="mailto:Jim.horn@alaska.gov">Jim.horn@alaska.gov</a>, <a href="mailto:andrew.pavey@alaska.gov">andrew.pavey@alaska.gov</a>, <a href="mailto:june.finkbiner@alaska.gov">june.finkbiner@alaska.gov</a>, <a href="mailto:steve.rice@alaska.gov">steve.rice@alaska.gov</a></td>
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<td>Property Management</td>
<td>eParcels</td>
<td>Andrew Keefe Regional ROW chiefs (users) Rob Murphy SER, John D. Bennet NR and Mike Hartman CR and Mark Neidhold HQ</td>
<td>Analyst/Programmer V</td>
<td><a href="mailto:Andrew.keefe@alaska.gov">Andrew.keefe@alaska.gov</a> <a href="mailto:rob.murphy@alaska.gov">rob.murphy@alaska.gov</a> <a href="mailto:johnd.bennett@alaska.gov">johnd.bennett@alaska.gov</a> <a href="mailto:mike.hartman@alaska.gov">mike.hartman@alaska.gov</a> <a href="mailto:mark.neidhold@alaska.gov">mark.neidhold@alaska.gov</a></td>
<td>8/16/2013</td>
<td>In/Out</td>
</tr>
<tr>
<td>Right of Way</td>
<td>ePermits</td>
<td>Andrew Keefe Regional ROW chiefs (users) Rob Murphy SER, John D. Bennet NR and Mike Hartman CR and Mark Neidhold HQ</td>
<td>Analyst/Programmer V</td>
<td><a href="mailto:Andrew.keefe@alaska.gov">Andrew.keefe@alaska.gov</a> <a href="mailto:rob.murphy@alaska.gov">rob.murphy@alaska.gov</a> <a href="mailto:johnd.bennett@alaska.gov">johnd.bennett@alaska.gov</a> <a href="mailto:mike.hartman@alaska.gov">mike.hartman@alaska.gov</a> <a href="mailto:mark.neidhold@alaska.gov">mark.neidhold@alaska.gov</a></td>
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<td>Title</td>
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<tr>
<td>Right of Way (needs link to GIS)</td>
<td>Right of Way (ROW) Data Pertinent to Planning</td>
<td>Regional ROW chiefs, Rob Murphy SER, John F. Bennett NR, Mike Hartman CR, Mark Neidhold HQ</td>
<td></td>
<td><a href="mailto:Rob.murphy@alaska.gov">Rob.murphy@alaska.gov</a> <a href="mailto:john.f.bennett@alaska.gov">john.f.bennett@alaska.gov</a> <a href="mailto:mike.hartman@alaska.gov">mike.hartman@alaska.gov</a> <a href="mailto:mark.neidhold@alaska.gov">mark.neidhold@alaska.gov</a></td>
<td>9/12/2013</td>
<td>Detailed</td>
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<tr>
<td>Roadway</td>
<td>Highway Performance Monitoring System (HPMS)</td>
<td>Jill Sullivan Howard Helkenn- Central Jennifer Eason Anderson – Northern (Randi Lynn Motsko filling in) Ryan Silverly – Southeast Mary Ann Dierckman (HPMS Hwy Travel Inventory and WIM Manager)</td>
<td></td>
<td><a href="mailto:jill.sullivan@alaska.gov">jill.sullivan@alaska.gov</a> <a href="mailto:howard.helkenn@alaska.gov">howard.helkenn@alaska.gov</a> <a href="mailto:jennifer.anderson@alaska.gov">jennifer.anderson@alaska.gov</a> <a href="mailto:ryan.silverly@alaska.gov">ryan.silverly@alaska.gov</a> <a href="mailto:maryann.dierckman@alaska.gov">maryann.dierckman@alaska.gov</a> <a href="mailto:randi.motsko@alaska.gov">randi.motsko@alaska.gov</a></td>
<td>8/26/2013</td>
<td>In/Out</td>
</tr>
<tr>
<td>Roadway</td>
<td>Roadway Data System (RDS) – (component of Spatially Integrated Roadway Inventory System (SIRIS))</td>
<td>Jack Stickel Jill Sullivan Talena Adams Kerry Kirkpatrick David Oliver Sean Jordan Garry Remsberg</td>
<td>Jack Stickel – TIG Mgr Jill Sullivan – Trans Data Programs Mgr Talena Adams – TGIS Mgr Kerry Kirkpatrick – TGIS Planner David Oliver – TGIS Planner Sean Jordan – TGIS Planner Garry Remsberg – TGIS GIS Analyst</td>
<td><a href="mailto:jack.stickel@alaska.gov">jack.stickel@alaska.gov</a> <a href="mailto:jill.sullivan@alaska.gov">jill.sullivan@alaska.gov</a> <a href="mailto:talena.adams@alaska.gov">talena.adams@alaska.gov</a> <a href="mailto:kerry.kirkpatrick@alaska.gov">kerry.kirkpatrick@alaska.gov</a> <a href="mailto:david.oliver@alaska.gov">david.oliver@alaska.gov</a> <a href="mailto:sean.jordan@alaska.gov">sean.jordan@alaska.gov</a> <a href="mailto:garry.remsberg@alaska.gov">garry.remsberg@alaska.gov</a></td>
<td>9/3/2013</td>
<td>Detailed</td>
</tr>
<tr>
<td>Roadway</td>
<td>Traffic Server (new)</td>
<td>Jill Sullivan</td>
<td></td>
<td><a href="mailto:jill.sullivan@alaska.gov">jill.sullivan@alaska.gov</a></td>
<td>8/26/2013</td>
<td>Detailed</td>
</tr>
<tr>
<td>Major Asset Class/Subclass</td>
<td>Data Systems</td>
<td>Interviewees</td>
<td>Title</td>
<td>Email</td>
<td>Interview Date</td>
<td>Interview Type</td>
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<td>----------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Roadway</td>
<td>Traveler Information (511) – RIDE</td>
<td>Jill Sullivan, Lisa Idell-Sassi</td>
<td>Jill Sullivan – Trans Data Programs Mgr</td>
<td>Lisa.idell-sassi.alaska.gov, <a href="mailto:jill.sullivan@alaska.gov">jill.sullivan@alaska.gov</a></td>
<td>8/30/2013</td>
<td>In/Out</td>
</tr>
<tr>
<td>Roadway</td>
<td>Weigh in Motion (WIM) Data Port</td>
<td>Mary Ann Dierckman</td>
<td>HPMS Hwy Travel Inventory and WIM Manager</td>
<td><a href="mailto:maryann.dierckman@alaska.gov">maryann.dierckman@alaska.gov</a></td>
<td>8/26/2013</td>
<td>Detailed</td>
</tr>
<tr>
<td>Safety</td>
<td>Crash Data Entry System &amp; Crash Reporting and Analysis System for Safer Highways (CRASH)</td>
<td>Jack Stickel and Bonnie Walters</td>
<td>Trans Planner</td>
<td><a href="mailto:Jack.stickel@alaska.gov">Jack.stickel@alaska.gov</a>, <a href="mailto:bonnie.walters@alaska.gov">bonnie.walters@alaska.gov</a></td>
<td>8/19/2013</td>
<td></td>
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<tr>
<td>Transit</td>
<td>Grant Management &amp; Program Administration System (GMPAS)</td>
<td>Stephanie Bushong</td>
<td>Transit Program Planner</td>
<td><a href="mailto:Stephanie.bushong@alaska.gov">Stephanie.bushong@alaska.gov</a></td>
<td>8/16/2013</td>
<td>In/Out</td>
</tr>
<tr>
<td>Transit</td>
<td>Transit and Rail</td>
<td>Debbie Howard, Eric Taylor</td>
<td>Transit Coordinator</td>
<td><a href="mailto:Debbi.howard@alaska.gov">Debbi.howard@alaska.gov</a>, <a href="mailto:eric.taylor@alaska.gov">eric.taylor@alaska.gov</a></td>
<td>8/16/2013</td>
<td>In/Out</td>
</tr>
</tbody>
</table>

in 2014 – component of SIRIS

Howard Helkenn- Central Jennifer Eason Anderson – Northern (Randi Lynn Motsko filling in) Ryan Siverly – Southeast Mary Ann Dierckman (HPMS Hwy Travel Inventory and WIM Manager)
### Major Asset Class/Subclass

<table>
<thead>
<tr>
<th>Data Systems</th>
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<th>Title</th>
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<td>Jack Stickel, Lisa Idell-Sassi</td>
<td>Transportation Planner Real-Time Systems Coordinator</td>
<td><a href="mailto:jack.stickel@alaska.gov">jack.stickel@alaska.gov</a> <a href="mailto:lisa.idell-sassi@alaska.gov">lisa.idell-sassi@alaska.gov</a></td>
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<td>Randy - (CR- Chief Highways and Aviation), Jessica (Aviation Planner), Judy (Transportation Planner), Ryan and Judy can provide input on databases and structure, Martin (Database Specialist II, Anchorage International Airport)</td>
<td><a href="mailto:randy.vanderwood@alaska.gov">randy.vanderwood@alaska.gov</a> <a href="mailto:jessica.dellacroce@alaska.gov">jessica.dellacroce@alaska.gov</a> <a href="mailto:ryan.anderson@alaska.gov">ryan.anderson@alaska.gov</a> <a href="mailto:judy.chapman@alaska.gov">judy.chapman@alaska.gov</a> <a href="mailto:verne.skagerberg@alaska.gov">verne.skagerberg@alaska.gov</a> <a href="mailto:martin.pezoldt@alaska.gov">martin.pezoldt@alaska.gov</a></td>
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<td><a href="mailto:randy.vanderwood@alaska.gov">randy.vanderwood@alaska.gov</a> <a href="mailto:jessica.dellacroce@alaska.gov">jessica.dellacroce@alaska.gov</a> <a href="mailto:ryan.anderson@alaska.gov">ryan.anderson@alaska.gov</a> <a href="mailto:judy.chapman@alaska.gov">judy.chapman@alaska.gov</a> <a href="mailto:verne.skagerberg@alaska.gov">verne.skagerberg@alaska.gov</a> <a href="mailto:martin.pezoldt@alaska.gov">martin.pezoldt@alaska.gov</a></td>
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<td>Randy - (CR- Chief Highways and Aviation), Jessica (Aviation Planner), Judy (Transportation Planner), Ryan and Judy can provide input on databases and structure</td>
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<td><strong>Airport - Passur</strong></td>
<td>Keith Day</td>
<td>Intl Airpts Controller</td>
<td><a href="mailto:keith.day@alaska.gov">keith.day@alaska.gov</a></td>
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<td>Andrew Keeffe, Becky Iles (main one – statewide), Lynette Campbell (Acting Chief when Becky retires in Jan. ’14)</td>
<td>Andrew - Analyst/Programmer V</td>
<td><a href="mailto:andrew.keeffe@alaska.gov">andrew.keeffe@alaska.gov</a> <a href="mailto:becky.iles@alaska.gov">becky.iles@alaska.gov</a> <a href="mailto:lynette.campbell@alaska.gov">lynette.campbell@alaska.gov</a></td>
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<td>Keith Day</td>
<td>Intl Airpts Controller</td>
<td><a href="mailto:keith.day@alaska.gov">keith.day@alaska.gov</a></td>
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<td>Marine Highway</td>
<td>Asset Management Operating System (AMOS)</td>
<td>Greg Jennings Cisco Flores</td>
<td>Greg - Port Engineer Cisco - Marine Engineering Mgr</td>
<td><a href="mailto:cisco.flores@alaska.gov">cisco.flores@alaska.gov</a> <a href="mailto:gregory.jennings@alaska.gov">gregory.jennings@alaska.gov</a></td>
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<tr>
<td>Marine Highway</td>
<td>ATLAS</td>
<td>Captain Dana Jensen Rachel Kindred Trene Elliot Shanna Burns</td>
<td>Rachel (Programmer - moves data from other systems into ATLAS) Trene (Research Analyst II) Shanna (HR Consultant - user of ATLAS and subject matter expert for portions of ATLAS development)</td>
<td><a href="mailto:rachel.kindred@alaska.gov">rachel.kindred@alaska.gov</a> <a href="mailto:Trene.elliott@alaska.gov">Trene.elliott@alaska.gov</a> <a href="mailto:shanna.burns@alaska.gov">shanna.burns@alaska.gov</a></td>
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<td>Marine Highway</td>
<td>Fleet Condition Survey</td>
<td>Troy Jorgens Andy Lertscher Cisco Flores</td>
<td>AMHS Construction Manager</td>
<td><a href="mailto:troy.jorgens@alaska.gov">troy.jorgens@alaska.gov</a></td>
<td>8/16/2013</td>
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<tr>
<td>Marine Highway</td>
<td>Reservations Management System</td>
<td>Richard (Dick) Leary John Gerrish in SE</td>
<td>Marine Trans Svrs Mgr</td>
<td><a href="mailto:richard.leary@alaska.gov">richard.leary@alaska.gov</a> <a href="mailto:john.gerrish@alaska.gov">john.gerrish@alaska.gov</a></td>
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<td>Marine Highway</td>
<td>Ship Maintenance Requests (SMRs)</td>
<td>Greg Jennings, Cisco Flores, Trent Headley</td>
<td>Greg - Port Engineer, Cisco - Marine Engineering Mgr</td>
<td><a href="mailto:cisco.flores@alaska.gov">cisco.flores@alaska.gov</a>, <a href="mailto:gregory.jennings@alaska.gov">gregory.jennings@alaska.gov</a>, <a href="mailto:walter.headley2@alaska.gov">walter.headley2@alaska.gov</a></td>
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<tr>
<td>Marine Highway</td>
<td>Shore Condition Survey</td>
<td>Kirk Miller, Cisco Flores</td>
<td>Kirk (SER Design Group Member), Cisco - Marine Engineering Manager</td>
<td><a href="mailto:cisco.flores@alaska.gov">cisco.flores@alaska.gov</a>, <a href="mailto:kirk.miller@alaska.gov">kirk.miller@alaska.gov</a></td>
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<td>Ward Mace, Cisco Flores, Cheri Murphy</td>
<td>Cisco - Marine Engineering Manager</td>
<td><a href="mailto:ward.mace@alaska.gov">ward.mace@alaska.gov</a>, <a href="mailto:cisco.flores@alaska.gov">cisco.flores@alaska.gov</a>, <a href="mailto:cheri.murphy@alaska.gov">cheri.murphy@alaska.gov</a></td>
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<td>MEASUREMENT STANDARDS / COMMERCIAL VEHICLE ENFORCEMENT (MS/CVE)</td>
<td>LIBRA</td>
<td>Chris Kotyk, Doug Deiman</td>
<td>Analyst/Programmer V</td>
<td><a href="mailto:chris.kotyk@alaska.gov">chris.kotyk@alaska.gov</a>, <a href="mailto:doug.deiman@alaska.gov">doug.deiman@alaska.gov</a>, <a href="mailto:steve.rice@alaska.gov">steve.rice@alaska.gov</a></td>
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<td>Measurement Standards</td>
<td>Metrology Laboratory System (MetLab)</td>
<td>Dan Smith, Douglas Deiman, Garret Brown</td>
<td>Douglas (Div Director), Garret (State Metrologist)</td>
<td><a href="mailto:dan.smith1@alaska.gov">dan.smith1@alaska.gov</a>, <a href="mailto:doug.deiman@alaska.gov">doug.deiman@alaska.gov</a>, <a href="mailto:garrett.brown@alaska.gov">garrett.brown@alaska.gov</a></td>
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<td>Chris Kotyk, Jeremy P. Arnold, Dan Byrd, Steve Rice, Susan Adkison</td>
<td>Analyst/Programmer V</td>
<td><a href="mailto:chris.kotyk@alaska.gov">chris.kotyk@alaska.gov</a>, <a href="mailto:jeremy.arnold@alaska.gov">jeremy.arnold@alaska.gov</a>, <a href="mailto:daniel.byrd@alaska.gov">daniel.byrd@alaska.gov</a>, <a href="mailto:susan.adkison@alaska.gov">susan.adkison@alaska.gov</a></td>
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<td>State Equipment Fleet</td>
<td>Equipment Management System (EMS)</td>
<td>Diana Rotkis</td>
<td>SEF/Public Facilities Facilitator</td>
<td><a href="mailto:diana.rotkis@alaska.gov">diana.rotkis@alaska.gov</a></td>
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<td>State Equipment Fleet</td>
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<td>Kerry Harper</td>
<td>SEF Analyst/Programmer</td>
<td><a href="mailto:kerry.harper@alaska.gov">kerry.harper@alaska.gov</a></td>
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<td>Charlie (Procurement Specialist V)</td>
<td><a href="mailto:charlie.deininger@alaska.gov">charlie.deininger@alaska.gov</a>, <a href="mailto:brian.idzik@alaska.gov">brian.idzik@alaska.gov</a></td>
<td>8/16/2013</td>
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<td>eDOCs</td>
<td>Andrew Keeffe, Steve Rice and maybe consultant Applied Microsystems</td>
<td>Andrew - Analyst/Programmer V; Steve - Data Processing Manager</td>
<td><a href="mailto:andrew.keeffe@alaska.gov">andrew.keeffe@alaska.gov</a>, <a href="mailto:steve.rice@alaska.gov">steve.rice@alaska.gov</a></td>
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<td>Federal Aid Agreement Management (FAAM)</td>
<td>Liz Balstad, Pete Christensen</td>
<td>Pete - Juneau Program Development Division, Capital Improvement Program Manager</td>
<td><a href="mailto:liz.balstad@alaska.gov">liz.balstad@alaska.gov</a>, <a href="mailto:peter.christensen@alaska.gov">peter.christensen@alaska.gov</a></td>
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<td>Integrated Resource Information System (IRIS)</td>
<td>Amanda Holland, Steve Rice</td>
<td>Workforce Development Manager</td>
<td><a href="mailto:amanda.holland@alaska.gov">amanda.holland@alaska.gov</a>, <a href="mailto:steve.rice@alaska.gov">steve.rice@alaska.gov</a></td>
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<td>Management Reporting System (MRS)</td>
<td>Liz Balstad, Chris Kotyk, Wendy Parker, Geri Henricksen, Shelley Potter, Phil Kvapil, Sean Jordan from TDS</td>
<td>Trans Planner I Chris (Analyst/Programmer) Wendy (Analyst/Programmer) Shelley (NR project control)</td>
<td><a href="mailto:liz.balstad@alaska.gov">liz.balstad@alaska.gov</a>, <a href="mailto:chris.kotyk@alaska.gov">chris.kotyk@alaska.gov</a>, <a href="mailto:wendy.parker@alaska.gov">wendy.parker@alaska.gov</a>, <a href="mailto:geri.henricksen@alaska.gov">geri.henricksen@alaska.gov</a>, <a href="mailto:shelley.potter@alaska.gov">shelley.potter@alaska.gov</a>, <a href="mailto:phil.kvapil@alaska.gov">phil.kvapil@alaska.gov</a>, <a href="mailto:sean.jordan@alaska.gov">sean.jordan@alaska.gov</a></td>
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<td>8/26/2013</td>
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<tr>
<td>Timesheet Entry and Reporting System (TEARS)</td>
<td>Craig Walsh, Steve Rice, Wendy Parker</td>
<td>Craig - Admin Operations Mgr I  Steve - Data processing Manager  Rachel - Analyst Programmer  Wendy - Analyst Programmer</td>
<td></td>
<td><a href="mailto:craig.walsh@alaska.gov">craig.walsh@alaska.gov</a>  <a href="mailto:steve.rice@alaska.gov">steve.rice@alaska.gov</a>  <a href="mailto:wendy.parker@alaska.gov">wendy.parker@alaska.gov</a></td>
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</table>
B. Interview Questions

B.1 IN/OUT OF TAMIS

The following questions will be used to determine if a data system/data set is "in" or "out" of TAMIS.

1. Why are these data being collected (ADOT&PF requirements, federal mandates, other)?
2. What do you use it for (i.e., does it support asset management decisions within your department)?
3. What types of data are included in the system (i.e., does it contain inventory data that could be used for asset management purposes)?
4. Is the data in a format that is ready to be integrated into TAMIS?
5. Could the system be used to support TAM performance measures, which support National Performance Goals (e.g., capacity, safety, bridge, pavement, redundancy, freight)?
6. Is the data in the system being used to support department performance targets related to asset management? If so, what are the performance targets?
7. Is the system used on a Statewide or Regional basis?
8. How often is the data updated (i.e., in real-time or on a periodic basis)?
9. Is the system supported by adequate resources (i.e., are there resources for data updates or system improvements)?
10. Are there plans for future retirement/replacement of the system? If so, when?

B.2 DATA INTEGRATION POINTS

The following questions will be used to determine the data integration points (from data systems and data sets) to support the TAMIS framework. These questions are grouped into categories of overall data management, purpose of the data, data collection, data quality, data integration, data storage, referencing system used, and data documentation. The “XXX” denotes the data system/data set of interest.
Data Management

11. What is your primary responsibility for managing and/or maintaining data in the “XXX” system (i.e., are you considered a data steward (have access to update data), business data owner (make business decisions using the data), or data user (use the data to make business decisions))? Are you currently using business decision-support tools with the “XXX” system? Is there documentation available on the tools and types of decisions made?

12. What data elements from the “XXX” system would make the most sense for cross-comparison with other systems (which systems) to support asset management decisions?

13. What data elements are not currently available in the “XXX” system that you would like to have to improve your business decisions?

14. Regarding TAMIS, which other data systems do you currently interact with/will interact with in the future?

15. What significant changes are planned for the data systems that you are working with (e.g., changes in data collection, dissemination, data uses, or storage of the data)?

16. What is your vision for the “XXX” system within the TAMIS framework?

Data Collection

17. What data are collected? What are the attributes of these data?

18. How are the data collected (i.e., procedures, equipment, coverage)? What data collection standards are in place?

19. Who collects the data (e.g., DOT, contractor)?

20. What type of data collection record keeping takes place?

Data Quality

21. What is the quality of the data? How is it measured?

22. What quality assurance processes are involved with the data collection (e.g., timeliness, reliability, accuracy, standards)?

23. Do you have documentation regarding the data quality control processes used for the “XXX” system?

24. How do problems with data quality impact your effectiveness or those of your customers?

25. What steps do you think can be taken to improve the quality of the data?
Data Integration
26. Are there any known technical issues with integrating data from the “XXX” system with other systems at ADOT&PF?

27. Are you aware of any institutional issues impacting the ability of data from the “XXX” system to be integrated with other systems?

Data Storage
28. How are the data stored in your department for the “XXX” system (PC, server, data warehouse, legacy system)?

29. Is the data for the “XXX” system stored outside of ADOT&PF? If so, how are the data stored by other agencies outside of ADOT&PF?

30. Are there specific national, state or agency standards that govern the storage of the data?

31. Is the database linked to data in any other data system, both inside ADOT&PF and outside?

32. Are these data redundant with any other data systems? Are there any issues with multiple sources for the same data?

Referencing System
33. What linear referencing system do you use to locate your assets in the “XXX” system?

34. Do you use a common geographic referencing system and a common map-based interface for analysis, display, and reporting?

Data Documentation
35. Do you have documentation that you can provide that illustrates data file structures and/or data dictionaries used to support the “XXX” system?

36. Are there any other improvements in the collection, storing, stewarding, analysis or dissemination of the data that would improve the data management program?

B.3 USE CASES
The following questions will be used to develop the Use Cases for the data systems/data sets that may be used to support TAMIS. The questions cover: (1) data access and uses, and (2) data flow and transformation.

Data Access and Uses
37. How are the data accessed (computer applications, network, internal web)?
38. How are the data reported (documents, print files, web, etc.)?

39. What standard reports are generated using the “XXX” system? Can you provide the example reports and/or formats and layouts of the reports?

40. What business decisions are made using this data? What do you use this data for (e.g., specific analysis, reporting, decision-making, dissemination)?

41. Are you aware of any other uses of these data by other stakeholders?

42. Are there any restrictions for sharing data from the “XXX” system with other agencies or the public?

43. How does the data that you use interface with other asset related management programs?

44. Are there partnerships with other agencies in terms of collecting or reporting the data?

45. Are there or should there be ownership and/or gatekeeper controls for this system (e.g., open/restricted access, userid/password control, internal web, server)?

**Data Flow/Transformation**

46. How do you receive/transmit the data for the ‘XXX’ system?

47. What analyses or transformations do you perform on the data (e.g., missing data, normalization, augmentation, comparisons)?

48. Are you aware of any transformations that occur either before you receive the data or after you pass the data to the next party?

49. Are these transformations reported back to the data provider or forward to any other data users? If yes, how?

50. Who do you pass the data along to?

51. Do you think that there are other potential uses of this data that are not currently being done?

52. What is the update cycle for data in the “XXX” system? (daily, weekly, monthly, quarterly, annually?)
C. Data Catalog

Table C.1 provides a Data Catalog of available system documentation for each of the data systems that are “in” TAMIS. The documents listed in the Data Catalog are available on the following FTP site:

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Password: Asset8800

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<td>3. Bridge Status Report: <a href="http://web.dot.state.ak.us/bridgestatus/">http://web.dot.state.ak.us/bridgestatus/</a> (shows info from Pontis and MRS)</td>
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<td>Various documents in multiple formats including docx, pdf, and PowerPoint presentations describing the Geotechnical Asset Management (GAM) program and the (Tongass) Corridor Asset Management Pilot Program.</td>
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<td>1. Corridor Asset Management Pilot Program Proposal 1-4-12 v.1.docx</td>
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<td>2. GAM concepts for Safety projects.pptx</td>
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<td>3. GAM Plan Research Task A - Literature review and research plan 7-1-13.pdf</td>
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<td>4. GAM Program Status August 2013.docx</td>
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<td>5. GAM Project Status + Description 7-15-13.docx</td>
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<td>9. Stanley PP for 9th TAM Conf.pptx</td>
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<td>10. Tongass Corridor Management Program 4-26-12.docx</td>
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<td>13. RES-12-007 APP B Amendment 11-1-13 DS.docx</td>
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<td>14. TAMIS Interview Notes - Geotechnical</td>
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<td>7. FHWA Asset Management Audit Report (May 2010)</td>
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<td>2. RDS HandBook (draft) (RDS_Handbook.pdf)</td>
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<td>2. RDS_SIRIS.pptx (Powerpoint slides demonstrating relationship between RDS and SIRIS)</td>
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<td>3. GEO Data Models.xlsx (describes the feature classes, event tables, and domains that make up the RDS data model)</td>
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<td>Crash Data Entry System &amp; Crash Reporting and Analysis System for Safer Highways (CRASH)</td>
<td>3</td>
<td>Various documents regarding CRASH (including a Crash Concept of Operations (ConOps) ):</td>
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<td></td>
<td>3. Crash Data System Concept of Operations (Crash ConOps FINAL 4-12-12.pdf)</td>
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<td>Transit Grant Management &amp; Program Administration System (GMPAS)</td>
<td>2 – while system does not support enterprise asset mgmt, it does support asset mgmt &amp; funding for the Transit business area</td>
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<td>Transit</td>
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<td>7. HAS Documentation - Accident Processing and Packages.pdf</td>
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<td>9. Email from Jack Stickel RE Monday's TAMIS Meeting on Crash Data.pdf</td>
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<td>10. TAMIS Interview Notes (Crash)</td>
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<td>A draft user manual for GMPAS is in progress</td>
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<td>AVIATION</td>
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<td>Airport – Facilities Alaska Aviation System Plan (AASP)</td>
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<td>1. RWIS General Information: <a href="http://www.dot.state.ak.us/iways/roadweather/forms/About.html">http://www.dot.state.ak.us/iways/roadweather/forms/About.html</a></td>
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<td>2. RWIS Glossary: <a href="http://www.dot.state.ak.us/iways/roadweather/forms/Glossary.html">http://www.dot.state.ak.us/iways/roadweather/forms/Glossary.html</a></td>
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<td>3. TAMIS Interview Notes (RWIS &amp; 511)</td>
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<td>2. Draft Inventory Database Manual (2010-7-12 Draft Inventory Database Manual.pdf)</td>
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| | | 4. Public site to view Facilities Inventory database:
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<td>Airport - Facilities</td>
<td>Airport and Highway PMS systems</td>
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<td><a href="http://www.AlaskaASP.com">www.AlaskaASP.com</a></td>
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<td>1. TAMIS – Interview LIBRA and LP Rev120413.docx</td>
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<td>2. TAMIS – Follow-up Interview PONTIS and LP Rev112513.docx</td>
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<td>Training Guide documents and Overview documents of EMS include the following:</td>
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<td>1. EMS Asset Record Layout.docx</td>
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<td>2. GUIClientUserGuide.doc</td>
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<td>3. GUITraining_CustomerInq.pdf</td>
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<td>4. State Equipment Fleet Overview 052311a.pdf</td>
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<td>5. Syllabus_EMS_UserTraining_DataEntry_sjs.doc</td>
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<td>6. Syllabus_EMS_UserTraining_Foremn_sjs.doc</td>
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<td>7. Syllabus_EMS_UserTraining_InquiryUsers_sjs.doc</td>
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<td>8. Syllabus_EMS_UserTraining_Mechs_sjs.doc</td>
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<td>ADMINISTRATIVE SERVICES / OTHER</td>
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|                             | eDOCs              | 3    | 1. eDocs Overview and Demonstration Outline 20130408.doc  
2. taxonomy_fairbanks.xlsx  
3. TAMIS Interview Notes (eDOCS and eLeasing)                                                                                                           |
|                             | Federal Aid Agreement Management | 3    | 1. Complete Manual.docx  
2. Email from Liz Balstad RE_Desk reference manual for FAAM.pdf  
3. TAMIS Interview Notes (FAAM)                                                                                                                      |
|                             | Integrated Resource Information System (IRIS) | 1    | Multiple documents have been produced for the IRIS system, which is still under development. The first 6 documents listed below provide an inventory of the potential systems for integration in IRIS. Items 7-11 below provide detailed information with data flows indicating Mainframe and Non-Mainframe systems that provide information for IRIS.  
1. DOC042913-pt.1_alt.pdf  
2. DOC042913-pt.2_alt.pdf  
3. DOC042913-pt.3_alt.pdf  
4. IRIS - DOT Mainframe - AKPAY -FINAL.PDF  
5. IRIS - DOT Mainframe - AKSAS - FINAL.PDF  
6. IRIS - DOT Mainframe - TPBS - Flows - FINAL.PDF  
7. IRIS - DOT Mainframe Systems Flows - FINAL.PDF  
8. IRIS - DOT Non-Mainframe Systems Flows - FINAL.PDF  
9. TAMIS Interview Notes (IRIS)  
10. TAMIS Follow-up Interview Notes (IRIS)                                                                                                                |
|                             | Management Reporting System (MRS) | 1    | 1. Online data dictionary: [http://web.dot.state.ak.us/cgi-bin/dd.d/tables.pl](http://web.dot.state.ak.us/cgi-bin/dd.d/tables.pl)  
2. Bridge Status Report: [http://web.dot.state.ak.us/bridgestatus/](http://web.dot.state.ak.us/bridgestatus/) (shows info from Pontis and MRS)  
4. Two User Manuals for data entry staff:                                                                                                                 |
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<th>Major Asset Class/Subclass</th>
<th>Data Systems</th>
<th>Tier</th>
<th>System Documentation</th>
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2. Link to the Divisional Dashboard and different portal pages: [http://web.dot.state.ak.us/pets/divdashboard.shtml](http://web.dot.state.ak.us/pets/divdashboard.shtml)  
3. Link to FHWA Portal Page: [http://cmm.dot.state.ak.us/cognos10/cgi-bin/cognos.cgi?b_action=dashboard&pathinfo=/cm&frag-header=true&path=storeID(%22i0B59C35D42C743A48411E335E4D66112%22)&backURL=%2fcognos10%2fcgi-bin%2fcognos.cgi%3f_action%3dxts.run%26m%3dportal%26cxts%26m_folder%3di4B61883BEC18415D919E3CA7859E97C](http://cmm.dot.state.ak.us/cognos10/cgi-bin/cognos.cgi?b_action=dashboard&pathinfo=/cm&frag-header=true&path=storeID(%22i0B59C35D42C743A48411E335E4D66112%22)&backURL=%2fcognos10%2fcgi-bin%2fcognos.cgi%3f_action%3dxts.run%26m%3dportal%26cxts%26m_folder%3di4B61883BEC18415D919E3CA7859E97C)  
4. List of PETS owners (PETS owners.pdf)  
5. List of PETS OMB owners (PETS OMB owners.pdf)  
6. Email from Craig Walsh.pdf  
7. Email from Rachel Kindred.pdf  
8. TAMIS Interview Notes (PETS) |
D. Interview Summaries

D.1 511 SYSTEM

In/Out of TAMIS?

One of the questions being addressed as part of the TAMIS research project is to determine if a system that captures real-time data (such as the 511 system), should be part of TAMIS?

Alaska staff provided the following analysis regarding the 511 system and its potential use for TAMIS.

It is important to consider what business processes related to TAMIS would rely on 511 data. The DOT still has much to accomplish regarding their use of real-time data. Currently, the only Department staff using the 511 data to make decisions are the Maintenance & Operations (M&O) staff. The 511 system is however used on a statewide basis by the public.

Regarding the use of 511 data for allocation of asset resources, Alaska staff explained that the driving conditions and construction projects are put into a geodatabase and are used as a tool with 511. The 511 system is used for data queries for weather conditions, and for individual data requests. As the 511 data is archived over time, it can potentially be used for risk assessment purposes, especially when it is integrated with crash and pavement condition data.

Data Storage

An off-site contractor hosts the database that is used to store data for the 511 system.

Recommendations for 511 as it relates to TAMIS

The business unit responsible for the 511 system wants to continue to raise awareness of the potential use of the 511 data and continues to track usage statistics including the number of calls received per month/year and documents what the 511 system is being used for by the public.

Conclusion: Due to the real-time data capture method associated with 511, it is NOT a likely candidate system to support TAMIS.
D.2 ADA INVENTORY

Why are these data being collected (ADOT&PF requirements, federal mandates, other)? ADOT&PF received a grant to create a transition plan for the ADOT&PF’s pedestrian facilities within it right of way.

What do you use it for (i.e., does it support asset management decisions within your department?) We will be using it for the creation of a transition plan.

Does it support any decision-making related to other areas such as capacity, safety, bridge, pavement, freight? Yes, accessibility.

What types of data are included in the system (i.e., does it contain inventory data that could be used for asset management purposes)? Asset management, project development.

Is the system used on a Statewide or Regional basis? Statewide.

How often is the data updated (i.e., in real-time or on a periodic basis)? It will be updated on a periodic basis.

Is the system supported by adequate resources (i.e., are there resources for data updates or system improvements)? I believe so.

Are there plans for future retirement/replacement of the system? If so, when? No.

Does the ADA Inventory interact with any other data systems? The ADA Inventory is using an interactive GIS mapping program. This will allow for updated information to be imputed directly into the map (onto the feature) when information becomes available.

Is the data being geolocated and mapped? If yes, what geographic referencing system is being used (e.g., latitude/longitude, roadway linear referencing system, etc.)? Yes, Latitude/longitude.

Is the quality of the data adequate to meet your business needs? Are there any quality assurance processes involved with the data collection (e.g., timeliness, accuracy, standards)? Because data is collected in house, the quality of the data can be improved if not adequate.

How are the data being stored (e.g., Oracle, Access database, etc.)? This question should be addressed to Talena Adams or Garry Remsburg.

Is there a data dictionary, user’s manual, or other documentation available? If yes, would it be possible to send us a copy? Not that I am aware of.

Who are the primary users of the data? Currently the only primary user of the data is the Civil Rights Office. However, when the transition plan is complete, it should be accessible to all members of the department – specifically Planning, PD&E, and Construction program areas.
D.3 ALASKA AVIATION SYSTEM PLAN

There is an RFP in place to do system integration for the AASP and the work to be accomplished will include the web development and integration of data and information for the AASP.

How the Plan relates to TAMIS

There is no primary source of data used for the AASP. There is a data dictionary that identifies the source of the data used for the AASP. The AASP extracts information and uses it, but it is not providing data to any other system. Jessica will send Kim the login information to get access to the data dictionary on the Alaska website.

Data Management

What is your primary responsibility for managing and/or maintaining data for the AASP (#1)? They are the primary business data owners and data users of this type of data.

What data elements used with the AASP system would make the most sense for cross-comparison with other systems (which systems) to support asset management decisions (#2)? Surfaces (conditions, types, pavement condition index (PCI), runways taxis and aprons, lighting, markings, navigation facilities that they own). They would like to associate aviation traffic forecasts at the aviation facilities to use in making capital funding decisions. They rely on carrier reports provided by FAA and on passengers/cargos moving through the facilities for that type of information. Most airports do not track this type of information (passenger/cargo traffic) coming/going at the airport.

Regarding TAMIS, which other data systems do you currently interact with/will interact with in the future (#4)? They use the Aviation Facilities Inventory database. Jessica is sending us the link to the data dictionary to help us identify the data that is in this database (see below). They also populate some of the data needed for the AASP from other sources but do not recall what else may need to be included in the AASP database. Jessica provided the following information in a follow-up email:

- There is also a public site (www.AlaskaASP.com), at which most of the facilities inventory database can be viewed. The internal side just has a little additional data, it can be viewed more ways (such as by community or by carrier serving the various airports), the performance measure reports are published only internally, and the pilot project inspection results and needs lists are on the internal site only.

- The data dictionary document can be found on the internal site on the right hand side of the screen from most tabs. I’ve also attached the dictionary, the database manual, and the Mission, Goals, Objectives report for ease of reference.
What significant changes are planned for the data systems that you are working with (e.g., changes in data collection, dissemination, data uses, or storage of the data) (#5)? Within the next month, they will have the contractor identify what formats and databases are used to support the AASP. At this time, the data is available in an Excel format and is stored in an Access database. The contractor hired for this work will be their representative on TAMDIT.

What is your vision for the AASP within the TAMIS framework (#6)? They want to be able to use data from the Aviation Grants History database (regarding capital funding on airports). That type of information would be helpful to have in an integrated system to support the AASP. They also use information from the Airport Improvement Program (AIP). The AIP, which is established under chapter 471 of title 49, United States Code (U.S.C.) is a major grant program for the planning, construction, improvement, and repair of United States airports. “The AIP System is used to manage grants and funding in order to satisfy legislative requirements. They also use the SOAR (System Of Airports Reporting) system. The System of Airports Reporting (SOAR) supports the AIP and PFC programs, collecting and processing data for approximately 1,000 air carriers at over 1,950 U.S. airports annually. This data is then used to categorize airports and issue capital improvement grants.”

(Data Collection

Facilities Inventory Data and Inspection Data

What data are collected (#7)? Data are collected for two main systems, (1) Facilities Inventory System and (2) Inspection data. The type of data collected for the facilities inventory includes: headings, location of runways and helipads, services available, lights markings, the types of buildings located at the airport, and the types of equipment available). The Facilities Inventory System (FIS) is linked to the eDOCS system so that information can be pulled from that system to supplement the FIS. The facilities inventory was last updated in 2012. There is not a one-to-one match from the DOT airport facilities inventory and the Facilities Inventory System. There are several different lists (of airports) that they work from.

The inspection data pertains to approximately 20 airports. The inspection data is not a comprehensive list; it is just a first attempt at using a web-based data inventory system. The inspections occurred in 2012 and the data was compiled and released in early 2013. The general plans going forward, are to collect the data on electronic tablet devices so that the collectors can collect the data (hopefully on an annual basis). They want to develop a comprehensive database that includes data airport needs for an additional 20-30 airport facilities. They plan to use the available tablet devices to continue building the conditions inventory.)
Are there federal requirements for collection of the data (#7)? There are no specific federal requirements for collection of the data, but the data is needed to develop airport projects or to provide information to the FAA and to maintain grant assurances. The requirements for collection/reporting of the data are specific to the responsibilities associated with the grants. They basically need to report on what they are doing with their facilities and how the facilities are maintained. The master records for the airport are maintained as part of this process. Much of the data is updated on an annual cycle, but there is other data that is pulled from the FAA airport master records on a 45-day cycle (from an airports national data center).

How are the data collected (i.e., procedures, equipment, coverage)? What data collection standards are in place? Who collects the data (e.g., DOT, contractor) (#8)? Consultants collect the data for the field inspection data. The sources of the facilities data are either the DOT or the airport owner staff.

What type of data collection record keeping takes place (#9)? Data is retained for Facilities Inventory, and Inspection data.

**Data Quality**

What is the quality of the data? How is it measured (#10)? The consultant collects the data, compiles it, and provides it to the owner (of the airfield) to review. There is an issue with the currency of data. When it comes to actual facilities changes, capturing those changes is difficult. The aviation system (to be developed) is hopefully going to be used to improve the information collected for the airport facilities. They have a lot of facilities that are NOT visited regularly due to location/weather, etc. The staff in the Regional offices try to review and keep up with updating the data as needed.

**Data Integration**

Are there any known technical issues with integrating data for use with the AASP (#15)? Yes, the technical issues with data integration are primarily due to the fact that this is a consultant housed database, which makes it challenging to maintain links with other DOT systems (like eDOCS). However, there is a link between eDOCS and the Facilities Inventory database. It is a live link at this time. Data is extracted from eDOCS using a 3-letter id for the airport. They can view what is publicly available from eDOCS.

Are you aware of any institutional issues impacting the ability of data for the AASP to be integrated with other systems (#16)? Yes, maintaining data for a system like this is a challenge. They do not have a lot of people in the Regions to do a lot of aviation operations and planning type work. Trying to keep the AASP up to date is a challenge due to limited resources. They do this as a consultant supported effort and are able to take advantage of aviation planning funding. However, they have not been able to take advantage of in-house databases for location data for instance. The state-owned airports and other
government owned airport facilities are located on state’s GIS, but not on all of the airport facilities across the state. We will distinguish between the different categories of airports that would potentially provide info/data to TAMIS. There is also a report that explains how the data is used with performance measures.

**Data Storage**

How are the data stored in your department for the AASP (#17)? The data is maintained by an external consultant as a web-based application.

Are there specific national, state or agency standards that govern the storage of the data (#19)? Not that they are aware of, regarding storing of the data.

Is the database linked to data in any other data system, both inside ADOT&PF and outside (#20)? There is a link between eDOCS and the Facilities Inventory database. It is a live link at this time. Data is extracted from eDOCS using a 3-letter id for the airport. They can view what is publicly available from eDOCS.

**Referencing System**

What linear referencing system do you use to locate your assets tracked for the AASP (#22)? The state-owned airports and other government owned airport facilities are identified on state’s GIS basemap, but not on all of the airport facilities across the state.

**Data Documentation**

Do you have documentation that you can provide that illustrates data file structures and/or data dictionaries used to support the AASP (#24)? Jessica is sending Kim a link to access the data dictionary and additional documentation.

**Use Cases**

How are the data accessed (computer applications, network, internal web) (#26)? Certain people have edit privileges, but others only have view privileges. The primary user is the publisher of the Alaska Aviation System Plan. The hope is to update the Plan annually, but they are not at that point yet. Capital Improvement projects for airports are listed in the STIP, but these are separate from types of projects identified in the AASP.

What standard reports are generated for the AASP? Can you provide the example reports and/or formats and layouts of the reports (#28)? Canned reports for performance measures are available through the internal website.

What business decisions are made using this data? What do you use this data for (#29)? The pictures of failing infrastructure are used as part of decision-making tools; they don’t need to broadcast this type of information to the public.

Are there any restrictions for sharing data used for the AASP with other agencies or the public (#31)? They are not aware of any restrictions on the use of data. There is a public and an internal website, so that information is not shared about
what is being worked on at specific aviation facilities. Information is available on the Alaska website through the Aviation System Plan website. This information includes airport layout plans, which are available to the public.

They provide the pavement condition report on the airports (as of the last inspection) on their publicly available website. They do not foresee any issues with using this information for linking with TAM and asset management.

We may want to get in touch with the consultant when they get on board and are under contract so that we can ask more specific questions if needed.

D.4 ASSET MANAGEMENT OPERATING SYSTEM (AMOS)

Background Information from Troy Jorgens

Asset Management Operating System (AMOS) is used to track the preventative maintenance for equipment on the ship. Each individual ship has its own database. Certain tasks will come up that need to be accomplished on a routine maintenance schedule based on how long the equipment operates (e.g., change oil in the generator). Some engineers do a better job than others at maintaining the information in AMOS. The program isn’t very user friendly, so there is a lot of resistance to using it. Troy will send us contact information for a Port Engineer to explain how AMOS works.

Are there any decisions made across the fleet of vehicles using AMOS? On each ship, there are 4 to 6 people on the vessel that would use the system. They want their asset management initiative (TAMIS) to come up with a better way to share the information from the system.

Does AMOS interface with other databases? No. AMOS needs to be replaced, as it is reaching the end of its useful life, but it is something that required to be in place for each vessel. Each ship is constructed according to a certain set of rules of the Flag State (Coast Guard) and Classification Society. The rules govern that there must be a preventative maintenance database onboard each vessel.

Ship-related databases include the Ship Maintenance Request (SMR), FCS, and AMOS. There are a couple of other systems that we need to look at:

- Shore Condition Survey. This survey is a database on the positions of terminals, dock structures, etc. The survey is done once a year.
- Terminal Maintenance Request
- Ship’s Maintenance Request. SMR is in Excel spreadsheet format. It does not work well and is very error prone. They would like to upgrade this system.

The databases are all managed by different people in different units. There is a need for one system to maintain information for ships, preventative maintenance, and terminal/building/dock needs. Under TAMIS, there may
need to be a substructure that shows how the AMHS is managed (similar to the Pavement Management System).

How is the money allocated to the improvements of all the assets? There is a method for allocation between resources, but Troy is not sure how the allocation occurs. Most of his work is with the federally funded capital improvement projects, which allocated $20M/year for ships. These projects are in the STIP, and we can see them in the STIP online. They look at the needs in the Fleet Condition Survey to prioritize projects for this program. Troy will send us contact information for the Marine Engineering Manager, who can provide more information on the prioritization process.

**Background on AMOS**

AMOS is a shipboard-focused program used to track maintenance requirements for all machinery used onboard the ships. The information is tracked on time basis with intervals commonly reported in hours, months, annually, or in some instances longer periods. The information tracked includes what maintenance is coming due, is past due; when maintenance was done and who it was done by, and what parts were used during maintenance activities. The AMOS system is vessel specific and fleet specific and is tailored to the specific job performed. The AMOS system does not share data with any other data systems in its current iteration.

AMOS is used for the International Safety Management (ISM) regulatory program, which requires a maintenance system to be in place per the regulatory requirements of the American Bureau of Shipping (ABS) or Det Norske Veritas (DNV) and the Preventive Maintenance System (PMS).

Troy Jorgens is a Vessel Construction Manager and the AMHS representative to the TAMDIT. He manages the capital funding improvement projects, including taking ships out of service for several months to do multi-million dollar upgrades.

Greg Jennings is the Port Engineer for three vessels and he manages the day to day operations, maintenance and repair needs, and is the shore side contact for the vessels.

**AMOS System Architecture**

Where does the data reside? AMOS is a distributed system, whereby each vessel has a database that is delivered shore side periodically to Juneau. In Juneau, the data is compiled into a master database, which can be used to view all ships. This process creates a slight discrepancy (about a one week difference) between what is on the vessel and what is in the database shore side. The vessel version and the master database version of AMOS use the same program with the database component stored in Oracle, Sun Server Databases.

Is there a data dictionary? No.
AMOS is a very restrictive system as far as who has access and update privileges for the system. The amount of editable data is restricted to Chief Engineers and selected other Engineering officers aboard the vessels. These engineers can create new jobs to be done and record these in AMOS. The Shore side Managers and Administrator can change data on inventory parts related to jobs, delete jobs, or can tailor tasks for jobs on an individual basis. The Administrator sets up rights for use of the system, including user name and password.

Resource allocation decisions - The system tracks what needs to be done. For big items like main engine overhaul work, the system is used to determine when and how the work will be done. Resource allocations are done by the Chief Engineer and First Engineer.

**Reporting capabilities**

Reports from AMOS are used to show the ABS inspector that the maintenance for the vessels are being tracked and to provide whatever audit information is requested by the inspector. There are no paper reports routinely produced from the program. The reports are intended to track inventory parts that are received/used. When a job requires use of a specific part, the part is checked off and removed from the inventory.

Is the system supported by adequate resources? The software works sufficiently, but updates would make the system easier to use. A follow-up interview will be held with Cisco Flores in October to discuss plans to upgrade the software.

Preventative maintenance and special maintenance for vessels are considered to be two separate activities. AMOS is not used to do any maintenance planning for items outside the specifically defined machinery items. Instead, the licensed crew is relied upon to identify patterns of any problems with machinery or vessel infrastructure that is outside of normal preventative maintenance activities.

**Conclusion**

The AMOS system is primarily used to manage the maintenance work onboard vessels and is not used for higher level asset management decisions at the Department and would not likely be used to support the TAMIS framework. However, additional information needs to be obtained from Cisco Flores to make a determination on whether information from AMOS can be used to support TAMIS decisions at a higher level.

**D.5 ATLAS**

ATLAS is a dispatch assisting tool to track training records, qualifications, endorsements, and similar documents used by mariners (ferries) to be in compliance with coast guard regulations while at work. It is a people management tool used to track safety training and other mandated training
(federal, state) that employees are required to have. ATLAS assists dispatchers in assigning mariners to appropriate positions based on qualifications. The data doesn’t support department decisions outside of AMHS.

ATLAS data also includes emergency contact and address information. Payroll/HR uses ATLAS to view employee/contact information. Most of this information is already in the payroll system, but some weekly payroll data is transferred into ATLAS.

ATLAS tracks the time people work on the vessels. Data housed in ATLAS is used for dispatching and managing staff.

There is a separate system used to determine which vessels will travel when and on what routes. ATLAS supplements this system by providing information on who runs the vessel and whether they have proper qualifications.

Access to ATLAS is limited to AMHS, payroll, and HR. Trene Elliott is a technical expert and can tell us who has access to it.

There is no interaction between ATLAS and the Fleet Condition Survey or AMOS. It is not used to support decisions outside of AMHS (e.g., safety or capacity).

Conclusion: ATLAS should not be included in the TAMIS framework, but it could be an integration point for resource allocation.

D.6 BIDTAB

Why are these data being collected (ADOT&PF requirements, federal mandates, other)? Bidtab data is collected to establish a record and an inventory of our active estimates and archived bid costs for various pay items and units of those items throughout the state.

What do you use it for (i.e., does it support asset management decisions within your department?). The cost data that is available through the bidtab system might assist in making decisions on how to build or maintain the assets that are owned within the Department.

Does it support any decision-making related to other areas such as capacity, safety, bridge, pavement, freight? Not specifically.

What types of data are included in the system (i.e., does it contain inventory data that could be used for asset management purposes)? The data contained in the Bidtab system is the active engineer’s estimates for our construction projects, and an archive of projects that have already opened and the bid costs for those projects.

Is the system used on a Statewide or Regional basis? The system is supposed to be used on a statewide basis. In Northern Region Bidtab is used exclusively.
How often is the data updated (i.e., in real-time or on a periodic basis)? The data is updated real time.

Is the system supported by adequate resources (i.e., are there resources for data updates or system improvements)? This software was developed and is maintained by a consultant. All modifications are done by that one individual under a maintenance contract. This makes getting things changed in the program difficult some times. Additionally, each of the regions maintains their data and their users individually, and it isn’t always consistent. The inconsistencies cause issues with being able to completely extract the data needed. Additionally, the final numbers after construction are never entered into the Bidtab system so the loop isn’t ever completed and Designers can only ever create estimates from the numbers that were bid, not the actual after the fact numbers of what was paid out.

Are there plans for future retirement/replacement of the system? If so, when? I don’t know that there are plans to retire the system, but it may become a necessity if we move to the AASHTO softwares that the Department is currently looking into. The data that is collected in our Bidtab system would be integrated with that new software, and would be automatically updated and maintained just by using the software. There would also be a broader availability for technical support and maintenance.

D.7 **BUYSPED ONLINE**

Why are these data being collected (ADOT&PF requirements, federal mandates, other)? BuySpeed Online (BSO) is the department’s purchasing database/application.

What do you use it for (i.e., does it support asset management decisions within your department?). It is used for processing requisitions, solicitations, purchase orders and inventory issues.

Does it support any decision-making related to other areas such as capacity, safety, bridge, pavement, freight? No.

What types of data are included in the system (i.e., does it contain inventory data that could be used for asset management purposes)? It is used to manage inventory and inventory transactions (replenishment and issue) of consumable supplies for purchase by department agencies.

Is the system used on a Statewide or Regional basis? Yes

How often is the data updated (i.e., in real-time or on a periodic basis)? All functionally is real-time.

Is the system supported by adequate resources (i.e., are there resources for data updates or system improvements)? Yes
Are there plans for future retirement/replacement of the system? If so, when? The department is migrating to DOA’s new IRIS system, July 1, 2013. BSO will be retained for historical data reference.

D.8 CONSTRUCTION DATA MANAGEMENT (CDM)

Why are these data being collected (ADOT&PF requirements, federal mandates, other)? The primary purpose of this database is to a) maintain a status of the projects that have a competitively bid contract, b) be able to analyze how our construction contracts have changed from the time of contract award to the final contract, c) and as a regional management tool for staffing purposes (work load).

What do you use it for (i.e., does it support asset management decisions within your department?) No, it doesn’t support asset management.

Does it support any decision-making related to other areas such as capacity, safety, bridge, pavement, freight? No.

What types of data are included in the system (i.e., does it contain inventory data that could be used for asset management purposes)? It primarily tracks project status, staffing information (project management), construction contract status (accumulation of change order activity and dates related to the contract).

Is the system used on a Statewide or Regional basis? It’s a combination of both. Elements of the data are used statewide, while some pieces are unique to what our regional management wants to maintain/track.

How often is the data updated (i.e., in real-time or on a periodic basis)? Periodic. Whenever paperwork is generated related to a construction contract, certain elements of that data are included/updated into the database.

Is the system supported by adequate resources (i.e., are there resources for data updates or system improvements)? Yes. Employees are responsible for the data updates and numerous individuals are trained to make those updates. Hardware/software wise, we also have excellent support.

Are there plans for future retirement/replacement of the system? If so, when? No.

Response by Shelley Potter, Northern Region Project Control and Phil Kvapil, Northern Region IT
D.9 **CRASH DATA ENTRY SYSTEM & CRASH REPORTING AND ANALYSIS SYSTEM FOR SAFER HIGHWAYS (CRASH)**

**Introductory Comments**

Update on where ADOT&PF is with the Crash Data Entry System & Crash Reporting and Analysis System for Safer Highways (CRASH)? Bonnie is working with the Traffic Records Coordinating Committee (TRCC). The APD crash forms for 2011 and 2012 are being entered into the new electronic crash processing system. The programmer is still working on the new crash form (version 2), and he is almost done with the new interface to accept crash data for 2013 and forward. They will be able to accept the Anchorage and Fairbanks crash reports. They are still working on the ability to process TRACS crashes forms electronically, so they are still being submitted in paper form for the time being.

They have not built the analysis piece of CRASH yet. Dean Deeter (Athey Creek Consulting) has finished the requirements and is the process of preparing an RFP for this analysis piece, which will be complete in the next few months.

What are your thoughts regarding how the crash system fits into TAMIS? The details are still in development, but there are two big pieces that TAMIS is expected to fulfill: 1) An inventory of data elements from other data systems, and how MIRE data would fit into that framework; and 2) Identification of how the Highway Safety Improvement Program (HSIP) (i.e., identification of high crash rate locations, as identified under the SIRIS banner) fits into the TAM structure.

**Data Management**

What is your primary responsibility for managing/maintaining data (#1)? They fulfill all of these roles – steward, owner, and user of data.

What data elements make the most sense for cross-comparison with other systems (#2)? Location of crashes, crash type, and crash severity are the data elements that other people would be interested in. If you know the crash number, you can access all other information associated with the crash (e.g., condition of the road, icy conditions, time of day/night, etc.), subject to data privacy restrictions. The crash system would also provide access to roadway information (e.g., curve and grade data) and any data layers that go with that type of data (e.g., roadway owner, functional class, etc.).

The TAMIS potential is to integrate data elements for high-level business decisions (like a dashboard). Potentially, there would be reports generated that provide information that can be used at a TAMIS-decision level.
What data elements are not currently available in CRASH (#3)? It’s always been a manual process to match up pavement condition data (IRI) with crash data. They would also like to automate HSIP program data.

What significant changes are planned for the data systems you work with (#5)? Jack will send us the Crash ConOps after the interview. (DONE)

What is your vision for the CDS within TAMIS framework (#6)? They want a system where they can identify high crash locations and join it to other data systems. For example, functional classification data is available and the HSIP addresses things like curve, grade, and signage, which are also useful data for other systems. They are missing some HSIP data elements from the crash form. For example, crash data is needed, as it is defined differently than FARS. A table will be used to keep additional variables that are needed regarding the crash.

**Data Quality**

What data quality documentation is available (#13)? Data quality documentation is available in an activity diagram that Athey Creek developed (HAS Documentation for Accident Processing). Jack will send us the Athey Creek report (DONE) and the following additional documents to help answer questions on this topic.

- Crash Data Improvement Program (CDIP) Final Report - (Oct 2011). The CDIP provides specific guidance to law enforcement on the crash reporting side. (Received)
- Roadway Safety Data Partnership (RDSP) State Roadway Safety Data Capability Assessment - (Jan 2012). This document uses a maturity model to examine the data elements needed as part of a crash data program, and it describes where data quality will go in the future. (Received).
- RDSP Alaska Safety Data Action Plan (Nov 2011) (Received)
- Model Performance Measures for State Traffic Records Systems (NHTSA, Feb 2011) (Received)
- Fundamental Data Elements (Aug 2011) (Received)

**Data Integration**

Are there any known technical or institutional issues impacting the ability of data to be integrated with other systems (#16, 17)? Milepoint data is one of the types of data that has to be entered on STIP project sheets. The biggest concern is the IT infrastructure (IT server issue) needed to support all of this. They are looking at the basemap needed to support the All Roads Network. It will be 18 months to 2 years before they make progress on those initiatives. There are two issues that we can help Jack’s group with:
• The Roads & Highways (R&H) Pilot will offer the power of programs partnerships like with HPMS. R&H is for internal work, not for a TAMIS application, but it could be used if needed by TAMIS.

• There needs to be a common governance model that talks about common data definitions and SMEs for the agency.

• They also have a need for something to tie together all of the data systems needed to meet MAP-21 requirements. There was a Peer Exchange that discussed meeting MAT-21 requirements about a week ago. This included Planning Director level staff (37 states attended). Jack will send us information on this. (DONE)

Carolyn and Shannon have asked CS to help develop a Policy & Procedures (P&P) document for TAMIS. The P&P may address the IT governance P&P and the P&P from Jack’s group. The P&P needs to identify the common structures/data definitions needed for TAMIS. They do NOT get information from the TAMDIT group ahead of time to allow input from the Transportation Data Services group. Other groups need to have time to add items to the TAMDIT meeting agenda.

CS wants to discuss more information about the Roads and Highways pilot to prepare for the pilot that we need to do for TAMIS. According to Jack, some people thought that the R&H pilot was going to support Asset Management, but that is not what it is being developed for; this needs to be clarified. Per Anita, we will want to look at how the R&H and things like Agile Assets can support something like a TAMIS.

For the future, the interaction with HHS and the DMV will radically change – i.e., Driver’s Services will have their own electronic database, so Jack’s group will not provide them anything anymore. The Driver’s Services group only tracks driver’s name, history of crashes, etc., and are not interested in location information.

Are there any known institutional issues impacting the ability of data to be integrated with other systems (#17)? Stove pipe data systems are still preventing use of a common key to locate data. The biggest challenge is getting enterprise to accept that a common referencing system is critical for data exchange. There is an RFP for an enterprise data collection program out now. They are trying to get the pavement and highway groups on the same page.

Data Storage

How are data stored for the CDS (#18)? ORACLE database is being used to store the data for the crash system.

Are there any specific standards that govern storage of data (#20)? They built the new crash form based on on MMUCC 4 compliance. The CDIP and Roadway Safety Data Partnership are based on the six areas of data quality and
providing recommendations for them, but they do not address how the data should be stored in the crash database.

Traffic and crash data are going to be linked under the SIRIS umbrella. The Traffic/Crash ConOps has a diagram showing the relationship between each of the 3 components of SIRIS: Traffic Server, CRASH, and Roadway Data System (RDS). The capability to conduct searches/queries will also be shown there.

Data Access and Uses

Are there restrictions for sharing data with other agencies (#32)? The confidentiality of the data is a key concern. They will be talking to Health and Human Services (HSS) regarding the trauma registry in the future. DMV Driver Services will have their own repository for crash data, so ADOT&PF won’t be providing them anything anymore. Maintaining confidentiality of information will no longer be a concern. HSS will have record matching capability within 6 months of a crash instead of having to wait 2 years. DMV uses information on: 1) driver history – citations, alcohol, behavior; and 2) mandatory insurance requirements. Refer to the Crash ConOps for additional information regarding confidentiality of data.

ESRI Roads and Highways and MAP-21 requirements for LRS on all public roads are some of Jack’s main concerns. There are two key things that TAMIS needs to provide: 1) There needs to be a common metadata and data dictionary and knowing who data experts are within an agency; and 2) There needs to be an overall tie together of all these data systems.

D.10 eDOCS

Why are these data being collected (#1)? eDOCS is document management system for the Department, and it is used as a repository to store all types of documents such as surveys, plats, memos, financial documents, ROW documents, as-built plans, satellite images, etc. Documents are scanned and stored in eDOCS so that they are accessible by other users. There are no requirements that people use eDOCS. They are building slowly and trying to make sure they don’t grow too fast. Development of the system started in 2004/2005. It was originally implemented in Anchorage, and then it became available in Juneau and Fairbanks.

What do you use it for (#2)? The value of eDOCS is that it makes any document available to anyone who needs it, without having to dig through file cabinets.

Does it support any decision-making related to other areas such as capacity, safety, bridge, pavement, freight (#3)? It stores both scanned images and electronic versions of documents (if available) to support
documentation of current projects or that are not tied to a specific project but could be useful down the road if a project were to be built in that area.

What types of data are included in the system (#4)? The system contains documents on materials sites documents, geotechnical documents, foundation reports, airport layout plans, master plans, and as-built plans. Andrew will forward us an overview document for eDOCS that defines what the system is, lists the various document types, the agencies that use the document types, and list of examples of custom screens and integration. He will also send us a copy of the taxonomy used for eDOCS so we can see how the document categories are established in the system (B level taxonomy) (Received)

Is the system used on a statewide or regional basis (#5)? There are no requirements to use eDOCS. It’s used on a voluntary basis at the statewide level, and the dependence on the system varies by region. eDOCS requires some customization for each particular utilization, which requires developing the structure, interface, custom search screen, metadata, tutorial, etc. for each user group. Andrew is responsible for setting this up.

How often is the data updated (#6)? Documents are stored in the system as needed. The documents are stored in Oracle content server.

Is the system supported by adequate resources (#7)? Andrew Keeffe is the primary technical support person for eDOCS, and he is supported by two other programmers.

Are there plans for future retirement/replacement of the system (#8)? There are no plans to replace eDOCS, but there are informal plans to upgrade the system and increase storage.

Conclusion: eDOCS should be considered in TAMIS. It was mentioned in the P&P on data governance as a key example of a place where data governance could be applied. It is critical to TAMIS because it could be used as a tool for housing backup documentation for projects.

**D.11 eLEASING**

Becky Iles and Lynette Campbell are responsible for managing the eLeasing program.

Why are the data being collected (#1)? This system tracks applications for airport land use permits and also serves as a customer service system to make it easier for customers to apply for and pay for their lease. The requirements governing this system are related to meeting grant
obligation requirements for airports. The purpose of the system is to make data more accessible to the public. Leasing documents are posted and are attached to a person’s account so that users can view building permits, lease permits, and other documents that are tied to the lease at airports. Users can apply for land use permits online, as well as make invoice payments on-line for land use (leasing) (although it isn’t used to track payment deadlines). The system also contains activity reports for public sales.

They are looking at moving the functionality over to the PropWorks system, but they are not sure how much of eLeasing will be moved over. PropWorks is used for issuing airport land use permits for the rural airport system. It tracks permits and allows them to view active permits and invoicing information.

Does eLeasing link to any other data systems? eLeasing is linked to the Revenue Accounting System (RAS), which is a separate departmental accounting system. There is no link to the AKSAS system.

What is the system used for (#2)? eLeasing is not used to support asset management decisions in the Department. They use it to review leasing applications. When an application is entered into the system, it is reviewed by staff in Maintenance & Operations, Planning, Design, Environmental, and ROW. Applicants have to respond to questions on regulatory requirements, so these staff use the information to review building permits, development, and construction activities on airport property.

Are the regulatory requirements available online? Federal requirements are those related to grant obligations and FAA requirements.

What types of data are included in the system (#4)? eLeasing contains application data on land use at airports, including the identification of the airport and where the lease is located at. It pulls vacant parcel information from RAS on the property side so an applicant can see what is available and apply online for its use. The system is used for customer service and allows applicants to submit their application and fee through the system. A leasing specialist receives the application and coordinates the process. The leasing officer is typically the person who’s assigned to that particular airport (and that information comes from RAS).

Is the system used on a statewide or regional basis (#5)? It is a statewide system for rural airports.

How often is the data updated (#6)? Routinely, daily, and a back-up is done nightly. The data is stored in an Oracle database.
Is the system supported by adequate resources (#7)? Andrew Keeffe is sole technical support person for eLeasing, and he provides support for a number of other systems. Support is adequate as long as no major changes are planned.

Are there plans for future retirement/replacement of the system (#8)? This will depend on what happens with PropWorks (which will eventually replace RAS) – e.g., how PropWorks gets utilized and what functionality is provided.

The website link for eLeasing is http://dot.alaska.gov/stwdav/leasing.shtml.

Conclusion: There is no direct link between eLeasing and asset management decisions.

**D.12 ePARCELS**

Why are these data being collected (ADOT&PF requirements, federal mandates, other)? Federal regulations require extensive reporting on parcel acquisition to obtain right-of-way for federally funded projects. eParcels is a data entry and reporting system for this information.

What do you use it for (i.e., does it support asset management decisions within your department?). See above

Does it support any decision-making related to other areas such as capacity, safety, bridge, pavement, freight? No

What types of data are included in the system (i.e., does it contain inventory data that could be used for asset management purposes)? Parcels acquired or about to be acquired for projects. Ownership information. Types of negotiation and by whom. Transaction information.

Is the system used on a Statewide or Regional basis? Statewide

How often is the data updated (i.e., in real-time or on a periodic basis)? Parcel and transaction information is entered by ROW staff. Project and phase information is downloaded from AKSAS periodically.

Is the system supported by adequate resources (i.e., are there resources for data updates or system improvements)? I support this system. Its maintenance requirements are low.

Are there plans for future retirement/replacement of the system? If so, when? There are no plans for retirement or replacement.

**D.13 ePERMITS**

Why are these data being collected (ADOT&PF requirements, federal mandates, other)? State law requires that property owners obtain a permit before
constructing a driveway, a sign or one of a number of non-permanent uses of highway right-of-way. (See pages 9-11 to 9-13 of the right-of-way manual at http://www.dot.alaska.gov/stwddes/dcsrow/assets/pdf/manual/ROWall.pdf). The ePermits tracks permit applications and granted permits.

What do you use it for (i.e., does it support asset management decisions within your department?) As a record of permit applications received and a record of driveways and other objects in the ROW. ePermits is also a workflow/review system for applications currently being processed.

Does it support any decision-making related to other areas such as capacity, safety, bridge, pavement, freight? Possibly. I would have to check with ROW staff.

What types of data are included in the system (i.e., does it contain inventory data that could be used for asset management purposes)? See above. ePermits is part of the record which answers the question "What is on this highway between mileposts x and y?"

Is the system used on a Statewide or Regional basis? Statewide

How often is the data updated (i.e., in real-time or on a periodic basis)? In real time. Members of the public make applications and ROW staff add data and review applications daily.

Is the system supported by adequate resources (i.e., are there resources for data updates or system improvements)? The system is supported by a fraction of a programmer (me). I have time for minor improvements and fixes, user administration, restarts, and resolving data problems that can't be addressed through the user interface.

Are there plans for future retirement/replacement of the system? If so, when? There are no plans for retirement or replacement.

**D.14 EQUIPMENT MANAGEMENT SYSTEM (EMS) AND FILE MAKER PRO (FMP)**

**Overview of the System**

FMP is a commercially available program used to develop Alaska’s database system for purchasing. It primarily houses the portion of the business where the Contracting Office buys equipment, and the system houses financial information associated with that process. When the purchasing process ends, the associated information is housed in EMS. It is a large system that houses all information used, and it has an interface link to AKSAS for the monthly billings.
Data Management

What are the types of data elements stored in EMS/FMP that make the most sense for TAMIS (#2)? Data includes equipment number, year/make/model, location of equipment, owner of equipment (i.e., the steward who has the equipment at a location – e.g., design/construction, aviation, maintenance), and a Federal Usage Rate (FUR) that is developed every year. The scope of the system includes all equipment for the DOT as well as the 12 other executive branch agencies.

How is location defined within EMS/FMP (#23)? It is a simple city description (e.g., Anchorage, Palmer, etc.). They are stewards of all assets, and the equipment is used all over the place, so they don’t have detailed location information in the data system. Assets aren’t linked to any specific project ID information either.

Is there any documentation available on the data elements (#25)? No documentation is available. There is some data field documentation but it can only be accessed from within the EMS application by placing the cursor on a data field and pressing the Help key. There is currently no method to print an actual data dictionary listing. Documentation detail is probably fair to marginal.

What other systems does EMS/FMP interface with besides AKSAS (#21)? It interfaces with the Maintenance Management System (MMS) within M&O. EMS/FMP provides information on all assets and FUR/IFUR Rates. This data also gets passed to AKSAS and the Asset Master File. There is also a link between AKSAS & EMS – each month when they close the books, they send a billing file so that they can bill all agencies (e.g., Department of Revenue, etc.). Once a year, they pass AKSAS IDs and cost per unit information (mile or hour) so the Time & Equipment (T&E) system can bill the Feds for reimbursement.

What is your vision for how EMS/FMP could support the TAMIS framework (#6)? They see a big role for equipment data. Equipment is usually not mentioned as part of TAM, but the data could be used in MMS by people responsible for maintaining roads. Equipment data could also be used for building locations in remote locations (e.g., remote airports) to optimize the amount of equipment at the site (e.g., optimize how much equipment is there based on the number of operators). They are working on this concept with the building, maintenance, and airport groups. They don’t know any other functional groups with this type of need. Design and Construction use the FUR Rates – they don’t put the data in MMS, but rather enter it in their own databases used to house cost information for financial work or to make business decisions. They would like to see this
process automated more than it is right now. AMHS also uses this information.

What additional opportunities are there for automation in future (#5)? The first time information is fed into the Station Profile system, it is in the form of a tab delimited spreadsheet. From a big picture, the best way would be to automate the data upload into the Station Profile system so that it’s always current. The data upload would need to occur once a month. There is a need and desire to do automated loading, but there isn’t a plan in place to accomplish this yet. They would like to accomplish this in the next 6 months. They are having to re-create a system that hasn’t been used in awhile, which required repairing links manually. Kerry will work with the folks in Juneau to figure out how to do that.

What other significant changes are planned (#5)? FMP should not be integrated with TAMIS because once the transition to IRIS to do purchasing is in place, FMP will go away. Once IRIS comes online (anticipated July 2014), FMP will be discontinued about 6-8 months later.

**Data Collection**

Who’s responsible for data collection and entering data into EMS/FMP (#9)? Data collection/entry is a widely distributed function, and access rights depend on the type of data being entered. Asset data are input here, while maintenance data (parts, etc.) are entered by regional staff – this could be done by either admin staff or mechanics. There are over 150 people that can enter data, and another 150+ people that can do inquiries and pull reports. Data entered into FMP are typically done by headquarters procurement staff, and admin staff edit the information as updates become available.

**Data Quality**

What quality control processes are in place? For equipment (asset) data, cross-checks are done in-house within the procurement system and the EMS. Systems analysts (who work with Kerry) and the senior contracting officer audit all information. Daily reports on work orders (e.g., labor, parts) are reviewed by multiple levels of people. At the end of the year, accounting and financial statements catch anything that is left over. Overall, the error rate is small considering the amount of data included in the system.

They also contend with meter reading errors (e.g., errors or transposed numbers), but not daily and of a large volume. They deal with this issue maybe 8-10 time a month. Diana recently put out a memo reminding
mechanics and foremen to be more attentive when obtaining and entering meter readings for equipment when in the shop for repairs. They are concerned about any financial data or equipment related data entry that affects multiple layers of detail. Meter readings do that as well as entering bad charge codes or costs.

**Data Access and Restrictions**

Are there any restrictions on who can edit information in the system (#32)? Users are limited in what information they can enter into the system. Admin staff are limited in the types of information they can change. Access restrictions are assigned based on functional group. For example, regional staff with access to asset information could change up to 3 fields, but once it goes to Active, In Service (AIS) in EMS, it goes down to 2 fields they can change.

**Data Integration**

Are there any technical/institutional issues impacting data integration (#16, 17)? IRIS implementation will occur in the next year and a half, and they will be linking data back and forth with IRIS. The only issue that might arise is that with the new IRIS, the data format of Asset ID or location code could be different (e.g., 3 digit vs. 5 digit code). With IRIS, inbound and outbound interface coding required to be in XML. Kerry doesn’t have experience with XML. If tab delimited text file, no problem. Differences with shared data elements if EMS/FMP conflicts.

**Data Storage**

How is the data stored? Data is stored within DOT. For the EMS, data are stored on a Unix server in Juneau. The system was developed using a software called APPX, and they have a proprietary database management system (not a relational database) called APPX-IO. The database includes a series of key index files. They don’t use Oracle because transmission of data to/from outlying areas is slow and they didn’t want the additional overhead associated with passing data through Oracle. The response time from the Unix server is sufficient, although data transmission rates can be slow from Western Alaska and a few other areas, especially those using Starband satellite systems. There have been lots of problems with response time.

What format are data transmitted in? The data transmission format would be Unix or other database format. It would require business need to justify a different format for extraction/transmission of data. It could
be as simple as using Excel, Access, or other format to populate data needed to support TAM.

Are there any redundancies with other data systems (#22)? There is redundancy in dual entry of data in both EMS and FMP. All equipment information in MMS is coming from them. If any information is being entered manually into MMS, they aren’t aware. ***CS needs to talk to MMS about redundancy with EMS/FMP.

Are there any government mandates that mandate data elements or storage of data (#20)? There are federal requirements (Government Accounting Standards Board (GASB) 34 reporting) that dictate how they name assets and depreciation.

**Data Documentation**

Is there any documentation for EMS or FMP in the form of manuals/policies/procedures? There isn’t any formal documentation. There was a User’s Manual that was developed when they first bought the system, but it was more attuned to how to operate the system rather than the data entered into it. For APPX-IO, there is some Help information in the system but no true data dictionary (i.e., a list of data elements/fields and description/what they are related to).

How are staff trained on EMS and FMP in each region? As SEF people are hired, they go through training on how to use EMS. The training will differ for each functional group, as mechanics, foremen, and Headquarters people each use a different set of menus/functions for EMS. No training materials exist; the System Administrator conducts the training on an ad hoc basis (i.e., “off the top of his head”). Steven (and Sue before him) wanted to develop a manual for EMS, but it was never done. The system was originally purchased in 1991, so it has evolved substantially over the years. Even the original documentation was antiquated within the first few years of system use.

They have had the system for so long, and they are continually coming up with new projects and system improvements. Their focus is on getting the work done and not on documentation. There have been discussions about developing a User’s Manual, but they have never dedicated the time or resources to do so. Now they are trying to figure out the best mechanism and resources to do it. There would be a need to make the documentation available on everyone’s computer rather than accessing it through a server, so this further compounds the problem of keeping the documentation updated.
***Kerry will ask Steve Delmain what he uses for training and will send Kim a response via email. (DONE)

**Data Access and Uses**

Who are the users once the system is linked with AKSAS (#30)? There is a bill generated that is sent out to all agencies using their equipment. It’s how they collect revenue. EMS has the capability to extract data in the form of a tab delimited text file. This file is passed to users to load into Excel for project use. The billing data goes straight into AKSAS and is sent out to all Executive Branch agencies – for payment of their bills. Agencies receive bills from the system and provide revenue back to the state equipment fleet (not back to DOT).

Clarification about monthly bill: Each month we bill users for use of equipment (replacement and/or operating charges), shop services (repairs/maintenance costs) and fuel costs. This bill is generated as a pdf document and sent to users via email attachment. The user can also specify if they want the data contained in the pdf document be sent as data files (tab-delimited text files that can be opened in Excel). The billing data, in a summary format, is sent to the State’s mainframe for processing and loading into the State’s accounting system (AKSAS). This data file is in EBCDIC format in order to be processed on the mainframe computer.

Are there other potential uses of data, particularly once IRIS is in place (#31)? We have covered everything within the department. Agencies outside the department use the data for the same purposes as DOT. For example, running reports to see how much vehicles are costing, whether they should be replaced, how much particular work orders cost, etc. They can run rates for the entire year for use in projections. FUR rates are used the same way as DOT does.

They could also do charting of costs to see if they are increasing (i.e., for use in cost/benefit analysis). There is lots of raw data available that could be manipulated using Excel or another utility to do a myriad of things. The billing data is an electronic PDF file, but people can get a copy of a tab delimited file format and use it to track billings by month. Very few people are using it for that purpose though.
D.15 FACILITIES MAINTENANCE MANAGEMENT SYSTEM (FMMS)

Background on FMMS

FMMS was needed to serve as a database to store information about all of the work requirements and needs in the region for all of the buildings with regard to repairs and maintenance requests. Peter indicated that his predecessor tracked maintenance requirements for all 400 (NR) buildings from memory. Items were often overlooked. FMMS would facilitate the tracking of this type of information.

The type of data tracked in FMMS includes ledger code assignments per building/structure to keep track of costs, including time and materials for providing maintenance and service to building facilities, per diem and travel, boiler maintenance, and environmental controls in buildings (fixed utility and equipment costs). It also tracks whether the equipment is operating and maintained properly. FMMS was implemented because the state accounting system (AKSAS) does not provide this type of information. AKSAS is used for budget reconciliation and tracking expenditures.

The FMMS database is used in the Northern and Central Regions, but is not used in the Southeast (SE) region. The SE region would like to implement FMMS in that region to help manage maintenance requests. There is a lot of location information in the system for the SE region at this time. The staff would like to be able to track costs of repairing equipment in buildings so that they know when to retire a piece of equipment or bring in new equipment that does not require as much repair and maintenance.

FMMS and TAMIS

FMMS staff inquired about the types of data that will be included in TAMIS. Anita explained that TAMIS will include a framework that identifies what assets need to be tracked to make decisions at a higher level. Data is needed to make decisions on maintenance and timing of pavement and bridge repairs, etc. Data integration points will also be identified to help make decisions across different types of assets. MAP-21 requires state DOTs to have an asset management plan in place for pavement and bridges, at a minimum, by 2015.

Some of the issues that have been identified during the interviews for the TAMIS project include those issues related to accessing information across assets. The original intent driving TAMIS was to have a Transportation Asset Management Plan (TAMP) in place by 2015 for pavement and bridges, but ADOT&PF wants to look at all assets. TAMIS will not replace existing asset management systems. Instead, TAMIS will look at what types of data are needed from other systems to help make decisions? What issues exist with getting the necessary data to make
decisions? How are data shared between systems? What are the challenges in integrating data?

**Issues related to FMMS**

FMMS was developed because of staff not being able to get information from the state accounting system other than budget or financial data. FMMS is not uniformly in place across all regions, although the Northern and Central regions have access to and manage the system. The data is housed in an Oracle database in Juneau with a web-interface and 3 servers (to support the interface). There are different business rules for use of the data in the Northern and Central regions. It is anticipated that the Southeast region will be online soon and will then have access to FMMS.

The majority of the assets maintained in FMMS are for facilities and other structures/equipment. There is needed authority from a higher level for the facilities to be tracked and the information integrated so that duplicate databases do not have to be maintained. There is duplicate data or a subset of data used for each facility as they are tracked at different levels by different departments throughout the state. There is a need to have a common ID to match up facilities across data systems throughout the state. There are facility numbers assigned to buildings called Departmental Property ID numbers assigned by the respective Procurement office for each facility. Risk Management will then assign a Risk Management Property ID number which is primarily used by the Department of Administration (DOA). There is a duplication of identification of facilities and this could be eliminated by integration with the authority database. Areas where this approach would be beneficial include the risk management property list. Northern Region currently enters all expenditures in FMMS including utility information, contractor payments, and equipment costs. Central Region does not record these expenditures as this time. DOT&PF HQ office in Juneau tracks utility data from a spreadsheet, which contains the current year’s prices with last year’s consumption in order to make projections for utility costs on a monthly basis. Central Region uses an MS Access database to track invoices for utilities, including price per kilowatt and how many kilowatts are used, while Northern Region uses an Excel spreadsheet followed by data entry into FMMS. Cost savings in dollars and cents are also being tracked so that this type of information can be reported monthly. There is also a legislative mandate to provide utility information to the Alaska Highway Commission.

**Data Collection**

There are different types of data collection activities in each region and these activities are not tied to the main FMMS system. BuySpeed Online (used to purchase parts and supplies) is not tied into FMMS either. When parts and supplies are ordered, this information is entered into FMMS, thus generating an automated numbered stock. In the Northern Region, everything is driven by a work order, which has a ledger code tied to the building or structure that the
work pertains to including equipment bills and utilities. When stock requests are
generated and then entered into Buyspeed, the Procurement office will issue a
purchase order (PO) which is entered into FMMS against the PO. When we
receive copies of invoices being paid by our Finance office, we will then entered
the invoice into FMMS against the PO. FMMS is used as a tracking and
reconciliation process to see what is outstanding and what is still needed to
project budget needs for the following month.

Is there a list of data that is in FMMS? A copy of the FMMS data dictionary was
provided to CS after the interview. The users do not interact with the relational
database and only have access to a User View of the data. This process has
evolved over the years to include users in the Central Region, but the system
originally started in the Northern Region, where there has been more success in
incorporating their databases into the FMMS system.

FMMS is used to track labor and material purchases for work orders. Northern
Region does enter costs for capital projects on facilities into FMMS. Central
Region may enter some purchases into FMMS, while others may not be entered
into the system. The other region’s process relies on the work leads to track
down the purchase orders and enter the information into FMMS. It is estimated
that only 20% of the data is entered into FMMS. Central Region’s utility data is
an MS Access database instead of in FMMS.

FMMS and AKSAS

The accounting report out of AKSAS for total labor and materials expenditures
for the year may not match FMMS; therefore, when reconciling the date from
FMMS and AKSAS audit trails, we are able to track expenditures and project the
budget for the next year. The financial data in FMMS duplicates data that is in
AKSAS, but there is no link between the two systems. For Northern Region,
FMMS has the most accurate information, so it is used as the source of
expenditures because the information is entered in FMMS before it is paid
through our Finance office. The FMMS is used to track things on a more real-
time basis. Northern Regions uses a bar-code for timesheets so that they can
scan the information into AKSAS using a wand device. Bar code sheets are
generated when utility costs are entered in FMMS. They are then scanned in by
our Finance office. The most current information for Northern Region is
entered in FMMS, where the system is used to track expenditures and it can be
used to reconcile audit reports from ALDER.

There have been discussions in the past about transferring data between FMMS
and AKSAS, and decisions were made to delay this effort until later. The plan
now is to replace AKSAS with the Integrated Resource Information System
(IRIS). The timecard information from FMMS is scanned into AKSAS in order
for the information to be processed and reallocated to the appropriate ledger
codes in the state accounting system. The flowcharts provided by Steve Rice
illustrate the manual data entry process into AKSAS. Steve provided PDF
versions of the flowcharts after this interview for review by the CS team.
Data sources and Data integration

What is the main data source for the condition of the building? They recently developed a statewide list to identify the buildings inventory and to determine the location of the buildings. The Central and Northern Regions have an Excel spreadsheet with information on each building, including the year it was built, square footage, building value, replacement cost, and accounting cost information. Another region used an inventory list only, which included a list of the buildings and where they were located. It was determined that there was no value in maintaining that list because they could not get funding for building improvements based on that list. The same information is available in FMMS, but FMMS only has the buildings included that have work being performed on them (Northern Region has all buildings (LC’s) entered in FMMS). The Excel list used in Central Region is a more comprehensive list. A comprehensive inventory list is one of the items that would be needed in TAMIS.

How do you see TAMIS helping you plan for buildings? The building itself represents a data integration point for TAMIS, however the processes used to track and share information on buildings is not uniform. There needs to be a new business process developed to facilitate tracking and sharing of information on buildings.

Conclusions

FMMS does not appear to be a system that would be part of the TAMIS framework, since it is not used statewide, is not fully populated with data, and it is not updated consistently throughout the Regions.

There is more of a need to integrate FMMS data with IRIS rather than TAMIS because FMMS data is more transactional. While FMMS could eventually be absorbed by IRIS, it is recommended that TAMIS be the authoritative source for building inventory.

While FMMS is a valuable tool to track what the requirements are for buildings, the work that needs to be done on the buildings, and the cost of doing maintenance and building repairs, it does NOT satisfy all needs for information in every region (e.g., central region budgetary information with kilowatts and utilities used).

There is also a disconnect between the building ID data and the building name, even though Central region revised their list to resolve these inconsistencies. (After this discussion, Northern Region is working on updating and providing consistency as well). Also, there are no standards for data collection.

There is a need for a “one stop shop” for all facilities information.

FMMS is focused more on business processes used to manage facilities, provide financial management, and it is targeted at the facility maintenance management level.
There are other databases used with FMMS including AKSAS, ALDER, EMS, etc., and there is also a need to integrate FMMS data more with the BuySpeed system. The FMMS system has limited life expectancy in the long-term. However, per Steve Rice, there is no plan to absorb FMMS into IRIS at this time. In a follow-up email, Steve noted that a likely scenario is growth of FMMS (i.e., include SE Region), added functionality (e.g., interfaces to IRIS and possibly other systems), and an emphasis on data consistency across all three regions.

FMMS was originally based on the Maximo system. Maximo was the original system, with a web interface developed to enter the data. The system slowly converted over from Maximo into FMMS. The system DOES contain fields to accommodate GPS/location data, but they are not currently populated.

D.16 **FEDERAL AID AGREEMENT MANAGEMENT (FAAM)**

**Background on Federal Aid Agreement Management (FAAM) System**

1. Why are these data being collected (ADOT&PF requirements, federal mandates, other)? The FAAM system is used to satisfy Federal-Aid requirements and is used to prepare the Federal-Aid agreement document for FHWA’s signature. Alaska uses their own system to prepare the Fed-Aid agreement document, which is sent to FHWA and FHWA enters the information into a master system.

2. What do you use it for (i.e., does it support asset management decisions within your department?) It is the result of asset management decisions. Project related decisions have already been made by the time the information is entered into FAAM. The Fed-Aid Team at the Program Development Division develops a federal-aid agreement, which is submitted to FHWA, to obtain needed federal dollars to start the projects.

3. Does it support any decision-making related to other areas such as capacity, safety, bridge, pavement, freight? NO, FAAM is impacted by TAMIS decisions in those business areas, but does not help make decisions in those areas.

They have ‘x’ amount of federal dollars that can be obligated to projects. Pete’s staff (Fed-Aid Agreement Team) helps to develop the Statewide Transportation Improvement Program (STIP). The Regions are queried about what projects they intend to do during the year and this information is sent to the Fed-Aid Agreement Team staff. The projects for the Regions are programmed into the STIP and funds are allocated per their estimates. A mixture of federal and state funds are identified and documented in an Excel spreadsheet. If the project estimates are over the amount available, then senior management determines the priorities for projects based on 5 program areas: (1) NHS, (2) AHS, (3) Community Transportation Program (CTP), (4) TRAC (formerly Alaska trails),
and Required projects (i.e., HPMS data collection, access statistics, planning studies, ITS, and projects that are not required but do not fit into any other category). This information is not coming from FAAM system itself, this is a description of how the project prioritization process occurs.

4. What types of data are included in the system (i.e., does it contain inventory data that could be used for asset management purposes)? No, FAAM does not contain inventory data (only inventory-related data would be road termini type data for projects). FAAM is used to keep track of funds that are obligated, not expended.

5. Is the system used on a Statewide or Regional basis? Neither, only the HQ staff are allowed to update data in FAAM. The Project Delivery Authorization (PDA) form is used to identify how much money is needed and also the legislative authority used for the funds. The PDA form includes information on the termini of roads within a project, and the scope of the project. They are developing a FAAM version of the document electronically so that they can transfer the information into the Federal-Aid Agreement document.

6. How often is the data updated (i.e., in real-time or on a periodic basis)? Data is updated periodically, as needed for projects. It is saved in FAAM and data is also transferred to the Management Reporting System (MRS).

7. Is the system supported by adequate resources (i.e., are there resources for data updates or system improvements)? Yes, FAAM has sufficient resources for support.

8. Are there plans for future retirement/replacement of the system? If so, when? No, there are no plans to retire/replace the FAAM system.

Data storage

It is believed that FAAM is stored in a Oracle database. It was designed and is hosted by a contractor, using some proprietary software. The contractor (Applied MicroSystems, Inc.) also hosts applications for the municipality of Anchorage.

Documentation

There is a user manual for FAAM, but it needs to be updated because FAAM has been updated over the last year. Also, Liz Balstad (Fed-Aid Team) and the contractor are still working on a data dictionary for FAAM.

The primary users of FAAM are the Federal-Aid Team in the Program Development Division.

Conclusion: FAAM documents the results of TAMIS decisions, and is not used to help make TAMIS decisions. Use of the system is also very restricted to HQ staff only. However, due to the link of the FAAM with the MRS system, which is a recommended TAMIS system, it is recommended that FAAM be considered as a Tier 3 application for TAMIS.
D.17 **FLEET CONDITION SURVEY**

**How the System Relates to TAMIS**

Troy is not the main contact person but was involved in the development of the system. Troy will send us a contact within the Marine Engineering Department.

It is an Access database that resided on the Ketchikan server. It houses long-term maintenance and improvement needs for the 11 vessels in the fleet. Each vessel undergoes an overhaul every year. The database captures items that were not done during overhaul period, either because it can’t be done or is cost prohibitive. Typically, they will pick two ships each year to conduct deferred maintenance improvements as part of their federally-funded capital improvement project program. This will rotate by year depending on what the needs are. If an item is not done during one year, it will be included in the Fleet Condition Survey for deferred maintenance. The FCS includes items like certain mandatory upgrades (fire insulation, doors have to have a certain type of air vent), ships radars are old and need to be updated, flooring in the pursers area needs to be replaced, item cost, and priority of item (ranked between 1 – 5; 1 is safety required, 5 is nice to have).

Typically, one user at a time has access to the system.

Any connections to other databases (#14)? Right now, there are none. It does not have download/upload capabilities with other systems.

Any federal/state requirements governing need for database (#1)? There are not currently any state or federal mandates to use the database, but it’s how AMHS prioritizes needs for different vessels.

Is the system used for performance targets (#6)? When putting together projects, they would run a report of current items in the FCS database to see what the priority items are and how much it would cost to address them. Priority 1 would be the highest, then going down depending on funding available. Troy isn’t sure whether there are any external performance criteria.

Is there a regular process for doing the survey (#8)? They try to do an update annually. Reports are generated annually.

Ongoing resources available (#9)? The current database was developed in 2006 and has been enhanced since that time. They want to get the Ship Maintenance Requests (SMR) integrated into the Fleet Condition Survey (FCS) system. However, there would need to be some kind of checks and balances system for this type of integration so that the FSC is not corrupted by people with special interests. They used to pay a consultant to do the FCS, but they were not deploying it for making good business decisions, and now they have someone that is responsible for maintaining it each year. They are getting back to where they would print out paper copies from the system for everyone’s use instead of using electronic reports.
Plans for future retirement/replacement of the system (#10)? There are no plans to retire system anytime soon.

**Data Integration Points**

Are there any users of the FCS database outside of AMHS (#11)? It is used to justify funding to legislators.

Are you integrating data from any other sources (#14)? There are pictures and diagrams associated with different items. Everything they need comes out of the FCS.

What significant changes are planned (e.g., data collection, collection, dissemination, usage) (#15)? Not actively at this point. There have been discussions with aviation folks, who are currently using laptops for inventory at airports. It may be beneficial to develop a similar system (e.g., documented on a tablet). There is no system like that now; it is all done on paper.

What quality assurance processes are used? Some items tend to remain in the FCS database for awhile, even after it has been accomplished. They have to periodically go through the data to see if items still need to be addressed or if they have been completed (through other maintenance work). This is done manually by talking to the crew on a vessel or checking with the person who goes out to a vessel. It is a very time consuming process.

Is the database linked to any other data system (#31)? There really isn’t any integration to any other data system. They do integrate the FCS data to a specific location on the vessel using a grid system to describe where the item is located. The grid system is unique to each individual ship.

Are these data redundant with any other data systems (#32)? Some items could be redundant with the SMR system, and possibly AMOS. This is done because some things don’t get recorded in FCS, so they choose to have data in both places to serve as a double-check.

Is there any documentation available (#35)? There was a manual. Troy will see if he can locate it and send it to us. Include this request in a follow-up email to him. Per 9/6/13 email from Troy: unfortunately, no manual for the Fleet Condition Survey database exists. There was one for the original database design, but the database has been modified and reconfigured to a point where the original manual is not applicable. AMHS may elect to have one developed to assist the users of the database, but this will take some time.

**Use Cases**

How are the data accessed (#37)? FCS is an Access database that is accessed from individual laptops. A few years ago, all data and reports were put in a single file. Now, there are separate files for data and reports.
Are there restrictions for ownership/gatekeep controls (#45)? There are no restrictions for people to access the database. This is probably a need. They also need a better way for keeping a backup copy.

How are the data reported (#38)? The electronic information that was put out wasn’t used, so they went back to printed format.

Who do you pass the data along to (#50)? The main data providers are the people on the ship and the vessel construction manager. The main users would be the senior vessel construction manager and the marine engineering manager.

D.18 GEOTECHNICAL ASSETS

Overview of Geotechnical Asset Management Program

Geotechnical asset management (GAM) is relatively new, and it was first mentioned in research in 2002. Dave became interested in TAM in 2008, and he quickly realized that no one was talking about geotechnical assets. He embarked on a program to bring GAM into the forefront at ADOT&PF, and it has turned into a national effort.

There is a large group of geotechnical professionals working on GAM to bring it into agency decision making. Dave is currently working on 3 STIP projects related to GAM, and the individual projects are in various stage of development:

- Material Site Management. The inventory part of this project is finishing up soon. It involves developing a material site inventory and associated documentation available under external design and construction services, as well as a statement management resources website.

- Unstable Slope Management – They have an unstable slope database created and tested. It started before the GAM program started and is presently populated with the top 200 worst slopes in the state. In the last 2 years, they have worked hard to develop the asset management and performance management components, which will be done by the end of 2014. They will be developing a publicly accessible website as well.

- Retaining Walls Management. There is not as much need for managing retaining wall data, so program development has been slower. They are developing a data dictionary and inventory, but the project is likely to move at a slower pace because there is not as much risk in this area in terms of maintenance management efforts.

Dave would be happy to meet with CS face to face and walk us through the entire program.

Materials Site Inventory

A link to the Materials Site Inventory is available through the following website: http://www.dot.state.ak.us/stwddes/desmaterials/matsiteportal/welcome.shtm
ml. They looked at the ROW section files and Materials section files for the region, and the inventory is a snapshot of what the contractor found when reviewing the files and what was observed during field investigations. They did an inspection for all material sites (e.g., quarries, borrow, pits, etc.) with the potential for further development, then they did inspection reports for each individual site. There are about 2,600 materials sites on the road system, and about 900 of these are active sites.

The information about materials sites in the inventory is at a planning and design level – primarily where the sites are, permit status, quantity and quality of materials and other site details – and is intended for internal staff use. If a user needs more specific information for a site, they can go to the regional materials sections to view files.

How often are the sites inventoried and kept up to date? Site information is updated as ADOT&PF comes to them for projects. A snapshot for each site was created at Headquarters, and it is up to the regions to keep the information updated. Regions are the owners of the files. Training will be conducted to raise awareness and encourage use of the files at the regional level.

The materials site characteristics have already been inventoried, so there is not a lot to do in terms of TAM. The idea is to get information to the Planning group at project inception for planning and design so they can see where there are gaps and where they are lacking materials. For example, on the Dalton Highway there are sections with no material sites for up to 20 miles. They plan to use the program to locate project extents and determine the quality and quantity of materials and whether they have control of the materials in place.

The implementation plan for the Materials Site Inventory involves educating users that the tool is available and demonstrate it to them. They plan to do a roadshow of the tool and demonstration to Planning staff.

Unstable Slope Management Program

The Unstable Slope Management Program (USMP) database is currently in MS Access format and resides on the contractor’s server, however work is underway to migrate the USMP database to Statewide GIS on the Oracle database. There are 200 individual rated sites with rock or soil slopes around the state. There may be an additional 1,500 to 2,000 slopes remaining to be rated. Each location is rated by hazard and risk ratings. The referencing system is based on milepoint and lat/long. The database includes physical data on the height of the slope, the kind of rock on the slope, the potential hazard (e.g., rock slide, land slide), a physical engineering description of the slope, and risk related items that have to do with site distance, line of site, and the length of the slope (i.e., how long vehicles are exposed in the hazard zone). Hazard and risk are rated separately but combined into a single score. The higher the number, the greater hazard and risk for the slope. The rating number is accentuated by scale (e.g., 3, 9, 27, 81). Ratings are done by trained observers (e.g., geologists or engineers with
knowledge of slope issues). ADOT&PF runs reports based on the ratings in the database to compare and rank sites.

They are using the new PhotoLog Viewer (video log) to conduct preliminary research and pull milepoint and lat/long coordinates for each site, and they are starting to collect some data from M&O staff. SE Region has been developing a way for M&O staff to do incident reporting. Some information can be extracted from MMS, but it is pretty spotty around the state on how well MMS is being used. The MMS has a single category for rock slide and landslide cleanup. They need a means to get the incident reports so they can establish the frequency and size/cost of hazardous occurrences. Once they have an incident report, the Materials staff can go out and do a slope rating and enter it into the database.

Drew is also developing an ArcGIS map (USMP ArcGIS map) that will eventually go on a public facing website.

Washington DOT has an Unstable Slope Management system in place, but they tend to be reactive and wait for unstable slopes to occur. Alaska is more proactive, plans to rate all slopes with any indication of instability, and has implemented a watch system. Staff update the information whenever they go to the site.

They are creating a condition index that could be applied to an individual slope, a set of slopes, a corridor, an area, etc. This would allow them to compare geotechnical assets with other assets like bridge and pavement. They are doing a pilot in the Tongass Highway corridor in Ketchikan, and they are rating all slopes and collecting or developing condition indices (0 – 100) for all assets (e.g., bridges, culverts, pavement, ROW) critical to decision-making. They are trying to engage the Planning Section to plan projects based on the condition of all assets together in order to determine where projects should be built.

The initial idea for corridor management was to do a corridor pilot for the Parks Highway. Dave developed a data collection project to demonstrate the ability to collect critical data and offer access to it through a GIS map-based webpage with links to all the data they could get for the corridor. The effort was successful. At the same time, the corridor management pilot was discussed but never fully developed. The pilot corridor management project is presently again under consideration by the TAM staff. Dave is doing his own thing in terms of making the corridor concept work with emphasis on geotechnical assets, but including others as well. He is mining data from other functional groups as he and the staff can find it and link to it. Dave has geotechnical, risk management and TAM consultants working on the project with the Southeast Region Materials group.

### Retaining Walls Inventory

The Retaining Walls Inventory has a partially developed database and a data dictionary in spreadsheet format. The data is presently being plotted on a GIS map that will eventually be linked with the GeoDatabase and a DOT&PF enterprise database. Data elements include the retaining wall location, physical
characteristics, height, design type, and material (e.g., modular, concrete wall, etc.). Construction personnel mine as-builts to gather information for retaining walls and enter it into the database with links to the as-built files. Retired staff may be used as consultants to help with the data mining, so they can provide anecdotal information on walls and problem areas. They will eventually hire a consultant to develop the full inventory. Re-rating or condition surveying of walls will be done probably by regional staff (or consultants) at long intervals (e.g., every 5 to 10 years).

Is there a way to monitor as-builts so that the inventory can be updated accordingly? They will eventually ask for STIP funding to do yearly updates or ongoing updates when they develop a new material site or update material site. They anticipate they would need $100,000 – 200,000 per year, and the regions would be responsible for the updates. [Regarding updating inventory with new as-builts: we are considering a new special provision to provide inventory and condition surveys of selected assets as construction projects are completed. Not much progress on this yet.]

**GeoDatabase**

There is a proposed enterprise geotechnical data database that would serve as the statewide database for all geotechnical data. ADOT&PF polled all critical materials staff around the state and they agreed to do this. Drew and Statewide GIS are creating an enterprise ArcGIS map with connections to all subsidiary databases. The GeoDatabase is expected to eventually be absorbed into an enterprise database for the Department. The goal is to have all geotechnical databases linked. There is general agreement among staff that they want to do this, but there is not a funded project in place.

Dave is working with Drew to develop an ArcGIS map interface for all projects they do. These data maps would have several layers, and users could select a link and access a database or spreadsheet to view detailed data for that asset.

**Wrap-up**

Dave is currently training 2 geologists on his staff, and he is trying to get the programs up and running, the architectures built, and the inventory developed as much as possible before he retires.

Are there any known technical or institutional issues with integrating data from these data programs? The biggest institutional problem is recognition that geotechnical assets are important. Dave has a saying: all structures are supported by soil or rock (i.e., geotechnical assets) – if not, they would float, fly or fall over. Many roadways in the northern region are built on permafrost. The pavement can last for 25-30 years, and much of the state’s pavement is already at that age. However, embankments over frozen ground generally only last 7-10 years. Therefore, when the embankment fails, they are throwing away about 20 years of pavement life. This is an enormous waste of money, but it is not often
talked about. The goal of GAM is to support decision-making. If designs for embankments and pavement are tuned, they could spend less money on paving and more money on embankments to reduce costs.

For slopes, there are several instances in which unstable slopes have closed roads. For example, the Whittier rockslide closed the road into Whittier, and the only access was via railroad. This essentially closed the road and town of Whittier at the beginning of tourist season. It was a huge cost to repair, and the cost of not having the road open was significant. There are lots of smaller incidents where a road is closed for half a day. ADOT&PF has had 3 contractor personnel killed in rockfalls, but no one from the public yet. While this is a good thing, it has been a hindrance to people realizing the importance of this issue.

Dave is conducting research on GAM at the national level through TRB.

Dave recommends using condition indices and health indices that combine different conditions or set of assets for a corridor and using it as a higher level tool to indicate performance issues. This is more powerful than presenting geotechnical information alone. Data is important because it feeds into condition indices, but Dave does not recommend using data itself to tell a story.

A sign inventory is not needed every year. Signs last long enough to be replaced when they rebuild a road. Geotechnical assets do not need to be inventoried each year either, but they need to determine which data elements are most critical (e.g., height of slope, how much water is in the slope, etc.) and how often they should be rated or surveyed.

What is your vision for geotechnical asset management within the TAMIS framework, or what message do you want to bring forward? Accessibility of the TAMIS architecture is important; it has to be easy to get to the data you are looking for. Condition indices are most important and will allow comprehensive management of assets at a higher level rather than within a particular asset class.

What type of geotechnical decisions are made at a higher executive level? From a policy standpoint, if you have a group of slopes in a corridor, it would be desirable to have a group of slopes at a condition level that will keep the performance of corridor where we want it to be. For example, bridges and pavement are both very expensive assets, but which one is more important? Pavement is the most visible asset, and ADOT&PF receives lots of calls from the public about pavement conditions. However, if you don’t have a bridge crossing, you cut off access to critical areas. A risk based approach is important here.

Dave has a research project on incorporating risk into geotechnical asset management. The project involves incorporating risk cost into a group of assets or along a corridor. The work will be complete by December 2014, and the communication and implementation plan for training and conference papers will be completed in 2015.
Users have to understand what can be done with data, and what are the most important pieces of data in the system. It is an iterative process.

Dave will send CS some PowerPoint presentations and a bibliography of additional research papers (reference list with links). He has a GAM webpage under development that will have links to various materials. He will also send CS some scopes of geotechnical asset management work. Wyoming maintains a list of corridor needs and shows what funding levels are needed to improve condition, let stay the same, or deteriorate. The TRB Geotechnical Asset Management Subcommittee AFP10(2) website is also a good resource (https://sites.google.com/site/trbcommitteeafp10/Welcome/geotechnical-asset-management-subcommittee).

Mitch McDonald with the Southeast Materials Group has been working to get slope rating information, and he will have good information in the next few months. Dave will send CS a copy of the scope. (DONE)

**D.19 GRANT MANAGEMENT & PROGRAM ADMINISTRATION SYSTEM (GMPAS)**

GMPAS is a hosted system supported by Panther International (located in Florida). Panther Int’l is responsible for maintaining the secured servers which are external to the DOT&PF. The database and servers are not maintained by the DOT&PF staff.

The GMPAS system is a new system, being implemented as separate modules, and it replaces an older system that had (transit) vehicle inventory data only, but no grant management capabilities. The GMPAS system is used to manage grants from the FTA and other funding sources, in support of transit operations in Alaska. The governor’s Community and Public Transportation Advisory Board also uses the data for decision-making.

The new GMPAS system includes the following components: (1) application and review process, (2) allocations and grant agreements, and (3) vehicle inventory (transit vehicles). They hold a lien on the vehicles for the federal interest period. The types of transit vehicles include buses, cut-aways, min-vans, sedans and support vehicles such as trucks used for snow removal at bus stops. The vehicles are used for general public transportation, and cut-aways are used to help transport seniors and the disabled. Some of the accessible mini-vans are leased to taxi-cab companies for accessible rides, and some of the sedans are used for one-on-one transportation by different agencies (to assist with any type of disability).

The GMPAS system is being implemented in phases, so the user guide is not complete, but they will forward us a copy of existing documentation.

Why are these data being collected (ADOT&PF requirements, federal mandates, other)? For the most part, the data is collected because of Federal Transit
Administration (FTA) requirements and requirements of the Alaska Mental Health Trust Authority. The data is used to meet federal reporting requirements for transit related programs and to meet state reporting requirements. They generate standard reports and ad-hoc reports as needed to meet those reporting requirements.

What do you use it for (i.e., does it support asset management decisions within your department?) To support management of transit related assets. The funding source determines how the funds are delivered. For example, using FTA funds, under category 5311, the funds disbursed are formula-based using ridership, population and mileage information, for category 5310, the funds are based on human service needs and available funding. Both of these categories take into consideration whether or not vehicle replacement is needed, or are more vehicles needed? They evaluate when was the last time that a particular type of service program got a new vehicle? The operations side of these programs are funded through other sources. They also get matching funds from the state as part of the state General Fund.

Does it support any decision-making related to other areas such as capacity, safety, bridge, pavement, freight? No decision-making is done related to these categories. Some of the decision-making would be done at the community and transportation advisory board level, including evaluating what are the ridership details? (number of riders, mileage, etc.)

What types of data are included in the system (i.e., does it contain inventory data that could be used for asset management purposes)? The system includes performance-based data (e.g., ridership, mileage, operating cost, expenditures to date, funding data (dollars/ride)) and is not used for asset management at the Department. **It is used for transit management in the state.**

Is the system used on a Statewide or Regional basis? The system is not used by DOT staff on a statewide basis, but is used statewide by the sub-recipients who update data in the system. It is used for cradle to grave grant management and to maintain the cradle to grave vehicles inventory. There are currently only 3 people at the DOT doing transit management for the state. They are located in the Program Development Division in Juneau.

How often is the data updated (i.e., in real-time or on a periodic basis)? At a minimum, the performance data is updated quarterly, but data can be updated in real-time as needed. There are no automated systems feeding data into GMPAS. It does NOT have links to other systems now, but will be using data extracts from IRIS (sometime in 2014?) for grant data in the future. They are currently using the AKSAS system for this type of data.

Is the system supported by adequate resources (i.e., are there resources for data updates or system improvements)? Yes for now, and everyone has been involved in the evolving process to implement GMPAS. They will be adding one person to help maintain the system.
Are there plans for future retirement/replacement of the system? If so, when? GMPAS is the new system that replaces the old system (primarily used for vehicle inventory, but no grant management capability). That function had to be done manually using Excel spreadsheets, but this function is now part of the GMPAS system.

**Conclusion:** While the GMPAS program is not considered a key system for enterprise asset management (Tier 1) for TAMIS, it could be considered a Tier 2 application for TAMIS, in that it is used to manage transit assets for a specific business area although no direct link with other DOT systems, does have links with AKSAS and will have links with IRIS.

### D.20 Highway Performance Monitoring System (HPMS)

What do you see as the role/connection between HPMS and TAMIS? HPMS is essentially an asset management system for the federal government. It is used as a management system for data on the use and condition of roads in the country. The data is a sampling only, so it may not be at the granularity needed to support TAMIS. They are aggregating the data at the level needed for HPMS, so TAMIS may be better off getting the data from the original databases (e.g., traffic, pavement, urban boundaries) and not from HPMS. HPMS should be treated as a report used for national level reporting.

**Conclusion:** HPMS is a reporting system that integrates and summarizes data from other systems (e.g., pavement, traffic, roadway features). It should NOT be part of TAMIS.

### D.21 Integrated Resource Information System (IRIS)

This interview focused on a high-level discussion of the documents that Steve sent us and how IRIS will replace those systems.

The following systems are under consideration for replacement by IRIS:

- Third Party Billing System (TPBS)
- BuySpeed
- Equipment Management System (EMS) (FMP is potentially going to be replaced as well - they are still in talks). In a follow-up email, Steve Rice noted that EMS is not going to be replaced by IRIS. It will have multiple inbound/outbound interfaces with IRIS. The functionality of FMP will be included in IRIS, although FMP will be retained for historical look-up purposes.
- Revenue Accounting System (RAS) – RAS has dual functionality. Part of it is related to airport property management, and that functionality will be addressed by a system that the airports are in the process of procuring (PROPworks). The other part of RAS relates to accounts receivables and will be part of IRIS.
- PeachTree
- SumTotal
- PCIS – The current plan is to eliminate, not replace, PCIS.

The documents represent a high level overview of the IRIS interface and inputs/outputs to various DOT systems. The purpose was to identify the various integration points between DOT systems (e.g., AKSAS, AKPAY) and determine what will be impacted by IRIS.

IRIS doesn’t include the data systems that CS is interested in. We envision developing a similar structure for TAMIS, but PMS and bridge aren’t included in the list for IRIS.

What will be included in IRIS and what will be impacted by TAMIS? IRIS is a financial procurement and HR management enterprise system. It will contain all requisitions, purchase orders, and information about what is being purchased. The link between TAMIS and IRIS could be to conduct financial analyses (e.g., cost of sand storage building, cost to build a new one, cost if don’t have the building, cost if do have the building, cost to move sand over the winter). The system could also be used for reporting and billing for all federal projects (e.g., FHWA, FTA, etc.) and to track project delivery, project overages, and comparison of estimated vs. actual cost of a project. The system could also track fixed asset values of construction projects as they are built (i.e., for a 3 year project, the fixed asset will gain value each year as it becomes built). The fixed asset piece could also be used for TAMIS. All data reporting/analysis of IRIS data will be extracted from the State’s data warehouse system, ALDER. In conjunction with the IRIS project, a new release of ALDER will be made available – ALDER 2.0.

If TAMIS includes HR, payroll, and resources, the Human Resources side could also be included.

Is there any documentation on users, key data elements, etc. for IRIS? Everything pertaining to IRIS is available on the DOA IRIS Sharepoint site: [http://intra.dof.doa.alaska.gov/sites/iris/SitePages/Home.aspx](http://intra.dof.doa.alaska.gov/sites/iris/SitePages/Home.aspx).

What is vision for IRIS within the TAMIS framework? IRIS will provide information to critical parts of TAMIS like the Management Reporting System (MRS). IRIS will also interface with several systems in TAMIS, such as MMS and State Equipment Fleet information. These interfaces have been identified, and analysis is being completed. Financial and purchasing information are two of the biggest areas that would benefit from TAMIS. However, these systems would
have a supporting role compared to, say, the Pavement Management System (PMS).

IRIS will link to the following systems: MMS, EMS, LIBRA, LP, MRS, eParcels, and the Rural Airport Badging System (RABS) (they are working on the RFP now, and this system should have an interface to IRIS). In a follow-up email, Steve noted that Libra, LP and Peachtree are not currently scheduled to be included in Phase I. They will be addressed at a later date. Peachtree functionality will eventually be addressed by IRIS; LP and Libra will then interface with IRIS, and Peachtree will go away.

What will be the key integration point for assets (i.e., how will data be integrated in IRIS, and how will it share data with other databases)? It is anticipated that the connection will be via financial coding information. The exact data element is yet to be determined; they are in the build phase right now and are trying to answer that question. It could be based on ledger codes, project numbers, or co-location codes. However, they anticipate that there will be no ledger codes or co-location codes in IRIS.

What type of data is in IRIS and what is the timing? January 1, 2016 is the due date for the Phase 2 HR component on the payroll side.

Who has authority to enter data into IRIS? There are over 1,000 employees in the Department who will have access to IRIS, including accounting clerks, admin assistants, pursers/stewards, PMs, airport leasing, budget analysts, accountants, and procurement specialists. There are 400 users with access to BuySpeed on the procurement side, and another 400 users on the financial side. There is a very widespread user base that is inputting data, including requests for purchasing, coding for travel, pay bills, handling accounts receivable, etc. They anticipate that the work flow will change with IRIS, but they are not sure how. However, based on the number of users today, IRIS will have approximately 800-1000 users.

There is a module to manage all state training of the 3,500 employees within DOT.

Any desire to replace MMS is premature at this point. They will have to make sure MMS can interface to IRIS by July 1, 2014.

CS determined during this interview that more time is required to review the flowcharts sent to us by Steve Rice and also the scanned in documents from April 29, 2013 that Steve gave to Anita at the meeting in March 2013.

CS will contact Amanda and Steve for a follow-up interview after September 16, 2013 (at the recommendation of Amanda). At that time, recommendations on the inbound and outbound interfaces for IRIS will be identified and there will also be recommendations on the security of data in IRIS and the workflow regarding TAMIS. (Complete)

In a follow-up email, Steve noted that all MMS interfaces have been identified.
Follow-up Interview

There are two aspects to IRIS implementation: IRIS at ADOT&PF and IRIS for the entire state of Alaska. They found that there is going to be some baseline functionality in IRIS that won’t meet DOT’s needs, and they have been meeting intensively with DOT stakeholders to identify what these issues might be and how to resolve them.

Abdul Quayyum is the project manager under contract from Dye Management Group, and he has done 30 BRP implementations. He created a work plan that estimates that 28,000 hours of staff time will be required between now and June 30, 2015 to get IRIS up and running. The focus is to get through the data conversions, training, and interfaces by July 1, 2015.

There are two areas that could be helpful for TAMIS, and there is probably no need to physically connect between IRIS and TAMIS.

- **The money side of grants and projects.** Information on how much is spent on certain projects could be pulled from IRIS. (This information will actually be pulled from ALDER 2.0).

- **The fixed assets arena.** IRIS will record all State of Alaska assets above a threshold value of $100,000. DOT has reached an agreement with the IRIS team to have their own category for assets between $5,000 and $100,000, since ADOT&PF is required to report this information to the feds. These assets could include equipment, big rigs, and some facilities. Ferries will be above the $100,000 threshold. As they are building a road, IRIS can be used to calculate the fixed asset value based on how much has been spent and progress of construction. A fixed asset value could then be assigned to individual pieces of the project that are constructed, as they are constructed. IRIS should be able to do this for all asset types, including ferries, bridges, roads, and buildings.

IRIS will include interfaces with the following data systems:

- EMS
- MMS
- MRS
- eParcels
- Rural Airport Badging System (RABS) (still need RFP, so future)
- Airport Information System

The following data systems will be converted to IRIS:

- Third party billing information
- Fixed asset information for EMS
- Customer information from Revenue Accounting System
• Time and Equipment (T&E), although the contractor will need to modify the
  system to accommodate T&E.
ADOT&PF will stop using the following data systems once IRIS is implemented:
• The Project Control Information System (PCIS) will be decommissioned after
  IRIS is implemented.
• They won’t convert BuySpeed. They will quit using BuySpeed on 6/30 for
  new transactions (although BuySpeed will be used for historical lookups and
  open transactions will be completed) and will start using IRIS on 7/1 for all
  new transactions. However, they will have to pull vendor information from
  BuySpeed and manually enter it into IRIS.
• SumTotal is a learning management system that is hosted off site. As soon as
  the Learning Management System comes online with IRIS, they will
  discontinue their contract with SumTotal. They will do a data dump of all
  training classes and load this information into IRIS.
• RAS – they may keep RAS for awhile for historical purposes, but they won’t
  be using it.
• FMP – will be retained for historical lookup, but no further utilization.

Peachtree connects to LP, Libra, and Metrology lab. They will keep Peachtree
running as is and will enter information into IRIS after implementation. Then
will address the Peachtree issue. In a follow-up email, Steve noted that Libra, LP
and Peachtree are not currently scheduled to be included in Phase I. They will be
addressed at a later date. Peachtree functionality will eventually be addressed by
IRIS; LP and Libra will then interface with IRIS, and then Peachtree will be
decommissioned.

FTA grants is in the process of implementing a Grant Management System. This
may need to talk to IRIS, but they are looking into this.

***CS will follow up with Amanda and Steve in a month to get another update
once they get the work plan set up. Amanda is planning to develop an Intranet
site to provide more regular updates on IRIS implementation to ADOT&PF staff.

D.22   LIBRA

Background on Libra

Why is the data for Libra collected? The data for Libra is collected to comply with
the regulation requirement that commercial weighing and measuring devices be
registered with the state. There is a fee associated with the use of this type of
equipment for commercial purposes when used by device owners. The legal
requirements for weights and measures are specified in Alaska law AS4575.

What is the data used for in your area? (i.e., does it support asset management
decisions within your department)? The Libra database is used to track the
18,000 – 20,000 devices in the state and to process billing on an annual cycle. There is a quarterly registration cycle for devices, which adds/subtracts devices throughout the year. The devices are tracked by serial number, owner, company and location. Tests are performed every year to ensure that the devices are accurate and that inspection requirements are met for the type of device. There is also a field in the database to monitor the type of device and the inspection data. The data is retained for several years.

Libra is also used to keep compliance records and to forecast the amount of capital/operating funding needed to keep up with the trends in business (e.g., certain type of device in demand may require more resources). The data is used in quarterly reports to show the legislature or interested commerce stakeholders the current trends and how much activity occurs in one area vs. another. For instance, the reports can be used to determine if more equipment is needed to support the fishing industry by calculating the money needed to travel to the areas where the fishing is located. The data also allows for analysis regarding airport expansion projects, highway construction projects, and if a gas pipeline project goes through, they can project the amount of time to be spent on the haul rode.

Libra does not itself have travel forecasting or budget forecasting capabilities, but the data can be used for these purposes by other applications, such as the Peachtree database that is used for billing. The data is extracted from Libra and converted for use in Peachtree for billing purposes and to generate certificates for those who have paid their required fees. The IT staff handles the extraction of data from Libra and integration into Peachtree. The Peachtree database is then used by the accounts clerk to send out bills for each billing cycle. The IT staff and the accounts receivable staff are the primary users of the system.

Could the system be used to support TAM performance measures, which support National Performance Goals (e.g., capacity, safety, bridge, pavement, redundancy, freight)? The weights and measures data is not used to support any national performance goals other than as the data pertains to national conferences on weights and measures, which is not in the transportation realm.

The Libra system is used on a statewide basis and the data is updated in real-time. They do have weigh stations and WIM scales that are set up throughout the state to monitor freight loads. Libra is not used to track the WIM scales, but annual tests are performed to assess the scale accuracy for the seven weigh stations in the state.

**Data Collection**

Who enters data into Libra? The trained staff of eleven inspectors enters data into Libra. They test the devices and add/subtract businesses as needed, update the inspection data, and make corrections to field findings regarding device locations and condition.
What type of training is provided for data collectors? There is a 2-3 page manual that was produced by the Libra system developer. They will provide a copy of the manual (DONE). New employees are provided with the training manual and basically do on the job training with someone who knows the system. The system is not very complicated, so it is easy to use and there are staff meetings held to refresh everyone’s knowledge on the system details.

**Data Storage**

The Libra data is stored in a Microsoft (MS) SQL server database and they can provide a copy of the SQL server diagrams. The data is used to generate canned crystal reports that are built into the application. They will provide the sample reports that are generated from the Libra database.

Jeremy’s involvement with the system is relatively new and documentation for each system is being accumulated to develop a roadmap of the data. There is no data dictionary available.

Is any of the Libra data redundant in other systems? No, the MS SQL server database is the sole repository for the Libra data. Peachtree would be the only other database with similar data used for billing purposes.

**Data Quality**

Are there any quality control processes used for Libra? There are not any embedded processes in the Libra system to check for data quality. It is the responsibility of the inspectors to make sure that the data is correct. There are supervisory reviews of the data from time to time to ensure that there are no glaring errors. Some billing errors are found during the billing cycles when device owners respond to bills indicating that they have more or fewer devices than those indicated on the bill, or that the bill may contain an incorrect serial number for a device.

The data collection/inspection report is completed on paper. The printout generated from the Libra system is used to identify the correct location of the device for the inspectors. The inspectors verify that corrections from the last inspection have been made, and they provide signed copies of the inspection reports to the device owners, and then complete the data entry into Libra.

There is some discussion of streamlining the data entry process in the field. There is a 2-3 week backlog if the inspector is out in the field and cannot do the data entry.

**Referencing System**

What type of referencing system is used? Each device is assigned a device ID number, which is used more for billing purposes than for location identification. Inspectors use address information (city, street, state) for the location of devices.
A device ID is assigned based on the serial number and a number used for billing.

There is an inventory list maintained of scales that are checked. There is also an inventory of businesses that are certifying the devices (it does NOT include any state owned assets, except for the seven weigh stations).

**Use Cases**

The Libra data probably needs to be in the state accounting system (AKSAS) where it can be used by a broader group of stakeholders, but it is not currently directly tied to AKSAS. There is, however, a link between Libra and Peachtree, whereby the accounts receivable and administrative staff all have access to Peachtree.

Are there any restrictions on sharing the data? Lawyers help identify what information is requested/provided related to law enforcement. They do not release pass/fail information pertaining to the scales/meters devices.

Are there any other users? They sometimes receive Freedom of Information (FOI) act requests for information in the Libra database, but there is no other specific entity using the data.

**Future Plans for Libra**

Future plans for the Libra system include developing a possible link to the Integrated Resource Information System (IRIS) to track financial data, but the Libra system will not be incorporated into IRIS. The IRIS system will however, replace Peachtree. There are no plans for enhancements to the Libra system except for general maintenance. However, they may include new features like enabling iPAD users.

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**D.23 LOCAL PERMITS (LP)**

**Background on LP**

Susan Adkison provided the following information on the Local Permits (LP) system, which is used to issue permits to commercial vehicles.

The LP system is used to store information on large commercial loads using the roads. Examples of this includes houses being relocated, or large excavator equipment being relocated with escort vehicles in the travel caravan. Dimensional data is also collected including the length, width, height, weight, number of axles on the hauling vehicle and the route (begin and end points) traveled.

How many people are accessing and using the LP system on a regular basis? There is public and internal access to the LP system. The carriers use a link to LP via the myAlaska website (i.e., the extended online permitting (XOP)
application). Here, the carriers can login to obtain certain types of permits within certain dimensions and they can pay for the permit online. If the carrier vehicle exceeds the size limitations for obtaining permits online, the carrier can send the permit request via the myAlaska website, fax to the office in Anchorage, or deliver the request in person.

There are five staff responsible for issuing the permits at the Anchorage office, including Susan. The permits are issued for all on-system and off-system roads and for all bridges that are inspected. They have to review the overweight loads going across the bridges.

**LP System Architecture**

The LP database is stored in SQL server and it is used to serve two applications. There is the LP application used by the permit staff to generate permits and an extended online permitting (XOP) application available on the web. The XOP application is protected by user restrictions. The public can self-issue a permit within certain criteria using the LP (XOP) system available on the myAlaska website. They can request a PDF copy of the permit and they can also query PDFs of permits.

The location referencing information for the permits includes an origin/destination location (which are addressed-based) and an LP number.

**Other Systems Interfaces**

Do other offices have access to the LP database? Not to the LP program itself, although the myAlaska website can be used to obtain a PDF copy of permits.

There is a threshold over which they involve other offices, but only on a rare basis, not day to day. For instance, with the MEA Power Plan project, the DOT ROW and Pavement Management groups were involved because the movement of diesel engines also involves the power plant. Actually, these agencies were involved due to the request to fill in the median on the Glenn Hwy so that the Super Load may cross the highway to the power plant.

Does anyone request information regarding permits from a TAM perspective? The bridge design group at the DOT is involved from a TAM perspective as the primary owners of the Alaska Bridge Analysis System (AKBAS). The AKBAS system (from the bridge management area) is used to determine if an overweight load can travel safely over a bridge.

AKBAS needs to be added to the list of systems to be evaluated for TAMIS. It is part of the Bridge Management system. It is separate from PONTIS and was custom built by a contractor. It was originally built in MS Access and eventually an interface was developed with the LP program. Gary Scarborough is their contact for the AKBAS program. Also, Richard (Rich) Pratt (bridge design manager) can provide information on AKBAS. The bridges have to be inspected every two years and any new information related to a bridge is entered into
AKBAS. The data is categorized by spacing (axle group) and load per axle group and is then applied to the bridge.

There is an intermediate component in LP for use with AKBAS, where the state DOT ArcGIS server uses the origin/destination information from LP and it generates a route number. The CDS route number and bridge program number are then manually entered into AKBAS to verify that the bridge exists. This is an important link between the LP and AKBAS systems and the ArcGIS server. Originally a carrier could enter latitude/longitude (lat/long) information into LP, but it was found to be too difficult for law enforcement to look at a lat/long location on the permit and know where it is located. Address locations are preferred for law enforcement reasons.

**Future plans for LP**

Are there any future enhancements/changes planned? They are in a maintain phase at this time, with short-term needs for updates and feature enhancements, but there are no plans to replace the LP system at this time.

Steve Rice inquired if there are any plans to connect information from Local Permits into the MMS system? This determination has not been made until further analysis of the potential TAMIS systems is completed.

**Conclusion**

LP is determined to be a system that would be included in the TAMIS framework, due to its importance in providing information for pavement deterioration analysis. There is a connection to AKBAS that is important, and needs to be investigated further. The connection to TAMIS needs to be from the perspective of the business processes used with the LP system. The business processes involve obtaining information about where and when overweight vehicles are traveling on roadways and how this impacts bridges and pavement and how the overweight information can be used for design, maintenance, and asset management.

There is an important caveat to be considered regarding the subjective use of the term overweight – do not include weight restriction on roads as part of the permit information. This is because the percentage amount overweight of the vehicle on roads is variable (depending upon the season, etc.) and determination of overweight status requires input on whether a specific road is under any weight restriction at all.

How do you know whether maintenance is underway on a roadway that a permit is issued for? MSCVE is supposed to be notified by the Construction division of construction on certain routes, so that the construction information can be included on the permit. The carriers are also required to review their travel routes 8 hours ahead of time for any construction activities. Does this include M&O activities for roadway maintenance? It is supposed to.
**D.24 MAINTENANCE MANAGEMENT SYSTEM (MMS)**

**Interview with Regional Staff**

*The role of MMS in the Regions*

Regional management primarily use MMS to extract data, and they do not do any data entry into the system. They use the Federal reporting products from MMS to perform quality assurance checks on the roads, report on the status of the overall system, and evaluate future Maintenance & Operations (M&O) funding for maintenance projects. They also use the information for design projects, follow-on design projects and complete redesign projects in the Department. The deferred maintenance amount available depends upon the governor’s spending limit. The funds are divided by regions and by projects. They have latitude to redistribute funds as needed. FHWA provides $22-23 million for preventative maintenance through the STIP process. Alaska uses 30-40% of these funds each year for M&O maintenance programs. The remaining amount (about 60-70%) is allocated to Design for pavement preservation projects.

*Business Decisions using MMS*

The type of business decisions made include, Where to focus preventative maintenance dollars? and Where to use federal dollars for future highway projects? They help with the design aspect of these decisions to determine the highest priority needs based on quality assurance reports, PMS reports, and visual inspections to make decisions on improvements.

*Reports used with MMS*

They use the standard reports designed in the federal reporting section of MMS for project level close-out and management of the federal projects. Ruth Carlson (Central), James Kaleta (SE), Karen Zubillaga, and Jinlan Tomasic are the Analyst Programmers that support the system. They are supervised by Chris Kotyk in Anchorage.

There are a lot of batch reports that Ruth developed that reside outside of MMS. Some reports were part of the MMS system originally and are vital to operations, but some of the reports are flawed regarding the quality assurance aspect.

*Other databases used with MMS*

Have you tried integrating MMS with other data sets? No.

What other databases do you use on a regular basis? Budgetary information is obtained from the Administrative Services staff who get the information from AKSAS and ALDER. Information is also used from PONTIS, and from the Pavement Management System, but M&O staff do not have access to those systems, so reports are requested from the data owners of those systems as
needed. They ask for this information as needed, not on a planned cycle. MMS staff rely on recommendations from the staff that maintain assets in those systems to identify projects that need to be done so that they can be entered into MMS.

The other source of data they use is the Design Status Report, which is generated from data extracted from MRS (not MMS). It is used for project control and planning. They can use the report to review information about projects and to determine the current status of the project (i.e. is it in design status? Planned status? What is the current status?) The report is now available in electronic format and includes the name of the project manager. Project Control produces the Design Status Report, but it is updated monthly by the project managers. It is only available on the internal website. The report is not map-based. Queries can be run by roadway name or project name or project manager name. There is a push to incorporate the report into a GIS environment. There are discussions about getting a new system to replace MMS, but no plan in place yet to do so. The users in the regions want a more user friendly system where they can run queries and retrieve information themselves from the system when needed.

Is traffic data and crash data of interest to you? Yes, they get questioned about that quite a bit. If that data was easily accessible, it would be used to help make decisions. Mainly the traffic data is important for decision-making. The crash data is used for HSIP project decisions.

Equipment data is needed for decision-making. They are moving towards streamlining and pooling equipment between district and regions by sharing equipment and reviewing costs of equipment and the ability to get it when needed. Currently, this is an initiative that is just being started. The equipment fleet information is in the EMS system and the M&O staff are able to get information from the EMS system. The life of the equipment and cost of equipment would be useful information for MMS.

What about geotechnical data (slope)? Not much of that is of interest for maintenance work, unless it is tied to a specific project.

Results of culvert and sign inventories would be helpful to have in MMS. All of this should be under one system for asset management. All of this could be inside of an MMS system.

Should pavement and bridge be inside an MMS system? Or have a method where these three systems could talk to one another? If the other systems were tied into MMS and were functional, that would be great. The greatest need is that the system be user-friendly for those entering data into the system. The Sign Inventory program is not very user friendly either. A lot of money is being invested in the Sign Inventory program. The Foremen cannot enter data into it. The Quality Assurance program is also a part of the MMS system. The bottom line is that if a system is not user friendly, it will not be used.

There are plans to collect guardrail and culvert inventory, but the collection is not being done at this time. No decisions have been made yet on who is going to
collect the data and maintain it, or any decision made on where it will be maintained.

Who is managing the plan to collect this data? Ocie (Adams) may indicate that there have been discussions about entering the data in the MMS system, but the data is not accessed via the MMS system. Data is stored for the Sign Inventory system in tables that are part of the MMS database, but the data is extracted using a COTS customized system separate from MMS. MMS itself is stored on an Oracle database.

How critical is the sign inventory to making asset management decisions? Initially, it was determined that the sign inventory would be too hard to be maintained. Data collection was done through a consultant and they were asked to provide a report on what needed to be repaired or replaced. It was determined that the sign inventory is of no use for the future. They have to wait until major projects come through for a particular corridor to use the sign inventory data. They do not have a tool to incorporate sign data and major corridor projects will replace all signs anyway. In Northern Region, the sign inventory for roadway projects is updated from Project Selection. The difficult question to answer is how to keep up with the inventory? If it is updated, that would be helpful from a budgetary standpoint for sign replacements.

Data Quality in MMS

One of the problems with MMS is that it is at least 5 versions behind the latest Oracle Forms release.

They have signed documentation from the FHWA preservation program that financial reports out of MMS would be acceptable for closing out projects, however, they cannot use it for that function, because the data is not that accurate. They cannot use the data for budgeting purposes because the data being entered is not that accurate. The timesheet information is accurate, but not much else. The users have learned to streamline data entry (using a “workaround”) to get the job done quickly.

Are the data quality issues being addressed? Not at this time; this would be part of the new system. The data quality issues would need to be addressed at the user level, and the operators who are entering data are generally not computer savvy. If someone outside of MMS needs to get information from it, they contact Chris Kotyk (supervisor for analyst programmers).

Issues with use of MMS

Are all of your needs met using MMS? They are trying to use MMS as the main tool for entering data on highway maintenance, but from their perspective, MMS is not very user friendly. Most persons entering data into the system cannot easily extract the data out of it without doing data mining or running queries. The Foreman level worker is responsible for data entry. Ruth Carlson developed
reports to get data out of MMS that is used by foremen, workers and superintendents.

MMS is not used at the Northern Region Maintenance Manager level as much because they have no way to get to the data. They go to the representative (foreman) who provides the data to them. Superintendents can enter projects into MMS, but most of them do not because it is difficult to use.

MMS has been around for about 10 years. There are two main issues that impact the use of MMS: (1) users cannot access data in the system on their own, and (2) when MMS users ask programmers questions about the system or the data (e.g., data queries), the response time is slow, so they tend to find another source of the information. Karen and Ruth get about 2-4 requests for ad hoc reports each month (e.g., how much was spent on a specific segment of road last fiscal year?) M&O was recently asked by the governor’s office how funding was spent and what was accomplished. They were not able to extract the information needed from MMS. This is a major need from the system. One of the other sources of information used is the Detail Design Report (3 inches thick), May 2003. Also, Ruth and Karen conduct a training seminar on MMS for new employees. CS will ask Karen to forward a hard copy of the training materials to supplement the research for TAMIS. (Received)

Regarding item (1) above, the difficulties in using the system have to do with the screen template being difficult to work through. If a mistake is made on the screen, it cannot be edited. The user has to delete the report and start over. The foremen can spend half of their time entering data for reports. The connections are slow from the remote locations, which complicates the problem. Many of the mistakes do not get fixed.

The information that has to be entered into MMS is very important for decision making. There are lots of fields in MMS that would be used if they worked (e.g., contract information, project information, reports). They do not need any new data elements as much as they need current functionality to work.

MMS is a procured off-the-shelf system that was customized for the DOT. Booz-Allen Hamilton originally developed the product, but stopped supporting it 4-5 years ago. Now, the four analyst programmers at ADOT&PF provide the technical support.

Linear Referencing and MMS

Is there any linear referencing system with MMS? No, they have never seen any GPS coordinates placed in the system. The search for data is associated with project name, project numbers, and financial codes. Canned reports can search the system by region code, ledger code, etc.
**Future Plans for MMS and TAMIS**

In October 2013, there will be a statewide managers meeting which will include a discussion about MMS and whether to replace it with a more user-friendly system. CS will ask Ocie Adams more about this during the next MMS interview with Headquarters staff. Steve Rice indicated that he has attended meetings where there is discussion of replacing MMS, possibly with Agile Assets. These discussions are preliminary. The discussions include recommendations to combine MMS data with other asset data systems and to develop a new way to access the assets from a central point. That would be the desired functionality, but no one has begun addressing how this is going to happen.

What is your vision for TAMIS and how it could help you? Most helpful to the maintenance people and M&O would be a system that could replace MMS. An MMS that would tie in with Pavement, Bridge, STIP, project control report, and GIS and would allow the user to run reports to determine highest need for pavement work, and could be used to program deferred maintenance list and M&O funding more easily would be very beneficial. It would be helpful to be able to get a list of programmed projects to see where the DOT will spend money on projects over the next 3 years.

Any other comments/questions? If done properly, an asset management system will be able to provide the needed information for making decisions. Also, when a system is developed, there has to be specific personnel assigned to support that system. M&O cannot readily absorb this into their regular work load.

**Additional Comments Received from Henry Cole via email on 11/7/2013:**

**Sign/Culvert Inventory:**
- As noted in the summary, the sign inventory and culvert inventory are not input or accessed through MMS, so field personnel need to use an additional system for these inventories. In addition, there is presently no way to run user-generated reports on the contents of the inventories; the only access is through directly querying the database, which is unsustainable.

- I disagree with the statement in the report that “the sign inventory is of no use for the future.” In fact, I cannot disagree more strongly. The data would be invaluable if we had an efficient means of accessing it.

**MMS Replacement:**
- Before any replacement decisions are made, end user staff MUST be directly involved; and hands-on demonstrations should be done wherever possible, including at remote camps where network access speeds are slow. Since we are effectively unable to “beta test” the software once it’s been rolled out, these demonstrations would be our only realistic preview of what such a deployment would look like.
Interview with Headquarters Staff

This interview is a follow-up to the discussions CS held in Alaska with the Maintenance Management System (MMS) staff at the end of May. Also, there was a lot of information gathered during the previous interview with the Region MMS staff on September 3rd, so, this interview will focus on data governance issues as a whole for TAMIS.

Can you give us your perspective from a high-level for TAMIS? Dan, based on your experience with Jack (Stickel), what is your work with data governance? Dan developed a draft data governance document, using the data governance document developed by Jack and HQ IT staff as a basis. Dan’s version of the document was forwarded to Mary Siroky for review. Dan also forwarded a copy of his draft to the CS team for review after this interview.

Ocie explained that the MMS system will probably become part of the new asset management system, whether that is Agile Assets or whatever option is selected.

MMS System Architecture

The front-end of MMS is currently maintained in Oracle Forms 6i. The backend (actual database) is Oracle 11g. It was developed at a cost of about $8 million dollars. The data integration function is built into the MMS system.

It has an export file, one for payroll and one for State Equipment Fleet usage data. There is no export file for payroll. It generates timesheets (Daily Work Reports), which are manually entered into AKPAY. It does have interfaces to AKSAS (Time & Expense – T&E) for budgeting. Twice a month, 3 files are generated – one for each region.

There are eleven import files for assets at a couple of levels, including roadways (station profiles from feature inventory and pavement maintenance information) and employee information, including payroll codes, ledger codes, and leave time.

Some of these system interfaces are expected to change due to the work on the Integrated Resource Information System (IRIS) project. The IRIS project will identify data sources for that system, including any data needed from MMS.

From Ocie’s perspective, Agile Assets can perform some of the same functions (as MMS), but it does not fill the role without modification.

Future Plans for MMS

What are your next steps going to be? To explore Agile Assets or other another alternative solution. The plans are to continue maintaining MMS in the near term.

How do you fund overhaul of systems like this in the Department? Federal funding is sometimes used and other states outsource their maintenance management. Alaska currently has 5 analyst programmers that maintain MMS...
on the state side. There are 4 Analyst Programmers who are full time, plus a
supervisor (who has other duties and does very little work on the system).

How do you prioritize improvements or enhancements? The prioritization of
improvements/enhancements to MMS is based on requests received from the
users.

What are the upper level managers expecting you to provide from MMS? Cost
information like What is the average cost to fill a pothole? Or What is the cost to
do a certain type of work? MMS can provide information related to budget costs
and assignment of personnel.

How are you anticipating that TAMIS will help you? TAMIS is not a factor in
considering a replacement for MMS. MMS is being replaced to improve
maintenance work and the modifications to the system are being made to
provide a better system to the users.

Who do we talk to about decisions regarding how funds get allocated? Mike
Coffey would be the person to talk to regarding M&O and capital improvements.
The CS team should also talk to Carolyn Morehouse and Mary Siroky about the
different funding categories.

**Documentation**

Ocie will send us a copy of the training manual for MMS (DONE). He noted that
there is a major system change in progress (which has not been deployed) that
will record Start and Stop Times for employees for Morning start, break time
stop/start, lunch start/stop and evening stop at the end of the business day or
when the employee leaves work on leave. The training insert for the training
manual is still in draft form since the module modification is not complete. He
also referred the CS team to the audit report done by FHWA on Transportation
Asset Management in Alaska (May 2010) for additional information regarding
MMS. CS has a copy of this document for review. There are also design
manuals available for review and these can be obtained from Steve Rice. (DONE)

**Follow-up Action Items for CS Team**

- CS Team will need to obtain/review the following documents:
  - MMS Training Manual (from Ocie Adams) (Received)
  - FHWA Asset Management Audit Report (May 2010) (Received)
  - Design Manuals (from Steve Rice) (Received)

- CS Team needs to have follow-up interviews with Mike Coffey, Carolyn
  Morehouse and Mary Siroky regarding funding categories and capital
  improvements. (DONE)
Follow-up Interview (M&O and CIP)

This interview was conducted to determine how funds are allocated for maintenance and capital improvement projects. Mike Coffey is the manager responsible for allocation of the funds.

How is funding allocated for maintenance and for capital improvement projects? They start with the General Fund as their annual base budget, which is incremented or decremented each year. Last year’s budget ($160M) is used as the base for the new year. If there are more lane miles added or an increase in cost of commodities like de-icing chemicals, they will request an increase in the budget.

Within the base budget are there funding categories for preservation, etc.? No, the funding is not done that way, but they hope that TAMIS will help them get to the point of being able to budget for preservation and other funding categories. They currently use five funding categories (personnel services, commodities, service/contractual, travel, x) for the basic operating budget and each region has their own portion of that budget. None of this budget is for project costs, this is the General Fund operating budget only. The budget is used for highways and aviation with $60 million dollars allocated to highways.

How much of that goes to maintenance, pavement, bridges? None, this is the operating budget only, but the repairs like crack sealing, and guard rail repairs are done through the MMS operating budget.

The overall operating budget is further sub-divided by district within each region. Currently, any underspent funds in one district will be allocated to an overspent district. The funding is not based on targets with an expectation that assets will be maintained to a certain service level. They would like to get to this point so that there is more accountability. They would like to have the allocation tied to a target such as Level of Service (LOS) “C” for example.

In addition to the basic operating budget, they receive a capital allocation for project specific funding and deferred maintenance projects, and also receive FAA/FTA funding for capital improvements. There is some crossover with operating funds for some projects (e.g., guardrail repair), and these are tracked in MMS. Fiscal year 2015 will be 5th year of the governor’s $100 million dollar deferred funding program, which allocates $16.9 million to highways and $3.5 million to aviation. They are in the 5th year of getting these extra funds.

How is this money allocated? For highways, each of the 3 regions submits a spreadsheet (needs list) that is compiled into a statewide needs list. These needs are divided into different categories including vegetation management, culverts, bridges, shoulders, gravel surfacing, etc., with priorities assigned to the needs by each region.

The 3 regional requests are then used to create a master list of highway needs for the state, which is then submitted to the Office of Management and Budget (OMB). Once it is approved by OMB, Mike allocates the $16.9M to the regions
according to their priorities. He uses the MMS report card, to some degree to
determine the deferred maintenance funding (e.g., if one area is performing well,
he will move funding to another area that is not performing well).

What else enters into the decision besides universe needs? He includes statewide
initiatives and also safety projects tend to rise to the top of the priority list. He
tries to balance the funding among regions/districts and priority areas. While
the #1 priority on the list may be a $500M rehab project, he may only give it
$500,000 because of the need to balance the money between regions and districts
(for other projects like signs, traffic signals, etc.). The Universe of needs list is all
capital needs NOT operating cost needs. A lot of the work is done themselves
and does not need to be bid if they have the manpower to do the work
themselves.

Are there any other broad categories that maintenance could take advantage of?
Alaska received $50M ($15M?) per year in preventative maintenance funds, but
most of it is allocated to pavement and preservation projects.

They also get capital allocations and FHWA and FAA funding for capital
projects. Within the region, they allocate funding to the districts and each district
ends up with a budget. They do not use targets when allocating the budget, but
it would be good to use a process where funds are allocated and a target is
specified.

In addition to capital project money, legislators will sometimes allocate money
for specific projects and the Department receives the money for that purpose.

$50M is allocated for pavement improvement (resurfacing) projects. They try to
keep their pavement to a 1R rating and this money is not used to add capacity or
turning lanes, it is just used to replace worn out pavement.

The STIP funds are used for bridge replacement and capital improvement
projects. Check with Jeff Ottesen for information on how the STIP funds are
allocated.

How do you see the future vision for TAMIS helping you? From the M&O
perspective, they need a broader group of items (like winter maintenance) on the
M&O report card and they need a better measure of what they are doing and
how they allocate funds. They need to establish standards and measures and to
budget for projects and track accountability based on those standards and
measures.

They would like to see a certain amount of money to go to preservation and to be
more data driven for allocation of funds, based on needs rather than political
influences. They also need a better pavement management system that estimates
lifecycle costs and allows them to dedicate funding based on needs (using a more
structured process).

How much of that is addressed through the planning and programming process?
He is not involved in the planning and programming process (within the STIP), but supports the fact that pavement data is used to help determine needs within the STIP.

He process involves combining the spreadsheets from the 3 regions into a single Excel spreadsheet (used by the OMB) and submits it to the OMB. If he needs additional information from the MMS system, he requests Ocie (Adams) to provide the information to him. Mike does not personally extract data from MMS.

Are there regularly scheduled reports from MMS? The reports used are more specialized reports. He was using an overtime report in one area of the state, because he wanted to look at the overtime charges in that area in more detail. He also uses MMS to track expenses such as snow/ice and gravel by region so that he can compare and check for outliers.

What are your thoughts on the future of MMS? He is trying to get people to use MMS more. The MMS system was developed by Booz Allen Hamilton but is not user friendly. Field workers are short cutting data entry procedures. The system needs to be simple, straightforward, and intuitive for users instead of the current methods for update and use. The accuracy of the data is questionable.

What are your thoughts on procuring a system for MMS separately from PMS? From what he knows, Mike is impressed with Agile Assets. He likes the fact that it is all inclusive and contains modules for MMS, PMS, and equipment management for fleets (which is what they need). Under his area, he is responsible for maintenance, pavement and fleet equipment and he thinks the one-stop shop approach (in Agile Assets) is good for what he needs. If there are other systems that can provide similar capabilities (to Agile Assets) and are less expensive, then he would also support their use to meet his needs. Also, since the bridge section is dependent upon PONTIS, if Agile Assets (or other systems) could communicate with PONTIS, that would be great. From the pavement perspective, there is a life cycle with trade-off analysis capability using Agile Assets and this would be a plus, because the existing pavement system (Dynatest) is fairly weak and cannot do extensive analysis.

It is also possible that TAMIS could provide that one-stop shop capability.

**D.2 MANAGEMENT REPORTING SYSTEM (MRS)**

**Overview of MRS**

MRS was initiated in 1999 and is used to track all capital projects – name, locations, etc. They are not sure how to integrate it and use it to track assets as part of TAM. A large part of MRS database includes contractor names, cost of contracts. MRS is also used to track obligation activities.
Data Management

What is your primary responsibility for managing and/or maintaining data in the MRS system (i.e., are you considered a data steward (have access to update data), business data owner (make business decisions using the data), or data user (use the data to make business decisions))? Are you currently using business decision-support tools with the MRS system? Is there documentation available on the tools and types of decisions made (#1)? There is a difference between the owner and who puts data into the system. HQ Admin Services Division owns hardware/software and maintains it. Regional Project Controls is the lead for basic data input at Regional level. Phil Kvapil is lead IT person, but not officially part of MRS team. How do you differentiate between nuts and bolt vs. business side? Hardware/software/Oracle database/servers – nuts and bolts. Each region takes lead in entering project data for their region. Once construction contract issued, there is another group responsible for entering information related to that contract. Then Liz’s group comes in on obligation side. HQ also has projects that are completely different from construction projects – planning, data, etc. HQ has project control role, as well as obligation piece. They directly tie federal obligations into basic table. They are not sure how the MRS system would be used to track assets, but they are able to use it now to document performance measures.

What data elements from the MRS system would make the most sense for cross-comparison with other systems (which systems) to support asset management decisions (#2)? FAAM takes the data fields from MRS so that this system does not have to do duplicate entry. Federal-aid data is entered into 3 tables in the MRS system. We need to illustrate this connection to MRS. The recommendation is that FAAM needs to be put back into the TAMIS framework.

Project managers in the regions use the Design Status Reports (designed by Chris) available on the web to update project status into a web form directly into the MRS database. Construction and contract managers also input data into MRS.

Wendy – there is another system (Alaska State Accounting system (AKSAS)) that populates a financial summary in the MRS system. This is a daily FTP of data from AKSAS into MRS.

A programmer is able to extract data from MRS for use with construction projects and sideline reports.

MRS has a daily update once/day.

Chris – one of the plan changes will replace AKSAS with IRIS within the next year. IRIS is in development, it is an accounting system for the entire state not just the DOT.

MRS is an Oracle driven system. Project Control section initiates a new record for a new project. There is historical tracking of projects so that the info pertinent to it is retained permanently. Is there a schedule for closing certain records? Yes,
once the final acceptance package is complete, the project is closed in the system. There is not a schedule based on a certain time of year, but each project has a timeline from start to finish. There is a STIP component. It is forward looking. Projects are projected out at least 4 years as part of the STIP and the STIP projects are included in the Long Range Transportation Plan (LRTP).

Who is the owner of the system? It is a statewide system and is not specific to a Region. HQ Admin Services owns/maintains the hardware/software part. In the Northern Region, Phil Kvapil helps support the system from the IT perspective. Each Region has a Project Controls office that is responsible for supporting the system. They assign different responsibilities for different tasks on a contract to be managed. HQ is in a project control role and there is the obligation piece (this is Liz’s job). They tie the fed obligation into the project table.

There are others responsible for updating information in MRS – they are in contracts and construction section. The construction folks merge data from the AKSAS to create financial reports. Special privileges are required to update MRS data, but any user can view the reports. Each day, the managers can view projects through an internal web application. The project number (unique ID) is used to access the reports. The STIP database overlays with MRS and project ID is used to link the records. There is a separate GIS system in the DOT that handles location, referencing, coordinates. There are however, location descriptions in MRS. MRS has fields for lat-long, but they are not being populated at this time.

How often are they updating data? Daily

How do you differentiate between business decisions and the hw/sw part? Hw/sw refers to the Oracle database and servers.

What data elements are not currently available in the MRS system that you would like to have to improve your business decisions (#3)? A programmer (Rachel Kindred) has attempted to connect MRS data to a pavement system (using Project number – but it is not a unique identifier -Use of project numbers is not consistent across the state). CS is going to talk to Rachel during the PETS interview and we can ask her about this at that time.

Regarding TAMIS, which other data systems do you currently interact with/will interact with in the future (#4)? MRS interfaces with the Bridge Management System (BMS) – there are unique bridge identifiers used in the BMS and they are also found in NBI and in MRS. There is additional information (like milestone dates, and engineers assigned to the bridge) that are in MRS but not in BMS. The bridge can be linked to FHWA projects. CS needs to request Wendy to send us the URLs for the Bridge reports. No interaction with the MMS system. There is no connection to other systems other than projects need to be set up in MRS first.

What is your vision for the MRS system within the TAMIS framework (#6)? They are struggling to see how the MRS fits into the TAMIS framework. CS will
send them the Vision and Components document to help them understand where they might see the MRS system fitting in.

**Data Quality**

What quality assurance processes are involved with the data collection (e.g., timeliness, reliability, accuracy, standards) (#12)? For the federal obligations it has to accurately reflect the federal system to the penny. There is QA on every single project to ensure that dollars allocated by FHWA is exactly matching their MRS system. There is a limited group that has access to input data and they are trusted to enter the correct data limited to offices in control of their dataset.

From the Oracle point of view, the database has constraints on certain pieces of data (funding type can only match 1 of 4 codes). Security level roles are also assigned for access to update the data or if their role is ‘view only’.

**Data Integration**

Are there any known technical issues with integrating data from the MRS system with other systems at ADOT&PF (#16)? AKSAS is going to be replaced by IRIS in next year. They will need to make changes to accommodate that. IRIS is still in development, it’s not in production yet. IRIS is enterprise-wide (whole state) accounting system.

Are you aware of any institutional issues impacting the ability of data from the MRS system to be integrated with other systems (#17)? There are other data systems/people who interact on regular basis with MRS. Project/program managers with active projects are required to update fields. Design status report – reports that are available on web. Info comes from MRS. Managers in the regions and they update their status comments via web form directly into MRS database. Project managers – status. Contracts (Construction section) also enter information. Designers, engineer assistance, etc. also enter comments on design and construction documents. Wendy – FTP of data from state accounting system populates financial summary in MRS, this info gets published in reports and on web pages. Daily ftp update.

Is MRS supported by adequate resources? Plans for changes? Depends on where department wants to go. Based on FHWA requirements, they may have to change federal side significantly.

**Data Storage**

How are the data stored in your department for the MRS system (PC, server, data warehouse, legacy system) (#18)? Data is stored in an Oracle database.

Is the data for the MRS system stored outside of ADOT&PF? If so, how are the data stored by other agencies outside of ADOT&PF? (#19) MRS data is not stored outside of ADOT&PF, although there is incorporation of data into MRS from the AKSAS system.
Are there specific national, state or agency standards that govern the storage of the data (#20)? Not that they are aware of. Oracle is the standard (platform) for the DOT.

Is the database linked to data in any other data system, both inside ADOT&PF and outside (#21)? The database has links to AKSAS, which will be replaced with IRIS.

Are these data redundant with any other data systems? Are there any issues with multiple sources for the same data? (#22) They avoid redundancy of data as much as possible. They recently moved the duplicate pieces of construction’s data into a table in the MRS system. Construction reports - if information already available in MRS, they use that data and don’t replicate it in any other system. HQ and IFD pushing for consulting statewide to make sure everyone needs it, would use it, and would benefit from it. Construction developed separate table but have since been added to MRS.

Referencing System

What linear referencing system do you use to locate your assets in the MRS system? (#23) There is project location information descriptions in the MRS system, but they do not use a lat/long or other referencing system to track projects. There are lat/long fields in the database, but they are not populated.

Do you use a common geographic referencing system and a common map-based interface for analysis, display, and reporting? (#24) The department has a common GIS system, but MRS is not tied to that system as a common geo-referencing system.

Data Documentation

Do you have documentation that you can provide that illustrates data file structures and/or data dictionaries used to support the MRS system (#25)? Craig Walsh wrote a manual a couple of years ago – federal side has changed dramatically since that was written. There are 2 manuals. There is an on-line data dictionary that shows technical information. Wendy sent us the URL to access the on-line dictionary and the Manuals written by Craig (see below). Liz also has a desk reference manual for FAAM. FAAM feeds data to MRS.

There are 2 MRS manuals for data entry people, written by Craig Walsh:

- [http://web.dot.state.ak.us/mrs/docs/ProjectStatus-ManagerInputFINAL.pdf](http://web.dot.state.ak.us/mrs/docs/ProjectStatus-ManagerInputFINAL.pdf)

The MRS online data dictionary is a live Oracle web page (a good percentage of the comments you'll see are written by Wendy), and is here: [http://web.dot.state.ak.us/cgi-bin/dd.d/tables.pl](http://web.dot.state.ak.us/cgi-bin/dd.d/tables.pl)
The Bridge Status Report at [http://web.dot.state.ak.us/bridgestatus/](http://web.dot.state.ak.us/bridgestatus/) simultaneously shows info from MRS and Pontis Bridge Management System.

In addition, there are a number of MRS-only reports that display info about bridges using the same bridge ID as is used in Pontis. Here is one example: [http://www.dot.state.ak.us/stwdplng/cip/stip/needslist/](http://www.dot.state.ak.us/stwdplng/cip/stip/needslist/). The page gives the option of searching on a bridge by number and name.

**Data Access and Uses**

How are the data accessed (computer applications, network, internal web)? (#27) Anyone who’s a project manager or administrative staff will put data into system and use it. Also includes MS/CVE users. There are people who have access and maintain projects in MRS.

How are the data reported (documents, print files, web, etc.)? (#28) and What standard reports are generated using the MRS system? Can you provide the example reports and/or formats and layouts of the reports? (#29)

They use MS Access is used to generate over 200 reports from MRS. They provide status reports for the Maintenance Division, Design Division, Construction Division, etc. They use MRS to respond to many ad-hoc queries and use diverse canned reports. Accounting, maintenance groups, many others request different types of reports. When other regions are low on staff, they can answer questions on a statewide basis using these reports. They rely heavily on the reporting side of the system. HQ does have a tracking report on-line for the regions to ensure that they don’t over-obligate funds. There are tracking reports online for all regions, STIP obligations reports. They also have reports that are sent to directors regularly. AKSAS pulls obligations and sends these types of reports to director’s level to track amount of money obligated. The Construction group has unique reporting needs. Their programmer takes core information from MRS (on projects) and merges with financial information. Each region generates a status book once/month for a monthly manager/director meeting to review the reports. SE Region generates the paper report once/month. Northern region uses a web-link to view the report on a screen during meetings for a single project or for a specific manager instead of printing the report. Design chief is trying to tie in Google maps so location could be pulled up during meeting. There are about 6 meetings per year. When CS talks to SIRIS group, we will find out more about this.

Are you aware of any other uses of these data by other stakeholders (#31)? Yes – 3 have full access. Construction and contracts (?) section also maintain data.

Are there any restrictions for sharing data from the MRS system with other agencies or the public? (#32) Wendy – 3 things: (1) budget system is restricted to the internal website (2) when project managers enter progress on individual projects, that information is kept internally only not published to the public (3) when going through the contracting process engineering estimates are not published to the public – only a range for the estimate is used. There may be
varying degrees of information from project managers made available to the public....they are concerned about the PR side of it and want to ensure consistency in what is presented to the public. When management became interested in content made available on MRS, decision was made to limit amount of information released publicly from a PR perspective so that PIO didn’t have to be responsible for reviewing every description.

Are there partnerships with other agencies in terms of collecting or reporting the data? (#34) Not that they can think of, except Dept of Administration is owner of accounting data and it is like an agreement between the two departments on the exchange of data. Chris – they will try to tie in utilities info where there is a construction project going on – the Municipalities (of Anchorage) Water and Waste Water (WWU) will use this info. They have to report a lot of the data to FHWA for HSIP and M&O – pulling data out of MRS to report to FHWA.

They have OMB and governor’s office that they have to respond to performance measures using data from MRS. They have a connection between the Alaska budget system (owned by governor’s office). They import certain budget file into MRS and create a linkage between the two and provide that on a web-page (internal website). It is used as a vehicle for the governor’s office to look at and make decisions on looking up information for the legislature. This is a way for them to be an intermediary between DOT data and legislators. It is not used internally within the DOT.

Are there or should there be ownership and/or gatekeeper controls for this system (e.g., open/restricted access, userid/password control, internal web, server)? (#35 )Methods for getting buy-in on needs for the system is through emails that document what’s needed and then it is sent to Wendy and Chris to get is programmed.

**Data Flow/Transformation**

What is the update cycle for data in the MRS system? (daily, weekly, monthly, quarterly, annually?) Anyone that is a project manager is inputting data into the system and maintain projects within MRS on a daily basis.

How can TAMIS help you? They struggled to make the connection between MRS and TAM. Part of the TAMIS umbrella is trade-off analysis and return on investment. Financial information from MRS would relate to this.

### D.3 **METROLOGY LABORATORY PROGRAM (MetLab)**

Garret (Gary) Brown is the Metrology Laboratory Manager at ADOT&PF located in Anchorage, Alaska. His lab is part of the MSCVE Division. The Metrology Lab is responsible for certifying standards used by weights & measures and industry throughout the state. The Metrology Laboratory has custody of, and is responsible for the state standards of mass, volume, and frequency.
Gary has what is known as a ‘recognized’ status by the National Institute of Standards and Technology (NIST) of the U.S. Department of Commerce. Alaska is the only state that has their Metrology Laboratory located in the DOT. Other states typically have this function in their Department of Agriculture. At this time, there are 46 states that are ‘recognized’ by NIST in the area of legal metrology. Gary works for Doug Deiman at MSCVE. Doug was interviewed in a prior TAMIS interview regarding the LIBRA system.

Why are these data being collected (ADOT&PF requirements, federal mandates, other)? The data is collected/generated to ensure compliance with NIST requirements and to maintain the legal traceability of the state’s Metrology Laboratory and the measurements it performs. The type of work that Gary performs involves the science of measurement. His lab is responsible for certifying standards that are used in the public and private sector on a statewide basis. Testing is performed in a closely controlled environment; pressure, temperature, and barometric pressure can all affect the results of measurements.

Gary is responsible for generating certificates for the standards and these certificates are considered legal documents for use in a court of law. The processes used for weight and measurement certification must be tracked using a set of state and federal guidelines. Gary also has to maintain the historical data for all measurements performed by the laboratory ensuring measurement assurance policies are followed.

His inventory of measuring equipment includes:

- Precision polished stainless steel weights – Primary mass standards, State Office (working) mass standards, and check mass standards for avoirdupois (pound), and SI (metric) ranging from 1000 lb – 0.001 lb, and 30 kg – 1 mg.
- “Slicker plate type standards” and “provers” – Primary and secondary volume standards ranging from 100 gallon – 5 gallon.
- GPS reference receiver, and precision frequency counter – A GPSDO (Global Positioning System Disciplined Oscillator) system used for frequency calibrations.
- There are 9 mass comparators used for comparing a standard to an unknown. They do mass comparisons, they do not “weigh” artifacts in the traditional sense. Mass is the same everywhere on the planet, weight is affected by local gravity and is different everywhere. The laboratory is only recognized to perform mass comparisons.

Some of the type of standards that he calibrates and certifies includes the equipment used to test gas pumps and to certify portable wheel load weighers. If his calibrations are not accurate to within specified limits, this can have a tremendous impact on the state’s economy.

What do you use it for (i.e., does it support asset management decisions within your department?) The measurement and certification data that is stored in
hundreds of Excel spreadsheets is used to maintain metrological traceability for Alaska through NIST. The Excel spreadsheets document the measures of mass, volume and frequency calibrations of measure and weight equipment used throughout the state.

Does it support any decision-making related to other areas such as capacity, safety, bridge, pavement, freight? Not directly. The MSCVE has portable wheel load weighers, which are used by law enforcement to write tickets based on those scales. The certification of the equipment (by the Metrology Lab) and the truck scales must be accurate for this purpose.

There is no asset related decision-making regarding annual procurement of equipment for the Metrology Lab. The equipment is unique in the sense that the replacement cycle for the different types of equipment varies by equipment. The sources of funding used to support the Metrology Lab includes the capital budget, the operating budget, and the end of fiscal year surplus. The funding source used depends upon whether the expenses are for salaries, equipment, or consumable materials.

What types of data are included in the system (i.e., does it contain inventory data that could be used for asset management purposes)? The type of data tracked in the Excel spreadsheets include mass, volume, and frequency measurement history for weights and measures equipment, and industry standards used throughout the state.

Is the system used on a Statewide or Regional basis? No, the metrology laboratory data in the spreadsheets is used exclusively at that office in Anchorage. The data is stored in several Excel spreadsheets and data entry is restricted to metrology staff. The data is backed up on a division internal server. No one outside of the area enters any data into the spreadsheets. The accuracy must be to 8- or 10- or 12 decimal places in most cases. Since much of the data used in the spreadsheets is used in successive formulas, if there is a change or error, it can have an impact in successive calculations.

How often is the data updated (i.e., in real-time or on a periodic basis)? The data is updated almost daily. A recognition submission is also generated annually to identify the new corrections and uncertainties. This report is sent to NIST to maintain the State’s ‘recognized’ status.

**Documentation**

There is an Administrative Procedures Manual and a Quality Manual that are used for the work performed in the Metrology Lab. Each of these are briefly described below and copies of these manuals were also provided after this interview.

- Administrative Procedures Manual - “This is the laboratory procedure for protection of client confidentiality and proprietary rights. The laboratory will use the system outlined in this Administrative procedure to protect
client confidentiality and proprietary rights to the extent allowed by law. All laboratory data and records are considered official public record according to State Statute. The laboratory will not release records except in accordance with official request procedures.”

- Quality Manual – “The Quality Manual describes the quality assurance program used in the Alaska State Metrology Laboratory and sets out the established requirements to competently and effectively achieve the program objectives of the State Metrology Laboratory. The measurement program objectives of the laboratory are:
  - Maintain the State standards of mass, volume, and frequency; and
  - Provide reliable metrological measurement services suited to the needs of weights and measures staff and industry.”

- Quality Manual (Appendices) – contains multiple appendices including definitions of commonly used metrology terms.

Is the system supported by adequate resources (i.e., are there resources for data updates or system improvements)? There are currently two metrologists responsible for running the Metrology Laboratory and for certifying the equipment; however, there are a lot of checks and balances used to perform these processes.

Are there plans for future retirement/replacement of the system? If so, when? Gary had a meeting a few weeks ago with the IRIS project team since they were investigating the possibility of integrating his billing process with the statewide billing system. His billing process includes billing the owners of equipment in the private sector, for his calibration services. This includes about 140-145 customers. There is no charge for calibrating the state-owned equipment; however the AST is billed about $7,000 - $10,000 annually for calibrating equipment used for public safety. In support of the research by the IRIS team, Gary provided them with his Excel spreadsheets for their review. The IRIS team determined that his billing process was small and unique enough, that it did not fit under the umbrella for the statewide billing system.

The possibility of developing a database to maintain the Metrology Laboratory data (currently in Excel) was also explored, however, the IT division determined that it was too technical and that the ‘spreadsheets system’ should continue to be used at this time.

**Conclusion**

While the work performed at the Metrology Laboratory is important work on behalf of the state of Alaska, there is no database system per se that would support enterprise asset management at ADOT&PF. Also, the data entry and use of the data is very restricted and therefore, this set of data and Excel spreadsheets does NOT meet the criteria as a data system that supports TAMIS. Since the weight equipment (for trucks, etc.) may be useful for determining pavement
deterioration, there is only a remote connection to asset management; however, it is from an equipment perspective not a data system perspective.

D.4 NAVIGATOR

Mike stated that this is probably not the type of data to be included in TAMIS. CS noted that the Navigator website (http://www.alaskanavigator.org) doesn’t appear to be accessible from the main ADOT&PF website.

Why are these data being collected (ADOT&PF requirements, federal mandates, other)? Navigator is a public outreach campaign/website to communicate with the traveling public regarding highway construction activities and their expected impacts (e.g., delays, closures). In terms of performance targets, Navigator is approved by FHWA and helps ADOT&PF document that the requirements for construction projects comply with Title VI requirements (i.e., Navigator is reported to FHWA as an activity/tool being used to track impacts to certain ethnic/income groups).

What do you use it for (i.e., does it support asset management decisions within your department?) Navigator was set up in the 1990s to let the traveling public know about traffic delays or road closures associated with construction projects throughout the Central Region. In 2012, the Navigator program was expanded to include Northern Region. Navigator was available to the public before 511 was developed. Mike feels that Navigator is more useful than the 511 system. Prior to the development of the Navigator program, they had to rely on contractors to place construction notice advertisements in the newspaper. The contractors had no stake in the process, so results were inconsistent. ADOT&PF decided to put the information out there instead. They hired a public relations consultant to put together the format for Navigator, and they are also responsible for reaching out to media and updates to the 511 and Navigator websites. Navigator includes radio, newspaper ads, door hangers, email and mail out flyers in addition to the Navigator website. Since the implementation of Navigator, the feedback from the public is more positive.

Does it support any decision-making related to other areas such as capacity, safety, bridge, pavement, freight? It is not used for decision making in the other business areas. It is specifically designed for communicating with the traveling public.

What types of data are included in the system (i.e., does it contain inventory data that could be used for asset management purposes)? Data includes details on construction activities in the regions where Navigator is deployed (either Central or Northern), including project location, duration, “What you need to know” notices (e.g., lane restrictions/closures, presence of pilot car and flagging operations, paving/striping operations, hazardous conditions, and hours of impact), expected traffic impacts, end result of the project, and contact for more
information. Users can sign up for weekly email updates for specific projects from the Navigator website.

Is the system used on a Statewide or Regional basis? Two of the regions participate in the Navigator contract – the Central region (developed the system and has been using it since 1990s) and Northern region (just started their involvement). The Southeast region doesn’t see a need for it and doesn’t participate.

How often is the data updated (i.e., in real-time or on a periodic basis)? Data is updated on a weekly basis by the Navigator contractor (Spawn Alaska). Project engineers communicate directly with the Navigator contractor at least once/week to update project specific information. Updates are submitted using an electronic form that the contractor has set up. The database is housed by the contractor and is not housed in a DOT system (to his knowledge). Updates for the weekly newspaper advertisements must be submitted by COB on Monday so that information can be updated for print by the following Friday. These weekly newspaper advertisements list information for construction activities, including a location, description, and the types of delays to expect. The advertisement is published every Friday and is located on the same page every week. The Navigator website is updated more frequently (at least weekly), and door hangers, direct mail outs, emails, and radio spots are updated as needed. Research is conducted about every three years to identify success stories and recommendations for future activities. A written report is produced, based on the information gathered.

Is the system supported by adequate resources (i.e., are there resources for data updates or system improvements)? A contractor is used to support the system.

Are there plans for future retirement/replacement of the system? If so, when? Two years from now, Navigator will still be in existence and will probably co-exist with 511. Navigator is approved by FHWA. There has been talk within ADOT&PF of the possibility of merging Navigator and 511 in some fashion. 511 alone cannot provide the functionality needed.

Is the construction information data duplicated in MMS or CDM? No, they are currently not using anything like that. All of the information comes from project engineers.

D.5 PASSUR

Why are these data being collected (ADOT&PF requirements, federal mandates, other)? AIAS utilizes PASSUR provided data as one of many sources of information regarding commercial aircraft activity at ANC and FAI.

What do you use it for (i.e., does it support asset management decisions within your department?). AIAS utilizes Passur provided data as a cross-check of other sources of information regarding commercial aircraft activity at ANC and FAI.
Does it support any decision-making related to other areas such as capacity, safety, bridge, pavement, freight? PASSUR does not serve as support for decision making regarding capacity issues by itself due to accuracy rate and reliability of information provided.

What types of data are included in the system (i.e., does it contain inventory data that could be used for asset management purposes)? Information regarding aircraft providing commercial air service at ANC or FAI such as aircraft type, operator, owner, etc.

Is the system used on a Statewide or Regional basis? ANC and FAI

How often is the data updated (i.e., in real-time or on a periodic basis)? Daily

Is the system supported by adequate resources (i.e., are there resources for data updates or system improvements)? Yes

Are there plans for future retirement/replacement of the system? If so, when? Not at this time.

D.6 PAVEMENT MANAGEMENT SYSTEM (PMS)

Responsibilities regarding pavement management

The staff responsible for pavement management are considered to be the data stewards, owners, and users of the pavement data. The data is collected by a contractor off-site and is stored in the off-site database. ADOT&PF staff do not have access to change or modify the data in the off-site database. The Department does get a full copy of the raw and processed data each year. The data is kept at the DOT in Access and Excel formats for use by the pavement management staff. The data is collected every summer and the collection is completed in late July or early August. This year’s data is being processed and compiled at this time. ADOT is provided one snapshot of the data every year to use until the following year. There is no formal process in place for quality control measures however, the ASTM and AASHTO standards are followed and a calibration site is used to calibrate the data collection equipment. The ASTM and AASHTO standards used include the following:

- ASTM E-950 (surface profile, equipment, lasers, accelerometer)
- AASHTO PP 44-01 (cracking requirements)
- AASHTO R-43 (IRI) & AASHTO R-48 (rutting data)

The HPMS rules are followed for collection of the cracking data. The contractor provides ADOT&PF with a letter stating that the Class 1 level of accuracy is met for the pavement data. Historically, there have not been any problems with the quality control of the data. The same data protocols will be used with the new pavement management system when it is implemented.
Additional data needs for pavement management

Additional pavement data elements may be collected over time like friction data and rolling weight deflectometer data, but not for the next 3-4 years. The goal is to collect a set of baseline data in the next few years, but the baseline would not be collected on a routine basis. Collection of cracking data will be a separate effort. Dynatest was selected to do visual observation for inspections (by a trained team) because they have a lot of experience and are cheaper and faster than using digital inspection. They cannot use the automated data collected by the project in the TDS section (Planning Division), so the plan is to continue maintaining a separate contract to collect the data. The latest collection contract ended with the most recent collection, so the Department will be advertising again for data collection. They would like to be able to compare the roads collected for rutting data, etc., with curb and gutter data, edge of pavement data, and other assets.

Data Integration Issues

There are certain data integration issues that impact the automated use of pavement data with other systems. For instance, the pavement data is needed for HPMS, which is a silo system. There may be a connection developed in the future with HPMS but at this time, there is no accurate Coordinate Data System (CDS) in the pavement databases to be synched with the RDS system. A match on CDS with the RDS system existed 4-5 years ago, but the CDS has been updated so many times so they are now out of sync. Hopefully, the ESRI Roads and Highways (R&H) tool can be used to establish the synchronization again. Regarding geographic referencing, they are working to sync their pavement sections with the linear network, but for now they maintain their own maps of pavement sections.

A link to MMS would also be a large improvement to track maintenance expenditures with pavement rutting and cracking related needs. The ideal pavement system would include tabs with data and information to download data that could be used to plan projects, and would include project and maintenance information and could be used to help support planning, design and asset management decisions.

How is this linkage envisioned? They could use their pavement data table (currently in Access database) and once it is tied to centerline data, the pavement data can be linked to other databases using CDS and milepoint. Once this link is established, the data can be connected to the Roads and Highways (R&H) test tool to see how it can be used to tie to other systems. For the most part, their data is synched with geodatabase in TDS office within 1/10th mile accuracy, except for local roads which are not even in CDS. Some local roads are collected by them and are stored under one CDS number for 3 different roads. There are several issues like this that need to be addressed. The HPMS group spends many hours manually correcting this data.
Other data needed for asset management includes crash locations and traffic data, number of lanes and pavement width. This information needs to tie into the highway data and safety databases. There is no way to directly link this information into the pavement management system. Crash data cannot be linked to rutting locations on the roadway and as far as traffic data goes, a consultant was used to enter the traffic data for the Department and the data was several years old. Since the traffic group has not released the current data, the pavement group does not have access to it.

The current pavement data stored in an Access database is exported into Excel for manipulation and reporting of the data in 1/10th mile sections to meet user needs including HPMS federal reporting purposes.

They are using the RDS system from Planning and they are going to test the R&H tool. There is no guarantee that this will work, so they still have tools in place to maintain the table of linear referencing by providing their table of data with section IDs, CDS and milepoint values. This table will be updated and sent to the contractors to load new milepoint values.

**Recommendations for New Pavement Management System**

CS is making recommendations on a virtual framework for TAMIS that will provide access to a number of data systems across the Department and which is not specific to any particular system. The business decisions made in the pavement, bridge and maintenance areas and other asset areas would remain with those business areas. The immediate deliverable that the CS team is working on includes describing how any system like Agile Assets or any other solution could fit into the pavement management framework. It is important that CS is aware of business decisions made by business areas in order to address the asset management system needs for the Department as a whole. The business rules for use of data in each area need to be identified, so that data can be compared and integrated in a virtual sense for use in making asset management decisions. CS will not be making recommendations of one vendor product over another.

From the perspective of the pavement management staff, they see Agile Assets as a good software solution with an excellent pavement management module.

Are you comfortable with the CS recommendation that you proceed with your pavement management system procurement and that CS document what is needed to support asset management? Per the pavement management staff, the idea is to have the ability to obtain equipment fleet information and information from the Maintenance Management System (MMS) to be able to do preservation and project calculations.
Users of Pavement Data

Who are the primary users for pavement data? CS developed a use case diagram for pavement management in 2005 and the diagram needs to be updated as part of the TAMIS project.

Users of the pavement data include the following offices/sections:

HPMS – pavement data is required for the HPMS report.

Design engineers, planners, M&O - pavement data is used by these groups for pavement analysis purposes. The design engineers need to be able to match project locations and materials sites.

Materials engineers – pavement data is used for rutting analysis, roughness, and review of structural data. The material engineers need to look at remaining pavement life, and to make predictions based on rutting rates, and IRI. They would like to be able to use the data for funding projections and calculations.

Some users have access to PERS (Performance and Economic Rating System) to get the pavement data, but other users in the Department have to go through the pavement management group to have them extract the data out of PERS for them. PERS is a pavement data system owned by Dynatest. The pavement section staff would consider transferring the pavement data from PERS into a new system entirely.

Future Vision for Pavement Management and TAMIS

What other vendors are you looking at? Deighton is one of the other vendors being considered. Their system does not have as many modules as Agile Assets. Deighton uses existing asset systems and connects them within an overall management system. It is their understanding that Deighton does have a pavement management system.

Can you purchase only certain modules of Agile, like pavement? Yes, a base system can be purchased using Agile Assets and additional modules (like MMS, geotech, etc.) purchased as needed.

Whatever system is selected, they have to get the system synched with the LRS system (ESRI R&H is compatible with Agile Assets). If R&H is not chosen, then there needs to be tables to integrate the new pavement management system with the RDS.

What is the current evaluation process being used and its timing? What is the next step for acquiring a system? They have been put on hold and have not thought about the process.

Is there anything that CS can do to recommend funding solutions? Is the funding being provided in-house? As an enterprise solution? They are not sure yet about the funding.
They need a system that does the modeling needed to support MMS, safety, traffic, and highway data and that is accessible with pre-formed tabs to download data and synthesize it to produce project lists for the STIP, or preservation lists for roadways with certain conditions.

They want a seamless way to join the data with other data systems (including the latest versions of systems being used for planning, design, maintenance, and traffic).

What kind of modeling are you doing with the data? Residual life or remaining life of pavement. Rutting and IRI data are also used for regression analysis for remaining life.

They want to be able to do more with the pavement data, but the existing system does not function well and is not user friendly. It does, however, have an optimization feature in it. They need a system to do project modeling and system modeling to project into the future and to provide funding calculations (e.g., rutting level for the state roadway system, based on funding levels for 5-7-10- years into the future). They do not have future projection capabilities at this time, they need to have models that can project numbers.

Are you linking manually with MMS, traffic, safety? Data out of MMS is useless because data is not accurate for locations (spatial and CDS milepoint are not accurate). Location information is faxed to Juneau where the location is coded into the system and this is an inefficient process. Regarding traffic data, they have a consultant enter the traffic data into their system, but it is not the most current data. Also, crash data owners have not released the current data that is in sync with the centerline.

Is there a close tie to what Dave Stanley is doing on the geo-technical side? Not now, but it might become important for the materials sites data which is under his responsibility. CS explained that there is an interest in getting more involved with the Tongass pilot project that Dave is working on and the pavement management staff are also interested in becoming more involved in Dave’s project.

Would you be willing to participate in a pilot project for TAMIS using a corridor to show the benefits of data integration? Drew is willing to be involved in the pilot project for TAMIS. He has mapped project locations in the Central region and has put this data into ArcGIS online.

**D.7 PERFORMANCE ELECTRONIC TRACKING SYSTEM (PETS)**

**Data Management**

Can you give us a high level view of the system and the different metrics that are tracked? ADOT&PF started PETS to track performance indicators across the
department. They started with reports for KPIs that are reported to the legislature on an annual basis, which included over 117 KPIs. They reduced this to 22 KPIs, which is a more manageable number. Some of the original 117 KPIs were identified as no longer necessary; some KPIs are still included and cascade down from the 22 key KPIs; and some needed to be rewritten or reworked. There are five focus areas in the Department’s strategic plan, and the KPIs were matched up to these focus areas. They conducted workshops across the state to review how the measures were being reported, the data sources for calculating the measures, etc. Now they are working with FHWA to incorporate the stewardship agreement into PETS. The Strategic Plan was also rewritten to include maintenance, which resulted in a restructuring of measures. They still report measures and maintain stewardship as part of the measures. They are now waiting to see what will happen with TAM and MAP-21.

The workforce planning cube is updated monthly and is used to track retirement projections and training needs. Rachel maintains the cost data for the cube, and she also does a payroll cube for each fiscal year. She is playing around with one for EEO tracking. They are planning a cube for pavement management data, but it is not in production yet. They see lots of potential for cubes, but it is a matter of finding a program, project, or information system with a definite need for cubes. Setting up the cube and maintaining it requires a lot of work. They haven’t announced their cube capability to other groups yet because they want to make sure they have the resources to manage it and produce results.

What is the difference between Cognos, PETS, and cubes? Cognos is the entire tool; PETS is the part of the tool used for metrics and PMs; and cubes slice and dice and pull information together. Cubes could be used to feed metrics, but they aren’t currently being used for that function. They wouldn’t recommend using cubes to feed information to any other data systems. Cubes simply draw on information in on other databases (could be Excel spreadsheets or databases) to show information in a different format.

The Metric Store is the only true database within Cognos. It is linked to actual metrics that are keyed in. Cubes draw information from other databases. For example, cubes could pull data from AKSAS, AKPAY, and Retirements & Benefits system. They don’t use the budget system apps anymore. Cubes are handy for taking data from different systems, putting it together, and showing the data that is really needed.

They worked on a cube for the Pavement Management System last year. It wasn’t a big deal, until they wanted to add in financial information and tie it to different corridors. Cognos can’t make the logic choices needed to match up roadway and financial data because the data links in the various systems are not present.

For TAMIS, we need to think about whether to link to the original data system or the cube.
Are there any other planning documents or dashboards that are used to report on measures? Different sections have different databases that are used to obtain metric results, and they could be in either spreadsheet or database format. PETS is the official performance measurement tool of the department. In theory, all PMs should be managed through PETS, but they are not sure this is really happening. They haven’t seen any measures that come from systems other than PETS.

Is there a list of the 22 KPIs and the databases they draw from? The numbers for each timeframe are entered by users, but they could get us a list of measure owners (Received). The owners are currently updating the results. Some do go in and maintain KPIs, while others report a single number that is reported through PETS. Sometimes they attach documents or links as backup documentation. Sometimes these documents are stored in eDOCS.

**Data Quality**

Are there any business rules or data quality procedures that are required to be followed (#12)? The only requirement is to meet the annual reporting deadline. They typically have to track people down to get updates. Users have the ability to enter internal measures on a monthly basis so they can use the data to make business decisions.

The measures linked to operating budgets are the focus of PETS, not those linked to the capital budget (because the legislature doesn’t work that way). The KPIs are focused on safety, MS/CVE, infrastructure, Maintenance & Operations, and Marine Highway. They tie back to assisting legislators in appropriating funds for the operating budget. A business rule is to make sure the measure is accurate and makes sense so that the legislature will continue funding. The measures don’t encompass the whole department, which makes it difficult to adapt the whole department to a PM culture. Only one third of the total budget is operating.

Are measures used to make trade-off decisions? The legislature tends to only add or remove funds from a category, so the KPIs are linked to show a direct need for funding. For example, they are currently working on the budget for FY15 (start July 2014). If they wanted to change the KPIs to focus on MS/CVE instead of safety, they would need to propose the new KPIs to the Office of Management & Budget in May. They would then report the new measures to the legislature. The Department has some flexibility to evolve as a situation changes and identify new measures as needed. As a reminder, the KPIs are tied to the operating budget only. One specific indicator (e.g., runway lighting) is part of the bigger picture that is tied to maintenance and operations.

Are there KPIs for the capital side? Only operating KPIs are required by the legislature. Any capital budget will be through the Feds and MAP-21. The operating budget goes through the House, and they do a detailed review. The
Senate does the capital budget, then it goes to the House. The KPIs are for the governor and House of Representatives.

Data Storage

Data is stored within Cognos.

Data are all entered by hand. They only link is to documents within eDOCs, which involves a visual display of reports, not an actual exchange of data.

Referencing System

PETS does not utilize a LRS.

Documentation

Is there any documentation on PETS available? There is no documentation on the PETS system itself, and the development documentation is probably not applicable anymore since the system has changed so much. However, there is a list of KPIs, a dashboard, and documents on the website. The information on the website is the most current. There are also links to different portal pages available on the Intranet. These links are as follows:

- [http://dot.alaska.gov/performance-dash/index.shtml](http://dot.alaska.gov/performance-dash/index.shtml). This links to the dashboard and list of KPIs through the public website that is outside of Cognos. It is Cognos data, but it is not within Cognos.

- [http://web.dot.state.ak.us/pets/divdashboard.shtml](http://web.dot.state.ak.us/pets/divdashboard.shtml). This is the link to the Divisional Dashboard and different portal pages. CS should be able to log in using a LDAP signon. There will be 2 logons. One is for the Departmental Intranet and the other is for Cognos. When you bring up a portal page, you are actually within Cognos. On the Metric lists, the prefix “OMB” indicates that it is an OMB metric and “Int” indicates that it is an Internal Metric. The “Commissioner’s Office” Portal Page includes all the OMB metrics.

Data Access and Uses

Are there any access restrictions? There is a security group within Cognos for subject matter experts so they can alter their own metrics. The workforce planning cube is not accessible, but information from the cube is available on the Intranet. The Payroll cube has the most complex security settings, and a user’s security level determines what they can view in the Payroll cube. If a user doesn’t have specific access, they won’t be able to see anything. M&O users are limited to M&O information. The workforce planning and payroll cubes are currently in production. Payroll cube versions are produced for each fiscal year. They are working on the EEO cube, which will be used for reporting purposes to keep federal funding. The pavement management system cube is in limbo until they see what happens with TAM.
FHWA Stewardship can be accessed through the Intranet. FHWA has access to the stewardship agreement, so they can go in and view the metrics. FHWA is an external client who enters data into the system, but they only enter data for FHWA Stewardship. The following website links to the FHWA Stewardship Portal page: [http://cmm.dot.state.ak.us/cognos10/cgi-bin/cognos.cgi?b_action=dashboard&pathinfo=/cm&fragment=false&path=storeID(%22i0B59C35D42C743A48411E335E4D861D1%22)&backURL=%2fcognos10%2fcgi-bin%2fcognos.cgi%3fb_action%3dxts.run%26m%3dportal%2fcc.xts%26m_folder%3di4B61883BEC18415D919E3CA7859E907C](http://cmm.dot.state.ak.us/cognos10/cgi-bin/cognos.cgi?b_action=dashboard&pathinfo=/cm&fragment=false&path=storeID(%22i0B59C35D42C743A48411E335E4D861D1%22)&backURL=%2fcognos10%2fcgi-bin%2fcognos.cgi%3fb_action%3dxts.run%26m%3dportal%2fcc.xts%26m_folder%3di4B61883BEC18415D919E3CA7859E907C)

They will be using PETS for the foreseeable future.

There has been discussion about the ability to use PETS to provide reports to the Feds on MAP-21. There is certainly a connection in AKDOT&PF’s mind that PETS could be used for reporting purposes for TAM and MAP-21.

Craig is considered the system owner (Admin Services Division), but Craig/Steve are considered system owners for PETS.

What is the vision for PETS within the TAM framework? They see PETS as a key provider of performance measures, and it could be expanded to include capital and other operating measures. They challenge will be in obtaining department wide involvement/buy-in. Once that happens, the Admin Services Division has the ability to provide the necessary technical support to make it happen.

What are the obstacles to obtaining department wide buy-in? There would need to be a culture change on the part of people inputting data as follows: 1) the people inputting data need to understand how vital/important it is; and 2) the supervisor assigning them work has to understand how important it is. Currently, it is not seen as a priority. We need a culture that supports performance management. Only then will we see use of the system increasing and adequate resources in place to support the system. Because people don’t connect it, they don’t realize there are KPIs that are tied to budget, and particularly the operating budget. Change management tasks need to occur first. Most people see as a pointless exercise and don’t understand why it is important and the benefits associated with it. For many users, there aren’t direct benefits for them.

Another challenge is that the current metrics are worded in such a way that going to the original data source to get the information is nearly impossible. The calculation metrics have evolved over the years.

How would you go about the changing system to meet the needs of TAMIS but still meet the needs of the legislature? The Department has to focus on what it needs to satisfy internal functions/infrastructure. Measures need to be able to roll up into easily identified areas that other people can understand, with specific measures identified for submittal to the legislature, MAP-21, etc. There is currently no comprehensive department-wide performance reporting system, but one is needed. They need to decide which way they are doing it and what is
needed in the end. Also, training is needed on how to write performance measures.

**Conclusion:** This is less about documenting what’s in PETS and more about potential future developments and how Cognos as a whole could be used to support TAM.

## D.8 PONTIS/BRIDGE MANAGEMENT SYSTEM

### Documentation

Is there any documentation of the data elements or metadata for PONTIS? We should refer to the FHWA NBI coding and recording guide (1993) and associated interim updates/supplements. There is no Alaska specific documentation, except for a dozen additional Smart Flags in their Bridge Management System. They will forward this information to us (DONE). Smart Flags are used to supplement the data in PONTIS and includes elements such as the approach rail, signs, and brush.

Alaska Bridge Mgmt System = PONTIS.

PONTIS (v4.4) is the outgoing system, and the Bridge Management System (BrM v5.1) is the new replacement system. PONTIS mainly tracks deterioration (i.e., deterioration of paint, elements, etc.), while the new BMS is intended to address both deterioration and structural deficiencies (i.e., impact damage from cars, plows, etc.).

The current system doesn’t address wing walls and the approach slab. The new system may incorporate these, but they are not sure yet. They anticipate that it will include the same functionality, even if they have to add Smart Flags for these data elements.

Mike Knapp is with the hydraulics group and does work related to the NBI. The Bridge Section collects sounding data, and they are currently stored digitally on the evault system as Excel spreadsheets and printed as hard copy appendices to inspection reports. M&O has access to printed inspection reports, and select individuals have access to the evault system. Mike noted that it may be useful to link sounding data to a geospatial map format (Google earth) or GIS so that users could view sounding information. This is separate data from the BMS, so it won’t be included.

### Data Management

What other data systems have direct or indirect data links from BMS? They currently feed data to the MS/CVE permitting office in Anchorage, including bridge number and CDS route/milepost, and they manually enter load rating information for each bridge. It is a very manual process and is not automated. Load rating information is also available in paper file, with data entered into a separate interface with MS/CVE. It is not part of BMS yet. They also measure
rail height and asphalt thickness as part of cover sheet data that is maintained in Excel. They also have an in-house Field Inspection MS Access Program for maintaining data on rail height, asphalt thickness, hydraulic information (erosion, scour, etc.), utilities, and roadway width. This database captures anything that is not covered in PONTIS.

What is the link to PONTIS? It is a totally separate program, with no link to PONTIS. Sound data and field inspection data are used with PONTIS to make asset management decisions for bridges.

When they print a Bridge Inspection Report, it includes pages from the Access database, PONTIS data, bridge inspection data, hydraulic data, and photos as part of the complete set of data. They also print the sounding data with the bridge inspection report to provide additional information as needed. They will provide a copy of a bridge inspection report and note the data sources used to produce each page. (DONE)

The information is provided to decision makers to justify the work candidate items listed in the report itself. It provides evidence of and support for work candidates. The reports aren’t sent up to other decision makers.

Are data elements from BMS sent up to a higher decision level? They receive inquiries on bridge rail heights and asphalt thickness as a result of paving. Typically, a bridge could handle the weight load of the additional asphalt, but the bridge rail height must meet certain standards for safety reasons. They are not sure if this is a TAM decision.

Are there any other database used on a regular basis to track features, characteristics, and maintenance aspects? Bridge photos are used and could represent a form of data for TAMIS. For hydraulics, they use photographs and sounding data to track channel changes over time, and they maintain a list of photographs for each bridge. The photos are housed on the DOT server.

**Data Collection**

Within BMS, who is collecting data on the condition of bridges? The data is collected primarily by field inspectors, who have in-field devices/laptops for data collection.

There are protocols, processes, and procedures in place for collecting the data. Following the inspection, they will take their laptop and extract the data for their route. The data is uploaded into PONTIS and the Access database. There are protocols in place for data collection, although they do take into account considerations for safety (e.g., traffic, bad weather, etc.), and they will come back to collect certain types of data at a later date (i.e., when traffic control can be set up) if they pose a safety risk.

Safety meetings are held at the beginning of each month, and topics include a review of data collection procedures for certain types of data. The data collection
procedures and a list of emergency and maintenance contacts are contained on the data collection device (laptop) itself.

**Data Quality**

What quality assurance processes are in place? If an inspector changes the coding by more than 2 points (e.g., a field that was previously a 5 is now a 7), it is flagged and sent to a supervisor via email. The supervisor reviews the rating to determine if there is sufficient explanation (verbage) to justify the change (e.g., a big improvement or structural deficiency). The same procedure is in place for when a bridge is downgraded, especially if it was previously categorized as deficient.

They also recently started a QA process where a team leader inspects 10% of the routes to check that they are in agreement with the ratings and that inspectors met all inspection criteria for bridges. This is basically an in-house quality assurance process that focuses on the inspectors and their procedures rather than the data itself.

They aim for a 90 day turnaround from data collection to input of data into BMS.

**Data Integration**

Are there any known technical issues with integrating data from PONTIS with any other systems? They manually integrate bridge data with HAS and bridge location data with the LRS. These are manual extracts in Excel that are sent to David Oliver or the Data Port group (Sean Jordan) via email or data dump.

There is also a link between PONTIS and MMS. Ocie Adams does a View Extract quarterly or semi-annually after inspections are done. They provide him a read-only view of PONTIS, and the data shows up on local maintenance station computers. At this time, Ocie is the only person with access.

Their location data is kept by lat/long. Lat/long isn’t the best LRS, so they are starting to rely on David Oliver’s location data for longer routes. The bridge group obtains the lat/long data from quad maps, handheld GPS, or Google Earth, none of which are acceptable by David’s standards. They are working with him to resolve these issues, particularly at locations where the bridge lat/long don’t align with David’s location data.

What are you using David’s locations for? How does this data feed back into PONTIS or reporting? Occasionally, they receive requests from external agencies for maps of bridge locations in certain boroughs or cities. Bridges will show up ½ mile off the roadway, and they will work with David to correct the lat/long and produce a map.

Are you aware of institutional issues impacting integration? Within the organization, it is difficult for them to have access to GIS mapping staff. They need access to this type of staff to support their business needs in the Bridge area and to integrate bridge data into the main GIS spatial data used by the...
Department. They have to rely heavily on KMZ (Google Earth) files to display point data for bridges because they don’t have access to GIS staff. Location is critical in distinguishing between public and private bridges, and it helps inspectors and maintenance staff locate the bridge and make sure they are talking about the same bridge location. Ownership information for bridges is also very important. Inspectors may not realize they are on private property, and they could be put in harms way if they try to inspect a bridge that is private.

Are there any other extracts out of PONTIS? They extract to FHWA as part of their annual data submittal. They also provide ad hoc queries to planners and internal decision makers. The bridge group manipulates the data and provides it to them. One key marker, structurally deficient deck area, is extracted from PONTIS and used as a planning tool to prioritize need for improvements. This list is provided to planning and the legislature, and it is also used to publish the bridge reports.

**Data Storage**

Are there specific national, state, or agency standards that govern storage of the data? There are no national standards; it is left up to the discretion of each entity to set their own standards.

Are these data redundant with other any other data systems within DOT? There may be some duplication between storage of traffic volume and location data; however, specific to the structure (steel girders, deck, vertical clearance, substructure, etc.) itself, there is no duplication. Signs on bridges may be duplicated in MMS, and bridge rail data may be in the traffic/safety data systems. With regards to hydraulics, there are multiple repositories of culvert data -- maintenance staff often have records; regional hydraulics engineers also keep their own set of data; the Maintenance Management System (MMS) includes culvert data; the Department of Fish & Game has collected and maintains culvert data (through DOT&PF funding); and the Bridge Section has collected data on culverts larger than 10 feet. Therefore, other databases likely exist.

How do you plan to integrate the culvert data? The MMS would be the best comprehensive system for housing all of the stakeholders’ data on culverts, as there are a large number of data fields that could be customized to the data. It would simply be a matter of getting the data to Ocie Adams. Ocie already has a data collection project underway in which M&O staff are collecting culvert data. Once collected, people could see that the database exists and could support ongoing data collection efforts. Another benefit of MMS is that M&O personnel regularly update the database as culverts are repaired, replaced, etc.

**Data Access and Use**

What type of standard reports are generated in PONTIS, and are they ad hoc or a set annual report? Most of the reports are routine inspection reports.
Are there data sets populating PONTIS? The inspection data is used to populate PONTIS. They are also getting information from HPMS and Traffic (e.g., ADT, functional class). Data transfer is automated via an IT-developed screen that compares the PONTIS database with HAS and allows users to accept/reject new values for ADT or functional class. ADT values are updated annually, and any changes greater than 10% are flagged for further review. The Program Development group recently did a functional class reclassification project, and the Bridge group had to manually compare the new functional class values once they were accepted by FHWA. It would be helpful to automate these processes and flag values that differ by more than 10%.

What business decisions are made using data from BMS, either within the Bridge Management Division or externally? Safety related decisions are a high priority (e.g., immediately flagging unfit bridges and tracking responses to critical deficiencies). Everything else goes through a review process, and the bridge owner determines which improvements will be made.

Critical deficiency is one criteria that requires immediate attention, but it isn’t well defined. There are different levels of criticality defined based on NBI data and those determined at the regional level. For example, it is up to the Bridge Chief to decide whether the issue is critical enough that he can’t leave the bridge site without taking some form of action or closing the bridge. There are also different levels of criticality defined from the maintenance perspective. Critical actions are listed within 1 month, 1 year, and 3 years. Reports pick up the 1 to 3 year deficiencies so maintenance can get it programmed and funded. In these cases, the structurally deficient deck area and AADT are used to prioritize the list of improvements.

Projects are programmed in the STIP and budget is assigned to handle scour related issues in-house. They use the STIP ID number to track and fund improvements for bridge scour. Maintenance has its own budget program to address bridges, and actions are decided based on proximity/opportunity-based decision making (i.e., there are resources located nearby). Each region gets its own allotment of federal funds and has the authority to choose which projects to advance within their program.

Mike noted that the decision to dedicate public funds towards a specific project ultimately resides with our political appointees. The Governor’s staff - Commissioner, Deputy and Assistant Commissioners, etc. - decide what projects the Department will pursue. The Statewide Planning Chief and Regional Directors (all Deputy or Assistant Commissioners) may delegate responsibilities to subordinate staff, but final decisions are theirs (subject to legislative approval). Technical staff have the role of informing upper management about the purpose and need for proposed projects, and have influence over the prioritization of projects. (In an emergency situation, a critical finding associated with existing infrastructure would be addressed immediately by M&O.)
The new PONTIS is trying to incorporate new things like deficiency based on sub-structure conditions. They have no way to code these types of conditions now, but these are points of vulnerability and need to be documented, especially where rail piles, slope stability or earthquake prone areas damage the sub-structure. This would make the bridges eligible eventually for funds.

To address this before PONTIS is ready, they will add a smart flag that relates to the sub-structures. Soon, they will be able to relate concrete cracking to the bridge and this will be added to PONTIS.

What are your future directions for PONTIS or using the BRM? They are in a test environment for the new BRM system. PONTIS data was migrated to the BRM, and they are reviewing it and it will eventually be used for programming and funding. TAMIS is coming into this picture at a transition point for the bridge group.

Resource allocations based on reassessing staff time allocated to bridge work has not been consistent in the last few years. Addressing FHWA reviews will require pulling staff from data collection and more into a reporting mode. For example, last year staff spent more time doing bridge inspections than previous years to meet the maximum 24 month cycle. A fairly recent change in regulatory pressure has forced a redistribution of staff resources and they anticipate greater scrutiny of data. In the future, there will be more eyes on the data, potential for errors in the data, etc.

AV: We will recommend going forward that there be a specific set of data that can be used on a broader level. Can you identify what types of data could be used for external consumption? Bridge efficiency, deficiency, and waterway data would be some of the data that could potentially be used. They have access to a lot of data in their files, but users need to explain what they need the data for so they can be directed to the correct data. Rich Pratt will be the one probably making decisions on what will be sent out to others.

Presently, DOT&PF has the responsibility to maintain state-owned bridges, not the private ones or the municipalities' bridges. There may be an owner and a maintainer of the bridge, and these may be different entities. If the state determines that a bridge is deficient, they write a letter to the owner entity so that some group is held accountable for maintaining the bridge on behalf of public safety.

AV: Are there any other concerns that you have? Due to limited resources, they will need to be able to support any additional system that is developed (like TAMIS) so that it can be maintained over time.

**Programming Decisions**

CS conducted a follow up interview with Richard Pratt to get additional information on higher level programming type decisions regarding bridges.
How do you request funding for bridge projects? How do you prioritize bridge projects? They develop a prioritized list of structurally deficient bridges, based on such data as ADT and the structural condition of each bridge. This list is provided to the Program Development staff (Jeff Ottesen) on an annual basis and is also sent to the regions to help identify bridge replacement projects. Program Development is responsible for entering the projects into the STIP, including bridge projects.

Bridge replacement and rehabilitation projects are funded out of the STIP. There is a line item in the STIP for bridge inspection and inventory needs. Currently $13.6M per year is allocated to this project ($6.1M for bridge inspections and design, and the remainder for right-of-way and construction).

What about the future plans for the PONTIS database? They have been using PONTIS since 1994 to collect element level data, but it is not generally used to program any work. Carolyn Morehouse may do another contract with Paul Thompson to do deterioration modeling using bridge data, similar to what he has done for another state. During August-September (2013), Paul had a contract with ADOT&PF to review their PONTIS data and to examine how the data is collected. He also provided his recommendations on how they could use the data for deterioration and performance modeling, using a series of excel spreadsheets.

A new version of PONTIS is being developed now, but it will be a couple of more years before it will be completed. [As a side note, during the CS Team interview with Bridge staff in May 2013, we were advised that the new bridge management system will be implemented in May 2014]. ADOT&PF may have Paul develop similar spreadsheets as those he developed using PONTIS data (for purposes of deterioration and performance modeling) as they transition to the new bridge management system.

What about integrating and interacting with other databases to make those decisions? They do not interact with other databases to make funding decisions regarding their bridges. There are 1000 bridges in the state and they are very familiar with the conditions of those bridges. They know which ones need rehab or replacement. They are also members of the Western Bridge Preservation Partnership, which helps them stay informed on what other states are doing pertaining to their bridge programs.

Are there any other funding sources that you have access to? Not that they control. The funding is allocated when Program Development or the Regional Planning Section identifies a project in a region (within the STIP). Funding for bridges is allocated when the STIP project contains a bridge within the project limits. In recent years, the STIP appears to have placed a priority on replacing or rehabilitating structurally deficient bridges. There is also state funding available using emergency bridge repair funds. Roger Healy, the Chief Engineer can release those funds to do bridge work.
They are still trying to figure out how to allocate funds based on the new rules under MAP-21. They are aware that they have to have an asset management plan in place by 2015 and that their federal funding will be impacted (per FHWA) if they do not have a plan in place. Even if a database is developed to help determine how to allocate funds, the legislature will still have input into those decisions.

**Future Use of TAMIS**

Anita clarified that TAMIS will be used as a tool to use to view how asset data is mapped across different types of assets (e.g., viewing pavement data compared to future capacity management). TAMIS will also investigate how to integrate data across assets, such as using some kind of virtual data warehouse. It will not provide decisions, but will be used to support decisions for asset management.

Rich explained that for upper level decision-makers, it would be helpful to let them know how investments in bridges would help the overall system compared with allocating funds for pavement projects or other types of assets. They do not currently have this type of trade-off analysis capability of comparing data from separate management systems. This is a function that would be helpful.

**LP and AKBAS**

This interview also briefly addressed the link between the Local Permits (LP) system and AKBAS, which is part of the bridge management program. There is a bridge overload program that is used to analyze where heavy weight vehicles can be routed. This is the AKBAS system. AKBAS keeps track of this type of information, but it does not use data from PONTIS. A list of load ratings for bridges is provided to the office that issues the over-load permits. The LP office can input information like axle spacing and weight into AKBAS to compare the load effect with the load ratings (capacity) to determine whether heavy weight vehicles can safely cross bridges along a planned travel route. The National Bridge Inventory (NBI) database provides the load rating data for the AKBAS program, which is then compared with the axle spacing and other data entered by LP staff to come up with a capacity value for purposes of issuing permits for routing over bridges.

### D.1 Reservation Management System (RMS) III

RMS III is a reservation system used to book reservations on AMHS vessels and to ticket the appropriate reservations. The system is used internally to forecast passenger loads and to schedule when ships go between ports. This is an older system, and there are not enough funds to replace that system at this time.

Why are these data being collected (ADOT&PF requirements, federal mandates, other)? The current Reservations & Management System (RMS3) gathers data to book reservations on AMHS vessels and to ticket the appropriate reservations.
The system also collects data to prepare the USCG mandated vessel manifest which is a requirement to operate in revenue service status. The system also collects traffic and vessel data for management reporting.

What do you use it for (i.e., does it support asset management decisions within your department?) The RMS3 system supports asset management decisions through the gathering of historical traffic data.

Does it support any decision-making related to other areas such as capacity, safety, bridge, pavement, freight? The RMS3 system contains historical data used in management decision making.

What types of data are included in the system (i.e., does it contain inventory data that could be used for asset management purposes)? The only inventory items collected in the system is how many spaces (passengers, car-deck and cabins) are available for purchase at any given time.

Is the system used on a Statewide or Regional basis? This system is used along the total system route (Bellingham north to Whittier and west to Dutch Harbor). The system covers 3 Transportation Plans (Southeast, Prince William Sound and Southwest).

How often is the data updated (i.e., in real-time or on a periodic basis)? Portions of the system are updated in real time (those involved in the travel portion) and the entire system is updated weekly (historical results).

Is the system supported by adequate resources (i.e., are there resources for data updates or system improvements)? The current system is adequately supported.

Are there plans for future retirement/replacement of the system? If so, when? We are currently in the process of replacing the existing system. We expect to have an RFP on the street by the first week in October. We expect to have a functioning new replacement system by October of 2014.

**D.2 RIGHT-OF-WAY (ROW) DATA FOR PLANNING**

**Background on ROW Data for Planning**

For ROW in general, TAM is a big issue, but it doesn’t rise to the top for funding purposes. Their responsibilities include providing ROW estimates data for the department. One of first questions in project planning is, where is the existing ROW, how wide is it, etc.

Alaska is the most primitive state in terms of having ROW information at their fingertips compared to other states. Prior to statehood, the ROW information was maintained by the Federal government. They have this set of information acquired since statehood. Traditionally, they only did ROW mapping when a project required realignment of the roadway and acquisition of ROW was involved. There are still parts of highways that haven’t been mapped yet. There is no geodatabase/GIS map for the state that shows ROW at all locations.
Their focus has been on Capital Improvement Projects (CIP) as opposed to property management. Because they generally aren’t well funded on the property management side of ROW and permits management, they don’t have a good tracking system. They have been using spreadsheets and small databases to manage data on utilities permits, driveway permits, and encroachment permits.

During the last several years, they have been putting information into eDOCS so that the ROW information could be retrieved more easily. They are in the early stages of their eDOCS system for ROW data, and they are working on scanning documents.

**Linear Referencing and ROW**

They have not mapped the ROW data in the state. They are working with Angela Parsons to test the use of some GIS tools using scanned PDFs of ROW plans and Google Earth images to identify ROW.

The GIS system being developed by the Planning Division is not at the level of accuracy needed by the ROW section for encroachment identification with a 10-20 ft accuracy. Also, the centerline of physical roads often doesn’t align with centerline mapping in GIS. The centerline and level of accuracy are the biggest issues. There is a need for a common set of standards for GIS for ROW that everyone should follow.

**Data Needs for ROW**

What type of data is collected for ROW? They have never mapped the ROW, so it is based on the nature of the pre-existing land. They have to survey the physical centerline and run a title analysis to determine existing ROW widths along the section. They have never surveyed or done a title analysis on some portions of the highway network. The type of data that are needed for ROW work include geographic location of the ROW, coordinates for the roadway centerline, the nature of the interest in the ROW, the parcels that ADOT&PF has acquired to associate them with any scanned files they have. This includes property management and links to anything that is permitted (e.g., driveway, encroachment, directional signing, utilities, and material sites that are on and off the ROW).

The FAA has had a big push on GIS regarding airports. Smaller rural airports have a localized GIS system that could be brought into TAMIS fairly easily. Both AMHS facilities and airports are included in TAMIS. The Regional Design Section has been putting together a GIS system for regional airports.

**Interface with eDOCS**

The ROW section does not have a retention schedule for their files like other areas in the Department, so they have a large amount of hard-copy files, and these are NOT stored in eDOCS.
How is data referenced in eDOCS? Data are referenced using key words, tags, project number, financial accounting number, highway number, project name, and random text search. Having them tagged in a GIS environment would be more effective than anything they have.

GIS and ROW

Has there been exploration of using the Roadway Data System that is being developed? If they were able to enter ROW data into a system that is geographically accurate, they could go out in the field with GPS units, locate an encroachment, and then determine if it is inside or outside the ROW. However, they would need 1-2 ft accuracy to do this.

They have been working with the Department of Natural Resources (DNR) to integrate ROW data into their online database, which allows people to search for ROW plans by road name, township section and range, and other parameters. DNR is pulling the plug on it, so they will need to develop some other mechanism.

ROW Needs for TAMIS

There is no data system in place for ROW data, just the repository of documents in eDOCS.

Is ROW data supported by adequate resources? No, they don’t have adequate resources to maintain records and provide ROW information in a timely manner.

Is there a subset of ROW data that is useful for asset management? Yes, subsets of data would include data on how many driveway permits are there.

Has there been discussion of a statewide system to address this? ePermits is used by the public to request permits. At one time, the decision was made for ROW to handle all of the permits programs. Several years ago, driveway permits were issued by paper at the local maintenance station level. Therefore, there are thousands of driveway permits that have never been entered into any electronic system. Driveway regulations were developed several years ago to ensure that driveways are built to standards and located appropriately. As-built drawings were used to verify that the driveway was built and is considered permitted. However, these driveways were not entered into any system either. If you did a query between mileposts, you wouldn’t get the total picture because it wouldn’t include the driveways that were never entered.

John would like to see all permits, the parcels acquired, and the materials scanned and made available in eDOCS and TAMIS.

The problem is getting to long-range thinking; the Department tends to focus on immediate projects.

Conclusion: CS needs to delve into the ROW issue when we address the data governance issue.
D.3 **ROAD WEATHER INFORMATION SYSTEM (RWIS)**

**In/Out of TAMIS?**

Regarding the RWIS system, Alaska is starting to use different types of sensors in the pavement and for air quality purposes. The environmental sites locations are stored in a geodatabase. The biggest link to asset management from RWIS is the temperature data probes profile data. This data is used for weight restrictions as it pertains to the pavement and is used for winter weather maintenance decisions. The air temperature data and the wind data can be used to make decisions to support TAMIS, including decisions on weight restrictions and to evaluate driving conditions before rural maintenance crews go out each day.

**Data update cycle**

The temperature probe data is updated at 10- or 20-minute intervals. It is packaged into a 24-hour file and is sent in to the Department by the contractor for review of the temperature signatures.

**Conclusion:** Due to the availability of RWIS data for maintenance and weight restriction decisions and the use of the system on a statewide basis, RWIS is determined to be an important data system for support of TAMIS.

**Recommendations for RWIS as it relates to TAMIS**

Identify what datasets are available (archive of surface temperatures and sub-probe data). A lot of these types of datasets have been exported for research purposes (evaluating wind data, wind loadings and snow loadings for buildings and structures).

**Data Collection**

The data collection methods for RWIS are documented in prior Concept of Operations (ConOps) documents prepared for ADOT&PF as part of a Data Business Plan. Those documents will be reviewed for data collection activities that support the TAMIS framework.

**Data Quality**

The data quality criteria for RWIS are documented in prior ConOps documents prepared for ADOT&PF as part of a Data Business Plan. Those documents will be reviewed for data quality criteria that supports the TAMIS framework.

**Data Integration**

Based on this interview, the only potential data recommended for integration to support TAMIS at this time would be the RWIS data (specifically the surface temperature and sub-probe data).
Data Storage

Previous ConOps documents will be reviewed to identify the data storage methods used for RWIS data.

Referencing System

Previous ConOps documents will be reviewed to identify the referencing methods used for RWIS data.

Data Documentation

Previous ConOps documents will be reviewed to identify data documentation related to the RWIS system.

Use Cases

Detailed use case diagrams and narratives were prepared for the RWIS system as part of the development of the Data Business Plan. The Use Case documentation for RWIS will be reviewed to determine if any updates are needed to document potential link of RWIS to support TAMIS.

Data Flow/Transformation

The data flow/transformation information for RWIS was documented as part of the development of the data business plan and will be reviewed for identification of potential data transformation that would need to occur for use of RWIS data to support TAMIS.

D.4 ROADWAY DATA SYSTEM (RDS) AND SPATIALLY INTEGRATED ROADWAY INVENTORY SYSTEM (SIRIS)

Data Governance

AV: How could Jack’s ideas for Data Governance be incorporated into the TAMIS framework?

JS: Data Governance was addressed at the SCOP meeting. The biggest concerns for implementing data governance include a lack of common definitions and common data dictionary to establish understanding of diverse data terms across business units.

AV: We are helping to develop a high-level P&P for TAMIS and Data Governance. Do you have any questions for us on TAMIS?

Talena: They have been sharing their GIS efforts with Regions and they are finding that there are several independent efforts to develop GIS systems to
support their own business needs (e.g., the SE region has developed a materials geodatabase). Most of the work is being done on people’s desktops. They are trying to figure out how to integrate the data, but they are not set up yet.

AV: There could be a couple of reasons for this. The focus has been on headquarters (e.g., pavement), and regional involvement has been hit or miss.

Talena: The regions are doing a lot of work with data management, but it tends to be at the staff level rather than management level. It might be helpful to develop data governance rules for the regional level that are specific to the applications they are working on. Talking to some of the region geodatabase managers might be helpful to the TAMIS effort. Talena will provide a list of regional contacts she’s run across.

Overview of SIRIS

AV: We want to talk about SIRIS and the fact that the Roadway Data System, Traffic and Crash are all incorporated into SIRIS. Why is it that those systems are in SIRIS? Thinking about integration, shouldn’t the RDS be separated from SIRIS? How does SIRIS link to TAM as a whole?

Alaska: This is a carry-over from HAS. They have not done much in building out the SIRIS yet, except for the traffic component. It is in a conceptual stage at this time. The concept also included a data warehouse, and SIRIS would serve as the umbrella for that data warehouse. Traffic and crash data would be linked up with the roadway network so that users can access the integrated data. The new Traffic Server is a first step in that direction.

SIRIS is the umbrella for the core business processes that program development was involved with. They chose to include the traffic and crash data programs, but they could have easily done it for other systems as well. Weather (RWIS) and 511 traveler information are small components of SIRIS. Someone else will be maintaining attribute data for other assets, while they will maintain the location data.

The plan was that the Roadway Data System would be the spatial component of SIRIS. However, SIRIS is largely conceptual right now, so they could have a different RDS in the business environment. If TAMIS creates an environment for linked databases using a common RDS, then traffic and crash could be included in a broader enterprise system.

Bruce: SIRIS could be seen as a mini version of TAMIS. It is an enterprise GIS for program management. There is no reason to limit it to traffic and crash. You could just as easily add pavement, bridge and other data to create an enterprise wide GIS. SIRIS could also be a model for enterprise GIS for the Department. The challenge here will be the timing – the traffic data procurement and crash data systems are coming later. Events may bypass looking at SIRIS as a model. The Roads and Highways (R&H) pilot project may serve as a better model for an
enterprise GIS, and pavement and bridge could be included as part of the R&H pilot.

AV: TAMIS doesn’t mean the creation of another database or LRS. It will provide a framework for how to integrate databases and an agreed upon update cycle so managers can have confidence that the data is current. If TAMIS can fill the niche of establishing the update cycle and framework and provide a common place where people could go to get integrated business data, it could fulfill the need for SIRIS. The question is, would an expanded version of SIRIS become the Department’s TAMIS, or would we have a new TAMIS and access the databases that exist in SIRIS? It would not be a huge step to add pavement and bridge data to SIRIS and let it be the starting point for TAMIS. It could provide a nucleus for building out, since there are overlapping and similar needs.

Alaska: They don’t think there are datasets in SIRIS that wouldn’t help in TAMIS. If there is a direct link to PONTIS to get bridge information, there would be reports generated to serve their business needs. Each asset will have business needs that extend beyond TAMIS. Individual business groups will need to maintain their own reports in addition to the subset provided by TAMIS.

**Bridge Data**

AV: We have heard from the Bridge folks and they need more reconciliation on location data for bridges. Can we hear from you on what the concerns and issues are related to bridges?

Alaska: Coordination is very crude right now. The Bridge group doesn’t care about bridge locations, while TDS GIS folks are very concerned about it. It is a very manual process to enter bridge locations into the RDS. TDS is interested in the Functional Classification and traffic volume data for the bridges. If they have a bridge number, they can go to the bridge database and get the attributes that they need.

John Orbistondo said that they will develop the new bridge system this fall, and their consultant will talk to the TDS GIS folks to see how the efforts can be integrated. They also have a text log viewer tool they are developing, which will be a replacement for the highway data port. Everyone will need to go there to get the bridge extract from now on. They are planning to maintain their own identifier that the bridge group could link to for integration purposes.

With the R&H pilot, they are looking into whether they can store location data in the R&H database and attribute data in external databases. They are trying to go to the business owners to see what the best option for them is. They are trying to develop a toolbox approach rather than one size fits all. Bridge location will be an anchor point in the RDS, and TAMIS or SIRIS could be used as a way to pull in the attributes to relate to a location.
Pavement Data

Pavement has been an evolving target over the last few years. DYNATEST has developed an application that will fit with the location data used at ADOT&PF. They are looking at physically loading the pavement section data into the LRS. They are using 1-mile segments, but MaryAnn needs the 1/10th mile level of granularity. They are trying to address the integration of data on many fronts. They just put out an RFP for data collection to reconcile the photolog and inventory data collection. This will give them one consistent dataset to snap to the network, which would allow them to be consistent with route IDs, AADT, and data collection year. RFP responses are due back this week. They are trying to do a pilot data collection in late September or early October of 500 miles to demonstrate how pavement data could be integrated with the LRS and other inventory data collection efforts. Full data collection will take place in the spring with or without pavement, in which case the pavement manager would need to procure their own data collection effort.

Bruce: Can the results of that pilot integrate with the R&H pilot? Alaska: Yes, event data can be added so that the results can be used in the R&H pilot.

ESRI Roads & Highways Pilot Project

AV: What about the R&H project?

Alaska: They are wrestling with how to migrate data from the existing RDS into R&H. They are looking at 6 different calibration methods for integration of external data, but none are a good fit for someone with an existing LRS that doesn’t have existing calibration points. They determined that there will need to be a certain amount of calibration work to get the data into the system, then they might be able to use the out-of-box calibration that R&H provides. They are going to create a network using the most/least complex calibration methods and pull in some of their data to see how it performs. This seems like a more viable approach than upgrading to a custom solution.

Bruce: In the other TAMIS interviews, has CS probed what database managers are looking for in terms of location accuracy? AV: No, but we could follow up with that question. ESRI is suggesting that the R&H level of accuracy is relative, so long as the events along the roadway appear in the right order and are a relatively correct distance from each other. Does Alaska really need the measurement to be correct within 1 meter?

Alaska: The Department is not used to seeing their data in a spatial format, only tabular. There is a perceived level of accuracy that is not there. When they started looking at the photolog data, they found the GPS to be more accurate than the DMI locations. GPS has better accuracy, but the LRS can be used to simplify management of the data once it is in the GIS system. Calibration is only critical during the migration of the data to minimize spatial shifting. Once the data has been migrated, it will take a backseat to the actual data from the LRS.
they can integrate pavement data into their data collection effort, they can move past the LRS/GPS issue.

AV: What are obstacles to taking the model used in TDS to the enterprise level?

Alaska: Funding is a big issue. Ongoing dialog with the TAM governance structure also needs to be improved. They need to be able to provide input to agenda items for TAM group meetings. Communication needs to be improved across the entire Department.

AV: Regardless if TAMIS is part of the GIS effort, isn’t the GIS effort being set up to be used as the Department’s Enterprise GIS?

Alaska: There are two IT issues that have to be addressed first: 1) We need to identify the integration options (pros/cons) of each, and we need defined integration methods and examples so we can meet with each business option, describe the options and then select one; and 2) Governance is needed to improve collaboration across business line boundaries.

Bruce: There is another issue. If there are large number of databases where GIS staff responsible for updating/maintaining location, would this be heavy drain on staff resources?

Alaska: That is the whole premise behind the IMT (an integration tool), and getting data into the system initially was an issue. They gave the tool out to people, but they had licensing issues. Also, the Roadway Characteristics Editor does not maintain data back in the source (external) database. There is a need for a business rule where the functional class or RDS attributes be maintained in a geodatabase or statewide system like RWIS. Criteria could be established to determine what data from external data sources would be included in the geodatabase, where the data would be stored, and how and who is responsible to maintain the data. TDP, RWIS, and WIM experiences have shown the getting the location established and maintained isn’t a great effort. Something more complex would require management of data by individual business lines.

AV: Is there a data catalog that lists the data elements in the RDS? Alaska: Yes, they have developed a data model, desk manual, and online data dictionary and will provide this to CS.

AV: If there is a limited set of data associated with attributes and locations, does it make sense to put it all into the geodatabase? Alaska: Yes, as long as the IT infrastructure is there to support to the data needs and the governance is in place to oversee this effort. The ability to view data graphically and to be able to use it for business decisions will drive them to want to maintain their data.

AV: Have you given any thought to what the rules would be as to what is IN or OUT of the geodatabase? Alaska: Rules could include, Is it critical to the business needs of the Department? Is it critical to referencing things on the LRS? Is data used for performance needs? Is data valuable to many users? Does it contain sensitive information that shouldn’t be viewed by the general public (e.g. crash data)? Depending upon the answers to the questions, a determination
could be made if this data should be stored in the geodatabase or external database(s).

What are some other IT related issues? There is a need for a database, web servers, database administration, web servers/ArcGIS server administration, and people/hardware infrastructure. They will need to look into long term funding and resources to support the data system.

AV: What is the impact of R&H options on the TAMIS solution? Alaska: The TAMIS solution using R&H is pretty clear at this point, but they need to research the integration options. They have limited integration options with their current system (i.e., maintaining the location information in the geodatabase), but there will be a broader range of integration options with R&H.

AV: Is RDS encompassed within SIRIS once the conceptual model is developed? No.

AV: Would TAMIS house data that are mission critical to department? What is considered mission critical and who would be gatekeeper (i.e., what’s in, what’s out)? Alaska: The only difference in SIRIS and TAMIS is the scale. One is division specific and one is department specific.

AV: What is RDS and how does it differ from a single spatial database? Alaska: The RDS uses roadway centerline geometry, while the LRS is tied to a centerline geometry that allows attribute data to be tied to the centerline and be displayed. R&H is a tool for managing and updating the LRS and tying other databases to the LRS. There is a whole set of geospatial data that is tied to the roadway centerline, while other data such as airports uses point data that is not tied to the roadway centerline itself. There is a broader set of geospatial data and tools for displaying data that encompasses RDS but goes beyond it.

AV: How much of other data needs to be managed by GIS folks or becomes mission critical? There are two places in MRS that tie into project data. For each MRS location, what is the functional class. This should be derived and not hard coded. There is a need for business rules and tools to handle this type of function. There is also a need for a geodatabase where the data gets married up.

The end-users use the published version of the schema (geodatabase) where attributed are aligned with location. The Photolog viewer and other applications are tied to the published version of the data.

**Highway Data Inventory**

*Why are these data being collected (ADOT&PF requirements, federal mandates, other)?* Data is collected to provide road inventory data for HPMS. This includes functional class, DOT region boundaries, borough boundaries, rural/urban area, pavement data, number of lanes, speed limit zones, milepost signs, and maintenance stations covering that portion of road. They also use aerial imagery to figure out how to collect more data for their database, and they may
coordinate with regional planners to collect data. They don’t have turnout data in the RDS yet.

What do you use it for (i.e., does it support asset management decisions within your department)? Data is used to support HPMS and other needs in the Department whenever they receive requests for data extracts. The data is used in reports for lane miles, centerline miles and to locate traffic links and HPMS segments.

What is the role going forward to support SIRIS and HPMS? RDS will be used to support the road log component of SIRIS. SIRIS will also include Traffic and Crash data, and it is intended to eventually be the replacement system for HAS. SIRIS does not exist yet. They recently provided a test extract to M&O to see how the data might be used for their maintenance work, although M&O has not been able to review the data yet. They are concerned with the amount of time being spent on a roadway and where milepost signs are located.

Does it support any decision-making related to other areas such as capacity, safety, bridge, pavement, freight? RDS data primarily includes location and roadway feature data, but it can support safety, bridge and pavement since it also tracks bridge location, bridge number, pavement type, etc. NOTE: There are no explicit system interfaces between RDS and other systems. Data extracts are provided to other applications as needed. For example, RDS data is used to support the ADA inventory (crossings, lights, sidewalks, etc.); data was collected using the photolog database and the information was used to enter data for the RDS. They are in continuous talks to add data to support other groups (e.g., roadslide data).

What types of data are included in the system (i.e., does it contain inventory data that could be used for asset management purposes)? Other data besides the road feature data already identified (see #1) includes the following: airport locations, AMHS ports and harbor locations, and eagles’ nests. Data is stored in an Oracle database. Additional feature tables can be added to the database as needed.

Is the system used on a Statewide or Regional basis? Data is available for use statewide, but update responsibilities reside with the TDS group. Other groups provide road feature information to TDS, but TDS is solely responsible for updating the RDS system.

How often is the data updated (i.e., in real-time or on a periodic basis)? Data is updated as needed.

Is the system supported by adequate resources (i.e., are there resources for data updates or system improvements)? There are specific types of data in RDS that each person in the TDS section is responsible for maintaining, such as Sean’s responsibility to maintain the functional class, NHS and AHS system data.

Are there plans for future retirement/replacement of the system? If so, when? The RDS is intended to support SIRIS.

Documentation
A draft user manual exists for the RDS system (contact Kerry Kirkpatrick for a copy). Talena Adams is working on an on-line version of the user manual.

We need to also refer to/review the RDS Overview document that David Oliver sent to us on September 20th.

D.5 **SHIP MAINTENANCE REQUESTS (SMR)**

*Background on SMR*

The Ship Maintenance Request (SMR) is a database (and SMR form) system to provide information on what the ship identifies that needs to be maintained to keep the ship operating (outside of preventative maintenance needs due to age of ship, poor condition, or does not meet required functions, etc.). The ship identifies the issue and provides information on it including detailed scope of work, current condition on board, what parts are required, what problems might be discovered in doing the work, and estimated costs/labor hours. It is submitted by the vessel to shore side management where it is reviewed and approved/disapproved for work to be done. If approved, the work is tracked in a database (Excel spreadsheet).

The SMR form is filled out electronically, and submitted electronically (via email) to the shore side manager, program administrator, and administrative staff for tracking.

The SMR system is a multi-level program whereby a department head identifies the problem, generates the form, and submits it to the Chief Engineer who also serves as the repair officer onboard the vessel. The Master submits the form to the shore side management group. There is a lot of interaction between the ship and the shore side management; data is not flowing automatically, a lot of the communication is done via email.

Each vessel is a large organization with a number of shore side people working to manage the operations, including the following staff:

- Port Captain – operations
- Port Engineer – engineering issues
- Port Steward – quality of life, passenger services issues
- Passenger Representatives – crew/passenger issues

Is there talk about more automation? And data flow? There have been some discussions about upgrading programs to make them more efficient and looking into linking them, but not that much discussion on linking various systems.

Preventative maintenance is a separate function from the other types of maintenance functions. The operators identify the preventative maintenances needs and document those needs from information on the SMR form, where the
information is stored in one large file that includes multiple sheets with one sheet per vessel. A report is issued once/month on active SMRs.

The SMR form has a tab with information that is copied into Excel and another tab that has information with data that is copied into a table. The Excel database has some advantages and some shortcomings because sometimes data does not get entered on the correct line. In the future, they may move the SMR system to an Access database to limit corruption of the data.

How do you maintain version control? It is maintained on the mainframe server.

The reporting features are primitive. They could be improved to make them more usable, however, they are understaffed to be able to make these improvements.

The overall program is not that old, but the Excel solution is a little underpowered for the job. There is room for improvement.

The SMRs were originally recreated each year with a new number and the old one discarded, so there was no way to track (over many years) if an SMR was repeated each year. There was no way to track revisions to SMRs so that they did not have to recreate them and therefore, it was not always clear how long an item has been in the database. New procedures have alleviated these shortcomings and created a running history of such maintenance items. There is however a lack of clear history due to previous methods. There is an archive of completed or closed SMRs, however, they sometimes have problems getting the work closed out in the SMR system and archiving the records.

**Future Plans for SMR**

The goal is to enforce policies and procedures for closing out SMRs and to identify what has/has not been completed.

Which of Alaska Marine Highway System (AMHS) systems are most relevant for TAMIS? The Fleet Condition Survey (FCS) for long-term needs.

If SMRs are not completed the year that they are proposed, they are added to the FCS.

They are having internal discussions about where to keep the primary repository, either SMR or FCS? and how long should the maintenance need be tracked in SMR? When does it go to FCS and disappear from SMR?

One of the reasons that it is in both places is to catch it twice so that it does not get missed. They have talked about the automated transfer of information from SMR into FCS. They have to be careful so that they do NOT corrupt the information in the FCS. There is an A crew and a B crew and they have different ideas about what is to be done in the best interest of the ship.
Relevance to TAMIS

Is there any message to carry forward for TAMIS? They are not sure about how to incorporate information about AMHS systems into the rest of the Department’s asset management systems. There are many components on a vessel that require tracking and this amount of data tracked in a large database would be cumbersome. They are not sure about how more information on the vessels would benefit the DOT, other than what the maintenance needs are for the ship and to report those vessel costs to the DOT. They use the crew, specialty vendors, and shipyard support personnel when the ship is in the shipyard to complete the maintenance work. No M&O staff are used to do the maintenance. The capital improvement projects for the ships are in the STIP. The CS team will interview Cisco Flores to get more information about the budget processes related to the SMR.

Conclusion

The SMR system (and form) are not directly tied to the TAMIS framework, but it can be used to provide vessel cost information to the DOT including maintenance costs for the vessels. Capital improvement projects for the vessels are also included in the STIP. Since the TAMIS framework can be used to support the STIP, there is a limited use of the SMR information for TAMIS decisions related to the STIP.

D.6 SHORE CONDITION SURVEY

Kirk Miller is Design Group Chief who supervises the marine design section with the SE Region of the Alaska Department of Transportation and Public Facilities (DOT&PF). The marine design section conducts a Shore Condition Survey of all AMHS ports. The survey includes inspection of shore facilities and bridge structures every 2 years in conjunction with the National Bridge Inventory (NBI) program. The engineers responsible for these inspections work separately from AMHS. They are also responsible for the design of most AMHS shoreside facilities. AMHS is considered to be their client. Ward Mace is in charge of the long-term maintenance of shoreside facilities and he consults with the AMHS staff on the maintenance work.

A Shore Condition Report (SCR) is produced every two years. This report is separate from the National Bridge Inventory (NBI) reporting system since it includes the inspection of items other than bridges. Bridge inspection data is entered into the national PONTIS bridge management system that is ultimately managed by the FHWA. AMHS has 30 terminals statewide and while the Bridge Department is the ultimate owner of all PONTIS data statewide, they rely on the shoreside engineers to do the PONTIS inspections for marine facilities bridges and these engineers also do inspections for ancillary facilities at AMHS ports of call.
The SCR is produced as an MS Word document with Excel spreadsheets used for tabular data in the report. The data is not actually stored in a database per se. The data comes from annual inspections, field notes, documents, photos, and video cameras. These individual reports are updated every year. Historical data is available on structures, facilities and when the facilities were built.

**SCS and Other Databases**

Besides PONTIS do you access anything else? Kirk’s department enters data from the bridge inspections into the PONTIS system and works with the Bridge Department to maintain the required bridge records.

**SCS Report and Regulations**

The Shore Condition Survey is not part of any federal mandate. The shoreside inspection is a program that was established over 12 years ago to periodically review infrastructure to determine if the structures are safe for public use and to determine the current and future maintenance needs. The tabular and written data are very subjective.

The shore condition report is published under the following website: [http://dot.alaska.gov/project_info/AMHS_Shore_Fac_Report.shtml](http://dot.alaska.gov/project_info/AMHS_Shore_Fac_Report.shtml). Examples of the data and associated inspection reports can be found in this document.

Is the report statewide? The report covers all AMHS ports of call throughout Alaska and including Bellingham, WA and Prince Rupert, BC.

Who does the report go to? The AMHS Port Captains and Terminal Managers are the main recipients of the report as they are the clients that provide the funding for the report. Copies of the reports are also sent to the 15 facilities not owned by AMHS. This includes owners of facilities in various cities and municipalities.

The Shore Condition Survey report is used as a planning tool to generate future construction projects – primarily encompassing major repairs or replacement; however, it is generally not detailed enough for routine or minor repairs. The report does not adequately address individual facilities components associated with terminal buildings and other upland amenities (e.g., doorknobs, etc.), but it is used more for major large capital improvement projects.

**SCS and TAMIS**

Have you reviewed the vision and components document for TAMIS? CS provided a brief discussion of the relationship between TAMIS, TAM, and the MAP-21 requirements. TAMIS is a framework that can be used to define business processes and data systems used for making cross-asset decisions, such as reviewing data related to a bridge (e.g., the inventory number associated with it), and utilizing this information for maintenance projects.
What are your recommendations regarding AMHS and TAMIS? They are looking at obtaining good maintenance management software and would be interested to know what (programs/software) could be used to provide AMHS data for use with TAMIS.

The type of data that they track includes inspections (fracture critical inspections). They need a system to do underwater inspections for critical fracture inspections and Shore Condition reports. They need to be able to produce information on buildings including square footage. They have also received requests for this same type of information from the Integrated Resource Information System (IRIS) project.

Post Interview

After this interview, the CS team received the following documents from Troy Jorgens:

- A copy of the latest SCR Report
- An SCR Update Memo (Aug 30, 2013) regarding an updated standardized form and process for fleet and Shoreside managers
- A copy of the latest SCR form and instructions

**D.7 SITE MANAGER**

Why are these data being collected (ADOT&PF requirements, federal mandates, other)? The data in the Site Manager database is collected to document construction contract progress, quality, and quantity. This data is collected to meet AKDOT&PF, FAA, and FHWA requirements.

What do you use it for (i.e., does it support asset management decisions within your department)? The data is used to produce contract progress payments to contractors. The materials management portion of SiteManager tracks materials quality testing results from material sites and suppliers used for construction of airports, bridges, and highways. The data in the database can also aid in claim analysis and historical pricing data and trend analysis.

The system also provides the ability to customize reports that pull from the data in the system. This allows construction management to mine the data and analyze trends in change orders, bid prices, material test results/quality, price adjustment items, quantities of materials used, and other information contained in the data. These customized reports increase the efficiency of NR construction workflow and collect the data in easy to read, interpret, and understand formats.

Does it support any decision-making related to other areas such as capacity, safety, bridge, pavement, freight? The customizable reports discussed above can be applied to other areas. Further, expansion of the AASHTOWare suite can include modules specific to Bridge and Pavement. If these modules were implemented Statewide, the suite of software could be used to support decision
making in those areas. Our current knowledge and experience with the construction administration (SiteManager) and materials testing (Laboratory Information and Management System) modules could enhance any further implementation of the AASHTOWare Suite.

What types of data are included in the system (i.e., does it contain inventory data that could be used for asset management purposes)? The data that is currently being entered into the system are: bid prices, change order prices, as built quantities, change documents, materials testing data, contractor work history (inspector daily reports and project engineer diaries).

Is the system used on a Statewide or Regional basis? The Northern Region currently has fully implemented the system, and the majority of construction projects are using it. There are plans to implement the software in the other regions.

How often is the data updated (i.e., in real-time or on a periodic basis)? Real-time

Is the system supported by adequate resources (i.e., are there resources for data updates or system improvements)? Yes, supported by InfoTech via AASHTOWare, and internally by Jaclyn Elmes, a NR DOT&PF Construction employee. The NR Construction IT section also supports the technical aspects (computers, network connections, etc.)

Are there plans for future retirement/replacement of the system? If so, when? There are future upgrades to the system planned. An expected update in 2015 will shift the system to a web-based software interface. There are other components/modules of the AASTOWare suite that can be used in the data management of Bridges, Pavement, ROW, and flow of project development from Planning to Construction. Implementations of these data management suites have been discussed at various levels of management within the Department.

**D.8 STATEWIDE ASSET LOCATION LOG (SALLY)**

The Statewide Asset Location Log (SALLY) was created because of an initiative by Mitch McDonald – it was initially intended to provide a simple, easily useable avenue for M&O (and others) to enter incident reports and other data about specific site events. The future of use of the SALLY webpage/database is not settled.

SALLY is not being used on a statewide basis; it is a regional effort that began in the Southeast region. SALLY is a new concept that was originally intended to give M&O personnel a platform to record incidents or problems they are having with geotechnical assets (e.g., rockslides, landslides, etc.). It was developed around geotechnical features, but it’s on a base enough platform that M&O could add other types of information if desired. SALLY uses centerline and milepost data, along with free imagery provided by ESRI. Flex ArcGIS server interface or MapOptix server with ArcGIS server are two options for the operating platform.
D.9 STATION PROFILES

Data Management

What type of data is included in station profiles? Station profiles include data that describes stations, including number of highways, number of buildings/facilities, the number of personnel assigned, the equivalent number if personnel that should be at that location, the number of lane miles, and bridges associated with a station’s roadways. A station is a maintenance camp or airport where ADOT&PF personnel work from. There are 84 maintenance stations/airports. Some have dual responsibility (i.e., an airport manager and highway system within the same station boundaries).

How is station profile data stored? In an Oracle database.

Who maintains the data? Ocie is the database owner, and he was involved with entering the original data into the database in 2002 when the program was developed.

What significant changes are planned for the database? Several changes are planned. The pages have been reformatted to a state standard, and the data itself is also being refreshed. The database also holds cost data, and they are getting ready to import costs.

Is there any documentation available for the system? Ocie will send a list of data elements included in the data dictionary.

Are there any access restrictions? Access is restricted to internal ADOT&PF personnel only.

How many people access the database on a regular basis? Primary users are district managers or above. Station managers use the system periodically, but not very often. District and regional managers use the system often.

Where do the data for Station Profiles come from? The data comes from a few locations. Expenditure data is imported from AKSAS. They used to get roadway information from HAS, but now they get it from the geodatabase. Airport data comes from the Airport Layout Plan and loading data and is loaded by analyst/programmers. Bridge information comes from PONTIS (now the Highway Analysis System for Bridges). Information is updated annually. MMS includes prorated cost data, which is used to bill back to the Feds. FUR rates and IFUR rates come from EMS. Asset inventory quantities flow back and forth between data systems. The only interchange (input and output) is with MMS.

What type of decisions are made using the data? The system is used for personnel assignments or moving people. They look at the number of personnel and operating costs per station to make management decisions and answer questions such as how many people should be at a station, how many people are actually there, and the operating costs.
Do you report data up the line? The Deputy Commissioner level has access to the system, but they typically ask the regional managers, who will use station profiles or MMS to answer their questions.

What is the vision for Station Profiles within the TAMIS framework? There is a need to support asset management from the standpoint of maintaining inventory. MMS will give centerline miles but not number of lane miles.

Updates are often made based on manager request. If there are lots of changes, they can acquire the update anytime during the year. For example, they recently did a manual update of divided centerline miles to accommodate divided highways.

Are there specific standards that govern the data? Since the system is in Oracle, IT standards within the department apply.

Are there any known technical issues associated with integration of the data from the system? They are conducting testing soon for the interface with the payroll system so they can get payroll and accounting into station profiles. They will do a manual import first, then an interface import.

What type of referencing system is used? Most assets are coded by milepoint. David’s staff can convert lat/long into the LRS used for the Highway System. Airports are listed by lat/long.

MMS will be repository for feature inventory data.

Are there any access restrictions in place? Ocie and the analyst/programmer can edit data or change forms. Everyone else has access to the reporting tools only.

Are there any alternative uses of the data that you are aware of? There could be some in the future, such as by Program Development as they start to think about inventories. There will be quantity information available from station profiles and MMS. Quantities are captured in station profiles, while inventory data is captured in MMS. They already share information on lane miles on shoulders with the ADOT&PF bike manager. Data such as bike lane width is used to support an annual bicycle riding event between Fairbanks and Anchorage.

**D.10 TERMINAL MAINTENANCE REQUESTS**

The Terminal Maintenance Request (TMR) system does not utilize a database. An Excel spreadsheet is used instead. When a TMR is initiated, the approved TMRs are entered into a spreadsheet, which tracks the date received, date work is assigned, and date work is completed. It is more like a work order. Ward is responsible for the TMR system.

When a need is identified, it is entered on a spreadsheet and then funding is sought to do the approved work. Funding is sought from AMHS, which owns everything on the shoreside. Ward provides them (AMHS) with a maintenance budget each year based on upcoming maintenance needs.
There is a correlation between the Shore Condition Reports (SCRs) and the TMRs in that the SCRs are used to identify maintenance jobs that need to be done (can be done by maintenance crews) and the TMRs are used to log and keep track of the maintenance work. Ward is the maintenance manager, but he does not have authority to determine major improvements to buildings. He goes to upper level management to obtain approval for those types of jobs and once they are approved, he logs the work to be done into the TMR. He is the only person doing this task for the entire state.

The Shore Facilities Projects report is a wish list of projects that need to be done. AMHS has a planner who determines what the project needs are each year. Christa Hagen is the planner. Christa, Troy (Jorgens) and Ward work together to determine which projects get funded. This is a very subjective process. The staff are familiar with what needs to be fixed and they get projects done before problems occur. Vessel improvement needs may be a higher priority than shore condition projects, however, if there is a broken bridge, they will find funds immediately to fix that type of problem.

They forecast project needs for a 3-year period only, and can only do 3-4 jobs (projects) per year, based on greatest need. The other jobs are outsourced. It usually takes about 2 years to conceptualize and realize a federal aid project. It takes 1 year to develop the project, 3-6 months to advertise for the work, and 1 year to finish the project, which is part of the STIP programmed projects. They always have about 2-3 projects in the queue with $4-5 million dollars per year allocated to AMHS projects. As the projects finish the construction phase, they are removed from the list.

Is three years an adequate forecast period for decision makers? The process seems to work well within AMHS, although there are some people who may want to see longer range forecasting capabilities.

**TMR and other data sources**

What other data sources are used to populate the spreadsheet? The crew schedule and TMR log are used. If a furnace goes down, they will typically contract out that type of work. They also track requisitions and invoices, by year but not in any database. They would like to have a database to identify assets and generate work orders from the database. They need to retain schematics of hydraulic cylinders and track the tools needed to work on them, and to store photos and track maintenance done on each piece of equipment.

**TMR and TAMIS**

What are your thoughts regarding how the TMR can be used to support TAMIS? It would be nice to have a system that could elevate information to higher level decision makers, but they are not sure how to achieve this goal. Washington State Ferries has a maintenance program, database, and adequate staff to address
their needs and they have had discussions with them to research how they track and use their data.

Over the years, they have discussed using life-cycle needs and cost information and putting it into a TAMIS type of framework. Currently, Ward maintains a TMR spreadsheet on his computer. He is finding it challenging to keep track of everything now, including scheduling crews, fixing equipment (working 6 days/week from 7 a.m. to 6 p.m.) There is a need for the use of a knowledge management system to store some of this type of information. He would like to be able to contract out the inventory process and to utilize barcodes to track equipment. He would also like to be able to scan work orders and to upload the latest status of those work orders as needed.

Is there anyone else at AMHS that could help with providing information to the CS team on the cross-decision making processes? Cisco Flores is the contact that CS will follow-up with to get more information.

There are 4 components related to AMHS that need to be considered with respect to future use with TAMIS:

- The AMHS program is vessel-oriented
- AMHS includes both ferry terminals and shore side facilities
- Long term maintenance needs to be tracked
- Bridges are located at each of the facilities

All of these components are subject to federal aid and therefore, would fit within the TAMIS framework.

Post Interview

After this interview, the CS team received the following documents from Troy Jorgens:

- A copy of the latest SMR Report
- An SMR Update Memo (Aug 30, 2013) regarding an updated standardized form and process for fleet and Shoreside managers
- A copy of the latest SMR form and instructions

D.11 TIMESHEET ENTRY AND REPORTING SYSTEM (TEARS)

Why are these data being collected (ADOT&PF requirements, federal mandates, other)? Time worked for Payroll, and project time reported to project managers.

What do you use it for (i.e., does it support asset management decisions within your department?). Time worked is used to pay staff, and project time is used by project managers for federal reporting.
Does it support any decision-making related to other areas such as capacity, safety, bridge, pavement, freight? No.

What types of data are included in the system (i.e., does it contain inventory data that could be used for asset management purposes)? No.

Is the system used on a Statewide or Regional basis? Yes, Statewide.

How often is the data updated (i.e., in real-time or on a periodic basis)? Bi-monthly, but can be used in between the pay period ending dates.

Is the system supported by adequate resources (i.e., are there resources for data updates or system improvements)? Not supported – We have two staff (one DOT, and one Fish & Game Non-Perm) that resolve issues as they come up.

Are there plans for future retirement/replacement of the system? If so, when? IRIS project has plans for a time reporting module in possibly 2016, and if TEARS fails before then, we'll be doing paper time sheets.

**D.12 TRAFFIC SERVER**

**Introductory Comments**

Anita explained that TAMIS is the data component side of TAM. Data used for cross asset decision making. By early 2016, states have to have a TAMP in place and TAMIS will review the data systems that support TAMP. Today, we are interviewing Alaska regarding Traffic data and have interviewed many other data owners. We may need to have a separate conversation about HPMS. TAMIS is a project for the Research Department (Carolyn Morehouse and Shannon Kelly are the project managers). One of the things we are identifying is whether a database is 'in' or 'out' of TAMIS. Traffic is considered 'in' TAMIS.

Status of Traffic Server RFP: Jill noted they are looking forward to awarding a contract this week and will start collecting data in January 2014. They want to compare 2013 traffic data with data in the new system and make sure the new system is appropriate to meet their needs.

What is your vision of how traffic data supports the TAM framework (#6)? It is very important. TAM will be used to make asset management decisions for highways, which will depend on vehicle volume, class, speed and weight data. It is close to what the federal level uses with HPMS, but the traffic data at the state level is more detailed. HPMS does not include future routes, but Alaska needs to be able to show how traffic moves from an existing route to a future route for an asset management system. This will require both current and future traffic data. They also would like to include links on the Canadian border; they currently only monitor weight coming in at one highway.

JS: One of the key requirements is to have the new TDS integrate with SIRIS (roadway data system and GIS). This will be key link for TAMIS.
Data Integration

Any known technical issues with integrating data from Traffic (#16)? We are not expecting to create data or pull data from another system. What we are envisioning is to find out the integration data points for supporting asset management decisions. We need to identify what is the official source of traffic data and what data quality is needed for the data used to support TAMIS.

MD: Will TAM be pulling in real-time or near real-time data? AV: We probably won’t be concerned with real-time data sources for use with TAM.

Any known institutional issues with integrating data from Traffic (#17)? ADOT&PF is currently transitions from HAS to the new GIS environment. Traffic and Crash are two main components of this transition. The vision for the transition is to integrate the data using a common single linear referencing system and making everything available through a single intuitive interface. All Traffic and Crash data are available through HAS, and they want the same functionality with whatever system they develop. The SIRIS interview will cover the RDS data type, not necessarily the traffic and crash. They are also piloting the Roads & Highways module, but there are still a lot of questions to be answered regarding integration of external data systems, maintaining existing customization, feasibility, etc.

Headquarters is looking at meeting Federal and state needs for a common LRS for the entire system, but it is unknown whether they will use the Traffic or Pavement LRS. JS believes that this will be a commissioner level or TAM group decision to say which LRS will be the official one. The Transportation Information Group (TIG) has been keeping this in mind during the transition to ensure their own business needs are being met. The TIG has also been discussing the need for a GIS Data Governance Plan to initiate a formal process for adding new features or changes (like code changes) to the GIS database.

AV: We will need to do a pilot for TAMIS and would like to build on the existing pilot for roadway data collection.

Data Storage

How are the data stored (#18)? Oracle is department standard for both the Traffic and CRASH for the future.

Closing Remarks

JS: They are going to put the historical traffic data in the new traffic system.

AV: We will be needing historical AND future trend data to help with forecasts.

Is there any information available regarding your data governance plans? JS: Kerry Kirkpatrick has identified lists of metadata and attributes for all GIS data, but identifying who the data stewards are for all of the data is a lot of work. It will be a phased governance plan and will take some time. Dean Deeter is the
consultant for the transition. AV: We are working with Carolyn to draft a P&P for data governance for TAMIS. CS would like to coordinate with Dean Deiter to share information on data governance best practices. JS gave CS permission to contact Dean to discuss his data governance findings for the TIG.

JS: What is the schedule to have the TAMIS model done? AV: The entire project will be complete by next year, but the TAMIS model recommendations will be developed by the end of this year (November or December).

Update from Jill Sullivan via email on November 8, 2013

Since this interview, we signed a contract with Transmetric America (TransAM). The new system is called Traffic Server. This will replace the HAS Traffic Data System. TransAM agreed to work with our Transportation GIS staff to pilot the new Roads & Highways. We hope to have full integration by next April. Until then, we will integrate with the current RDS, but it will not be real-time like R&H.

D.13 TRANSIT AND RAIL DATA

Why are these data being collected (ADOT&PF requirements, federal mandates, other)? Federal mandates, planning purposes

What do you use it for (i.e., does it support asset management decisions within your department?). Asset management decisions, requirement for Federal Transit Administration Section 5339 funds.

Does it support any decision-making related to other areas such as capacity, safety, bridge, pavement, freight?

What types of data are included in the system (i.e., does it contain inventory data that could be used for asset management purposes)? Vehicle information (such as model, vin, number of wheelchair positions), condition of vehicle, photo of vehicle, title information, Federal interest, etc.

Is the system used on a Statewide or Regional basis? Statewide

How often is the data updated (i.e., in real-time or on a periodic basis)? As needed and certified annually as a condition of funding

Is the system supported by adequate resources (i.e., are there resources for data updates or system improvements)? Yes

Are there plans for future retirement/replacement of the system? If so, when? This is a new system, scheduled to be available in the fall.

D.14 WEIGH-IN-MOTION (WIM) DATA PORT

Weigh station data should be included in TAMIS. Weight stations are located on the main highways in Alaska, and the sites are strategically opened
based/closed. There are mobile vehicle capacity equipment for weight data, but that would be real-time data, so TAMIS would probably not use it. We could get data from the WIM data port.

Is there documentation available (#25)? Mary Ann will send Kim an email with some sample weight data reports. (Received).
E. References

TAMIS Task 3 Report (Asset Management Best Practices)
AASHTO Asset Management Guide
NCHRP 20-90 - Improving Management of Transportation Information
NCHRP 666 – Target-Setting Methods and Data Management to Support Resource Allocation by Transportation Agencies
ADOT&PF Transportation Asset Management Information Systems (TAMIS) and Data Research Project

TAMIS Framework

prepared for
Alaska Department of Transportation & Public Facilities

prepared by
Cambridge Systematics, Inc.

December 2013
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1.0 Introduction

1.1 BACKGROUND

The Alaska Department of Transportation and Public Facilities (ADOT&PF) has initiated a research effort that will support the development of the Transportation Asset Management Information System (TAMIS). The goal of the TAMIS will be to provide the backbone for the Asset Management program for ADOT&PF. The program will ultimately support the FHWA State Transportation Improvement Program (STIP) and Long Range Transportation Plan development activities of the Program Development Office.

This report is the primary deliverable for Task 6 of the research effort: Develop ADOT&PF TAMIS Framework (Desired Condition). The objective of this task was to establish the desired framework of TAMIS for ADOT&PF.

1.2 METHODOLOGY

The following work steps were conducted for Task 6:

1. Definition and Components of TAMIS – This step includes developing a customized definition and detailed description of ADOT&PF’s TAMIS based on the vision developed in Task 4. The specific components of the TAMIS are proposed using the AASHTO AM Guide Section 8.1.2 and Figure 8-1 in particular. The scope of the TAMIS in terms of functionality/business processes, stakeholders, data and associated supporting databases, geospatial elements, software, interfaces and data collection systems are also identified. Table 8-1 from the AASHTO AM Guide is used as a guide for identifying the data elements. The Definition and Components were presented in draft form to the stakeholders and finalized after feedback from them.

2. TAMIS Integration Framework – Development of a framework. TAMIS Task Team meetings and stakeholder vetting to review the definition, components and framework.

3. Identification of key integration points in coordination with ADOT&PF and stakeholders. Figure 8-2 and Table 8-2 of the AASHTO AM Guide are used as templates. The determination of data integration points needed for TAMIS is a result of the series of interviews that were conducted regarding the data sources for TAMIS, as well as a review of the ‘data level’ type documentation provided by the data owners. This includes, but is not limited to, data dictionaries and user manuals for several of the systems.

4. Development of a Roadway Asset Hierarchy based on the example in Table 8-4 in the AASHTO AM Guide.
1.3 **ORGANIZATION**

The remainder of this document is organized as follows:

Section 2 – TAMIS Framework – Desired Condition

Section 3 – Scope of TAMIS – Desired Conditions

Section 4 – Data Catalog – Desired Condition

Section 5 – Next Steps
2.0 TAMIS Framework (Desired Condition)

2.1 TAMIS Definition

A Vision and Components document for TAMIS was developed as part of Task 4 of the TAMIS project. The Task 4 report includes a definition for a TAMIS in general terms, as well as a definition for TAMIS specific to Alaska DOT&PF. The definitions are as follows:

In general, a TAMIS is a collection of hardware, software, data, and processes that support asset management business processes.

Alaska’s TAMIS is the collection, synthesis and maintenance of data from multiple sources. It will include a set of business processes (technical and institutional), and integration tool(s) to ensure that Alaska’s key asset information is available to support transportation asset management (TAM). It will encompass existing and proposed data in designated data systems. Identification of these data will be part of the TAMIS development process. ¹

The specific definition for Alaska’s TAMIS was used to guide the development of the ADOT&PF TAMIS framework. This framework, illustrated in Figure 2.1, includes Data Sources, Business Processes, and Asset Management Decisions. Each of these components is described in the next section.

¹ Transportation Asset Management Information Systems and Data Research Project, Task 4 – Vision and Components, July 2013
2.2 TAMIS COMPONENTS

Data Sources

The initial set of potential data sources for TAMIS (originally identified in the Task 4 report) was greatly expanded, based on extensive interviews conducted during research for Task 5. Task 5 results indicate that there is an abundance of potential data sources at ADOT&PF to support TAMIS. Of the 52 potential data sets evaluated, 26 were found to be sources of data and information recommended to support the TAMIS framework and asset management decisions at the Department. The data sources include systems and data sets that encompass the major asset classes of Highways, Aviation, Marine Highway, Measurement Standards/Commercial Vehicle Enforcement (MS/CVE), State Equipment Fleet, and Administrative Services.
Each of the data sources identified for TAMIS was assigned a level of relative importance (i.e., Tier level) for providing TAMIS support. The Tier level assigned does not indicate the importance of the application to the Department overall, or importance in supporting a specific business area. The Tier level represents the importance of the application in supporting enterprise asset management at the Department.

Tier 1 represents key data systems that support asset management at an enterprise level, Tier 2 indicates systems that support asset management decisions for a specific business area, and Tier 3 indicates systems that support a business area, but do not directly relate to asset management functions. There was one system determined to be a Tier 1* application and this is the RDS Enterprise Linear Referencing System (LRS). This application is one of three components of the Spatially Integrated Roadway Inventory System (SIRIS)), which serves as the primary location mechanism for assets, based on route and milepoint, as defined in the Coordinate Data System (CDS) used at ADOT&PF. There are also assets that utilize a different location method than the CDS (e.g., bridge-id for bridges), but for those assets relying on the CDS, the RDS system (SIRIS) will be the source of the LRS data. As such, it is a critical system that supports location-based assets at the Department. Refer to the Task 5 report, Table 3.2, Analysis of Data Source Systems for TAMIS, for a complete list of data systems recommended to support TAMIS.

Each of the potential TAMIS data systems was evaluated according to the following criteria:

- Data quality;
- System interfaces;
- Data storage environments;
- Available system documentation; and
- Range of stakeholders/users for each system.

The results of the evaluation of these systems ultimately will impact the proposed model for TAMIS. The discussion of available model alternatives and the recommendation for ADOT&PF’s TAMIS model is presented in the Task 8 memorandum, Potential Models for a Transportation Asset Management Information System (TAMIS). The model recommended by Task 8 relies on overall good data quality, with system interfaces that already exist between key systems, or which can be developed for use with asset management analytical tools to inform asset management decisions.

**Business Processes**

Just as TAMIS relies on quality data for supporting asset management decisions, the business processes used to manage the data are also an important component of the TAMIS framework. Existing business processes were documented during
the Task 5 research, and the need for new business processes to support TAMIS (such as those related to data governance) were also identified.

The business processes in TAMIS include: (1) technical (e.g., data quality, IT compatibility), (2) institutional (e.g., data governance and management), and (3) integration tools (e.g., geospatial component, BI tools, interfaces, analysis tools, and software and hardware). A set of business process rules is used to guide an organization in managing the day-to-day business activities of the organization. The following questions will be used to determine the business process rules that are recommended for TAMIS:

- What needs to be in place?
- What documentation is needed?
- What institutional policies and governance are needed for TAMIS?
- What data standards are needed?
- Are there going to be owners of the data who are accountable for the accuracy of the data?
- Is there a main data guru function?
- The timeliness of data is also critical if it is needed for annual decision making processes. At what point does the data need to be available for use?

Many of these questions were answered for specific business areas during the Task 5 research. This includes determining if sufficient documentation for data systems are available; identifying if data standards are in place for those systems, and identifying business data owners for the many TAMIS data systems. However, additional research is still needed to identify and document the business processes and governance standards being used (and those that should be developed) to support TAMIS. For instance, there are Department policies that could be implemented to define the roles and responsibilities for supporting asset management at ADOT&PF (within a governance framework). A draft Policy and Procedure (P&P) document pertaining to data governance has been submitted to the ADOT&PF TAMIS project team for further consideration.

In addition to the need for a P&P to establish a governance structure for TAMIS, a Data Catalog is also being developed to document the data systems, data business owners, data stewards, data custodians, and data stakeholders for the systems. The roles/responsibilities of each of these groups also needs to be documented as part of the data catalog. The Data Catalog should be made available to Department employees on a widespread basis, using the existing eDOCS system as a viable solution for distribution of the Catalog.

Data standards are also needed to document data quality requirements pertaining to TAMIS support systems. The types of data quality requirements include the level of accuracy, completeness, timeliness, validity, coverage, and accessibility of data. The evaluation of the TAMIS support systems is documented in Table 3.2, Analysis of Data Source Systems for TAMIS, of the
Task 5 report. Overall, the analysis regarding data quality indicates that many of the Tier 1 (key) systems that support TAMIS such as pavement, bridge, and state equipment fleet data are of good data quality, while other systems such as the Maintenance Management System need improvement in data quality as identified by many of the interviewees for this system.

The establishment of data standards for systems supporting TAMIS includes the need for metadata standards to identify the most appropriate data system to use for different types of asset management decisions. Asset management decisions typically include those pertaining to the condition of assets, and costs associated with maintaining those assets. A more detailed discussion of asset management decisions at ADOT&PF follows in the next section.

**Asset Management Decisions**

There are several asset management decisions that are made on a routine basis at ADOT&PF. It is the intent of the TAMIS research project to recommend a model for TAMIS (as discussed in the Task 8 report) and a TAMIS framework (as presented in Figure 2.1) that is the most suitable option to meet the Department’s asset management needs. The key asset management decisions supported by TAMIS are organized around the Transportation Asset Management Plan (TAMP) elements required by MAP-21. These requirements include identifying asset inventories and determining which assets should be included in the asset management program. This is a fundamental question, the response to which will influence the answers to all subsequent questions.

ADOT&PF may choose to focus on answering these questions for a limited number of assets, which are identified as the most critical in the initial implementation of the TAMIS framework. This could include the pavement, bridge, and maintenance management data systems. Each of these questions are organized to address a specific need related to asset management (e.g., condition, objectives, performance gap assessment, etc.). Below is the list of questions to address specific needs:

- **Asset condition**
  - What performance measures should be used to summarize the condition of ADOT&PF’s assets?
  - How should these measures be calculated?

- **Asset management objectives**
  - What are the objectives of ADOT&PF’s asset management program?

- **Performance gap assessment**
  - What short-term performance targets should ADOT&PF establish?
  - What long-term performance targets should ADOT&PF establish?

- **Life cycle cost considerations**
What types of preservation and preventive maintenance treatments should be considered for each asset?

What is the ideal timing for these treatments?

How much do they typically cost?

How can ADOT&PF design a project to ensure that it minimizes life-cycle costs?

Risk management

How can ADOT&PF design a project to ensure that it minimizes life-cycle costs?

What risks could impact ADOT&PF’s achieving its asset management objectives?

What risks could impact each individual program? The bridge program? The pavement program? Etc.

Which assets are the most vulnerable to external and environmental risks?

What is the likelihood of these risks occurring?

What are the consequences if they occur?

What are ADOT&PF’s priority risks?

How should the priority risks be mitigated?

Financial plan

How should ADOT&PF allocate funds between its asset management programs and other priorities?

How should ADOT&PF allocate funds between the various asset management program areas (e.g., pavement versus bridge)?

How should ADOT&PF allocate funds to the Regions?

Investment strategies

What are ADOT&PF’s priority assets?

What candidate projects should be considered?

How should ADOT&PF prioritize candidate projects and select projects for the capital program?

Should the scope of candidate projects be enhanced to address other issues along the project location? If so, which issues should be addressed?

How should the maintenance program influence the capital program?

How should the capital program influence the maintenance program?
- Should ADOT&PF increase truck weight limits, or implement other types of policies that impact asset conditions?

- What risk mitigation strategies should be funded and implemented?

The research to date for the TAMIS project is designed to help answer many of these questions. In particular, the results of the numerous interviews for the Task 5 help to identify high priority assets for the Department, and to define objectives for asset management at ADOT&PF. The performance gap assessment and other gaps will be identified and evaluated as part of Task 7 of the TAMIS project. The life-cycle costs, financial plan, and investment strategies can be developed for TAMIS, based on existing business practices at ADOT&PF and best practices at other DOTs identified in the Task 3 report. Identifying and addressing risk management issues will be included as part of the development of the Data Business Plan in Task 11 of the TAMIS project.
3.0 Scope of TAMIS – Desired Condition

This section presents the desired condition for the TAMIS Framework, including the scope of TAMIS implementation, as well as the data integration points that are needed to support cross-asset decision making at the enterprise level at ADOT&PF.

3.1 SCOPE OF TAMIS IMPLEMENTATION

The AASHTO Asset Management Guide provides an example scope for TAMIS implementation as shown in Figure 3.1. The guide suggests the following elements be considered for implementation:

- Dark shaded elements are typically included in a TAMIS implementation. These elements support data management for **asset inventory, inspection, and condition information**, as well as **analytical tools** for assessing current needs, projecting future conditions, assessing treatment options, conducting trade-off analysis, and optimizing work.

- Lighter shaded elements are sometimes part of a TAMIS implementation. These elements include **network and linear referencing management functionalities; business intelligence/reporting tools**, and specific tools for **maintenance and capital work planning, scheduling, and management**.

- Unshaded elements are generally not included in a TAMIS but may be implemented with the TAMIS. These include **geospatial data management and analysis tools, capital/construction project management tools; and financial and resource management tools** (e.g., equipment and materials management, procurement, timesheets, and budgeting).

The guide recommends that TAMIS implementation consider integration needs and opportunities across each of the components.
Figure 3.1  Example Scope for TAMIS Implementation

Ideally, the scope of ADOT&PF’s TAMIS implementation should include data systems to support all of these functions. Figure 3.2 shows application of this diagram to ADOT&PF’s data systems and illustrates the specific systems that could be used to support asset data management, analytical tools, network and linear referencing management functionalities, geospatial data management, business intelligence/reporting tools, specific tools for maintenance and capital work planning/programming, capital/construction project management tools, and financial and resource management tools.
Figure 3.2  Desired Scope for ADOT&PF’s TAMIS

- **Equipment**
  - EMS, MMS, Transit & Rail
- **Materials**
  - EMS, MMS, Material Sites Inventory
- **HR**
  - IRIS, MMS
- **Labor/Time**
  - IRIS, MMS
- **Budgeting**
  - EMS, IRIS, MMS, MRS, STIP
- **Purchasing**
  - EMS, IRIS, MMS
- **Payables**
  - EMS, IRIS
- **Receivables**
  - EMS, IRIS
- **Capital Project Management (Schedules, Payments)**
  - MMS, MRS
- **Capital Programming/Budgeting**
  - FAAM, MRS, IRIS, GMPAS, EMS, STIP
- **Analytical Tools**
  - Treatment Rules, Cost Models, Deterioration Models, Economic Analysis, Optimization, Simulation, Tradeoffs
  - Pavement Analysis – PMS, WIM, Traffic Server, Crash, EMS, MMS
  - Bridge Analysis – PONTIS/BMS, WIM, Traffic Server, Crash, Local Permits
  - Maintenance Analysis – MMS, EMS
  - Fleet Management Analysis (Highways & AMHS) – EMS, Fleet Condition Survey
- **Asset Data Management**
  - Pavement – PMS
  - Bridges – PONTIS/BrM 5.1
  - Signs, Culverts, Guardrails – MMS, MMS Inventories
  - Retaining Walls – Retaining Walls Inventory
  - Material Sites – Material Sites Inventory
  - Pedestrian Facilities – ADA Inventory
  - ITS Assets – RWIS, WIM
  - Aviation Facilities – AASP
  - Airport Pavement – Airport & Hwy PMS
  - Transit Vehicle Inventory – GMPAS
  - State Equipment Fleet – EMS
  - Maint. Facilities – MMS
- **Inspections**
  - Pavement – PMS
  - Bridge – PONTIS/BrM 5.1
  - AMHS – Fleet Condition Survey
  - AMHS – Shore Condition Survey
  - Aviation Facilities – AASP
  - Airport Pavement – Airport & Hwy PMS
- **Condition**
  - Pavement – PMS
  - Bridge – PONTIS/BrM 5.1
  - AMHS – Fleet Condition Survey
  - AMHS – Shore Condition Survey
  - State Equipment Fleet – EMS
  - Transit Vehicles – Transit & Rail
  - Unstable Slopes – Unstable Slopes Inventory
  - Performance – WIM Data Port, Traffic Server, Crash, Local Permits
- **Work History**
  - MMS, MRS, EMS
- **Network Description & Location Reference Management**
  - RDS (Future SRIS)
- **Geospatial Data Management**
  - Enterprise GIS
3.2 **KEY INTEGRATION POINTS**

The AASHTO Asset Management Guide provides guidance on key integration points to support a TAMIS, including the types of data and systems to be integrated and the purpose of the integration in support of TAMIS. Table 3.1 summarizes these key integration points, along with mapping to the specific ADOT&PF data systems (identified in the “ADOT&PF System” column) that are needed to provide information to fulfill the stated purpose. The Guide recommends that system integration be planned in advance of system implementation to ensure that data structures are compatible and that common unique identifiers are in place for linking data entities. An analysis of Table 3.1 clearly identifies some emerging gaps in key data integration points. These and other gaps will be further identified and explored as part of Task 7, TAMIS Gaps Analysis.

**Table 3.1 Key Integration Points**

<table>
<thead>
<tr>
<th>Data Type(s)</th>
<th>Systems Integrated</th>
<th>ADOT&amp;PF System</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Network and Linear Referencing</td>
<td>Enterprise GIS, Enterprise LRS</td>
<td>RDS (Future SIRIS) (Tier 1*)</td>
<td>Integrate TAMIS and other geospatial data; keep TAMIS location referencing in synch with enterprise LRS over time.</td>
</tr>
<tr>
<td>Geospatial Data Layers</td>
<td>Enterprise GIS</td>
<td>Enterprise GIS (Tier 1*)</td>
<td>Utilize geospatial data within the TAMIS; provide map interface for field data collection.</td>
</tr>
<tr>
<td>Functional Classification, Highway System Designation, Control Section</td>
<td>Highway Inventory</td>
<td>RDS (Future SIRIS) (Tier 1*)</td>
<td>Provide TAMIS with highway designation data for use in treatment assignment, prioritization and analysis.</td>
</tr>
<tr>
<td>Asset Inventory</td>
<td>Across specialized inventories for single assets or asset groupings</td>
<td>PMS (Tier 1) PONTIS (BMS – 2014) (Tier 1) MMS (Tier 1) MMS Inventories (Tier 1) Retaining Walls Inventory (Tier 2) Material Sites Inventory (Tier 2) ADA Inventory (Tier 1) Road Weather Information System</td>
<td>Assess needs and develop work programs reflecting multiple assets in a corridor; filter data based on pavement type or bridge locations; consolidate information for HPMS reporting; consolidate information for financial reporting.</td>
</tr>
<tr>
<td>Data Type(s)</td>
<td>Systems Integrated</td>
<td>ADOT&amp;PF System</td>
<td>Purpose</td>
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<td></td>
<td>(RWIS) (Tier 2)</td>
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<td>Alaska Aviation System Plan (AASP) (Tier 2)</td>
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<td>Airport and Highway Pavement Mgmt System (Tier 2)</td>
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<td>GMPAS (Tier 2)</td>
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<td>EMS (Tier 1)</td>
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<tr>
<td>Asset Condition and Performance</td>
<td>Executive Information, Enterprise Reporting, Performance Management</td>
<td>PMS (Tier 1)</td>
<td>Display asset performance data on enterprise performance reports or dashboards, consolidate multiple performance indicators for internal or external reporting. Traffic, WIM, and crash provide data on asset condition and inform performance indicators.</td>
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<tr>
<td></td>
<td>PONTIS/BMS (Tier 1)</td>
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<tr>
<td></td>
<td>Fleet Condition Survey (Tier 2)</td>
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<td>Shore Condition Survey (Tier 2)</td>
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<td>EMS (Tier 1)</td>
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<td>Transit &amp; Rail (Tier 2)</td>
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<td>Unstable Slopes Inventory (Tier 2)</td>
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<td>WIM Data Port (Tier 2)</td>
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<td>Traffic Server (Tier 2)</td>
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<td>Crash Data System (Tier 3)</td>
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<td>Local Permits (Tier 2)</td>
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<td>COGNOS – Exec Info Mgmt., Enterprise Rept. PETS (Tier 1)</td>
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</tr>
<tr>
<td>Work Accomplishment</td>
<td>Maintenance Management, Contract Management</td>
<td>TBD</td>
<td>Relate work plans to work accomplishments, improve forecasting models</td>
</tr>
<tr>
<td>Identifiers and Codes for Assets, Activities, Accounts, Projects, and Administrative Units</td>
<td>Financial, Enterprise Master Data</td>
<td>MMS (Tier 1)</td>
<td>Keep TAMIS coding in sync with other systems, avoid need for duplicate data maintenance as code changes occur.</td>
</tr>
<tr>
<td></td>
<td>FAAM (Tier 3)</td>
<td></td>
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<tr>
<td>Employees</td>
<td>Human Resources</td>
<td>IRIS (Tier 1)</td>
<td>Select staff resources for assignment to maintenance work activities (for TAMIS including maintenance management functions).</td>
</tr>
<tr>
<td></td>
<td>MMS (Tier 1)</td>
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<tr>
<td>Vehicles/Equipment</td>
<td>Fleet and Equipment Management</td>
<td>EMS (Tier 1)</td>
<td>Select equipment resources for assignment to maintenance work</td>
</tr>
<tr>
<td></td>
<td>MMS (Tier 1)</td>
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<tr>
<td></td>
<td>Transit and Rail (Tier 2)</td>
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</tr>
<tr>
<td>Data Type(s)</td>
<td>Systems Integrated</td>
<td>ADOT&amp;PF System</td>
<td>Purpose</td>
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<tr>
<td>Materials</td>
<td>Materials or Inventory Management</td>
<td>EMS (Tier 1)</td>
<td>Select materials for assignment to maintenance work activities based on available stocks (for TAMIS including maintenance management functions).</td>
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<tr>
<td></td>
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<td>PMS (Tier 1)</td>
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<td>MMS (Tier 1)</td>
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<td></td>
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<td>PONTIS (BMS - 2014) (Tier 1)</td>
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<td>Material Sites Inventory</td>
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<td>(Tier 2)</td>
<td></td>
</tr>
<tr>
<td>Resource Utilization</td>
<td>Financial, Human Resource</td>
<td>MMS (Tier 1)</td>
<td>Obtain cost transactions associated with work orders in order to track maintenance costs by asset and location.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IRIS (Tier 1)</td>
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<tr>
<td></td>
<td></td>
<td>EMS (Tier 1)</td>
<td></td>
</tr>
<tr>
<td>Project Budgets and Actual Costs</td>
<td>Financial, Capital Programming</td>
<td>FAAM (Tier 3)</td>
<td>Provide planning-level cost estimates from TAMIS to financial or capital programming systems. Obtain current cost estimates from financial systems for integration into TAMIS work plans or for tracking historical asset maintenance and rehabilitation costs.</td>
</tr>
<tr>
<td></td>
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<td>MRS (Tier 1)</td>
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<td>IRIS (Tier 1)</td>
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<td>GMPAS (Tier 2)</td>
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<td>EMS (Tier 1)</td>
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<tr>
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<td></td>
<td>MMS (Tier 1)</td>
<td></td>
</tr>
<tr>
<td>Treatment Recommendations</td>
<td>Programming and Contracting</td>
<td>Site Manager, Bid Tab, STIP</td>
<td>Provide TAMIS recommendations to be further developed for contracting and scheduling. This would be for programs like Site Manager, Bid Tab and the STIP.</td>
</tr>
<tr>
<td>Work Requests</td>
<td>Call Center</td>
<td>AMHS Call Center</td>
<td>Route asset maintenance work requests to the TAMIS (for TAMIS including maintenance management functions) and provide completion status. ADOT&amp;PF has a call center for AMHS, but no other known call centers at this time.</td>
</tr>
<tr>
<td>Work Orders</td>
<td>Financial</td>
<td>TBD</td>
<td>Track actual costs by TAMIS work order</td>
</tr>
</tbody>
</table>
### 3.3 Asset Inventory Hierarchy

An asset inventory hierarchy establishes a framework for defining where it is desirable to monitor parts of an asset (e.g., elements of a bridge or components of a signal system). The asset hierarchy helps to facilitate collection of field data elements and analysis to support asset decision making, asset maintenance, and calculation of lifecycle costs for an individual asset or grouping of assets. The recommended asset inventory hierarchy for the TAMIS framework uses the following asset hierarchy structure in descending form:

- **Major Asset Class**: A logical grouping of assets at its highest functional level within the asset hierarchy (e.g., highways, aviation, marine highway, equipment).
- **Asset Subclass**: A collection of assets that form the major asset class (e.g., the asset subclass for highways would include bridges, pavement, roadway, drainage, ITS assets, etc.).
- **Asset Type**: The most general group of asset types that allows for inventorying of asset subclasses (e.g., for the roadway subclass, asset types would include the roadway, pedestrian facilities, guardrails, highway lighting, signs, and traffic).
- **Asset Components**: The distinct inventory data elements that comprise an individual asset type. Asset components have specific attributes such as the location, condition, service life, and maintenance requirements.

It should be noted that all major asset classes and asset types are critical for safety analysis and decision making. The recommended asset inventory hierarchy is presented in Figure 3.3.
**Figure 3.3  Asset Inventory Hierarchy**

**All major asset classes and asset types critical for safety analysis & planning**
Marine Highway
- Fleet
  - Fleet Condition
    - Survey
      - Type of Mandatory
        Upgrades
      - Priority Rank
      - Location on vessel
      - Item cost
      - Pictures/diagrams
        associated with items
  - Shore
    - Shore Condition
      - Survey
        - Bridge inspection
data
        - Fracture critical
          inspection data
        - Type of AMHS
          shore-side structure
        - Type of AMHS
          shore-side facility
        - Date shore-side
          facilities built
        - Condition of
          shore-side facility
        - Condition of
          shore-side structure

Equipment
- Equipment/Vehicles
  - State Equipment Fleet
  - Transit Vehicles
    - EMS
      - Equipment year,
        make, model
      - Owner of
        equipment
      - FUR rate
      - Reliability ratio
      - Condition
        assessment
      - Maintenance
        Schedule
      - Utilization (miles
        and hours used)
      - Life cycle cost
    - Transit & Rail/
      GMPAS
      - Transit vehicle
        age
      - Vehicle condition
      - Ridership
      - Mileage
      - Operating cost
      - Expenditures to
date
      - Funding data
        (dollars/ride)
4.0 Data Catalog – Desired Condition

A Data Catalog is used to support the desired condition for the TAMIS framework by identifying the data systems that support TAMIS and identifying the data business owners, data stewards, data custodians, and stakeholders of the systems. The owner, stewards, etc. are typically identified as a specific person; however, for ADOT&PF, the office has been identified until at such time the Department implements a governance structure for TAMIS, under which individuals can be identified in the catalog. NOTE: The IT Custodian is meant to identify those persons in the Information Services Section, Administrative Services Division, who maintain the servers and databases for the various data systems. At this time, it is assumed that this is correct section for maintaining all hardware and software applications for the entire set of systems.

The data catalog also identifies any policy documents pertaining to management of TAMIS-related systems and lists existing documents such as user manuals, data dictionaries, or metadata that is available for each system.

The data catalog’s purpose is to provide a comprehensive catalog of information about the TAMIS data systems and to assist those persons/offices responsible for maintaining those systems, as well as to provide a repository of information to inform employees about TAMIS. Typically, a data catalog is made available through a document management system or knowledge management system. At ADOT&PF, the likely repository for the TAMIS Data Catalog is the eDOCs system. Table 4.1 identifies the recommended components of the TAMIS Data Catalog (desired condition).
Table 4.1 Data Catalog – Desired Condition

<table>
<thead>
<tr>
<th>Data Type(s)</th>
<th>ADOT&amp;PF System - (Tier level)</th>
<th>Business Data Owner</th>
<th>Business Data Steward</th>
<th>IT Custodian</th>
<th>Stakeholders/ Users</th>
<th>Documentation (to be stored in eDOCS)</th>
</tr>
</thead>
</table>
| Road Network and Linear Referencing      | RDS (future SIRIS) – (Tier 1*) | TDS – Program Development Div. | TDS – Program Development Div. | Information Services Section, Administrative Services Division | Current: HPMS, CRASH, 511 Future: Traffic, MMS, PMS, CRASH, SIRIS (RDS integrated into SIRIS) | 1. RDS Overview document (RDS-Overview.pdf)  
2. RDS HandBook (draft) (RDS_Handbook.pdf)  
3. RDS_SIRIS.pptx (Powerpoint slides demonstrating relationship between RDS and SIRIS)  
4. GEO Data Models.xlsx (describes the feature classes, event tables, and domains that make up the RDS data model)  
5. TAMIS Interview Notes (SIRIS)  
6. TAMIS Interview Notes (Highway Data Inventory) |
| Geospatial Data Layers                    | Enterprise GIS – (Tier 1*)     | TDS – Program Development Div. | TDS – Program Development Div. | Same as above                           | Same as above        | Same as above                                                                                           |
| Functional Classification, Highway System Designation, Control Section | RDS (future SIRIS)– (Tier 1*) | TDS – Program Development Div. | TDS – Program Development Div. | Same as above                           | Same as above        | Same as above                                                                                           |
| Asset Inventory                           | PMS- (Tier 1)                 | Pavement Management Section | Pavement Management Section | Same as above                           | HPMS staff, Design Engrs., Materials Engrs. | 1. TAMIS Interview Notes (PMS – Aug. 6, 2013)  
2. TAMIS Interview Notes (PMS & GIS)  
3. ASTM standards  
4. HPMS requirements per HPMS Field Manual  
5. AASHTO standards                                                                 |
| Asset Inventory                           | PONTIS (BrM 5.1 – 2014) – (Tier 1) | Bridge Section | Bridge Section | Same as above                           |                      | 1. 2006 Changes in Pontis Elements and Smart Flags for the Bridge Management System (AK_Pontis_Custom.pdf)  
3. Bridge Status Report: http://web.dot.state.ak.us/bridgestatus/ (shows info from Pontis and MRS)  
4. TAMIS Interview Notes (PONTIS)  
5. TAMIS Follow-up Interview Notes (PONTIS & LP)                                                                 |
| Asset Inventory                           | MMS – (Tier 1)                | Maintenance & Operations (M&O) | Maintenance & Operations (M&O) | Same as above                           | M&O staff in Regions and HQ | 1. MMS Training Manual  
2. MMS User Manual – Materials and Stockpiles  
3. MMS User Manual – Projects  
4. Managing Materials documentation  
5. Managing Projects documentation  
6. FHWA Asset Management Audit Report (May 2010)  
7. Design Manuals  
8. TAMIS Interview Notes (MMS Central)  
9. TAMIS Interview Notes (MMS Regional)                                                                 |

Cambridge Systematics, Inc.
<table>
<thead>
<tr>
<th>Data Type(s)</th>
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<th>Business Data Steward</th>
<th>IT Custodian</th>
<th>Stakeholders/ Users</th>
<th>Documentation (to be stored in eDOCS)</th>
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<tr>
<td>Asset Inventory</td>
<td>MMS Inventories – (Tier 1)</td>
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<td>M&amp;O</td>
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<td>Materials Sites Inventory - (Tier 2)</td>
<td>Statewide Materials</td>
<td>Statewide Materials</td>
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<td>1. PDF versions of inspections sites reports, summary spreadsheets, and quantity charts.</td>
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<td>ADOT&amp;PF Office of Civil Rights</td>
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<td>Current users are Office of Civil Rights. When the transition plan is complete, it will be made available to users in Planning, PD&amp;E, and Construction</td>
<td>TAMIS Interview Notes.</td>
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<td>Road Weather Information System (RWIS) – (Tier 2)</td>
<td>Program Development Division</td>
<td>Program Development Division</td>
<td>Same as above</td>
<td>M&amp;O, Planner, Local transportation authorities, Numerous external DOT&amp;PF agencies (i.e. DOA Risk Mgt.)</td>
<td>1. Concept of Operations document for ADOT&amp;PF Data Business Plan (2009). 2. TAMIS Interview Notes.</td>
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<td>Asset Inventory</td>
<td>Alaska Aviation</td>
<td>Aviation Planners</td>
<td>Aviation</td>
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<td>1. Data Dictionary (2010-1-21 Data Dictionary.pdf)</td>
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<td>2. Draft Inventory Database Manual (2010-7-12 Draft Inventory Database Manual.pdf)</td>
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<td>4. Public site to view Facilities Inventory database: <a href="http://www.AlaskaASP.com">www.AlaskaASP.com</a></td>
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<td>5. TAMIS Interview Notes (Airport Systems)</td>
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<td>1. TAMIS Interview Notes.</td>
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<td>2. GUIClientUserGuide.doc</td>
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<td>4. State Equipment Fleet Overview 052311a.pdf</td>
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<td>1. List of KPIs through the Public website outside of COGNOS: <a href="http://dot.alaska.gov/performance-dash/index.shtml">http://dot.alaska.gov/performance-dash/index.shtml</a></td>
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<td>2. Link to the Divisional Dashboard and different portal pages: <a href="http://web.dot.state.ak.us/pets/divdashboard.shtml">http://web.dot.state.ak.us/pets/divdashboard.shtml</a></td>
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| | | | | | | 3. Link to FHWA Portal Page: http://cmm.dot.state.ak.us/cognos10/cgi-bin/cognos.cgi?f_action=dashboard&pathinfo=/cm&frag-header=true&path=storeID%220B59C35D42C743A48411E335E4D861D1%22&backURL=%2fcognos10%2fcognos.cgi%3fb_action=3dxts.run%26m%3ddportal%2ffcc.xts%26m_folder%3di4B61883BEC18415D919E3CA7859E907C
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<th>Stakeholders/ Users</th>
<th>Documentation (to be stored in eDOCS)</th>
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</table>
| Asset Condition and Performance | Traffic Server - (Tier 2)       | Program Development Division – Transportation Information Group | Program Development Division – Transportation Information Group | Same as above                                     | ADOT&PF Planning, Highway Safety, local government agencies, law enforcement, FHWA | 1. TAMIS Interview Notes  
| Asset Condition and Performance | WIM Data Port - (Tier 2)        | Program Development Division – Transportation Information Group | Program Development Division – Transportation Information Group | Same as above                                     | ADOT&PF staff                                                                     | 1. User Manual  
2. ADOT&PF Concept of Operations (2009) |
| Asset Condition and Performance | CRASH - (Tier 3)               | Program Development Division – Transportation Information Group | Program Development Division – Transportation Information Group | Same as above                                     | MS/CVE, Regional M&O, Highway Safety Office, Planning, Design & Engineering Services, Regional Traffic & Safety, Alaska Injury Prevention Center, FARS, local agencies | 1. CRASH ConOps |
| Asset Condition and Performance | Local Permits (LP) – (Tier 2)  | Measurement Standards & Commercial Vehicle Enforcement (MS/CVE) | Local Permits Office - Anchorage                            | Same as above                                     | Motor carriers, public (public can self-issue permits within certain limits)       | 1. TAMIS - Interview LIBRA and LP Rev120413.doc  
2. TAMIS - Follow-up Interview PONTIS and LP Rev112513.doc |
2. TAMIS Interview Notes (Shore Condition Survey & Terminal Maintenance Requests) |
<p>| Asset Condition and Performance | Fleet Condition Survey – (Tier 2) | Alaska Marine Highway System                              | Alaska Marine Highway                                     | Same as above                                     | Senior vessel construction manager,                                                | 1. TAMIS interview notes. |</p>
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<td>PMS- (Tier 1)</td>
<td>Pavement Management Section</td>
<td>Pavement Management Section</td>
<td>Same as above</td>
<td>HPMS staff, Design Engrs., Materials Engrs.</td>
<td>1. TAMIS Interview Notes (PMS – Aug. 6, 2013) 2. TAMIS Interview Notes (PMS &amp; GIS) 3. ASTM standards 4. HPMS requirements per HPMS Field Manual 5. AASHTO standards</td>
</tr>
<tr>
<td>Asset Condition and Performance</td>
<td>PONTIS (BrM 5.1 – 2014) – (Tier 1)</td>
<td>Bridge Section</td>
<td>Bridge Section</td>
<td>Same as above</td>
<td></td>
<td>1. 2006 Changes in Pontis Elements and Smart Flags for the Bridge Management System (AK_Pontis_Custom.pdf) 2. Routine Inspection Report (1188_Routine_2013_partial.pdf) 3. Bridge Status Report: <a href="http://web.dot.state.ak.us/bridgestatus/">http://web.dot.state.ak.us/bridgestatus/</a> (shows info from Pontis and MRS) 4. TAMIS Interview Notes (PONTIS) 5. TAMIS Follow-up Interview Notes (PONTIS &amp; LP)</td>
</tr>
<tr>
<td>Asset Condition and Performance</td>
<td>Transit and Rail - (Tier 2)</td>
<td>Program Development Division – Transit Planning</td>
<td>Program Development Division – Transit Planning</td>
<td>Same as above</td>
<td>Transit Planners, FTA, Alaska Mental Health Trust Authority</td>
<td>TAMIS Interview notes (Transit Rail)</td>
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</table>
| Identifiers and Codes for Assets, Activities, Accounts, Projects, and Administrative Units | MMS – (Tier 1)                         | Maintenance & Operations (M&O)    | Maintenance & Operations (M&O)    | Same as above | M&O staff in Regions and HQ | 1. MMS Training Manual  
2. MMS User Manual – Materials and Stockpiles  
3. MMS User Manual – Projects  
4. Managing Materials documentation  
5. Managing Projects documentation  
6. FHWA Asset Management Audit Report (May 2010)  
7. Design Manuals  
8. TAMIS Interview Notes (MMS Central)  
9. TAMIS Interview Notes (MMS Regional)  
10. TAMIS Follow-up Interview Notes (M&O and CIP) |
2. Email from Liz Balstad RE_Desk reference manual for FAAM.pdf  
3. TAMIS Interview Notes (FAAM) |
| Employees                                                                   | IRIS – (Tier 1)                        | Administrative Services Division | Administrative Services Division | Same as above | Accounting clerks, admin assistants, pursers/ stewards, PMs, airport leasing, budget analysts, accountants, procurement, financial, human resources | Several documents produced by the IRIS team regarding the potential system interfaces with EMS, MMS, MRS, eParcels, Rural Airport Badging System, and Airport Information System. The format of these documents was PDF files illustrating several tables regarding the potential use of systems with IRIS. |
| Employees                                                                   | MMS – (Tier 1)                         | Maintenance & Operations (M&O) Division | Maintenance & Operations (M&O) Division | Same as above | M&O staff in Regions and HQ | 1. MMS Training Manual  
2. MMS User Manual – Materials and Stockpiles  
3. MMS User Manual – Projects  
4. Managing Materials documentation  
5. Managing Projects documentation  
6. FHWA Asset Management Audit Report (May 2010)  
7. Design Manuals  
8. TAMIS Interview Notes (MMS Central)  
9. TAMIS Interview Notes (MMS Regional)  
10. TAMIS Follow-up Interview Notes (M&O and CIP) |
| Vehicles/Equipment                                                           | EMS – (Tier 1)                         | M&O – Statewide Equipment Fleet  | M&O – Statewide Equipment Fleet  | Same as above | M&O staff, Design & Construction, AMHS | Training Guide documents and Overview documents of EMS include the following:  
1. EMS Asset Record Layout.docx  
2. GUIClientUserGuide.doc  
3. GUITraining_CustomerInq.pdf  
4. EMS Long Description of Policies and Procedures.pdf |
<table>
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<th>Data Type(s)</th>
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<th>Documentation (to be stored in eDOCS)</th>
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<td>Maintenance &amp; Operations (M&amp;O) Division</td>
<td>Maintenance &amp; Operations (M&amp;O) Division</td>
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<td>M&amp;O staff in Regions and HQ</td>
<td>1. MMS Training Manual</td>
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<td>3. MMS User Manual – Projects</td>
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<td>4. Managing Materials documentation</td>
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<td>6. FHWA Asset Management Audit Report (May 2010)</td>
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### ADOT&PF System Information Systems (TAMIS) and Data Research Project

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</table>
| Materials             | PONTIS (BrM 5.1 – 2014) – (Tier 1) | Bridge Section     | Bridge Section        | Same as above | Regional Planning & Design Staff                                                                 | 1. 2006 Changes in Pontis Elements and Smart Flags for the Bridge Management System (AK_Pontis_Custom.pdf)  
3. Bridge Status Report: [http://web.dot.state.ak.us/bridgestatus/](http://web.dot.state.ak.us/bridgestatus/) (shows info from Pontis and MRS)  
4. TAMIS Interview Notes (PONTIS)  
5. TAMIS Follow-up Interview Notes (PONTIS & LP)                                                                                          |
| Resources             | MMS – (Tier 1)                | Maintenance & Operations (M&O) Division | Maintenance & Operations (M&O) Division | Same as above | M&O staff in Regions and HQ                                                                 | 1. MMS Training Manual  
2. MMS User Manual – Materials and Stockpiles  
3. MMS User Manual – Projects  
4. Managing Materials documentation  
5. Managing Projects documentation  
6. FHWA Asset Management Audit Report (May 2010)  
7. Design Manuals  
8. TAMIS Interview Notes (MMS Central)  
9. TAMIS Interview Notes (MMS Regional)  
10. TAMIS Follow-up Interview Notes (M&O and CIP)                                                                                          |
| Resource              | IRIS – (Tier 1)               | Administrative Services Division | Administrative Services Division | Same as above | Accounting clerks, admin assistants, pursers/ stewards, PMs, airport leasing, budget analysts, accountants, procurement, financial, human resources | Several documents produced by the IRIS team regarding the potential system interfaces with EMS, MMS, MRS, eParcels, Rural Airport Badging System, and Airport Information System. The format of these documents was PDF files illustrating several tables regarding the potential use of systems with IRIS.                                                                                                           |
| Resource              | EMS – (Tier 1)                | M&O – Statewide Equipment Fleet | M&O – Statewide Equipment Fleet | Same as above | M&O staff, Design & Construction, AMHS                                                                 | Training Guide documents and Overview documents of EMS include the following:  
1. EMS Asset Record Layout.docx  
2. GUILClientUserGuide.doc  
3. GUITraining_CustomerInq.pdf  
4. State Equipment Fleet Overview 052311a.pdf  
5. Syllabus_EMU_UserTraining_DataEntry_sjs.doc  
6. Syllabus_EMU_UserTraining_Foremn_sjs.doc                                                                                                                                                                                                 |
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<tr>
<th>Data Type(s)</th>
<th>ADOT&amp;PF System - (Tier level)</th>
<th>Business Data Owner</th>
<th>Business Data Steward</th>
<th>IT Custodian</th>
<th>Stakeholders/ Users</th>
<th>Documentation (to be stored in eDOCS)</th>
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<td>Project Budgets and Actual Costs</td>
<td>FAAM- (Tier 3)</td>
<td>HQ - Fed-Aid Team</td>
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<td>HQ – Fed-Aid Team</td>
<td>1. Complete Manual.docx</td>
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<td></td>
<td>2. Email from Liz Balstad RE_Desk reference manual for FAAM.pdf</td>
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<td>3. TAMIS Interview Notes (FAAM)</td>
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<td>MRS- (Tier 1)</td>
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<td>Regional Project Controls, HQ Project Controls and Obligation Mgr.; HQ Admin Services owns the hw/sw; staff in contracts and construction also update data in MRS</td>
<td>Same as above</td>
<td>Regional Project Controls and Obligation staff, Contracts staff, Construction staff, Region Project Controls</td>
<td>1. Online data dictionary: <a href="http://web.dot.state.ak.us/cgi-bin/dd/d/tables.pl">http://web.dot.state.ak.us/cgi-bin/dd/d/tables.pl</a></td>
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<td>2. Bridge Status Report: <a href="http://web.dot.state.ak.us/bridgestatus/">http://web.dot.state.ak.us/bridgestatus/</a> (shows info from Pontis and MRS)</td>
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<td><a href="http://web.state.ak.us/mrs/docs/ProjectStatus-ManagerInputFINAL.pdf">http://web.state.ak.us/mrs/docs/ProjectStatus-ManagerInputFINAL.pdf</a></td>
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<td>5. Email from Wendy Parker 100613.pdf</td>
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<td>6. TAMIS Interview Notes (MRS)</td>
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<td></td>
<td>IRIS – (Tier 1)</td>
<td>Administrative Services Division</td>
<td>Administrative Services Division</td>
<td>Same as above</td>
<td>Accounting clerks, admin assistants, pursers/ stewards, PMs, airport leasing, budget analysts, accountants, procurement, financial, human resources</td>
<td>Several documents produced by the IRIS team regarding the potential system interfaces with EMS, MMS, MRS, eParcels, Rural Airport Badging System, and Airport Information System. The format of these documents was PDF files illustrating several tables regarding the potential use of systems with IRIS.</td>
</tr>
<tr>
<td></td>
<td>GMPAS – (Tier 2)</td>
<td>Program Development Division – Transit Planning</td>
<td>Program Development Division – Transit Planning</td>
<td>Same as above</td>
<td>Transit Planners, FTA, Alaska Mental Health Trust Authority</td>
<td>1. TAMIS Interview Notes.</td>
</tr>
<tr>
<td></td>
<td>EMS – (Tier 1)</td>
<td>M&amp;O – Statewide Equipment Fleet</td>
<td>M&amp;O – Statewide Equipment Fleet</td>
<td>Same as above</td>
<td>M&amp;O staff, Design &amp; Construction, AMHS</td>
<td>Training Guide documents and Overview documents of EMS include the following: 1. EMS Asset Record Layout.docx</td>
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<td>2. GUIclientUserGuide.doc</td>
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<td>3. GUITraining_CustomerInq.pdf</td>
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<td>4. State Equipment Fleet Overview 052311a.pdf</td>
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<td></td>
<td></td>
<td>5. Syllabus EMS_UserTraining_DataEntry_sjs.doc</td>
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</tbody>
</table>
| Project Budgets and Actual Costs     | MMS – (Tier 1)                | Maintenance & Operations (M&O) Division | Maintenance & Operations (M&O) Division | Same as above | M&O staff in Regions and HQ | 1. MMS Training Manual  
2. MMS User Manual – Materials and Stockpiles  
3. MMS User Manual – Projects  
4. Managing Materials documentation  
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6. FHWA Asset Management Audit Report (May 2010)  
7. Design Manuals  
8. TAMIS Interview Notes (MMS Central)  
9. TAMIS Interview Notes (MMS Regional)  
10. TAMIS Follow-up Interview Notes (M&O and CIP) |
| Treatment Recommendations            | Site Manager, Bid Tab, STIP (Note: Site Manager and Bid Tab were previously marked as OUT of TAMIS) | TBD                          | TBD                         | TBD          | TBD                 | 1. TAMIS Interview Notes (Site Manager, Bid Tab)                                                 |
| Work Requests                        | AMHS Call Center              | Alaska Marine Highway System (AMHS) | Alaska Marine Highway System (AMHS) | Same as above | TBD                 |                                                                                                 |
| Work Orders                          | ADOT&PF data system?          | TBD                          | TBD                         | TBD          | TBD                 | TBD                                                                                              |
| Multiple                             | COGNOS                        | TBD                          | TBD                         | Same as above | Senior Executives, Business Unit Managers |                                                                                                 |
| Multiple                             | eDOCS – (Tier 3)              | Administrative Services Division | Administrative Services Division | Same as above | 1. eDocs Overview and Demonstration Outline 20130408.doc  
2. taxonomy_fairbanks.xlsx  
3. TAMIS Interview Notes (eDOCS and eLeasing) |
5.0 Next Steps

This report establishes the desired framework of TAMIS for ADOT&PF. The next steps for the TAMIS project will be to conduct the following tasks:

1. Further investigation of the gaps (as part of Task 7) between the existing and desired state of what is needed for a Transportation Asset Management (TAM) system, in accordance with requirements of MAP-21 and the AASHTO Asset Management Guide.

2. Evaluation of the recommended TAMIS model (in Task 8) and approval by ADOT&PF of a model.

3. Develop the architectural vision and GIS vision for the Department to support the recommended TAMIS model and framework.

4. Develop Action Plan (Task 9) for implementing the TAMIS framework and TAMIS model to support enterprise asset management at ADOT&PF.
report

ADOT&PF Transportation Asset Management Information Systems (TAMIS) and Data Research Project

TAMIS Gap Analysis

prepared for
Alaska Department of Transportation and Public Facilities

prepared by
Cambridge Systematics, Inc.
1566 Village Square Boulevard, Suite 2
Tallahassee, FL  32309

date
March 14, 2014
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1.0 Introduction

1.1 BACKGROUND

The Alaska Department of Transportation and Public Facilities (ADOT&PF) has initiated a research effort that will support the development of the Transportation Asset Management Information System (TAMIS). The goal of the TAMIS is to provide the backbone for the Asset Management program for ADOT&PF. The program will ultimately support the FHWA State Transportation Improvement Program (STIP) and Long Range Transportation Plan.

This report is the primary deliverable for Task 7 of the research effort, the TAMIS Gap Analysis. The objective of this task is to compare existing data and information systems with the desired framework and scope for TAMIS to develop an action plan to address gaps. This research builds on the results of the Task 5 (TAMIS Data Systems Evaluation) and the Task 6 (TAMIS Framework) research efforts. The results of this task are intended to be a starting point for discussion with ADOT&PF stakeholders regarding needs and gaps. The next report, Data Business Plan, will detail recommendations.

1.2 METHODOLOGY

The following work steps were completed for Task 7.

1. Conducted a maturity assessment per Section 8.4.1 and Chapter 2 of the AASHTO Transportation Asset Management Guide (AM Guide) in accordance with the following maturity levels: initial, awakening, structured, proficient, or best practice. This step involved reviewing the maturity assessment process and tools described in Chapter 2 and determining the best approach for applying the methods and tools for a maturity assessment of TAMIS systems.

2. Compared “existing” to “desired” state - This step involved identifying gaps between existing conditions (presented in Task 5) and the TAMIS Framework for Desired Conditions (presented in Task 6). The types of gaps are grouped according to three criteria:

   System - gaps related to data systems, data collection, data storage, quality of data, data integration, data analysis, data elements, and analytical tools;

   Technical - gaps related to software, hardware, system interfaces, IT compatibility, business intelligence (BI) tools, and network issues; and

   Institutional - gaps related to business processes (manual vs. automated), geospatial location, data management, and resource availability (costs).
3. **Examined linkages between highway safety and road system performance and asset management** – This step involved examining the relationship between highway safety and road system performance data and asset management, especially asset data that is reported in the annual Highway Performance Monitoring System report (HPMS) and asset data that is used to support the Highway Safety Improvement Program (HSIP).

4. **Examined linkages between pavement data and asset management systems** – This step examined the dependency upon pavement data for asset management purposes. This relationship was explored with regard to recent MAP-21 legislation.

5. **Examined linkages between bridge data and asset management systems** – Similar to the use of pavement data for asset management, there is also an important dependency upon bridge data, especially condition data, for use in asset management. This relationship was explored, especially with regard to recent MAP-21 legislation.

### 1.3 ORGANIZATION

The remainder of this document is organized as follows:

- **Section 2** – Maturity Assessment
- **Section 3** – Gap Analysis (Existing versus Desired State)
- **Section 4** – Highway Safety and Performance Data and Asset Management
- **Section 5** – Pavement Data and Asset Management
- **Section 6** – Bridge Data and Asset Management
- **Section 7** – Conclusions
- **Section 8** – Next Steps
- **Appendix A** – References
- **Appendix B** – Asset Management Systems Documentation
- **Appendix C** – Information Resource Manager (Chief Information Officer)
2.0 Maturity Assessment

2.1 Asset Management Decisions

This section evaluates the asset management maturity level at ADOT&PF with respect to the data systems that have been identified as necessary for supporting TAMIS. The maturity assessment process follows the steps outlined in the AASHTO AM Guide. The assessment steps have been customized for ADOT&PF to focus on the data systems used to support asset management decisions (previously identified in the Task 6 report, Section 2.2, Asset Management Decisions).

The Transportation Asset Management (TAM) Steering Committee recently approved a comprehensive list of asset management decisions that ADOT&PF currently makes and/or will have to make to meet the requirements of MAP-21. The decisions are presented in the form of questions, organized around the Transportation Asset Management Plan (TAMP) elements required by MAP-21.

While airport and aviation assets are not specifically addressed by MAP-21, they are noted here in the interest of providing a comprehensive view of the Department’s asset management concerns. Aviation asset management data will be collected and maintained in the Alaska Aviation System Plan Database in most cases, but may be imported to the TAMIS as necessary to support multi-modal data and decision-making.

The following list of questions is grouped into four categories: Asset Inventory, Risk Management, Financial Plan, and Investment Strategies.
### Table 2.1 Maturity Level Assessment Questions

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>CONSIDERATION</th>
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<tr>
<td><strong>Asset Inventory</strong></td>
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<tr>
<td>What assets should ADOT&amp;PF include in its asset management program? (This is a fundamental question for ADOT&amp;PF’s asset management program. The answer to this question will influence the answers to all subsequent questions.)</td>
<td>Alaska’s vision is to start with Assets data that have been collected for years. 1) This includes the following inventory: a. Bridge and Pavement (including airport pavement) b. Safety, Crash (accident) data only c. ITS and Security Systems (hardware upgrades) 2) Alaska would eventually include asset inventories that support the Maintenance Performance Condition report card: a. Brush Cutting, Drainage, Gravel Roads, Guardrail, Pavement, Signage, Markings, and Winter Driving Conditions. Winter Driving Conditions would be based on the Level of Service appropriate for the roadway based on Priority Level (I, II, III). Facilities and Equipment Fleet need to be added to the Maintenance Report Card. b. Airport inventory and inspection data collected as part of the Alaska Aviation System Plan (AASP) and maintained in the AASP Database. c. Geotechnical Assets (robust data currently available). d. Maintenance costs per highway mile find high maintenance cost areas. The Maintenance Management System can do this, but an easier to use system is needed with quality information entered. e. All AMHS Capital Assets (defined by minimum dollar amount to replace) » Vessels » Terminal and Maintenance Buildings (roof replacement, pavement etc.) » Marine Structures (hydraulics, transfer bridge, cathodes, dolphins etc.) » ITS and Security Systems (hardware upgrades) Any additional asset inventory and condition data needs to be recommended by technical teams, selected by the TAM Steering Committee, and approved by the Executive Leadership.</td>
</tr>
<tr>
<td>ADOT&amp;PF will need to answer the following questions for each asset included in its asset management program:</td>
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<tr>
<td><strong>Asset Condition</strong></td>
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<tr>
<td>What performance measures should be used to summarize the condition of ADOT&amp;PF’s assets?</td>
<td>ADOT&amp;PF will use AASHTO recommended performance measures until MAP 21 Performance Measures are developed by rulemaking. An exemption will be sought for the IRI performance measure for NHS and Interstate. The Pavement Condition Index performance measure will be used instead, which would be more meaningful for Alaska. ADOT&amp;PF will use their OMB Measures and the Maintenance Report Card Performance measures developed for Brush Cutting, Drainage, Gravel Roads, Guardrail, Pavement, Signage, Markings, and winter driving conditions. Performance measures for facilities and equipment fleet need to be developed when they are added to the Maintenance Report Card. ADOT&amp;PF has developed Aviation performance measures as part of the AASP. These are currently under review as part of the Rural Airport Strategic Planning effort in order to bring together one set of measures that meets the needs of the AASP, and the Department’s measures that are reported to OMB and the Legislature, and which are displayed in the Performance</td>
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<tr>
<td>QUESTION</td>
<td>CONSIDERATION</td>
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<tr>
<td>Electronic Tracking System (PETS).</td>
<td>ADOT&amp;PF needs to develop performance measures for AMHS assets on PETS. Lifecycle Costs, Safety, and Risk (reliability) will be used to determine the AMHS measures. Facilities performance measures need to be developed. An evaluation needs to be done regarding what assets are worth maintaining or should they be rebuilt or retired.</td>
</tr>
<tr>
<td>How should these measures be calculated?</td>
<td>MAP 21 measures calculations should be given to ADOT&amp;PF. OMB calculations as shown in PETS; Maintenance Report Card Items by LOS and field audit. AMHS and other measures will use a systematic numeric approach.</td>
</tr>
<tr>
<td>Asset Management Objectives</td>
<td>Determine the best use of public funds. Provide the most benefit out of every dollar spent. To define need based on systematic measurements of asset integrity related to reliability of the system to perform at optimal levels and to provide an “apples to apples” assessment on Capital Program decision making. Ensure a safe and sustainable transportation system that continues to meet the state’s transportation needs.</td>
</tr>
<tr>
<td>Performance Gap Assessment</td>
<td>AMHS Replacement schedule for assets that are reaching the end of their lifecycle as maintenance costs increase at an exponential rate. ADOT&amp;PF will need to identify the roads that they have not spent any federal dollars on and the roads they have not spent federal dollars on in the last 20 years.</td>
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<tr>
<td>What short-term performance targets should ADOT&amp;PF establish?</td>
<td>Use AASHTO recommended performance measures to set targets for bridges, pavement, and safety.</td>
</tr>
<tr>
<td>What long-term performance targets should ADOT&amp;PF establish?</td>
<td>These will be determined after MAP 21 performance measures are developed. ADOT&amp;PF needs to develop a non-NHS bridge performance measure because it will not be part of MAP 21 but is important to their system. They will need a level of service for winter maintenance. They will develop performance measures that relate to enterprise wide activities and support the ultimate goal of TAM. They will determine if they should develop a statewide capacity performance measure.</td>
</tr>
<tr>
<td>What should it look like?</td>
<td>ADOT&amp;PF desires a fully functional data integration and data automation. They would like to program AMHS capital expenditures at a cycle that is sustainable to reduce preventative maintenance costs over time. They will have more information on Aviation when they develop performance measures as part of the Rural System Strategic Plan.</td>
</tr>
<tr>
<td>Life Cycle Cost Considerations</td>
<td>Each technical group will be recommending preservation and preventative maintenance treatments for each asset identified. Pavement preservation includes thin overlays and chip seal where appropriate. Bridge deck resurfacing, cleaning, painting, etc. AMHS needs a preventative maintenance replacement and upgrade schedule. A Pavement Research project report has recommended treatments such as the following “Current preservation techniques used are Thin HMA overlays, Chip seals, Slurry surfacing, Crack sealing, and Pre-saw cut joints. Most of the treatments are applied only once. Crack sealing and patching are applied also at intervals from more than once per year to every 4 years. Thin bonded wearing courses.” This same research project suggests looking at the following techniques: “Cold in-place recycling; Micro-surfacing to fill studded tire rutting; Thin rubber modified asphalt wearing courses.” Airport pavement and gravel surfaces have different requirements that will be addressed through continuing AASP work. ADOT&amp;PF will continue to rely on the Department’s pavement management program for condition information and</td>
</tr>
<tr>
<td>QUESTION</td>
<td>CONSIDERATION</td>
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| Preservation recommendations.  
*Bridge preventative maintenance treatments are cleaning, painting and surface treatments that protect the bridge structure.* | |
| What is the ideal timing for these treatments? | This will come from the modeling. For AMHS assets, it will be determined by mid-life or by manufacturer's recommendation to maximize life of the asset and mitigate other factors that would cause greater deterioration of the asset.  
*Pavement: From the same research project identified above.*  
“The average service life of the treatments varies from about 3 to 7 years. Crack sealing, patching and fog seals have the lowest service lives of about 3 years, whereas AST/BST, thin overlays, bonded wearing courses, and in-place recycling last on average 6 years or more. In-place recycling has the longest average service life of 7.8 years. The great variability of service lives warrant further research about affecting factors and predicted service lives for Alaskan conditions.” |
| How much do they typically cost? | AMHS Vessel Projects typically range from $8-$10M, Shore-side range from $1-$5M. Pavement preservation is a minimum of $500,000 per lane mile but increases as you replace signs, guardrail, lighting etc. |
| How can ADOT&PF design a project to ensure that it minimizes life-cycle costs? | They still need to determine their lifecycle costs and perform forecast modeling. They need to stop building 20-year pavements on 10-year embankments. The AMHS planning and eventual design projects should include upgrades that will sustain the functionality of the asset and have a standardized/consistently planned preventative maintenance to maximize the life of the asset.  
Evaluate the project scope to minimize the cost over the lifetime of the asset. Does it make sense to spend $7 Million to get another 3-4 years of pavement life on non-principle roadways? They need to start asking these types of questions. |

**Risk Management**

| What risks could influence ADOT&PF’s achieving its asset management objectives? | MAP 21 is a 2-year bill ends October 1, 2014. MAP 21 rulemaking has been delayed and it is unclear when it will happen. This leaves the States with much uncertainty. This bill had no new funding for the Trust Fund or another funding plan. Another risk is reduced FHWA funding coupled with uncertain state funding. Some other risks are lack of management support, lack of program understanding, lack of personnel support at the implementation. The state may need to get rid of ownership of lower functional class roads and it is unclear whether the local communities can fill the gaps.  
For airports, risk management and the establishment of a risk registry are issues that will likely be addressed in aviation through the implementation of Safety Management System requirements that the FAA will impose at some point in the future. |
| What risks could influence each individual program? The bridge program? The pavement program? Etc. | MAP21 changed the funding from a program specific (Bridge, Safe Routes to schools, Scenic Byways, etc.) to three “pots” of federal money (National Highway Performance Program (NHPP), Surface Transportation Program (STP), and Highway Safety Improvement Program (HSIP)). There are two different types of risks that need to be addressed: Agency risks (e.g., how to budget the needs for ferries and highways) and individual project risks. They cannot just focus on the project level risks.  
ADOT&PF needs to create a risk registry for each asset. Pavement risks include permafrost, slope failing, wash out etc. Bridge risks include scour, impact, seismic. They need corridor wide planning and the ability to determine the risks associated with that corridor. The following describes an example of a road failure risk: 6th Avenue in Anchorage has high ADT (impacts a lot of people) but it also has several streets that can provide a bypass in close proximity. Therefore, the 6th Avenue closure is less risk than closing a road to a rural airport with an ADT of 50 that is the only connection a community has to the rest of the state. ADOT&PF needs to evaluate why they have airports to communities 6 miles apart connected by road - are there any cost savings that can happen? This is an example of reviewing the functionality of airports and alternatives to maintaining... |
<table>
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<th>QUESTION</th>
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</table>
| Which assets are the most vulnerable to external and environmental risks? | The risk registry will highlight the most vulnerable risks: geotechnical, bridges, and roads from seismic and flooding. For Climate Change - M&O and D&ES Research is participating in a vulnerability assessment group. For AMHS  
  • Shore side Dolphin degradation, Float and Bridge wave impacts  
  • Vessel Hull and Vessel end of lifecycle – increasing demands on replacement                                                                                                                                                                                                  |
| What is the likelihood of these risks occurring?                       | Need a risk registry for each asset and primary corridor to answer this and the following questions. For AMHS assets, the risks are variable depending on weather and location.                                                                                                                                                                                   |
| What are the consequences if they occur?                               | Need a risk registry for each asset and corridor to answer this and the following questions. What are ADOT&PF’s priority risks? Need a risk registry for each asset and corridor to answer this and the following questions. For AMHS assets, risks are a reduction or loss of transportation services to coastal communities-which is sometimes the only reliable link. |
| How should the priority risks be mitigated?                           | Prioritized by what affects the customers the most or most cost to mitigate, or by likelihood of occurrence. Relative importance of risks versus performance activities.                                                                                                                                                                                                    |
| Financial Plan             |                                                                                                                                                                                                                                                                                                                                                     |
| How should ADOT&PF allocate funds between its asset management programs and other priorities? | First priority is to finish projects that are already in design and still contribute to success with performance measures and overall statewide priorities. They will evaluate the 10-year plan compared to the Performance Measures selected. This should match the Strategic Plan (goals of Safety, Preservation, Maintenance, Access, Connectivity, etc.). Develop a preservation program; eventually adding assets that increase efficiency in design and maintenance functions. AHMS Project funds should be allocated to assets that have a high risk factor in safety and operating functionality, to ensure levels of service desired. |
| How should ADOT&PF allocate funds between the various asset management program areas (e.g., pavement versus bridge)? | ADOT&PF tentatively plans to use the project selection criteria and allocated funds in three areas: Preservation, Mobility, and Safety. LRTP in development will further explain the project selection criteria. Corridor Planning will be weighted based on the Performance Measures.                                                                                                   |
| How should ADOT&PF allocate funds to the Regions?                     | Projects selected will be shown in the STIP and the Region in which the project is located will request the funding. Regional planners will have input into Project Selection criteria, which will feed the STIP. For preservative or deferred maintenance, each region needs a defined source of money. Each region’s funding amount should be based on highway type, traffic volume including percent heavy vehicles, total lane miles, location, and other factors identified.  
  Airport Asset management is, largely, inherent in the continuous planning process under the AASP and strategic planning efforts. Current tasks include reviewing and determining the need for changes to our Aviation Project Evaluation Board process and the distribution of available funds across the spectrum of airport needs.  
  AMHS has its own source of money for maintenance. Large Capital projects need to be on the STIP if FHWA funded.                                                                                                                                                                                                   |
| Investment Strategies                                                 |                                                                                                                                                                                                                                                                                                                                                     |
| What are ADOT&PF’s priority assets?                                   | The Strategic Plan states ADOT&PF priorities (1) Provide for the safe and efficient movement of people and goods; (2) Provide statewide access and connectivity and (3) Provide access for exploration and development of Alaska’s resources.                                                                                                                     |
### QUESTION | CONSIDERATION
---|---
What candidate projects should be considered? | Projects that lead to meeting or showing progress toward performance measure targets; projects that are already in design and have a significant investment already and by its completion support the Alaska goals of Safety, Mobility, and Preservation.
How should ADOT&PF prioritize candidate projects and select projects for the capital program? | This will be spelled out in greater detail in the LRTP. The criteria needs to be weighted based on strategic investment.
Should the scope of candidate projects be enhanced to address other issues along the project location? If so, which issues should be addressed? | Features that reduce Maintenance or Operations costs or increase safety of a road.
How should the maintenance program influence the capital program? | Proposed Capital projects should estimate what effect (positive and negative) its completion will have on the Maintenance operating costs (additional lane miles, lighting, and bike paths). Keep in mind that the costs include positions (PCNs) and equipment/commodities not just money. This needs to equal to ten-year plan and operating budget.
How should the capital program influence the maintenance program? | Proposed Capital projects should include a long-term fix to solve problems that Maintenance is having or expending excess resources or are safety issues.
The Maintenance program could help update asset inventory and condition data, which helps feed the project selection criteria.
Should ADOT&PF increase truck weight limits, or implement other types of policies that influence asset conditions? | Permits are already needed for overweight vehicles. Seasonal Load restrictions are implemented by M&O. Need more enforcement. Establish and enforce Truck routes.
What risk mitigation strategies should be funded and implemented? | Once ADOT&PF has a risk register they can come up with strategies to mitigate asset risks. Have Design, Construction, and Maintenance personnel participate in Planning Process. Use Design/Build or CMGC options for contracting (less risk on contractors = save money) Increase amount of QA done for Maintenance Report Card, to feed maintenance projects; they must complete this feedback loop, between M&O – Planning (Life Cycle of a Project).

The information needed to provide answers to many of these questions is contained in the data systems that have been identified (in TAMIS Task 5 report) as necessary for supporting asset management at ADOT&PF. However, there are varying degrees of levels of maturity for those data systems with regard to their ability to support asset management. The next section explains how the maturity level assessment process works and what can be done to advance to the next level of maturity for the TAMIS data systems.
2.2 Maturity Assessment Process

This section evaluates the ADOT&PF asset management maturity level with respect to the data systems that have been identified as necessary for supporting TAMIS. The maturity assessment process uses the TAM Maturity Scale identified in the AASHTO AM Guide. There are five levels of maturity in the scale (initial, awakening, structured, proficient, and best practice). Each level is described in Table 2.2.

<table>
<thead>
<tr>
<th>TAM Maturity Scale Level</th>
<th>Maturity Level Number</th>
<th>General Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>1</td>
<td>No effective support from strategy, processes, or tools. There can be lack of motivation to improve.</td>
</tr>
<tr>
<td>Awakening</td>
<td>2</td>
<td>Recognition of a need and basic data collection. There is often reliance on heroic efforts of individuals.</td>
</tr>
<tr>
<td>Structured</td>
<td>3</td>
<td>Shared understanding, motivation, and coordination. Development of processes and tools.</td>
</tr>
<tr>
<td>Proficient</td>
<td>4</td>
<td>Expectations and accountability drawn from asset management strategy, processes, and tools.</td>
</tr>
<tr>
<td>Best Practice</td>
<td>5</td>
<td>Asset management strategies, processes, and tools are routinely evaluated and improved.</td>
</tr>
</tbody>
</table>


The AASHTO AM Guide cautions that the boundaries between each of these levels are not always solid and the advancement through the levels of maturity typically is through each step, without skipping any steps.

For additional information regarding maturity levels, the recently completed (January 31, 2012) FHWA Roadway Safety Data Partnership Capability Assessment used the maturity levels defined in the Capability Maturity Model (CMM). The CMM originated in the information technology arena to track the development of computer systems. CMMs are now seeing a wider application as a means for identifying phases of growth and development from a combined qualitative and quantitative perspective. This approach provides the project team the ability to assess subjectively the States (DOTs). The principles of the CMM place each State into “capability categories.” These categories are based on a five-point scale from less to more mature. The five maturity levels used in this analysis are identified in Table 2.3.
Table 2.3 Capability Maturity Model (CMM)

<table>
<thead>
<tr>
<th>CMM Maturity Level</th>
<th>Maturity Level Number</th>
<th>General Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial/Ad-hoc</td>
<td>1</td>
<td>The organization does not possess a stable implementation environment and the safety data collection, management (entering/coding, processing, and evaluating) and maintenance process is 'ad hoc' with no interconnection within the organization. Interoperability and expandability are not planned.</td>
</tr>
<tr>
<td>Repeatable</td>
<td>2</td>
<td>Activities are based on the results of previous projects and the demands of the current one. Decisions are considered during individual projects.</td>
</tr>
<tr>
<td>Defined</td>
<td>3</td>
<td>The process is documented throughout the organization rather than on a per-project basis. Projects are carried out under guidance of the organization's standards and are tied to an adopted strategy.</td>
</tr>
<tr>
<td>Managed</td>
<td>4</td>
<td>Projects are started and supervised by process management. Through performance management, processes are predictable and the organization is able to develop rules and conditions regarding the quality of the products and processes.</td>
</tr>
<tr>
<td>Optimizing</td>
<td>5</td>
<td>The whole organization is focusing on the continuous improvement. The organization possesses the means to detect weaknesses and to strengthen areas of concern proactively.</td>
</tr>
</tbody>
</table>

The maturity assessment process developed for TAMIS focused on tools and processes used to conduct the assessment for agency-wide asset management. The maturity process for TAMIS has been customized to focus on the data systems used to support TAMIS. The maturity assessment used for TAMIS involved two steps:

1) Evaluating the maturity level of the organization with respect to each TAMIS data system individually

2) Evaluating the maturity level of the organization with respect to all TAMIS data systems as a whole.

This approach was used to highlight areas of greatest maturity for specific data systems and to identify areas where data systems and their associated business processes offer opportunities for improvement.

Table 2.4 describes the maturity levels as they pertain to TAMIS data systems. These descriptions have been customized from the ones listed in Table 2.1 to reflect maturity levels with respect to impact on (1) people/resources, (2) technology/tools, and (3) institutional/governance issues. These maturity levels are based on the Data Management Maturity Model Matrix recommended in NCHRP Report 666: Target-Setting Methods and Data Management to Support Performance-Based Resource Allocation by Transportation Agencies (2010).
### Table 2.4 TAMIS Maturity Level Descriptions

<table>
<thead>
<tr>
<th>TAMIS Maturity Scale Level</th>
<th>Maturity Level Number</th>
<th>General Description</th>
</tr>
</thead>
</table>
| **Initial**                | 1                     | **People:** Not aware of need for improved asset management (TAMIS)  
**Technology/Tools:** No tools in place to manage data system used for asset management (TAMIS)  
**Institutional/Governance:** No institutional policies or procedures in place for data system used to support TAMIS. |
| **Awakening**              | 2                     | **People:** Aware of need for improvement in a particular data system to support asset management (TAMIS)  
**Technology/Tools:** Planning for use of technology/tools to support data system that is used for asset management (TAMIS)  
**Institutional/Governance:** Agency or Business Unit is discussing needs/plans for policies/governance regarding a particular data system (e.g., GIS) used for asset management (TAMIS). |
| **Structured**             | 3                     | **People:** Aware of need for improvement in a particular data system to support asset management (TAMIS). Some steps have been taken to improve the data system through use of technical tools and business processes.  
**Technology/Tools:** Implemented some technology tools to improve maintenance and use of a particular data system used to support asset management (TAMIS).  
**Institutional/Governance:** Policies and Procedures and/or governance have been implemented pertaining to a particular data system or group of data systems used to support asset management (TAMIS). |
| **Proficient**             | 4                     | **People:** Aware of need for improvement in a particular data system to support asset management (TAMIS). Improvements are underway for the data system and technical tools and business processes for improvement have been implemented where practical.  
**Technology/Tools:** Widespread implementation of technology and tools is occurring to facilitate use of a particular data system to support asset management (TAMIS), but there is no integration of the system with other systems.  
**Institutional/Governance:** Assessment of data systems to support asset management has been completed and identification of how a data system supports the TAMIS framework has been defined. |
| **Best Practice**          | 5                     | **People:** Aware of need for improvement in a particular data system to support asset management (TAMIS). Technology and institutional processes are in place to support management of a particular data system used for TAMIS.  
**Technology/Tools:** Widespread implementation of technology and tools is occurring to facilitate use of a particular data system to support asset management (TAMIS), which also includes automated integration with other systems.  
**Institutional/Governance:** Policies and Procedures or governance is fully implemented regarding a particular data system used to support asset management (TAMIS). |

Table 2.5 documents the assessed maturity level for each of the 26 TAMIS data systems, based on the maturity scale defined in Table 2.3. The determination of the maturity level was primarily based upon information obtained through
extensive interviews with data business owners and users of the TAMIS data systems and additional research conducted by the CS Team (using additional documentation provided by ADOT&PF). Although this process is somewhat subjective, there are justifications provided in the maturity level column to indicate why a particular maturity level was assigned to a data system. This table is organized by asset type: highways, aviation, marine highway, measurement standards/commercial vehicle enforcement (MS/CVE), state equipment fleet, and administrative services.
### Table 2.5 TAMIS Systems Maturity Levels

<table>
<thead>
<tr>
<th>Data System</th>
<th>Tier</th>
<th>Purpose</th>
<th>Maturity Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGHWAYS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PONTIS (BrM 5.2 – 2014)</td>
<td>1</td>
<td>Inventory of bridge identification, location, characteristics, and condition ratings for state and federal reporting.</td>
<td>2 – Awakening – aware that business rules are needed for access to pavement and GIS data, additional technology and tools being implemented with new system which will support asset management (including use of Smart Flags to identify data not currently stored in PONTIS)</td>
</tr>
<tr>
<td>ADA Inventory</td>
<td>1</td>
<td>ADA Inventory is being conducted as part of a transition plan for ADOT&amp;PF pedestrian facilities within its ROW.</td>
<td>1 – Initial – user group limited to Office of Civil Rights, no tools currently in place to manage the ADA inventory for supporting asset management</td>
</tr>
<tr>
<td>Material Sites Inventory</td>
<td>2</td>
<td>Includes site inventory and inspection data for all material sites (e.g., quarries, borrowsl, pits, etc.), as well as associated documentation.</td>
<td>2 – Awakening – data just beginning to be collected to eventually support asset management</td>
</tr>
<tr>
<td>Unstable Slope Inventory</td>
<td>2</td>
<td>Inventory of the Top 200 unstable rock and soil slopes around the state.</td>
<td>2 – Awakening – aware that this data is needed to support project prioritization as part of the Asset Management process</td>
</tr>
<tr>
<td>Retaining Walls Inventory</td>
<td>2</td>
<td>A data dictionary and retaining walls inventory is in development.</td>
<td>1 - Initial – ADOT&amp;PF as a whole is not aware of the importance of this data for asset management purposes, no database exists at this time</td>
</tr>
<tr>
<td>Maintenance Management System (MMS)</td>
<td>1</td>
<td>Provides tools to manage the planning, scheduling, reporting, and analyzing of maintenance actions. Provides information for managing special programs, administrative and financial tasks, contracts, and project work.</td>
<td>2 – Awakening – aware of need for improvement in MMS system to support asset management and for improvement in data quality and use of MMS system across the Department.</td>
</tr>
<tr>
<td>MMS Inventories: Sign, Culvert, Guardrail, Quality Assurance Program Inventory</td>
<td>1</td>
<td>Sign inventory – available as tables in MMS, but not user friendly. Culvert and Guardrail inventories – no data collection yet for these inventories. Quality Assurance Program - part of MMS.</td>
<td>1 – Initial – aware of need for improvement in MMS Inventories, but, no tools in place to manage the inventories and no ownership or governance implemented to oversee the inventories</td>
</tr>
<tr>
<td>Pavement Management System</td>
<td>1</td>
<td>System used to document pavement conditions and to minimize cost of pavement maintenance and rehabilitation projects while maintaining a specified level of performance. Data extracts are used to provide data for use with HPMS and by Design engineers, Materials engineers, Planners, and M&amp;O staff.</td>
<td>2 – Awakening – aware of need for integration of asset data from other systems (e.g., MMS, Bridge) and pursuing tools to address pavement data needs, which will in turn be beneficial for asset management</td>
</tr>
<tr>
<td>Roadway Data System (RDS) – Enterprise Linear Referencing System (LRS)</td>
<td>1*</td>
<td>RDS is used to support HPMS and other business needs in the Department related to use of location and roadway feature data. RDS will be used to support the road inventory data component of SIRIS.</td>
<td>3-Structured – Department is aware of the core role that the RDS will play in integrating agency databases using geographic location as a common link. Specific tools and processes have been developed to facilitate the integration of agency asset databases to the RDS centerline network, including migration to ESRI Roads and Highways (R&amp;H), development of the Roadway Information Portal, and expansion of the roadway centerline network to include all public roads. Workflow processes for collecting, geocoding and updating of asset location data are being developed as part of the migration to R&amp;H.</td>
</tr>
<tr>
<td>Traffic Server</td>
<td>2</td>
<td>Traffic Server will be the primary source of traffic data after the transition from HAS is complete.</td>
<td>2 – Awakening – Department is aware of need for new traffic data system to support traffic data needs at ADOT&amp;PF. New system being implemented to address this need and governance policies needed regarding use of traffic data across offices within the Department.</td>
</tr>
</tbody>
</table>
### ADOT&PF Transportation Asset Management Information Systems (TAMIS) and Data Research Project

<table>
<thead>
<tr>
<th>Data System</th>
<th>Tier</th>
<th>Purpose</th>
<th>Maturity Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weigh in Motion (WIM) Data Port</td>
<td>2</td>
<td>WIM site sensors measure truck weight and axle configurations of trucks at highway speeds. WIM sites provide pavement life data in support of Alaska’s PMS and FHWA’s LTPP Program.</td>
<td>4 – Proficient – WIM Data Port is established to provide data from WIM sites to pavement engineers and others needing the data. Governance policies regarding reporting of WIM data are identified by FHWA through the HPMS Field Manual and the Traffic Monitoring Guide and the Concept of Operations for a Data Business Plan for the Program Development Division. ADOT&amp;PF may need to add new WIM sites to ensure adequate coverage, but overall WIM sites provide what is needed regarding weight data.</td>
</tr>
<tr>
<td>Crash Data Entry System &amp; Crash Reporting and Analysis System for Safer Highways (CRASH)</td>
<td>3</td>
<td>Crash Data Entry System – accepts electronic and manual crash reports and stores data into Oracle database (DB). The crash data processors use it to geolocate a crash in RDS and to validate the data and save it to the Oracle DB. Crash data is automatically saved to HAS. CRASH – Used by traffic and safety engineers to analyze crashes, produce crash rates, sliding spots, etc. and produce reports. Traffic AADTs will be integrated from the new Traffic Server application.</td>
<td>3 – Structured – Department is aware of need to improve access to/integration of crash data for safety analysis and to support asset management. Steps underway to implement GIS technology tools to support identification of crash locations. Governance policies/framework recommended by Program Development Division for collection/use of crash data as part of a formal Concept of Operations for a Data Business Plan.</td>
</tr>
<tr>
<td>Grant Management &amp; Program Administration System (GMPAS) (BlackCat Grant Management)</td>
<td>2</td>
<td>GMPAS (BlackCat Grant Management) is used to manage grants from the FTA and other funding sources in support of transit operations in Alaska. Governor’s Community and Public Transportation Advisory Board also use data for decision-making. System is new and is being implemented in phases. Three main components of GMPAS (BlackCat Grant Management): (1) application and review process, (2) allocations and grant agreements, (3) [transit] vehicle inventory.</td>
<td>3 – Structured – Department is aware of need for new system for grant management and program administration and is in the process of implementing a new system (technology, tools) in phases.</td>
</tr>
<tr>
<td>Transit and Rail</td>
<td>2</td>
<td>Database for tracking transit assets and supporting transit asset management decisions as required by FTA Section 5339.</td>
<td>4 – Proficient – new system in place to manage transit and rail data, in accordance with federal government requirements per FTA Section 5339. No integration with other data systems. Assessment of how this system could support TAMIS has been completed (see TAMIS Task 5 report).</td>
</tr>
<tr>
<td>Road Weather Information System (RWIS)</td>
<td>2</td>
<td>System of atmospheric sensors, pavement sensors, and temperature data probes, and cameras to provide information on road and driving conditions to support winter weather maintenance activities and weight restriction decisions.</td>
<td>4 - Proficient – system used internally and externally by many stakeholders, assessment completed for how RWIS can support TAMIS (see TAMIS Task 5 report). Department is aware of improvements needed in sensors and equipment to support this system and is planning to make improvements where practical. Governance practices regarding RWIS formally defined in the Concept of Operations for a Data Business Plan for the Program Development Division (Data Owner for RWIS).</td>
</tr>
</tbody>
</table>

### AVIATION

<table>
<thead>
<tr>
<th>Data System</th>
<th>Tier</th>
<th>Purpose</th>
<th>Maturity Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alaska Aviation System Plan (AASP)</td>
<td>2</td>
<td>Used to track the aviation facilities inventory data and inspection data for several Alaska airports. Data is used to publish the Alaska Aviation System Plan.</td>
<td>1- Initial – No primary source of data for AASP, no match on data with Facilities Inventory System, no tools in place to manage AASP for purposes of asset management</td>
</tr>
<tr>
<td>Airport and Highway PMS systems</td>
<td>2</td>
<td>Used to track the aviation facilities inventory data and inspection data for several Alaska airports. Data is used to publish the Alaska Aviation System Plan. Data dictionary includes data on ADOT&amp;PF owned airports including paved/unpaved areas at the airport.</td>
<td>3 – Structured – Tools, such as a data dictionary have been developed to help manage the pavement data at airport facilities. Data is used to meet Department’s aviation planning needs.</td>
</tr>
<tr>
<td>Data System</td>
<td>Tier</td>
<td>Purpose</td>
<td>Maturity Level</td>
</tr>
<tr>
<td>-------------</td>
<td>------</td>
<td>---------</td>
<td>----------------</td>
</tr>
<tr>
<td>MARINE HIGHWAY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADA Inventory (for Marine Highways)</td>
<td>3 – Structured</td>
<td>Inventory exists and it is applied to the tracking tool used for new builds. Established regulations (governance) are followed for management/use of ADA inventory.</td>
<td></td>
</tr>
<tr>
<td>Fleet Condition Survey</td>
<td>3 – Structured</td>
<td>System has database, a manager and is supported by established policy. Report is generated for use in prioritizing Capital Improvement Projects (CIP). System is used to build work packages for annual maintenance CIPs, federally funded replacement, and refurbishment CIPs.</td>
<td></td>
</tr>
<tr>
<td>Shore Condition Survey</td>
<td>2 – Awakening</td>
<td>Aware of need to advance the final reporting system to a more efficient and readily available system and to incorporate day-to-day maintenance reporting.</td>
<td></td>
</tr>
<tr>
<td>MEASUREMENT STANDARDS / COMMERCIAL VEHICLE ENFORCEMENT (MS/CVE)</td>
<td></td>
<td>3 – Structured – automated tools in place to manage internal and external components of Local Permits system, governance rules indicate that motor carriers are “supposed” to coordinate with internal Department offices (e.g., M&amp;O) on selecting travel routes. However, it is not always possible to confirm that the carriers have followed the rules, prior to starting their travel.</td>
<td></td>
</tr>
<tr>
<td>Local Permits (LP)</td>
<td>2 – Awakening</td>
<td>Aware of how data from EMS could be shared across Department for asset management purposes; aware that better automated tools are needed for transmission of data across state; aware that governance (business rules) are needed to maximize the use of EMS data in other offices across the Department.</td>
<td></td>
</tr>
<tr>
<td>STATE EQUIPMENT FLEET</td>
<td></td>
<td>2 – Awakening</td>
<td>Aware of how data from EMS could be shared across Department for asset management purposes; aware that better automated tools are needed for transmission of data across state; aware that governance (business rules) are needed to maximize the use of EMS data in other offices across the Department.</td>
</tr>
<tr>
<td>Equipment Management System (EMS)</td>
<td>2 – Awakening</td>
<td>Aware of how data from EMS could be shared across Department for asset management purposes; aware that better automated tools are needed for transmission of data across state; aware that governance (business rules) are needed to maximize the use of EMS data in other offices across the Department.</td>
<td></td>
</tr>
<tr>
<td>ADMINISTRATIVE SERVICES</td>
<td></td>
<td>3 - Structured</td>
<td>eDOCS is in widespread use across the Department and an assessment of how it can be used to support asset management has been completed (see TAMIS Task 5 report). Department is aware that improved business processes are needed to define stewardship, oversight and management of eDOCS, and training for staff on use of eDOCS.</td>
</tr>
<tr>
<td>eDOCS</td>
<td>4 – Proficient</td>
<td>FAAM functions well for its intended purpose, which is used to satisfy Federal-Aid requirements. Assessment has been completed regarding how FAAM is related to Asset Management (it will actually be a result of TAMIS activities, not a source data system.</td>
<td></td>
</tr>
<tr>
<td>Federal Aid Agreement Management (FAAM)</td>
<td>4 – Proficient</td>
<td>FAAM functions well for its intended purpose, which is used to satisfy Federal-Aid requirements. Assessment has been completed regarding how FAAM is related to Asset Management (it will actually be a result of TAMIS activities, not a source data system.</td>
<td></td>
</tr>
<tr>
<td>Data System</td>
<td>Tier</td>
<td>Purpose</td>
<td>Maturity Level</td>
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<td>-------------------------------------------------</td>
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<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Integrated Resource Information System (2015)</td>
<td>1</td>
<td>A financial procurement and HR management enterprise system that will contain all requisitions, purchase orders, and information about what is being purchased. Phase I (Financial) of IRIS will be implemented in July 2015. Phase II (HR) will be implemented January 2016.</td>
<td>2 – Awakening – Department becoming aware of how the IRIS system will integrate components of existing systems that are used for asset management, once IRIS is implemented.</td>
</tr>
<tr>
<td>Management Reporting System (MRS)</td>
<td>1</td>
<td>Used to track all capital projects. Data includes project names, locations, contractor names, STIP, obligation estimates, obligation transactions, costs of contracts, and project status.</td>
<td>2 – Awakening – aware that there are improvements needed in the MRS system (e.g., missing data for lat/long) that could benefit the Department by providing use of the data for asset management purposes, aware that governance rules may need to be changed regarding the entry/use of data into the system, based on any changing federal requirements.</td>
</tr>
<tr>
<td>Performance Electronic Tracking System (PETS)</td>
<td>1</td>
<td>PETS is used to track key performance indicators across ADOT&amp;PF.</td>
<td>3 – Structured – governance policies in place to designate PETS as the official performance measurement tool of the Department. Automated tools (such as cubes) are being developed to facilitate management of performance measures data.</td>
</tr>
</tbody>
</table>

1 Tier 1: A critical, core system that supports enterprise asset management decisions  
Tier 1*: A critical core system that supports enterprise asset management although the system itself is NOT an asset management system (e.g., RDS, GIS)  
Tier 2: A system that supports business area asset management decisions and interacts with other data systems  
Tier 3: A system that supports business area, not directly related to asset management
Figure 2.1 illustrates the comparison of how many TAMIS systems are at each of the five maturity levels. There are:

- 4 systems at Initial (level 1)
- 10 systems at Awakening (level 2)
- 9 systems at Structured (level 3)
- 3 systems at Proficient (level 4)
- 0 systems at Best Practice (level 5)

The majority of TAMIS systems appear to be at either the “awakening” or “structured” stage with respect to asset management maturity levels. This is not surprising, given the emphasis and importance that ADOT&PF has placed on asset management. There is an oversight committee (TAM Steering Committee) for asset management and individuals who are responsible for coordinating asset management functions at the Department. Additionally, the TAMIS Research Project was undertaken to evaluate the best approaches for ensuring that the existing and planned data systems at ADOT&PF will allow the Department to meet its asset management obligations under MAP-21.
The AASHTO AM Guide recommends that once the Maturity Level evaluation is completed, the next step in the asset management process is to evaluate gaps in where the organization is with respect to asset management and where they desire to be regarding the ability to meet asset management needs in the future. The next section discusses the gap analysis process used for TAMIS.
3.0 Gap Analysis (Existing versus Desired State)

This section presents the results of the Gap Analysis of TAMIS data systems. It identifies specific issues that need to be addressed to advance ADOT&PF from the existing TAMIS Framework (Figure 3.1) to the desired scope for TAMIS. The desired scope is one that utilizes many key data systems to support asset management. The scope includes use of analytical tools, especially for trade-off analysis in pavement, bridge, and fleet management. The desired scope has a significant component that addresses Capital Project Management and Capital Programming/Budgeting as well as Maintenance Management and Maintenance Programming/Budgeting. Many underlying data systems are needed to support day-to-day asset management functions and to make the best decisions regarding financial and resource management at the Department.

Figure 3.1 TAMIS Framework

Figure 3.2 shows the desired scope for TAMIS.
Figure 3.2  Desired Scope for ADOT&PF's TAMIS

- **Financial and Resource Management**
  - Equipment: EMS, MMRS, Transit & Rail
  - Materials: EMS, MMRS, Material Sites inventory
  - HR: IRIS, MMRS
  - Labor/Time: IRIS, MMRS
  - Budgeting: EMS, IRIS, MMRS, MRS, STIP
  - Purchasing: EMS, IRIS, MMRS
  - Receivables: EMS, IRIS
  - Payables: EMS, IRIS
  - Federal Billing: IRIS, FAAM, CMPAS, EMS

- **Capital Project Management (Schedules, Payments)**
  - MMS, MRS

- **Capital Programming/Budgeting**
  - FAAM, MRS, IRIS, CMPAS, EMS, STIP
  - MMS, STIP

- **Maintenance Management**
  - MMS, RWIS (Winter Maintenance)

- **Analytical Tools**
  - Treatment Rules, Cost Models, Determination Models, Economic Analysis, Optimization, Simulation, Tradeoffs
  - Pavement Analysis: PMS, WIM, Traffic Server, Crash, EMS, MMRS
  - Bridge Analysis: PONTIS/BMS, WIM, Traffic Server, Crash, Local Permits
  - Maintenance Analysis: MMS, EMS
  - Fleet Management Analysis (Highways & AMHS/EMS): EMS, Fleet Condition Survey

- **Asset Data Management**
  - Inventory
    - Pavement – PMS
    - Bridges – PONTIS/BMS 5.1
    - Signs, Culverts, Guardrails – MMS, MMRS inventories
    - Retaining Walls – Retaining Walls inventory
    - Material Sites – Material Sites inventory
    - Pedestrian Facilities – ADA Inventory
    - ITS Assets, Traffic and Cameras – RWIS, WIM
    - Airport Pavement – Airport & Hwy PMS
    - Transit Vehicle Inventory – CMPAS
    - State Equipment Fleet – EMS
    - Maint. Facilities – MMS
  - Inspections
    - Pavement – PMS
    - Bridge – PONTIS/BMS 5.1
    - AMHS – Fleet Condition Survey
    - AMHS – Share Condition Survey
    - Aviation Facilities – AASP
    - Airport Pavement – Airport & Hwy PMS
  - Condition
    - Pavement – PMS
    - Bridge – PONTIS/BMS 5.1
    - AMHS – Fleet Condition Survey
    - AMHS – Share Condition Survey
    - State Equipment Fleet – EMS
    - Transit Vehicles – Transit & Rail
    - Unstable Slopes – Unstable Slopes inventory
  - Work History
    - MMS, MRS
    - EMS

- **Network Description & Location Reference Management**
  - RDS (Future SIRIS)

- **Geospatial Data Management**
  - Enterprise GIS
Task 8 of this effort explored TAMIS recommended data models. Figure 3.3 shows the recommended option for system integration.

**Figure 3.3 Recommended Approach for ADOT&PF**

Option 1

*Fully integrated self-contained system*

Option 2

*Blend of options: some feeds, some integrated*  
*Asset management planning and analytical tools*

Option 3

*Separate systems with interfaces*

Option 2 is shown in Figure 3.4. The centralized integration system(s) extracts data from the other systems and combines it in a way that supports asset management decisions. In this option, agencies must develop data integration approaches to combine data from multiple systems. Examples include creating data crosswalks, developing processes for data conversion, clarifying key data integration points, and developing processes for combining data.

**Figure 3.4 Asset Management Planning Tool with Data Feeds**

This approach will enable ADOT&PF to take advantage of existing systems that are working well, use a best in breed approach when replacing and adding new systems, implement high priority cross-system functionality immediately, expand functionality of the TAMIS incrementally, and minimize initial costs.

The exact location on the spectrum will depend upon two future decisions.

1. What is the best approach to enhancing specific asset management systems? For example, as ADOT&PF explores options for new pavement, maintenance, and fleet systems, it will decide if it is best to have a single platform for all three systems, or multiple platforms. If ADOT&PF opts for a single platform, it will move to the left of the spectrum. In this scenario, the final architecture might look similar to that depicted in Figure 3.4, except that the maintenance and pavement boxes would be consolidated into a single box.

2. Does it make sense to integrate some of the source systems directly, outside of a new asset management integration tool? Potential connection points between ADOT&PF’s existing systems are discussed in the Task 5 report for this research effort. If ADOT&PF opts to connect some source systems directly, it would be moving to the right side of the spectrum. In this scenario, the final architecture might look similar to Figure 3.4, except that some of the source systems would be linked directly together.

We recommend that the decisions to these questions be made on a case-by-case basis for each individual system, and considered collectively over the course of this research effort. Also, it is important to note that the two decisions to these questions are not mutually exclusive. ADOT&PF could decide to integrate some management system functionality into a single system AND connect other systems directly.

3.1 GAP ANALYSIS PROCESS

The following paragraphs outline the recommended steps from the AASHTO AM Guide that were used to perform a gap analysis for asset management. These steps have once again been customized for use with TAMIS, as noted in the explanation of each step.

1) The process starts with determining the desired or target level of TAM performance and the period over which it is to be reached. In the case of ADOT&PF this means determining which asset management systems have performance measures and evaluating if those PMs and targets are being met. The determination of whether a system supported TAM performance measures was identified in Table 3.1 of the TAMIS Task 5 Report TAMIS Data Systems Evaluation. This information was used to complete Step 1.

2) Items are noted that need improvement. The data system improvements that are needed to support enterprise asset management at ADOT&PF are described
in Table 3.1. The improvements are categorized from three perspectives: System, Technical, and Institutional.

3) Assess the gaps between the current and desired performance at summary and detail levels. This step assesses gaps that must be addressed to move from the “current” state to the “desired” state of performance for ADOT&PF TAMIS systems. For instance, in the Institutional category, there is a need to establish business rules for several application systems regarding the exchange and sharing of data and information between business offices. While there may exist a vertical exchange of information between data business owners and managers and executive decision makers above them, there does not appear to be a lot of horizontal exchange of information between business offices (at least through automated means) to achieve a desired performance level in asset management.

4) Identify priorities. This step prioritizes the list of needs regarding TAM performance objectives. The AASHTO AM Guide explains, “a good way of doing this is to consider the risk associated with the gaps and the gaps’ relevance to achievement of stated agency performance objectives.” As this pertains to TAMIS, any gaps identified for Tier 1 level applications that are needed to meet agency performance objectives pose a higher risk to the agency than would gaps identified for Tier 3 applications. Risks could include the following:

- Limited or no resources to continue maintenance of the system;
- Data inaccessible for extended periods of time;
- Lack of technology or tools needed to maintain and improve the system;
- Lack of coordination across offices to exchange information between systems; and
- Cost to maintain the system is unsustainable.

5) Short-list actions. This step identifies smaller prioritized groups of actions that can be taken to address the gaps. In the case of TAMIS, the short-list of actions focuses first on the gaps related to Tier 1 applications. The AASHTO AM Guide emphasizes, “By dealing with the gaps in smaller prioritized groups, the process can be made more manageable, and chances of success are improved”.

6) Develop Improvement Plan. The Improvement Plan is developed to address the worst or most critical needs first (as prioritized in Step 4). The Improvement Plan includes recommendations for how to address the high-priority needs identified in Table 3.1, and for moving forward with implementing the Improvement Plan. In the case of TAMIS, ADOT&PF will need to rely upon the support of the TAM Steering Committee and the business line managers to support the Improvement Plan in their specific business areas.

7) Implement Improvement Plan. This task is the responsibility of ADOT&PF managers and their staff. An important part of this implementation involves at least an annual evaluation of how the improvements are progressing to support asset management at the Department.
3.2 GAP ANALYSIS RESULTS

The Gap Analysis for TAMIS indicates that there are opportunities for improvement in data systems and business processes to meet existing and future asset management needs. Table 3.1 presents the summary of the comments and issues raised by the program managers that fed the Gap Analysis.
### Table 3.1  TAMIS Gap Analysis

<table>
<thead>
<tr>
<th>Data System</th>
<th>Tier</th>
<th>Data Owner</th>
<th>System</th>
<th>Technical</th>
<th>Institutional</th>
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<tr>
<td>HIGHWAYS</td>
<td></td>
<td></td>
<td>1. New Bridge Management system implementation – is scheduled for October 2014 – may require an adjustment period for use of new system and development of deterioration and performance models based on new system.</td>
<td>1. Manual link only with MSCVE permitting office - Automated link needed with MSCVE permitting office. 2. Need geospatial capability to link sounding data to GIS format data for users to view sounding information. 3. Need automated methods to compare data with data in other databases - Bridge section had to do a manual comparison of new functional classification values because of the FC reclassification project from the Program Development group. 4. Data integration – Need automated processes to integrate data with other systems; currently, manual processes are used to integrate bridge data with HAS and to integrate bridge location data with RDS.</td>
<td>1. Business rule needed - need bridge data accessible to pavement section and M&amp;O for cross-asset analysis and project prioritization.</td>
</tr>
<tr>
<td>PONTIS (BrM 5.2 – 2014)</td>
<td>1</td>
<td>Bridge Section</td>
<td>2. Collection – Smart Flags have to be added to the BMS system to address items such as wing walls, approach slabs, and other items not stored in current system. 3. Collection – currently, there is no ability to code deficiencies based on sub-structure conditions. 4. Data storage - duplication of data may be kept in MMS (for signs), bridge rail data in traffic/safety systems, and there are multiple repositories for culvert data. 5. Documentation - Data definitions – term ‘critical deficiency’ is not well defined and this issue needs immediate attention.</td>
<td>No gaps identified.</td>
<td>1. Limited user group - Currently the only users of the system is the Office of Civil Rights – eventually it will be available to users in Planning, PD&amp;E, and Construction. AMHS is a user of the ADA Inventory provided by Civil Rights in order to prioritize ADA upgrades on the aging fleet and is available at the planning level through the AMHS Fleet Condition Survey.</td>
</tr>
<tr>
<td>ADA Inventory</td>
<td>1</td>
<td>ADOT&amp;PF Office of Civil Rights</td>
<td>1. Documentation - Lack of system documentation.</td>
<td>No gaps identified.</td>
<td>1. Limited user group – Currently the only users of the system is the Office of Civil Rights – eventually it will be available to users in Planning, PD&amp;E, and Construction. AMHS is a user of the ADA Inventory provided by Civil Rights in order to prioritize ADA upgrades on the aging fleet and is available at the planning level through the AMHS Fleet Condition Survey.</td>
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<tr>
<td>Material Sites Inventory</td>
<td>2</td>
<td>Statewide Materials</td>
<td>1. Collection – There are some sections of roadways (e.g. Dalton Highway) where there are no material sites identified for 20 miles. 2. Storage - Data beginning to be populated in geodatabase, currently stored as PDFs of reports, summary spreadsheets, and quantity charts.</td>
<td>No gaps identified.</td>
<td>1. Business rule needed to manage distributed data maintenance responsibility - Snapshot of each materials site was created at Headquarters and it is up to each Region to maintain the data. They are the owners of the files. Training will be conducted to raise awareness of this need/responsibility.</td>
</tr>
<tr>
<td>Unstable Slope Inventory</td>
<td>2</td>
<td>Statewide Materials</td>
<td>1. Collection – it is estimated that there may be 1,500 to 2,000 slopes remaining to be</td>
<td>No gaps identified.</td>
<td>1. Limited user group – Southeast Region developing a way for M&amp;O staff to run incident</td>
</tr>
<tr>
<td>Data System</td>
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</table>
| Retaining Walls Inventory         | 2    | Statewide Materials | 1. Collection – just beginning retaining walls inventory collection and development of data dictionary.  
2. Storage – no database developed at this time. | No gaps identified.                                                      | 1. Largest institutional challenge regarding geotech assets is getting the recognition of the importance of this information for asset mgmt. since “all structures are supported by soil or rock”.  
2. Business rule needed to address distributed maintenance responsibility - Once the initial retaining walls inventory is completed, the plan is for the Regions to be responsible for maintaining the inventory. |
| Maintenance Management System (MMS) | 1    | M&O            | 1. Quality – data quality could be improved re: accuracy, completeness, timeliness, validity, coverage, and accessibility.  
2. Quality – some of the batch reports that were part of the original MMS system are flawed regarding the quality assurance aspect and need to be revised.  
3. Quality – Data cannot be used for budgeting purposes because data being entered is not that accurate.  
4. Access to data – MMS not used at the Northern Region Maintenance Manager level as much because of inability to get to the data. They go to the representative (foreman) who provides the data to them. | 1. Manual links only to several other systems (e.g., PONTIS, PMS, etc.) and budgetary information is obtained from Admin Services who get the information from AKSAS and ALDER.  
2. Need MMS that would tie into Pavement, Bridge, Equipment Management, STIP, project control report, and GIS, and would allow users to run reports to determine highest priority maintenance work. | 1. Need to be able to provide information to decision makers – e.g., governor’s office and other offices on what funds were spent and what was accomplished.  
2. ADOT&PF resources needed to maintain the system – the original system developed by consultant is no longer supported by them and now requires 4 analyst programmers to provide the technical support. |
| MMS Inventories: Sign, Culvert, Guardrail, Quality Assurance Program Inventory | 1    | M&O            | 1. Collection – no data collection for culvert and guardrail inventories at this time.  
2. Storage – sign inventory available as tables in MMS but not user friendly, data is extracted using COTS software that is separate from MMS.  
3. Quality – data quality could be improved re: completeness, timeliness, coverage, accessibility.  
4. Reports - No user-generated reports available on the contents of the inventories; | No gaps identified.                                                      | 1. Ownership - No decision has been made on whom/which office will maintain the inventories, once they are collected. |
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<th>Data System</th>
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<tr>
<td>Pavement Management System</td>
<td>1</td>
<td>Pavement Management Section</td>
<td>1. Storage – no ADOT&amp;PF storage of raw data – data is stored in PERS system by contractor and provided as Access and Excel files annually to ADOT&amp;PF.</td>
<td>1. No automated interfaces to other systems – extracts of data provided to HPMS staff and for use by design engineers, materials engineers, planners, and M&amp;O staff. In addition, there are no automated interfaces to other systems (e.g. CRASH, and Traffic Server) or other data like number of lanes and pavement width – a link is needed to the highway data and safety databases.</td>
<td>1. Business rule needed regarding use of traffic data - Traffic section has not released current traffic data – so, it is not accessible by the pavement section.</td>
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</table>

2. Data Access - ADOT&PF staff do not have access to change or modify the data in the off-site database.

3. Quality control – no formal process in place for quality control measures, however, ASTM and AASHTO are followed and a calibration site is used to calibrate the data collection equipment – historically, there are no issues with quality control of the data.

2. Data integration – the pavement management section would like to be able to compare the rutting data, etc. collected for roads with curb and gutter data, edge of pavement data, and other assets.

3. A link to MMS system would be a large improvement to track maintenance expenditures with pavement rutting and cracking related needs.

4. Data integration – there is no accurate CDS in the pavement databases to be able to synch it with the RDS system. Also, separate maps are maintained by the pavement section, as they work to synch their pavement sections with the linear network and georeferenced data.

5. Functionality - they need a system that does the modeling needed to support MMS, safety, traffic, and highway data and that can produce project lists for the STIP, or preservation lists for roadways with certain conditions. They need a system to do project modeling and system modeling to project into the future and to provide funding calculations (e.g., rutting level for the state roadway system, based on funding levels for 5-7-10 years into the future). |

Roadway Data System (RDS) – Enterprise Linear Referencing System (LRS) | 1* | Program Development Division – Transportation Information Group (TIG) | 1. Collection – according to the interview with the pavement management section, the RDS does not contain all local roads, but, does have some of them. | 1. Governance rules needed - The interviews for this application identified that the governance rules are needed to improve collaboration across business line boundaries. | 2. Business rule needed where the functional class or RDS attributes will be maintained in a geodatabase or statewide system like SIRIS. |

2. People/hardware infrastructure needed - The interview for this application identified the need for a database, web servers, database administration, web servers/ArcGIS server administration, and people/hardware infrastructure.

3. Interfaces – there are no explicit automated

3. GIS Data Governance Plan – A GIS Data Governance Plan is needed to initiate a formal process for adding new features or changes
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<tr>
<td>Traffic Server</td>
<td>2</td>
<td>Program Development Division – Transportation Information Group</td>
<td>1. <strong>Storage</strong> – ADOT&amp;PF has extracted all traffic data since 1967 and are in the process of loading it to Traffic Server. They will break the tie to the HAS Mainframe this summer (2014). Data storage occurs in two places; server located at new ETS (downtown Juneau), and as backup on Transmetric America server.</td>
<td>interfaces between RDS and other systems. Data extracts are provided to other applications as needed.</td>
<td>(like code changes) to the GIS databases. They have a final draft of the TIG Data Governance Plan which addresses SIRIS components: RDS, Traffic &amp; Crash. The governance plan will prevent duplication of data, identify data stewards/custodians, improve quality of data, and create a data management team to oversee critical data sets within RDS.</td>
</tr>
<tr>
<td>Weigh in Motion (WIM) Data Port</td>
<td>2</td>
<td>Program Development Division – Transportation Information Group</td>
<td>1. <strong>Quality</strong> – data quality could be improved re: coverage 2. <strong>Access</strong> – The access to the WIM data needs improvement. Currently, it is made available to other business units via the Highway Dataport, which is in the process of being decommissioned and replaced with the Roadway Information Portal (RIP).</td>
<td>1. <strong>Data Integration</strong> – The Weigh In Motion data will need to be (and will be) integrated with Traffic Server for reporting and access to data.</td>
<td>1. <strong>GIS Data Governance Plan</strong> – as part of the interview for the Traffic Server system, the Transportation Information Group (TIG) mentioned that they have been discussing the need for a GIS Data Governance Plan to initiate a formal process for adding new features or changes (like code changes) to the GIS databases. They have a final draft of the TIG Data Governance Plan which addresses SIRIS components: RDS, Traffic &amp; Crash. The governance plan will prevent duplication of data, identify data stewards/custodians, improve quality of data, and create a data management team to oversee critical data sets within RDS. 2. <strong>Ownership, Stewardship identification needed</strong> - Lists of metadata and attributes for all GIS data have been identified, but it will take some time to identify the data stewards for all of the GIS data.</td>
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<td>Data System</td>
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<tr>
<td>Crash Data Entry System &amp; Crash Reporting and Analysis System for Safer Highways (CRASH)</td>
<td>3</td>
<td>Program Development Division – Transportation Information Group</td>
<td>Note: New CRASH system has not yet been procured. Will occur in Summer 2014. 1. <strong>Silo (stovepipe) data systems</strong> are still preventing the use of a common key to locate data. The biggest challenge is getting the enterprise (overall Department) to accept that a common referencing system is critical for data exchange. 2. <strong>Collection</strong> – ability to process crash forms electronically is still in progress (currently submitted in paper format). 3. <strong>Collection</strong> – There are some HSIP data elements missing on the crash form. A table will be used to keep additional variables that are needed regarding the crash. 4. <strong>Data analysis</strong> – the analysis component of CRASH has not been developed yet (as of Fall 2013).</td>
<td>1. <strong>Functionality</strong> – the new CRASH system will need to maintain the same functionality for access/use of crash data as that currently available from the HAS system. 2. <strong>Data integration</strong> – need to match up pavement condition data with crash data. 3. <strong>Data integration</strong> – need to identify high crash locations and join this data to other data systems. 4. <strong>Data integration</strong> – crash data will need to be (and will be) integrated with traffic data (AADT’s).</td>
<td>1. There needs to be a common set of metadata and data dictionary and the ability to know who the data experts are within the agency.</td>
</tr>
<tr>
<td>Grant Management &amp; Program Administration System (GMPAS) (BlackCat Grant Management)</td>
<td>2</td>
<td>Program Development Division – Transit Planning</td>
<td>NOTE: System is new and replaces an older system that only kept transit vehicle inventory data, but no grant management capability. The new system will have this capability and is being implemented in phases.</td>
<td>1. No automated links to other systems, but uses data extracts from AKSAS (will use IRIS in the future).</td>
<td>No gaps identified.</td>
</tr>
<tr>
<td>Transit and Rail</td>
<td>2</td>
<td>Program Development Division – Transit Planning</td>
<td><strong>Note: This is a newly implemented system</strong> and contains vehicle information (i.e. model, vin, number of wheelchair positions) and the condition of the vehicle, photo of vehicle, title information, Federal Interest,</td>
<td>No gaps identified.</td>
<td>No gaps identified.</td>
</tr>
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</table>

TIG Data Governance Plan which addresses SIRIS components: RDS, Traffic & Crash. The WIM system is also part of the TIG Data Governance Plan. The governance plan will prevent duplication of data, identify data stewards/custodians, improve quality of data, and create a data management team to oversee critical data sets within RDS.
**ADOT&PF Transportation Asset Management Information Systems (TAMIS) and Data Research Project**

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<tr>
<th>Data System</th>
<th>Tier</th>
<th>Data Owner</th>
<th>System</th>
<th>Technical</th>
<th>Institutional</th>
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<tbody>
<tr>
<td>Road Weather Information System (RWIS)</td>
<td>2</td>
<td>Program Development Division</td>
<td>1. Communication – Some low band width locations cannot access the web site road weather information. 2. Quality control – a dynamic real-time quality assurance and health of the network reporting system does not exist, which prevents timely fixes and risks providing inaccurate weather information for winter weather maintenance decisions.</td>
<td>1. Sensor Network – The sensor network for pavement temperature and temperature probe collection is significantly below full operational capability. 2. Power Modules – Some RWIS sites are not operational due to obsolescence of the power module generators and electronics, thus depriving winter weather maintenance operations and travelers key road weather information.</td>
<td>1. Business rule needed – As the RWIS site deployment is completed, ADOT&amp;PF needs new business rules for long term maintenance and sensors/equipment. 2. Training – Training and program guidance materials are needed for both the users of the RWIS system and RWIS system administrations.</td>
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</table>

**AVIATION**

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<tr>
<th>Data System</th>
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<th>Technical</th>
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<tbody>
<tr>
<td>Alaska Aviation System Plan (AASP)</td>
<td>2</td>
<td>Aviation Planners,</td>
<td>1. Silo systems – The Facilities Inventory System (FIS) – that is one of the systems that data is collected for to support the AASP - is linked to the eDOCS system so that information can be pulled from eDOCS to supplement the FIS. The facilities inventory was last updated in 2012. There is not a one-to-one match from the ADOT&amp;PF airport facilities inventory and the Facilities Inventory System. There are several different lists (of airports) that they work from. 2. Data access – The aviation planners want to be able to use data from the Aviation Grants History database (regarding capital funding on airports). 3. Quality – data quality could be improved re: completeness, timeliness, and coverage. There is an issue with the currency (timeliness) of the data. When it comes to actual facilities changes, capturing those changes is difficult. 4. Collection – there is no primary source of data for the AASP; the data comes from many sources as identified in a data dictionary. 5. Collection – The inspection data collected so far pertains to approximately 20 airports. They want to develop a comprehensive database that includes data airport needs for an additional 20-30 airport.</td>
<td>1. Link of aviation data to other systems – the aviation planners would like to associate aviation traffic forecasts at the aviation facilities to use in making capital funding decisions. They currently rely on carrier reports provided by FAA and on passengers/cargos moving through the facilities for that type of information. 2. Data Integration – technical issues with data integration are primarily due to the fact that this a consultant-housed database, which makes it challenging to maintain links with other ADOT&amp;PF systems (like eDOCS)</td>
<td>1. Lack of available resources – maintaining the data for a system like this is a challenge. They do not have a lot of people in the Regions to do a lot of aviation operations and planning type work. Trying to keep the AASP up to date is a challenge due to limited resources.</td>
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<td>Data System</td>
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<tr>
<td>Airport and Highway PMS systems</td>
<td>2</td>
<td>Pavement managers</td>
<td>No gaps identified specifically pertaining to pavement data at airports.</td>
<td>No gaps identified specifically pertaining to pavement data at airports.</td>
<td>No gaps identified specifically pertaining to pavement data at airports.</td>
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<tr>
<td>MARINE HIGHWAY</td>
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</table>
| Fleet Condition Survey           | 2    | AMHS           | 1. **Collection** – The collection of information (data) is currently all done on paper. They may eventually use electronic methods to capture data.  
   2. **Processing** – manual processes are used to determine if action items have been completed. This is a very time consuming process.  
   3. **Reporting** – the electronic information that was generated was not used, so they went back to using the printed format for reports.  
   4. **Documentation - No user manual exists** for use of the Fleet Condition Survey database. AMHS may decide to have one developed to assist the users of the database, but this will take some time. | 1. **There are no links** to other systems.  
2. **Data Integration - There is a need to get the Ship Maintenance Requests and ADA survey information electronically transferred into the FCS.** |                                                                               |
| Shore Condition Survey           | 2    | AMHS           | 1. **Collection** – data is not stored in a database, it comes from annual inspections, field notes, documents, photos, and video cameras.  
   2. **Reporting** – the Shore Condition Survey report primarily encompasses major repairs or replacements; it is generally not detailed enough for routine or minor repairs. | 1. **Functionality - Need to obtain good maintenance management software to support their operations.** – They need a system to do underwater inspections for critical fracture inspections and Shore Condition reports. There is also a need to produce information on buildings, including square footage.  
2. **Data Integration** – there is a need to integrate data received on the uplands shoreside infrastructure with the marine asset inventory and have an electronic format to support this reporting need. | No gaps identified.                                                                 |
<table>
<thead>
<tr>
<th>Data System</th>
<th>Tier</th>
<th>Data Owner</th>
<th>System</th>
<th>Technical</th>
<th>Institutional</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEASUREMENT STANDARDS / COMMERCIAL VEHICLE ENFORCEMENT (MS/CVE)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Local Permits (LP)</td>
<td>2</td>
<td>Local Permits Office - Anchorage</td>
<td>No gaps identified.</td>
<td>No gaps identified.</td>
<td>1. Business rules need to be established for the following activities that are “supposed” to happen: a) MSCVE is “supposed” to be notified by the Construction division of construction on certain routes, so that the construction information can be included on the permit. b) The carriers are also required to review their travel routes 8 hours ahead of time for any construction activities. This is also “supposed” to include M&amp;O activities for roadway maintenance. (Note: this particular activity cannot actually be covered by a TAMIS business rule, since it is an external activity conducted by persons (carriers) outside of ADOT&amp;PF.)</td>
</tr>
<tr>
<td>STATE EQUIPMENT FLEET</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment Management System (EMS)</td>
<td>1</td>
<td>M&amp;O - Statewide Equipment Fleet</td>
<td>1. <strong>Documentation is minimal</strong> – there is some data field documentation, but it can only be accessed from within the EMS application by placing the cursor on a data field and pressing the Help key. There is currently no method to print an actual data dictionary listing. 2. <strong>Access</strong> – need to automate processes associated with EMS so that use of the Federal Usage Rate (FUR) data by Design, Construction, AMHS, and others could be accessed using an automated method. 3. <strong>Quality</strong> – There are also meter-reading errors (e.g., errors or transposed numbers) that may occur 8-10 times/month when mechanics and foremen are entering meter readings for equipment sent to the shop(s) for repairs. 4. <strong>Duplicate data entry</strong> – there is redundancy in dual entry of data in both EMS and FM. 5. <strong>Documentation is lacking</strong> – re: formal</td>
<td>1. <strong>Data Integration</strong> – there is a need to have an automated upload of data into the Station Profile system about once/month so that it is always current. 2. <strong>Data Integration/Links to external system(s)</strong> – There may be issues with exchange of data with the IRIS system. The data format of Asset ID or location code could be different (e.g., 3 digit vs. 5 digit code) between EMS and IRIS. – Also, with IRIS, inbound and outbound interface coding is required to be in XML. Not all staff have experience with XML. 3. <strong>Data transmission rates can be slow</strong> to/from remote areas in western Alaska – for those persons/offices using the Starband satellite systems.</td>
<td>1. <strong>Business rules needed</strong> – equipment data from EMS could be used: a) in MMS by those responsible for maintaining roads b) to locate buildings in remote locations (e.g. remote airports) c) optimize the amount of equipment at a site (e.g. optimize how much equipment is there, based on the number of operators) 2. <strong>No training materials available</strong> – the System Administrator conducts the training on an ad-hoc basis “off the top of his head”.</td>
</tr>
</tbody>
</table>

Cambridge Systematics, Inc.
<table>
<thead>
<tr>
<th>Data System</th>
<th>Tier</th>
<th>Data Owner</th>
<th>System</th>
<th>Technical</th>
<th>Institutional</th>
</tr>
</thead>
<tbody>
<tr>
<td>eDOCs</td>
<td>3</td>
<td>Administrative Services Division</td>
<td>1. Documentation – need overview of eDocs, systematic tracking/reporting of ongoing projects, training manuals, etc. 2. Standards – need development of consistent enterprise standards.</td>
<td>1. Data Integration – need automated processes to integrate with other systems.</td>
<td>1. Business rules needed - as use of eDOCs expands, rules, processes and records retention methodology need to be evolved and standardized, including document stewardship, and custodian responsibilities and roles. 2. eDOCs implementation Manager – currently the system has a dedicated programmer analyst and an informal stakeholder group, but no single point of contact to manage the enterprise system and develop system governance. 3. Culture change needed – a culture is needed that supports proper document management. 4. Training is needed – to expand the group of users (document custodians and users of documents), and how to use the system and/or request customizations.</td>
</tr>
<tr>
<td>Federal Aid Agreement Management (FAAM)</td>
<td>3</td>
<td>HQ – Fed-Aid Team</td>
<td>1. Documentation – current user manual needs to be updated because FAAM has been updated during the last year. However, the development of a FAAM data dictionary is complete.</td>
<td>No gaps identified.</td>
<td>No gaps identified.</td>
</tr>
<tr>
<td>Integrated Resource Information System (2015)</td>
<td>1</td>
<td>Administrative Services Division</td>
<td>NOTE: This is a new system under development and it will integrate data and replace several ADOT&amp;PF systems as the system of record for many types of data. Refer to the Task 5 TAMIS report for additional information on the IRIS system in Appendix D (Interview Summaries) of that report.</td>
<td>1. Functionality – ADOT&amp;PF has found that there is going to be some baseline functionality in IRIS that will not meet ADOT&amp;PF’s needs, and they have been meeting intensively with ADOT&amp;PF stakeholders to identify what these issues might be and how to resolve them.</td>
<td>1. Business rules needed – it is anticipated that workflow will change in various offices with the implementation of IRIS, which will have about 800-1000 users. The changes in workflow are unknown at this time. 2. Business rule needed - Many data systems at ADOT&amp;PF will no longer be used after IRIS is implemented. Some systems will be kept for historical data purposes and business rules may be needed to direct the use of the systems kept for historical purposes.</td>
</tr>
<tr>
<td>Management Reporting System (MRS)</td>
<td>1</td>
<td>Regional Project Controls, HQ Project Controls and</td>
<td>1. Missing data – there are data fields in the MRS database to store latitude/longitude, but the fields are currently blank. The fields may never get filled in, but may instead, be in the Geodatabase and linked to MRS.</td>
<td>1. Functionality – Based on FHWA requirements, significant changes may be required on the “federal side” of MRS.</td>
<td>1. Business rule needed – to define the processes to be used with MRS when the AKSAS system is replaced with IRIS. This will have some impact on the MRS system and business processes (which currently involves</td>
</tr>
<tr>
<td>Data System</td>
<td>Tier</td>
<td>Data Owner</td>
<td>System</td>
<td>Technical</td>
<td>Institutional</td>
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</tbody>
</table>
| Performance Electronic Tracking System (PETS) | 1    | Administrative Services Division | Roads and Highways will likely fill this need/gap for ultimate tracking of project locations. | several offices/persons entering data into MRS.  
2. **Business rule needed** – there may be varying degrees of information regarding projects made available to the public. There is a concern about presenting consistent project-related information to the public. |

1. **Documentation is lacking** – there is no documentation on the PETS system itself, and the development documentation is probably not applicable anymore since the system has changed so much. However, there is a list of KPIs, a dashboard and documents on the website.  
2. **Data access and uses** – development of the pavement management system cube is in limbo until they see what happens with TAM.  
3. **Data access and uses** – the current metrics are worded in such a way that going to the original data source to get the information is nearly impossible. Measures need to be able to roll up into easily identifiable areas that other people can understand, with specific measures identified for submittal to the legislature, MAP-21, etc.  
3. **Reporting** - There is currently no comprehensive department-wide performance reporting system, but, one is needed.  

1. **Missing data links** – PETS is the part of the Cognos tool used for metrics and performance measures. However, Cognos cannot make the logic choices needed to match up roadway and financial data because the data links in the various systems are not present. This may impact the ability of what can be displayed through the PETS tool (as part of Cognos).  

1. **Business rule needed** – PETS is the official performance measurement tool of the department. In theory, all PMs should be managed through PETS, but they are not sure that this is really happening.  
2. **Business rule needed** – the only requirement regarding PETS is to meet the annual reporting deadline. They often have to track people down to get the updates that are needed for the annual reports.  
3. **Culture change needed** – on the part of the data entry staff to (1) understand how vital/important the data is and (2) the supervisor assigning them work to understand how important it is. A culture is needed that supports performance management.  
4. **Training is needed** – on how to write performance measures.
3.3 **ENTERPRISE LEVEL GAPS**

In addition to the gaps identified for specific data systems, there are several observed overall gaps that need to be addressed at an enterprise level. Each of these is described below.

**Adequate IT Infrastructure to support enterprise-wide database integration** - The Department needs to invest in IT hardware, IT software, IT standards and policies, and training for staff to support agency-wide database integration.

**Role of GIS in agency-wide data integration** - The role of GIS and spatial data needs to be clearly defined with respect to integration of databases throughout the Department.

**Windows and ArcGIS support** - Additional resources are needed to support the maintenance and administration of Windows and ArcGIS server platforms.

**Information Resource Manager Position** - Agency needs an Information Resource Manager who reports to the Executive Management level.

**Data Collection** - Data collection needs to be streamlined so that data is collected once, used many times.

**System Integration** - Integration between systems needs to be more efficient to provide access to multiple types of data across systems.

**Data linkage and data governance** - Data linkage (between systems) needs to be part of overall data governance strategy at ADOT&PF.

**Funded and planned projects** - Source of information (system(s) of record) for projects funded and planned needs to be defined.

**TAM and Performance Measures** - Need to define what performance measures are required for TAM and complete TAMP.

**Bridge and Maintenance projects** - Need ability to look at scheduled bridge projects and maintenance projects through a single access portal.

**Deferred Maintenance** - Need ability to report on deferred maintenance work.

The recommendations for how to address these gaps are explained in the following section.

3.4 **APPROACHES TO ADDRESS GAPS**

This section identifies specific actions that ADOT&PF can take to address the gaps identified in Table 3.1 and the enterprise level (EL) gaps identified in Section 3.3. Following these steps can help the Department to advance to the next maturity level with respect to the data systems used to support TAMIS. Many of these solutions have been used at other state DOTs to strengthen the management of their data systems used for decision-making purposes. These solutions can also be used to support asset management decisions identified in
Section 2 of this report. The recommended solutions are organized around the gap categories of System, Technical, and Institutional gaps.

**System**

*Gap [1]: Data Collection*

**Solution:** Procure and utilize automated data collection equipment (where feasible) to supplement current manual data collection methods or to capture data where needed for missing data items. (e.g., culvert, guardrail, sign, and retaining walls inventory). This could be addressed through ADOT&PF’s most recent service contract with Mandli for roadway data collection.

*Gap [2]: Storage Systems*

**Solution:** Consider utilizing other data storage systems (such as enterprise databases and data warehouses) accessible across the agency.

*Gap [3]: Data Quality*

**Solution:** Implement **data standards** as part of a Data Business Plan (DBP) and implement **common data definitions** for each TAMIS system as part of a Data Governance Framework to improve data quality across all TAMIS applications. The DBP needs to clearly define the data standards to be used for data collection, data processing and reporting at ADOT&PF. Incorporate any state or federal requirements in the list of documented standards, or identify where the data requirements can be found (HPMS Field Manual, Traffic Monitoring Guide, federal, state, or Department regulations, Policies and Procedures documents, etc.) Data dictionaries can be developed for each system, based on the DAMA Data Dictionary and Book of Knowledge. Use of these reference materials can provide benefit to ADOT&PF by standardizing vocabulary, terminology, and common understanding of data across the Department.

*Gap [4]: Documentation*

**Solution:** Provide documentation that includes, but not limited to, data dictionaries, user manuals, and data catalogs. The documentation may be for established national best practices, e.g., the Model of Inventory of Roadway Elements, or may be developed to address the ADOT&PF TAMIS data systems. Develop a Data Governance Manual that includes references to all materials (publications) needed to support data governance at ADOT&PF, including data dictionaries, user manuals, training manuals, etc., listed above. Develop an ADOT&PF Data Registry to capture and document information about other data systems in the Department that are not part of a TAMIS Data Catalog. Refer to Appendix B for descriptions of Data Governance Manuals, Data Dictionaries, Data Catalogs, Data Registries, etc.
Gap [5]: Reporting Needs

Solution: Utilize new technology and business intelligence tools to facilitate ad-hoc reporting in a timely, efficient manner to meet needs of users (e.g., need reports on unstable slope inventory, reports on bridge and maintenance projects in one report).

Gap [6]: Silo Systems

Solution: The recent FHWA Roadway Safety Data Partnership (RDSP) Assessment (January 2012) indicated that there are still a “significant amount of stove pipe databases (material sites, traffic data) and systems (pavement management system) that must have a common GIS road network and linear referencing system. These systems are very costly when trying to integrate/merge/link and produce multiple data collection efforts driving the same roads and sometimes, yes, even collecting the same data”. Identify and prioritize silo systems that should be replaced with new applications that integrate data and introduce new functionality (e.g., GIS) into one system, and which is accessible to users on an enterprise basis (e.g., pavement, bridge, maintenance management).

Gap [7]: System Access

Solution: Identify stakeholders needing access to asset management systems and authorize the access where needed. A Data Catalog can be developed to document the data systems, data business owners, data stewards, and stakeholders (users) for all TAMIS systems to ensure that those persons needing access to specific systems can be granted that access.

Technical

Gap [8]: System Interfaces

Solution: Develop automated interfaces to replace existing manual processes where they exist. Utilize technology currently available at ADOT&PF to improve the automation of manual processes and take advantage of the valuable resources in the IT office for the development/deployment of automated tools/solutions. Evaluate needs for procurement and deployment of additional servers, workstation platforms, and data transmission networks to support operations at Headquarters and in the Regions, especially in remote areas of the state (e.g., Alaska Aviation System Plan, Geotechnical Assets).

Gap [9]: Link to Geospatial Data

Solution: Develop a Department GIS Enterprise Plan that establishes the policies and standards for management of enterprise level GIS data. Utilize available Department geospatial data where feasible to implement a geographic link (e.g., lat/long, CDS location, etc.) from the source asset management database to the Department’s enterprise geodatabase.
Gap [10]: Technology tools (hardware/software)

**Solution:** Procure the necessary hardware, and develop (or outsource the development of) the necessary software to improve transmission and management of data needed for asset management at ADOT&PF.

Gap [11]: Functionality

Solution: Develop system requirements for adding new functionality to an existing system or developing an entirely new system to support asset management needs at ADOT&PF. System requirements are typically documented by interviewing business users to identify the latest needs for information in response to federal or state legislative mandates, and/or Department policies and procedures, etc. For instance, there are new federal reporting requirements for traffic and pavement data as a result of the HPMS 2010 Reassessment. New functionality is also needed in the MMS system to include a better user interface.

Engage primary stakeholders in the development of these system requirements to ensure that all need functionality is incorporated.

Gap [12]: Data Integration/Data links missing

Solution: Currently, COGNOS cannot match up financial and roadway data for decision-making purposes. Utilize the data integration points identified in TAMIS Task 5 and Task 6 reports to develop automated links for the integration of, or transfer of data between systems and for display in COGNOS, where applicable.

Institutional

Gap [13]: Business rules needed

**Solution:** Establish business rules for collection and use of data needed to support asset management. Business rules should be established in coordination with data business owners, and managers needing specific data systems to support their business needs. Business rules should be formalized in a Data Business Plan and made available department-wide through a document management system, such as eDOCs.

Gap [14]: Limited User Groups

**Solution:** Develop Communities of Interest (COIs) for application systems. The COIs include all stakeholders (users, data providers) that have a business interest in information from a particular data system. COIs can be comprised of internal and external ADOT&PF staff.
Gap [15]: Governance needed for data management of TAMIS systems

Solution: Establish a Data Governance Framework, enforced by Policies and Procedures and outlined in a Data Governance Manual or Data Business Plan, for use department-wide.

Gap [16]: Coordination across business lines

Solution: Establish business rules under a Data Business Plan for coordination and communication of data and information across business lines.

Gap [17]: Information to decision makers

Solution: Utilize existing COGNOS system to continue development of ‘cubes’ which can organize data in an efficient way to provide information to decision makers. This data includes, but is not limited to, data related to performance measures and targets.

Gap [18]: Define system ownership, stewardship roles/responsibilities

Solution: Establish a data governance structure that includes the documentation of ALL roles for data governance within the organization, including data business owners, data stewards, data custodians, and stakeholders (Community of Interest (COI) for each data system). Document the data governance structure and framework in a Data Governance Manual.

Gap [19]: Limited resources

Solution: Reallocate resources as available between business units to meet needs, or supplement existing staff with consultant services. Business areas needing additional resources include Geotechnical assets (Material Sites Inventory, Retaining Walls Inventory, Right of Way).

Gap [20]: Training needs

Solution: Implement training tools, via web meetings if not feasible for students to attend training on-site. Develop training manuals targeted for data collectors, data processors, and users of application systems (e.g., improved training recommended for MMS application so that users in the regions can find information when needed)

Enterprise Level (EL) Gaps

Gap [EL-1]: Adequate IT Infrastructure to support enterprise-wide database integration

Solution: Conduct a system-wide review of the IT infrastructure with respect to enterprise-wide database integration requirements
Gap [EL-2]: Role of GIS in agency-wide data integration

Solution: Develop an Enterprise GIS Plan to document the databases, business processes, and tools that shall be used to manage enterprise GIS data for the Department. The Program Development Division at Headquarters should take the lead in developing this Plan in coordination with the IT office and Region users of GIS data. The GIS CAD Integration and work team initiative already begun should be an element of the Enterprise GIS Plan.

Gap [EL-3]: Windows and ArcGIS support

Solution: ADOT&PF should consider funding positions that can support the maintenance and administration of Windows and ArcGIS server platforms.

Gap [EL-4]: Information Resource Manager Position

Solution: ADOT&PF should consider hiring an Information Resource Manager position to oversee and coordinate management of information resources across business units within the agency and to manage distribution of information to external agencies.

Appendix C provides examples from Federal and State agencies that describe typical job duties for Information Resource Managers. These agencies also refer to these positions as Chief Information Officer.

Gap [EL-5]: Data Collection

Solution: Implement data collection policies and procedures for existing and new applications (e.g., culverts, guardrails, sign inventories) that defines data collection procedures at a precision level that is usable across multiple applications and that has strict standards regarding data quality.

Gap [EL-6]: System Integration – make integration more efficient between systems

Solution: Utilize Oracle Data Integrator Enterprise Edition and similar tools to facilitate efficient integration and exchange of data between systems.

Gap [EL-7]: Data linkage and data governance

Solution: Utilize data governance framework to define link between data systems and the support they provide for business functions across the Department.

Gap [EL-8]: Identify single source of information for projects funded and planned

Solution: Document in a Data Catalog the primary source of information (data system) to be used for projects funded and planned.
Gap [EL-9]: TAM and Performance Measures

**Solution:** Define performance measures (PMs), where none exist, for asset management applications, especially those that are identified as TAMIS level Tier 1 applications. Establish targets for the PMs that can be monitored through COGNOS.

Gap [EL-10]: Bridge and Maintenance projects

**Solution:** Develop standard reports that can be used by bridge and maintenance engineers regarding planned, scheduled, and ongoing bridge and maintenance projects. Reports should be able to pull information from both applications and display information in the same report to provide cross-asset comparison of data and information regarding those type of projects.

Gap [EL-11]: Deferred maintenance work

**Solution:** Develop and implement a new data system or identify an existing system (e.g., MMS) to store data on state funded deferred maintenance work. Develop standard reports that can be generated (by authorized users) from this system to provide information on deferred maintenance when needed.

In addition to these recommended solutions, ADOT&PF needs to utilize the Key Integration Points identified in Table 3.2, to determine where it is feasible to develop automated links across systems that are needed to support the desired scope for TAMIS. A more detailed list of primary and secondary data integration points for TAMIS (Tier 1 and Tier 2 applications) is identified in Table 4.2 of the TAMIS Task 5 report. These integration points should be part of the considerations regarding enhancements to existing TAMIS applications or development/procurement of new applications that can serve broader based needs for asset management at the Department.

The following sections examine linkages between asset management and critical data systems, including those used for HPMS reporting and Safety management, pavement management, and bridge management. These are all high-priority areas for FHWA and each area has specific federal legislative reporting requirements for state DOTs. A closer look at how these systems are related to or linked to asset management is warranted, due to their importance at the federal level.
<table>
<thead>
<tr>
<th>Data Type(s)</th>
<th>Systems Integrated</th>
<th>ADOT&amp;PF System</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Network and Linear Referencing</td>
<td>Enterprise GIS, Enterprise LRS</td>
<td>RDS (Future SIRIS) (Tier 1*)</td>
<td>Integrate TAMIS and other geospatial data; keep TAMIS location referencing in sync with enterprise LRS over time.</td>
</tr>
<tr>
<td>Geospatial Data Layers</td>
<td>Enterprise GIS, Enterprise RDS</td>
<td>Enterprise GIS (Tier 1*), RDS (Future SIRIS) (Tier 1*)</td>
<td>Ent. GIS - Utilize geospatial data within the TAMIS; provide map interface for field data collection; provide map interface for integration, analysis and display of TAMIS data Ent. RDS – Provide roadway feature data for routes identified in geospatial data layers.</td>
</tr>
<tr>
<td>Functional Classification, Highway System Designation, Control Section</td>
<td>Enterprise GIS, Enterprise LRS</td>
<td>RDS (Future SIRIS) (Tier 1*)</td>
<td>Provide TAMIS with highway designation data for use in treatment assignment, prioritization, and analysis.</td>
</tr>
<tr>
<td>Asset Inventory</td>
<td>Across specialized inventories for single assets or asset groupings</td>
<td>PMS (Tier 1)</td>
<td>Assess needs and develop work programs reflecting multiple assets in a corridor; filter data based on pavement type or bridge locations; consolidate information for HPMS reporting; consolidate information for financial reporting.</td>
</tr>
<tr>
<td>Asset Condition and Performance</td>
<td>Executive Information, Enterprise Reporting, Performance Management</td>
<td>PMS (Tier 1)</td>
<td>Display asset performance data on enterprise performance reports or dashboards, consolidate multiple performance indicators for internal or external reporting. Traffic, WIM, and crash provide data on asset condition and inform performance indicators.</td>
</tr>
<tr>
<td>Work Accomplishment</td>
<td>Maintenance Management, Contract Management</td>
<td>TBD</td>
<td>Relate work plans to work accomplishments, improve forecasting models</td>
</tr>
<tr>
<td>Identifiers and Codes for Assets, Activities, Accounts, Financial, Enterprise Master Data</td>
<td>Maintenance Management, Contract Management</td>
<td>MMS (Tier 1)</td>
<td>Keep TAMIS coding in sync with other systems, avoid need for duplicate data maintenance as code changes occur.</td>
</tr>
</tbody>
</table>
| Projects, and Administrative Units | Employees | Human Resources | IRIS (Tier 1)  
MMS (Tier 1) | Select staff resources for assignment to maintenance work activities (for TAMIS including maintenance management functions). |
|-----------------------------------|-----------|----------------|------------------|---------------------------------------------------|
| Vehicles/Equipment                | Fleet and Equipment Management | EMS (Tier 1)  
MMS (Tier 1)  
Transit and Rail (Tier 2) | Select equipment resources for assignment to maintenance work activities (for TAMIS including maintenance management functions). |
| Materials                         | Materials or Inventory Management | EMS (Tier 1)  
PMS (Tier 1)  
MMS (Tier 1)  
PONTIS (BrM 5.2 – 2014) (Tier 1)  
Material Sites Inventory (Tier 2) | Select materials for assignment to maintenance work activities based on available stocks (for TAMIS including maintenance management functions). |
| Resource Utilization              | Financial, Human Resource | MMS (Tier 1)  
IRIS (Tier 1)  
EMS (Tier 1) | Obtain cost transactions associated with work orders in order to track maintenance costs by asset and location. |
| Project Budgets and Actual Costs  | Financial, Capital Programming | FAAM (Tier 3)  
MRS (Tier 1)  
IRIS (Tier 1)  
GMPAS (BlackCat Grant Management) (Tier 2)  
EMS (Tier 1)  
MMS (Tier 1) | Provide planning-level cost estimates from TAMIS to financial or capital programming systems. Obtain current cost estimates from financial systems for integration into TAMIS work plans or for tracking historical asset maintenance and rehabilitation costs. |
| Treatment Recommendations         | Programming and Contracting | Site Manager, Bid Tab, STIP | Provide TAMIS recommendations to be further developed for contracting and scheduling. This would be for programs like Site Manager, Bid Tab and the STIP. |
| Work Requests                     | Call Center | AMHS Call Center | Route asset maintenance work requests to the TAMIS (for TAMIS including maintenance management functions) and provide completion status. ADOT&PF has a call center for AMHS, but no other known call centers at this time. |
| Work Orders                       | Financial | TBD | Track actual costs by TAMIS work order number. |
| Multiple                          | Data Warehouse/Business Intelligence | COGNOS  
eDOCS (Tier 3) | Make information from the TAMIS available via enterprise reporting or business intelligence tools. |
4.0 Highway Safety and Performance Data and Asset Management

This section discusses the importance of establishing automated linkages of asset management data and data needed to meet federal reporting requirements, especially those requirements related to highway safety and highway performance. There is an inherent relationship between asset data and safety and performance data, since safety and performance of a state’s transportation system both rely on well-maintained assets.

MAP-21 requires state DOTs to have an inventory program for safety as part of the MIRE requirements. MIRE is the Model Inventory of Roadway Elements. According to FHWA, “Development of a Model Inventory of Roadway Elements, referred to as MIRE, is recommended so that State, local, and Federal agencies understand the importance of roadway inventory and traffic data for safety programs and know what critical roadway data variables are required to make more effective and efficient safety improvement decisions, as well as to take advantage of current and future cutting-edge analytical tools and resources.” 1

One of the components of the desired scope for TAMIS (Figure 3.2) is the use of analytical tools to support financial and resource management.

The Highway Performance Monitoring System (HPMS) is used to report to Congress on the extent (mileage), condition (pavement), and performance (traffic) of the nation’s public road network. The information from HPMS is also used in apportionment of Federal aid dollars to the states. It is imperative that the states provide the most accurate data to FHWA on an annual basis.

For the most part, state DOT’s rely on their road inventory databases and linear referencing system (LRS) for the mileage information, pavement databases for condition data, and traffic databases for performance data. Asset management, likewise, utilizes each of these databases for locating assets (LRS), evaluating condition of assets (e.g., pavement, bridge), and maintaining inventory of assets (e.g., signs, signals).

As part of the evaluation of asset management systems for TAMIS, specific needs have been identified that should be addressed for crash, pavement, and traffic data. Addressing these needs will facilitate access to data needed to meet Federal reporting requirements for both safety and highway system performance and improve the systems for their use in asset management. Each of the needs is

1 http://www.fhwa.dot.gov/publications/research/safety/07046/
described below, with recommendations for how to address needs related to each type of data.

**Crash**

Crash data used for the Highway Safety Improvement Program (HSIP) at ADOT&PF needs a comprehensive inventory of roadway elements, and a complete road network system, i.e., state (on-system) roads plus local roads. The integration of local road data is a challenge for all state DOTs and many of them, including Alaska, rely on local governments to provide much of the mileage and traffic data for the local road network. A common location reference key also needs to be defined for use at the enterprise level at the Department.

**Recommendation:** ADOT&PF is in the process of implementing a new Crash Data Entry System and a Crash Reporting and Analysis System for Safer Highways (CRASH). The new CRASH system should maintain the same functionality for access/use of crash data as is currently available from the Highway Analysis System (HAS) system to ensure that ADOT&PF can continue to meet federal Fatality Analysis Reporting System (FARS) requirements.

ADOT&PF should add the recently developed Secondary Roads Network (version 1) as a key geospatial component of the RDS database. This network provides roadway centerline geometry for local roads that can be used to locate and display crashes that occur off the primary state system.

The Department should also continue the development/implementation of the Spatially Integrated Resource Information System (SIRIS) to facilitate the use of crash data that is linked to a common GIS and linear referencing system currently maintained by the Program Development Division. SIRIS will also provide the needed link to traffic data as described below.

**Traffic**

Traffic data is also needed in the analysis of crashes. The previous set of traffic data at the Department was entered by a consultant and is several years old. Compounding this challenge is the delay in the release of the most current traffic data, for use in other business areas of the Department.

Alaska also needs to be able to show how traffic moves from an existing route to a future route for an asset management system.

**Recommendation:** ADOT&PF is in the process of procuring a solution for a new traffic system (Traffic Server). The new system will need to provide the same functionality for use of traffic data as currently provided by HAS. The traffic data from HAS is needed to meet federal HPMS reporting requirements.

The Department should continue the development and implementation of the SIRIS system, which will also incorporate traffic data as a primary component of the system.
ADOT&PF should also investigate whether the addition of traffic message channel (TMC) location identifiers to the RDS roadway centerline network will facilitate linking of future (real-time) traffic data feeds.

**Pavement**

There is a specific need for use of pavement data in safety analysis, including linking high crash incidents to rutting locations along the roadway.

**Recommendation:** Since ADOT&PF is in the process of implementing a new crash database and is also evaluating available options for a pavement management system (through the Request for Information (RFI) process), this is the perfect time to consider implementing automated linkages and analytical tools that can accommodate safety needs using both systems. It is recommended that ADOT&PF develop a standard set of SQL queries that can extract the data needed from both systems for further use with safety analysis tools.

The pavement management system should also be linked to the common GIS and linear referencing system maintained by the Program Development Division. This appears to be the most up to date source of location information for the Department, with staff assigned to the maintenance of the GIS/LRS databases.
5.0 Pavement Data and Asset Management

This section discusses the important reliance on the use of pavement data for asset management at ADOT&PF. A discussion of performance measures and expectations at the federal level regarding pavement data (in accordance with MAP-21 legislation) is also presented.

This research addresses current data and information systems related to asset management within ADOT&PF, considers MAP-21 requirements, draws from relevant national research efforts, and takes advantage of successes and lessons learned in other states.

The FHWA’s pavement management roadmap identified over 200 specific needs statements for research and development required to improve pavement management and its contribution to asset management. Data collection (condition data) and data quality were major areas of need and combined had over 50 individual needs. This volume of needs speaks to the complexity of the pavement condition data collection process. It also plainly focuses on the importance of sound information in managing pavement assets.

5.1 BACKGROUND

An effective asset management system depends on reliable, accurate, and complete information. Recognizing that data collection and management are cost effective and not overwhelming benefits an agency immediately. Having quality pavement management data is directly linked to the development of reasonable and reliable recommendations as part of a larger decision making framework. Decisions regarding the agency's overall transportation network and investment strategy rely on sound pavement data as overall investments are compared across other investment categories.

Pavement condition data can be used to model pavement performance, to trigger various actions ranging from maintenance to rehabilitation to reconstruction, to evaluate program effectiveness, and to satisfy many other purposes. While there are many different methodologies used for assessing pavement condition, ranging from manual surveys to fully automated procedures, the need for collecting and analyzing quality data remains the same.

Available systems of pavement condition evaluation and monitoring range from state-specific performance management systems (PMS) to the national Highway Performance Monitoring System (HPMS). The majority of states collect various distress data along with International Roughness Index (IRI), which is required
for the HPMS. IRI, however, does not provide a complete indicator of pavement condition. The HPMS 2010+ effort allows a combined distress and IRI scoring method. Implementation of the FHWA’s Pavement Health Track adds a level of additional condition information going forward that would enhance asset management and life cycle assessments of investment. These types of tools allow a comprehensive pavement condition score based on ride, distress and structural remaining life.

5.2 ADOT&PF USE OF PAVEMENT DATA

In most scenarios, pavements are generally the largest single class of assets managed by transportation and public works agencies.

Alaska currently uses a robust pavement management system to manage its pavement network and meet statutory obligations, including basic performance reporting. The intent of the PMS is to maintain the network at a desirable performance level at a minimum cost (DPOL 07.05.020). Previous studies have held that the pavement management policy is fairly detailed, but it is not supported by policies related to inventory, condition assessment, maintenance work accomplishment tracking, project and program development, or priority setting in general. The public policies described in the Statewide Policy Plan are not supported by internal policies and procedures that specify how preservation needs are identified, prioritized, and funded.

The Pavement Management Section at ADOT&PF has identified specific types of data linkages that would benefit all users of pavement data across the Department. This includes linkages to the CRASH system to support crash and safety analysis, links to the MMS system to improve tracking of maintenance expenditures with rutting and cracking related needs, and the use of the same GIS and LRS systems used for the new CRASH system and the Highway Performance Monitoring System (HPMS) to facilitate analysis of pavement data with these systems.

In Task 3 of the TAMIS Research Project, the research team investigated and synthesized related practices at 10 state departments of transportation (DOTs). This synthesis included a best practices discussion from Utah that identified the pavement management system data needs. In the area of pavement management, they are working together in the department to obtain the needed data. Initially, each region had their own group of data collectors, but, as a result of the steering committee actions they are using the following approach for collecting pavement data and using it to formulate recommendations for pavement management:

- Collect on a two-year cycle, attributes collected are quite extensive;
- Aggregate to one-tenth mile sections;
- Divide these sections into segments with history of when each was built;
• Run data through the Pavement Management System with optimization tools to indicate the best result/most cost effective solutions for pavement management;

• Run scenarios based on different funding levels to identify scenarios that will happen in the future; and

• Make recommendations to the Regions on what projects should be done, based on the scenarios that are run.

This approach is one that can assist overall decision making by allowing a set of priorities to be given to regions, without necessarily mandating project selection. Decisions remain grounded to collect data and advance overall network performance.

5.3 MAP-21 REQUIREMENTS

MAP-21, the Moving Ahead for Progress in the 21st Century Act (P.L. 112-141), was signed into law on July 6, 2012. The bill provides funds for surface transportation investments in fiscal years 2013-14, and also establishes a new performance-based management framework.

MAP-21 requires states to develop risk-based asset management plans to improve or preserve the condition of the assets and performance of the system. It mandates that the plan includes strategies that lead to a program of projects that make progress toward targets and support the achievement of national goals. This “Highway Performance Plan” will include targets for pavement condition set by each state.

MAP-21 includes a process for requiring minimum condition levels for the interstate system. Specifically, the Secretary must establish a minimum level of condition for Interstate pavements, which may vary by geographic region. The legislation holds that if, during two consecutive reporting periods, Interstate pavement conditions in a State fall below the minimum set by the Secretary, the State must, at a minimum, devote the following resources to improve Interstate pavement conditions during the following fiscal year (and each year thereafter if the condition remains below the minimum):

• NHPP funds in an amount equal to the State's FY 2009 Interstate Maintenance (IM) apportionment, to increase by 2% per year for each year after FY 2013.

• Funds transferred from the STP (not from suballocated amounts) to the NHPP in an amount equal to 10% of the amount of the State's FY 2009 IM apportionment.

This mandate requires ADOT&PF to include defensible condition information in order to receive a full allocation of federal support for the Interstate system.
Other sections of this summary report describe the complete impact of MAP-21 legislation on overall asset management practices.

5.4 DISCUSSION

Based on the importance of the pavement assets, accurate data and its management remain critically important considerations for TAMIS. Effective transportation asset management needs knowledge of condition and characteristics of pavement that relate to its overall continuing utility and service life. Simply holding the data in a closed system is insufficient to efficiently feed decisions. Data needs to be in a form and place where it can influence rehabilitation, maintenance, replacement, inspection, and other cycles.
6.0 Bridge Data and Asset Management

This section discusses the important reliance on the use of bridge data for asset management at ADOT&PF. A discussion of performance measures and expectations at the federal level regarding bridge data (in accordance with MAP-21 legislation) is also presented.

This research addresses current data and information systems related to asset management within ADOT&PF, considers MAP-21 requirements, draws from relevant national research efforts, and presents lessons learned in other states.

6.1 BACKGROUND

An effective asset management program depends on reliable, accurate, and complete information. Recognizing that data collection and management are cost effective and not overwhelming activities benefits an agency immediately.

Management systems, including those for pavements, bridges, safety, etc., are sub-elements of an overall Asset Management Program. Well-designed management systems include data pertaining to inventory, condition, and performance. These management systems allow an operator to perform "what-if" analysis based on various performance targets and outcomes using various investment strategies. This helps to optimize asset performance based on funding constraints. A typical bridge management system includes four basic components: data storage, cost and deterioration models, optimization and analysis models, and updating functions.

Having quality bridge management system data is directly linked to the development of reasonable and reliable recommendations as part of a larger decision making framework. However, overall asset management is more than a pavement management system or bridge management system alone.

The most complete and uniform asset inventory across the nation is the National Bridge Inventory (NBI), mandated by Federal legislation. Each state DOT is required to submit an update of this inventory to the Federal Highway Administration (FHWA) each year, for nearly all bridges of at least 20 feet in span that are open to the public, regardless of ownership. The contents of this inventory are specified by the NBI Coding Guide (FHWA 1995). ADOT&PF, like 40 other state DOTs, uses AASHTO’s Pontis bridge management system to house its bridge database and to meet the NBI requirements.
The Pontis database contains all NBI data items, as well as more detailed element-level inspection details. For example, the NBI file contains a single condition rating for a bridge’s superstructure. The Pontis database contains additional data on the distribution of conditions by condition state for each structural element of the superstructure, including elements such as girders, stringers, floor beams, etc.

Basing preservation needs and system investments upon sound data is a logical and preferable way to pursue bridge preservation. Previous studies have shown that nationally much of the older National Bridge Inventory data is problematic and fraught with inconsistencies. Quality control processes and the granularity of the data are very important for successful integration into asset management systems and for preservation needs.

6.2 ADOT&PF USE OF BRIDGE DATA

Currently ADOT&PF has a considerable amount of data on specific asset classes and certain performance concerns, particularly pavement roughness and rutting, bridge condition and geometrics, geotechnical material sites, unstable slopes, and rolling stock. Bridge condition and geometrics are collected in PONTIS.

As required by Federal legislation, the Department maintains an inventory of all bridges open to the public, of at least 20 feet in span, regardless of ownership. In addition, certain bridges and culverts with span lengths of 10-20 feet are included. The inventory has all data items required by the NBI Coding Guide, and also all structural elements described in the AASHTO CoRe Element Guide (AASHTO 2002, Exhibit 1.2-9).

The Department follows the National Bridge Inspection Standards and the AASHTO CoRe Elements. These efforts provide sufficient data for many common asset management needs. Other studies have noted however that there is no routine monitoring for bridge fatigue, scour, or buildup of ice or debris, which would be necessary for a reliable risk management program.

One of the key uses of bridge data currently is preparation of the Alaska Bridge Reports. The existing reports are well utilized and help develop positive stakeholder relationships.

6.3 MAP-21 REQUIREMENTS

MAP-21, the Moving Ahead for Progress in the 21st Century Act (P.L. 112-141), was signed into law on July 6, 2012. The bill provides funds for surface transportation investments in fiscal years 2013-14, and establishes a new performance-based management framework.

MAP-21 requires states to develop risk-based asset management plans to improve or preserve the condition of the assets and performance of the system. It mandates that the plan include strategies that lead to a program of projects that
make progress toward targets and support the achievement of national goals. This “Highway Performance Plan” includes required minimum NHS bridge conditions.

If more than 10% of the total deck area of NHS bridges in a State is on structurally deficient bridges for three consecutive years, the State must devote National Highway Performance Program funds in an amount equal to 50% of the State's FY 2009 Highway Bridge Program apportionment to improve bridge conditions during the following fiscal year (and each year thereafter if the condition remains below the minimum).

MAP-21 also outlines bridge and tunnel inspection standards that require corrective action if a state is in noncompliance.

These requirements strengthen the need for a TAMIS to account for at least a subset of the national performance measures, current condition levels of those measures, and the national thresholds for them.

Other sections of this summary report describe the complete impact of MAP-21 legislation on overall asset management practices.

6.4 DISCUSSION

By far, bridges are one of the most visible and important components of a transportation system. By providing crossings and efficiency at important locations, bridges maintain network continuity, allowing travel over natural and manmade elements that otherwise would add significant detouring. Replacing or building new bridges introduce substantial capital costs so the need to sustain an appropriate level of preservation investment throughout the lifespan of a bridge, and its structural and functional components, is paramount. Long standing approaches to capture and collect bridge condition information through Pontis and routine inspections, form the core output for communicating information to decision makers and other interested parties.

ADOT&PF should maintain its existing inspection and data collection processes in order to continue building upon its established bridge management systems.
7.0 Conclusions

Task 7 of the TAMIS project was conducted to identify the gaps between the existing framework for TAMIS and the desired scope for the systems that are needed to support asset management at ADOT&PF. The process first required an assessment of the maturity level of the data systems as they relate to asset management.

Once the maturity level for each system was established and an overall maturity level determined for TAMIS systems as a whole, the next step was to conduct a gap analysis to identify where opportunities exist for improvement in TAMIS systems.

Research for Task 7 indicates that opportunities exist in all three areas, relative to system, technical, and institutional needs. Solutions have been proposed for how to address the gaps in order to advance ADOT&PF to higher levels in the maturity assessment scale and to reach the desired scope for TAMIS. These steps remain to be completed in advancing asset management at the Department, and are discussed in the following section.
8.0 Next Steps

The following steps remain to be completed as a result of the gap analysis presented in this report.

**Step 1: Review with Systems Owners.** CS should meet with system owners to determine if there is agreement regarding maturity level and next steps as described in this document.

**Step 2: Short list actions.** This step identifies smaller prioritized groups of actions that can be taken to address the gaps. In the case of TAMIS, the short list of actions focuses first on the gaps related to Tier 1 applications. The AASHTO AM Guide emphasizes, “By dealing with the gaps in smaller prioritized groups, the process can be made more manageable, and chances of success are improved.” The recommendations for short list actions identified in Section 3.3 as solutions can be applied to a select group of TAMIS systems initially, starting with Tier 1 applications and then for lower Tier applications in successive steps. A data action plan for TAMIS systems can be developed to identify the data systems, issues, and proposed actions needed to improve management of data systems. A data action plan was developed for Program Development Division in September 2009 and a similar plan can be developed for TAMIS systems. This can be accomplished through the Data Business Plan task.

**Step 3: Develop Improvement Plan.** Develop an improvement plan to address the worst or most critical needs first (as prioritized in Step 4). The plan includes recommendations for how to address the high-priority needs identified in Table 3.1, and for moving forward with implementation. The plan should involve participation by business data owners, data stewards, data custodians, IT, and stakeholders for the TAMIS systems. Successful implementation will rely upon the support of the TAM Steering Committee and the business line managers across the Department. This can be accomplished through the research recommendations task.

**Step 4: Implement Improvement Plan.** This task is the responsibility of ADOT&PF managers and their staff. An important part of this implementation involves at least an annual evaluation of how the improvements are progressing to support asset management at the Department.
A. References

AASHTO Transportation Asset Management Guide, Chapter 2 (2011)
TAMIS Task 5 Report: TAMIS Data Systems Evaluation
TAMIS Task 6 Report: TAMIS Framework
TAMIS Task 8 Report: System Model Alternatives
B. Asset Management Systems Documentation

Listed below are definitions of a Data Governance Manual, Data Catalog, Data Dictionary, Asset Management Data Dictionary, Business Terms Glossary, and Data Registry. Similar documents can be developed for ADOT&PF to support management of the data systems used for asset management (TAMIS). The decision regarding which documents to develop would be part of the Improvement Plan for TAMIS systems, referenced in Section 8, Next Steps.

Data Governance Manual – A manual to provide a single source of information for all staff on the standards, policies, and procedures regarding the use of data and data programs within the organization. The data governance manual includes the following components:

- Data governance charter
- Agency formal data management policy
- Data governance model diagram used for the agency
- Roles of data governance participants
- Glossary of terms

Data Catalog - a listing of data sets and metadata that describes how each data set is used, and which identifies the owners and users of the data sets.

The data catalog includes the following components:

- List of data programs in the agency
- List of business owners of the data program, with their contact information
- List of data stewards responsible for the data program, with their contact information
- Instructions for accessing data standards and definitions used with each data program

Data Dictionary – A data dictionary, or metadata repository, as defined in the IBM Dictionary of Computing, is a "centralized repository of information about

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2 NCHRP Report 666: Target-Setting Methods and Data Management to Support Performance-Based Resource Allocation by Transportation Agencies

3 NCHRP Report 666
data such as meaning, relationships to other data, origin, usage, and format." (http://en.wikipedia.org/wiki/Data_dictionary)

Another definition of a data dictionary provided by the Data Governance Institute states that a data dictionary is a “database about data and database structures. A catalog of all data elements, containing their names, structures, and information about their usage, for the benefit of programmers and others interested in the data elements and their usage.” (http://datagovernance.com/glossary-governance.html)

A data dictionary typically includes the following information about each data field in a particular database:

- Field Description
- Field Name (as used in the physical database)
- Field Format
- Field Type (numeric, alpha, alphanumeric)
- Field Width (how many digits/characters in the field)
- Comments/how the Field is used

**Asset Management Data Dictionary** – Two definitions are provided for an Asset Management Data Dictionary.

The first comes from the International Foundation for Information Technology (IF4IT) that defines an Asset Management Data Dictionary as “A Data Dictionary that specifically includes the definitions of data and data related constructs that are specific to, of or for the Discipline known as Asset Management.” (http://www.if4it.com/SYNTHESIZED/GLOSSARY/A/Asset_Management_Data_Dictionary.html)

The second definition from the AASHTO Transportation Asset Management Guide, January 2011, describes the elements that are to be included in an asset management data dictionary. These are the *business descriptions of each data element, its source and how it is used.*

**Business Terms Glossary** – A glossary of commonly used business terms with definitions of the terms. It is typical within an organization for business terms to be used to refer to data elements that reside in data systems, instead of using technical names that may be used by the Information Technology (IT) staff. (e.g., “employee name” instead of “emp_id”, or “vehicle ID” instead of “VIN”).

**Data Registry** – A report on metadata registries from the Bureau of Labor Statistics describes what is meant by a registry for metadata. This description is equally applicable for development of a Data Registry for data sets maintained by and used at ADOT&PF.
“A metadata registry is a database used to store, organize, manage, and share metadata.”

A data registry for ADOT&PF would be used to store, organize, manage, and share the names of the data systems and data sets used across the Department. ADOT&PF may wish to also include in their Data Registry the names of data sets and data systems that are used by the Department but are owned by other state agencies, such as the AKSAS system (the statewide accounting system).

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C. Information Resource Manager (Chief Information Officer)

This appendix provides examples from Federal and State agencies of the typical job duties of an Information Resource Manager (also referred to as a Chief Information Officer in some agencies).

**U.S. DOT**

The Office of the Chief Information Officer (CIO) serves as the principal advisor to the Secretary of Transportation on matters involving information and technology. The DOT CIO also has oversight responsibility over the entire Department of Transportation (DOT) IT portfolio of over $3 billion annually, the 6th largest in the federal government. Additionally, the CIO has operational responsibilities for the DOT Common Operating Environment consisting of local area networks, wide area networks, desktops, and backend services for all DOT modes except FAA. The CIO also promotes entrepreneurship, innovation, investment, and alliances to address transportation issues by creating technology solutions. The CIO is also implementing a holistic cyber security plan to strengthen DOT’s security framework.

**MONTANA DOT**

Montana has an office responsible for prioritizing all IT requests, ranging from minor bug fixes to the implementation of new systems. All requests go through this office. A prioritized list of requests is then generated for further action. This office is charged with being the interface between the business offices and the IT office, and identifying and resolving IT issues that cross business units.

**TXDOT**

Texas DOT’s Chief Information Officer oversees information technology. The CIO is responsible for the planning and development of all TxDOT's information systems' solutions, overseeing implementation, support, and maintenance.

**CALTRANS**

CALTRANS’ CIO has oversight responsibility over the Caltrans IT portfolio and maintains operational responsibilities for the local area networks, wide area networks, desktops, and backend services. The CIO promotes innovation, investment, and partnerships to address transportation issues by creating
technology solutions and implementing a holistic cyber security plan to strengthen Caltrans security framework.

**FDOT**

In accordance with Section 282.3055 Florida Statutes, the Agency Chief Information Officer (CIO) serves as the director of OIS. The CIO must, at a minimum, have knowledge and experience in both management and information technology resources.

The CIO is responsible for assisting the agency head in carrying out the Department's information resources management responsibilities including but not limited to:

(a) Coordinating and facilitating the planning and management of agency information technology services.

(b) Implementing agency information technology planning and management procedures, guidelines, and standards that are consistent with the procedures and standards adopted by the Agency for Enterprise Information Technology.

(c) Advising agency senior management as to the information technology resource planning and management needs of the agency.

(d) Assisting in the development and prioritization of the information technology resource needs for the agency's legislative budget request.

(e) Assisting the Agency for Enterprise Information Technology in the development of strategies for implementing the enterprise information technology services established in law and developing recommendations for enterprise information technology policy.

**ODOT**

The Oregon Department of Transportation's (ODOT) Chief Information Officer provides overall leadership planning, development and delivery of information technology services for ODOT and several other non-transportation organizations. As CIO for the second largest state agency in Oregon, the ODOT CIO is responsible for systems supporting highways, bridges, rail service, right-of-way determinations, DMV, and Motor Carrier commercial trucking inspections and licensing throughout the state.

Oregon CIO Council  -- (NOT transportation specific but provides helpful information)

The Chief Information Officer Council (CIOC) is an important component of the state’s information resource management (IRM) framework to serve the needs of Oregon citizens. The CIOC has operated since 2002 as a successful point of collaboration for agency CIO’s to share information and to plan and conduct multi-agency and enterprise-level IRM activities.

The purpose of the CIOC is to:
• Support information technology (IT) and IRM objectives of agencies and state government as a whole;

• Advise the State Chief Information Officer (State CIO), Technical Advisory Board (TAB) and other appropriate bodies on IT and IRM-related business needs and challenges;

• Form workgroups as needed to consider and act on IT and IRM issue;

• Strive to search consensus when appropriate to enable high-quality decisions, recommendations and advice;

• Proactively identify and act on opportunities for multi-agency and enterprise initiatives to optimize government services and information;

• Facilitate cross-agency communication and collaboration to improve efficiencies and effectiveness in planning and service delivery;

• Establish, promote and support achievement of IT and IRM strategic direction; and

• Help state policymakers achieve their key objectives through the education and evaluation of emerging technologies and innovative use of IT and IRM.

The CIOC is sponsored by the State Chief Information Officer (State CIO). Its charter is created per the consensus of the CIOC members coordinated by the CIOC Chair and Vice Chair.
System Model Alternatives

Transportation Asset Management Information System

Technical Memorandum

prepared for

Alaska Department of Transportation and Public Facilities (DOT&PF)

prepared by

Cambridge Systematics, Inc.

March 11, 2014
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1.0 Overview

As part of its overall asset management strategy, the Alaska Department of Transportation and Public Facilities (DOT&PF) is developing a Transportation Asset Management Information System (TAMIS). The TAMIS will encompass both existing and future data in various systems, representing a collection of hardware, software, data, and processes that support comprehensive transportation asset management efforts at the agency. In practice, Alaska’s TAMIS will enable the collection, synthesis, and maintenance of data from multiple sources. The functional requirements of the TAMIS Framework include:

- Asset data storage
- Integration of key data to support asset management decisions
- Analytics such as tradeoff analysis

Implementation of the TAMIS will also be consistent with ADOT&PF’s overall motto for its asset management efforts, which is “Start Simple, Grow Smart, Show Continuous Improvement.” In line with this philosophy, this report presents information related to TAMIS implementation, principally different models for data integration, options for advancing the agency’s pavement analysis capabilities, and an initial set of system requirements for a pavement management system, maintenance management system, and fleet management system.

The goal for ADOT&PF’s TAMIS is to meet the “needs of stakeholders by integrating data and establishing institutional methods to ensure that integration results in improved decision-making for TAM.”
2.0 TAMIS Data Integration Models

2.1 INTRODUCTION

This Section presents potential options for the integration tools component of a TAMIS and recommends a model for Alaska DOT&PF. The integration tools will connect various enterprise databases, systems, and reporting tools. Overall, the integration tools should leverage ADOT&PF’s existing geodatabase and linear reference initiatives. The connection between enterprise databases, systems, and reporting tools will be necessary to support analytical elements that support decision-making. For example, the TAMIS could include functionality that enables DOT&PF to evaluate options for allocating funds across programs areas.

As described in the DOT&PF’s Vision document, key features of the TAMIS include:

- Business Processes
  - Technical – Data quality and IT (information technology) compatibility
  - Institutional – Data governance and management
- Integration Tools
  - Geospatial component
  - Business intelligence (BI) tools
  - Interfaces
  - Analysis tools (software and hardware)

As shown in Figure 1, the TAMIS will include a set of business processes and integration tools to ensure that Alaska’s key asset information is available to support transportation asset management decision-making. Figure 1 depicts the three primary components of ADOT&PF’s TAMIS Framework:

- Data sources – provides data on programs and assets
- TAMIS – provides a set of business processes and integration tools to turn data into information that supports asset management decisions

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1 A specific list of systems recommended for inclusion in the TAMIS is included in the Task 5 memorandum developed for this research effort.
• Asset management decisions – lead to desired outcomes, promote wise investment of resources, promote credibility, accountability, and transparency

Figure 1. Alaska DOT&PF TAMIS Framework

Further work in the TAMIS research project will provide more detail regarding the specific components and organization of the model to support the remainder of the functional requirements of TAMIS (such as data storage and analysis tools). Future work will also result in recommendations regarding business processes. Business processes will support the TAMIS Framework – especially those related to data governance.
2.2 **INTEGRATION TOOLS COMPONENT OPTIONS**

The AASHTO *Transportation Asset Management Guide: Volume 2* describes three options for TAMIS implementation:

- **Option 1:** Fully integrated, self-contained TAMIS
- **Option 2:** Asset management planning and analytical tools with data feeds
- **Option 3:** Separate management systems with interfaces

These options are discussed in more detail below. Each option represents a simplified, theoretical version of what a TAMIS might look like. In practice, every TAMIS will be slightly different because every DOT has a different set of existing systems, different levels of maturity between its data and systems (for example, many DOTs have more confidence in their ability to model pavement and bridges than other assets), different cost constraints in terms of initial and ongoing costs, and different decision-making needs.

Figure 2 presents the options as a continuum, from a single system to several systems, based on the number of systems included in the final TAMIS.

**Figure 2. TAMIS Continuum**

<table>
<thead>
<tr>
<th>Option 1</th>
<th><strong>Option 2</strong></th>
<th><strong>Option 3</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully integrated self-contained system</td>
<td>Blend of options: some feeds, some integrated</td>
<td>Asset management planning and analytical tools</td>
</tr>
</tbody>
</table>

Less Systems More Systems

**Option 1. Fully Integrated, Self-contained TAMIS**

In this option, a single, fully integrated, and self-contained system is produced that can combine data and analytics for different assets using different methods. Figure 3 illustrates this option. In this example, data collected in the field is spatially referenced and feeds directly into the asset characteristic and condition module (there is one module for each asset type). The asset characteristics and condition data feed into planning and budgeting analytical tools and into a querying, reporting, and mapping tool.

---

In terms of implementation options, some vendors offer an initial software package and separate modules or add-ons for different asset types. Others offer a single software package and allow agencies to add tables for assets to a central database. Agencies that pursue Option 1 often have a relatively small network for which they are responsible, are just starting to develop asset management systems, or are completely replacing their existing systems. DOTs typically do not implement this approach in its entirety. Instead, they purchase priority modules or systems (pavement or bridge, for example) and add modules or assets over time. This approach is consistent with Options 2 and 3.

**Strengths.** One strength of using a fully integrated model is that a single vendor and single system provide all functionality. In the ideal scenario, all aspects of the TAMIS are inherently compatible: all data integrate seamlessly together, and users and IT personnel need only learn to install, use, upgrade, and manage a single system. In the event that the software malfunctions, an agency would need to contact only one vendor.

**Weaknesses.** A disadvantage of this approach is potential limitations in system functionality. For example, if an agency is implementing a new pavement management system and bridge management system, the same vendor may not provide the best solution for both. In this case, the agency would have to choose which functionality to forgo. Another disadvantage of the single system approach is that agencies may feel “locked-in” to a particular vendor, and face significant costs if they pursue a different system in the future, because they would have to implement an entirely new system. Finally, this option may not
be cost-effective if an agency already has key systems in place that are functioning well. In this option, all existing systems would need to be replaced.

**Costs.** Option 1 may have a higher initial cost relative to the other options, particularly if existing systems that are functioning well are replaced. In contrast, it could have lower future annual costs if a vendor provides a discount for purchasing multiple modules. However, once the system reaches a sunset status and needs to be replaced, Option 1 would have the highest replacement cost because the entire system would need to be replaced.

**Option 2. Asset Management Planning and Analytical Tools with Data Feeds**

In this option, DOTs maintain various systems and tools and create a central asset management integration system (or series of systems) that combines the output data and/or provides additional analysis. Option 2 is illustrated in Figure 4. The centralized integration system(s) extracts data from the other systems and combines it in a way that supports asset management decisions. In this option, agencies must develop data integration approaches to combine data from multiple systems. Examples include creating data crosswalks, developing processes for data conversion, clarifying key data integration points, and developing processes for combining data. An enterprise GIS (geographic information systems), as discussed in Recommendation #3, would support this option.

Figure 4. Option 2 - Asset Management Planning Tool with Data Feeds

**Strengths.** This option allows agencies to take advantage of existing systems that are working well. It also enables a “best in breed” approach in which agencies pick each individual system based on its ability to meet a specific function. As such, ADOT&PF would evaluate potential pavement management systems separately from potential maintenance management systems and determine which options best meet its needs. Another strength of this option is that it is modular in nature. For example, an agency using the example in Figure 4 could initially use its existing feeder systems that surround the integration system, and replace or upgrade them over time. Additional feeder systems could also be added over time. Most importantly, the functionality of the integration system(s) could also evolve over time, with an initial focus on an agency’s highest priority needs.

**Weaknesses.** Option 2 requires staff to maintain multiple systems on different platforms and at multiple integration points. Another disadvantage of this approach is the need to integrate multiple feeder systems to the central system. Each integration point must be dealt with separately, which can drive up the cost of implementing this option.

**Costs.** Since Option 2 is modular in nature, the initial costs are highly variable and are based on which modules an agency chooses to implement first. For example, an agency may implement a new pavement management system, maintain another system as is, and develop high priority functionality for a central integrated system. This option may have higher annual costs relative to Option 1, because internal staff would have to maintain multiple platforms, and the economies of scale described for Option 1 would not be feasible.

**Option 3. Separate Management Systems with Interfaces**

In this option, an agency maintains self-contained systems similar to Option 2. However, there is no central integration system although the individual source systems can still integrate with each other. Figure 5 shows an example of Option 3.
**Figure 5. Option 3 - Separate Management Systems with Interfaces**

![Diagram of Separate Management Systems with Interfaces](source: AASHTO Asset Management Guide, 2011)

**Strengths.** Option 3 has the same benefits as Option 2 – it enables a best in breed approach to system implementation, and is modular and incremental in nature.

**Weaknesses.** The disadvantages of Option 3 are also similar to those of Option 2, but they are amplified. With integrated systems, the amount of effort required is directly proportional to the number of connection points. Whereas with Option 2, each source system has one connection point to a central system. In Option 3, each source system can have connection points to multiple systems. For example, in the example provided in Figure 5, the maintenance budgeting system integrates with seven different systems. Another weakness of Option 3 is that new cross-system functionality must be added to an existing system rather than implemented through a separate central planning system. In addition, Option 3 may create an environment in which multiple vendors are asked to work together so that their systems can be integrated.

**Costs.** Similar to Option 2, the initial cost of Option 3 will vary greatly depending upon the number of systems that are initially integrated. This option may have the highest annual costs because internal staff will have to maintain...
multiple platforms, the economies of scale described for Option 1 would not be feasible, and there could be numerous connection points to maintain.

2.3 **AVAILABLE PRODUCTS**

An important factor in considering options for a TAMIS is the availability of tools to implement each option. Therefore, as part of this research effort the study team reviewed several commercial products that are offered by asset management system vendors. The most common vendors used by DOTs include AASHTOWare, AgileAssets, Bentley Systems, Deighton, and Oracle. Table 1 shows the products offered by each vendor and describes how their products fit into the options described in this Section.

**Table 1. Common Asset Management Vendors and Products**

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Products used by DOTs</th>
<th>TAMIS Options Represented by these Products</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>AASHTOWare</td>
<td>Project (Trns.port), Right of Way, Pavement, Bridge Maintenance (formerly Pontis), Bridge Design and Rating (formerly Virtis/Opis) and Safety Management</td>
<td>Option 3</td>
<td>Vendor sells different software packages that must be integrated together.</td>
</tr>
<tr>
<td>AgileAssets</td>
<td>AgileAssets system foundation, plus numerous modules that address different assets and functionality</td>
<td>Option 1 and 2</td>
<td>Vendor sells individual asset management systems as modules that can be integrated into one system. Alternatively, these modules can be integrated with other asset management systems.</td>
</tr>
<tr>
<td>Bentley Systems</td>
<td>MicroStation, ProjectWise, AssetWise, InRoads, OnSite, GEOPAK, InspectTech, SUPERLOAD, LARS Bridge</td>
<td>Option 3</td>
<td>Vendor sells different software packages that must be integrated together.</td>
</tr>
<tr>
<td>Deighton</td>
<td>dTIMS</td>
<td>Option 1 and 2</td>
<td>Vendor sells one software package in which multiple assets and functionality can be integrated. Alternatively, the system can be integrated with other asset management systems.</td>
</tr>
<tr>
<td>Oracle</td>
<td>Primavera P6, PeopleSoft (Asset Management, Human Resources, Financials), Database, Use Productivity Kit, Business Intelligence</td>
<td>Option 3</td>
<td>Vendor sells different software packages that must be integrated together.</td>
</tr>
</tbody>
</table>

In addition to purchasing a commercial product, DOTs have the option of developing customized tools. Given the breadth of Option 1, this would not be a cost-effective approach for that option. However, adding customization capabilities could be a very attractive alternative for Option 2. With Option 2, a DOT could identify specific needs for combining data from various source
systems and develop functionality that is tailored to their decision-making processes. On the other end of the spectrum, some form of customization would be required for Option 3, which would involve integrating various systems directly to one another.

2.4 SUMMARY AND RECOMMENDATIONS

Table 2 summarizes the strengths, weaknesses, and costs of the options discussed in this Section.

<table>
<thead>
<tr>
<th>Option</th>
<th>Strengths</th>
<th>Weaknesses</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Fully Integrated Model</td>
<td>Single vendor supports entire system Users and IT personnel need only learn</td>
<td>An incremental approach is not possible Does not take advantage of existing</td>
<td>Highest initial cost Potential for lower annual costs if a vendor provides a discount for purchasing multiple modules Once the system is in sunset status and needs to be replaced, this option would have the highest replacement costs</td>
</tr>
<tr>
<td></td>
<td>about one system and platform</td>
<td>systems Potential limitations in functionality for individual modules</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Agencies may feel “locked-in” to a particular vendor Switching to a</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>different system in the future would require redevelopment of all</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>functionality</td>
<td></td>
</tr>
<tr>
<td>2 - Asset Management Planning Tools with</td>
<td>Takes advantage of existing systems Enables a best in breed approach to</td>
<td>Users and IT personnel need to learn and maintain multiple systems and</td>
<td>Initial costs are highly variable and based on which components an agency chooses to implement May have higher annual costs because internal staff will have to maintain multiple platforms, and the economies of scale described for Option 1 would not be feasible</td>
</tr>
<tr>
<td>Data Feeds</td>
<td>system implementation Is modular in nature and can be implemented</td>
<td>platforms Requires integrating multiple feeder systems to the central</td>
<td></td>
</tr>
<tr>
<td></td>
<td>incrementally</td>
<td>system, which complicates implementation</td>
<td></td>
</tr>
<tr>
<td>3 - Separate Management Systems with</td>
<td>Enables a best in breed approach to system implementation Is modular in</td>
<td>Users and IT personnel need to learn and maintain multiple systems and</td>
<td>Initial costs are highly variable and based on which components an agency chooses to implement May have highest annual costs because internal staff will have to maintain multiple platforms, the economies of scale described for Option 1 would not be feasible, and there could be numerous connection points to maintain</td>
</tr>
<tr>
<td>Interfaces</td>
<td>nature and can be implemented incrementally</td>
<td>platforms Requires integrating the highest number of feeder systems, which complicates implementation New cross-system functionality must be added to an existing system rather than implemented through a separate central system May create an environment in which multiple vendors are asked to work together so that their systems can be integrated</td>
<td></td>
</tr>
</tbody>
</table>
Recommendation #1 – Aim for the Middle Portion of the Implementation Spectrum

Based on our understanding of ADOT&PF’s needs and the research conducted to evaluate the experience of other transportation agencies (Colorado, Georgia, North Carolina, New York, Pennsylvania, Utah, etc.), we recommend that ADOT&PF aim for the middle of the TAMIS option spectrum as illustrated in Figure 6.

**Figure 6. Recommended Approach for DOT&PF**

This approach will enable ADOT&PF to take advantage of existing systems that are working well, use a best in breed approach when replacing and adding new systems, implement high priority cross-system functionality immediately, expand functionality of the TAMIS incrementally, and minimize initial costs.

The exact location on the spectrum will depend upon two future decisions.

1. What is the best approach to enhancing specific asset management systems? For example, as DOT&PF explores options for new pavement, maintenance, and fleet systems, it will decide if it is best to have a single platform for all three systems, or multiple platforms. If DOT&PF opts for a single platform, it will move to the left of the spectrum. In this scenario, the final architecture might look similar to that depicted in Figure 4, except that the maintenance and pavement boxes would be consolidated into a single box.

2. Does it make sense to integrate some of the source systems directly, outside of a new asset management integration tool? Potential connection points between ADOT&PF’s existing systems are discussed in the Task 5 report for this research effort. If ADOT&PF opts to connect some source systems directly, it would be moving to the right side of the spectrum. In this scenario, the final architecture might look similar to Figure 4, except that some of the source systems would be linked directly together.

We recommend that the decisions to these questions be made on a case-by-case basis for each individual system, and considered collectively over the course of this research effort. In addition, it is important to note that the two decisions to these questions are not mutually exclusive. ADOT&PF could decide to integrate...
some management system functionality into a single system and connect other systems directly.

**Recommendation #2 - Identify and Develop Priority Functionality for an Asset Management Planning System**

Regardless of the details of the decisions described above, we recommend that ADOT&PF continue to identify high priority functionality for an asset management planning system and implement this functionality on a pilot basis. This recommendation is consistent with the original work plan for this research effort. Because Option 2 is incremental in nature, ADOT&PF could focus initially on developing a small set of functionality, and build the functionality up over time. Depending upon the nature of the new functionality, the integration tools could be built as a single asset management planning system or as a collection of tools. Examples of potential functionality to pilot includes:

- A tool that combines inventory and current performance measure information from multiple systems and presents them in the form of a performance dashboard that provides a comprehensive view of ADOT&PF’s asset management programs.

- A tool that combines future performance measure output from multiple systems, and presents them in a form that supports cross-program tradeoffs, resource allocation, and target setting.

- A tool that combines needs and/or project information from multiple systems (e.g., preservation needs, safety needs, capacity needs, planned projects, etc.) and presents them in a way to support the evaluation and prioritization of potential projects, and the project development process.

- A tool that facilitates the integration of data from source systems. For example, this would import pavement condition data and convert it to a format that can be used by a safety system. This type of tool is discussed further in Recommendation #3.

We recommended that functionality identified throughout this research effort that is not piloted be captured for future implementation, so that the scope of the asset management planning system can be expanded over time.

**Recommendation #3 – Explore the use of GIS and TransXML to Facilitate Data and System Integration**

Option 2 requires integrating data from various systems into new asset management planning and analysis tools. We recommend that ADOT&PF explore the use of an enterprise GIS and TransXML (shorthand for Transportation Extensible Markup Language) to facilitate data and system integration.

Because location is a common attribute of most transportation assets, an enterprise GIS can serve as the core of a centralized asset management integration system. An enterprise GIS utilizes a common roadway centerline and
linear referencing system (LRS) to which all roadway assets or events (e.g., bridges, pavement conditions, highway projects, crashes) can be located. Geospatial analysis tools (e.g., proximity analysis, buffering) can be used to relate assets stored in different databases (e.g., identify if any pavement improvement projects are co-located with a proposed bridge rehabilitation). Additionally, common GIS visualization tools, such as map displays, graphs, and tables can be used to combine and present data contained in multiple asset databases. Assets that are not specifically linked to the roadway system, such as airports or marine highway facilities, can also be analyzed and displayed using an enterprise GIS.

For the overall structure of data feeds, we recommend exploring the use of TransXML. The National Cooperative Highway Research Program (NCHRP), through two research efforts, has produced the beginnings of a framework that would allow for collecting data from disparate systems, analyzing them, and sending results back to any other system. These efforts have produced a common language for asset management called TransXML (Transportation Extensible Markup Language).³ NCHRP has produced some initial TransXML schema, identified existing schema that could be adapted to work with TransXML, and integrated several external schema to work with TransXML. The available schemas are summarized in Table 3.

### Table 3. Available TransXML Schema

<table>
<thead>
<tr>
<th>Schema Type</th>
<th>Type of Data for Schema</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing XML schema</td>
<td>Area features</td>
</tr>
<tr>
<td></td>
<td>Geometric roadway design</td>
</tr>
<tr>
<td></td>
<td>Design project</td>
</tr>
<tr>
<td></td>
<td>Bid package</td>
</tr>
<tr>
<td></td>
<td>Construction progress</td>
</tr>
<tr>
<td></td>
<td>Materials sampling and testing</td>
</tr>
<tr>
<td></td>
<td>Project construction status</td>
</tr>
<tr>
<td></td>
<td>Bridge design and analysis</td>
</tr>
<tr>
<td></td>
<td>Crash report</td>
</tr>
<tr>
<td></td>
<td>Highway information safety analysis</td>
</tr>
<tr>
<td></td>
<td>Linear referencing</td>
</tr>
<tr>
<td>Existing schema that could be adapted</td>
<td>Road safety audit</td>
</tr>
<tr>
<td></td>
<td>Geometric roadway design/landGML</td>
</tr>
<tr>
<td></td>
<td>Construction payroll</td>
</tr>
<tr>
<td></td>
<td>Permit application</td>
</tr>
</tbody>
</table>

We recommend that DOT&PF explore the use of these schema to facilitate the integration of systems. For example, if a safety system uses pavement roughness as part of its analysis, or if it would benefit from knowing the location and extent of guardrails, the central system could use TransXML schemas to transfer these data from the pavement system and maintenance feature system into the safety system for analysis. Developing these schema and an analytical backbone requires thinking through each data integration point and answering specific questions about how the functional requirements of each system would be met. For example, the pavement system might not output data in the right spatial location relative to what the safety system can use as input. However, an enterprise GIS would address this issue.

Adapting a GIS and TransXML now as the protocol for system integration will set the stage for more efficient data integration activities in the future. The long-term vision would be a TAMIS in which data from any system could be used by any other system as long as the data is spatially managed (when appropriate) and converted to a standard data schema. This approach would maximize ADOT&PF’s flexibility to expand the scope of the TAMIS over time and to update, replace, or add new systems with little consideration about how the improved system would integrate with the other systems.

<table>
<thead>
<tr>
<th>Schema Type</th>
<th>Type of Data for Schema</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridge maintenance activities</td>
<td></td>
</tr>
<tr>
<td>Bridge design analysis</td>
<td></td>
</tr>
<tr>
<td>Pavement deflection data</td>
<td></td>
</tr>
<tr>
<td>Supported external schema</td>
<td>Crash data MMUCCXML</td>
</tr>
<tr>
<td></td>
<td>CityGML</td>
</tr>
<tr>
<td></td>
<td>Geometric roadway design/landXML</td>
</tr>
<tr>
<td></td>
<td>DIGGS</td>
</tr>
<tr>
<td></td>
<td>ITS standards</td>
</tr>
</tbody>
</table>

Source: NCHRP 20-02 Task 295.
3.0 Pavement Management System Options

3.1 INTRODUCTION
As part of its asset management efforts, Alaska DOT&PF is considering options for improving its pavement management system (PMS). A PMS is a key component of an overall asset management program, and we highly recommend that DOT&PF work towards state-of-the-art pavement analysis capabilities. This Section summarizes DOT&PF’s options for moving forward in this area, highlights PMS implementation issues that should be addressed, and describes PMS capabilities in the context of the agency’s comprehensive TAMIS.

3.2 CURRENT ALASKA DOT&PF PRACTICES

Pavement Data
DOT&PF maintains a database of pavement inventory and condition data. Every year, the agency collects International Roughness Index (IRI), rutting, and cracking data on its entire pavement network (about 4,500 centerline miles). Condition data is collected through a combination of profiling and a windshield survey. In addition, DOT&PF maintains information on thickness, materials, and other design parameters. DOT&PF is exploring options for improving the efficiency of the data collection process. These changes would influence the data collection process only. The agency is not currently considering changes to the data elements that are collected.

Pavement Management System
Pavement data is stored in the Performance and Economic Rating System (PERS), which is a proprietary system maintained by a vendor (Dynatest). In theory, PERS is capable of using this information to predict future pavement conditions. However, DOT&PF has not used PERS for this purpose, and generally does not have confidence in the tool’s modeling capabilities.

Decision-Making Process
Each year, a pavement management report is developed and submitted to the Regions. This report ranks pavement segments based on current IRS and rutting data that is stored in PERS. The Regions also have access to the raw data via spreadsheets. The Regions review the data and recommendations, combine
them with local knowledge and regional priorities, and develop a list of candidate pavement projects for the capital program. The Regions then submit candidate projects to agency headquarters, where they are combined with the candidates from other Regions, prioritized and programmed.

3.3 **HIGH LEVEL PMS FUNCTIONAL REQUIREMENTS**

Following is a set of high-level PMS functional requirements that have been compiled through conversations and interviews conducted as part of the DOT&PF’s TAMIS effort.

1. The PMS should provide easy access to inventory and condition information to staff throughout the agency. The system should generate standard reports, enable users to develop custom reports, and provide map-based viewing of all data.

2. The PMS should identify and prioritize capital pavement projects. This process should consider current conditions; expected rates of deterioration based on pavement design, age, condition, traffic usage; and life cycle cost considerations for potential pavement treatments. The PMS should also consider previous maintenance work when recommending treatments. This information (what work, when, and where) would be captured in a maintenance management system (MMS). The PMS should recommend the location, type, and timing of treatments.

3. The PMS should perform network analysis, and predict future pavement conditions based on different funding scenarios. For example, it should be able to answer the following types of questions: What condition can be achieved in 10 years, if the current pavement budget is held constant going forward? What budget is required to maintain existing conditions over the next 10 years? The PMS should present this information in a manner that supports the budgeting process, and the development of condition targets, such as those required by Moving Ahead for Progress in the 21st Century Act (MAP-21).

4. The PMS should provide a list of programmed projects to maintenance staff, so that they can be considered during the maintenance process. For example, if a segment of road is scheduled for an overlay next year, maintenance crews should address their interim work accordingly.

5. The PMS should support the project development process. For example, it should enable agency staff to view other needs along a segment, such as safety concerns, rock fall issues, and planned capacity work, so that the pavement project can be designed accordingly. In addition, the PMS should provide information on pavement conditions and needs to staff developing non-pavement driven projects.
The list of functional requirements presented above provides a basis for exploring PMS options. However, more details would be needed before procuring a new PMS.

Recommendation #1. It is recommended that prior to issuing a request for information (RFI) or a PMS, DOT&PF build off the above list and develop a more detailed list of functional requirements.

3.4 IMPLEMENTATION OPTIONS

We have identified three options for addressing the requirements defined in Section 3.3. Each option takes advantage of the anticipated functionality of the TAMIS. For example, functionality #1 addresses the desire for widespread access to pavement data. It is envisioned that some set of agency staff could access detailed pavement data directly through the PMS, while others could access to a synthesized data through a broader system that fall under the TAMIS umbrella.

In addition, functionality requirement #5 addresses the desire for non-pavement data to be made available during the development of pavement projects. The TAMIS will provide an ideal framework for integrating and sharing critical asset management data across systems, and alleviate the need for DOT&PF to build this functionality into each individual system.

Recommendation #2. It is recommended that DOT&PF consider part of functionality #1 (which addresses access to pavement data) and all of functionality #5 (which addresses data and system integration) as part of the broader evaluation of TAMIS options.

Functionality #1 and #5 could be addressed through a PMS. They also could be addressed with other systems and data sharing protocol as part of the overall TAMIS effort. Therefore, it is recommended that DOT&PF focus initially on functionality critical for a PMS, and revisit the larger reporting and data integration issues as part of the TAMIS development process. If DOT&PF procures one of the PMS described below, it will be possible to build additional reporting and integration capabilities incrementally onto the system.

Option 1 – Implement a New PMS in Coordination with a MMS

In this option, DOT&PF would procure a system that enables a PMS and a MMS to be integrated through the same software platform. More details on specific systems that meet this criteria are discussed in the following section. This option was identified by DOT&PF staff because of the desire for a PMS that considers previous maintenance activities while recommending capital pavement projects. In this approach:
• Functionality #1 would be addressed through a combination of a PMS and TAMIS.

• Functionally #2, and #3 and #4 would be addressed by the PMS.

• Functionality #5 would be addressed by the TAMIS.

**Option 2 - Implement a new PMS Separate from a MMS**

In this option, DOT&PF would procure a PMS that runs on a different platform than the MMS. In this approach:

• Functionality #1 would be addressed through a combination of a PMS and TAMIS.

• Functionality #2 and #3 would be addressed by a PMS.

• Functionality #4 and #5 would be addressed by TAMIS.

**Option 3 - Leverage Existing Tools**

This option relies on a combination of DOT&PF’s current PMS, business process improvements, functionality envisioned for the TAMIS, and a pavement analysis tool developed by the FHWA. In this approach:

• Functionality #1 would be addressed through a combination of PERS and TAMIS. DOT&PF currently has mechanisms in place for sharing pavement data with staff. These mechanisms could be enhanced through TAMIS.

• Functionality #2 would be addressed by developing guidance related to preventive maintenance treatments. DOT&PF could develop guidance on the scope and timing of these types of treatments, and incorporate them into the segment recommendations that are provided to the Regions. For example, Regions are currently provided a list of pavement segments ranked by condition. This list could also recommend a treatment for each segment.

• Functionality #3 would be addressed by implementing the FHWA’s Highway Economics Requirement System – State Version (HERS-ST). This system was developed by FHWA to support network-level analysis of the pavements in the U.S. HERS-ST has been used by a number of agencies to conduct network-level analysis and support longer-term budgeting and target-setting processes. The system relies on data already collected by DOT&PF as part of the Highway Performance Monitoring System (HPMS) program. If DOT&PF implemented HERS-ST, it would need to customize the pavement deterioration model to account for the impacts of studded tires.

• Functionality #4 and #5 would be addressed by the TAMIS.
3.5 **EVALUATING THE IMPLEMENTATION OPTIONS**

The three implementation options are summarized in Table 4. As illustrated, all of the defined functionality could be addressed in some form by each of the options.

### Table 4. Implementation Options

<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1. New PMS in coordination with a MMS</td>
<td>New PMS and TAMIS</td>
<td>New PMS</td>
<td>TAMIS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. New PMS in isolation of a MMS</td>
<td>New PMS and TAMIS</td>
<td>New PMS</td>
<td>TAMIS</td>
<td>TAMIS</td>
<td></td>
</tr>
<tr>
<td>3. Leverage existing tools</td>
<td>Existing PMS and TAMIS</td>
<td>Existing PMS and Process Improvements</td>
<td>HERS-ST</td>
<td>TAMIS</td>
<td>TAMIS</td>
</tr>
</tbody>
</table>

**Considering Option 1 Versus Option 2**

The study team found examples of both Option 1 and Option 2 at state DOTs. For example, the New York and North Carolina DOTs are pursing Option 1, with AgileAssets as their PMS and MMS. In contrast, the Arizona, California, Indiana, Mississippi, Ohio, Pennsylvania and Utah DOTs are using Option 2, with different combinations of systems.

Given the success of both of these options, it is recommended that the decision between Option 1 and Option 2 be made as follows:

- Determine which PMS provides the best value in terms of addressing the agency’s PMS needs and long-term costs. (Specific PMS options are described in Section 2.4.3.)
- Separately, determine which MMS provides the best value in terms of addressing the agency’s MMS needs.
- If the same vendor provides the best value for both the PMS and MMS, then pursue Option 1.
- If different vendors provide the best value for the PMS and MMS, then consider the following issues:
  - **Potential efficiencies of using the same vendor.** For example, one benefit of using the same platform for both systems is improved
economies of scale related to IT support. IT staff would only have to learn to use one system and maintain one database, rather than two. This benefit was identified by the New York DOT, which is pursuing Option 1. However, other DOTs have different opinions on the magnitude of this issue. For example, the Mississippi DOT estimates that it takes less than one-half of full time equivalent (FTE) of IT support for its PMS. Caltrans conducted a detailed cost analysis as part of a PMS feasibility study. The agency assumed 2.3 FTEs for IT support during the initial two-year implementation period, and then 1.6 FTE after that. The Pennsylvania DOT felt that potential IT efficiencies were too minor to influence their overall systems strategy.

- **Potential efficiencies in the area of LRS integration.** PMS’ need to store data in a particular way in order to support the modeling process. They can integrate with an external LRS tool through routines that transfer external LRS data to their structure for use in the modeling process, and then transfer results back to the original structure so that they can be used as input into an external LRS tool. Depending on the LRS approach used by DOT&PF, Option 2 might require the development of two LRS integration processes, while Option 1 might require only one. This topic will be discussed further in future TAMIS deliverables.

- **Potential implications for business workflows.** The Mississippi DOT, which uses separate vendors for its PMS and MMS, described to the research team how the use of two systems has made their business workflows more complicated. The use of two separate systems has caused agency staff to add steps to its workflows that could likely have been removed had they used the same vendor for both systems. The research team spoke with one DOT staff member who suggested that this issue could be significant enough to drive an agency to a single vendor for its management systems.

- **Potential procurement issues.** For example, the Pennsylvania DOT described to the research team that one of the main drivers of its decision to pursue a PMS instead of a broader system was the State’s procurement regulations. The DOT would have lost the ability to select the PMS that best fit their needs had they expanded to other functionality.

- **The level of maturity of other asset management areas.** For example, the research team spoke with a staff member from the Arizona DOT who is procuring a standalone PMS. The agency felt that the potential cost and business process efficiencies enabled by a single system makes Option 1 the ideal solution. However, the DOT is pursuing Option 2 because it was ready for a PMS and not ready at this time to implement other types of asset management systems. Therefore, the agency’s plan is to integrate the PMS with additional systems over time.
Based on the consideration of the issues described above, conduct a tradeoff analysis to determine if Option 1 or Option 2 provides the best value for the agency.

**Recommendation #3.** When evaluating PMS and MMS options it is recommended that DOT&PF consider its management system needs in conjunction with the issues described above when comparing Option 1 against Option 2.

**Evaluating Option 3**

Option 3 would be the least expensive option. However, the ongoing cost of PERS would have to be considered. Beyond that, HERS-ST is available free from the FHWA, and the TAMIS functionality is consistent with what would be included in the other options. There would also be some costs and/or staff resources required to improve the project identification process.

The main benefit of Option 3 is that it would enable DOT&PF to improve its pavement management processes very cost effectively. For example, using HERS-ST for network level analysis would enable DOT&PF to support the budgeting and target-setting process in the short-term until resources are available for a new PMS. The main drawbacks of Option 3 is that DOT&PF would still not have a state-of-the-art PMS, and the consideration of maintenance activities during the project identification process may not be feasible. Although, it may be possible to incorporate these considerations into the new treatment recommendation process. For example, if maintenance treatments are captured by segment in the MMS, this information could be overlaid against the existing information in PERS, and the project guidance could be updated to reflect this addition. The integration of these data sets could potentially be done through TAMIS.

**Recommendation #4.** It is recommended that DOT&PF pursue either Option 1 or Option 2, unless the resources are not available. In this case, it is recommended that DOT&PF pursue Option 3 as a low cost alternative (or possibly interim) strategy to advancing its pavement management practices.

**Selecting a PMS**

Looking beyond PERS, the study team identified three commercial off-the-shelf PMS that are being used at that state level. In addition, some agencies, such as the Maryland and Michigan DOTs, have developed custom PMS. In addition, there is a variety of other PMS that have been implemented at the city or county level. Examples of these systems include Cartegraph, PAVEMENTview, CitiTech Management Software, and BlockviewPMS. The remainder of this
discussion focuses on the commercial systems that have been deployed statewide. These three systems are:

**AgileAssets Pavement Analyst**  
Vendor: AgileAssets Inc  
Website: www.agileassets.com  
Sample DOT clients: Georgia, New York, North Carolina

**dTIMS**  
Vendor: Deighton  
Website: www.deighton.com  
Sample DOT clients: Colorado, Ohio, Mississippi

**Highway Pavement Management Application (HPMA)**  
Vendor: Stantec Consulting Services, Inc  
Website: www.stantec.com  
Sample DOT clients: Arizona, Minnesota, New Jersey

Based on a literature review of these systems, it is our understanding that these three systems have several similarities, including:

- They represent the state-of-the-art in PMS functionality;
- They are customizable, commercial off-the-shelf systems;
- They are browser-based systems;
- The can be used with DOT&PF’s existing pavement data; and
- They provide compatibility with GIS software.

Since these systems were developed by different vendors, there are some differences in how the systems model pavements and recommend projects. However, many of these details are proprietary because they represent each vendor’s competitive advantage. Therefore, it is not possible to recommend one system over the other without finalizing the DOT&PF’s functional requirements and asking each vendor how their system could address them.

**Pricing**

Details regarding the pricing of these systems are also proprietary. However, the traditional pricing model for an off-the-shelf management system includes the following four cost components:

- **Initial Software Cost** – This is the cost to purchase the tool. It does not require customization and implementation services.
- **Annual Maintenance Fee** – This is the annual cost for the tool, which is often based on a percent of the initial software cost.
- **Annual License Fee** – This is a cost per user of the tool. Some vendors build this cost into the initial software costs, rather than calling it a license fee.
• **Implementation Cost** – This cost covers items such as developing custom reports, integrating the system with other agency systems, developing deterioration models, etc.

The study team found a couple of examples of the first three cost components. For instance, the New Mexico DOT executed a contract with AgileAssets in June 2012. This contract includes costs for a several modules, including pavement, bridge, fleet, maintenance, etc. The costs related to pavement are listed in Table 5.

**Table 5. Example AgileAssets Cost Structure**

<table>
<thead>
<tr>
<th>Component</th>
<th>Initial Software Cost</th>
<th>Annual Maintenance Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>System foundation (covers data structure, security, GIS interoperability, and other items)</td>
<td>$90,000</td>
<td>$18,000</td>
</tr>
<tr>
<td>Pavement Analyst</td>
<td>$131,950</td>
<td>$36,390</td>
</tr>
<tr>
<td>User license fee, per user for the first 5 users</td>
<td>$5,000</td>
<td>$1,000</td>
</tr>
<tr>
<td>User license fee, per user for users 6-20</td>
<td>$4,200</td>
<td>$840</td>
</tr>
<tr>
<td>User license fee, per user for users 21-50</td>
<td>$3,400</td>
<td>$680</td>
</tr>
<tr>
<td>The license fee continues to scale down until users 1001 and above</td>
<td>$400</td>
<td>$80</td>
</tr>
</tbody>
</table>

Source: Letter from the State of New Mexico to AgileAssets, dated June 29, 2012, regarding: Request for Proposals (RFP) #20-000-00-01508; Final Award.

The contract also lists the annual license fees, which vary based on the number of users, as illustrated in Table 6.

**Table 6. Example AgileAssets License Fee Structure**

<table>
<thead>
<tr>
<th>Component</th>
<th>Initial Cost</th>
<th>Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>User license fee, per user for the first 5 users</td>
<td>$5,000</td>
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</tr>
</tbody>
</table>

Source: Letter from the State of New Mexico to AgileAssets, dated June 29, 2012, regarding: Request for Proposals (RFP) #20-000-00-01508; Final Award.

Tables 5 and 6 reflect only three of the four cost components listed above. They do not account for the implementation cost. It is not possible to infer an accurate estimate for Alaska DOT&PF based on this example without looking at the details of the New Mexico DOT procurement and comparing them to Alaska’s
specific needs. However, this provides one data point. As another example, a price list provided by AgileAssets to the Ohio DOT in July 2012 includes an initial cost of $120,000 for the system foundation and $145,000 for Pavement Analyst. The study team could not find similarly detailed contracts for dTIMS or HPMA.

In terms of pricing, the largest unknown is the implementation cost. This cost will depend on a number of agency variables such as the extent to which custom forms and reports are required, the number of external systems that must connect to the PMS, etc. One PMS vendor mentioned that the implementation cost for a statewide PMS could range from a few hundred thousand dollars to millions. Some vendors have also developed additional pricing models for example, adding extra capabilities are included in the initial software cost, which in turn helps decrease implementation cost; and providing software leasing options. In addition, vendors are reluctant to provide details regarding their pricing structure outside of a formal procurement process to maintain their competitive advantage. To understand the true costs of implementing a new PMS, DOT&PF could request detailed procurement documents directly from state DOTs, such as California and Mississippi. These documents are not publically available.

Recommendation #5. If DOT&PF opts to implement a new PMS, it is recommended that it ask vendors through a Request for Information (RFI) to provide a range of potential costs, and to explain the main drivers of the costs.

Additional Implementation Considerations

As DOT&PF considers moving forward with a new PMS, the following implementation issues should be considered:

- **Building confidence in modeling results.** With any new management system, there can be a significant effort needed to create buy-in and confidence in modeled results. For example, DOT&PF’s bridge management system has been in use for several years. The DOT&PF’s Enterprise TAM Synthesis and Workplan recently identified the need for a $120-$200,000 effort to enhance its modeling capabilities in order to improve confidence in its results. Management systems can only be effective if decision-makers have confidence in their output.
Recommendation #6. Regardless of what PMS option DOT&PF pursues, it is recommended that the agency conduct an outreach effort to create buy-in for the new capabilities from regional staff responsible for recommending projects, and central office staff responsible for making budgeting and programming decisions. This topic will be discussed further in future TAMIS deliverables.

Recommendation #7. It is recommended that DOT&PF ask vendors through an RFI to describe the requirements for using existing pavement condition data to develop custom PMS models. For example, what steps are required to develop the models, and how can DOT&PF tell if their existing data are adequate for this purpose?

- Enhancing the budgeting and programming processes. Even if decision-makers have confidence in a management system’s output, the results and recommendations still may not influence the decision-making process. For example, the current pavement programming process relies heavily on the local knowledge and priorities of regional staff, and budgeting and prioritization processes at headquarters that are not well understood throughout the agency. The relationship between initial recommendations developed using PERS and the final list of pavement projects included in the State Transportation Improvement Program (STIP) is unclear. Implementing a state-of-the-art PMS cannot improve pavement decisions without a formal, transparent process that takes advantage its output.

Recommendation #8. Regardless of what PMS option DOT&PF pursues, it is recommended that the agency continue its efforts to update and document the budgeting and programming processes to take advantage of the new capabilities.
4.0 DRAFT Request for Information

One of the recommendations found in this Report is that DOT&PF formally solicit vendor feedback through a request for information (RFI). This Section presents draft materials for possible inclusion in a RFI for a pavement management system, a maintenance management system, and a fleet management system.

4.1 BACKGROUND

As part of its broader asset management efforts, the Alaska Department of Transportation and Public Facilities (DOT&PF) wishes to procure and implement three commercial management systems: a pavement management system (PMS), a maintenance management system (MMS), and a fleet management system (FMS). The overall objective of implementing these systems is to help DOT&PF minimize the life cycle costs associated with managing and maintaining its assets.

The purpose of this request for information is to solicit information from potential vendors regarding options for these three systems. In particular, DOT&PF is interested in better understanding the pros and cons of two potential implementation options: 1) procuring a single solution that can address the requirements of all three systems, and 2) procuring two or three different solutions based on a best-fit analysis for each individual component.

4.2 HIGH LEVEL FUNCTIONAL REQUIREMENTS

DOT&PF is currently considering the following functional requirements for each system.

Pavement Management System

1. The PMS shall provide on-line access to inventory and condition data to staff throughout the agency. (DOT&PF’s pavement network consists of about 4,500 centerline miles.) The system shall generate standard reports, enable users to perform custom queries, and provide map-based viewing of all data.

2. The PMS shall model future pavement deterioration based on current conditions, pavement type and design, age, historic conditions, traffic usage, etc.
3. The PMS shall recommend the location, type, and timing of pavement treatments based on life-cycle cost considerations and budget constraints.

4. The PMS shall consider previous maintenance activity when recommending treatments. This information (what work, when, and where) would be captured in the MMS (see requirements below) and be provided as input into the PMS.

5. The PMS shall perform network-analysis, and predict future pavement conditions based on different funding scenarios. For example, the PMS shall be able to answer the following types of questions: What condition can be achieved statewide in 10 years if the current pavement budget is held constant going forward? What budget is required to maintain existing conditions over the next 10 years? The PMS shall present this information in a manner that supports the budgeting process, and the development of condition targets, such as those required by the Moving Ahead for Progress in the 21st Century Act (MAP-21).

6. The PMS shall provide the above functionality using only DOT&PF’s existing pavement condition data. DOT&PF collects International Roughness Index (IRI), rutting, and cracking data on its entire network annually.

7. The PMS shall export a list of programmed projects to a MMS, so that they can be considered during the maintenance process.

8. The PMS shall integrate with DOT&PF’s existing geodatabase and linear reference initiatives, which are housed within the agency’s Division of Program Development.

**Maintenance Management System**

1. The MMS shall provide the capability for developing and analyzing yearly work plans to project manpower, equipment and material needs, using at a minimum, data from the Pavement Management and Bridge Management (currently Pontis) systems, and equipment fleet information (lifecycle estimates and cost) from the FMS system.

2. The MMS shall enable DOT&PF to develop equipment and materials budgets based on financial and budgetary data and information provided by the Administrative Services Section. The original source of this information is the AKSAS and ALDER systems.

3. The MMS system shall enable DOT&PF to develop and track work orders tied to specific assets and/or locations.

4. The MMS system shall track contract maintenance projects.

5. The MMS system shall compare contract vs. in-house maintenance costs.

6. The MMS system shall enable Alaska to maintain an inventory of Culvert, Sign, and Guardrail.
7. The MMS system shall integrate with DOT&PF’s existing geodatabase and linear reference initiatives, which are housed within the Division of Program Development.

Fleet Management System

1. The FMS shall provide on-line access to state equipment fleet inventory data to staff throughout the agency. The system shall maintain all information currently being collected for all state vehicles and equipment, including equipment number, year/make/model, VIN, location of equipment, owner of equipment, billing class (shop labor, replacement, parts, fuel, pool), lifecycle estimates, costs, historical information about equipment, etc.

2. The FMS shall meet federal (GASB 34 reporting) requirements for naming assets and depreciation.

3. The FMS shall provide management tools, query capabilities, and ad hoc/standard reports for tracking expenditures on vehicle/equipment (e.g., parts, materials, supplies, etc.), fuel usage, warranty and accident costs, billing data and status, maintaining inventory, work order tracking, calculating class average operating rates (shop labor, replacement, parts, fuel, pool), tracking cost trends to see if they are increasing or for use in benefit/cost analysis, and tracking billings by month. Users need to be able to run reports to answer the following types of questions: How much are vehicles costing? When should vehicles be replaced? How much does a particular work order cost?

4. The FMS shall interface with the Maintenance Management System to provide information on equipment and operating rates.

5. The FMS shall interface with AKSAS to track monthly billing status and provide information on operating rates, replacement rates, fuel usage, and billable work orders.

6. The FMS shall interface with the Station Profile system and exchange information needed to support analysis of the optimal amount of equipment at each station based on the number of operators.

7. The FMS shall integrate with DOT&PF’s existing geodatabase and linear reference initiatives, which are housed within the Division of Program Development, to facilitate tracking of vehicles and equipment.

8. The FMS shall provide sufficient data transmission rates for outlying areas such as Western Alaska or areas using StarBand satellite systems.
4.3 **REQUESTED ITEMS**

**System Functionality**

1. Provide an overview of the solution, including a description of which systems can be addressed by it (PMS, MMS, and/or FMS).

2. Identify which functional requirements can be addressed by the solution. Explicitly flag any requirements that cannot be met or that would be cost prohibitive to meet.

3. Describe system functionality that is not listed above that DOT&PF should consider.

4. If the solution can serve as a PMS, describe how it predicts pavement condition. For example, does it use a deterministic or probabilistic approach? Describe the process used to develop agency-specific deterioration models, and what types of data are required. How can DOT&PF determine if its existing data is sufficient for this purpose? Based on examples from other DOTs, describe the level of effort required to develop these types of models.

5. If the solution can serve as a PMS, describe the approach used to recommend treatments. What information and what level of effort are required to develop agency-specific recommendations?

6. If the solution can serve as a MMS, describe the capabilities (queries? reports? data extracts?) for extracting data from the pavement management, bridge management, and equipment management systems.

7. If the solution can serve as a MMS, describe the approach used to extract and/or integrate data from other Department legacy systems or other statewide systems (outside the ADOT&PF firewall).

8. If the solution can serve as a MMS, describe the functionality of the user interface. Is it capable of allowing edits for individual fields on a screen? Is it based on point and click of locations on a map to identify maintenance sections? Or is it based on route descriptions (begin and end points on route)?

**System Architecture and Linear Referencing**

1. Describe the system architecture of the solution. For example, what data management system does it use, how can it be integrated with other systems, etc. Provide examples of integration from other DOTs.

2. Describe how the solution can integrate with a DOT’s existing linear referencing system (LRS). Provide examples from other DOTs. Can linear referenced roadway events and attributes (e.g., pavement condition) be input directly into the solution without first converting the linear measures to an internal or proprietary LRS?
3. Does the solution include any mapping and/or geospatial analysis capabilities, or the ability to generate GIS-compatible output files? If so, what GIS-output files does it support?

4. Does your Asset Management software interface with ESRI Roads and Highways LRS Management software? If so, describe this interface.

**Cost Information**

1. Provide a range of costs for the solution, based on work by other DOTs. Provide separate ranges for initial costs and annual future costs.

2. Discuss the main drivers that will influence the final cost. What issues will determine where within the cost range the final cost lies? Provide enough detail so that DOT&PF can assess the costs and benefits of potential requirements.

3. Provide an estimate for the level of effort required by internal DOT&PF IT staff to maintain the system once it has been implemented. Also, describe any special training that is necessary, and the cost of this training.

4. If the solution can serve as more than one of the systems described above (PMS, MMS, and FMS), describe the cost implications of implementing a single solution versus multiple solutions. Describe in terms of external costs and internal resources needed to support the solution.

**Other Information**

1. Describe any other issues that DOT&PF should consider as it develops an RFP.

2. Provide a list of agencies that have implemented the solution, and three client references.
TAMIS Implementation Plan

and Summary of Research Recommendations

Report

prepared for

Alaska Department of Transportation and Public Facilities

prepared by

Cambridge Systematics, Inc.

September 23, 2015
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date
September 23, 2015
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Introduction

This implementation plan provides a set of recommendations for incorporating asset management concepts throughout the agency. It provides a road map for ADOT&PF to use as it moves forward and addresses critical process and system issues related to systems and data to support asset management.

Alaska Department of Transportation & Public Facilities (ADOT&PF) has experienced many challenges in the management of data and application systems to support Transportation Asset Management (TAM) decision-making across the Department. The Transportation Asset Management Information System (TAMIS) research project identified gaps and made recommendations related to data and information functions to support all asset management processes. Following recommendations and structure provided in the AASHTO Transportation Asset Management Guide, Section 8.4.2 and in NCHRP Report 666, the purpose of this document is to provide ADOT&PF with a summary of recommendations and a complementing Implementation Plan for TAMIS.

Many challenges identified in research for the TAMIS project could be addressed through improved data management practices provided in the reports supporting the project. The following list is a brief overview of all tasks showing how they contributed to the development of TAMIS:

- *The Project Management and Work Plan* (Task 1) developed an outline of tasks and a schedule for the entire TAMIS project.
- *Federal Requirements and Associated Research* (Task 2) researched, complied, and analyzed current Federal requirements and literature related to the development of a TAMIS.
- *Other State’s Best Practices* (Task 3) researched and summarized noteworthy practices in other states with respect to asset management planning, data integration/management and data governance.
- *Stakeholder Coordination* (Task 4) resulted in a Vision and Components report that clearly identified the goals for TAMIS
- *Evaluate Current Systems and Extent of Integration* (Task 5) included documentation and assessment of the Department’s current state for Data and Information Systems the details collected in this task were used to analyze maturity and support much of the work in later tasks of the project.

---

1 AASHTO Transportation Asset Management Guide: A Focus on Implementation
2 NCHRP Report 666: Target-Setting Methods and Data Management to Support Performance-Based Resource Allocation by Transportation Agencies

Cambridge Systematics, Inc. 1-1
• **Develop ADOT&PF TAMIS Framework** (Task 6) utilized what was learned from the current state evaluation to develop a desired framework for TAMIS.

• **TAMIS Gap Analysis** (Task 7) further assessed ADOT&PF’s data, data programs and information systems to identify gaps, provide recommendations, and describe measures that could help address gaps.

• **Research TAMIS System Model Alternatives** (Task 8) provided several options for a TAMIS, discussed pros and cons, and recommended the optimal model for ADOT&PF.

• **This Task - Research Recommendations for TAMIS** (Task 9) prioritizes key recommendations identified in all TAMIS tasks and includes the action plan for implementing TAMIS.

• **TAMIS Project Communication Plan** (Task 10) deployed strategies to encourage collaboration and a shared ownership of the TAMIS research project by stakeholders and key decision makers.

• **The Data Business Plan** (Task 11) established business rules and data quality expectations to guide enterprise improvements to data and information practices.

• The **TAMIS Proof of Concept** (Task 12) demonstrated and validated concepts of integrated data and data management improvements using a subset of ADOT&PF’s asset management data.

• The **Data Governance Manual (DGM)** (Task 13) is a document that supports the Department’s Policy and Procedure for Data and IT Governance and this DBP by defining the data governance model for ADOT&PF and lists the actual standards, policies, procedures.

The **TAMIS Executive Summary** (final report) provides a brief summary of all TAMIS tasks and links to all reports or deliverables for the project.
1.0 Asset Management at ADOT&PF

1.1 Definitions

**Asset Management** - The American Association of State Highway and Transportation Officials (AASHTO) defines asset management as 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 on quality information and well-defined objectives.”

AASHTO’s Asset Management Guide states “a mature asset management program is fueled by consistent, high quality, integrated data and processes for transforming data into information that influences decision making at tactical, operational and strategic levels.”

**Business Owner** - A subject matter expert accountable for the data specifications, data quality and information delivery of specifically assigned business areas, subject areas, or databases.

**Data Business Plan (DBP)** – Documents business rules and data quality standards for the information systems that support TAMIS which will result in improved asset management decision-making at ADOT&PF.

**Data & IT Governance Council** - Established in the Data and IT Governance P&P, this council comprised of several division directors serves as the primary “governing body” for the management of data systems.

**Data & IT Governance Work Group** - ADOT&PF’s Data Governance Work Group is comprised of Business Owners and System Owners who provide expertise on business area data requirements, help establish business rules, and participate in the management of the Department’s Data Governance Manual.

**Data & IT Governance Policy & Procedure (P&P)** – Describes expectations for Data and IT Governance for all ADOT&PF employees. The P&P provides structure and authority for data related activities by:

- Supporting and enforcing the roles and responsibilities, data governance principles, practices, procedures, and standards described in the approved Data Governance Manual;
- Establishing the Data and IT Governance Council and Data and IT Governance Work Group;
- Formalizing Data Governance Principles to be applied at ADOT&PF.
Data Governance Manual (DGM) - A manual to provide a single source of information for all staff on the standards, policies, and procedures regarding the use of data and data programs at ADOT&PF.

System Owner - Information System and Services Division professional(s) supporting the technical and functional aspects of data management and information delivery for specifically assigned business areas, subject areas, or databases.

Transportation Asset management Information System (TAMIS) – a data system that encompasses both existing and future data in various systems, representing a collection of hardware, software, data, and processes that support comprehensive transportation asset management efforts at the agency. In practice, Alaska’s TAMIS will enable the collection, synthesis, and maintenance of data from multiple sources.

1.2 Scope

Transportation infrastructure assets are the physical elements, such as pavements, bridges, culverts, signs, pavement markings, and other roadway and roadside features that comprise the highway infrastructure network. An important component of an effective asset management program is the existence of an inventory of infrastructure assets by type and condition. Following is a list of assets (grouped by asset type) that ADOT&PF currently manages or may want to consider as part of their asset management program.

Note: Some of the assets listed are data assets that would support analysis and decision-making for an asset management system.

Administrative & Finance
- Funding data (Federal Aid, Project Control)
- Knowledge management (eDocs)
- Performance measure data
- Planning data (STIP, 10-year, LRTP)

Airports
- Airport pavement
- Aviation system data

Bridge
- Bridges
- Large culverts
**Environmental & Preconstruction**
- As-built data
- Project design data
- Wetlands data

**Equipment**
- Vehicle fleet
- Equipment fleet

**Facilities**
- Buildings

**Materials & Geotechnical**
- Material sites inventory
- Retaining walls
- Unstable slopes data

**Maintenance & Operations**
- Guardrails
- Signs
- Pavement markings
- Culverts (may be included in both bridge and M&O data)
- Maintenance action data (stations)

**Marine Highways**
- Fleet condition
- Shore condition
- MSCVE permit data
- Commercial vehicle data

**Roads & Highways**
- Linear reference system (LRS)
- Highway designations data
- Weigh in motion
- Road weather data
• Intersections
• Pavement condition
• Milepost locations
• Rail crossings
• Driveway locations
• Traffic data (speed zones, AADT, PTR locations)
• Tunnels
• ADA inventory (sidewalks, pedestrian facilities)

Safety

• Crash data
• Safety improvement (planning & projects) data

Some assets (including several data assets) still need to be evaluated and prioritized; and a determination needs to be made on how (or if) they should be managed by ADOT&PF. Since not all of the assets managed by ADOT&PF have sufficient data to support analysis in TAMIS, some listed here are not included in the implementation plan other than a possible recommendation that the Department consider developing them for future inclusion in TAMIS.

1.3 ASSET PROCESSES

There are generally two major types of asset management functions performed by a state DOT; they are asset specific or cross asset.

Asset Specific Processes

Asset specific processes refer to functions that are necessary for each asset to meet the needs of the business area. These are:

1. Inventory
2. Asset condition, performance and tracking
3. Prediction of condition and performance
4. Life cycle management
5. Resource allocation and work planning
6. Reporting

Asset specific processes for all systems managing data needed for TAMIS should be evaluated, documented, and reported in an accessible location following the standards and methods described in the DGM. This will allow designated data governance teams (described in Section 1.4) the opportunity to review each area
that supports TAMIS to look for efficiencies in processes and decide on the best method for data integration to support TAMIS.

Cross Asset Processes
These analyses support overall asset management decisions that lead to desired outcomes, promote wise investment of resources, and promote credibility and transparency of investment decisions. The following types of asset management decisions benefit from cross asset processes:

- **Programming** – Conducting tradeoff analysis in order to allocate funds to program areas, and establish performance targets
- **Strategy** – Evaluating activities within asset groups (e.g. preventative maintenance)
- **Project** – Prioritizing assets and/or projects
- **Project Development** – Designing projects and evaluating project alternatives (e.g., conducting life cycle cost analysis)
- **Policy** – Evaluating AM policy issues (e.g., understanding the implications of increasing truck weight limits)

The TAMIS research project identified several specific data queries that would help with asset management decisions. The focus on cross asset processes is to provide the ability to use trusted data and analysis tools to quickly run queries and use the results to make informed decisions.

### 1.4 Data Governance Teams

One of the most important recommendations for TAMIS is to make organizational changes that establish roles and responsibilities for data management/governance. **To encourage coordination for data management and integration each major system for TAMIS needs representation by both a Business Owner and System Owner point of contact.**

The Data and IT Governance P&P establishes two teams to support data governance activities. They are the Data and IT Governance Council and the Data and IT Governance Work Group. The Council provides oversight and conflict resolution while the Work Group will coordinate most of the specific data management activities and advise the council. Both teams support partnerships between Business Owners and System Owners on data related projects, issues, and decisions.

**Data and IT Governance Council**
The Data and IT Governance Council is introduced in the Data and IT Governance P&P and described in detail in Section 4.2 of the Data Governance
Members of this group are high level managers including the Department’s Administrative Services Director, Information Systems, and Services Director, each Regional Director and all other division directors. For the Implementation of TAMIS, the Council’s responsibilities include approval and enforcement of procedures, standards, and manuals for data management, oversight of the Data and IT Governance Work Group activities, and conflict resolution on data management issues as necessary.

Issues that will affect policy, procedures, standards, and/or processes should be presented to the entire group for discussion and final decision.

**Data and IT Governance Work Group**

The Data and IT Governance P&P also establishes a Data and IT Governance Work Group that is described in detail in Section 4.2 of the Data Governance Manual. The Data and IT Governance Work Group should include the members of the Transportation Asset Management Data Integration Team (TAMDIT) that worked on this TAMIS project and should be expanded to add Business Owner and System Owner points of contact that can represent each data system included in TAMIS.

The Data and IT Governance Work Group should be thought of as a “sounding board” for all data related issues, ideas, and requests. The Council can assign members to specific tasks as appropriate or have the team work together as a large group when necessary. The vision of the group is to research the technical aspects of issues, ideas and requests, and use their subject-area expertise to provide informed recommendations to the Data and IT Governance Council.

Responsibilities for the Data and IT Work Group for TAMIS Implementation include:

1. Maintain and revise (as needed) the Data Governance Manual and distribute the manual to all staff at the department with presentations and training according to the Implementation Plan.
2. Help to research and prioritize business needs of the Department as requested by the Council and identify the data programs that support those business needs.
3. Research requests to develop new applications and/or enhancements to existing applications to support business operations of the Department.
4. Meet as needed, to discuss and resolve issues related to developing information systems for the Department.
5. Conduct outreach meetings for Users/Stakeholders for the data programs that support the business operations of the Department.
6. Populate and maintain a dataset registry and audit on an annual basis. Coordinate with ISSD on linking data sets to cataloged systems.

Note – All of the above responsibilities should be assigned by the Council as appropriate.

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3 [ADOT&PF Data Governance Manual](#), August 2015.
ADOT&PF needs to establish a workflow to ensure that The Data and IT Governance Council makes the final decision on data governance processes and standards to be included in the Data Governance Manual.

1.5 ADOT&PF Asset Management Framework

Figure 1 is the Asset Management framework that has guided the overall definition of TAMIS for this project. It includes a collection of hardware, software, data, and processes. As shown in the diagram, the requirements of the TAMIS Framework include three basic components:

- Data Sources – Systems, databases, or tables that manage information for Department business areas.
- TAMIS - Integration of key data (from data sources) to support asset management decisions.
- Asset Management Decisions – Analysis, reporting and decision-making capabilities such as applications, analysis tools, services, and reports.

Figure 1: TAMIS Framework Diagram
The following sections describe the 3 main components of the Framework in detail.

1. Data Sources

The Data Sources part of the TAMIS framework identifies the major systems and data that support TAMIS and supported the task that evaluated each for level of importance using Tier levels (defined below). This implementation plan focuses on Tier 1*, 1 and 2. Tier 3 are not directly related to asset management, but may have information useful for the decision-making process.

The Tier level definitions used are the following:

**Tier 1** - A critical core system that supports enterprise asset management (integration) although the system itself is NOT an asset management system (e.g., Roadway Data System).

**Tier 1** – A critical, core system that supports enterprise asset management decisions.

**Tier 2** – A system that supports business area asset management decisions and interacts with other data systems.

**Tier 3** – A system that supports a business area, not directly related to asset management.

Systems and data sources are a moving targets because they are constantly subject to change to meet the evolving needs for decision making (including data management tools, data services, analysis capabilities, and reporting functions). To better manage change, a process for developing and maintaining a centralized inventory of systems, data sets and supporting metadata for each needs to be the starting point. To support this TAMIS Research Project, an inventory of systems and data was researched, evaluated, and prioritized. The Data System Details and Recommendations section in Chapter 2 of this report provides a more detailed description of each system based on TAMIS research and recommends integration strategies for each. This builds upon research in the TAMIS Data Systems Evaluation Report (deliverable of Task 5) and recommendations from TAMIS framework (Task 6), TAMIS Gap Analysis (Task 7), TAMIS System Model Alternatives (Task 8), the TAMIS Data Business Plan (DBP) (Task 11), and the TAMIS Proof of Concept (Task 12).

Based on further research and findings, Figure 2 shows systems that manage data needed for TAMIS (data sources), their Tier scores (described above) and lists some of the specific asset data they might contribute.
The asset specific processes currently take place within the data systems shown above. Some of these systems are already organized and deploying integrated data strategies. These are described in detail along with any suggestions for improvement in the Data System Details and Recommendations section in Chapter 2.

2. TAMIS

The focus on this research effort has been on the TAMIS part of the framework. TAMIS is a set of business processes and integration tools that allows for cross asset queries and analysis to support data-driven decision making.
The goal for Alaska’s TAMIS is, “A TAMIS that meets the needs of stakeholders by integrating data and establishing institutional methods to ensure that integration results in improved decision making for TAM.” The TAMIS objective is, “Transformation of data into information to fulfill the needs of TAM in Alaska.”

The intended functions of TAMIS are to:

1. Integrate data
2. Convert data to information
3. Provide decision makers with access to data
4. Bring decision makers together

**Business Processes**

To build a TAMIS for ADOT&PF, the Department should follow recommendations for improvements to address the following types of challenges:

**System** – Evaluate and develop datasets, databases, and storage media.

**Technical** - Address technology infrastructure and/or functionality issues.

**Institutional** – Focus on people, business processes, organizational structure improvements.

**Enterprise Level** - Look for ways to create efficiencies in processes related to asset management across the Department.

The TAMIS Data Business Plan (DBP) lists several challenges in each of these areas and provides recommended solutions. The key recommended solutions are included in the Action Plan (Chapter 3) of this report. The Recommendations Summary (Chapter 2) of this report addresses recommendations made in other reports as part of the TAMIS project and describes the ADOT&PF solution for each.

The recommendations will guide ADOT&PF in:

- Knowing what needs documentation.
- Implementing institutional policies and governance needed for TAMIS.
- Providing a single resource for data standards.
- Defining the roles, responsibilities, accountabilities related to data governance at ADOT&PF.
Integration Tools

Once business process improvements are identified and improved to facilitate integration, tools can be deployed to query, combine, and format data needed for TAMIS so it can be used in a variety of analysis tools and applications. Integration tools are software and applications used to manage structure and combine data; these are also referred to as database management systems (DBMS). Some examples are linked spreadsheets (Microsoft Excel), database software (Microsoft Access), business intelligence software (IBM Cognos) and GIS (ESRI ArcGIS).

The overall goal the implementation of TAMIS is to follow recommendations that will align business processes, standards, and policies to allow for integration of the data needed for decision making. TAMIS integrates data, converts it to information, and provides decision makers with access to it.

3. Asset Management Decisions

The primary reason for investing in data collection, quality control, data management, and data improvement activities is to support the development or maintenance of reliable tools to analyze information to make data-driven decisions. ADOT&PF has been working on data business planning activities to support several key business areas for several years and is now expanding beyond core business areas to work on planning at an enterprise level. To “make the case” for collaboration and centralization of data management activities, it helps to show the benefits in the form of better data analysis capabilities with complete, current data and tools that meet a variety of needs. Some recent examples are:

GIS Tools:

- **Roadway Information Portal (RIP)** – Developed mainly to serve the needs of the Division of Planning and Program Development, RIP is the replacement tool for the former Highway Data Port which read roadway data from a mainframe database that has recently been retired. The GIS group worked with staff in planning to ensure the tool met their needs and have ongoing projects to enhance its capabilities to meet new needs or simplify tedious processes. Since the GIS team is no longer limited to working on GIS capabilities that serve only program development (due to Department restructure), it is highly possible that the Department could choose to invest in some enhancements to the tool to serve needs of other business areas. RIP builds on the Department’s LRS system, is integrated with the roadway data collection and photo log program, interfaces with the internal web mapping application (STAR), and is configurable and expandable.

- **Spatial Transportation Applications and Resources (STAR)** – STAR is the Department’s internal web-based GIS application developed to support planning and project development needs. The STAR application works much like GIS software in allowing interactive, map-based queries and analysis using data managed in the Department’s Roadway Data System geospatial
database. STAR integrates with Google Street View, the data collection program and photo log, and links to specific details through the Department’s LRS.

- **ArcGIS Online** – This newly-deployed capability allows for sharing of published roadway data features with both internal staff and the public. Published Alaska DOT roadways and associated data features easily link to other Departments and even nation-wide data to be displayed on-the-fly in a user defined map.

- **ESRI Roads & Highways** – This GIS software application is being tested and eventually deployed to help the limited GIS staff manage the LRS and at the same time allow users in the Department access to the latest version of the LRS to reference and manage their own business area data related to it.

- **TAMIS Proof of Concept (POC)** – The POC demonstrates how integrated data could better support an asset management program at ADOT&PF. Although some of the functionality of the POC could be handled with existing tools; there are many details and nuances that would be best handled with a separate application to specifically serve the asset management program at ADOT&PF. The POC used published data from several TAMIS data systems and integrated it in a temporary data warehouse to make a tool that would answer specific asset management queries and display data in a number of ways for analysis.

ADOT&PF should continue to maintain and improve existing tools for data analysis; specifically those that could be expanded or enhanced to serve as enterprise applications. In addition, any efforts to improve or replace legacy systems such as those used for pavement, maintenance, and equipment should be pursued to support the current focus on implementing improved business processes and data management strategies that enable integration and analysis for cross asset processes.

Before procurement of new tools or software for analysis functionality desired for a TAMIS, it is recommended that ADOT&PF perform a detailed requirements gathering process that includes detailed documentation of all data, queries, visualization (e.g. mapping) functionality, and reporting capabilities needed for TAMIS. A key part of that documentation should be understanding what the system of record (the system that “owns” and manages the data) for all TAMIS data sets is and ensuring that the functionality desired of that data is not already available. Data users and stakeholders should be directed to (or be able to easily identify) the correct system analysis tool for more detailed analysis. Centralizing tools and applications sponsored by the Department in a web-based information portal may help with this issue.
2.0 Recommendations Summary

This chapter is a summary of recommendations from the TAMIS Gap Analysis (Task 7) report in Section 2.1 followed by system specific summaries and recommendations. The Action Plan in Chapter 3 of this report presents ADOT&PF with a prioritized list of recommendations and schedule for implementing TAMIS based on the results of the summary of all recommendations in this chapter. The Action Plan takes into account accomplishments and changes that have addressed recommendations from the Gap Analysis.

2.1 GAPS, RECOMMENDATIONS AND SOLUTIONS

The Gap Analysis Report (TAMIS Task 7) makes recommendations on specific issues that need to be addressed to move forward with the development of a TAMIS. The following sections list system, technical, institutional, and enterprise recommendations from the Gap Analysis (in bold), followed by what needs to be done (or has been done) to address them.

System

Data Collection

Procure and utilize automated data collection equipment (where feasible) to supplement current manual data collection methods or to capture data where needed for missing data items.

- **Solution:** A data collection contract is in place that includes extraction and processing of certain roadway data features and pavement characteristics. The contract includes photo logs and LiDAR along with tools for extracting data manually as needed.

Storage Systems

Consider utilizing other data storage systems (such as enterprise databases and data warehouses) accessible across the agency.

- **Solution:** The Department reorganized IT functions and a plan is in development to address storage, data management, hardware, and software issues.

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http://www.dot.state.ak.us/edocs_code/edocs_document_relay_nativefile_bydocname.cfm?ddocname=DOT-JNU_062065&inline=1
Data Quality

Implement data standards as part of a Data Business Plan (DBP) and implement common data definitions for each TAMIS system as part of a Data Governance Framework to improve data quality across all TAMIS applications.

- **Solution:** To support TAMIS and improved data management at the Department, a new Policy and Procedure for Data and IT Governance is adopted and is supported by a Data Business Plan (DBP) and a Data Governance Manual (DGM).

Documentation

Provide documentation that includes, at minimum, data dictionaries, user manuals, and data catalogs. Develop an ADOT&PF Data Registry to capture and document information about other data systems in the Department that are not part of a TAMIS Data Catalog.

- **Working on Solution:** As part of the TAMIS research project, a data and systems catalog was started and documented in the TAMIS Data Systems Evaluation Report (Task 5). In addition, a web-based data and information systems catalog was started to help maintain the inventory of systems and data sets at the enterprise level.

Reporting Needs

Utilize new technology and business intelligence tools to facilitate ad-hoc reporting in a timely, efficient manner to meet needs of users.

- **Solution:** ADOT&PF business areas understand their reporting requirements and update their area specific reporting tools and data as necessary. A process has been established to evaluate requests for new software through the Information Systems and Services Division (ISSD) to ensure procurements do not duplicate capabilities already available.

Legacy Systems

Identify and prioritize systems that should be replaced with new applications that integrate data and introduce new functionality that makes key data for asset management accessible to users on an enterprise basis.

- **Working on Solution:** Steps have been taken to provide enterprise level tools that are designed to be expandable to meet as many analysis and reporting needs as possible. In addition, some systems and a database structures have been targeted for replacement and/or upgrade (pavement, maintenance, equipment, highway analysis system).
System Access

Identify stakeholders needing access to asset management systems and authorize the access where needed.

- Working on Solution: The data and information systems catalog can be further developed to document the access levels required for business owners, data stewards, and stakeholders (users) for all registered systems. In addition, the TAMIS project has fostered collaboration between business areas making it easier to identify stakeholders and user requirements.

Technical

System Interfaces

Develop automated interfaces to replace existing manual processes where they exist.

- Solution: ISSD is monitoring and evaluating needs for servers, workstation platforms, and data transmission networks to support automated data tools/solutions at the enterprise level.

Link to Geospatial Data

Develop a Department GIS Enterprise Plan that establishes the policies and standards for management of enterprise level GIS data. Utilize available Department geospatial data where feasible to implement a geographic link from the source asset management database to the Department’s enterprise geodatabase.

- Solution: To better meet the technology needs of the Department (including GIS capabilities) ISSD was formed and the GIS staff are now working in that division. Standards for GIS, location referencing and integrating data through spatial attributes are described and maintained in the DGM.

Technology tools (hardware/software)

Procure the necessary hardware, and develop (or outsource the development of) the necessary software to improve transmission and management of data needed for asset management at ADOT&PF.

- Working on Solution: The TAMIS research includes recommendations to improve and manage asset data and tools for decision making and analysis purposes. The TAMIS proof of concept demonstrates desired functionality which can be further developed into a functional system once data management strategies are implemented at ADOT&PF.
Functionality

Develop system requirements for adding new functionality to an existing system or developing an entirely new system to support asset management needs at ADOT&PF.

- **Working on Solution:** The TAMIS project has documented some of the requirements for an asset management system. As part of TAMIS implementation, ADOT&PF will need to conduct a more extensive requirements gathering process which will include continued engagement with business owners, system owners and primary stakeholders to ensure that all need functionality is incorporated.

Data Integration/Data links missing

Utilize the data integration points identified in TAMIS Task 5 and Task 6 reports to develop automated links for the integration of, or transfer of data between systems and for display in COGNOS, where applicable.

- **Working on Solution:** Data integration strategies will need to be discussed and agreed upon for each system and data set required for asset management by the Data and IT Governance Work Group and approved by the Data and IT Governance Council established in the P&P for Data and IT Governance. Where possible, recommendations are made in this report and they may need to be re-evaluated as systems are upgraded. New systems should be required to address integration issues in advance of deployment.

Institutional

Business rules needed

Establish business rules for collection and use of data needed to support asset management. Business rules should be established in coordination with data business owners, and managers needing specific data systems to support their business needs. Business rules should be formalized in a DBP and made available Department-wide through a document management system, such as eDocs.

- **Solution:** The TAMIS DBP, P&P for Data and IT Governance and the supporting DGM establish and describe data business (including definition of roles and responsibilities) for the collection, management, and use of data for asset management and other enterprise data systems.

Limited User Groups

Develop Communities of Interest (COIs) for application systems. The COIs include all stakeholders (users, data providers) that have a business interest in information from a particular data system. COIs can be comprised of internal and external ADOT&PF staff.
• Solution: The Transportation Asset Management program established at the Department is supported and guided by several stakeholder teams. These teams have representation from several program areas that have interest in the data systems and integration strategies for enterprise data management.

Governance needed for data management of TAMIS systems
Establish a Data Governance Framework, enforced by Policies and Procedures and outlined in a DGM or DBP, for use Department-wide.
• Solution: As part of the TAMIS project, a Data Governance Framework was established, a P&P for Data and IT Governance is proposed, and a DBP and DGM supporting Department-wide data management improvements have been delivered.

Coordination across business lines
Establish business rules under a DBP for coordination and communication of data and information across business lines.
• Solution: A DBP and DGM define Roles and Responsibilities and establish teams to ensure coordination across business areas of the Department.

Information to decision makers
Utilize existing COGNOS system to continue development of ‘cubes’ which can organize data in an efficient way to provide information to decision makers (including data for performance measures and targets).
• Working on Solution: The capabilities of COGNOS are being explored for use in data analysis beyond the current use to support performance measures and other business area needs.

Define system ownership, stewardship roles/responsibilities
Establish a data governance structure that includes the documentation of ALL roles for data governance within the organization. Document the data governance structure and framework in a DGM.
• Solution: The P&P for Data and IT Governance, the DBP and the DGM document and explain Roles and Responsibilities in data governance.
• Working on Solution: Establish partnerships between business and system owners on data matters that may affect multiple business areas.

Limited resources
Reallocate resources as available between business units to meet needs, or supplement existing staff with consultant services.
• *Working on Solution:* Department structure and resources are being assessed to determine efficiencies and possible re-allocation of resources.

Training needs

Develop training targeted for data collectors, data processors, and users of application systems.

• *Working on Solution:* As new strategies are deployed, the Department should develop and deliver appropriate training as necessary.

Enterprise-Level

Adequate IT Infrastructure to support enterprise-wide database integration

Conduct a system-wide review of the IT infrastructure with respect to enterprise-wide database integration requirements

• *Working on Solution:* ISSD is currently working on this. TAMIS Research and other initiatives at the Department support the effort through several recommendations and system architecture reports for enterprise data management and GIS development.

Role of GIS in agency-wide data integration

Develop an Enterprise GIS Plan to document the databases, business processes, and tools used to manage enterprise GIS data for the Department.

• *Working on Solution:* The GIS group is now a part of ISSD and tasked with documenting the database, business processes, standards, and enterprise GIS tools as part of the plan to migrate the LRS and data integration tools to a new commercial off the shelf Solution. Changes to standards and processes that affect enterprise data integration and management will need to be collaborated with key members of the Data and IT Governance Work Group, approval by the council, and documentation in the DGM.

Windows and ArcGIS support

ADOT&PF should consider funding positions that can support the maintenance and administration of Windows and ArcGIS server platforms.

• *Solution:* The restructuring of the Department and moving the GIS functions to ISSD has created the opportunity for re-purposing some positions and making changes to IT processes.

Information Resource Manager Position

ADOT&PF should consider hiring an Information Resource Manager position to oversee and coordinate management of information resources across business units within the agency and to manage distribution of information to external agencies.
• **Solution:** The restructure of the Department and moving the GIS functions to ISSD addressed this recommendation.

**Data Collection**

Implement data collection policies and procedures for existing and new applications (e.g., culverts, guardrails, sign inventories) that defines data collection procedures at a precision level that is usable across multiple applications and that has strict standards regarding data quality.

• **Solution:** The GIS group in ISSD maintains responsibility for the data collection contract. Consult the GIS group to address data collection needs on an individual basis.

**System Integration – make integration more efficient between systems**

Utilize Oracle Data Integrator Enterprise Edition and similar tools to facilitate integration.

• **Working on Solution:** ISSD is evaluating and exploring options for tools to facilitate efficient integration and exchange of data between systems.

**Data linkage and data governance**

Utilize data governance framework to define link between data systems and the support they provide for business functions across the Department.

• **Working on Solution:** Recommendations are included in the TAMIS research project.

**Identify single source of information for projects funded and planned**

Document in a Data Catalog the primary source of information (data system) used for projects funded and planned.

• **Working on Solution:** Recommendations are included in the TAMIS research project. The proposed data and information systems catalog can be configured to do this.

**TAM and Performance Measures**

Define performance measures (PMs), where none exist, for asset management applications, especially those that are identified as TAMIS level Tier 1 applications. Establish targets for the PMs monitored through COGNOS.

• **Proposed Solution:** Business Owners and System Owners of each Tier 1 asset management system should collaborate to develop internal PM’s for their systems.
Bridge and Maintenance projects

Develop standard reports for use by bridge and maintenance engineers regarding planned, scheduled, and ongoing bridge and maintenance projects. Reports should be able to pull information from both applications and display information in the same report to provide cross-asset comparison of data and information regarding those type of projects.

- Working on Solution: Business and System Owners of the Bridge Management System and the Maintenance Management systems should work together to assess the requirements for standard reports, develop them based on defined needs, then ensure they are the standard for all to use by documenting in DGM.

Deferred maintenance work

Develop and implement a new data system or identify an existing system (e.g., MMS) to store data on state funded deferred maintenance work. Develop standard reports that can be generated (by authorized users) from this system to provide information on deferred maintenance when needed.

- Working on Solution: The Department is investing in a new system for Maintenance and Operations. It is likely the system chosen will manage data for deferred maintenance work and will be able to produce standard reports as defined by authorize users. The Business and System Owners of the new system for Maintenance should coordinate with maintenance representatives in the Data and IT Governance Work Group to develop standard processes and document them in a centralized knowledge management system.

2.2 DATA SYSTEM DETAILS AND RECOMMENDATIONS

This section provides details about each system evaluated for TAMIS including descriptions, integration points, and specific recommendations (in bold) related to TAMIS implementation.

Tier 1*

Roadway Data System (RDS)

RDS is the system that maintains the Department’s Linear Reference System (LRS) and Geographic Information System (GIS) capabilities. Much of the data collected for and managed in RDS supports the Highway Performance Monitoring System (HPMS) requirements and meets analysis and reporting needs for traffic, safety and planning business areas. The RDS system supports asset management integration through standard location referencing methods.
and by providing simple access to some of their already integrated assets such as bridge, safety (crash locations) and traffic data.

Integration with RDS requires review and prioritization based on the value of the data for GIS applications and other business areas and by the data management strategy. The location referencing method chosen will depend on what is most appropriate and what will efficiently meet the most needs. The RDS system has data management tools and applications that can link data by location through the following methods:

Linear:
- CDS Number, From Milepoint, To Milepoint

Point:
- CDS Number, Milepoint
- Latitude/Longitude
- X/Y coordinate

Area:
- Polygon Boundaries (Jurisdictional, Political, DOT Regional, Maintenance Areas)

Data from other systems link to RDS using a unique ID (e.g., Bridge ID, Pavement Section ID, and Project ID) and a location reference. Depending on the method used, linking to RDS can enable integrated system data sharing via GIS tools and applications.

The most efficient method of integration with RDS is through the LRS. As much as possible, all data should be linked this way. The software tools used to manage RDS will soon provide users with web-based access to manage and edit their own data referenced to the LRS, making it easier and more efficient to keep data synced and current. Using this method will ensure that data managed using the LRS tools will be updated when the LRS changes or is updated.

The RDS system also provides GIS data services used in other systems. This can be accomplished in a number of ways and they should be planned and coordinated for key asset management systems such as pavement, traffic, and maintenance to avoid duplication and versioning issues.

Recommendations:

- Support the implementation of the enterprise GIS tools and applications that will allow systems to manage data linked to the LRS most efficiently.
- Ensure all systems are using the same location referencing techniques as RDS.
- Coordinate with GIS staff on all data proposed for integration with TAMIS to get help with location referencing standards.
- Document the data integration and location referencing method and include metadata such as business case, update cycle, ownership and any other technical or management details.

**Tier 1**

**Bridge Management System**

The Bridge Management System manages a detailed inventory of information about all bridges in Alaska. Information collected during inspections, design, construction and maintenance of bridges is included in the system. Information needed for the National Bridge Inventory (NBI) is derived from this system and processed through calculations to meet federal reporting requirements. Much of the information managed by bridge engineers is detailed and specific to meet the needs of bridge design, construction, and maintenance. The system is secure and tracks ongoing activities not ready for publishing and analysis tools. Since there is no accessible system for analysis of bridge data, the GIS database meets the Department’s needs by incorporating certain details on bridges (currently only location, name, ownership, and bridge number) in the GIS database (Roadway Data System (RDS)).

The main integration points for asset management are bridge number and locations currently managed in RDS. Secondary data that may be useful for asset management could include approach rail, bank protection, debris, approach fill, seismic retrofit, wingwall, utility, traffic impact, bridge condition, load rating, clearances (vertical, horizontal), geometry, scour, ice or debris buildup, fatigue, cost and value information.

**Recommendations:**

- For asset management purposes, adding additional (published) bridge data would be useful. This should include information such as ownership, management responsibility, and condition ratings (as reported in NBI) linked to the GIS database through structure ID and location reference.
- The asset management representatives should identify attributes needed from the bridge system and work with GIS staff to link those attributes via bridge numbers.
- The Bridge and GIS Business and System Owners should meet to discuss, agree upon, and document a process (as automated as possible) for linking bridge information to RDS and keeping it maintained.

**Equipment Management System (EMS)**

EMS identifies vehicles and equipment in the State Equipment Fleet, track costs, bill customers, maintain inventory, calculate rates, and store historical
information about equipment. This tracking also provides cost information for budgeting and forecasting and supports enterprise asset management of the state equipment fleet.

The primary integration points for EMS are location of equipment (city description) and equipment number. Additional data that could be used for asset management analysis are: equipment year, make, model, owner of equipment, FUR rate (developed each year), reliability ratio (P&P 11.04.012), condition assessment (P&P 11.05.020), recommended maintenance schedule, utilization, and life cycle cost (economic life per P&P 11.05.001).

Recommendations:

- The EMS is currently in process of upgrade. As the new system deploys, a clear process for linking equipment asset data to TAMIS should be discussed, agreed upon, and documented.

- To make integration with other systems easier, each piece of equipment should be tracked with a unique ID number and a clear process for location referencing should be established.

**Integrated Resource Information System**

An enterprise financial, accounting, procurement and human resource management information system that will contain all requisitions, purchase orders, information about purchases, and human resource information. It is likely that multiple data integration points will provide information for TAMIS, most of them related to financial information, based on TAMIS interviews with data business owners.

Likely integration points will be unique project ID numbers (similar to AKSAS project numbers), and human resource position control numbers (PCN) for personnel resources. Other integration points might include requisition numbers, purchase order numbers, and other ID numbers for specific datasets.

Recommendations:

- Since IRIS is a statewide system and required for all accounting, payroll, procurement, and human resource functions, the recommendation is that integration strategies be tailored to the system’s current configuration.

- The Department will need to adjust to IRIS processes in order to integrate financial and human resource data resources.

**Maintenance Management System**

A new Maintenance Management System will provide tools to manage the planning, scheduling, reporting, and analyzing of maintenance actions. This will include information for managing special programs, administrative and financial tasks, contracts, and project work.
Primary integration points for material related activities are to be determined. Other key integration points might include material ID number, MMS project number (ID), roadway number (CDS), milepoint, project begin/end termini (to, from milepoint), region, M&O station (ID), materials number, milepost.

Establishing key integration point and methods in this new system will allow linkage to other maintenance data identified in the TAMIS project research. Possibilities include:

- Project name
- Project manager name
- Organization unit
- Road CDS information
- Lane mile, station routes
- Material source type
- Direct purchase (DP)
- Stockpile (SP) number
- Stockpile name
- Material cost (planning),
- Road, pit name (all three used for aggregate stockpiles)
- Unit cost
- Capacity
- Recommended quantity
- Reorder point
- Vendor name
- Bill of lading number

Allotment (funding amount)
Authorized charges for labor
Equipment and material
Authority to proceed
Work begin/end
Aggregates
Asphalts
Blades
Brushes (sweeper)
Chemicals
Culverts (pipe & bands)
Cutting edges
Guardrail (rail & posts, end Sections, crash attenuator)
Labor SEF
Lumber
Paint
Signals & luminaries
Signs (signs, posts & markers)

Recommendations:

- **Maintenance and Operations Business and System Owners should coordinate the integration methods with the GIS group to ensure the data structure is compatible with the LRS.** Each distinct dataset in the maintenance system should have a unique identifier and a location reference formatted in a way that allows the most efficient integration with the Department’s LRS. Methods will be determined through coordination between the new system vendor, ISSD (GIS group) and the asset management coordinator.

- **MMS Inventory data should have a way to uniquely identify distinct assets and integration points that could link to costs and condition of inventory items, and other details like rail, posts, end sections, and crash attenuator for guardrails and reflectivity, dimensions, posts and markers for signs.**
• The Department may be planning for MMS Inventories for signs, culverts, and guardrails. If ADOT&PF decides to invest in collecting and managing data for these inventories, the data structure and management plan should be discussed. For example, a culvert inventory is managed by the Department of Fish and Game for fish passage. The ADOT&PF Maintenance inventory for culverts should be coordinated and compatible with the Fish and Game inventory to be most useful and efficient for planning and asset management analysis.

Management Reporting System (MRS)

MRS is a system developed using the Department’s Oracle database and application software to facilitate project reporting. The system links to data from Alaska’s statewide accounting system (AKSAS) and supports several web based reports including project status reports (both public and internal) and the Statewide Transportation Improvement System (STIP). Key data sets include:

Contracts - Used by construction staff and contract managers to enter contract data for updating the advertising, consultant plan holders, and overall monitoring of contract related information.

Projects - Used by Project Control staff to setup a new project or the shell of a new project from the funding request that they receive from the Project Manager.

Project Needs - A list of fiscally unconstrained projects used by ADOT&PF planners to identify and report project needs based on coordination with local communities and tracking of projects proposed for federal funds. The needs list is the starting point for the development of the STIP; all projects must be in the Project Needs database to be included in the STIP.

STIP - The STIP tables link to project needs and are set up for STIP planners to enter planned funding data that produces the STIP report. The STIP tables also contain data fields that support the Department’s 10-year-plan.

Grants - Used by Project Control to enter FAA Grant and Grant Projects information.

Detail Estimates - Used by Project Control to enter data based on the project information sheet that is provided by the project manager and gives phase estimates when the project is starting out. Data from the Detail Estimates appear in the Design Status Report, which details when the next funding will be needed, and when a new phase is anticipated to begin.

Obligation Plans - Central Region Project Control uses to create their obligation plans.

Obligation Estimates - Used by Program Development to track and enter obligation estimates.

Obligation Transactions - Used by Program Development to track the use of the various federal apportionments. Project Control uses Obligation Transactions to
track FHWA approval of funding requests and print out FHWA approvals to fund projects in advance of receiving approval paperwork back from FHWA.

**Employment** - Contractors are required to submit employment information to the ADOT&PF regional construction sections by completing our Form – 25D-1589 for the American Recovery and Reinvestment Act (ARRA) contracts at the end of each month. The construction staff then enters employment data into the Employment screen of MRS.

Including the short list of datasets above, there are a reported 174 database tables that comprise the MRS Oracle database. Each table has its own set of data that is stored depending upon the type of data. The data sources needed for project reporting are likely to change with the implementation of the state’s new accounting system (IRIS). In addition, some business areas have implemented or plan to implement new software systems (Federal Aid (FAAM), STIP (Scope Scheduling and Estimates, Programming and Balancing), and possibly others). These changes have left many areas of MRS unused, obsolete, or overlapping, but applications and reports may still exist and be in use by employees and stakeholders. Each area listed above needs evaluation in detail to determine needs to meet ADOT&PF project reporting requirements and where applicable, utilize and document new processes and integrations. Since MRS contains so many tables, it may take a team of people who have interest in the data to review and analyze what data to maintain moving forward.

For project data that could support TAMIS, key data integration points include primary ID for each dataset (e.g., Need ID, federal project number, state accounting number) and location referencing compatible with the roadway data system. Currently only STIP projects link to the Roadway Data System to support a web-based mapping tool and integration of project data. Maintaining this data in both MRS and RDS is cumbersome and inefficient. Moving forward, STIP, Federal Aid and Project Control staff should coordinate with the Data and IT Governance Work Group on project data management, reporting needs and to develop integration strategies.

Key Integration points can link to data stored in MRS that could be useful for TAMIS; possibilities include:

<table>
<thead>
<tr>
<th>Project names</th>
<th>CDS Route</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locations</td>
<td>Functional Class</td>
</tr>
<tr>
<td>Contractor names</td>
<td>Project Name</td>
</tr>
<tr>
<td>STIP</td>
<td>Project Phase Number</td>
</tr>
<tr>
<td>Obligation estimates</td>
<td>Contract Number</td>
</tr>
<tr>
<td>Obligation transactions</td>
<td>Contractor ID</td>
</tr>
<tr>
<td>Costs of contracts</td>
<td>Associated Airports</td>
</tr>
<tr>
<td>Project status details</td>
<td>Region Project Level data</td>
</tr>
<tr>
<td>Project control section</td>
<td>Project control data (HQ)</td>
</tr>
<tr>
<td>Borough/Census Area</td>
<td>Federal obligation data (HQ)</td>
</tr>
</tbody>
</table>
Project location descriptions
Unique bridge ID (also in BMS and NBI)
Milestone dates
Engineers assigned to bridge
Design status
Construction status
Highway
Region
House District
Need category
Mode

Federal Cost to Complete
MPO
Primary Type of Work
Secondary Type of Work
Sponsor Type
Need ID
Priority (HQ use only)
Sponsor
Program
Criteria Type (used for ranking projects)

A few of the above are italicized because the data is not managed in the MRS database. Further work is needed at ADOT&PF to ensure spatial attributes for projects are not duplicated in MRS to accommodate web reports but rather derived automatically from the system of record (RDS) or TAMIS.

**Recommendations:**

- Identify clear ownership, roles, and responsibilities for the MRS database and task them with management and update of the system.

- Establish a team of stakeholders from appropriate business areas to evaluate each business area supported by MRS data tables to determine current needs and data requirements.

- Work with the GIS group to ensure spatial attributes that must be stored in MRS are consistent and linked to the RDS database appropriately.

- STIP, Federal Aid, and Project Control staff should coordinate with key representatives in the Data and IT Governance Work Group on project data management, reporting needs and to develop integration strategies.

**Pavement Management System**

The pavement management system documents pavement conditions derived from data collection and organized by location to help minimize cost of pavement maintenance and rehabilitation projects while maintaining a specified level of performance. Data from the Pavement system is used for HPMS and by Design engineers, Materials engineers, Planners, and M&O staff.

The key integration points are Location, Pavement Section ID and will link to pavement characteristic data such as roughness (IRI), rutting, cracking, surface distress,

A replacement pavement system integrated with the maintenance and equipment management systems is in process of purchase and implementation.
Recommendations:

- Pavement Business and System Owners should coordinate new system requirements, database structure and data needs with representatives in Data and IT Governance Work Group during implementation of the new system.

- Pavement Data analysis and reporting tools connected to the data collection contract should be integrated and compatible with those used for the Roadway Data System and managed in partnership with ISSD.

Performance Electronic Tracking System (PETS)

PETS tracks key performance indicators across ADOT&PF. Data gathering and input is mostly a manual process (happens annually) and the system generates web-based dashboards and reports tracking the Department’s key performance measures.

Key Integration Points are name of key performance indicator (KPI) and performance measures owner. Integration points link to target KPI, actual KPI, variance, variance %, and time period.

Recommendations:

- Using integrated data in TAMIS, automate the process of collecting data needed for PETS.

- ADOT&PF should evaluate the current data items needed for PETS and ensure they are included in TAMIS.

- Department to should consider adding other performance measures (some internal) to help track progress of current initiatives.

Tier 2

The recommendations for Tier 2 systems that follow are less detailed than Tier 1. For all, the general recommendations below apply, and a few specific recommendations are highlighted in bold text within their section descriptions.

General recommendations:

- Coordinate all data management activities for Tier 2 systems with their representatives in Data and IT Governance Work Group to ensure documentation of data resources, that there are no overlapping efforts, and that the most appropriate data management solution is provided.

- All systems need to be evaluated to identify data needed for TAMIS or other enterprise applications.

- Data items in each system need to be assessed and prioritized and the final decisions on their integration (or not) need to be documented and implemented.
During the initial implementation of TAMIS, the Data and IT Governance Work Group should meet as needed to discuss systems and data that serves more than one business area. Once inventory is updated, decisions are made, and results are documented, the group could meet to address new data requests or changes on a much less frequent basis.

**Airport and Highway Pavement Management System**

This system tracks the aviation facilities inventory data and inspection data for several Alaska airports. Data support the Alaska Aviation System Plan. The data dictionary includes data on ADOT&PF owned airports including paved/unpaved areas at the airport.

Key integration points are unique airport ID (UAID) and unique runway ID (URID) which can link to data including:

- Primary surfaces
- Full DOT ownership
- Runway extrapolated average
- PCI
- Expected runway replacement date
- Primary runway taxiway exists
- Area paved runway
- Area unpaved runway

**Alaska Aviation System Plan (AASP)**

The AASP database manages the aviation facilities inventory data and inspection data for several Alaska airports. Data are used to create and publish the Alaska Aviation System Plan.

Key integration points are unique community ID (UCID), unique airport ID (UAID), unique runway ID (URID), unique runway end ID (UREID) which may link to data such as:

- DOT road maintenance
- Road access status
- Road access
- Ferry service
- Ferry frequency
- Other modes
- Alt cargo transportation
- State region
- Facility status
- Federal grant obligation
- Maintenance provider
- Full DOT ownership
- Snow removal equipment (SRE)
- SRE building
- Unmet demand lease lots
- Unmet demand tie downs
- Useable tie downs
- Unmet demand floatplane parking
Useable floatplane parking  ARFF equipment
Unmet demand auto parking  ARFF building
Passenger shelter  DOT maintenance equipment
Public toilet available  Wx station

**The AASP data need further evaluation for items that might be useful for TAMIS and asset management decision making.** At the time of this research, the AASP data is managed by contractor who will help with integration options based on Department needs for asset management and decision making.

_Fairbanks Traffic Server_  
Traffic server manages data collected by traffic counters and recorders which support HPMS reporting and integrate with roadway data for analysis supporting safety, asset management, planning, and enterprise decision making processes.

Primary integration points are traffic segment ID and location linking to data including traffic volume, road classification, weigh station data, and speed.

_The department is currently implementing a new traffic system. Representatives from the Data and IT Governance Work Group should stay involved and offer assistance with data integration as needed._

_Fleet Condition Survey_  
Identifies deferred maintenance needs and mandatory upgrades for the 11 vessels in the AMHS fleet.

Primary integration points include vessel ID (name), type of mandatory upgrades, grid-based location of item on vessel, priority rank (of maintenance item), linking to secondary data such as item cost (for equipment, machinery, etc.), pictures and diagrams associated with items.

_Grant Management & Program Administration System_  
GMPAS manages grants from the FTA and other funding sources in support of transit operations in Alaska. The Governor's Community and Public Transportation Advisory Board also uses data for decision making. Three main components of the system include application and review processes, allocations and grant agreements, and transit vehicle inventory.

Primary integration points include vehicle ID, vehicle type, grant ID number, grant type linking to data including vehicle age, vehicle condition, ridership (number of riders), mileage, operating cost, expenditures to date, funding data (dollars/ride), and FTA grant category (e.g., 5311, 5310).
Local Permits

This is a commercial vehicle permit database that stores overweight/over dimension permit application information for large commercial vehicles (data entered by the public via forms). This system is included in TAMIS because it may provide a source for oversize/overweight data used for pavement deterioration assessment.

Key integration points for this system still need to be discussed in detail but they will be unique identifiers for loads or permits linking to details such as address based origin and destination locations, route begin and end points, and dimensional data including length, width, height, weight, and number of axles on hauling vehicle.

It is recommended this system and data within be further evaluated by technical representatives in the Data and IT Governance Work Group before including and linking data for use in TAMIS.

Material Sites Inventory

Includes site inventory and inspection data for all material sites (e.g., quarries, borrow, pits, etc.), as well as associated documentation.

Primary integration points are material site ID and location linking to data such as permit status, quantity, type, and quality of materials.

It is recommended this system and data within be further evaluated by technical representatives in the Data and IT Governance Work Group before including and linking data for use in TAMIS.

Retaining Wall Inventory

A retaining walls inventory and data dictionary is in development by a contractor.

Primary integration should be asset ID and location and should link to information such as retaining wall physical characteristics, height, design type, and material (e.g., modular, concrete wall, etc.).

For TAMIS, review data items for possible inclusion and ADOT&PF should work with contractor to format data so it is compatible for integration.

Road Weather Information System

A system of atmospheric sensors, pavement sensors, cameras, and temperature data probes to provide information on road and driving conditions to support winter weather maintenance activities and weight restriction decisions.

Primary integration points are Environmental Sensor Station (ESS) ID and location linking to information such as:
Pavement temperature | Snow depth
Temperature data probe (TDP) | Station pressure
Relative humidity (RH) | Subsurface temperature
Air temperature | Surface temperature
Dew point (note: calculated from relative humidity and temperature) | Wind speed
Precipitation occurrence | Wind direction
Precipitation accumulation | Wind speed maximum
Remote processing unit | Wind direction of maximum speed

It is recommended this system and data within be further evaluated by technical representatives in the Data and IT Governance Work Group before including and linking data for use in TAMIS.

**Shore Condition Survey**

A system that manages data from inspection reports on the condition of dock structures, bridges, associated floats, and loading ramps.

Primary integration points may include bridge ID, structure ID, location of AMHS terminal location, location of structures. These link to data such as bridge inspection data, fracture critical inspection data, types of AMHS shoreside structures, types of AMHS shoreside facilities, date shoreside facilities were built, condition of shoreside facilities, condition of shoreside structures.

**Unstable Slope Inventory**

Inventory of the top 200 unstable rock and soil slopes around the state.

Primary integration point is location of unstable slopes (milepoint and latitude/longitude) linking to information such as slope hazard and risk ratings, height of the slope, kind of rock on the slope, potential hazard (e.g., rock slide, land slide), a physical engineering description of the slope, and risk related items that have to do with site distance, line of site, and the length of the slope (i.e., how long vehicles are exposed in the hazard zone).

**Weigh in Motion (WIM)**

WIM site sensors measure and record truck weight and axle configurations of trucks at highway speeds. WIM sites provide pavement life data in support of Alaska's PMS and FHWA's Long-Term Pavement Performance (LTPP) program.

Primary integration is weigh station location and links to data including traffic, speed, and weight data.
Tier 3

The following Tier 3 systems indirectly support asset management decision making processes. Like Tier 2 systems, each may contain data helpful for asset management decision making and will need to be reviewed for data items needed and best integration methods (if applicable).

**Crash Reporting & Analysis System for Safer Highways**

ADOT&PF processes crash data in two separate applications. The Crash Data Entry System (built in-house) uses web-based data entry tools to document information needed for crash analysis such as locations and severity (generalized) type. The data is populated in Oracle database tables that are integrated with the Roadway Data System (RDS). The second component – the Crash Reporting and Analysis System (CRASH) is a tool (developed by a vendor) for traffic and safety engineers that will use the data available to analyze crashes, produce crash rates, identify sliding spots, and produce reports.

As the new CRASH analysis tool is implemented, the Business Owners and System Owners of the system should coordinate with their technical representatives in the Data and IT Governance Work Group to ensure data integration and avoid duplication.

**Electronic Document Management System (eDocs)**

EDocs is a document management system that is used as a repository to store all types of documents such as surveys, plats, memos, financial documents, ROW information and more. Many business areas will store documents in eDocs and link them to their database tables. An example is material sites. A data table tracks location, site ID, and a few other attributes including a field to link to the PDF document stored in eDocs that contains detailed information about each site.

The Department should explore ways to clarify the intended use of eDocs, develop simple interfaces for specific business area use and provide training on how and when to use the system.

**Federal Aid Agreement Management (FAAM)**

Used to prepare the Federal-Aid Agreement document for FHWA and to satisfy Federal-Aid requirements, this system interfaces with MRS. Once IRIS is implemented, federal aid data once stored in MRS may be moved to the new Accounting system database.

A review of the data items needed for asset management (possibly federal aid project locations and other linked information like funding) needs to be coordinated with representatives in the Data and IT Governance Work Group to avoid duplicate efforts or missing data needed for projects.
3.0 Action Plan

3.1 ACTION PLAN

This section outlines an Action Plan that provides a sequence of steps for implementing TAMIS at ADOT&PF. Building upon the asset-specific and cross-asset functions that need to take place and the summarized recommendations and accomplishments for each system presented in Chapter 2 of this report, the Action Plan:

- Identifies priorities for implementation of new processes and/or systems to support business needs;
- Proposes timeframes for implementing new processes/systems;
- Identifies the roles and responsibilities for supporting TAMIS; and
- Identifies methods to monitor progress of the Action Plan.

3.2 PRIORITIES

The recommendations summarized below are presented in priority order according to the proposed implementation schedule presented in Section 3.4 of this report. The priority order is subject to change based on shifting or new priorities identified by data business owners and/or directives from senior management.

1. **Continue to consider needed organizational changes.** ADOT&PF has already taken measures to address data management and IT infrastructure issues with the current restructuring of the Department by adding the Information Systems and Services Division (ISSD) and hiring a new director. Next steps should include:

   - Establishing which staff will be in the Data and IT Governance Work Group to support enterprise data business planning and data management at ADOT&PF. The recommendation is to start with the existing TAMDIT group but either add or remove members to ensure representation of all business areas and that there is adequate ISSD involvement. The main reason there is a need to have more ISSD representation is to ensure there are both Business and System owners working together on each system that manages enterprise data. A possible source for candidates could be the populated data and information systems catalog. If utilized, this system will identify and list business and system owners as well as executive sponsors for all systems and data.

   - Revising positions that are under-utilized (legacy system programmers and analysts) to include (for example) more GIS and CAD coordinator
duties. The Department should identify which of these positions (or changes to positions) could be implemented first, based on available funding and resources. These roles will provide strategic support to the data business planning process.

2. **Mission and Vision statements** for Enterprise Data Management have been included in the DBP and DGM. The persons and offices at ADOT&PF chosen to be responsible for overseeing implementation of TAMIS should consider formalizing the following Mission and Vision statements.

   **Mission Statement** - To provide reliable, timely, and accurate data and information that is easily accessed, shared for cross-asset analysis, and incorporated into ADOT&PF’s asset management decision-making process.

   **Vision Statement** - All ADOT&PF asset management business decisions are supported by reliable data that adheres to established data quality standards as defined in the ADOT&PF DGM.

   The adopted data governance strategy for TAMIS including new policies, roles, responsibilities, vision, and mission should be presented to all ADOT&PF Staff in an informational and promotional statewide meeting.

3. **Data management policies and procedures should be formalized, implemented, and maintained.** It may appropriate for ADOT&PF to implement additional policies as data governance evolves at the Department.

4. **Implement Data Governance policies**, standards, and procedures across the Department and document them in the DGM. In coordination with the individual database owners and ISSD, the Department should continue to build upon data governance policies implemented in individual offices (e.g., Planning Division) and expand those policies throughout ADOT&PF at the enterprise level.

5. **Establish ‘ownership’ for systems and document ownership in a centralized data and information system catalog** (detailed recommendations in the DISC report). It is extremely important that ownership of ADOT&PF data systems be established as soon as possible (where it does not currently exist) in order to provide a single point of contact (office or person) for data and information needed to respond to internal and external inquiries, or for cross-asset analysis purposes.

6. **Establish business rules for distributed responsibility for maintenance of data systems between Headquarters and Region offices and document the rules in the DGM.** While a primary office or person needs to be identified as the designated ‘owner’ of each system, business rules need to be established whereby support of a system is distributed to offices in Regions across the state. Examples of this might include distributed responsibility for collection of pavement data and traffic data used for reporting in the Highway Performance Monitoring System (HPMS). In addition to each system requiring a Business Owner, each should also be supported by a System
Owner to ensure that the technical functionalities are adequate to meet the business needs or the program areas.

7. **Complete development and implementation of a Data Governance Manual (DGM).** Following the approval of the Data and IT Governance Policy & Procedure, ADOT&PF should adopt and implement the DGM as soon as possible to provide a reference source for all persons in the Department who are responsible for data collection, analysis, reporting, and overall management of ADOT&PF data systems used for decision-making throughout the Department.

8. **Evaluate staff training needs with respect to data management and data stewardship across the Department.** This evaluation should occur in the near term (six months to one year) so that can move forward with an action plan to address training needs in the use of new technology or automated business processes that replace previous manual processes. Training Manuals should be developed and shared through a knowledge management system (eDocs) so that there is a continuity of operations when staff leave and new staff are hired.

9. **Formalize use of permanent electronic repository of information (available to all ADOT&PF employees) related to the DBP and DGM and assign staff to maintain these documents in the repository.** The eDocs system is currently being used as an electronic repository of documentation related to the TAMIS project and the DGM refers to it as a standard. Although issues and gaps relative to the eDocs system were documented in the TAMIS Task 7 report, this remains the most readily available system for electronic documentation. It is important that ADOT&PF maintain the DBP and DGM and that the latest versions of these documents are uploaded to eDocs regularly.

10. **Establish business rules for exchange of data and information between offices and document the rules in the DGM.** These business rules include those pertaining to exchange of data/information across offices in a horizontal organizational alignment as well as offices or persons representing a vertical organizational alignment within ADOT&PF.

11. **Implement the TAMIS considering recommendations for data management outlined in the TAMIS Proof of Concept (POC) technical report (Chapter 6).** The basic summary of these recommendations are:

   - Implement TAMIS incrementally – Start with priority systems and data for asset management (Tier 1).
   - Establish the system architecture - suggests a data warehouse and TAMIS viewer application.
   - Create a TAMIS data warehouse - to host copies of each asset database used in TAMIS.
   - Build or Procure a Web-based TAMIS Viewer Application – to allow access and analysis of data in the TAMIS data warehouse.

Once ADOT&PF adopts and formalizes the DBP and DGM, experiences with implementing them, both positive and negative, can be evaluated for use in
expanding to all enterprise systems. Since Tier 1 systems and data are key to asset management decisions and have already started on improvements, they would be an ideal starting point.

12. **Implement new technology and applications to support business needs of the Department.** The implementation of new technology includes the following items:

- Implement improved IT tools for transmission and sharing/exchange of data and information.
- Replace manual data exchange methods with automated methods.
- Replace or enhance legacy application systems with new applications that provide accessibility to data in offices across the Department (not just to a particular office). This is of course with the understanding that there is a business need for the data in specific offices, other than just the business area.
- Identify which data systems (and associated data elements) will be integrated into IRIS so that management of those data systems in the near term (six months to one year) are targeted as a top priority for maintaining high levels of data quality.
- Continue to monitor systems and technology for needed changes and plan for improvements and replacements as needed.

13. **Conduct Strategic Information Management Study.** The purpose of this study is to document the existing and future Information Technology (IT) architecture and state of Information Systems (IS) within ADOT&PF. The outcome of this study may influence the establishment of additional data management policies and standards, not already documented in the DGM.

14. **Develop Risk Registry and Risk Management Plan in coordination with Data (systems) Business Owners and the IT Office.** Development of a Risk Registry and Risk Management Plan will involve further discussions with the Data Business Owners in work group meetings to identify the types of data-related risks that exist at the Department from the perspective of the data providers and data users.

The potential risks may include loss of data from critical (core) systems that are needed to support business decisions (especially those decisions related to program funding). A Risk Management Plan needs to be developed within one to two years to document how the Department will manage any potential risks due to loss of data. The loss of direct access to data from a particular system may actually be due to migration of data from an existing system that is readily available to one that may not be as easily accessible (e.g., Integrated Resource Information System (IRIS)). Specifically, the Department should ensure that financial data and information currently available for business needs is still available where needed after implementation of IRIS.
3.3 **CONSENSUS ON RECOMMENDATIONS**

Additional discussions should be scheduled with smaller work groups (data business owners and stakeholders for data systems) to reach consensus on the prioritization of recommendations. Senior leadership at ADOT&PF needs to be involved in the final approval of the recommended priorities to ensure that there is sufficient support from the top of the organization to implement the recommendations.

The dedication of staff time and resources will be a consideration in reaching final consensus on the prioritized list of recommendations. Additional third-party consultant services may also be considered to facilitate implementation of some of the recommendations (e.g., work group discussions, stakeholder outreach, staff training needs survey, etc.).

A final presentation on the TAMIS project and recommendations for implementation should be made to executive management with a purpose to gain final approval for formalizing the Data and IT Governance P&P, the DBP, DGM and Implementation Plan. This should be an on-site executive overview meeting that includes upper management including all proposed Data and IT Governance Council members. The executive meeting should summarize the results of the TAMIS research project, share lessons learned and benefits of improving data management, then discuss next steps toward implementation.

Once consensus is reached on the prioritized list of recommendations, a timeline can be established for proceeding with the recommendations.

3.4 **SCHEDULE**

The suggested timeframes for implementing the recommendations are based on the following time periods: six months to one year, one to three years, and beyond three years. This schedule should be reviewed and revised as needed, based on shifting Department priorities related to data management and data business planning initiatives in various offices (e.g., Planning Division, Asset Management office, etc.). The proposed timeframe for implementing these recommendations is not intended to represent a single, linear schedule. Designated work groups throughout the Department may work on several of the tasks concurrently. Below is the recommended schedule.

**Six Months to One Year**

1. Continue organizational changes
2. Reinforce Mission and Vision statements for enterprise data management
3. Prioritize data management policies and procedures
4. Implement data governance policies, standards, procedures
5. Establish ownership of systems
6. Establish business rules for distributed maintenance (of data systems) responsibility
7. Continue development of the DGM
8. Evaluate staff training needs
9. Establish permanent electronic repository of information (eDocs) and develop supporting business rules, processes, and tools.

**One Year to Three Years**

10. Establish business rules for exchange of data and information between offices
11. Implement TAMIS starting with work on Tier 1 systems
12. Implement new technology to support business needs of the Department
13. Conduct Strategic Information Management Study
14. Develop Risk Registry and Risk Management Plan

**Three Plus Years**

Ongoing - Implement new or update existing applications to support business needs of the Department

### 3.5 ROLES AND RESPONSIBILITIES

The number 1 recommendation for implementing TAMIS describes the need for organizational changes. It is also worthwhile to note that almost every other recommendation for implementing TAMIS will lean heavily on people knowing and understanding their role in data governance.

The key to implementing organizational changes for TAMIS requires identification of the roles and responsibilities to support data governance at the Department. This includes identifying an Executive Sponsor to oversee implementation of TAMIS in coordination with a designated work group comprised of System and Business Owners from offices across ADOT&PF. Specific roles and responsibilities are outlined in Table 3.1 of the DGM\(^5\) and identifying the members to be included is recommended as part of this Implementation Plan for TAMIS.

In order to fully appreciate the impact on the Department in implementing TAMIS and data governance, it is necessary to have a better understanding of:

Which offices are impacted?

---

\(^5\) ADOT&PF Data Governance Manual, August 2015.  
Who oversees the data management in each office?
Who are the Data Business Owners? Systems Owners? Executive Sponsors?
Who are the key stakeholders and users and what are their needs?
The responses to each of these questions will help managers at the Department to
determine the best approach for implementing TAMIS and data governance at
the enterprise level.

3.6 Monitoring Implementation of Action Plan

Once ADOT&PF has begun the necessary steps to implement TAMIS, there
should be ongoing monitoring of progress with regard to the Action Plan. Due
to the relatively short turnaround time for completion of some of the tasks,
progress with the Action Plan should be monitored using monthly meetings with
the Data and IT Governance Work Group for the first year and via quarterly,
semi-annual, or annual meetings thereafter. The members of the Data and IT
Governance Work Group should be evaluated/expanded as needed and at the
very least, ADOT&PF should consider including members of TAMDIT, ISSD
staff, members of the Engineering Automation Team, and anyone who will
oversee data management for key business areas supporting enterprise systems
(including but not limited to TAMIS).

Discussions at the meetings should include reports on progress of current
implementation tasks (e.g., tasks completed, tasks remaining) and any
adjustments needed in the implementation schedule, due to changes in
Department priorities, policies, standards, or changes in management priorities.
These discussions may result in revising the priority order of some of the
recommendations.

Finally, a report should be provided to senior management quarterly present
progress on the tasks outlined in the Action Plan. An Annual report should be
prepared to document the previous year’s progress.
References

1. AASHTO Standing Committee on Planning, Subcommittee on Data, Core Data Principles Development, [http://planning.transportation.org/Pages/Data.aspx](http://planning.transportation.org/Pages/Data.aspx)


3. ADOT&PF Transportation Asset Management Information Systems and Data Research Project reports:
   - Task 2 - [Federal Requirements and Associated Research](http://www.aashto.org/assetmanagement), Final Report, June 2013
   - Task 3 - [Other State Best Practices](http://www.aashto.org/assetmanagement), July 2013
   - Task 4 - [Vision and Components Final Report](http://www.aashto.org/assetmanagement), July 2013
   - Task 5 - [TAMIS Data Systems Evaluation](http://www.aashto.org/assetmanagement), December 2013
   - Task 6 - [TAMIS Framework](http://www.aashto.org/assetmanagement), December 2013
   - Task 7 - [TAMIS Gap Analysis Final Report](http://www.aashto.org/assetmanagement), March 2014
   - Task 8 - [System Model Alternatives - Technical Memorandum](http://www.aashto.org/assetmanagement), March 2014
   - Task 11 - [TAMIS Data Business Plan](http://www.aashto.org/assetmanagement), July 2015
   - Task 12 - [TAMIS Proof of Concept](http://www.aashto.org/assetmanagement), June 2015
   - Task 13 - [Data Governance Manual](http://www.aashto.org/assetmanagement), June 2015

4. AIIM (Association for Information and Image Management) is the global community of information professionals - See more at [http://www.aiim.org/what-is-information-management](http://www.aiim.org/what-is-information-management).


7. Data Governance Program Guidelines (Draft) from Nevada DOT (2012)


ADOT&PF Transportation Asset Management Information Systems (TAMIS) and Data Research Project

Project Communication Plan

prepared for
Alaska DOT & Public Facilities

prepared by
Cambridge Systematics, Inc.

September 2013
ADOT&PF Transportation Asset Management Information Systems (TAMIS) and Data Research Project

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prepared for
Alaska DOT & Public Facilities

prepared by
Cambridge Systematics, Inc.
1566 Village Square Boulevard, Suite 2
Tallahassee, FL  32309

date
September 2013
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1.0 Introduction

The objectives of this research project are to make recommendations for planning and implementing a Transportation Asset Management Information System (TAMIS) and Data Solution. This process will include documentation and analysis of relevant research and requirements for TAMIS; assessment of existing business practices and information/data systems/tools related to TAMIS; development of a framework of the TAMIS – including a common vision; and conducting a gap analysis. The project activities will be closely coordinated with the ongoing development of a Transportation Asset Management Plan (TAMP) currently underway within ADOT&PF.

This project will result in improved data management for TAMIS which will benefit Alaska in the following ways:

- Create a system that all DOT&PF employees can easily use and for the State of Alaska to maintain;
- Strengthen the ability of data programs to support core business functions of the agency;
- Improve data quality throughout the organization;
- Protect data as an asset of the agency; and
- Limit risks associated with loss of data and information.

The underlying premise of a TAMIS is that multi-disciplined data should be well integrated, providing a solid information system to support asset management decisions. The TAMIS research project will not develop the integrated system, but will provide in-depth analysis of needs and uses of integrated data at ADOT&PF to support the TAMIS framework. A pilot TAMIS application will demonstrate the recommendations in the TAMIS plan on a test set of asset data and information systems within ADOT&PF. Keys to success will be ongoing, in depth coordination with stakeholders.

Continual communication throughout the research process will be employed at Alaska DOT&PF to build interest and enthusiasm for TAMIS outcomes and to ensure the successful implementation of TAMIS.

To implement research, there needs to be strong consensus about the value of the research and a willingness to change procedures, as needed, to institute a change. In the case of TAMIS, data from all systems of ADOT&PF are needed to provide a foundation of information that can support good decision making for asset management. All ADOT&PF staff will need to be informed about the research and many will need to be involved in implementation. This Communication Plan will link researchers and results with the stakeholders who can supply the data and use the information.
The goal of the TAMIS Communication Plan is to encourage collaboration and a shared ownership of the research project by key decision makers inside and outside ADOT&PF. Within ADOT&PF, all staff must be informed of TAMIS and key decision makers need to use it. More broadly, the results of the TAMIS research project should also be presented to the State’s ETS, executive branch and legislative branch in order to ensure a highly implementable product.

In addition, TAMIS will provide the backbone for the Asset Management program for ADOT&PF. The program will ultimately support the FHWA State Transportation Improvement Program (STIP) and Long Range Development activities of the Program Development office.
2.0 Coordination with Other Initiatives Within ADOT&PF

Several current and recent initiatives in the public and private sector regarding data and information management are focused on organizing, integrating and governing data. These initiatives also provide important opportunities for coordination of efforts and cohesive communication about the future of data management at ADOT&PF. Recent efforts include the Data Business Plan (including a comprehensive Data Governance Plan conducted by the Division of Program Development), Engineering Automation effort, and the ongoing Annual Information Technology (IT) Plan.

In addition to close coordination with the leadership of these initiatives, TAMIS will include data from all modes of transportation (air, highway, rail, marine) and will be linked to at least the following data/information systems:

- Integrated Resource Information System (IRIS),
- Maintenance Management System (MMS),
- Management Reporting System (MRS),
- Pavement Management System (PMS),
- COGNOS,
- Pontis,
- Highway Analysis System (HAS),
- Roadway Weather Information System (RWIS),
- Performance Economic Requirements System (PERS), and
- Spatially Integrated Roadway Information System (SIRIS).

There are also several other systems (identified as “Others”) that may be included in the TAMIS model. Additional discussions will be held with the TAMIS stakeholders to determine which systems should be included in the TAMIS model.
3.0 Target Audiences

A primary question for this communication plan is, “who” do we need to communicate with, and how are their interests aligned or not aligned with TAMIS outcomes or business processes.

The following list describes the various stakeholder groups.

- TAM Groups – Figure 3.1 illustrates the groups already established by the TAM effort. TAMIS will focus on the following TAM groups:
  - Executive Leadership
  - Steering Committee
  - TAM Development Team
  - Transportation Asset Management Data Integration Team (TAMDIT)

Figure 3.1 TAM Groups

- TAMIS Group – This is the core group of TAMDIT plus additional TAMIS key stakeholders. This is the group that was invited to the Vision Workshop on May 30, 2013. They represent all key data owners, potential TAMIS users and all others potentially affected by TAMIS. A list of this group is attached in Appendix A.

- Data System Owners – These are the data system owners.
- Data Users
- Other Internal Staff
• Legislature
• Alaskans

There is overlap in the members included in these stakeholder groups.
4.0 Key Messages and Key Message Testing

Another primary question for the communication planner is “how” to best communicate about the research. Formulation of key messages can be linked to the interests of the target stakeholder groups by mapping interests to benefits and then devising messages.

This dialogue began at the Visioning Workshop on May 30, 2013 and will be tested in interviews with executives and key decision makers. The criteria for messages is their appeal to target audiences, including executives.

If the messages are focused on articulating benefits of TAMIS to each target audience, then it is possible to effectively communicate the value of the research. For example, TAMIS will meet the needs of various stakeholders by integrating data and establishing institutional methods to ensure that integration results in improved decision making for TAM. By transforming data into information that can be used by decision makers, TAMIS will support TAM in a meaningful and powerful way.

Based on information gathered at the visioning workshop and subsequent interviews, the data/information needs of stakeholders will be discussed and documented, and assimilated with the statement of benefits of TAMIS. Messages will be developed to illuminate how TAMIS meets the specific needs of target audiences.

4.1 STRATEGY AND CONTENT

A number of benefits of TAMIS have already been defined, including data integration and establishment of institutional methods to enhance decision making. By linking each target audience group to specific benefits expected from TAMIS, it then becomes possible to devise communication strategies and content in the form of messages.

This Communication Plan will ensure the following goals are achieved:

1. Regular communication will occur with all stakeholders – frequency and message depends on stakeholder Group

2. Communication will ensure stakeholders are:
   a. Kept up to date on the progress of TAMIS
   b. Educated on the content, benefits and value of TAMIS including specifically how TAMIS fits into/enhances their data related business processes
c. Provided opportunity to share concerns especially related to the integrity of their existing data systems and plans for future ones

3. Feedback from Communication will be incorporated in TAMIS

4.2 CHANNELS

The mode of communication is also important because it affects both the content and the impact of the communication. The TAMIS research results need to be communicated in two primary channels: first, to internal ADOT&PF audiences and, second, to executives and elected officials outside of day-to-day TAM.

To best communicate with ADOT&PF’s staff, a variety of existing technology tools will provide a portal for collaboration, sharing, and notification of meetings. This effort will then expand to the rest of the Department to inform and educate all staff about TAMIS. The ADOT&PF audience is actually several distinct target audiences, as outlined above. A project collaboration website has already been developed to allow stakeholders to review meeting summaries, draft reports and schedules, and to be involved to the extent that their interest permits. This Confluence website will be maintained throughout the course of the research project by ADOT&PF. Cambridge Systematics, Inc. will provide updated reports and material for posting.

Given all of the initiatives underway and the changes occurring at ADOT&PF, a preferred strategy is to use communication channels already established and utilized. Education about the value and benefits of TAMIS can be communicated through visual aids and graphics that enhance the message, with clear relevance to the topics. The goal of communication materials will be to enhance the messages, not divert attention from it.

For elected officials and executive leadership, the communication channels will be different, taking the form of briefings and fact sheets to succinctly present the value of TAMIS to ADOT&PF in terms of their mission and goals. Similarly, it will be important to stress how TAMIS represents a wise investment of resources and can lead to more pertinent information and better decisions.

Table 4.1 summarizes the communications strategies, content, and channels for each of the target audience groups throughout the project. The table also identifies the frequency of communication and responsible party (CS and/or ADOT&PF).

Following is a detailed description of each column:

Target Audience Group – Includes all target groups both internal and external to ADOT&PF

Needs Related to TAMIS – Briefly summarizes why the TAMIS project team should be reaching out to the Group including our perception of the Group’s needs for TAMIS.
Benefits of TAMIS – Statement regarding how the Group will benefit from TAMIS

Communication Strategy – Describes how the message will be crafted for that particular Group including what will be emphasized

Communication Content – Describes what will be communicated

Communication Channels – Describes how the communication will occur

Frequency – Describes when/how often communication will occur

Who is responsible for the communication – Indicates whether ADOT&PF or CS are primarily responsible
Table 4.1  Summary of Communication Strategies, Content, and Channels

<table>
<thead>
<tr>
<th>Target Audience Group</th>
<th>Needs Related to TAMIS</th>
<th>Benefits of TAMIS</th>
<th>Communication Strategy</th>
<th>Communication Content</th>
<th>Communication Channels</th>
<th>Frequency</th>
<th>Who is Responsible for Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAM Executive Leadership and Steering Committees (Development Team)</td>
<td>Ensure TAMIS meets needs for TAM and is consistent with other ADOT&amp;PF initiatives</td>
<td>Improved Data Management as described in Executive Summary</td>
<td>Link messages to ongoing efforts</td>
<td>1. Updates of progress</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Ensure messages are high level</td>
<td>2. Review interim products as desired</td>
<td>1. During Regular committee meetings</td>
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<td>3. Transmittal of Final Plan</td>
<td>2. Upon completion of Project Task Deliverables</td>
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<td></td>
<td>3. Upon completion of Task 9 deliverables (June 2014)</td>
<td>3. CS</td>
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<tr>
<td>TAMDIT Group</td>
<td>Ensure data can be shared to support decision making</td>
<td>Improved ability to share data and achieve goals of TAM</td>
<td>Connect to TAM and individual business needs for data management</td>
<td>1. Updates of progress</td>
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<td>2. Review of interim products</td>
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<td>3. Transmittal of Final Plan</td>
<td>2. Updates on Confluence</td>
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<td>3. Presentation at a planned meeting (either during normal meeting time or specially planned meeting)</td>
<td>3. Upon completion of Task 9 deliverables (June 2014)</td>
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<tr>
<td>TAMIS Group</td>
<td>Ensure data can be shared to support decision making Ensure project goals are achieved</td>
<td>Improved ability to share data and achieve goals of TAM</td>
<td>Connect to TAM and individual business needs for data management</td>
<td>1. Discuss TAMIS role within TAM, definition and components of TAMIS, key data systems for TAMIS</td>
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<td>2. Review and approval of all deliverables and plans</td>
<td>1. Vision Workshop – This group was consulted to develop the Vision &amp; Components</td>
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<tr>
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<td>3. Updates of progress</td>
<td>2. Updates on Confluence – All products and TAMIS Group meeting notes will be posted on Confluence site as they are produced</td>
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<td>3. Quarterly teleconferences / webinars</td>
<td>3. Proposed at the end of the following months: September 2013, December, March, June, August 2014</td>
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<td>3. ADOT&amp;PF/CS</td>
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<td>Target Audience Group</td>
<td>Needs Related to TAMIS</td>
<td>Benefits of TAMIS</td>
<td>Communication Strategy</td>
<td>Communication Content</td>
<td>Communication Channels</td>
<td>Frequency</td>
<td>Who is Responsible for Communication</td>
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<tr>
<td>Data System Owners</td>
<td>Ensure data systems can still be maintained</td>
<td>Assist in recognizing value of data in systems</td>
<td>More detailed communication tailored to individual data systems Convey what TAMIS is and how it fits within existing data systems Overcome fears and concerns</td>
<td>1. Discuss TAMIS role within TAM, definition and components of TAMIS, key data systems for TAMIS 2. Review and approval of all deliverables and plans 3. Updates of progress 4. Discuss current practices in data management, collection, and integration 5. Overcome fears and concerns of those who might feel threatened by TAMIS</td>
<td>1. Vision Workshop – This group was consulted to develop the Vision &amp; Components 2. Updates on Confluence – All products will be posted on Confluence site as they are produced 3. Quarterly teleconferences / webinars 4. Phone interviews with stakeholder groups 5. One-on-one meetings with identified stakeholders</td>
<td>1. Vision Workshop held May 2013 2. Upon completion of Project Task Deliverables 3. Proposed at the end of the following months: August 2013, November 2013, February 2014, May 2014, August 2014 4. As part of Tasks 5, 6 and 7 (August – December 2013) 5. October - November 2013</td>
<td>1. CS 2. ADOT&amp;PF 3. ADOT&amp;PF/CS 4. CS 5. ADOT&amp;PF/CS</td>
</tr>
<tr>
<td>Data Users</td>
<td>Ensure data systems support business needs and decision-making Ensure integrity of existing systems and plans for future are maintained</td>
<td>Assist in recognizing value of data in systems</td>
<td>Convey what TAMIS is and how it fits within existing data systems Overcome fears and concerns regarding TAMIS</td>
<td>1. Discuss types of business decisions made using data, data systems used to make decisions, vision for TAMIS in supporting business needs. 2. Overcome fears and concerns of those who might feel threatened by TAMIS</td>
<td>1. Phone interviews with stakeholder groups 2. One-on-one meetings with identified stakeholders (ones with more concerns)</td>
<td>1. As part of Tasks 5, 6 and 7 (August – December 2013) 2. October - November 2013</td>
<td>1. CS 2. ADOT&amp;PF/CS</td>
</tr>
<tr>
<td>Target Audience Group</td>
<td>Needs Related to TAMIS</td>
<td>Benefits of TAMIS</td>
<td>Communication Strategy</td>
<td>Communication Content</td>
<td>Communication Channels</td>
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<tr>
<td>Other Internal Staff</td>
<td>Awareness of TAMIS to support business needs and decision-making</td>
<td>Improved ability to share data and support decision-making</td>
<td>Inform and educate internal staff about TAMIS</td>
<td>1. Demonstrate value of integrated data and TAMIS based on research results and examples from other states</td>
<td>1. Webinars</td>
<td>1. Upon completion of Pilot TAMIS in Task 12 (August 2014)</td>
<td>ADOT&amp;PF / CS</td>
</tr>
<tr>
<td>Legislature</td>
<td>Understand the value of the investment in TAMIS in terms of meeting ADOT&amp;PF mission and goals and MAP-21 requirements</td>
<td>Improved ability to obtain pertinent information on transportation assets to support decision-making</td>
<td>Ensure messages are high level and succinct</td>
<td>1. “Business case” for TAMIS in terms of meeting ADOT&amp;PF mission and goals and MAP-21 requirements 2. Benefits of enhanced data and information management</td>
<td>1. Briefing presentation at a planned meeting 2. One-page fact sheet profiling research results</td>
<td>1. Upon completion of Pilot TAMIS in Task 12 (August 2014)</td>
<td>ADOT&amp;PF 2. CS</td>
</tr>
<tr>
<td>Alaskans</td>
<td>Understand the value of TAMIS in terms of improvements on Alaska’s transportation network</td>
<td>Improved ability for ADOT&amp;PF to identify improvement needs for Alaska’s transportation network</td>
<td>Ensure messages are high level and easy to understand</td>
<td>1. Overview of TAMIS and benefits of enhanced data and information management</td>
<td>1. News releases and/or brochure profiling research results</td>
<td>1. Upon completion of Pilot TAMIS in Task 12 (August 2014)</td>
<td>ADOT&amp;PF</td>
</tr>
</tbody>
</table>
5.0 Strategies and Tactics

The strategies and tactics for communication parallel some of the goals and strategies of the research project. They include:

- Focus on benefits of research, including low hanging fruit/early wins
- Keep messages simple
- Ensure transparency, accountability, and credibility of work
- Maintain dialogue with stakeholders
- Sustainable structure (easy to maintain)
- Strengthen the ability of data programs to support core business functions of the agency
- Improve data quality throughout the organization
- Streamline policy and process to make data integration as easy as it can be
- Support communication that leads to TAMIS becoming a business process, part of culture

5.1 IMPLEMENTATION

Implementation of the communication plan will be conducted while the TAMIS research project is underway.

The following maps the project task efforts to the stakeholder groups:

Task 1 – Communication efforts are limited to the Project Management Team.

Task 2 and 3 – No Stakeholder involvement in preparing reports. Results to be communicated as indicated above.

Task 4 – Stakeholder Communication – This Communications Plan documents the stakeholder groups. All TAMIS Group members were invited to the Vision Workshop and several were interviewed to document the TAMIS Vision Statement. The result of the task is the completed TAMIS Vision and Components Report.

Task 5 – Evaluate Current Systems – The Data System Owners and Users will be interviewed for this task.

The Stakeholders will be contacted as necessary for the remainder of the tasks.
## A. Appendix: TAMIS Group

<table>
<thead>
<tr>
<th>Stakeholder Name</th>
<th>Title</th>
<th>Phone (all area codes 907)</th>
<th>Agency</th>
<th>Location</th>
<th>Email Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocie Adams</td>
<td>M&amp;O Specialist</td>
<td>465-6940</td>
<td>HQ</td>
<td>Juneau</td>
<td><a href="mailto:ocie.adams@alaska.gov">ocie.adams@alaska.gov</a></td>
</tr>
<tr>
<td>Talena Adams</td>
<td>Transportation Data Services Manager</td>
<td>465-6441</td>
<td>HQ</td>
<td>Juneau</td>
<td><a href="mailto:talena.adams@alaska.gov">talena.adams@alaska.gov</a></td>
</tr>
<tr>
<td>James Bauman</td>
<td>ADA Compliance Specialist</td>
<td>269-0852</td>
<td>HQ</td>
<td>Anchorage</td>
<td><a href="mailto:James.bauman@alaska.gov">James.bauman@alaska.gov</a></td>
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ADOT&PF Transportation Asset Management Information Systems (TAMIS) and Data Research Project

TAMIS Data Business Plan

prepared for

Alaska Department of Transportation and Public Facilities

prepared by

Cambridge Systematics, Inc.
ADOT&PF Transportation Asset Management Information Systems (TAMIS) and Data Research Project

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date
July 2015
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Introduction

Alaska Department of Transportation & Public Facilities (ADOT&PF) has experienced many challenges and issues in the management of data and application systems to support Transportation Asset Management (TAM) decision-making across the Department. Many of these challenges were identified in research for the Transportation Asset Management Information System (TAMIS) project and be addressed through improved data management practices as outlined in this Data Business Plan (DBP). Following recommendations and structure provided in the AASHTO Transportation Asset Management Guide, Section 8.4.2\(^1\) and in NCHRP Report 666\(^2\), the purpose of this document is to provide ADOT&PF with a DBP that will support data systems needed for TAMIS.

This DBP (Task 11) also explains why standards, policies, and procedures are needed to manage the asset related data systems.

The DBP documents business rules and data quality standards for the information systems that support TAMIS which will result in improving asset management decision-making at ADOT&PF. Together, the use of better business processes and the right tools helps to improve access to timely, accurate high-quality data for purposes of decision-making at all levels throughout the organization. In this DBP, all recommended improvements regarding data management are intended to be scalable for enterprise-wide systems and it is recommended that they be implemented at that level to be most successful.

A comprehensive and scalable DBP that supports the ADOT&PF TAMIS will facilitate better data management practices and allow for more efficient and reliable data sources to support enterprise asset management decisions.

In the AASHTO TAM Guide, Chapter 8, table 8-3, a sample outline is provided for a DBP. The high-level structure is as follows:

- Business Framework;
- Documentation of existing programs;
- Assessment of existing data programs;
- Performance framework for data programs
- Strategies and actions; and


Implementation plan.

Table 1.1 illustrates how tasks in the TAMIS project address one or more of the key concepts that should be included in a DBP.

**Table 1: Linking TAMIS Tasks to key DBP concepts**

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Throughout the course of the TAMIS project, tasks have been planned and carried out in support of developing this DBP. The TAMIS Executive Summary Report provides an overview of all tasks and links to detailed final reports. The following list is a brief overview of all TAMIS tasks showing how they supported the development of TAMIS:

- **The Project Management and Work Plan** (Task 1) developed an outline of tasks and a schedule for the entire TAMIS project.
• **Federal Requirements and Associated Research** (Task 2) researched, complied, and analyzed current Federal requirements and literature related to the development of a TAMIS.

• **Other State’s Best Practices** (Task 3) researched and summarized noteworthy practices in other states with respect to asset management planning, data integration/management and data governance.

• **Stakeholder Coordination** (Task 4) resulted in a Vision and Components report that clearly identified the goals for TAMIS.

• **Evaluate Current Systems and Extent of Integration** (Task 5) included documentation and assessment of the Department’s current state for Data and Information Systems the details collected in this task were used to analyze maturity and support much of the work in later tasks of the project.

• **Develop ADOT&PF TAMIS Framework** (Task 6) utilized what was learned from the current state evaluation to develop a desired framework for TAMIS.

• **TAMIS Gap Analysis** (Task 7) further assessed ADOT&PF’s data, data programs and information systems to identify gaps, provide recommendations, and describe measures that could help address gaps.

• **Research TAMIS System Model Alternatives** (Task 8) provided several options for a TAMIS, discussed pros and cons, and recommended the optimal model for ADOT&PF.

• **Research Recommendations for TAMIS** (Task 9) prioritizes key recommendations identified in all TAMIS tasks and includes the action plan for implementing TAMIS.

• **TAMIS Project Communication Plan** (Task 10) deploys strategies to encourage collaboration and a shared ownership of the TAMIS research project by stakeholders and key decision makers.

• **This task, The Data Business Plan** (Task 11) establishes business rules and data quality expectations to guide enterprise improvements to data and information practices.

• The **TAMIS Proof of Concept** (Task 12) demonstrates and validates concepts of integrated data and data management improvements using a subset of ADOT&PF’s asset management data.

• The **Data Governance Manual (DGM)** (Task 13) is a document that supports the Department’s Policy and Procedure for Data and IT Governance and this DBP by defining the data governance model for ADOT&PF and lists the actual standards, policies, procedures.
1.1 Why is a DBP Needed?

The following paragraphs explain why better data management practices are needed to support TAMIS.

Establish data quality expectations for TAMIS data systems

ADOT&PF’s data quality expectations are based on the following criteria:

- **Timeliness** – The degree to which data values or a set of values are provided at the time required or specified.
- **Accuracy** – The measure of degree of agreement between a data value or sets of values and a source assumed to be correct.
- **Validity** – The degree to which data values satisfy acceptance requirements of the validation criteria or fall within the respective domain of acceptable values.
- **Accessibility** – The relative ease with which data can be retrieved and manipulated by data consumers to meet their needs.
- **Completeness** – The degree to which the data values are present in the attributes (data fields) that require them.
- **Coverage** – The degree to which data values in a sample accurately represent the whole of that which is to be measured.

Each of these data quality criteria was used to evaluate the data systems and databases that support TAMIS at ADOT&PF to determine areas of improvement or areas where practices are exceptional, thereby providing best practice examples for use elsewhere in the agency.

Quality data is needed for performance measures

State DOTs have to rely on many key data systems to establish, monitor, and report progress on their performance measures in each of the goal areas listed above. Several of the TAMIS data systems are the same ones that are needed to support the MAP-21 performance measures goal areas, in addition to supporting the business needs of ADOT&PF. These systems include but are not limited to the following:

- CRASH (Safety);
- Traffic System (HPMS data, congestion reduction);
- Roadway Data System (HPMS data, road inventory, linear reference system);
- Pavement Management (Infrastructure condition);
- Bridge Management (Infrastructure condition);
- Maintenance Management System (Infrastructure condition); and
- Geotech assets (Infrastructure condition).
Given the importance of these systems for supporting ADOT&PF core business functions and for meeting MAP-21 requirements, it is imperative that the Department implement a formal DBP to protect these valuable data assets.

Quality Data for Decision Support

Decisions are made on a daily basis regarding the best approach for achieving these goals. Many of the decisions involve staff from across the Department. Input is necessary from staff that are knowledgeable in the data systems and business processes used to make decisions.

A comprehensive list of asset management related decisions was developed by the TAM Steering Committee in 2014. These decisions are presented in the form of questions, are organized around the TAMP elements required by MAP-21, and are grouped into four categories: Asset Inventory, Risk Management, Financial Plans, and Investment Strategies. The complete set of decisions (questions) and answers is found in the Existing Conditions Task 5, chapter 2 and in the Gap Analysis (Task 7) report. These questions were used in part, to develop the Proof of Concept (POC) for TAMIS (Task 12), which demonstrates how the TAMIS proposed model works to support asset management analysis and decision-making at ADOT&PF.

One of the benefits of the DBP is to provide recommendations for improved management of TAMIS data systems that are needed for TAM decision-making. Some of the most important decisions are those that correspond to the Mission and Strategic Plan of the Department. The Mission for ADOT&PF is to “Keep Alaska Moving through service and infrastructure.”

The Strategic Plan emphasizes that the Department will Keep Alaska Moving by doing the following:

- Provide for the safe and efficient movement of people and goods;
- Provide statewide access and connectivity; and
- Provide access for exploration and development of Alaska’s resources.

Enterprise improvements to data and information practices

Implementing better data and information management practices at the enterprise level will help the Department to:

- Establish data collection standards to facilitate a process where data is “collected once, but used many times;”
- Use consistent data for business decisions and for Federal and state reporting;
- Link data to performance measures and outcomes and improve evaluation of and/or changes needed to performance measures;

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3 Alaska DOT&PF Website, [http://www.dot.state.ak.us/](http://www.dot.state.ak.us/)
Formalize data governance practices at ADOT&PF to improve management of key data resources and application systems;

Integrate new IT tools to support data sharing across the Department;

Improve communication across the Department on the uses and benefits of existing applications and/or new proposed applications (through linking data systems to multiple business functions);

Improve management of data needed to support asset management requirements of MAP-21, including managing the roadway inventory data needed to support the Model Inventory of Roadway Elements (MIRE); and

Improve the project prioritization process needed for the State Transportation Improvement Program (STIP), the 10-Year construction plan, and the Long-Range Transportation Plan (LRTP).

**Establish business rules**

Data business rules are needed to improve exchange and sharing of data and information across the Department. Business rules identify specifics about tasks such as how data is extracted and who is responsible for the data extraction. They also identify the timing of updates for data systems, and the integration of datasets that may be needed for standard or ad-hoc reporting. Adopting and enforcing data business rules at the enterprise level will help eliminate confusion about who, what, when, how and with what IT tools data and information should be managed.

### 1.2 Goals of the DBP

- Document needs/gaps with managing and sharing asset management data and information across ADOT&PF and provide recommendations for addressing them;

- Improve coordination and communication across all ADOT&PF divisions with asset management data responsibilities to reduce redundant or uncoordinated efforts between offices;

- Define a DBP framework for collecting and managing ADOT&PF’s data assets required for TAM decision-making that is scalable for implementation at the enterprise level.

These goals for the DBP may be modified in the future as new policies or revised strategic directions are implemented that impact data management practices. It is recommended that the DBP be regularly reviewed for needed updates annually (at minimum) to ensure that the most current directives regarding data and information management practices at ADOT&PF are clearly documented.

The DBP is being delivered as one of four key deliverables for the Asset Management TAMIS project. The others include the Data Governance Manual...
(Task 13), the Proof of Concept (Task 12), and the TAMIS Implementation Plan (Task 9).
2.0 Data Governance

Establishing a DBP includes developing a customized Data Governance framework. Data Governance is the “exercise of authority and control (planning, monitoring, and enforcement) over the management of enterprise data assets”\(^5\). Data Governance provides the necessary authoritative role to support the implementation and ongoing use of the DBP. The Implementation Plan for TAMIS (Task 9) provides specific recommendations and an action plan for data governance strategies to support TAMIS. The DGM (Task 13) is the guide that details how data governance should be carried out at ADOT&PF.

It is reasonable to expect that there may be issues and challenges in implementing data governance within an organization where centralized data management and data governance practices do not already exist. The lack of data standards, policies and procedures in some areas also presents challenges.

2.1 Issues/Challenges Related to Data Governance at ADOT&PF

This section discusses the importance of Data Governance as a critical component of data business planning and, in particular, examines the challenges associated with implementing data governance at ADOT&PF. The section also presents proposed solutions for addressing those challenges.

Several challenges and issues have been identified at ADOT&PF during the research for the TAMIS project and are explained in detail in the Task 7 report. These challenges are summarized below. Recommendations are made in the following section for how to address the challenges.

System Challenges (those challenges related to the underlying datasets and databases and the storage medium for the databases).

- Data Collection (missing data, data collected that is never used or not important, standards and coordination are needed)
- Storage Systems (wide variety of storage systems impacts ability to integrate data);
- Data Quality (varying degrees of data quality exists);
- Documentation (minimal or no documentation exists for many systems);
- Reporting Needs (additional reports needed);
- Silo Systems (inhibit ability to integrate data); and

\(^5\) DAMA International 2009
• System Access (may be difficult to access system in remote areas or access is controlled by certain offices).

**Technical Challenges (those challenges related to technology infrastructure and/or functionality issues)**

• Need more efficient ways to locate and take advantage of available data and information;
• Need better methods to look at and integrate data from multiple sources;
• Need (business) processes and systems that reduce redundancy and promote consistency in data results;
• Need department-wide spatial data tools;
• Need System Interfaces (automated interfaces needed between systems);
• Need better links to Geospatial Data (necessary to simplify integration of data that is based on location);
• Technology tools (hardware/software improvements needed);
• Functionality (improvements needed in specific systems); and
• Data Integration/Data Links missing (no integration capabilities exist for certain systems).

**Institutional Challenges (those challenges related to people, business processes, organizational structure)**

• Business rules needed (to ensure timely update of data and accessibility of data across offices);
• Limited User Groups (inhibits ability of use of data on a widespread basis to offices where it is needed);
• Governance needed for management of TAMIS systems (this need applies to ALL ADOT&PF systems);
• Information to decision-makers (can be improved through use of Data Governance);
• Need to define system ownership, stewardship roles/responsibilities;
• Limited resources (careful planning needed to allocate resources to most critical areas);
• Training needs (continuous training program needed to keep staff skilled in the use of best technology);
• Limited appreciation by decision-makers of the role of data systems in supporting business operations; and
• Lack of formal policies and standards which guide the collection, processing, and use of data within the organization.
Before recommending solutions to specific issues/challenges related to TAMIS data systems, their relationship to enterprise-level challenges should be evaluated as well. Many of the TAMIS related issues/challenges are encompassed within the following enterprise challenges.

**Enterprise-Level Challenges (those challenges related to asset management across ADOT&PF)**

- Adequate IT Infrastructure to support enterprise-wide database integration (may require the procurement of new servers or database platforms to support database integration);

- Role of GIS in agency-wide integration (need to address how enterprise GIS will be supported, managed, which office(s) will have primary responsibility for GIS);

- Data Collection (need to coordinate and discuss what data is required, need to review data requests and collaboratively approve/deny/prioritize);

- System Integration (need to improve efficiency of integration between systems, including more automated processes to replace manual processes);

- Data linkage and data governance (need to document in DGM the recommended data standards, policies, and practices within a data governance framework that should be implemented to improve linking (or integrating) data systems to support decision-making);

- Identify single source of information for projects planned, funded, designed, constructed and final costs;

- Need ability to track Performance Measures targets for asset management using TAMIS data systems;

- Need to select Bridge and Maintenance projects through a single access portal; and

- Need ability to integrate and report data on deferred maintenance projects.

### 2.2 Recommended Solutions for Addressing Challenges Related to Data Governance

There are several options available for addressing these challenges and issues. The recommended solutions include implementing and using the following:

- Data Business Framework;

- DGM (data standards, data business rules, data catalog, etc.);

- Enterprise-level GIS Governance Plan (to ensure consistency, create and enforce GIS standards and consolidate GIS applications and resources);
• Strategic Information Management Study (develop plan for ISSD division structure);
• Phased replacement of legacy and silo data systems;
• IT tools to improve transmission, sharing, exchange of data; and
• Staff training program (new technology and business processes).

Each of these are described in more detail below.

### 2.2.1 Define a Data Business Framework

A customized version of a Data Business Framework for TAMIS data systems is illustrated in Figure 2.1 (ADOT&PF DBP Framework – Asset Management) to depict applications/systems that specifically support Asset Management at the Department. The top portion of the diagram illustrates the data sources that provide data on programs and assets. Ten of those systems have been identified as Tier 1 which are the most critical for supporting asset management. The Department should develop a similar diagram to represent a Framework for the enterprise.

**Figure 2.1: ADOT&PF DBP Framework**
2.2.2 Develop and Maintain a Data Governance Manual

A DGM provides detailed information about data principles, standards, policies, and procedures regarding the use and management of data at an agency. It defines the roles and responsibilities of the individuals charged with managing data systems on behalf of the stakeholders and users of the systems and includes a data governance framework for the agency to illustrate how the data governance process can be used to support the agency's core business functions. The TAMIS project includes a DGM (Task 13) containing the above material to support recommendations in this DBP (Task 11), the P&P for Data and IT Governance, and an Implementation Plan for TAMIS (Task 9).

2.2.3 Leverage Existing Data Governance Efforts

The main goals and strategies for data governance efforts already initiated at ADOT&PF in the Division of Program Development (DPD) are a useful start for TAMIS. Strategies include:

- Define what elements should be included;
- Define processes to evaluate new data or existing data for inclusion;
- Uphold high standards for data quality;
- Maintain integrity of data through defining roles and responsibilities;
- Establish a data governance board and data management team;
- Meet regularly to discuss issues and implement management solutions (such as screening data requests, develop and modify data models, and oversee development of a data catalog).

In addition to DPD data governance, focus groups and teams have been established to work on strategies and improvements related to data integration, interagency coordination, enterprise licensing and Information Technology (IT) architecture. Most teams meet regularly to monitor the progress of their identified action items and report their progress, successes and challenges directly to upper management.

The activities related to data governance occurring in specific program areas can be expanded to work at the enterprise level. The DGM will build upon work ongoing or already started and include those who are working on existing data improvement teams. Once the DGM is adopted for enterprise data management, individual data governance strategies can be discussed, prioritized and consolidated within the enterprise data management plan.

2.2.4 Plan for IT Improvements that will support TAMIS and Enterprise Data Systems

ADOT&PF conducted a Summit for Success in February 2014 to discuss and address key issues facing the Department. Since IT was identified as a “high priority” need,
an Information Systems (IS) team was formed to evaluate “information systems statewide and deliver a report that describes problems and potential solutions as discussed during the Summit for Success.” The results of this meeting were published in a May 2014 report on Information Management/Technology Organization at ADOT&PF. There were three primary recommendations from that report, which support enterprise level data business planning for Information Technology. The recommendations are to:

- Reorganize the IT functions by appointing or hiring a Chief Information Officer reporting directly to the Commissioner or Head of Administration;
- Conduct a Strategic Information Management Study to document existing and future architecture and state of IS within ADOT&PF; and
- Employ change management techniques to facilitate leading the organization from an existing state (in data management maturity) to a future state.

A Chief Information Officer was hired and will oversee the Strategic Information Management Study and facilitate the implementation of change management techniques in coordination with other high-level managers in key business areas of the Department.

2.2.5 Phased Replacement of Legacy and Silo Data Systems

ADOT&PF should continue to focus on replacement of legacy and silo data systems across the Department. In particular, ADOT&PF should focus on those applications that support core business functions of the Department and which are used by multiple offices either through automated or manual sharing of data. A plan should be developed to eliminate manual processes and to continue migration of applications away from legacy/silo systems to newer systems that employ new technology for improved display and sharing of data and information. The plan should include careful evaluation of existing systems and leverage and/or improve upon tools, databases and systems that are already working. Where applicable, recommendations will be made in the TAMIS implementation plan.

Work has already begun in this direction with the recent decommission of the legacy Highway Analysis System (HAS), and the development of the Spatially Integrated Roadway Information System (SIRIS) to replace it. In addition, the Department has updated Crash and Traffic data management and analysis systems and will soon adopt new Pavement, Maintenance and Equipment (e.g., Fleet) management systems.

As part of the process of updating systems, it is recommended that the Department follow a systems engineering approach including key stakeholders and data governance teams identified in the DGM to make sure replacement systems and applications are compatible with the adopted integration methods and to ensure standards are met for data quality, accuracy and integrity.

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2.2.6 IT Tools to Improve Transmission, Sharing, Exchange of Data
ADOT&PF needs to evaluate through comprehensive market research, what type of information technology tools should be procured to meet the current and future needs of the Department. Procurement of such IT tools should include consideration of compliance with current State and Department IT architecture standards and requirements. A plan needs to be developed for deployment of such tools at the enterprise level including details on integration methods, standards, roles, responsibilities, training and processes to support data quality.

2.2.7 Staff Training Program
ADOT&PF needs to conduct a comprehensive evaluation of training needs across the Department to support implementation and use of new technology and applications that support business functions in each office. One way to start this is to identify training needs while marketing new tools, systems or applications to department-wide staff. The process of marketing a new application, asking questions and getting feedback, is very helpful to identify training needs. Another part of the evaluation should focus on existing manuals and training materials and make sure all are updated and stored in a central and accessible location.

Once the initial assessment is completed, training can be conducted for targeted groups including but not limited to data collectors, data processors, and users of application systems. Development and use of training manuals should be archived in a centralized and accessible document management system such as eDocs for use in all offices across the Department. Further recommendations as to who in the department will organize training and monitor that information resources are stored in a document system will be made in the DGM and Implementation Plan for TAMIS.

3.0 Data Business Planning

3.1 DATA MANAGEMENT BUSINESS PRACTICES
This section includes additional recommendations for addressing multiple needs related to data business practices which refers to common and popular methods and techniques used to perform the processes and produce the deliverables. There are several recommendations that can be made to improve data management business practices at ADOT&PF. Some of these recommendations pertain to business rules or staff responsibilities for conducting daily work activities according to the business rules. Others focus on changes in business processes that involve integration of new technology, which include training for staff in the use of new technology. All recommendations are based on best practices in both the public and private sector.
The following recommendations are intended for consideration by ADOT&PF staff and managers in improving data and information management across the Department. The following list of recommendations is based on feedback from staff during interviews with various data system stakeholders as part of the TAMIS project and on best practices recommended through NCHRP research and Transportation Research Board (TRB) sponsored peer exchanges. The focus is on key TAMIS systems identified and prioritized in the Evaluate Current Systems and Extent of Integration (Task 5) report and recommendations in the Implementation Plan for TAMIS (Task 9).

- Roles and responsibilities could be identified for TAMIS data systems maintained by Headquarters and Region staff in a centralized data and information systems catalog.

- Data governance policies, procedures, and data standards can be established and documented for each TAMIS data system.

- Each TAMIS data system should recommend and document in a single document any new business processes that were implemented to improve exchange and sharing of data and information between business areas. This includes development of automated processes to replace manual processes, or revising automated processes to streamline access to data and reports across multiple offices.

- Business and System Owners involved in TAMIS implementation should meet regularly to assess how the new and improved coordination and integration efforts are impacting the ability to provide timely and accurate information for decision-making. Lessons learned from TAMIS implementation should be documented and used to inform the implementation of new recommendations at the enterprise level.

The following recommendations include establishing new business rules and establishing specific roles and responsibilities at ADOT&PF for consideration by the Department to improve management of asset related data systems. The specific examples of the new business rules and recommendations for roles and responsibilities are documented in more detail in the DGM. The list of recommended business rules (documented in detail in the DGM) includes rules to:

- Establish formal business rules for management of data systems, including which data systems are considered the “system of record,” what data standards are applied to ensure quality control measures are in place, what data integration methods are used to share and exchange data, identify who shall have access to data for query only purposes and who shall have update capabilities for data systems.

- Establish a permanent electronic repository of information (accessible to all ADOT&PF employees) related to the DBP and data governance policies, procedures, and participants.
• Establish roles and responsibilities for existing positions within the ADOT&PF organizational structure to support critical activities in each Region and at Headquarters. In particular:
  o Assign Business and System Owners for each system, dataset and application.
  o Establish data management coordinators,
  o Promote Data Governance teams for each business area, and

• Establish priorities for which staff positions, and data management policies and procedures need to be implemented first.

• Establish business rules regarding how, when and where staff should receive training to successfully perform their data management related job duties. This would differ from the typical training that most employees receive during new employee orientation sessions. This training would be specific to the IT tools and functionality of applications for which the employee is responsible.

3.2 RECOMMENDED TAMIS BUSINESS PROCESSES

The following recommendations are made based on the evaluation of TAMIS systems completed as part of the TAMIS Task 7 Gap Analysis research. These recommendations are adaptable for implementation across the Department. These recommendations are based on business processes, technical improvements and system improvements that need to be made during implementation of the DBP. Some of the high-priority needs are discussed in the following paragraphs.

Business Processes

1. Establish “ownership” of data and information systems. Roles and responsibilities for Business and System Owners will be defined and adopted by the Department and documented in the P&P for Data and IT Governance and the supporting DGM. Research and interviews conducted as part of the Evaluate Current Systems and Extent of Integration (Task 5) report should be leveraged and documented in a centralized data and information systems catalog.

2. Establish business rules for allowing automated access to various types of data for cross-function analysis. Examples include use of bridge data by the Pavement section and Maintenance and Operations (M&O) staff, and access to use of the most current traffic data by the Pavement section staff. As part of the TAMIS project, an evaluation was done to determine where access is needed to facilitate cross-functional analysis (e.g., investment strategy versus return on investment.) Recommended strategies will be detailed in the Implementation Plan for TAMIS (Task 9).
3. **Establish business rules to determine distributed responsibility for data management between Headquarters and Region offices.** There are certain applications (e.g., GIS, CAD) that could provide additional benefits to the Department if there was better coordination between Headquarters and the Regions.

4. **Coordinate across business lines (horizontal, not just vertical reporting to management) to ensure that prioritization of funding and investments meets the high-priority needs of the Department in accordance with its stated Mission and Goals.** The recommendation was made to implement data governance rules across the Department with the P&P for Data and IT Governance and the supporting DGM. The P&P establishes a Data & IT Governance Council and Work Group and establishes principles to follow for improved data and information management. The importance of data governance was presented in Section 2.0 of this DBP and the DGM (Task 13) is available for detailed information about which data governance standards, policies, and practices should be implemented at ADOT&PF.

5. **Establish the following Business Rules for Knowledge Management:**
   - Document how to request access to and properly utilize the electronic document management system known as eDOCs;
   - Identify who the access request is to be sent to;
   - Identify who is in charge of granting access to eDOCs and setting up the access;
   - Identify who is in charge of providing training in eDOCs; and
   - Identify what level of update privileges are allowed for users of eDOCs, etc.

Although the eDOCs system has a dedicated programmer analyst and an informal stakeholder group, there is no single point of contact to manage or to develop data governance for the enterprise system. Details of who should be responsible will be recommended in the Implementation Plan for TAMIS (Task 9) and will remain somewhat flexible as new roles are established and others repurposed.

**Technical Improvements**

1. There are some critical applications that need to include a method for automated transfer (or integration) of data between systems. Automated methods would be used to replace existing manual methods. Developing automated links on an enterprise basis would improve efficiency in the timely delivery of data and information. This approach would be particularly beneficial to the Department by linking Aviation, Marine, and Roadway applications where reasonable to do so in order to support project prioritization in all three areas.

2. Adding geospatial location capabilities to applications that contain linear referencing and other types of location data would facilitate more efficient
visualization of data and provide better analysis methods for data that includes viewing data on a map as well as in a tabular format.

3. Adding functionality to existing applications by providing enhanced modeling and reporting capabilities would improve decision-making pertaining to project needs and prioritization.

4. Replacing hardware and software with newer IT infrastructure is an ongoing activity of ISSD and will be included as part of an IT Strategic Plan.

**System Improvements**

1. Replacement of silo data systems with systems that serve the broader business needs of the Department can provide more streamlined access to data and information and also make maintenance of that information less challenging, including perhaps requiring fewer data management resources currently used to maintain independent systems.

2. Quality control standards and practices need to be implemented to ensure that the highest quality data is available to support decision-making. The types of quality control standards established will vary by application system, but should incorporate all of the six quality control criteria identified in Section 1.0.

3. Data collection standards and procedures need to be streamlined to eliminate duplication of data collection across the Department and to collect needed data where it is not available to support Department business needs. This includes collection of data needed for reporting on such items as deferred maintenance work and/or addition of smart flags to the existing Bridge Management System to handle data items that are not stored in that system. There are also other systems where data collection is not complete for the type of inventory data that is stored in the source system (e.g., culvert and guardrail inventories). To identify and create efficiencies in data collection efforts it is recommended that ADOT&PF finalize and manage the inventory of all systems and data sets at ADOT&PF. The systems should be inventoried by key data managers building on the inventory already started for TAMIS. For data sets, it is recommended that inventory is structured as a registry/request system that includes an agreed upon set of criteria and metadata fields. This will help the Data and IT Work Group (established in the Data and IT Governance P&P) evaluate and prioritize data and identify data collection needs, gaps and inefficiencies.

The next section provides a discussion of the importance of data standards in supporting the exchange of data between systems.
4.0 Data Standards

Since the ideal state is to have one ‘system of record’ for each critical piece of data, it is necessary to establish methods to transmit or exchange data between systems. In particular, data standards are needed for location referencing, asset identification, and metadata. Any new standards implemented should also maintain consistency with existing standards. Each of these topics is discussed in more detail in this section.

Data standards are used to support the efficient sharing and integration of data between different systems. Standards provide formalized rules for documenting data formats and data definitions, which are needed to integrate data at a detailed level. Data standards should be implemented for each of the following categories of data at ADOT&PF as described below. The official recommended data standards for each of these categories are identified and maintained in the DGM.

The following recommendations are for establishing any set of standards:

- The final decision about specifics such as official location data standards and metadata standards to be used will be made by the Data and IT Governance Council who will take recommendations from the Data and IT Governance Work Group.

- Assigning Business and System Owners to support specific databases on behalf of the enterprise will result in more accountability and responsibility for data management throughout the enterprise. This will require oversight and participation by upper management who need to be informed about key data activities but not necessarily need to be involved in daily management of business area data requirements.

- Specific types of documentation shall be defined in the DGM and required for all datasets prioritized for TAMIS and those needed for required information systems that support department funding, planning, design and construction functions.

- Standards for migration of data from a local database such as Access (used in a particular office) to one that is available on an enterprise basis such as Oracle should be identified, refined by the Data and IT Governance Work Group, and added to the DGM as needed.

Once the standards are developed and implemented, they should be reviewed on an annual basis and adjusted as needed, depending upon continued implementation of improved technology at ADOT&PF, including development of new application systems and/or enhancements to existing systems.
4.1 **Data Quality**

Use of data quality standards ensures that the data and information provided by ADOT&PF’s data programs pass the litmus test for data quality. This includes providing data that has improved accuracy, timeliness, completeness, validity, coverage, and accessibility. The data quality standards for the Department shall be established to:

- Address the collection and processing of data;
- Address missing or incomplete data;
- Ensure consistent data is used for performance measures;
- Ensure data is not duplicated in multiple datasets; and
- Indicate the update frequency and age of data.

The data standards recommended and adopted by the Department shall be maintained and easily accessible by staff in the DGM.

4.2 **Location Referencing**

A clear set of standards needs to be developed for location referencing data, since different datasets may use different types of data for location purposes. This includes, but is not limited to, the use of latitude/longitude coordinates and/or a CDS route and milepoint. Since location data is needed to support integration of datasets such as bridge, pavement, and maintenance management databases, it is imperative that the Department implement data collection standards for the location referencing data used with these systems. The standards for location referencing data shall include the following components:

- Identify which assets are linear and which are point assets from the perspective of location, identification and geospatial referencing;
- Document existing standards (or develop where none exist) for use of a common Linear Referencing System (LRS) at ADOT&PF. Specify if the LRS is used to support multiple Linear Reference Models (LRM) and data integration based on the multiple LRMs;
- Document existing standards (or develop where none exist) for GPS-based field data collection;
- Document existing standards (or develop where none exist) for managing temporal changes to the LRS based on route realignments, or jurisdictional boundary changes, etc.;
- Document standard procedures (or develop where none exist) for integrating different sets of linearly referenced data; and
- Document standard procedures (or develop where none exist) for use of consistent time stamping of data sets.
4.3 **Asset Identification**

“Asset” is defined in the AASHTO TAM Guide as “the physical transportation infrastructure (e.g., travel way, structures, other features and appurtenances, operations systems, and major elements thereof); more generally, can include the full range of resources capable of producing value-added for and agency: e.g., human resources, financial capacity, real estate, corporate information, equipment and materials, etc.; an individual, separately-managed component of the infrastructure, e.g., bridge deck, road section surface, streetlight.” Appendix B identifies how assets are typically defined. This includes how transportation infrastructure assets are defined compared to other assets, such as vehicles, buildings, land, etc.

Standard procedures and methods shall be established for asset identification. Preliminary analysis needs to be done to determine whether current methods for asset identification are sustainable at ADOT&PF, and whether the appropriate level of detail is currently being used for identifying assets, given the costs of maintaining accuracy and currency and the use of the information.

The recommended documentation for the standard list of asset types that are consistently defined, quantified and used throughout ADOT&PF is described in the Data and Information Systems Catalog (DISC) Report (part of Task 13). In the report, it is recommended that the catalog and registry be configured to provide a better understanding of how the Department defines different types of assets. For instance, are pavement markings considered to be a separate asset or an attribute of the pavement asset?

4.4 **Metadata**

A central repository of metadata for ADOT&PF’s systems, datasets and databases is necessary to clarify how data from disparate sources can be integrated or linked. The metadata includes definitions, roles and responsibilities, formats, sources, and accuracy levels for items inventoried in the catalog. It is proposed metadata about systems and data sets be tracked in a central data and information systems catalog (see DISC report - Task 13). At a more detailed level, the metadata should include the following components:

- Metadata (for geospatial data sets) that identifies whether/how the metadata conforms to the FGDC’s Content Standard for Digital Geospatial Metadata
- Documented methods that are used to provide metadata to users, so that they understand the uses and limitations of various datasets;
- Documented processes to ensure that metadata are being populated as needed and are sufficiently accurate and complete;

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7 AASHTO TAM Guide, Glossary
• Documented processes used (or developed as needed) to manage and populate standard coding for shared data elements across systems, to ensure code definitions are accessible to users;

• Documentation of where construction project information (e.g., as-built surveys, updated inventory, final costs) is stored and available for tracking work completed on each asset at a given location;

• Documentation of how maintenance expenditures on each asset are tracked at a given location;

• Documentation of where standard lists are maintained of equipment and materials used for planning and reporting work activities. Identification if the lists are centrally managed and accessible to all consuming systems; and

• Documentation of any hierarchies in activities and resource types that may allow for rolling up specific activities to fewer categories for use in budgeting and planning work.

4.5 **CONSISTENCY WITH EXISTING STANDARDS**

It is important to ensure that implementing any new data standards is consistent with existing ADOT&PF standards as identified in Policies and Procedures documents at the Department and any standards or guidance that may be established by statute. Data standards are described in the DGM and it is recommended that the new ISSD director coordinate with the Data and IT Governance Work Group to ensure that data standards, policies, and procedures documented are consistent and do not conflict with existing standards, policies, procedures and Alaska state statutes.

The data standards established at ADOT&PF shall document:

• How data systems support HPMS reporting without duplication of data collection efforts specifically intended for HPMS;

• How the ADOT&PF roadway asset data elements are consistent with the emerging Model Inventory of Roadway Elements (MIRE);

• How the bridge element-level data is consistent with the FHWA Initiatives for Collection of Element Level Bridge Inspection Data\(^8\);

• How the AASHTO protocols are followed for collection of pavement roughness data; and

• Best practices in use for data modeling in order to eliminate reinventing the wheel and maximizing future information sharing opportunities across the Department and with other agencies.

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\(^8\) FHWA Bridges and Structures, Bridge Inspection, NBI, April 2012, http://www.fhwa.dot.gov/bridge/nbi/120416.cfm
Over time, new standards need to be implemented and perhaps other standards revised to reflect changes in information technology architecture or Department policy, or changes in state statutes.

5.0 Risk Management

Risk management practices have traditionally been used with Asset Management programs as a means to provide early detection of potential problems, to allow enough time to develop a strategy to avoid risks. ADOT&PF should consider developing a formal Risk Management Plan to document actual and potential risks to its core data systems and to establish procedures for addressing those risks if/when they occur. Having a Risk Management Plan in place will help to sustain the data and information systems that are needed for important decision-making at ADOT&PF. While the DBP provides guidance in the day-to-day management of critical application systems, the Risk Management Plan (RMP) can be used to identify risks to the Department if loss of data occurs. The RMP also documents how risks should be handled in the event of actual occurrence. NCHRP 666 (Target-Setting Methods and Data Management to Support Performance-Based Resource Allocation by Transportation Agencies) identifies five basic steps for developing a risk management plan:

1. Identify risks;
2. Assess/analyze risks;
3. Develop a plan to mitigate (avoid) risks;
4. Assign resources to handle risks; and
5. Monitor ongoing and potential risks

5.1 IDENTIFY RISKS

The first step in developing a Risk Management Plan is to identify risks. For further clarification, a risk is defined as “a future phenomenon, condition, or event that may directly impact the transportation system.” In terms of risks to ADOT&PF regarding its core data systems, the definition can be refined somewhat to “a future phenomenon, condition, or event that may directly impact the data systems that are needed to provide information in support of the Alaska transportation system.” A Risk Register is a tool that is used to record information about each type of risk. The Risk Register includes a risk identification number assigned to the risk, the threat that may precipitate the risk, the event that will trigger the risk, the qualitative

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9 MnDOT District Highway Investment Program (HIP) Investment Risk Analysis Framework, October 2010.
analysis to be performed related to the risk and any actions that will be taken as a result of the risk. Table 6.1 (from NCHRP 666) identifies an example of a Risk Registry for HPMS and Real-Time Traffic Reporting requirements. A similar Risk Registry (perhaps building on framework within the recommended data and information system catalog (Task 13 - DISC Report) should be developed to document potential risks at ADOT&PF related to its data systems.

As part of the implementation of the DBP and associated Data Governance framework, several roles and responsibilities are identified for persons and offices that serve as data business owners, data stewards and data custodians for many applications across the Department. The most likely persons to be involved in handling risks to data systems will be the Business and System Owners included in the Data and IT Governance Work Group described in the P&P for Data and IT Governance. If ADOT&PF chooses to develop a risk management plan, CS recommends the monitoring and mitigating risks related to data and information systems should be the responsibility of the ISSD director or his designee and the Data and IT Governance Work Group.

It is helpful to add risks to a database so they can be monitored. Since the framework and application for a functional registry already exists, a corresponding Risk Registry could be developed as an enhancement to the existing application. Table 6.1 is an example of a Risk Registry that could be developed for the Department with minimal investment.

**Table 2: Example Risk Registry**

<table>
<thead>
<tr>
<th>Priority</th>
<th>Status</th>
<th>ID#</th>
<th>Date Risk Identified</th>
<th>Functional Assignment</th>
<th>Threat</th>
<th>Risk Details</th>
<th>Risk Trigger</th>
<th>Type</th>
<th>Probability</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Active</td>
<td>TDS- 001H</td>
<td>5/01/2008</td>
<td>TDS-HPMS</td>
<td>Need to revise HPMS report to comply with 2010 requirements</td>
<td>All internal data files and programs will need to be reviewed and revised as needed to provide HPMS 2010 report.</td>
<td>FHWA mandate for new HPMS 2010 requirements</td>
<td>Schedule Available resources Cost</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>2</td>
<td>Pending</td>
<td>TDS- 001T</td>
<td>1/01/2009</td>
<td>TDS-Traffic</td>
<td>Need to comply with Section 1201 SAFETEA-LU requirements.</td>
<td>Need Real-Time Traffic Mgmt. Plan within two years of final rule on Sect. 1201</td>
<td>SAFETEA-LU requirements</td>
<td>Schedule Available resources Cost</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>3</td>
<td>Pending</td>
<td>TDS- 001G</td>
<td>9/01/2008</td>
<td>TDS-GIS</td>
<td>Need to meet HPMS 2010 GIS requirements</td>
<td>Will need to provide HPMS 2010 report in GIS format</td>
<td>FHWA mandates for new HPMS 2010 requirements</td>
<td>Schedule Available resources Cost</td>
<td>H</td>
<td>H</td>
</tr>
</tbody>
</table>

Source: NCHRP 666 (2010).
5.2 **Assess/Analyze Risks**

The next step in developing a Risk Management Plan is to assess and analyze any actual or potential risks. A typical risk assessment for data applications includes documenting:

- How much data is needed;
- How accurate the data should be;
- What the refresh rate of the data should be; and
- Who should have access to the data.

The last three steps in risk management include:

- Developing a plan to avoid risks – the plan is documented in a formal Risk Management Plan;
- Assigning resources to handle the risks – this may be a working group comprised of data business owners, data stewards, and ADOT&PF Information Technology staff who provide technical support for data systems; and
- Monitoring ongoing and potential risks documented in the Risk Register.

The Risk Management Plan, similar to the DBP is a “living document” and maintained at least on an annual basis by ISSD. Business Owners, Systems Owners, and the Data and IT Governance Work Group can assist ISSD in maintaining a Risk Registry.

Another consideration of implementing a Risk Management Plan is to ensure that the data required for performance measures is available when needed. The next section discusses the important link between data systems and performance measures, especially those measures pertaining to asset management as directed by MAP-21.
6.0 **Link Performance Measures to Data Systems**

At the Federal level, MAP-21 legislation requires a set of national transportation performance measures. The state DOTs and Metropolitan Planning Organizations (MPO) are required to establish targets for those performance measures as well. The legislation organizes the measures by national goal areas. MAP-21 calls for national performance measures in the following goal areas:

- Safety;
- Infrastructure Condition;
- Congestion Reduction;
- System Reliability;
- Freight Movement and Economic Vitality; and
- Environmental Sustainability.

There is an inherent relationship between ADOT&PF’s DBP and the TAMP also required by MAP-21. The DBP will be used to help manage ADOT&PF’s data systems that are needed to meet the MAP-21 TAMP requirements discussed below.

MAP-21 legislation requires state DOTs to develop a TAMP that contains at a minimum:

1. An inventory of the pavement and bridge assets on the National Highway System in the State, including a description of the condition of those assets;
2. Asset management objectives and measures;
3. Performance gap identification;
4. Life-cycle cost and risk management analysis;
5. A financial plan; and
6. Investment strategies.

The paragraphs below provide a brief summary of each required MAP-21 TAMP element.

**Asset Inventory and Condition.** Compiling, maintaining, and monitoring data on the number and condition of assets is the foundation for effective asset management programs. It provides context for subsequent steps in the asset management process such as setting performance targets, allocating resources and monitoring progress towards stated objectives.
Objectives and Measures. Goals, as used in asset management, are desired outcomes expressed as policy. For example, an agency’s goal may be to improve the conditions of the existing highway system. Objectives are more explicit statements of what an agency hopes to achieve. Objectives often incorporate a performance measure and a specific value (i.e., target) of that measure that the agency wants to achieve. For example, an objective could be to maintain all interstate pavements above a specified pavement rating.

Performance Gap Identification. A comprehensive performance gap element of the asset management planning process would define short-term and long-term asset management planning horizons, describe traffic growth and demand on the system, present an analysis of future funding levels versus condition scenarios, and illustrate the performance gap between existing condition levels and future condition levels.

Life-Cycle Management. Life-cycle management is characterized as “maintaining existing system performance at a constant desired level while minimizing resource consumption and externalities over the long term.” Life-cycle management is a long-term strategy for managing assets with an aim to minimize whole life costs while maximizing system performance and public safety. Using life-cycle management can prolong an asset’s useful life while maintaining performance.

Risk Management. Risk management involves systematically identifying, analyzing, assessing, and managing the risks that threaten the ability to achieve organizational objectives. “Risk” is a broad term and could be related to any number of events, such as performance failure, weather events, cost controls, the selection of suboptimal preservation projects, regulatory delays, construction delays, etc.

Financial Planning. Financial planning enables agencies to compare current and future needs to anticipated revenue levels, and allocate existing funds. NOTE: Figure 6.1 illustrates how TAMIS supports Financial and Resource Management activities at ADOT&PF.

Investment Strategies. MAP-21 does not clearly define the term “investment strategies.” Potential types of strategies may include work strategies and condition thresholds for applying them, a list of assets that are prioritized for investment, and mitigation strategies that are derived from the risk assessment. Since investment strategies could derive from many of the other TAMP elements listed above, it is likely that a TAMP could support investment strategies by addressing the types of data and information already covered.

There is an important link between data systems and performance measures, especially regarding how data can be used to establish performance measures and targets. A good asset management strategy requires the ongoing evaluation of performance of assets. Establishing performance measures, in turn, relies on the

10 “Supplement to the AASHTO Transportation Asset Management Guide: Volume 2-A Focus on Implementation”
use of performance targets such as bridge condition index for bridges, International Roughness Index (IRI) for pavement data, and so on. This type of information is typically stored as data that is maintained in data systems used to support asset management in those business areas. ADOT&PF has defined a desired scope for TAMIS (illustrated in Figure 6.1), which incorporates an asset management strategy that relies on analytical tools to support financial and resource management.
Figure 6.1: Desired Scope for TAMIS

7.0 Implementation Plan

A plan for implementing the recommendations made in the DBP is detailed in Research Recommendations for TAMIS (Task 9) specifically in the Implementation Plan for TAMIS Report. The Implementation Plan provides a sequence of steps to establish the DBP at ADOT&PF. The Implementation Plan:

- Summarizes and prioritizes recommendations and actions for Implementing TAMIS;
- Identifies priorities for implementation of new processes and/or systems to support business needs;
- Proposes timeframes for implementing new processes/systems; and
- Identifies specific roles and responsibilities for implementation.
# Appendix A: TAMIS Acronyms with Definitions

## Table 3: Acronyms and Definitions

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<td>Highway Performance Monitoring System</td>
<td>The HPMS is a national level highway information system that includes data on the extent, condition, performance, use and operating characteristics of the nation's highways.</td>
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<td>IRI</td>
<td>International Roughness Index</td>
<td>The IRI is the roughness index most commonly obtained from measured longitudinal road profiles. It is calculated using a quarter-car vehicle math</td>
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<td>Acronym</td>
<td>Name</td>
<td>Definition</td>
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<td>---------</td>
<td>-------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>ISSD</td>
<td>Information Systems Services Division</td>
<td>Division created at ADOT&amp;PF in 2014 to centralize and better manage the Department’s information systems, infrastructure and data.</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
<td>The study or use of systems (especially computers and telecommunications) for storing, retrieving, and sending information.</td>
</tr>
<tr>
<td>JPG</td>
<td>Joint Photographic Experts Group</td>
<td>A file extension for a graphics file. JPG is used interchangeably with JPEG.</td>
</tr>
<tr>
<td>LRS</td>
<td>Linear Reference System</td>
<td>A method of spatial referencing, in which the locations of features are described in terms of measurements along a linear element, from a defined starting point, for example a milestone along a road.</td>
</tr>
<tr>
<td>LRTP</td>
<td>Long Range Transportation Plan (Alaska DOT)</td>
<td>Guides transportation planning by providing a vision, goals and general plan for construction for a 20-year period.</td>
</tr>
<tr>
<td>Acronym</td>
<td>Name</td>
<td>Definition</td>
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<td>---------</td>
<td>----------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
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<tr>
<td>STIP</td>
<td>Statewide Transportation Improvement Program</td>
<td>Federal compliance document outlining state plans for spending federal allocations - Usually 4-6 years in plan.</td>
</tr>
<tr>
<td>TAMDIT</td>
<td>Transportation Asset Management Data Integration Team</td>
<td>A team set up at ADOT&amp;PF to identify cross-organizational information and data needs for Transportation Asset Management.</td>
</tr>
<tr>
<td>TAMIS</td>
<td>Transportation Asset Management Information System</td>
<td>A system of linked data sources that provides information and analysis capabilities that can be used to plan for make informed asset</td>
</tr>
<tr>
<td></td>
<td>Management Plan</td>
<td></td>
</tr>
<tr>
<td>TAMP</td>
<td>Transportation Asset Management Plan</td>
<td>A focal point for information about the assets, their management strategies, long-term expenditure forecasts, and business management</td>
</tr>
<tr>
<td></td>
<td>Management Plan</td>
<td></td>
</tr>
<tr>
<td>TDP</td>
<td>Transportation Data Programs</td>
<td>A group within Program Development Division that oversees information management and reporting for several business areas including crash,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>traffic, roadway classification, Intelligent Transportation Systems and road weather and traveler information.</td>
</tr>
<tr>
<td>TGIS</td>
<td>Transportation Geographic Information Section</td>
<td>A group within the Information Systems and Services Division that is responsible for the inventory of public roadway features and linear</td>
</tr>
<tr>
<td></td>
<td></td>
<td>coordinates for the Roadway Data System (RDS) network (Alaska DOT&amp;PF's Linear Reference System or LRS) to meet Federal and State</td>
</tr>
<tr>
<td></td>
<td></td>
<td>requirements and the expanded needs of mandatory data programs within the department.</td>
</tr>
<tr>
<td>VMT</td>
<td>Vehicle Miles of Travel</td>
<td>Defined by the U.S. government as a measurement of miles traveled by vehicles in a specified region for a specified time period. VMT is</td>
</tr>
<tr>
<td></td>
<td></td>
<td>calculated by multiplying the amount of daily traffic on a roadway segment by the length of the segment, then summing all the segments’</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VMT to give you a total for the geographical area of concern.</td>
</tr>
</tbody>
</table>
Appendix B: Glossary of Terms

**Asset** - The term ‘asset’ for purposes of use in the DBP includes transportation infrastructure assets and other assets such as vehicles, buildings, land, etc. Each of these types of assets are managed through distinct data systems or independent data bases or inventory lists maintained by various offices at ADOT&PF.

**Business Owner** - A subject matter expert accountable for the data specifications, data quality and information delivery of specifically assigned business areas, subject areas or databases.

**Data** - A representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by humans or computers.

**Data Catalog** – a listing of data sets and metadata that describes how each data set is used, and which identifies the owners and users of the data sets.

The data catalog includes the following components:11
- List of data programs in the agency;
- List of business owners of the data program, with their contact information;
- List of data stewards responsible for the data program, with their contact information; and
- Instructions for accessing data standards and definitions used with each data program.

**Data Dictionary** – A data dictionary, or metadata repository, as defined in the IBM Dictionary of Computing, is a “centralized repository of information about data such as meaning, relationships to other data, origin, usage, and format.” [http://en.wikipedia.org/wiki/Data_dictionary](http://en.wikipedia.org/wiki/Data_dictionary)

Another definition of a data dictionary provided by the Data Governance Institute states that a data dictionary is a “database about data and database structures. A catalog of all data elements, containing their names, structures, and information about their usage, for the benefit of programmers and others interested in the data elements and their usage.” [http://datagovernance.com/glossary-governance.html](http://datagovernance.com/glossary-governance.html).

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A data dictionary typically includes the following information about each data field in a particular database:

- Field Description;
- Field Name (as used in the physical database);
- Field Format;
- Field Type (numeric, alpha, alphanumeric);
- Field Width (how many digits/characters in the field); and
- Comments/how the Field is used.

**Data Governance Manual**

- A manual to provide a single source of information for all staff on the standards, policies, and procedures regarding the use of data and data programs within the organization. The DGM includes the following components:
  - Data governance charter
  - Agency formal data management policy
  - Data governance model diagram used for the agency
  - Roles of data governance participants
  - Glossary of terms

**Data & IT Governance Council** - Established in the P&P for Data and IT Governance, this council comprised of several division directors serves as the primary “governing body” for the management of data systems.

**Data & IT Governance Work Group** - ADOT&PF’s Data Governance Work Group is comprised of Business Owners and System Owners who provide expertise on business area data requirements, help establish business rules, and participate in the management of the Department’s Data Governance Manual.

**Data Governance** - The people, policies, and procedures which govern data management and information systems. Data governance promotes the understanding of data as a valuable asset to the organization and encourages the understanding and management of data from both a technical and business perspective. Data governance provides:

- A central focus for identifying and controlling the collection, storage and sharing of data
- A data business plan and governance board to enforce data management
- Enterprise data standards, data dictionaries, and metadata

---

- Standard data quality assurance processes

**Data Management** – The development, execution, and oversight of architectures, policies, practices and procedures to manage the information lifecycle needs of an enterprise in an effective manner as it pertains to data collection, storage, security, data inventory, analysis, quality control, reporting and visualization.

**Data Program** – A data program in this report refers to specific data systems that support a business area of the organization. The “program” usually includes the functions of data collection, analysis, and reporting. In the case of a DOT, some examples of these programs include traffic, roadway inventory, safety, and pavement data. At ADOT&PF, the primary agency data programs that will support TAMIS are:

- Bridge
- Traffic
- Roadway
- Crash
- Pavement

**Data Registry** – A report on metadata registries from the Bureau of Labor Statistics describes what is meant by a registry for metadata. This description is equally applicable for development of a Data Registry for data sets maintained by and used at ADOT&PF.

“A metadata registry is a database used to store, organize, manage, and share metadata.”

A data registry for ADOT&PF would be used to store, organize, manage, and share the names of the data systems and data sets used across the Department. ADOT&PF may wish to also include in their Data Registry the names of data sets and data systems that are used by the Department but are owned by other state agencies, such as the AKSAS system (Alaska Statewide Accounting System).

**Data Set** – Any organized collection of data.

**Information** - Data and documents that have been given value through analysis, interpretation, or compilation in a meaningful form.

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Information Management - An overarching term used to describe the organization and control over the collection and management of information from one or more sources, and the processing, delivery, and sharing of that information to users. Information management addresses how an organization develops policies, practices, technologies, and other resources and capabilities to manage information as a resource. This includes the management functions associated with the creation, collection, processing, transmission, dissemination, use, storage, and disposition of information, both automated and non-automated. A simpler version of the definition is from AIIM (The Global Community of Information Professionals): “Information management is the collection and management of information from one or more sources and the distribution of that information to one or more audiences.”

Information Technology (IT) - The application of methods and scientific knowledge for the collection of information. IT is commonly associated with the use of electronic principles and devices for the development and implementation of electronic systems.

Information Systems - A combination of information technology and the activities of people associated to support and execute the necessary operations and management of the system with the responsibility of decision-making. Information systems include hardware, software, and staff.

Stakeholder - An organization, person, process, or system that can be affected by a change to a system or process.

System - DAMA Dictionary of Data Management defines system as “An interacting and independent group of component items forming a unified whole to achieve a common purpose”. For the context of this manual and TAMIS, an example of a system is the Road Weather Information System (RWIS) because it is a combination of data collection hardware, database structures, data, applications, and web access points serving the purpose of providing real-time road weather conditions on Alaska’s major roadways.

System of Record - A system that stores the ‘official’ version of a data attribute or data set.

System Owner - Information System and Services Division professional(s) supporting the technical and functional aspects of data management and information delivery for specifically assigned business areas, subject areas or databases.

Asset - The term ‘asset’ for purposes of use in the DBP includes transportation infrastructure assets and other assets such as vehicles, buildings, land, etc. Each of these types of assets are managed through distinct data systems or independent data bases or inventory lists maintained by various offices at ADOT&PF.
Appendix C: References

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3. ADOT&PF Transportation Asset Management Information Systems and Data Research Project reports:
   - Task 2 - [Federal Requirements and Associated Research](#), Final Report, June 2013
   - Task 3 - [Other State Best Practices](#), July 2013
   - Task 4 - [Vision and Components Final Report](#), July 2013
   - Task 5 - [TAMIS Data Systems Evaluation](#), December 2013
   - Task 6 - [TAMIS Framework](#), December 2013
   - Task 7 - [TAMIS Gap Analysis Final Report](#), March 2014
   - Task 8 - [System Model Alternatives - Technical Memorandum](#), March 2014
Transportation Asset Management Information System

Proof of Concept

Technical Report

prepared for
Alaska Department of Transportation & Public Facilities

prepared by
Cambridge Systematics, Inc.

June, 2015
Transportation Asset Management Information System

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1566 Village Square Boulevard, Suite 2
Tallahassee, FL 32309

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<td>Highway Performance Monitoring System</td>
<td>The HPMS is a national level highway information system that includes data on the extent, condition, performance, use and operating characteristics of the nation's highways.</td>
</tr>
<tr>
<td>IRI</td>
<td>International Roughness Index</td>
<td>The IRI is the roughness index most commonly obtained from measured longitudinal road profiles. It is calculated using a quarter-car vehicle math model, whose response is accumulated to yield a roughness index with units of slope (in/mi, m/km, etc.)</td>
</tr>
<tr>
<td>Acronym</td>
<td>Name</td>
<td>Definition</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>ISSD</td>
<td>Information Systems Services Division</td>
<td>Division created at ADOT&amp;PF in 2014 to centralize and better manage the Department's information systems, infrastructure and data.</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
<td>The study or use of systems (especially computers and telecommunications) for storing, retrieving, and sending information.</td>
</tr>
<tr>
<td>JPG</td>
<td>Joint Photographic Experts Group</td>
<td>A file extension for a lossy graphics file. JPG is used interchangeably with JPEG.</td>
</tr>
<tr>
<td>LRS</td>
<td>Linear Reference System</td>
<td>A method of spatial referencing, in which the locations of features are described in terms of measurements along a linear element, from a defined starting point, for example a milestone along a road.</td>
</tr>
<tr>
<td>LRTP</td>
<td>Long Range Transportation Plan (Alaska DOT)</td>
<td>Guides transportation planning by providing a vision, goals and general plan for construction for a 20-year period.</td>
</tr>
<tr>
<td>MRS</td>
<td>Management Reporting System</td>
<td>A database and associated web based data input and reporting tools that manages information related to funding, project development, planning and bidding.</td>
</tr>
<tr>
<td>NBI</td>
<td>National Bridge Inventory</td>
<td>A database, compiled by the Federal Highway Administration, with information on all bridges and tunnels in the United States that have roads passing above or below.</td>
</tr>
<tr>
<td>NHS</td>
<td>National Highway System</td>
<td>National Highway System consists of roadways important to the nation's economy, defense, and mobility.</td>
</tr>
<tr>
<td>PDO</td>
<td>Property Damage Only</td>
<td>A police term used for property damage traffic accident.</td>
</tr>
<tr>
<td>PNG</td>
<td>Portable Network Graphics</td>
<td>An extensible file format for the lossless, portable, well-compressed storage of raster images.</td>
</tr>
<tr>
<td>POC</td>
<td>Proof of Concept</td>
<td>Alaska DOT&amp;PF TAMIS Project Task 12</td>
</tr>
<tr>
<td>POC</td>
<td>Point of Contact</td>
<td></td>
</tr>
<tr>
<td>PSR</td>
<td>Pavement Serviceability Rating</td>
<td>Used internally by ADOT&amp;PF staff, PSR factors in both pavement roughness (IRI) and rutting to provide an overall picture of the amount of pavement maintenance or repair work required along a given stretch of road.</td>
</tr>
<tr>
<td>RFI</td>
<td>Request for Information</td>
<td>A solicitation used by ADOT&amp;PF procurement to get information from vendors to help describe a product or service in a request for proposal.</td>
</tr>
<tr>
<td>RFP</td>
<td>Request for Proposal</td>
<td>A document that invites a vendor to submit a bid for hardware, software and/or services.</td>
</tr>
<tr>
<td>RIP</td>
<td>Roadway Information Portal</td>
<td>Provides a user-friendly way to access information on roadway characteristics for roads that are managed by the Alaska Department of Transportation &amp; Public Facilities (ADOT&amp;PF), and currently maintained in the RDS database.</td>
</tr>
<tr>
<td>STAR</td>
<td>Spatial Transportation Applications and Resources</td>
<td>Internal web mapping application used for analysis of ADOT&amp;PF roadway features and inventory maintained in the RDS database.</td>
</tr>
<tr>
<td>RDS</td>
<td>Roadway Data System</td>
<td>Geodatabase that contains the Linear Reference Network and associated inventory features for Alaska DOT&amp;PF.</td>
</tr>
<tr>
<td>STIP</td>
<td>Statewide Transportation Improvement Program</td>
<td>Federal compliance document outlining state plans for spending federal allocations - Usually 4-6 years in plan.</td>
</tr>
<tr>
<td>Acronym</td>
<td>Name</td>
<td>Definition</td>
</tr>
<tr>
<td>---------</td>
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</tr>
<tr>
<td>TAMDIT</td>
<td>Transportation Asset Management Data Integration Team</td>
<td>A team set up at ADOT&amp;PF to identify cross-organizational information and data needs for Transportation Asset Management.</td>
</tr>
<tr>
<td>TAMIS</td>
<td>Transportation Asset Management Information System</td>
<td>A system of linked data sources that provides information and analysis capabilities that can be used to plan for make informed asset management decisions.</td>
</tr>
<tr>
<td>TAMP</td>
<td>Transportation Asset Management Plan</td>
<td>A focal point for information about the assets, their management strategies, long-term expenditure forecasts, and business management processes.</td>
</tr>
<tr>
<td>TDP</td>
<td>Transportation Data Programs</td>
<td>A group within Program Development Division that oversees information management and reporting for several business areas including crash, traffic, roadway classification, Intelligent Transportation Systems and road weather and traveler information.</td>
</tr>
<tr>
<td>TGIS</td>
<td>Transportation Geographic Information Section</td>
<td>A group within the Information Systems and Services Division that is responsible for the inventory of public roadway features and linear coordinates for the Roadway Data System (RDS) network (Alaska DOT&amp;PF’s Linear Reference System or LRS) to meet Federal and State requirements and the expanded needs of mandatory data programs within the department.</td>
</tr>
<tr>
<td>VMT</td>
<td>Vehicle Miles of Travel</td>
<td>Defined by the U.S. government as a measurement of miles traveled by vehicles in a specified region for a specified time period. VMT is calculated by multiplying the amount of daily traffic on a roadway segment by the length of the segment, then summing all the segments’ VMT to give you a total for the geographical area of concern.</td>
</tr>
</tbody>
</table>
1.0 Introduction

The Alaska Department of Transportation and Public Facilities (ADOT&PF) has initiated a research effort that will support the development of the Transportation Asset Management Information System (TAMIS). The goal of the TAMIS will be to provide the backbone for the Asset Management program for ADOT&PF. The program will ultimately support the Federal Highway Administration (FHWA) State Transportation Improvement Program (STIP) and Long Range Transportation Plan (LRTP) development activities of the Program Development Office.

Task 12 of the research effort involved conducting a TAMIS Pilot to demonstrate the concepts of data management on a subset of existing asset data and information systems. Key aspects of the demonstration included:

- Data and information collected or developed by one program office would be made accessible and understandable to other program offices in ADOT&PF. For example:
  - Crash frequency, severity, and primary/contributing causes
  - Key information on proposed highway improvement projects managed by different divisions (regions)

- Investigate what changes in existing databases, project planning workflow processes, and data visualization and analysis tools are needed to implement these integration of the data in TAMIS

Four possible pilot options were presented to ADOT&PF at a TAMIS project update meeting on December 10, 2013. These options are described below:

1. **Cross-program tradeoff tool** - Combines future performance measure output from multiple systems, and presents them to support cross-program tradeoffs, resource allocation, and target setting.

2. **Tool that supports project prioritization and development** - Combines needs and/or project information from multiple systems (e.g., preservation needs, safety needs, capacity needs, planned projects, etc.) and presents them to support evaluation and prioritization of potential projects, and the project development process.

3. **Tool that integrates high priority data for ad hoc reporting** - Facilitates the integration of data from source systems to enable ad hoc queries and generation of specific tables that merge data across program areas.
Transportation Asset Management Information System

4. **Performance dashboard** – Merges performance measure output from multiple systems into a single display system to support executive level monitoring and reporting of agency program performance.

Options 2 and 3 were selected by Alaska to be used in demonstrating the functionality of TAMIS, and it was requested that the pilot be called a “proof of concept” since its purpose is to demonstrate the functionality of TAMIS.

## 1.1 PURPOSE

The purpose of the TAMIS POC is to apply and demonstrate the functionality of TAMIS through development of an example tool/website to support project prioritization and development across different program areas. The proof of concept includes the following two parts:

- **Part 1: Tool that supports project prioritization and development** – A tool that combines needs, project information, and limited cost data from multiple systems (e.g., preservation needs, safety needs, capacity needs, planned projects, etc.) and presents them in a way to support the evaluation and prioritization of potential projects, and the project development process. The tool would enable identification of corridors for which there are significant improvement needs.

- **Part 2: Tool that integrates high priority data for ad hoc reporting** – A tool that facilitates the integration of high priority data from source systems. For example, pavement condition data could be imported and converted to a format that can be used by a safety system. The tool would build on the functionality developed in Part 1 by enabling ad hoc queries and generation of tables that merge data across specific program areas.

The Proof of Concept is not a prototype or a pilot. It includes an interface tool and a temporary data warehouse.

## 1.2 REPORT STRUCTURE

Section 2 describes the guiding principles and general methodology used to develop the Proof of Concept Application. Additionally, the initial set of queries proposed to be addressed by the POC is presented; this initial set was refined based on available data.

Section 3 discusses the data sources used in the POC, the information contained in each data source and modifications/enhancements that were made to each data source to address the specific queries in the POC.

Section 4 presents a general overview of the functions, user interface tools, and display capabilities of the POC applications.
Section 5 discusses the lessons learned with respect to current data sources, how they need to be integrated and maintained to support an operational TAMIS, and the tradeoffs that need to be considered among ad hoc query flexibility, system performance, and data availability.

Section 6 presents recommendations for developing a more robust operational TAMIS user interface tool, including implementation steps.
2.0 Development Approach

2.1 GUIDING PRINCIPLES

The following principles were proposed and evaluated by the TAMIDIT to guide the development and scope of the TAMIS user interface tool demonstrated in the POC.

1. Access published data sources. Each of the databases that are accessible through the TAMIS user interface will reside in a published temporary data warehouse, not the master databases maintained by individual ADOT&PF program offices. The data warehouse will contain a read-only copy of each TAMIS database whose content has been approved for release by the data steward responsible for that database (scrubbed “gold standard”). Not all data contained in a master database (e.g., Crashes, MRS) may be accessible. All databases stored in the data warehouse will be versioned, with a clearly identified publish date that enables users to determine the date of the data set. Databases may be updated at different frequencies, as determined by each responsible data steward; at a minimum, each database will be updated annually.

2. Be accessible to all ADOT&PF staff. Any ADOT&PF employee or authorized contractor should be able to access the data warehouse through the TAMIS user interface. This means that the TAMIS user interface will be designed as a web-based GIS tool, that can be accessed via standard web browsers, and not require additional desktop application software (e.g., ArcGIS desktop) or plug-ins. Designing the interface for a web-browser imposes some limitations on analysis functionality and complexity, but users can also download selected data records from the data warehouse if they want to use more sophisticated analysis tools.

3. Focus on integrating data from multiple sources with both pre-defined and ad-hoc query capabilities. The primary focus of the TAMIS user interface should be to select, display, and summarize data stored in the data warehouse and to facilitate integration of data originating from multiple databases. This means that the TAMIS user interface functionality should focus (at least initially) on the following:

- Provide a selection of pre-defined query reports that draw upon data from multiple sources and address planning and management needs;
- Provide generic, flexible query capabilities that draw upon data from multiple sources to answer ad hoc questions. Capabilities include:
  » Query and select data records by attribute value (e.g., find all highway projects with start date after 2015 and estimated cost over $1 million)
  » Query and select data records by location (e.g., point or line in polygon, roadway events between two linear mile point measures)
» Create buffers around locations and select data records based on the buffer (e.g., find number of crashes within 100 feet of selected intersections)

» Perform relational joins between two databases (e.g., combine pavement condition, bridge condition and maintenance level of service in selected locations)

4. Allow for the combination of asset condition for different asset categories to assist with prioritizing and screening projects. For example, the need to view major pavement issues along with bridge and safety/crash data on corridors.

5. Include only geographically referenced databases. Because geographic location is a fundamental means for combining data from two otherwise independent databases, each of the databases included in the data warehouse should include one or more of the following geographic references:
   - Geographic coordinates (i.e., latitude/longitude)
   - Linear reference measures (i.e., CDS number, mile point)
   - Locational proxy attribute (e.g., Borough or place name, DOT region)

6. Support tabular summaries, charts, mapping, and export of results. TAMIS is intended to support improved decision-making based on a holistic view of data from disparate source databases. With that aim in mind, the TAMIS application will provide support for visualizing and exporting results in multiple forms:
   - Display of data (and data summaries) through tables, maps, and graphs
   - Simple summaries and statistics (e.g., compute the total, average, highest and lowest values of an attribute for a selected set of data records)
   - Export or download selected data records to commonly used analysis formats (e.g., comma separated value (csv) and geospatial shape files)

7. Do not duplicate complex functions available in other systems. Specialized functions or models that are used for specific analyses (e.g., “hot spot” analysis, asset “aging” models, and “return on investment” calculators) should not be incorporated into the TAMIS user interface if they are already available in other software used by ADOT&PF.

Utilize existing software components from existing tools to the extent feasible. Functional components from existing web-based tools such as the Spatial Transportation Applications and Resources (STAR) map viewer, or the Roadway Information Portal (RIP), should be incorporated into the TAMIS viewer to the maximum extent practicable, rather than duplicated with new customized software. TAMIS will not replicate what other systems do.

2.2 OVERALL POC DEVELOPMENT STRATEGY

Based on the guiding principles described in the preceding section, a workplan was formulated to build the POC. The workplan consisted of the following steps:
1. Focus on integration of data from a subset of key databases:
   - RDS – Manages the LRS and linked traffic data, crash data, and other features such as political boundaries, highway designations (NHS, functional class), and locations of airports and ferry terminals.
   - Bridge Management System (PONTIS) – Condition ratings of bridges.
   - Pavement Management System – Details on pavement condition
   - MRS – For project needs data (STIP planned projects), funding categories and plans.
   - Unstable Slopes Management Program – Data regarding location and severity of unstable slopes on NHS.

By focusing on a small, manageable number of databases that were readily available and included key attributes (e.g., geographic location), the POC could demonstrate the power of data integration without becoming unnecessarily complicated by issues related to data acquisition or clean up.

2. Create a separate demonstration environment application for the POC on the GEODEV server. The demonstration environment should include an independent copy of the RDS Publish Geodatabase, copies of each Asset database to be used in the POC, setting up the host server environment, etc.

Due to issues associated with migration of ADOT&PF GIS servers from headquarters to a state server facility in downtown Juneau, the POC application was developed and resides on demonstration servers located at Cambridge Systematics.

3. Work with TAM steering committee, planning & programming, highway and TAMDIT team and/or ADOT&PF staff to define the types of questions that ADOT&PF managers and staff would expect to ask from the integration of these databases. The initial set of questions is presented in Section 2.4 below.

4. Examine the primary POC databases (above) to determine if the necessary data to develop the various summary/performance measures in Task 3 are available, or can be derived from the existing data. Some key questions to be addressed in this step were:
   - Should summary measures be calculated in advance and stored as additional attributes, or calculated on the fly as needed?
   - Should the POC application store and use static copies of the POC Asset databases, or should it attempt to query the actual databases as needed?

5. Develop a web-based, user-friendly interface that enables users to specify the database(s) of interest, to select feature incidences within the database(s) based on location and/or attribute values, and to generate various output reports based on the selection.

6. Demonstrate the user interface to the TAMIS Group through an incremental series of iterative development steps, consistent with the CS software development guide. Initial steps would include a demonstration of wireframes showing what the user interface would look like and how it would function.
7. Assuming the POC is well received by potential ADOT&PF users; investigate options for enterprise-wide database integration.

8. Some key questions that needed to be addressed through the investigation included:
   - Will asset databases be published to an enterprise-wide data warehouse or accessed on the fly from the TAMIS user interface?
   - If databases are published, how frequently should they be updated?
   - Should a data warehouse be centralized or replicated in each region?

9. Prepare a technical report that documents the POC development process and specifically addresses the following enhancements, issues, and questions needed to move forward toward a fully functional TAMIS system:
   - Recommended standards for specifying location in all asset databases
   - Recommendations for database storage, updates, and extraction
     » Should each asset database be queried in real time, or should specific data elements be extracted, published, and linked to location information for simplified querying and integration with other data?
     » If extracts are used, how frequently should these be updated?
   - Recommendations for computing and storing performance measures
     » How and where should performance measures be calculated (e.g., should they be computed on the fly depending on the specific query, or should they be computed as part of a publish process and stored as additional attributes in the asset database?)
     » What specific performance measures are needed for each asset database?
   - Recommendations for an efficient Geodatabase architecture to support an fully operational TAMIS:
     » Does the current TGIS Geodatabase architecture provide efficient performance for the types of queries and analyses associated with TAMIS?
     » What are desired enhancements to the POC user interface?
     » What additional query functions should be incorporated?
     » What additional reporting functions should be added?
     » Should specific analysis functions be added?

2.3 INITIAL SET OF QUERIES

With information obtained from ADOT&PF staff and TAMDIT in project planning meetings, the CS team prepared example questions that ADOT&PF may wish to answer as part of its asset management process. The list of questions were not intended to be exhaustive, but illustrative of the types of questions that the TAMIS
could support, providing a range of options for topics to address with a fully integrated TAMIS.

These questions were divided into topic areas: Inventory and Condition Assessment, Funding and Resource Allocation, Programming and Project Development, Operations, and Risk Assessment and Management. The following sections describe the queries initially considered for the POC, explain their potential utility in the context of TAMIS, and indicate whether they were included in the POC. For queries not included in the POC, reasons for their omission are included. Generally, the reasons for not including various queries can be grouped in three categories:

1. The required data were not readily available
2. Appropriate modeling would require further analysis
3. Required effort would exceed scope (time and budget) of POC development effort

Example questions are described below by topic area. For each question, motivation and outcome (included in POC or not) are also discussed.

### 2.3...1 Inventory and Condition Assessment

**Query 1.** The ability to report information on asset inventory and condition improves agency credibility and provides useful information to improve future decisions. What assets are ADOT&PF responsible for? How is this inventory broken out by functional class (interstates, freeways, arterials, collectors, etc.) and/or by region?

**Motivation.** This is a fundamental question for any asset management program. Combining data from multiple systems will enable the generation of a consolidated asset register that provides a comprehensive snapshot of the agency’s assets.

**Outcome.** Included in the POC.

**Query 2.** What is the current condition of these assets?

**Motivation.** This is another fundamental asset management question.

**Outcome.** Included in the POC.

**Query 3.** How have system condition and/or inventory changed over the last x years?

**Motivation.** A variety of performance indicators drawn from the existing collected data can be reported. Conditions could be shown to illustrate trends or to compare conditions versus expenditures. The information could be viewed at the segment, corridor, or network levels.

**Outcome.** Not included in the POC. While this could potentially be included in a mature TAMIS system, data on pavement condition in prior years were not readily available, and the development of appropriate metrics for changes in pavement condition over time would require further analysis.

### 2.3...2 Funding and Resource Allocation

**Query 4.** How much has ADOT&PF spent on each functional area (pavements, bridges, signs, marine infrastructure, etc.) over the past 10 years?
**Motivation.** Understanding historic expenditures can help in identifying trends, managing expectations for future allocations, and understanding the cost of achieving performance levels defined in Query 3.

**Outcome.** Not included in the POC. Data on past expenditures delineated by functional area were not readily available.

**Query 5.** How have funds been allocated (either historically or in the current STIP) by region or legislative district?

**Motivation.** The ability to quickly identify allocations to various regions is a recurring request from legislative members and the public. The TAMIS could allow these allocations to be readily available.

**Outcome.** Not included in the POC. Data on past expenditure delineated by geographic region were not readily available.

**Query 6.** What would be the estimated impact on network pavement or bridge condition if funds were decreased by 10 percent over the next 10 years?

**Motivation.** TAMIS output could be tailored by funding percentage increases or decreases but fundamentally the queries would allow for projections on conditions based on the funding scenarios.

**Outcome.** Not included in the POC. The level of modeling required to address this query was beyond what was possible given the scope of the POC development effort.

**Query 7.** What would be the impact on congestion (or safety, bridges, pedestrian/bicycle, airports) if this money was shifted from capacity program to the pavement preservation program?

**Motivation.** The TAMIS could allow users to access projections across other functional areas. Scenarios could be presented for any of these tradeoffs if funding is re-allocated.

**Outcome.** Not included in the POC. The level of modeling required to address this query was beyond what was possible given the scope of the POC development effort.

**Query 8.** How should available funding be allocated between functional areas (pavement, bridge, capacity, etc.) over the next 20 years?

**Motivation.** This question would combine information from Queries 6 and 7 to support tradeoff discussions. A key opportunity that TAMIS will provide is the ability to compare asset class tradeoffs. With information regarding the relationship between performance and funding for each area, planners could present data-driven investment scenarios that illustrate the implications of shifting funds from one area to another, and enable decision makers to select the preferred allocation.

**Outcome.** Not included in the POC. The level of modeling required to address this query was beyond what was possible given the scope of the POC development effort.
Query 9. What performance levels can be achieved with the funding split selected in Query 4?

**Motivation.** This functionality would enable DOT&PF to establish fiscally constrained performance targets based on the allocation of funds.

**Outcome.** Not included in the POC. The level of modeling required to address this query was beyond what was possible given the scope of the POC development effort.

2.3...3 **Programming and Project Development**

Query 10. What bridges or pavement sections are most critically in need of a major infrastructure project? What time frame should be identified for these projects?

**Motivation.** Based upon the data presented, a prioritized list of major projects can be generated based on an aggregate of information sources. The TAMIS approach allows several criteria to be applied beyond age and condition information. When fully implemented, the TAMIS system can identify project needs based upon meeting agency goals in safety, mobility, maintenance, or other criteria.

**Outcome.** Not included in the POC due to scope limitations; however, using Query 2 described above, the user can gain insight on this question.

Query 11. Do existing projects in the STIP address the critical needs from Query 10?

**Motivation.** Based on the outputs from TAMIS, planners could assess the expected impacts of currently programmed projects and those expected to be added. The queries also could help assess whether any changes need to occur for the STIP.

**Outcome.** Not included in the POC due to scope considerations; however, Query 12 implements a similar type of analysis with a focus on crashes rather than asset conditions.

Query 12. Which projects address sections of road with high levels of crashes?

**Motivation.** Merging several data sets begins to allow a wider variety of programmatic outputs. For example, including accurate crash information would allow planners to address safety or incident reduction in the project selection process. Choosing to reduce the likelihood of injury-causing crashes or particularly problematic property damage areas could be addressed with the integration of these data sets. The resulting reports could provide weighted information for planners when comparing multiple projects.

**Outcome.** Included in the POC.

Query 13. Which projects currently in the STIP are co-located and should be coordinated with respect to schedule?

**Motivation.** For addressing projects across bridge and pavement areas, the TAMIS could allow for minimizing customer inconvenience by coordinating efforts. For example, a bridge deck replacement project might be better coordinated with existing pavement projects.

**Outcome.** Not included in the POC due to scope considerations.
Query 14. What bridges and pavements require significant preservation work over the next 5 years?

Motivation. This question is similar to Query 10 except it is based on needs and recommendations generated by a pavement and bridge management system rather than projects included in the STIP.

Outcome. Not included in the POC. The required data from pavement and bridge management systems were not readily available.

Query 15. How have existing projects met their projected community “SCORE” process scores?

Motivation. The ADOT&PF “SCORE” process uses a logical framework for selecting projects that assess various performance objectives (e.g., cost per mile of detours, accident measures, etc.). The TAMIS could allow for review of the projected performance objectives.

Outcome. Not included in the POC. The level of modeling required to address this query was beyond what was possible given the scope of the POC development effort.

2.3...4 Operations

While the primary uses of TAMIS are not designed to support daily operations, there are useful queries for consideration. The principal operational questions address operations from planning perspective.

Query 16. What impact would a project have on the operations of heavy commercial vehicles?

Motivation. Projects that require detouring commercial vehicle traffic for extended periods of time may have additional operational impacts (including pavement damage, congestion, safety factors) that could be assessed with the TAMIS.

Outcome. Not included in the POC. The level of modeling required to address this query was beyond what was possible given the scope of the POC development effort.

Query 17. What is the expected congestion that will result from a particular slate of activities, if any?

Motivation. Projecting operational impacts and calculating potential delays provides a more complete picture of the costs for maintenance activities. This could also help ADOT&PF respond to the inquiries and concerns of the traveling public and other stakeholders.

Outcome. Not included in the POC. The level of modeling required to address this query was beyond what was possible given the scope of the POC development effort.

Query 18. What is the impact on evacuation routes from specific projects, if any? Are there appropriate mitigation measures in place?
**Motivation.** Ensuring that projects do not create challenges to emergency evacuation routes or impede rescue/recovery efforts in the context of natural disasters like earthquakes requires careful consideration.

**Outcome.** Not included in the POC. The level of modeling required to address this query was beyond what was possible given the scope of the POC development effort.

### 2.3...5 Risk Assessment and Management

**Query 19.** What are the external risks facing the transportation network? Which assets reside in high risk areas?

**Motivation.** The TAMIS could enable ADOT&PF to identify which assets could be impacted by natural events, such as earthquakes, extreme weather events, tsunamis, and flooding. This would help ADOT&PF to identify and prioritize risk mitigation strategies.

**Outcome.** Included in the POC. Due to limitations in readily available data, however, this query focused solely on risks related to unstable slopes.

**Query 20.** What are the internal risks facing the agency’s ability to meet its infrastructure preservation and maintenance needs?

**Motivation.** The TAMIS could allow multiple funding or staffing scenarios to be presented. The ability to conduct such sensitivity analyses could allow ADOT&PF to forecast potential project mixes based on a variety of inputs (staffing, funding, etc.)

**Outcome.** Not included in the POC. The level of modeling required to address this query was beyond what was possible given the scope of the POC development effort.

**Query 21.** How would a 10% reduction in federal funding affect ADOT&PF’s STIP and its ability to meet its asset management objectives?

**Motivation.** Financial uncertainty is a common agency-level risk being considered by DOTs. Similar to Query 6 above, TAMIS could help ADOT&PF explore the implications of different funding scenarios on project mix and network performance.

**Outcome.** Not included in the POC. The level of modeling required to address this query was beyond what was possible given the scope of the POC development effort.

**Query 22.** Based on the mechanistic-empirical design information on the pavement system, what pavements are most likely to fail prematurely?
**Motivation.** By compiling data and information from the pavement management system, including basic design information, TAMIS could display pavements of various mix designs and structural components. This information could be valuable in identifying pavements that may require additional treatments early in their life cycles.

**Outcome.** Not included in the POC. The level of modeling required to address this query was beyond what was possible given the scope of the POC development effort.

### 2.4 SOFTWARE DESIGN AND DEVELOPMENT APPROACH

CS employs a standardized software engineering process based on principles of user-centered design and incremental, iterative development. This approach ensures that functional requirements are met, exposes risk early, makes progress more transparent and predictable, and encourages continuous testing. CS emphasizes user-centered design by engaging users continuously from design throughout development, testing, and deployment with comprehensive procedures in place for developing and documenting system requirements. Quality assurance and testing activities are integrated fully into each iteration, so that the product of each iteration is a stable, integrated, and tested software product.

Application of this process for the TAMIS POC involved a series of meetings, presentations, and deliverables to demonstrate progress and solicit feedback on desired revisions and future enhancements. The following summarizes key interactions between ADOT&PF staff and CS that involved discussion or demonstration of new functionality and/or receipt of significant feedback on the POC.

- **TAMDIT meeting on June 30, 2014.** At the June TAMDIT meeting, the consultant team reviewed plans and principles for the POC, which were generally supported by ADOT&PF staff. Design principles for the POC included that it will:
  - Support project prioritization and development
  - Be developed in a temporary data warehouse to show how integration can work
  - Access published (approved) data only
  - Be accessible to all ADOT&PF staff via web browser
  - Include pre-defined and ad-hoc queries
  - Only include geo-referenced datasets
  - Support tabular reports

- **TAMDIT meeting on July 24, 2014.** At the July TAMDIT meeting, the consultant team reviewed a list of potential queries to include in the POC with the TAMDIT group and demonstrated a preliminary software design consisting of a set of “wireframes” (screen designs). These included:
- A welcome screen with query selection
- Several alternative screens for entering query parameters
- A screen to view results in tabular form
- A screen to view results on a map
- An alternative screen combining tabular and mapped results
- A screen to view aggregate results in chart form
- A screen to view aggregate results in a formatted report

Key feedback from this meeting included:
- General support for the proposed queries
- Request that tabular and mapped results be combined on one screen

- **Demonstration of POC on October 27, 2014.** In late October, the consultant team presented a demonstration (to all TAM teams and the steering committee) of initial POC functionality in the form of a slide deck containing screenshots from the web application. The principal features in this initial version included:
  - Implementation of the “ADOT&PF assets” query
  - An introductory starting page
  - A query configuration page
  - A tabular results page
  - A chart results page
  - A report results page

Key features missing from this initial version included the balance of queries to be supported by the application along with mapping functionality. Requests and feedback from ADOT&PF staff at this juncture included:
- Request to add the planned mapping functionality as soon as possible
- Requests for logical color ramps for symbolizing metrics (e.g. green, yellow, and red for good, fair, and poor)
- Requests for classifying roads based on NHS class rather than functional class
- Observation that for bridge status ratings, structurally deficient is worse than functionally obsolete

- **Demonstration of enhanced POC on December 9, 2014.** In early December, the consultant team presented (to all DOT TAM teams and steering committee) a live demonstration of the web-based POC featuring the following additional functionality:
  - Addition of asset conditions, route conditions, and unstable slopes queries
  - Addition of interactive mapping functionality on results page
  - Addition of “Explore” page featuring an interactive pivot tool enabling users to generate ad hoc tabulations of query results
With the addition of considerable query and display functionality at this point in the project, ADOT&PF staff were able to provide significant and very helpful feedback. Comments and requests included:

- Request for additional map symbology options on various queries
- Request to distinguish between five levels of pavement conditions, and adopt ADOT&PF conventions for characterizing pavement condition based on roughness and rut scores
- Request to fix ordering of categories in chart presentations so that they are listed in logical rather than alphabetical order (e.g., poor, fair, good instead of fair, good, poor)
- Request to show outlines of selected geographical areas on map display
- Request to expand options for classifying roads to include not just NHS class but also functional class, STRAHNET, etc.
- Request for documentation, as part of tool or as companion to tool, defining features, measures, and sources and dates of data.

**Demonstration of full-featured POC on February 9, 2015.** In February 2015, the consultant team demonstrated an updated version of the POC for the ADOT&PF TAMIS project manager. This version included all planned features for the POC and incorporated nearly all of the suggestions offered in earlier client interactions. Notable additions in this version included:

- Addition of query to examine crash statistics on road segments within planned projects
- Display of selected geographical areas (ADOT&PF regions or house districts) on map
- Addition of functionality to allow user to select among different metrics for symbolizing features on maps (e.g. symbolizing bridge condition based on status, deck condition, superstructure condition, substructure condition, or minimum condition)
- Classification of pavement condition in five categories—poor, mediocre, fair, good, and very good—per ADOT&PF conventions and derivation of the composite PSR metric for road condition based on both roughness and rut depth measures
- Sorting of metric classifications logically rather than alphabetically where appropriate

**Release of POC for ADOT&PF staff testing on March 26, 2015.** Subsequent to the February POC demonstration and in preparation for staff testing, the ADOT&PF TAMIS project manager directed the consultant team to meet with the traffic safety engineering group and the geotechnical engineering group to review metrics used in the software for the crashes and unstable slopes queries. These meetings took place, respectively, on February 13 and February 27 of 2015, and
resulted in further refinements in the metrics employed to measure and categorize safety performance and unstable slope hazards and risks.

On March 26, 2015, the consultant team demonstrated the revised full-featured version of the POC for ADOT&PF staff with a request that individuals test the tool and provide feedback on its functionality by April 17. Staff comments were generally positive and included many helpful suggestions. A summary of comments and feedback are listed below. Full comment details can be found in the table in Appendix A. Highlights include:

- Better explanation and use of terms
- Built-in tutorials, and readily available (within application and query results) metadata
- Status or loading indicator for queries in queue
- Expanded export options (excel, pictures)
- Addition of real-time or external data (police data, road weather)
- Ability to add/update data or configure application without additional programming by vendor
- Ability to add or configure to use for other performance measure tracking
- Add functionality to look at history on assets to track changes over time (degradation)
- Improve sorting and filtering capabilities to allow analysis without re-running a query
- Enhance functionality to better support project selection or highlight location in need of certain treatment (i.e. show areas with high safety concerns and no projects)
- Ensure application developed for asset management is not duplicating current functionality in existing applications
- Need to better describe proposed database (data warehouse) structure

If further work is pursued to develop a production version of this tool, many of the above suggestions and concerns could be addressed for ADOT&PF with a more intensive requirements gathering process involving key stakeholders and data governance teams.
3.0 Data Sources and Preparation

3.1 DATA SOURCES SELECTED FOR POC

The following six databases were selected for inclusion in the POC application:

- Roadway Inventory Data (from RDS)
- Bridge Data
- Pavement Data
- Crashes
- Project Needs
- Unstable slopes

Each of these databases is described in more detail on the following sections, including information on the current organizational units responsible for maintaining and updating the database, database size and storage medium, included attributes and frequency of updates.

Each database selected for the POC included location attitudes, either geographic coordinates (i.e., lat/lon), or a route identifier and milepoint measures based on ADOT&PF’s roadway centerline/linear referencing system (LRS). Consequently, every feature in each of the asset databases could be placed on a map using either location method.

3.2 ROADWAY INVENTORY DATA

“RDS_Publish.mdb” is a 1.03-gigabyte (GB) personal geodatabase of the August 2014 version of RDS Published Geodatabase. The master database contains 49 feature classes, 2 tables, and 3 datasets.
The following feature classes were specifically used in the POC, as described in further detail in section 3.2.1.

- **MAINTENANCE_RESPONSIBILITY**
- **NHS**
- **NUMBER_OF_LANES**
- **TRAFFIC_LINK**
- **REGION_ROUTE**
- **HOUSE_DISTRICT_ROUTE**
- **BRIDGE_LINE**
- **HPMS_PAVE_SECT_2013**
- **STIP_LINE**

### 3.2.1 Responsible ADOT&PF Organization Unit

The RDS Geodatabase is maintained by ADOT&PF’s Transportation Geographic Information Systems (TGIS) team, which has recently been re-organized and moved to the new Information Systems and Services Division (ISSD).

### 3.2.2 Update Methodology and Frequency
Some features in the RDS (e.g., road centerline and LRS routes) are updated on a continuous basis by TGIS staff in response to new roads, realignments of existing roads, or corrections of errors reported by users. Other RDS features and attributes are updated at least annually to support ADOT&PF’s HPMS submittal to FHWA.

An updated version of the RDS Geodatabase is published to an ADOT&PF database server several times a year (currently, there is no formal schedule for publishing) to support reporting and analysis tools. This published Geodatabase is used by several applications including ADOT&PF’s internal web-based map viewer (STAR), and the Roadway Information Portal (RIP). The most current version of the Published RDS Geodatabase, exported to an Esri personal geodatabase format, was used in the POC.

3.2...3 Modifications/Enhancements to the Existing Database

The existing database structure and complimentary tools may undergo a transition as the GIS group moves toward using ESRI Roads and Highways to maintain the LRS. It is also anticipated that the new ISSD division will develop a plan for IT infrastructure changes to upgrade the current environment. When this occurs, it is likely there will be changes to the database structure for the department’s GIS software and application.

3.3 BRIDGE DATA

“Bridges.xlsx” is a 10.6 MB Excel workbook containing 21,333 records.

“140624 Bridge for TAMP.xlsx” is a 6.34 MB Excel workbook containing National Bridge Inventory (NBI) (bridge) data analyzed for TAMP. It contains NHS(7,472 records), NON_NHS (13,284 records), and ALL_BRIDGES (20,756 records) worksheets, as well as some summary and metadata worksheets.

The spreadsheets that were started for Transportation Asset Management Plan (TAMP) were utilized for the POC since they already went through the exercise of compiling several years of NBI data that included status categories. The Bridge for TAMP spreadsheets were reconciled with locations from the RDS database for use in the POC.

3.3...1 Responsible ADOT&PF Organization Unit

ADOT&PF’s Bridge Section in the Statewide Design and Engineering Services Division is responsible for compiling data for the annual NBI Bridge reports.

3.3...2 Update Methodology and Frequency

The statewide Bridge engineering group works with ADOT&PF Programmers to convert the data from the Bridge Management System (BrM v5.1(formerly PONTIS)) to prepare annual submittals for the NBI.

3.3...3 Modifications/Enhancements to the Existing Database
BrM v 5.1 is fully controlled by the Bridge section. They update and manage data as necessary for their program. Other than the NBI and annual Bridge Inventory reports (internal to ADOT&PF) detailed bridge data is only available upon request and use of it for any reports or analysis require approval of managers in that division. The Bridge for TAMP spreadsheets were developed in coordination with bridge staff and were started as an extract from their management system. For the POC, the status data in the TAMP spreadsheets was linked by bridge numbers with LRS based location information in RDS.

### 3.4 Pavement Data

Pavement data for the POC was derived from select base fields in the HPMS_PAVE_SECT_2013 table in the RDS database. Using formulas and classification methods provided by the Statewide Pavement Engineer, CS calculated the pavement condition using data items in the table described above.

3.4.1 **Responsible ADOT&PF Organization Unit**

Pavement data collection and management is overseen by the Statewide Maintenance Pavement Engineer located in the Office of the Commissioner Transportation Management and Security who reports to the Chief of Statewide Maintenance and Operations.

3.4.2 **Update Methodology and Frequency**

Pavement data is collected annually and processed for use in annual Highway Performance Monitoring System (HPMS) submittals. For the POC, the pavement data used was from older methods as recently, new data collection contracts have started with different vendor and methods.

3.4.3 **Modifications/Enhancements to the Existing Database**

Pavement data collection is currently being coordinated with roadway data collection to be more integrated with GIS systems and a new system for pavement data management, analysis and reporting is in process of being procured.

### 3.5 Crash Data

“CRASH_2011.mdb” is a 42.9 MB Access database containing crash records for 2011 in a 2011_CRASH_DATA_ALL table of 12,576 records.

3.5.1 **Responsible ADOT&PF Organization Unit**

Crash data is collected by law enforcement agencies and certain data items are made available to ADOT&PF to meet their reporting requirements. ADOT&PF, in the division of Program Development, Transportation Data Programs (TDP) section has developed a tool for entering crash data received from law enforcement and adding location referencing to it.
3.5.2 Update Methodology and Frequency

TDP staff enter key crash data needed for the department’s applications and required reports, and references each crash to the road network. New crash data are entered continually, and staff are currently working on a backlog of reported crashes as part of a database transition and update to the crash analysis software that is soon to be implemented.

3.5.3 Modifications/Enhancements to the Existing Database

For crash data, there are likely to be changes due to needed updates of the IT infrastructure at ADOT&PF. The crash tools are updated as needed when GIS software versions change and new needs are identified for crash reporting and analysis.

3.6 PROJECT NEEDS DATA

“STIP.xlsx” is a 25 KB Excel worksheet containing 252 records of STIP project locations and attributes.

3.6.1 Responsible ADOT&PF Organization Unit

Planners in the Division of Program Development and in regional planning offices are responsible for data entry, management and quality of project needs data used for development of the Statewide Transportation Improvement Program (STIP)

3.6.2 Update Methodology and Frequency

Project needs data are updated as needed and published only after regulated notice requirements are met for the development of, or for amendments to, the STIP. Data are entered by planners and saved to an Oracle database that is connected to funding plans for each project.

The data used for the POC is a combination of the project needs data and the location referencing data managed by the TGIS group for each project depending on the location type.

3.6.3 Modifications/Enhancements to the Existing Database

The Federal Highway Administration has announced some required changes to the Federal Management Information System (FMIS) that tracks funding and location of all federal aid projects. One new requirement is a geo-referenced location for each project using the state’s LRS. This will likely trigger some changes in the STIP database and require closer coordination with the GIS staff. The STIP planners are also looking at updating and implementing software procured and developed by Applied Microsystems to better manage STIP project data and to make programming projects in the STIP easier.
3.7 **UNSTABLE SLOPES DATA**

“Unstable Slopes PGDB.mdb” is a 34.5 MB personal geodatabase containing the following feature class:

- **Unstable_Slopes_Snapped** – Point data from the “Top 200 Database Detailed Report 8-31-12.xlsx” worksheet snapped to the road centerline/LRS Route_Feature feature class described above.

3.7...1 **Responsible ADOT&PF Organization Unit**

Unstable Slopes data is managed by Landslide Technology (vendor) under the direction of the Statewide Engineering Geologist from Statewide Materials Section in Statewide Design and Engineering Services Division.

3.7...2 **Update Methodology and Frequency**

Landslide Technology has provided field crews to inspect and inventory unstable slopes in Alaska. Each slope is evaluated for preliminary, hazard, and risk rating using the department’s newly adopted rating criteria. Data is managed in a database hosted by Landslide Technology and is available to ADOT&PF in various formats for reporting and analysis requirements.

3.7...3 **Modifications/Enhancements to the Existing Database**

The Geotechnical Engineering manager and the GIS group have been working on ways to incorporate unstable slopes data into the GIS database to allow analysis for project development, safety and asset management purposes.

3.8 **GEOPROCESSING CONDUCTED FOR THE POC**

The data described in Section 3.1 were processed to incorporate them into the same linear referencing system (LRS) and to include only those fields that were needed for the POC. Additional fields were also created throughout processing to incorporate useful information. The types of processing and description of the resulting fields is described in more detail in the following sections.

3.8...1 **Roadway Inventory Processing**

**ROUTE_FEATURE feature class**

The provided RDS_Publish.mdb geodatabase contains a number of feature classes which were turned into linear referenced features. The ROUTE_FEATURE feature class contained routes with associated measure values. This feature class was used as the basis for the LRS. Specific fields retained from ROUTE_FEATURE included:

- **CDS_NUM** – This is the route ID.
- **FROM_MPT** – This is the beginning milepoint measure value (usually 0.000) for each route.
• TO_MPT - This is the ending milepoint measure value for each route.
• CDS_NAME – This was named ROUTE_NAME in the original data and contains the names for all of the routes.

**ASSETS_QUERY_ROUTE_RESULTS feature class**

Each of the following feature classes were overlaid on the ROUTE_FEATURE in order to assign linear measure values to those features along the route. The overlaying was done using the LRS Overlay Route Events tool from Esri’s ArcToolbox.

• REGION_ROUTE – The ADOT&PF Transportation REGION field was retained from this feature class.
• NHS – The NHS fields from the feature class contained values ranging from 1 through 10, which were summarized as “NHS” for values 1 through 9 and “NOT NHS” for values of 10 in a new field called NHS_BOOLEAN.
• NUMBER_OF_LANES – The NUM_LANE field was retained from this feature class.
• TRAFFIC_LINK – The AADT field was retained from this feature class to show the annual average daily traffic for a number of road segments.
• MAINTENANCE_RESPONSIBILITY – The Owner field was retained in order to give further information about who is responsible for maintaining each road. However, results were filtered to only include the State Highway Agency (value of 1) as an owner.
• HOUSE_DISTRICT_ROUTE – The HOUSE_DISTR and HOUSE_DISTR_NAME fields were retained.

The final feature class was called ASSETS_QUERY_ROUTE_RESULTS.

**3.8...2 Bridge Data Processing**

**ASSETS_QUERY_BRIDGE_RESULTS feature class**

The ASSETS_QUERY_ROUTE_RESULTS feature class from the Roadway Inventory processing was overlayed with the BRIDGE_LINE feature class in order to get the Bridge NAME field for the bridges incorporated into the overlay. The overlay was done using the LRS Overlay Route Events tool from Esri’s ArcToolbox. The results were filtered to exclude any features that had a null or empty bridge name, thereby narrowing down the features to just the bridge segments. This overlay was further processed to include only a subset of the fields from the ASSET_QUERY_ROUTE_RESULTS feature class, described in the previous section, and of the BRIDGE_LINE feature class. Since there were then two fields pertaining to names, they were differentiated as mentioned below.

• CDS_NAME – This is the name of the route that is carried by the bridge.
• NAME – This field contains the name of the bridge.

The resulting feature class was called ASSETS_QUERY_BRIDGE_RESULTS.
ASSETS_COND_BRIDGE_RESULTS feature class
The ASSETS_QUERY_BRIDGE_RESULTS table was further processed to add the following fields from the original data or from calculations.

- **STRUCTURE_LENGTH** – From the Bridges.xlsx Excel worksheet.
- **DECK_WIDTH_OUT_TO_OUT** – From the Bridges.xlsx Excel worksheet.
- **DECK** – From the Bridges.xlsx Excel worksheet.
- **SUPERSTRUCTURE** – From the Bridges.xlsx Excel worksheet.
- **SUBSTRUCTURE** – From the Bridges.xlsx Excel worksheet.
- **STATUS** – From the Bridges.xlsx Excel worksheet. The status codes are 1 for “Structurally Deficient”, 2 for “Functionally Obsolete” and 0 for “Not Deficient”. This field contains the original numerical codes.
- **BRIDGE_STATUS** – Contains the corresponding text descriptions for the STATUS field above.

The resulting feature class was named ASSETS_COND_BRIDGE_RESULTS.

3.8...3 Pavement Data Processing

ASSETS_COND_ROUTE_RESULTS feature class
The ASSETS_QUERY_ROUTE_RESULTS feature class described in section 3.2.1 above was processed further to add pavement information. The HPMS_PAVE_SECT_2013 feature class was overlaid onto it using LRS Overlay Route Events tool from Esri’s ArcToolbox and the following fields were retained:

- **MEAN_IRI** – This field came from the HPMS_PAVE_SECT_2013 feature class and is an average of the International Roughness Index (IRI) of the pavement on the right and left lanes. For this index, a lower number is better and the categories for the ranges are described further in the information below about the ROUGHNESS_SUMMARY field.
- **FULL_RUT** – This field came from the HPMS_PAVE_SECT_2013 feature class and contains the average depth of rutting in inches.

The resulting feature class was named ASSETS_COND_ROUTE_RESULTS and was imported into the ArcSDE TAMIS geodatabase.

3.8...4 Crashes Data Processing

HIGH_CRASHES_QUERY_RESULTS feature class
The ASSETS_QUERY_ROUTE_RESULTS feature class described in section 3.2.1 above was used as the basis for a crash overlay. The data in the 2011_CRASH_DATA_ALL table from the Crash_2011.mdb was joined to the CRASH feature class that came from the RDS_PUBLISH.mdb geodatabase. The resulting join was then overlayed onto the ASSETS_QUERY_ROUTE_RESULTS feature class using
the LRS Overlay Route Events tool from Esri’s ArcToolbox. The following fields were retained or calculated:

- **CDS_NUM** – This field came from the ASSETS_QUERY_ROUTE_RESULTS feature class.
- **FROM_MPT** – This field came from the ASSETS_QUERY_ROUTE_RESULTS feature class.
- **TO_MPT** - This field came from the ASSETS_QUERY_ROUTE_RESULTS feature class.
- **CRASH_NUM** – This field came from the CRASH feature class and contains each crash’s ID number.
- **ACC_SEVERITY** – This field came from the CRASH feature class and contains a description for the severity of each accident. The description categories are FATALITY, INCAPACITATING INJURY, NON-INCAPACITATING/POSSIBLE INJURY, and PROPERTY DAMAGE ONLY.
- **CRASH_CLASSIFICATION** – This classification was calculated using the ACC_SEVERITY field and the following categories were used:
  - PDO = PROPERTY DAMAGE ONLY
  - Minor = NON-INCAPACITATING/POSSIBLE INJURY
  - Major = INCAPACITATING INJURY
  - Fatal = FATALITY

The resulting feature class was named HIGH_CRASHES_QUERY_RESULTS and was imported into the ArcSDE TAMIS geodatabase.

### 3.8...5 Projects Data Processing

**PROJECTS_QUERY_RESULTS feature class**

The PROJECTS_QUERY_RESULTS feature class was the most complex one to generate and involved combining data from:

- **ASSETS_QUERY_ROUTE_RESULTS** feature class described in section 3.2.1 above,
- **HIGH_CRASHES_QUERY_RESULTS** feature class described in section 3.2.4
- “STIP.xlsx” Excel worksheet
- **STIP_LINE** feature class from RDS_PUBLISH.mdb geodatabase.

The “STIP.xlsx” Excel table was joined to the STIP_LINE feature class based on the NEED_ID field. The resulting join was then overlaid onto the ASSETS_QUERY_ROUTE_RESULTS feature class using the LRS Overlay Route Events tool from Esri’s ArcToolbox. The result from that overlay was then iteratively spatially joined with the crash data using the Spatial Join overlay tool from Esri’s ArcToolbox. Each spatial join iteration incorporated a different category of crash severity (Fatal, Major, Minor, PDO) in order to calculate fields that contained total
crashes for each category in each STIP project line. The following fields were retained or calculated:

- All of the fields described in the ASSETS_QUERY_ROUTE_RESULTS subsection of section 3.2.1 above were retained.
- NEED_ID – This field came from the STIP_LINE feature class.
- PROJ_NAME – This field came from the STIP_LINE feature class.
- PROGRAM_CODE – This field came from the “STIP.xlsx” Excel worksheet table.
- PROGRAM_NAME – This field came from the “STIP.xlsx” Excel worksheet table.
- PRIMARY_WORK – This field came from the “STIP.xlsx” Excel worksheet table.
- ACC_PDO – This field contains the total number of property-damage-only crashes that occurred along each project line.
- ACC_MINOR – This field contains the total number of minor crashes that occurred along each project line.
- ACC_MAJOR – This field contains the total number of major crashes that occurred along each project line.
- ACC_FATAL – This field contains the total number of fatal crashes that occurred along each project line.

The resulting feature class was named PROJECTS_QUERY_RESULTS and was imported into the ArcSDE TAMIS geodatabase.

### 3.8...6 Unstable Slopes Data Processing

**UNSTABLE_SLOPES_QUERY_RESULTS feature class**

The ASSETS_QUERY_ROUTE_RESULTS feature class described in section 3.2.1 above was used as the basis for the unstable slopes overlay. The Unstable_Slopes_Snapped feature class from the “Ustable Slopes PGDB.mdb” was overlaid onto the ASSETS_QUERY_ROUTE_RESULTS feature class using the LRS Overlay Route Events tool from Esri’s ArcToolbox. The following fields were retained or calculated:

- CDS_NUM – This field came from the ASSETS_QUERY_ROUTE_RESULTS feature class.
- FROM_MPT – This field came from the ASSETS_QUERY_ROUTE_RESULTS feature class.
- TO_MPT – This field came from the ASSETS_QUERY_ROUTE_RESULTS feature class.
- HOUSE_DISTR – This field came from the ASSETS_QUERY_ROUTE_RESULTS feature class.
- HOUSE_DISTR_NAME – This field came from the ASSETS_QUERY_ROUTE_RESULTS feature class.
Transportation Asset Management Information System

- **CDS_NAME** – This field came from the ASSETS_QUERY_ROUTE_RESULTS feature class.
- **AADT** – This field came from the ASSETS_QUERY_ROUTE_RESULTS feature class.
- **REGION_CODE** – This field came from the ASSETS_QUERY_ROUTE_RESULTS feature class.
- **REGION** – This field came from the ASSETS_QUERY_ROUTE_RESULTS feature class.
- **REGION_NAME** – This field came from the ASSETS_QUERY_ROUTE_RESULTS feature class.
- **HWYMILEPOST** – This field came from the Unstable_Slopes_Snapped feature class.
- **HAZARDSCORE** – This field came from the Unstable_Slopes_Snapped feature class.
- **TOTALSCORE** – This field came from the Unstable_Slopes_Snapped feature class.
- **RISKSCORE** – This field came from the Unstable_Slopes_Snapped feature class.
- **MITIGATIONPRESENT** – This field came from the Unstable_Slopes_Snapped feature class.

The resulting feature class was named UNSTABLE_SLOPES_QUERY_RESULTS and was imported into the ArcSDE TAMIS geodatabase.

### 3.9 COMPUTED AND CLASSIFIED DATA

In addition to data elements drawn directly from the data sources described above, the TAMIS POC also includes attributes that were computed or classified as part of the geo-processing analysis. These additional attributes were derived in order to:

- Support the development of performance measures useful to ADOT&PF staff
- Classify raw performance scores into comparable categories such as good, fair, and poor
- Classify variables with many possible values (e.g., AADT) into a smaller set of categories to facilitate map symbolization and aggregation within tables or charts

Note that ADOT&PF staff provided input to guide the computation and display of most of the performance-related measures. The following text enumerates computed data presented within the TAMIS, explains the utility of each computed field, and describes how each field was computed or classified. The fields are grouped based on their relevance to different types of information included in the POC queries (e.g., data related to bridges, pavement conditions, or crashes, etc.)

#### 3.9...1 General Purpose / Cross-Query Data
NHS Category (Roads and Bridges) - The National Highway System (NHS) classification system includes several categories of NHS facilities such as NHS mainline routes, and connectors to major intermodal facilities and Strategic Highway Network (STRAHNET) facilities. For the purpose of simplified classification and symbolization within the POC, assets maintained by ADOT&PF are designated as being either part of the NHS (including all NHS connectors) or not part of the NHS.

Centerline Miles (Roads and Bridges) - The length (in miles) of each road segment and bridge is determined by subtracting the beginning milepoint measure from the end milepoint measure.

Lane Miles (Roads and Bridges) - The lane miles measure for each road segment and bridge is determined by multiplying the length (as described above) by the number of reported lanes for the facility.

Deck Area (Bridges) - The POC includes computation of bridge deck area (in square feet) as an alternate metric for aggregating information about bridge assets and bridge conditions. For example, if the deck condition on a very large bridge is poor and the deck condition on a much smaller bridge is good, then tallying deck condition information by deck area (rather than simply indicating the number of bridges in each deck condition category) may help to clarify this imbalance. Deck area is computed by multiplying the Structure Length and Deck Width (Out to Out) fields from the National Bridge Inventory (NBI) data.

AADT Summary (Roads and Bridges) - Average annual daily traffic (AADT) data are available for all road segments and bridges in the RDS. The AADT summary field within the POC groups AADT values into different category ranges to assist with data aggregation and symbolization. The category ranges (chosen by CS) and interpretations for AADT Summary are as follows:

- 0 to 19,999 (lighter traffic)
- 20,000 to 39,999 (medium traffic)
- 40,000+ (heavier traffic)

VMT (Road or Project Segments) - Annual vehicle miles of travel (VMT) along a given stretch of road is employed within the POC to help normalize annual crash statistics. The computation of annual VMT involves multiplying AADT by 365 (the number of days each year) by the length of the segment in miles (as described above).

3.9...2 

**Pavement and Bridge Conditions**

PSR (Roads) - The Pavement Serviceability Rating (PSR), used internally by ADOT&PF staff, factors in both pavement roughness (IRI) and rutting to provide an overall picture of the amount of pavement maintenance or repair work required along a given stretch of road. The formula used to compute PSR, as provided to the consulting team by ADOT&PF pavement engineering staff, is as follows:

- If rut depth <= 0.5 inches, then PSR = 5e-0.0041*IRI
- Else, PSR = 5e-0.0041*IRI – 0.7*rut depth
PSR Summary (Roads) - The PSR Summary field, used in the POC for data aggregation and symbolization, bins PSR scores into five categories ranging from poor to very good. The categories, as specified by ADOT&PF pavement engineering staff, are as follows:

- $< 2.6 = \text{poor}$
- $2.6 \text{ to } < 3.0 = \text{mediocre}$
- $3.0 \text{ to } < 3.5 = \text{fair}$
- $3.5 \text{ to } < 4.0 = \text{good}$
- $4.0+ = \text{very good}$

Roughness Summary (Roads) - The Roughness Summary field, used in the POC for data aggregation and symbolization, bins mean pavement roughness (mean IRI) scores into five categories ranging from poor to very good. The categories, as specified by ADOT&PF pavement engineering staff, are as follows:

- $170+ = \text{poor}$
- $120 \text{ to } 170 = \text{mediocre}$
- $95 \text{ to } 119 = \text{fair}$
- $60 \text{ to } 94 = \text{good}$
- $<60 = \text{very good}$

Rut Summary (Roads) - The Rut Summary field, used in the POC for data aggregation and symbolization, bins pavement rut depth scores into five categories ranging from poor to very good. The categories, as specified by ADOT&PF pavement engineering staff, are as follows:

- $>0.75 = \text{poor}$
- $>0.5 \text{ to } 0.75 = \text{mediocre}$
- $>0.33 \text{ to } 0.5 = \text{fair}$
- $>0.2 \text{ to } 0.33 = \text{good}$
- $\leq 0.2 = \text{very good}$

Deck Condition Summary, Superstructure Condition Summary, and Substructure Condition Summary (Bridges) - The National Bridge Inventory data set includes ratings for deck condition, superstructure condition, and substructure condition. These ratings range from 0 to 9 as follows:

- $0 = \text{failed}$
- $1 = \text{imminent failure}$
- $2 = \text{critical}$
- $3 = \text{serious}$
- $4 = \text{poor}$
- $5 = \text{fair}$
• 6 = satisfactory
• 7 = good
• 8 = very good
• 9 = excellent

Additionally, a bridge condition score can be set to “N” to indicate not applicable. To provide a simpler classification scheme for data aggregation and symbolization, the POC includes the Deck Condition Summary, Superstructure Condition Summary, and Substructure Condition Summary fields. These summary fields, suggested by the consultant team, divide the bridge condition ratings into a smaller set of values as follows:

• 0 to 4 = poor
• 5 to 6 = fair
• 7 to 9 = good

Minimum Condition (Bridges) - Early feedback from ADOT&PF staff indicated that, when reviewing information about bridge conditions, it would be helpful to capture the lowest of the deck condition, superstructure condition, and substructure condition ratings, as the lowest of these often dictates the relative need for maintenance, repair, or replacement activities. The Minimum Condition field included in the POC therefore reflects, for each bridge, the minimum of these three component condition ratings.

Minimum Condition Summary (Bridges) - The Minimum Condition Summary field, to enable simpler data aggregation and symbolization, bins minimum condition scores into the same three ratings - poor (0 to 4), fair (5 to 6), and good (7 to 9) - used for the Deck Condition Summary, Superstructure Condition Summary, and Substructure Condition Summary fields.

3.9...3  **Crashes**

PDO Crashes, Minor Crashes, Major Crashes, Fatal Crashes - The geo-processing for the query that compiles crash statistics for planned projects begins with the spatial alignment of each project and then divides the project into one or more segments based on the structure and attributes of the underlying road network (for example, a project that spans two different routes might be broken into two different segments). Next, the analysis identifies the number of crashes for 2011 that occurred along each project segment. These crashes are coded by type: PDO (property-damage only), minor, major, and fatal. The PDO Crashes, Minor Crashes, Major Crashes, and Fatal Crashes fields in the POC represent the number of each type of crash along each road segment included in the project.

Major and Fatal Crash Summary - Based on feedback from ADOT&PF traffic safety engineering staff, the POC includes two aggregate crash statistics for each project link. The first of these focuses on the number of major and fatal crashes on a given project link, with three possible values:

• 0 major or fatal crashes = low concern
- 1 major crash = moderate concern
- 2+ major crashes or 1+ fatal crashes = high concern

Major and Fatal Crashes per 100 Million VMT Summary - The second aggregate crash metric requested by ADOT&PF traffic safety engineers relates major and fatal crashes to vehicle miles of travel (VMT). Specifically, the computation involves adding the number of major and fatal crashes along a project segment, dividing by annual VMT (as defined earlier), and scaling the result per 100 million VMT. Raw scores are then binned into three categories as follows:

- 0 major or fatal crashes per 100 million VMT = low concern
- >0 and <= 5 major or fatal crashes per 100 million VMT = moderate concern
- >5 major or fatal crashes per 100 million VMT = high concern

3.9...4 **Unstable Slopes**

The individual score for an unstable rock or soil slope is the sum of sub-scores received in 18 categories describing either slope hazard or risk. Each category is exponentially scored from 0 to 100, with 0 being the best possible score and 100 being the worst. There are 9 hazard categories and 9 risk categories. The maximum possible score for a slope in ADOT&PF’s Unstable Slope Management Program (USMP) rating system is therefore 1,800 points.

The Hazard Score describes the qualitative ranking of hazardous conditions at a given slope impacting the roadway, and includes such categories as past slope activity, ditch effectiveness, slope height, maintenance requirements, and water on the slope. The Risk Score describes the relative risk exposure to which an event will likely impact the public or the Department, and includes such categories as Annual Average Daily Traffic (AADT), percent of AASHTO decision sight distance, roadway width, and potential impacts to the environment or private property. This Risk and Hazard scores are added together to calculate the Total USMP score for the site. Because the Total Score is a combination of the Risk and Hazard scores, it is possible for a site of low relative risk exposure but of high relative hazard.

The hazards and risks associated with unstable slopes is characterized in the POC using three metrics: a risk score, a hazard score, and a total (risk plus hazard) score. For the purpose of the POC, ADOT&PF geotechnical engineering staff indicated that it would be useful to categorize scores for these metrics in three groupings corresponding to low, moderate, and high concern.

Risk Summary - For the Risk Summary field, the breakdown of Risk scores is as follows:

- 0 to 74 = low relative risk exposure
- 75 to 149 = moderate relative risk exposure
- 150+ = high relative risk exposure

Hazard Summary - For the Hazard Summary field, the breakdown of Hazard scores is as follows:
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- 0 to 149 = low relative hazard
- 150 to 299 = moderate relative hazard
- 300+ = high relative hazard

Total Summary - For the Total Summary field, the breakdown of Total scores is as follows:
- 0 to 224 = low concern
- 225 to 449 = moderate concern
- 450+ = high concern
4.0 TAMIS POC Application

4.1 POC OVERVIEW

The TAMIS POC is a web-based application that introduces and demonstrates the types of holistic asset management and strategic planning functionality that could be supported through a fully-executed TAMIS initiative. The POC includes five user-configurable queries that involve the integration of data drawn from disparate sources across ADOT&PF and offer insight into a variety of asset management and planning challenges. After configuring and executing a query, the user can examine detailed result on a map and in tabular form and can review aggregate statistics in the form of charts, predefined reports, and ad-hoc “pivot-table” reports.

User-configurable queries included in the POC are:

- **Assets** - This query returns basic information about the road and bridge assets managed by ADOT&PF within a specified geographical area (e.g. one or more House districts, or one or more ADOT&PF regions).
- **Asset Conditions** - This query returns information about the condition of pavement and bridge assets (e.g. pavement roughness or rut depth or bridge superstructure condition) managed by ADOT&PF within a specified geographical area.
- **Conditions of Specified Road / CDS** - This query returns information about pavement and bridge assets along a specified route as defined by a unique CDS (e.g., the Alaska Highway).
- **Project Crash Analysis** - This query provides crash statistics for road segments managed by ADOT&PF that are aligned with planned projects within a specified geographical area.
- **Unstable Slopes** - This query identifies and characterizes unstable slopes on roads managed by ADOT&PF within a specified geographical area.

4.2 DETAILED DESIGN AND FUNCTIONALITY

The POC consists of a series of screens that facilitate a logical workflow for selecting and configuring queries and then reviewing results. The screens include Home, Query, Results, Charts, Reports, and Explore. The following subsections introduce these screens and review the functionality provided for the different queries within each of the screens. Note that the Results, Charts, Reports, and Explore screens currently allow the user to print results. The ability to export results to csv files or image files, as appropriate, is not available in the POC but would be an important addition to any future version of the tool.

4.2.1 Home Screen
The Home, or Welcome, screen provides an introduction to the purpose of the POC, offers a caveat that some of the data used in the POC are no longer up-to-date, briefly enumerates the queries supported by the POC, discusses the process for signing in to use the POC (in essence, providing a name and email address to allow for subsequent collection of user feedback), and outlines the general workflow for executing queries and reviewing results. After reviewing information on the Home page, the user can proceed to selecting and executing a query by clicking on the Let’s Get Started button in the upper right or on the Query tab in the page banner. A screen shot of the Home screen is presented below.

Figure 4-1. Welcome Screen

4.2.2 Query Screen

On the Query screen, the user first selects the query to be executed. Next, the user is presented with a series of questions to help filter the results (e.g., choosing to focus on a particular geographic region). As the user makes these choices, the upper right side of the screen provides a review of the configuration options selected. Once the query has been fully specified, the screen presents a Submit Your Query button that allows the user to launch the query and proceed to reviewing results.

A screen shot of the Query screen is presented below. In this example, the user has selected the Assets query, chosen to group results by House districts, elected to focus
specifically on the Downtown Anchorage and Spenard districts, and chosen to show only NHS assets.

Figure 4-2. Query Screen

Configuration options for the different queries are enumerated below. Note that for all queries, results are automatically filtered to only include assets for which ADOT&PF has maintenance responsibility.

- **Assets** - As shown in Figure 2, query configuration choices for this query include:
  - Whether to group results geographically based on ADOT&PF regions or on House districts
  - Which specific geographic areas to include in the results
  - Whether to include road assets and/or bridge assets
  - Whether to include NHS assets and/or non-NHS assets

- **Asset Conditions** - Query configuration choices include:
  - Whether to group results geographically based on ADOT&PF regions or on House districts
  - Which specific geographic areas to include in the results
  - Whether to include road assets and/or bridge assets
  - Whether to include NHS assets and/or non-NHS assets
• Conditions of Specified Road / CDS - Query configuration choices include:
  - Designation of route/CDS to be analyzed

• Project Crash Analysis - Query configuration choices include:
  - Whether to group results geographically based on ADOT&PF regions or on House districts
  - Which specific geographic areas to include in the results
  - Whether to include road assets and/or bridge assets
  - Whether to include NHS assets and/or non-NHS assets

• Unstable Slopes - Query configuration choices include:
  - Whether to group results geographically based on ADOT&PF regions or on House districts
  - Which specific geographic areas to include in the results
  - Whether to only show unstable slopes on routes on which traffic exceeds a specified AADT
  - Whether to only show unstable slopes for which the total score exceeds a specified minimum
  - Whether to only show unstable slopes for which mitigation measures are not present

4.2...3 Results Screen

Once a query has been executed, the POC application will transition to the Results screen. This screen allows the user to view all of the asset information returned by the query in both tabular format and on a map. Tabular results are listed at the bottom of the screen, with a separate tab for each asset type returned by the queries (e.g., one tab that contains a listing of all road segments and another tab that contains a listing of all bridge assets).

The top of the screen contains a map that shows the locations of assets returned by the query along with the boundaries of the selected geographic areas. For each asset type shown in the map, the user can choose different options for symbolizing (or color coding) the assets based on various metrics. For example, in the Asset Conditions query, the user can opt to symbolize pavement condition based on Roughness Summary, Rut Summary, or PSR Summary classes (i.e. poor, mediocre, fair, good, or very good).

On the right side of the map is a narrow panel that provides a legend for the current symbology of the map. At the bottom of this panel there is a Modify Layer Display control that, when clicked, brings up a set of drop-down menus that allow the user to select the metrics to be symbolized within the map. Once the user has selected the metrics to symbolize, clicking on the Legend control will cause the legend to be shown again.

The tabular results and the map are both interactive. If the user clicks on an asset record in the tabular listing, the corresponding asset will be highlighted in the map.
If the user clicks on an asset in the map, then a pop-up tooltip will appear to provide more information about the asset. For convenience, there is also an Expand Map toggle button that allows the user to expand the map to fill the entire screen when helpful.

Figure 4-3 shows an example of the Results screen for the Asset Conditions query.

Figure 4-3. Results Screen

The following discussion provides additional details, for each of the queries, on the fields provided for each asset type in the tabular display, the assets shown on the map, and the options for symbolizing assets in the map.

Assets - Depending on choices made by the user in configuring the Assets query, the Results page may include tabular and mapped results for roads and bridges.

- Fields presented in the tabular results for roads, if returned by the query, include: geographic area, NHS class, CDS, route name, begin mile, end mile, number of lanes, centerline miles, lane miles, and AADT.

- Fields presented in the tabular results for bridges, if returned by the query, include: geographic area, NHS class, bridge name, CDS, route name, begin mile, end mile, number of lanes, centerline miles, lane miles, and AADT.

- Options for symbolizing both roads and bridges in the map include NHS class, number of lanes, and AADT summary.
Asset Conditions - Depending on choices made by the user in configuring the Assets Conditions query, the Results page may include tabular and mapped results for roads and bridges. If the query includes roads:

- Fields presented in the tabular results for roads include geographic area, NHS class, CDS, route name, begin mile, end mile, number of lanes, centerline miles, lane miles, AADT, mean IRI, rut depth, and PSR.
- Options for symbolizing roads in the map include roughness summary, rut summary, PSR summary, AADT summary, and NHS class.

If the query includes bridges:

- Fields presented in the tabular results for bridges include geographic area, NHS class, bridge name, CDS, route name, begin mile, end mile, number of lanes, centerline miles, lane miles, AADT, deck area, status, minimum condition, deck condition, superstructure condition, and substructure condition.
- Options for symbolizing bridges in the map include minimum condition summary, deck condition summary, superstructure condition summary, substructure condition summary, status, AADT summary, and NHS class.

Conditions of Specified Road / CDS - Depending on choices made by the user in configuring the Conditions of Specified Road / CDS query, the Results page may include tabular and mapped results for roads and bridges. The data displayed in the tables and map for this query, along with map symbolization options, are the same as for the Asset Conditions query.

Project Crash Analysis - The Results screen for the Project Crash Analysis query includes tabular results for project segments and maps both project segments and individual crash locations.

- Fields presented in the tabular results for project segments include geographic area, need ID, program, primary work category, CDS, route name, begin mile, end mile, number of lanes, AADT, VMT, PDO crashes, minor crashes, major crashes, and fatal crashes.
- Options for symbolizing project segments within the map include major and fatal crash summary and major and fatal crashes per 100M VMT summary.
- Crash locations shown on the map are automatically symbolized based on severity (PDO, minor, major, or fatal).

Unstable Slopes - The Results screen for the Unstable Slopes query includes tabular and mapped results for unstable slope locations and the underlying road network.

- Fields listed in the tabular results for unstable slopes include geographic area, CDS, route name, mile point, mitigation present, risk score, hazard score, total score, and AADT.
- Fields listed in the tabular results for roads include CDS, route name, NHS class, lanes, geographic area, begin mile, end mile, centerline miles, and AADT.
- Options for symbolizing unstable slope locations in the map include total score summary, risk score summary, hazard score summary, mitigation present, and AADT summary.
- Roads are automatically symbolized in the map based on AADT summary.

4.2...4 **Charts Screen**

The Charts screen enables the user to view summary statistics about the data returned from the query in chart form—for example, a bar chart showing lane miles of roads by NHS class within a given geographic area. For each dataset (e.g. roads or bridges) returned by a query, the user can choose (a) a selected measure to display in the charts, and (b) how to hierarchically summarize the data into a series of charts. As an illustration, a user might choose to view summary statistics about roads in terms of lane miles and to organize the summary such that there is a chart for each geographic area included in the query, with breakdowns by NHS class within each chart.

Note that for some queries there may be only a single available choice for the measure to summarize in the charts or for organizational structure for summarizing the data in multiple charts. The aim in such cases is simply to demonstrate the potential; more options could be provided in a future version of the tool.

Figure 4-4 illustrates the Charts screen for the Conditions of Specified Road / CDS query.

![Figure 4-4. Charts Screen](Image)
The following discussion provides additional details, for each of the queries, on the datasets that can be charted along with choices regarding the measures to be graphed within the charts and the structural organization of the chart summaries.

Assets - Depending on choices made by the user in configuring the Assets query, the Charts page may include charts for roads and bridges.

- The charts for roads, if included in the query, allow the user to choose either centerline miles or lane miles as the selected measure.
- The charts for bridges, if included in the query, allow the user to choose centerline miles, lane miles, or bridge count as the selected measure.
- For both roads and bridges, the user can choose to organize the summary to (a) include a chart for each geographic area along with a summary chart for all included geographic areas, with each chart configured to provide a further breakdown by NHS class, or (b) include a chart for each NHS class along with a summary chart for all NHS classes, with each chart configured to provide a further breakdown by geographic area.

Asset Conditions - Depending on choices made by the user in configuring the Assets Conditions query, the Charts page may include charts for roads and bridges.

- The charts for roads, if included in the query, focus on the roughness summary metric. The user can choose to count by either (a) centerline miles by roughness summary class, or (b) lane miles by roughness summary class.
- The charts for bridges, if included in the query, count the number of bridges classified by the minimum condition summary metric.
- For both roads and bridges, the user can choose to structure the charting functionality to (a) include a chart for each geographic area along with a summary chart for all included geographic areas, with each chart configured to provide a further breakdown by NHS class, or (b) include a chart for each NHS class along with a summary chart for all NHS classes, with each chart configured to provide a further breakdown by geographic area.

Conditions of Specified Road / CDS - Depending on choices made by the user in configuring the Conditions of Specified Road / CDS query, the Charts page may include charts for roads and bridges. The charts for roads and bridges are similar to those in the Asset Conditions query, focusing on roughness summary and minimum condition summary, respectively. For this query, however, there is only a single chart for roads and a single chart for bridges that summarize the entire length of the selected route.

Project Crash Analysis - The Charts screen for the Project Crash Analysis query sums the number of crashes occurring on project segments by crash severity level (PDO, minor, major, or fatal). There is one chart for each geographic area included in the query, along with an additional chart that provides sums for all included geographic areas. The user is not able to select alternate measures or chart structures in the POC, though additional choices would likely be helpful in a future version of this tool.

Unstable Slopes - The Charts screen for this query focuses on the total score summary for unstable slopes. There is a chart for each geographic area, along with a summary
chart for all geographic areas, included in the query. Each chart provides one grouping of bars for unstable slopes that have not been mitigated and another grouping for unstable slopes that have been mitigated, with the individual bars showing counts of the number of unstable slopes for the different total score summary categories. The POC does not currently provide other choices for the measure to be graphed in the charts or for the organizational structure of the summaries, though here again it would likely be valuable to provide more options in a future version of the tool.

4.2...5 **Reports Screen**

The Reports screen is conceptually similar to the Charts screen but presents summarized data in a preformatted tabular report rather than in charts. Because a report can display multiple measures of interest in different columns, the Reports page does not ask the user to select a specific measure upon which to focus; instead, most of the reports include multiple measures by default. As with the Charts screen, however, the user can still select options for structuring the summary hierarchically—for example, grouping results by geographic area then by NHS class.

Figure 4-5 illustrates the Reports screen for the Unstable Slopes query.
Figure 4-5. Reports Screen

The following discussion provides additional details, for each of the queries, on the datasets and reporting options available on this screen.

Assets - Depending on choices made by the user in configuring the Assets Conditions query, the Reports page may include reports for roads and bridges.

- The report for roads, if included in the query, summarizes centerline miles and lane miles statistics.
- The report for bridges, if included in the query, summarizes centerline miles of bridges, lane miles of bridges, and bridge count statistics.
- For both roads and bridges, the user can choose to organize the hierarchical structure of the report to (a) include a major subdivision for each geographic area along with a summary subdivision for all included geographic areas, with minor subdivisions for each NHS class, or (b) include a major subdivision for each NHS class along with a summary subdivision for all NHS classes, with minor subdivisions for each geographic area.

Asset Conditions - Depending on choices made by the user in configuring the Assets Conditions query, the Reports page may include reports for roads and bridges.
The report for roads, if included in the query, focuses on the roughness summary metric, providing summations of both centerline miles and lane miles for each roughness summary class.

The report for bridges, if included in the query, focuses on the minimum condition summary metrics, providing counts of the number of bridges for each class.

For both roads and bridges, the user can choose to organize the hierarchical structure of the report to (a) include a major subdivision for each geographic area along with a summary subdivision for all included geographic areas, with minor subdivisions for each NHS class, or (b) include a major subdivision for each NHS class along with a summary subdivision for all NHS classes, with minor subdivisions for each geographic area.

Conditions of Specified Road / CDS - Depending on choices made by the user in configuring the Conditions of Specified Road / CDS query, the Reports page may include reports for roads and bridges. The reports for roads and bridges are similar to those in the Asset Conditions query, focusing on roughness summary and minimum condition summary, respectively. For this query, however, the rows in the tables are only grouped into subsections based on NHS class and do not include a division based on geographic area.

Project Crash Analysis - The report for the Project Crash Analysis query sums, for each geographic area included in the analysis and for all geographic areas combined, the number of project segments, lane miles, VMT, total crashes, PDO crashes, minor crashes, major crashes, and fatal crashes. The user is unable to select alternate structures for summarizing the data in the POC, though additional options could be provided in a future version of the tool.

Unstable Slopes - The report for the Unstable Slopes query sums, for each geographic area included in the analysis and for all geographic areas combined, the number of unstable slopes for each of the total score summary categories. Here again, the POC does not provide other choices for how to summarize the data, though additional options may be useful in a future version of the tool.

4.2.6 Explore Screen

The Explore screen provides “pivot table” functionality that enables the user to construct ad hoc reports based on the data returned by each of the queries. Each of the available pivot tables for the different queries and data sets provides a list of relevant fields that can be included in the report. To structure the report, the user:

- Selects a field (e.g. lane miles or crashes) to summarize in the report
- Selects an operation (e.g., sum, count, minimum, maximum, etc.) for summarizing the data
- Selects one or more fields for hierarchically dividing the report into rows and columns (e.g., construct a report for road conditions that includes rows for each NHS class and geographic area and includes columns for each roughness summary classification)
Selects the presentation style for the resulting report table, with options including table, table barchart, heatmap, row heatmap, and column heatmap.

Each of the pivot tables provided for the different queries includes several pre-defined pivots from which the user can select. These are intended to (a) provide a set of canned reports that may be of interest to users, and (b) offer examples that may help the user understand how to use the pivot table functionality. After gaining familiarity with this functionality, the user can then create custom ad-hoc reports by moving different fields to create rows and columns, selecting the field to be summarized in the report, choosing the operation applied to the field summarized in the report, and selecting the presentation style for the report.

Note that for queries that return multiple datasets, the Explore screen includes the pivot table for each dataset in a separate tab. Figure 4-6 shows an example of the Explore screen for the Project Crash Analysis query.

![Explore Screen](image)

Figure 4-6. Explore Screen

The following discussion provides additional details, for each of the queries, on the datasets that can be explored using the pivot table, the fields available for constructing the pivot table, and the predefine pivots that have been created for the user.

**Assets** - Depending on choices made by the user in configuring the Assets query, the Explore page may include tabs for roads and bridges. If the query includes roads:

- Fields that can be used to construct the roads pivot table include geographic area, NHS class, CDS, route name, lanes, centerline miles, lane miles, AADT, and AADT summary.
Predefined pivots for the road data include (a) total centerline miles by geographic area and NHS class, (b) average lane count by geographic area and NHS class, and (c) total centerline miles by AADT summary, geographic area, and NHS class.

If the query includes bridges:

Fields that can be used to construct the bridge pivot table include geographic area, NHS class, bridge name, CDS, route name, lanes, centerline miles, lane miles, AADT, AADT summary.

Predefined pivots for the bridge data include (a) number of bridges by geographic area and NHS class, (b) total centerline miles by geographic area and NHS class, and (c) average lane count by geographic area and NHS class.

Asset Conditions - Depending on choices made by the user in configuring the Assets Conditions query, the Explore page may include tabs for roads and bridges. If the query includes roads:

Fields that can be used to construct the pavement conditions pivot table include geographic area, NHS class, CDS, route name, lanes, centerline miles, lane miles, AADT, AADT summary, PSR, PSR summary, mean IRI, roughness summary, rut depth, and rut depth summary.

Predefined pivots for the pavement conditions data include (a) total centerline miles by geographic area, NHS class, and roughness summary, and (b) total centerline miles by geographic area, NHS class, and roughness summary.

If the query includes bridges:

Fields that can be used to construct the bridge conditions pivot table include geographic area, NHS class, bridge name, CDS, route name, lanes, centerline miles, lane miles, deck area, AADT, AADT summary, status, minimum condition, minimum condition summary, deck condition, deck condition summary, superstructure condition, superstructure condition summary, substructure condition, and substructure condition summary.

Predefined pivots for the bridge conditions data include (a) number of bridges by geographic area, NHS class, and deck summary, (b) number of bridges by geographic area, NHS class, and minimum condition summary, and (c) sum of deck area by geographic area, NHS class, and deck condition.

Conditions of Specified Road / CDS - Depending on choices made by the user in configuring the Conditions of Specified Road / CDS query, the Explore page may include tabs for roads and bridges.

Fields that can be used to construct the pavement conditions pivot table and the bridge conditions pivot table are the same as those included in the Asset Conditions query above, with the exception that the geographic area field is not included in either case.

Predefined pivots for the pavement conditions data include (a) total lane miles by roughness summary and AADT summary, and (b) total centerline miles by roughness summary and AADT summary.
Predefined pivots for the bridge conditions data include (a) number of bridges by minimum condition summary and AADT summary, and (b) bridge deck area by deck summary and AADT summary.

Project Crash Analysis - The Explore screen for the Project Crash Analysis query provides a single pivot table for ad hoc reports on project segments.

- Fields that can be used to construct the project segments pivot table include geographic area, program, primary work category, PDO crashes, minor crashes, major crashes, fatal crashes, major and fatal crash summary, and major and fatal crashes per 100M VMT summary.

- Predefined pivots include (a) major and fatal crash summary by geographic area, and (b) major and fatal crashes per 100M VMT by geographic area.

Unstable Slopes - For this query, the Explore screen provides a single pivot table focused on unstable slopes.

- Fields that can be used to construct the unstable slopes pivot table include geographic area, route name, mitigation present, risk score, risk score summary, hazard score, hazard score summary, total score, and total score summary.

- Predefined pivots for the unstable slope data include (a) count of unstable slopes by geographic area, and (b) average total score by geographic area and mitigation present.
5.0 Lessons Learned

Development of the POC provided significant insight into the key issues that will need to be addressed by ADOT&PF to successfully implement TAMIS on an agencywide basis. Key lessons learned are presented below.

5.1 TAMIS DATA

1. The ability of TAMIS to answer specific questions is only as good as the data that it can access.

Many of the questions that were initially proposed could not be addressed in the POC because source data were not readily available or were missing key data elements. Missing data elements included:

- Geographic Location – To display assets on a map or to combine assets based on physical proximity (e.g., crashes per roadway section), each asset record must include at least one set of location attributes, either geographic coordinates (i.e., latitude/longitude) or a linear reference (i.e., route identifier and milepoint measures) that is consistent with the LRS used in ADOT&PF’s RDS.

- Condition and/or Performance over Time – In order to display trends in asset condition or performance over time, asset data require either multiple fields in each asset record representing key condition or performance measures by time period (e.g., by year), or separate asset records for each time period. Few of ADOT&PF’s current asset databases maintain a temporal dimension in any systematic way.

- Project Costs and Funding Sources – In order to address questions related to project costs, or the allocation of available transportation funding to specific projects, ADOT&PF will need to develop and maintain asset databases that include standardized cost attributes that can, in turn, be linked to specific funding categories. Existing databases such as the project needs/STIP database and the FMIS reporting system, provide potential homes for asset-specific financial data, but standardized work flow procedures must be developed to enter and track costs throughout the entire life cycle of each project.

2. Summary measures must be developed for most asset databases

In order to make comparisons among different assets, either through the use of symbology on a map or categories in a graph, raw measures of asset condition and/or performance (e.g., IRI ratings for pavement) need to be grouped into summary category ratings that are both consistent with the raw measures and easily interpreted by all TAMIS users. While it is theoretically possible to compute these summary measures on the fly, the criteria for each summary measure first need to be developed in coordination with the technical staff managing the asset database. Then the summary measures either need to be created as supplemental attributes in the asset
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database, or procedures need to be developed to create the summary measures from the original asset data elements as needed.

3. Storing asset databases together in a common data warehouse improves system performance and reliability

Establishing a data warehouse that houses a copy of each asset database used in TAMIS offers a number of benefits to both the TAMIS user and the owners of each asset database. These benefits include:

- Asset database owners maintain control of their own master database – By publishing a copy of their data, database owners can control what specific attributes are (or are not) made accessible to other users, how often updates are provided, and how summary measures are defined. Risks associated with unauthorized access to the master database are eliminated along with issues associated with use of new data that have not been verified or cleared by the database owner.

- Common attribute fields can be standardized across asset databases – For example, location attributes can be standardized both with respect to field names and geographic parameters (e.g., all linear-referenced features are matched to the RDS LRS). This greatly simplifies the logic for common queries, which can significantly improve query speed, as well as the ability to add new databases to the TAMIS data viewer.

- Maintaining all databases in a single server greatly simplifies network communications – Maintaining all asset databases together either in a single Geodatabase or on a common file server greatly reduces the number of separate network connections and protocols needed to access databases residing on separate servers and/or database management systems. This should result in significantly better query response time and reduce the risk of a query failure because a database server or communication link is down.

- Workflow Processes for extracting, transforming, and loading (ETL) asset data can be automated using publish scripts – Virtually all of the workflow procedures to extract the required data items from each master asset database, transform raw data elements into standardized or summary attributes, and load an updated version of the data into the data warehouse can be incorporated into a customized publish script, initiated from the data warehouse, for each master database. A customized script can also be applied with different update cycles for each database (e.g., daily vs. annually), depending on user needs and current update protocols of each database owner. Additionally, because each script can be implemented as a separate automated batch process, each script can scheduled to run at times of low demand (e.g., overnight or on weekends) to minimize disruption to both users and database owners.

5.2 TAMIS Viewer Application

1. On the fly computations can significantly impact system performance and responsiveness
In developing web-based data query and visualization software, it is important to understand that there is always a tradeoff between the system response time and the number and complexity of computations that are done on the fly. This is especially true with complex geospatial analyses (e.g., polygon overlays, proximity analyses) that require geographic searches and comparisons among all records in a database to identify the subset that meets specific query conditions (e.g., crashes along road sections where new improvement projects are planned). In the POC, these complex spatial queries were conducted as part of the data preparation, and the results (i.e., crash rates per project and crashes per 100 million VMT on project segments) were stored as attributes associated with each project record. This enabled the POC viewer to generate tables, graphs, and map displays of crash rates for various projects in a matter of seconds rather than minutes.

While it is certainly possible to conduct complex spatial analyses and multi-condition queries on the fly, the resulting response times are likely to be unacceptably long to most users, who are accustomed to having a reply to a web-based query in a matter of seconds. However, in order to compute and store the results of such analyses as supplementary attributes in an asset database requires that the set of potential complex queries be anticipated in advance.

2. Increasing analysis flexibility impacts the complexity of the user interface

Another consequence of providing web-based users with the flexibility to conduct complex “ad hoc” queries and analyses across multiple asset databases is that the user interface needed to support those queries and analyses becomes more complex. Instead of simple drop-down menus that enable users to select pre-defined questions, geographic areas, or specific groups of assets, ad hoc queries require significantly more complex formula-based query builder tools, deeper understanding of specific asset database record layouts and attribute domain ranges, as well as practical working knowledge of both geospatial and attribute-based selection procedures.

Therefore, a key decision that must be made early in the development of TAMIS is “who is the target audience” for the web-based TAMIS viewer. If the primary target audience are senior managers within ADOT&PF who are looking for quick answers to common questions that can be defined in advance, then a simple user interface, consistent with what was presented in the POC, may be most appropriate.

If, on the other hand, the target audience includes some users that would benefit from more flexible data exploration, then it may be useful to include certain ad hoc query capabilities in a future TAMIS viewer. Based on feedback from the POC testing period, for example, it became apparent that some users might find it beneficial to filter query results on the fly based on a range of criteria. To illustrate, a user considering future project needs might first request data on all roads maintained by ADOT&PF in a given region. Thinking in terms of maintenance or repair needs, the user might then ask the application to highlight the subset of roads for which some measure of pavement condition (e.g. roughness or rut depth) ranks as mediocre or poor. Recognizing that projects also represent an opportunity for safety improvements, the user might then refine the request to focus on roads for which pavement condition ranks as poor or mediocre and the rate of major and fatal crashes exceeds a certain threshold. Next, the user might filter out segments of roads that are already overlapped by planned projects, resulting in a set of road segments that
require maintenance and safety improvements and are not yet addressed in current plans. Supporting such flexible, ad hoc data analysis and exploration capabilities would require a more complex interface. While the complexity could be mitigated to some degree via good user interface design, it could not be eliminated entirely.

3. Users require the ability to select and download subsets of TAMIS data for further analysis

In addition to displaying transportation asset data in various forms (i.e., maps, graphs, and tables) on the screen, the TAMIS viewer application should also provide users with the ability to select subsets of TAMIS data records based on multiple criteria (e.g., bridges in Fairbanks-North Star Borough that are functionally obsolete), and then export those selected records in one or more common formats (e.g., comma separated value (CSV), Excel table, shapefile), for further analysis in other software applications. The ability to export TAMIS data lessens the burden on the TAMIS viewer to include complex, desktop analysis capabilities in a web-based application.

6.0 Recommendations

Based on experience in developing the TAMIS POC and on feedback received from POC users, the consultant team offers the following recommendations to ADOT&PF in moving forward toward a full-scale, operational TAMIS.

6.1 IMPLEMENT TAMIS INCREMENTALLY

As the POC clearly demonstrated, very few of ADOT&PF’s asset databases are currently designed to fully support a TAMIS. Most asset databases are missing at least one of the three key data elements identified in Section 5.1.1 – geographic location, condition and/or performance metrics by time period, and costs and/or financial metrics. Additionally, some asset databases currently reside on local desktop computers maintained by individual ADOT&PF staff, while others are maintained separately in each transportation region with limited coordination across regions with respect to included attribute fields, record layouts or updating procedures.

Because it is highly unlikely that all of ADOT&PF’s asset databases will be redesigned simultaneously to meet TAMIS requirements, the most effective implementation strategy is to begin with those databases that are currently most compatible with basic TAMIS requirements, and whose owners are both supportive of TAMIS and are willing to make necessary changes to their database to facilitate integration into TAMIS.

By starting with an initial set of asset databases and an appropriate set of queries that can be addressed by those databases, the initial TAMIS implementation can both serve as a useful tool for ADOT&PF decision makers and demonstrate to other asset database owners the benefits of integrating their database into TAMIS.
6.2 TAMIS SYSTEM ARCHITECTURE

The TAMIS system architecture should consist of two distinct, but interdependent components – the TAMIS data warehouse, which stores copies of each transportation asset database, and the TAMIS viewer, which provides a web-based user interface to access, display (via tables, maps, charts, and reports), and download data stored in the data warehouse.

The TAMIS viewer could take the form of either a single application or multiple applications, with the best approach depending on the degree of overlap in the required functionality for different groups in ADOT&PF that will make use of the viewer. If most users would benefit from a similar set of functionality, then it would make sense to develop a single TAMIS viewer application that supports a union of the functionality requested by different end-user groups. If, on the other hand, the needs of different groups within ADOT&PF are largely distinct, then an alternate approach might be to develop a suite of web applications, each of which is highly targeted to discrete functions within the organization.

The latter approach does not necessarily entail more work, as each of the targeted applications would likely be simpler in scope than a single large application intended to meet a more diverse set of needs. Additionally, some of the applications might be crafted as extensions to existing tools such as the RIP. The choice of how to divide TAMIS viewer functionality across one or more applications should be considered as part of the user requirements documentation discussed below.

Figure 6-1 presents a high-level representation of the overall TAMIS architecture.
As one of the first tasks in implementing TAMIS, ADOT&PF should create a TAMIS database warehouse to host copies of each asset database that will be used in TAMIS. Creating the data warehouse includes procuring the necessary server hardware, database management system (DBMS) software licenses, and staff support to operate the data warehouse, maintain and acquire updates to the included databases, and
provide technical support for expanding the data warehouse to incorporate new asset databases.

A key function of the staff support for the data warehouse will be to develop custom ETL scripts to update each TAMIS asset database from the master asset databases maintained by specific ADOT&PF departments. In addition to developing the ETL scripts, the technical staff would need to coordinate with each database owner to address such technical issues as:

- What specific attributes can (or cannot) be distributed through the TAMIS data warehouse
- How often should the database be updated
- What summary measures should be computed and what attribute values should be assigned to each category?

### 6.4 **BUILD OR PROCURE A WEB-BASED TAMIS VIEWER APPLICATION**

The TAMIS viewer (comprising, as noted above, one or more web applications) represents the primary interface between users throughout ADOT&PF and the TAMIS databases. As such, it needs to be responsive to TAMIS user requirements and expectations, user-friendly, and modular in design to be able to incorporate both new databases and user queries without extensive software reprogramming.

ADOT&PF could decide to construct a customized viewer application from scratch, purchase a commercial-of-the-shelf (COTS) viewer application, or modify an existing COTS viewer to meet specific requirements. The final selection will depend on a number of factors, including cost, comparison of existing COTS software functionality vs. TAMIS requirements, COTS licensing requirements, and adaptability of the available COTS software to handle future growth in number of users, functionality, and databases.

At ADOT&PF, improved data management practices (TAMIS Implementation) will be easier to implement and enforce if users know that it will support functionality of tools and reports that meet needs of their business areas. Based on lessons learned in the POC and other TAMIS tasks, CS has narrowed down recommendation for a development of a tool to the following three described below.

One possible solution would be to develop an application internally using a COTS package for which there is already licensing (e.g. ArcGIS Online (AGOL)). A solution using AGOL would be fast to set up with data that is not fully integrated but is not likely to handle all requirements and will require a lot of management. This is the most cost-effective and fastest to set up, but least likely to meet the user requirements identified for a “TAMIS Viewer”.

Another possibility would be to procure a new COTS package. This will likely be a more costly and time-consuming option as the detailed requirements process will have to be re-done for a new system and ADOT&PF will need to provide that as part
of the procurement process (Request for information (RFI) and Request for Proposal (RFP)). Although it is likely to cost more and take a year (or likely longer) to procure and implement, it is possible that ADOT&PF could find a product that will meet their needs and have the added benefit of not having to deal with maintenance of custom systems and applications.

A third option is to invest in a project to further develop user requirements gathered in the POC task to custom build a TAMIS viewer. Development should start with requirements and specifications already identified with the POC, the TAMIS Implementation Plan, and include a plan to ensure ADOT&PF owns and has ability to configure and manage the final product without contractor support. A TAMIS viewer option can leverage what has already been researched as part of the TAMIS project but also be flexible and adaptable to changes that are currently happening at the Department. Developing a custom application can meet all of the user needs, but it is hard to identify costs and time to implement since user requirements still need further research. Both costs and time to implement are likely to be somewhat less than a full COTS solution, and more than the internally developed solution.

6.4...1 **TAMIS Viewer Functions and Capabilities**

Based on feedback from users and issues encountered by the consultant team during the development and testing of the POC, an initial list of functions and capabilities has been identified for the TAMIS. It is likely that this list will be expanded during the development of the user requirements document.

- All TAMIS viewer functions should be accessible from common internet web browsers currently used by ADOT&PF staff (e.g., Internet Explorer, Google Chrome, Firefox). Some functionality may not be fully supported by older versions of some browsers.

- The viewer should include a dropdown list of pre-defined asset management questions, like those illustrated in the POC, that enable users to easily answer common types of questions, without requiring them to set up an extensive set of queries.

- Users should be able to dynamically select subsets of asset records using various filters, including but not limited to:
  - Drop-down menus for specific attributes (e.g., Borough, Place, or Region)
  - Simple structured query tool (e.g., roads where AADT >= 20000)
  - Geospatial proximity (e.g., all crashes within 2 miles of a specified intersection)

- The viewer should enable the user to examine query results via tables, maps, charts, and reports. Generally, the user should be able to dynamically configure these displays to gain greater insight on the results. For example, the user should be able to symbolize different asset attributes within a map, or choose to sum different data fields within a chart or a report.

- The viewer should be configurable to enable system administrators (not end users) to easily add new asset databases, add or change the contents of drop down
menus, or add new report templates or standardized questions without major software reprogramming.

- Users should be able to export a selected subset of records in one or more common database file formats for use in other software. Potential file formats include CSV, Excel spreadsheet, and Esri shapefile.

- Users should also be able to save an image of any map display, graph, or summary report generated by the TAMIS viewer in one or more common image formats (e.g., JPG, PNG).

- The viewer should include warning messages when a user specifies a query or selection that may take a significantly long time to execute. The message should provide an option of running the query as an off-line job and then notifying the user when the job is completed (similar to the Roadway Information Portal (RIP) tool).

- The viewer should have built-in tutorials for users to easily execute a query or configure the pivot tables for their analysis needs. In addition, metadata should be readily visible for all data in application so users know exactly what they are viewing.

6.4...2 Develop User Requirements Document

Regardless of what option is ultimately chosen, a critical first step is the development of an initial user requirements document that:

- Clearly defines the intended purpose(s) of the viewer
- Identifies the target audience with respect to both technical capabilities and organizational roles and needs, in turn providing insight on whether the viewer should be constructed as a single web application or as multiple web applications
- Specifies both critical and desirable functional capabilities and performance criteria from a user perspective
- Specifies criteria for the operating environment (e.g., must work with ORACLE and Esri software, must run on Windows (or Solaris) servers)

The user requirements document would serve as the initial design document for a customized viewer application or as the preliminary specification for a COTS software procurement. In either case, it is likely that the initial set of requirements may be revised based on technical considerations, costs, or changes in mandatory versus desired functionality based on feedback from potential users and/or application developers.
# Appendix A. Final POC Comments

## Table 2: Summary of POC comments (April 2015)

<table>
<thead>
<tr>
<th>From</th>
<th>Comment</th>
<th>Notes/Follow-up</th>
<th>Bug or Problem</th>
<th>Enhancement Request with Implications for:</th>
<th>Major Rec.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mike Crabb</td>
<td>Thanks to you and the Cambridge team for the presentation today. I’m thrilled at what’s been accomplished! I think Cambridge “hit a homerun” as this is right in-line with what I was envisioning for being able to analyze performance data to make informed, data driven planning and programming decisions. I especially like the visuals (maps) as it will assist in validating our investment decisions to FHWA and the public – especially as Alaska faces tough decisions given its current financial situation. Great job!</td>
<td>No follow-up required.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Joselyn Biloon</td>
<td>Thanks for the opportunity. This review seems a little premature. I really need to work with the system live to get a feel of how it works. Today’s webinar showed me how it could work in the future and that was pretty exciting. However there were so many glitches and utilization was slow so it is hard to give useful comments. Once the glitches are fixed and the whole thing works in real time, rather than preprogrammed I will be able to offer meaningful feedback.</td>
<td>Issue resolved - related to older version of Internet Explorer.</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>From</td>
<td>Comment</td>
<td>Notes/Follow-up</td>
<td>Bug or Problem</td>
<td>Enhancement Request with Implications for Major Rec.</td>
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</tbody>
</table>
|                    | Thanks  
Joselyn Biloone                                                                                                                                  |                                                                                                                                                                                                              |                |                                                     |
<p>| David Post         | Not a “concern” just a comment that it did not work. I was following along with the presentation almost click for click (I simply find this to be a better way to remember and familiarize myself). At about the halfway point in the presentation it ceased to bring up any mapping (defaulted to the north Atlantic and even after moving the map back to the region of Alaska queried only the base map showed without queried info). Randy indicated he was unable to get it to work either but I think he tried to pull it up later, possibly when multiple people started utilizing it is when it stopped functioning. | Issue resolved - related to older version of Internet Explorer.                                                                                                                                                 |                |                                                     |
| Jack Stickel       | Consider better use of language on the application. For example, assets should be used only to describe assets                                                                                           | If further development of the tool is pursued, the language could be adjusted as appropriate.                                                                                                                |                | X                                                   |
|                    | Jack’s view needed something to show the application was thinking, because it was slow. It would be nice to see a “loading” bar or something like that.                                                   | Behavior is somewhat inconsistent for different browsers. If further development of the tool is pursued, a progress bar could be added to inform user of status of query. |                | X X                                                 |
| Janelle White      | Wow – I like this – I use more columns then shown for the TAMP analysis – but I like being able to look up information for myself.                                                                    | No follow-up required.                                                                                                                                                                                         |                |                                                     |</p>
<table>
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<th>From</th>
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<th>Notes/Follow-up</th>
<th>Bug or Problem</th>
<th>Enhancement Request with Implications for Major Rec.</th>
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<tr>
<td></td>
<td>Bridge condition was really cool. This will be a good tool when complete.</td>
<td></td>
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<td></td>
<td>I wish that I could take the list that it generates and put it into excel so that I could analyze information.</td>
<td>If further development of the tool is pursued, this ability would definitely be included.</td>
<td></td>
<td>X X X</td>
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<td></td>
<td>I worked on a database like this in Portland – we connected police data to each crash site – general information which could help designers plan safety improvements. Information like weather during time of crash, time of day, reason for crash – information that could lead to some engineering analysis.</td>
<td>If further development of the tool is pursued, it would be useful to investigate this possibility in the processing of refining system requirements. Note that there would need to be a plan for collecting, storing, and processing any additional layers in the TAMIS environment.</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Is there a way to update information as we receive it? I could see a lot of benefit in adding eagle trees if someone at DOT can update the information.</td>
<td>If further development of the tool is pursued, it would be useful to investigate this possibility in the processing of refining system requirements. Note that there would need to be a plan for collecting, storing, and processing any additional layers in the TAMIS environment.</td>
<td></td>
<td>X X X</td>
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<tr>
<td></td>
<td>This could be an excellent planning tool, can information be sorted and compiled? For instance – can we choose all of the deficient bridges or choose all of the segments with high IRI? Basically – can we use this tool to</td>
<td>This is an excellent suggestion. If further development of the tool is pursued, it would be beneficial to structure the interface such that users can</td>
<td></td>
<td>X X X</td>
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<td>From</td>
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<td></td>
<td>target the areas where we should have projects to improve our percentages for the TAMP?</td>
<td>perform an initial query to gather a base set of information (e.g. all assets in a given geographic area) and then further filter the information (e.g. just show deficient bridges) on the fly without needing to rerun the query.</td>
<td></td>
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<td></td>
<td>I can see a lot of advantages with this tool – it could reduce the time spent analyzing large amounts of data.</td>
<td>No follow-up required.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>If you can tie these queries to performance measures then it will save all of us a lot of work.</td>
<td>The current POC already includes some performance measures, e.g. pavement condition ratings. If further development of the tool is pursued, we would recommend a more intensive requirements gathering phase to identify additional measures that would be helpful to develop and present for different TAMIS user groups.</td>
<td></td>
<td>X        X        X        X        X</td>
</tr>
<tr>
<td></td>
<td>I could also see it helping with degradation. If we could query old information and compare to new information then we could use it to show progress.</td>
<td>This is an excellent suggestion and gets at the larger question of what types of historical data should be stored in the TAMIS warehouse and what types of analysis should be possible to examine changes over time. If</td>
<td></td>
<td>X        X        X        X        X</td>
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<td>further development of the tool is pursued, we would recommend a more intensive requirements gathering phase to define and then develop such functionality.</td>
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<tr>
<td></td>
<td>Wow, I can see a lot of possibilities for this – it could be that I have spent a lot of time sorting data that this will sort for you.</td>
<td></td>
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<tr>
<td>Anna Bosin</td>
<td>I first tried generating the largest query (unstable slopes unlimited); Tried to get the risk score to go highest to lowest or vice versa- not sure it takes all pages into account when sorting? Maybe just the page you are on?</td>
<td>The sorting functionality appears to be working correctly. The POC will sort all slopes by the attribute in question (e.g. risk score) and then display the results in multiple pages.</td>
<td></td>
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<td></td>
<td>Looks like the south coast region needs to be defined still</td>
<td></td>
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<td></td>
<td>If you later want to refine the search, how do you “uncheck” or remove items using the legend key? Or do you have to start the query over again? The modify layer display didn’t show</td>
<td>Currently the query would need to be re-executed. If further development of the tool is pursued, it would be very useful to provide the capability of querying to get a base set of records (e.g. all assets in a region) and then further filtering the records on the fly by</td>
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<td>various attributes without needing to re-run the query.</td>
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<td></td>
<td>You might have already touched on this, but can you export the entries portion into an excel file?</td>
<td>If further development of the tool is pursued, this would be a high priority function to add, along with ability to export maps, charts, and reports.</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Next I queried the crash database. Just a suggestion to have the highway name at the topic rather than in the middle. Not sure VMT needs to have the 3 decimal points either.</td>
<td>If further development of the tool is pursued, these changes could be readily incorporated.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The search function works as a nice filter for the entries portion but doesn’t update the map. Would that be worthwhile to have it filter the map too? Maybe not possible.</td>
<td>If further development of the tool is pursued, it would be very useful to provide the capability of querying to get a base set of records (e.g. all assets in a region) and then further filtering the records on the fly by various attributes without needing to re-run the query.</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>I know the data pull is not complete, but this data field says there are 4 minor crashes and a fatal but I don’t see the fatal and I do see a Major (orange). It might be nice to be able to click on the crash and have the window highlight it (them). Maybe it is looking back through the entire crash database but only showing the most recent year of data? Unclear.</td>
<td>The development team has not been able to replicate this behavior, though it is possible that there was an error in codifying or symbolizing the crash data. If further development of the tool is pursued, the tool could be readily modified to include a tabular presentation of the crash</td>
<td>?</td>
<td>X</td>
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<td>Bug or Problem</td>
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<td>Have you already considered including mile posts on your base map? On the sterling highway it gets tricky because the posts and points are off by more than 30 miles and go in the opposite direction I think. Jill and Sean would know more about the latest on MPs.</td>
<td>If further development of the tool is pursued, it would be possible to include this dataset on the map if desired.</td>
<td>X</td>
<td>X X X</td>
</tr>
<tr>
<td></td>
<td>It would be nice if the attribute box could be pulled off the road to take a look at the route underneath</td>
<td>If further development of the tool is pursued, this suggestion could likely be implemented.</td>
<td></td>
<td>X</td>
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<td></td>
<td>I know we talked about how to better drill into the crash data to CREATE projects rather than list EXISTING projects- maybe having segments that have NO projects assigned filtered out that have crashes? Or even remove the 1R type projects since they don’t really address safety as directly as this reporting would want to?</td>
<td>This is an excellent suggestion. If further development of the tool is pursued, it would be beneficial to structure the functionality to support this capability.</td>
<td>X</td>
<td>X X X X X X</td>
</tr>
<tr>
<td>Jill Sullivan</td>
<td>It’s pretty easy to use. That is a major positive right off the bat.</td>
<td>No follow-up required</td>
<td></td>
<td></td>
</tr>
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<td></td>
<td>I queried Asset Condition, Downtown Juneau district and it came up fairly quickly so that I could start playing with it.</td>
<td>No follow-up required</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I really like all the information you can get and so quickly. With just one click of a pavement segment you can get the # of</td>
<td>No follow-up required</td>
<td></td>
<td></td>
</tr>
<tr>
<td>From</td>
<td>Comment</td>
<td>Notes/Follow-up</td>
<td>Bug or Problem</td>
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<td>lanes, AADT, CDS, Route name, NHS/Not NHS, IRI, PSR...overall pretty handy!</td>
<td>This suggestion raises the larger question of what types of historical data should be stored in the TAMIS warehouse and what types of analysis should be possible to examine changes over time. If further development of the tool is pursued, we would recommend a more intensive requirements gathering phase to define and then develop such functionality.</td>
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<td>I also ran the crashes for Downtown Juneau District. I think it would be handy to see what the targets are and a chart that shows the trend lines. This means you would need to plot 5 year rolling averages for 10 consecutive years. Also, somehow display whether we are meeting our targets or not.</td>
<td>The Legend shows as “Major Crashes” we refer to them as Serious Injuries as does our Alaska Highway Safety Office. We received different feedback from different groups on the appropriate nomenclature. If further work on the tool is pursued, the nomenclature could be updated as appropriate.</td>
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<td>The one overall comment I have is to add the metadata within the system, not just as a separate document. The users need to be aware at all times what data they are looking for.</td>
<td>This is an excellent suggestion. If further work on the tool is pursued, then it would be very useful to provide users with different feedback from different groups on the appropriate nomenclature. If further work on the tool is pursued, the nomenclature could be updated as appropriate.</td>
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<td>at. You can add dates to the Legend, charts, reports, and within pop-ups when someone selects a feature on the map.</td>
<td>metadata about the information returned by the queries, and the design could be updated in a number of ways to support this ability.</td>
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<td>More information about the data can be in separate text pages or something. For example, information about the origin of the data, data steward, coverage and who to contact.</td>
<td>This is an excellent suggestion. If further work on the tool is pursued, then it would be very useful to provide users with metadata about the information returned by the queries, and the design could be updated in a number of ways to support this ability.</td>
<td></td>
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<tr>
<td>Jill Sullivan</td>
<td>What you’ve done with the POC is a very good start. I think managers will really like the ease of use.</td>
<td>No follow-up required.</td>
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<tr>
<td>Carolyn Morehouse</td>
<td>Need a Query to screen bridges deck area and pavement condition. This would provide the locations for repaving to protect bridge substructure.</td>
<td>If further work on the tool is added, this functionality could be readily provided.</td>
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<tr>
<td>ADOT&amp;PF, TGIS: Kim Homan, Sean Jordan, Kerry Kirkpatrick, David</td>
<td>Generally the technology behind the POC is well received.</td>
<td>No follow-up required.</td>
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<td>Looks like a combination of RIP and STAR, but needs more interoperability to surpass our current applications. Need to be able to query through the map or add additional features to the map in order to satisfy all of the query needs.</td>
<td>If further work on the tool is pursued, we would suggest that the process begin with a more intensive requirements gathering process to identify and prioritize enhancements along these lines.</td>
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<td>Oliver, Jack Stickel</td>
<td>We went from original HDP to new HDP and to RIP, the users complained when the Query keeps asking questions. Users seemed to like all of the questions at once.</td>
<td>No follow-up required.</td>
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<td></td>
<td>Add an indicator that shows the application is still running. Hard to tell if the thing died or is running, especially if you run a large query. Something like RIP's.</td>
<td>If further development of the tool is pursued, a progress bar could be added to inform user of status of query.</td>
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<td></td>
<td>Needs a lot more data and report options to really get a good feel.</td>
<td>If further work on the tool is pursued, we would suggest that the process begin with a more intensive requirements gathering process to identify additional data and reports that would be helpful to include.</td>
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<td></td>
<td>Drag/drop for the explore section as well as the map interface and charts are good.</td>
<td>No follow-up required.</td>
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<td></td>
<td>When would one use RIP/STAR vs TAMIS? Where is the dividing line between the two systems. If we updated RIP/STAR would we want to make sure not to duplicate functionalities with a potential TAMIS. Since this is just a concept maybe take RIP/STAR and upgrade to include TAMIS features.</td>
<td>If further work on the tool is pursued, we would suggest that the process begin with a more intensive requirements gathering process which could help to determine whether TAMIS functionality would be layered onto RIP/STAR or instead provided in one or more separate tools.</td>
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<td>Additional enhancements for RIP include straight line diagrams.</td>
<td>If further work on the tool is pursued, we would suggest that</td>
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<td>the process begin with a more intensive requirements gathering process which could help to identify and prioritize such requests.</td>
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<td>Is there a commercial off-the-shelf system that does all this already? A number have been demonstrated to the GIS staff at one time or another.</td>
<td>We are not aware of an existing off-the-shelf system that includes all of the functionality in the POC, though there are certainly tools that address various subsets of the functionality.</td>
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<td>Need a help or workflow tutorial built into each tool, especially pivot tools.</td>
<td>If further work on the tool is pursued, it would be useful to provide additional help/tutorial resources.</td>
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<td>Originally, we understood this tool would answer a few key management questions and produce specific results. Did the scope of the tool change? Does it make sense to provide multiple levels of tools? Canned queries versus customized queries?</td>
<td>The tool is designed to provide insight into specific management questions conceptualized at earlier stages of the project. If further work on the tool is pursued, it would be useful to begin with a more intensive requirements gather process in which it would be possible to develop additional canned and customized query capabilities to meet additional management needs.</td>
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## Transportation Asset Management Information System

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<th>From</th>
<th>Comment</th>
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<th>Enhancement Request with Implications for Database Interface Function</th>
<th>Major Rec.</th>
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<td></td>
<td>Will this system pull data from other systems directly (services) or will there always be a hard coded database to feed the system? If so, who will maintain that database and what triggers will inspire an update</td>
<td>The tool is designed to pull data from a data warehouse that would periodically be updated with published data from source databases. Rules for updating data in the warehouse from source databases have yet to be determined but are likely to vary from one data source to the next (e.g., depending how frequently data in the source database is updated).</td>
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<td>We are beginning discussions about standardizing web application technology and building on a common platform of tools that can be repurposed for multiple applications. We are also starting to discuss common look and feel standards for the agency. Was this application built so that the tools here could be repurposed for other applications?</td>
<td>The POC is built based on commonly-used web application tools but has not been designed for repurposing for other applications. If further work on the tool is pursued, then it is possible that elements of the application could be designed for re-use in other contexts.</td>
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<td>John Lohrey - FHWA division office</td>
<td>I only have an old version of Internet Explorer, and our IT security rules don’t let us install Google Chrome or Firefox, so I didn’t play around in the demo program. The only comment I have is from your demonstration. The fully implemented version of this tool should include pavement cracking. I understand that cracking</td>
<td>Pavement cracking could presumably be added as another pavement attribute if further work on the tool is pursued.</td>
<td></td>
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<td>Clint Farr - ADOT&amp;PF Crash/Safety Planning Manager</td>
<td>information was not available at the time you started developing the proof of concept.</td>
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<td>Clint Farr - ADOT&amp;PF Crash/Safety Planning Manager</td>
<td>I looked at it today. I am going to defer to Jill’s feedback which pretty much covers my thoughts.</td>
<td>No feed-back required.</td>
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<td>Clint Farr - ADOT&amp;PF Crash/Safety Planning Manager</td>
<td>Per Jill’s correction/comment about how they refer to major crashes: (Clint Farr): I like Serious Injury Crash. It’s more precise. You can have a “major” crash where both cars are totaled, but if drivers and passengers walk away, the crash is not considered “major” by the Feds. Crash severity hinges upon injuries incurred by drivers and passengers. So I like Serious Injury Crash (or minor injury crash) because it spells out this fact and nobody envisions a “major” crash where cars get totaled but everybody is fine.</td>
<td>We received different feedback from different groups on the appropriate nomenclature. If further work on the tool is pursued, the nomenclature could be updated as appropriate.</td>
<td></td>
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<td>Barry Benko - Chief Engineering Geologist</td>
<td>For queries in the Unstable Slopes, is it possible/advisable to add the category text descriptors that correspond to the score ranges? i.e. Good/Low = 0-224; Fair/Medium = 225-499; Poor/High = 450+. Also, does CS have any indication of prospect for adoption of the demo system, for implementation in TAM program at ADOT&amp;PF?</td>
<td>If further work on the tool is pursued, the suggested text descriptors could be readily added.</td>
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<tr>
<td>Jill Sullivan</td>
<td>I take back the Major Injuries. Our AASHTO refers to them that way. We use Serious Injuries. I will leave this up to Clint?!?</td>
<td>We received different feedback from different groups on the appropriate nomenclature. If</td>
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<td>further work on the tool is pursued, the nomenclature could be updated as appropriate.</td>
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Data Governance Manual

for Alaska DOT&PF Data and Information Systems

prepared for

Alaska Department of Transportation & Public Facilities

prepared by

Cambridge Systematics, Inc.
Data Governance Manual

for Alaska DOT&PF Data and Information Systems

prepared for
Alaska Department of Transportation & Public Facilities

prepared by
Cambridge Systematics, Inc.
1566 Village Square Boulevard, Suite 2
Tallahassee, FL 32309

Date - (Update Annually)
Original - July 24, 2015
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Acronyms

ADOT&PF – Alaska Department of Transportation and Public Facilities
ASD - Administrative Services Division
FHWA – Federal Highways Administration
ISSD – Information Systems and Services Division
IT – Information Technology
MAP-21 - Moving Ahead for Progress in the 21st Century Act
P&P – Policy and Procedure
POC – Proof of Concept
TAM – Transportation Asset Management
TAMDIT – Transportation Asset Management Data Integration Team
TAMIS – Transportation Asset Management Information Systems

Definitions

Asset – The physical transportation infrastructure (e.g., travel way, structures, other features and appurtenances, operations systems and major elements thereof); more generally, can include the full range of resources capable of producing value-added
for an agency: e.g. human resources, financial capacity, real estate, corporate information, equipment and materials, etc.; an individual, separately-managed component of the infrastructure, e.g., bridge deck, road section surface, streetlight.¹

**Business Owner** - A subject matter expert accountable for the data specifications, data quality and information delivery of specifically assigned business areas, subject areas or databases.

**Data** – A representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by humans or computers.

**Data Set** – Any organized collection of data.²

**Data & IT Governance Council** - Established in the P&P for Data and IT Governance, this council comprised of several division directors serves as the primary “governing body” for the management of data systems.

**Data Governance** - The people, policies, and procedures which govern data management and information systems. Data governance promotes the understanding of data as a valuable asset to the organization and encourages the understanding and management of data from both a technical and business perspective. Data governance provides:

- A central focus for identifying and controlling the collection, storage and sharing of data
- A data business plan and governance board to enforce data management
- Enterprise data standards, data dictionaries, and metadata
- Standard data quality assurance processes

**Data Governance Work Group** - ADOT&PF’s Data Governance Work Group is comprised of Business Owners and System Owners who provide expertise on business area data requirements, help establish business rules, and participate in the management of the Department’s Data Governance Manual.

**Data Management** – The development, execution, and oversight of architectures, policies, practices and procedures to manage the information lifecycle needs of an enterprise in an effective manner as it pertains to data collection, storage, security, data inventory, analysis, quality control, reporting and visualization.

**Data Program** – A data program in this report refers to specific data systems that support a business area of the organization.³ The “program” usually includes the functions of data collection, analysis, and reporting. In the case of a DOT, some

---

¹ AASHTO Transportation Asset Management Guide
² DAMA Dictionary of Data Management
³ NCHRP Report 666
examples of these programs include traffic, roadway inventory, safety, and pavement data. At ADOT&PF, the primary agency data programs that will support TAMIS are:

Bridge
Traffic
Roadway
Crash
Pavement

**Information** - Data and documents that have been given value through analysis, interpretation, or compilation in a meaningful form.

**Information Management** - An overarching term used to describe the organization and control over the collection and management of information from one or more sources, and the processing, delivery, and sharing of that information to users. Information management addresses how an organization develops policies, practices, technologies, and other resources and capabilities to manage information as a resource. This includes the management functions associated with the creation, collection, processing, transmission, dissemination, use, storage, and disposition of information, both automated and non-automated. A simpler version of the definition is from AIIM (The Global Community of Information Professionals): “Information management is the collection and management of information from one or more sources and the distribution of that information to one or more audiences.”

**Information Technology (IT)** - The application of methods and scientific knowledge for the collection of information. IT is commonly associated with The use of electronic principles and devices for the development and Implementation of electronic systems.

**Information Systems** - A combination of information technology and the activities of people associated to support and execute the necessary operations and management of the system with the responsibility of decision-making. Information systems include hardware, software, and staff.

**RASCI** - A responsibility assignment matrix used to describe the participation of defined roles in completing tasks for a business process which is useful in clarifying roles and responsibilities in cross-functional/departmental projects and processes. RASCI is an acronym for the following typically used responsibilities: Responsible (R), Accountable (A), Supportive (S), Consulted (C), and Informed (I)

**Stakeholder** - An organization, person, process, or system that can be affected by a change to a system or process.

**System** – DAMA Dictionary of Data Management defines system as “An interacting and independent group of component items forming a unified whole to achieve a
common purpose”. For the context of this manual and TAMIS, an example of a system is the Road Weather Information System (RWIS) because it is a combination of data collection hardware, database structures, data, applications, and web access points serving the purpose of providing real-time road weather conditions on Alaska’s major roadways.

**System of Record** - A system that stores the ‘official’ version of a data attribute or data set.

**System Owner** - Information System and Services Division professional(s) supporting the technical and functional aspects of data management and information delivery for specifically assigned business areas, subject areas or databases.
1.0 Introduction

As part of the Transportation Asset Management Information Systems (TAMIS) research project, a Data Business Plan was developed which includes several key recommendations for improving data and information management at Alaska Department of Transportation & Public Facilities (ADOT&PF). This Data Governance Manual provides specific guidance supporting the TAMIS Data Business Plan and is intended to be expandable to apply to all data and information systems with an initial focus on those needed for Asset Management.

1.1 PURPOSE

This document is the reference handbook which describes a data governance framework, data governance roles & responsibilities, data related policies & procedures, and standards for data and information management at ADOT&PF.

1.2 SCOPE & APPLICABILITY

The Data Governance Manual for ADOT&PF will apply to data strategy and policies, data standards and architecture, regulatory compliance (communicating, monitoring, enforcing), issue management (escalating, resolving), and data management projects.

The current scope includes the systems, data and people that manage information needed to support TAMIS. As ADOT&PF makes improvements and implements recommended data governance strategies, this manual will be updated to include new information systems, data, standards, policies, procedures, integration methods and/or roles & responsibilities. With improved data governance, it is anticipated that ADOT&PF will establish and assign key roles described in this document. The responsibility for management and maintenance of the Data Business Plan and the Data Governance Manual resides with the Information Systems Services Division (ISSD) Director or designee and it is crucial to success that both are considered “living documents” and updated on an annual basis at a minimum.

1.3 DOCUMENT STRUCTURE

The National Cooperative Highway Research Program (NCHRP) publication 666 recommends agencies develop a data governance manual to provide a single source of information for all staff on the standards, policies, and procedures regarding the use of data and data programs within the organization. According to the publication, a data governance manual includes the following components:

• Data governance charter;
• Agency formal data management policy;
• Data governance model diagram used for the agency;
• Roles of data governance participants; and
• Glossary of terms.

ADOT&PF’s Data Governance Manual includes all of the above and adds a section detailing Data Governance Standards that will support Alaska’s TAMIS. Following are the sections included in this manual:

1.0 Introduction
   1.1 Purpose
   1.2 Scope& Applicability
   1.3 Document Structure
   1.4 Data Life Cycle

2.0 Data Governance Model
   2.1 Vision, Mission, and Goals
   2.2 Data Governance Framework
   2.3 Data Governance Principles

3.0 Roles & Responsibilities
   3.1 Business Owners & System Owners,
   3.2 Roles of Users
   3.3 RASCI

4.0 Authority
   4.1 Data Management Policies & Procedures
   4.2 Data Governance Charter

5.0 Data Standards
   6.1 Overview
   6.2 Data Standards and Processes

6.0 References

1.4  DATA LIFE CYCLE

A proper data governance practice ensures that data are trusted by users and are easy to access, comprehend, and translate for reporting and analytical use. The proper practice begins with collection of all required records and attributes, and ends with preservation and destruction protocols that meet all regulatory standards. At each phase of the data life cycle, principles of data governance
should be applied to ensure that data is trusted and understood. The phases include:

- **Collection**: Standards should exist for the recording of asset name, location, and descriptive attributes. Data should be updated regularly and predictably and returned to the data business owner promptly after collection. The data collected for each asset and attribute must reflect the requirements imposed by each successive phase of the life cycle.

- **Capture**: Data capture involves the transfer of records from the system used to create or update them to a system-of-record. It is at this phase that geographic comprehensiveness should be ensured, with regular verification that representative data exists for all division and regions or, where appropriate, for each individual asset statewide.

- **Management**: Management is the processing and validation performed on the system-of-record in order to improve ease-of-use. Management includes performing quality assurance and quality control (QA/QC) processes on data. Standards must exist for the level of detail to be provided in these “gold standard” data sets, reflecting the individual requirements of each data item.

- **Storage**: Data storage should be performed using systems with contemporary architecture that can easily be serviced both by the Business Owner and System Owner. Procedures should exist for identifying the people responsible for maintaining each database on the business and technical sides of the agency.

- **Archiving and Preservation**: The preservation, archival, and destruction of data is subject to a significant degree of regulation, particularly where sensitive financial or personal information is concerned. Some data are mandated for deletion after a certain period of time, while other records must be maintained and accessible into perpetuity. Decisions around the preservation, archival, and destruction of data should be subject to Department or State Agency standards specific to the business area and should be made under the authority of the Data Business Owner. The [Alaska State Archives Office](https://www.alaska.gov/archives/) provides leadership and guidance relating to records and information management for the state of Alaska.

- **Delivery and Retrieval**: Much like preservation, archival, and destruction, the dissemination and release of data is subject to legal restriction and regulations. In addition, data delivery is a distinct and separate function from data capture, representing the gatekeeper role of the data owner. Users may retrieve data, but they should not alter it or add to it in the system-of-record without the permission and possible assistance of the owner. Finally, data should be accessible to all current and potential future users through use of well-publicized retrieval methods, and in the form of ad hoc queries in addition to formal reports.
- **Refresh**: User needs and feedback on tools and data must be understood and communicated back to the Business and System Owners so appropriate revisions or corrections can be made.

Figure 1.1 represents the life cycle of data in relationship with primary roles described later in this manual. Note the necessary overlap among the Business Owner, System Owner and Users of the data.

**Figure 1.1 Data Life Cycle**
2.0 Data Governance Model

The data governance model for ADOT&PF (Figure 2.1) confirms the mission, vision and goals for data governance that support the overall Mission of Transportation Asset Management (TAM) and the Department. It also provides the framework that illustrates the relationship between the vision, mission, goals and the teams that will support and develop the Department’s information systems and data programs. Finally, the data governance model provides a list of principles for data governance and practices that can be put into action to support those principles.

2.1 Vision, Mission, and Goals

Mission Statement

To provide reliable, timely and accurate data and information that is easily accessed, shared for cross-asset analysis and incorporated into ADOT&PF’s asset management decision-making process.

Vision Statement

All ADOT&PF asset management business decisions are supported by reliable data that adheres to established data quality standards as defined in the ADOT&PF Data Governance Manual.

Goals

Enable better decision-making by establishing a timely and accurate single version of information disseminated within and external to the Department;

More effectively address the data and information needs of the public, the legislature, the commission, the regions, divisions and business areas of the Department;

Reduce costs and increase efficiency through coordination of efforts;

Organize people, processes, and information technology (IT) and business intelligence (BI) tools to support improved data management operations; and

Mitigate risks associated with data systems regarding statutory compliance issues.

2.2 Data Governance Framework

A recommended data governance framework is illustrated in Figure 2.1. The model depicts the relationship between the mission and goals of ADOT&PF and the corresponding reliance on people, technology, and business processes to achieve the mission and goals. The Policy & Procedure (P&P) “Data and Information Systems Governance” establishes the Data and IT Governance Council who will be responsible for:
• Approval of procedures, standards and manuals developed for data governance
• Enforcement of the Data and Information System Governance policies, procedures, and standards
• Mediation and resolution of issues or disagreements related to data governance.

The Data and IT Governance Work Group, is also established in the P&P to coordinate with the Division of Information Systems and Services Division, to develop and update the data and information systems procedures, standards and manuals.

The Data and IT Governance Council will be a team of department directors or designees and the Data and IT Governance Work Group will be comprised of key Business Owners, System Owners, and possibly data Users/Stakeholders. The technology used to maintain and manage the information systems and data sets is an inherent component of the agency data programs.

Agency Data Programs include business area data, systems and processes that are funded, mandated, owned and managed, and support critical functions of the department. At ADOT&PF, the primary agency data programs that will support TAMIS are:

Bridge
Traffic
Roadway
Crash
Pavement

Business and System Owners are represented in the Data and IT Governance Work Group. Business and System Owners will coordinate on data and information managed by the Agency Data Programs and will also interface with users and stakeholders to make sure the data needs are understood and appropriately met.
2.3 **Data Governance Principles**

The following data principles developed by the American Association of State Highway Transportation Officials (AASHTO) Standing Committee on Planning and Subcommittee on Data will be used to guide data governance policies at ADOT&PF. The practices were added as a result of discussions with ADOT&PF TAM teams.

<table>
<thead>
<tr>
<th>Principle</th>
<th>Practices</th>
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</thead>
</table>
| **Valuable**<br>Data is a core business asset that has value and is managed accordingly. | • Maintain and Enforce Data Governance Manual  
• Develop and maintain Data Catalog |
| **Available**<br>Data is open, accessible, transparent and shared. Access to data is critical to performing duties and functions. Data must be usable for diverse applications and open to all. | • Share published data in a centralized location  
• Provide tools, reporting capabilities and applications that meet enterprise business needs in the same central location  
• Evaluate what needs to be published and publish it |
| **Reliable** | Develop and enforce data quality standards  
Data quality and extent is fit for a variety of applications. Data quality is acceptable and meets the needs for which it is intended.
- Review standards and adjust as necessary
- Identity and evaluate critical data elements
- Ensure there is a system of record for every TAMIS data element |
| **Authorized** | Security standards are established and maintained  
Data is secure and compliant with regulations. Data is trustworthy and is safeguarded from unauthorized access, whether malicious, fraudulent, or erroneous.
- Get rid of disparate fields
- Document and train on security standards |
| **Clear** | Develop and maintain a data and information system catalog  
There is a common vocabulary and data definition. Data dictionaries and metadata are developed and established to maximize consistency and transparency of data across systems.
- Maintain metadata
- Ensure metadata is complete
- Create a table showing update cycles for all TAMIS data sets |
| **Efficient** | Data assessment and gap analysis is performed regularly  
Data is not duplicated. Data is collected once and used many times for many purposes.
- Understand user needs for data |
| **Accountable** | Data is integrated, turned into information and used for decision making  
Decisions maximize the benefit of data. Timely, relevant, high-quality data are essential to maximize the utility of data for decision-making.
- Get data in proper context – e.g. tabular or spatial
- Enforce standards for reporting |

The following principles are adopted for Information Technology management and Information management.

| **Guidance** | Review IT methodology and standards on a regular basis and catalog all guidance documents affected by changes  
Manuals, guidelines, publications, and other data-related artifacts shall be aligned with the established information technology methodology and standards.
- Include Data and IT Governance Work Group in IT standards and guidance document management activities
- Ensure guidance and standards allow for support of the Department’s major systems and applications |
| **Knowledge Management** | Ensure interface(s) with eDocs are easy to use and available for Business Owners  
All manuals, guidelines, publications related to data management, information management and information technology management shall be made available to Department employees through use of a knowledge management system.
- Provide information to Business Owners regarding the importance of the knowledge management system and provide training on how to use it |
| **Enterprise IT Management** | The Data and IT Governance Work Group review should be involved in the initial review and inventory of systems and data  
Enterprise core databases, elements, attributes and schemas shall be identified and maintained by the Information Systems and Services division in coordination with business data owners.
- Summarize and report all work group activities to keep the Data and IT Governance Council informed and included
- Set up a process to support a working relationship between Business Owners (Program area managers) and Systems Owners (IT Support) |
3.0 Roles & Responsibilities

In the Data Business Plan for TAMIS, the need for organizational changes was listed at the highest priority. The organizational changes are recommended to ensure structure is in place to oversee and enforce data governance policies. Transportation Asset Management at ADOT&PF has highlighted a number of data related concerns leading to implementation of more teams and an upper management focus on resolving data management issues. Certain positions in the Department have taken on more responsibility in data management and a new Information Systems and Services Division (ISSD) was created. The director of ISSD has authority to review the current structure of Information Technology (IT) staff at ADOT&PF and will create a new organizational structure that will involve increased staffing in IT and likely re-purposing of some positions. These changes are a step in the right direction for centralized data and information systems and this manual will support and document decisions made by the ISSD Director.

It is recommended that this manual be owned and maintained by ISSD in collaboration with the Data and IT Governance Work Group as described in the new Policy for Data and Information Systems. It will be the ISSD Director’s responsibility as a member of the Data and IT Governance Council to make sure activities and processes described in this manual are monitored and enforced, and that the manual is updated accordingly when a new process, standard or policy is implemented. For Business and System Owners, this manual will provide details on how to implement data governance standards for their business areas to support enterprise data governance.

3.1 BUSINESS OWNERS AND SYSTEM OWNERS

The definitions of roles described in this manual and the Data Business Plan are adapted from respected data governance sources to make the most sense for the organizational structure at ADOT&PF.

For each system and data set in an inventory, it is important that ownership, responsibility and accountability is established. The following descriptions for Business Owners, Systems Owners, and other key roles will be referred to in this manual and will be used to monitor responsibilities of those registered for data or systems tracked in a data and system inventory the Department chooses to adopt. As
organizational structure at the Department changes, the Roles & Responsibilities may change and should be updated in this manual.

### Table 3.1 Roles & Responsibilities

<table>
<thead>
<tr>
<th>Role</th>
<th>Description</th>
<th>Responsibility</th>
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</thead>
<tbody>
<tr>
<td>Business Owner</td>
<td>The Business area accountable for the data specifications, data quality and information delivery of their assigned business areas, subject areas or databases.</td>
<td>Manages the data and metadata for information systems within their area of responsibility for a business unit. Responsible for maintaining the data dictionaries for the data systems and for establishing business requirements for the applications in their area of responsibility. Presents requests to the Data Governance council regarding the development of new applications or enhancements to existing applications to meet business needs.</td>
</tr>
<tr>
<td>System Owner</td>
<td>Information Systems and Services Division professional(s) supporting the technical and functional aspects of data management and information delivery for specifically assigned business areas, subject areas or databases</td>
<td>Develops and maintains the functionality of application databases, data dictionaries, data models, metadata definitions, and security interfaces for applications, information and data for their business area. Ensures business area has tools and processes for data input and extraction that promote efficiency and accuracy of data to meet the needs of their business area. Understands and communicates technical challenges of systems and data in regard to meeting the business area needs for applications, data access, integration and reporting. Coordinates with Business Owners and their software/system vendors to ensure out-sourced systems and applications comply with department standards for data governance described in this manual.</td>
</tr>
<tr>
<td>Executive Sponsor</td>
<td>Person providing executive oversight, justifying work and funding for the business area that owns a system or data.</td>
<td>Directs work of Business Areas and ensures procurement, budgets, reporting, and data management are in line with the Department’s mission and goals, efficiently meet program requirements and adhere to relevant P&amp;P’s governing their business area. Participates and represents Department on high-level committees and summits related to Information Technology, Data Governance and Department initiatives. Communicates with Business Owners and System Owners about issues and challenges affecting data governance. Ensures required system and data are justified and supported in Department budgets</td>
</tr>
</tbody>
</table>
### Data and IT Governance Council

Established in the P&P for Data and IT Governance, this council comprised of several division directors serves as the primary “governing body” for the management of data systems.

- Approval of policies, procedures, standards and manuals developed for data governance
- Enforcement of the Data and Information Systems Governance policies, procedures, and standards
- Mediation and resolution of issues or disagreements related to data governance.

### Data Governance Work Group

ADOT&PF’s Data Governance Work Group is comprised of Business Owners and System Owners who provide expertise in business area data requirements, help establish business rules, and participate in the management of the Department’s Data Governance Manual.

- Provides information and subject matter expertise in their specific business areas for the purpose of fostering coordinated management of enterprise information systems.
- Researches, reviews and provides recommendations for improved processes and procedures that support the data business plan.
- Elevates issues to Data & IT Governance Council as necessary.
- Prioritize business needs of the Department and identify the strategic data programs that support those business needs.
- Consider requests to develop new applications and/or enhancements to existing applications to support business operations of the Department.
- Meet as needed, to discuss and resolve issues related to developing information systems for the Department.
- Approve and revise, as needed, the Data Governance Manual and distribute the manual to all staff at the Department with presentations and training according to the Implementation Plan.
- Updates to the Data Governance Manual will be noticed and made accessible through the Department’s electronic document management system (eDocs) and Intranet website.
- Conduct outreach meetings for Users/Stakeholders for the data programs that support the business operations of the Department.

### 3.2 Roles of Users

In the context of ADOT&PF, users can be defined as stakeholders (internal and external) that share a common interest in the enterprise information system, specific data and/or applications within the system. Stakeholder is defined in DMBOK\(^4\) as “An organization, person, process, or system that can be affected by a change to a system or process”. In Alaska, users include any ADOT&PF persons or offices that

\(^4\) DAMA Dictionary of Data Management 2\(^{ND}\) Edition
interface with, access, benefit from, or are otherwise affected by the information systems that support business operations. Also included are other State of Alaska agencies, local government, commercial entities, non-profits, and the public. Input and feedback from users is crucial to data governance to ensure that information systems and data efficiently meet as many needs as possible.

### 3.3 RASCI

RASCI\(^5\) is a responsibility assignment matrix used to describe the participation of defined roles in completing tasks for a business process which is useful in clarifying roles and responsibilities in cross-functional/departmental projects and processes.

RASCI is an acronym for the typically used responsibilities listed below:

**Responsible (R)** – The person or team who has responsibility for getting the work done or the decision made. Typically, this is one person like the team leader, but can be the entire team.

**Accountable (A)** – The person who is accountable for the correct and thorough completion of the task or activity. This must be one person and is often an executive, senior manager or project sponsor. The “accountable” person must approve the work that the “responsible” person provides.

**Supportive (S)** – The people or groups that provide resources and support the performance of the activity are considered “Supportive.” *This is an optional role type.*

**Consulted (C)** – The people who provide information for the task or activity and with whom there is two-way communication. This is usually several people, often subject matter experts.

**Informed (I)** – The people who are kept informed about progress and with whom there is one-way communication. These are people that are affected by the outcome of the tasks or activities so they need to be kept up-to-date.

Table 3.1 shows a RASCI table for ADOT&PF for the data governance process.

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4.0 Authority

4.1 DATA MANAGEMENT POLICIES & PROCEDURES

This Data Governance Manual is based on data governance principles detailed in the Data Business Plan from the TAMIS research project and is authorized through Policies & Procedures approved by ADOT&PF executive leadership.

The P&P for Data and Information Systems Governance will:

- Support and enforce the roles and responsibilities, data governance principles, practices, procedures, and standards described in the approved Data Governance Manual;
- Establish the Data and IT Governance Council and Data and IT Governance Work Group
- Introduce Data Governance Principles to be applied at ADOT&PF

The approved manual will:
- Describe the Data Life Cycle
- Provide a data governance model/framework for ADOT&PF that supports TAMIS and Enterprise system/data management
- Describe the Roles and Responsibilities established for Data Governance at ADOT&PF
- Support governance policies and procedures approved for ADOT&PF
- Introduce the Data and Information Systems Catalog
- List Standards and Processes for enforcing Data Governance at ADOT&PF
- Define Data Governance terms

### 4.2 Data Governance Charter

A Data Governance Charter is recommended to be a part of a data governance manual per guidance in NCHRP 666. ADOT&PF has taken the approach to build the key elements of the charter into the Policy and Procedure for Data and Information Systems Governance that authorizes this manual. Similar to a charter, the P&P establishes the Data and IT Governance Council, the Data and IT Governance Work Group, lists their responsibilities and lists the guiding principles the Department will follow for Data and IT Governance. The P&P points to the Data Governance Manual for details on roles and responsibilities, processes, and standards that will be enforced.

#### Data and IT Governance Council Members

The P&P describes a Data and IT Governance Council that includes the Department’s Administrative Services Director, Information Systems and Services Director, each Regional Director and positions further described in the Data Governance Manual. The positions further described in the list below include the positions listed above and expands the group to include directors from all regions and divisions. This is a large group and it would be a challenge to coordinate meetings including all members. For most data governance council activities, all members would not need to be at the table for every issue or meeting. The goal is to ensure executive management is informed and aware of data management initiatives and that they are involved in decision making, enforcement and conflict resolution as necessary. This can be accomplished through communication and coordination between data and IT Governance Work Group members and their leadership representatives on the council.

- Director of the Division of Design & Engineering Services
- Director of the Division of Program Development (DPD)
- Director of the Information System and Services Division (ISSD)
- Director of Statewide Maintenance and Operations
• Director of Administrative Services Division (ASD)
• Regional Directors
• Director of Statewide Aviation
• General Manager of Alaska Marine Highway System
• Director of Measurement Standards & Commercial Vehicle Enforcement
• Director of Public Facilities

Data and IT Governance Council Responsibilities
1. Approve the procedures, standards and manuals developed as indicated below.
2. Enforce the Data and Information System Governance policies, procedures, and standards.
3. Mediate and resolve issues or disagreements related to data governance.

In addition, the council representatives should make sure the commissioner’s office is aware and supportive of current data governance initiatives.

Data and IT Governance Work Group Members
This group will consist of the Data Business Owner point of contact for each major data system in the Department. It will also include designated System Owner point of contact(s). The Transportation Asset Management Data Integration Team (TAMDIT) should be the starting point for members of this group as they are already business and system owners that have been included in the development of this manual.

Data and IT Work Group Responsibilities
1. Prioritize business needs of the Department and identify the strategic data programs that support those business needs.
2. Consider approval to develop new applications and/or enhancements to existing applications to support business operations of the Department.
3. Meet as needed, to discuss and resolve issues related to developing information systems for the Department.
4. Approve and revise, as needed, the Data Governance Manual and distribute the manual to all staff at the department with presentations and training according to the Implementation Plan.
5. Updates to the Data Governance Manual will be noticed and made accessible through the Department’s electronic document management system (eDocs) and Intranet website.
6. Conduct outreach meetings for Users/Stakeholders for the data programs that support the business operations of the Department.
7. Audit data and information systems inventory on an annual basis.

## 5.0 Data Standards

### 5.1 Overview

Data standards and defined business processes are used to support the efficient sharing and integration of data between different systems. Standards provide formalized rules for documenting data formats and data definitions, which are needed to integrate data at a detailed level.

The following categories for data standards are derived from the AASHTO TAM Guide (Chapter 8) and are addressed in the following data standards section.

- Location Referencing;
- Asset Identification;
- Activity and Resource Identification and Linkage to Assets;
- Consistency with Existing Standards; and
- Metadata.

This manual will support standards by:

- Designating single authoritative sources for shared data entries;
- Ensuring clear and precise definitions for shared data entries;
- Standardizing data definitions, data structures, lists of values, and naming conventions; and
- Standardizing metadata creation and management.

The following defines standards organized by the five categories listed above from the AASHTO TAM Guide (Chapter 8). Sections in each category list specific standards and explanations for ADOT&PF including: data integration approach, Linear Referencing System (LRS), data quality, inventory, content and records management, acquisition of new data and information systems, storage, archiving, disseminating and retrieval, use of business intelligence tools, and use of electronic document management system.
5.2 DATA STANDARDS AND PROCESSES

Location Referencing

*Data Integration Approach*

Location referencing refers to using a spatial reference system (address, coordinates, Linear Reference System (LRS)) to describe the location of a data feature. Since ADOT&PF collects and maintains many data features that can be referenced to a particular point or linear location, using a common method of locating features is an efficient way to integrate data. ADOT&PF maintains a centralized LRS linked to an extensive data collection project that includes common roadway inventory, photolog, and LiDar and Pavement data. Asset data that is linear or can be located on the department’s centralized LRS at a given point should be located using the CDS and milepoint system and linked via a unique identification number used in the system of record.

In situations where relating data to the LRS is not feasible, ISSD will coordinate with Business Owners to propose location referencing solutions. The Department has already developed capabilities to analyze and report data that is not easily located on the LRS using other referencing methods such as latitude and longitude, address, or areawide labels such as community names, jurisdictional regions or statewide. These scenarios can apply to capital or maintenance project data, facilities, fleet, and other data that is not always easily referenced to the existing road network.

The following general standards will help ensure data is evaluated by the GIS staff and that appropriate location referencing methods are applied:

1. All systems and data sets that could be used for asset management, safety or planning and programming decisions and that contain data needed for analysis, decision making, and performance measures and reporting should be made known to ISSD staff and be registered in a data set registry.

2. Consult with the Data and IT Governance Work Group on location referencing methods for all data and systems

*Linear Reference System (LRS)*

At ADOT&PF, there is a designated GIS-enabled system that utilizes a common Linear Reference System (LRS) method which identifies each road with a unique number called a Coordinated Data System number or CDS number and locates features on roads in the network using milepoint measures.

The methods used for documenting and assigning the LRS or location referencing solution to registered data sets (and management of the data afterward) will depend on the implementation of ESRI Roads and Highways to manage the LRS, upgrades to the current hardware and software architecture, development and adoption of standard analysis and reporting tools and the progress of implementing data governance at ADOT&PF. Following are standards
1. ISSD in collaboration with the Data and IT Work Group will be responsible for screening data sets to determine compatibility with the Department’s LRS.

2. ISSD and the Data and IT Work Group will help determine integration standards for data sets that should be referenced to the LRS and provide Business Owners and System Owners guidance with processing and integration.

3. The Data and IT Governance Work Group established in the Data and Information Systems Governance P&P must have a participating representative who is actively involved with GIS and LRS procedures for ADOT&PF.

For enterprise Asset Management, the LRS must support:

- Multiple Linear Reference Models (LRMs) in order to integrate data collection based on GPS, distance along a route from state and other jurisdictional boundaries, and from stable reference points (e.g., intersections).

- Changes over time to LRS based on route realignments and jurisdictional boundary changes.

- Methods for revising linear referencing on business data based on these changes.

- A common understanding of which asset types are linear and which are point assets from the perspective of location and identification and geospatial referencing.

- Standard services for integrating different sets of linearly referenced data including dynamic segmentation and transitions across LRMs.

- Consistent time stamping on data to provide information necessary for temporal management of linearly referenced data and to provide business value (e.g., which crashes occurred following the replacement of signage along the corridor).

- Clear standards for GPS-based field data collection.

**Asset Identification**

The following general standards apply to asset identification:

1. Asset data that is linear or can be located on the department’s centralized LRS at a given point should be spatially referenced using the CDS and mile point system and linked via a unique identification number used in the asset’s system of record.

2. A data catalog (Data Registry) shall identify where (System of Record) data for each type of asset is maintained throughout the Department.
Data Quality

Data quality standards/principles – includes standards that are used to ensure that data is of the highest quality according to the following guiding principles:

**Accuracy** – The measure of degree of agreement between a data value or sets of values and a source assumed to be correct.

**Timeliness** – The degree to which data values or a set of values are provided at the time required or specified.

**Completeness** – The degree to which the data values are present in the attributes (data fields) that require them.

**Validity** – The degree to which data values satisfy acceptance requirements of the validation criteria or fall within the respective domain of acceptable values.

**Coverage** – The degree to which data values in a sample accurately represent the whole of that which is to be measured.

**Accessibility** – The relative ease with which data can be retrieved and manipulated by data consumers to meet their needs.

The following standards apply to data quality:

1. Business Owners and System Owners will develop a plan to audit data on a regular basis to assure quality.
2. Data quality control methods shall be utilized throughout the Department to ensure that data is accurate, timely, complete, valid and accessible.
3. The data quality QA/QC procedures shall be developed by the data business owners and data stewards.
4. The data custodians shall adhere to the QA/QC procedures in the routine maintenance of data sets.
5. Data Quality standards shall be documented per business area.

Inventory

Data systems, data and key integration points supporting asset management have been identified, cataloged and prioritized as part of the TAMIS project. A process shall be identified for management and upkeep of a data and information systems catalog and Data and IT Governance Work Group has been established in the Policy and Procedure of Data and Information Systems Governance to assist. The group will review all documented data sets and determine the best integration methods on a case by case basis. A spectrum of solutions will be developed. As each data set is reviewed, and a solution is determined, documentation will be updated in the data and information systems catalog adopted by the Department.

The following standards relate to inventory:
1. Inventory of data and information systems is the responsibility of all Business and System Owners and will be enforced and monitored by the Data and IT Governance Council following principles in the Data and Information Systems Governance P&P, this data governance manual, and processes adopted by ISSD.

2. All information systems (including TAMIS systems) will be documented in a system catalog managed by ISSD.
   - If a system is to be documented, one should propose it to the Data and IT Governance Work Group using the collaborative process adopted by the Department.

3. Data Sets will be documented in a data set registry/inventory managed by ISSD.
   - Business Owners will be responsible for documenting all required systems and data that support their Business area.
   - Data sets will be evaluated by the Data and IT Governance Work Group established in the Data and Information Systems policy and the Data Governance Manual.
   - Recommendations for “critical” data sets should be presented to the data and IT Governance Council for consideration and approval.
   - The Data and IT Governance Council is ultimately responsible for approving the definition and selections of the department’s “critical” data sets that will be supported by enterprise data governance.
   - Training will be developed and delivered in coordination with ADOT&PF’s Research, Development, & Technology Transfer section.

4. Naming standards and definitions for ADOT&PF enterprise data sets and some individual data items shall be identified and maintained in a data dictionary for each data set.

5. Business Owners shall coordinate management and population of standard coding for shared data elements across systems, and ensure that code definitions are accessible to data users.

**Activity and Resource Identification and Linkage to Assets**

ADOT&PF Business Owners will coordinate to ensure critical data for asset management, safety and decision making is accessible via linked data and information systems. To link assets to activities and resources, ADOT&PF should:

1. Develop processes and standards for tracking work done on each asset in a given location for construction projects.

2. Ensure the maintenance management system tracks expenditures on each asset in a given location and that they are linked to TAMIS through a location reference and identification number.
3. Document equipment and materials lists used for planning and reporting in a centralized and accessible location.

4. Use unique identifiers for each asset type and provide location referencing in each data set where possible.

**Content/Records Management**

The following standards apply to content and records management:

1. ADOT&PF shall use the eDocs system as the primary document management system.

2. ADOT&PF shall maintain a registry of all data used for primary systems and decision-making across the Department and it shall be maintained by the ISSD.

3. Data sets and records shall be managed in accordance with state and Department records retention policies.

4. A data taxonomy shall be defined for enterprise data and used to support enterprise content management. The taxonomy shall include a set of rules for identifying and grouping ADOT&PF data according to the business functions of the Department (including Highways, Marine, Aviation, Administrative Services, etc.) The taxonomy shall include:
   - Data set category
   - Business function
   - Organizational unit (data business owner)

**Reference and Master Data Management (“gold” standard)**

1. Documented data sets shall be evaluated by Data and IT Governance teams and linked to a system of record where possible.

2. Business Owners will coordinate to ensure data is not duplicated and that it efficiently meets as many business area needs as possible.

**Consistency with Existing Standards**

**Data Collection**

Data standards required for data collection, processing (including QA/QC for data quality), and reporting for each of the key data systems identified in the data governance framework will be documented. The data collection standards will vary depending upon the applications (e.g., pavement, bridge, safety, traffic, crash, GIS, etc.) and will include data quality standards for Metadata.

1. The Data and IT Governance Work Group will define and document data collection standards and establish a process to determine priorities.
2. The Department shall identify a system of record as the primary repository of data so that data is collected once and used many times.

3. Data collection standards shall be documented for data that is collected by the Department and by contracted services. Standards specific to data collection documentation processes shall include:
   - Coordination and consultation with ISSD on location referencing methods
   - Where applicable, an agreement should be documented
   - File format conventions
   - Layout of the data
   - Data definition for each data set to be collected
   - Data format of each data item (numeric, character, or combination)
   - Level of accuracy for each data item (units of measure)
   - Quality control methods that shall be applied at time of data collection.

Acquisition of new data and information systems

The newly formed ISSD has developed a collaboration process for procurement of data and information systems. Standards regarding system and data documentation should follow the ISSD procedures. Recommendations and standards should be implemented in support of the new processes.

The following standard applies for acquisition of any piece of equipment, software data or service that can interact with the network agency information systems, third-party systems and services or stores, processes or transmits information.

1. Follow current processes to ensure collaboration between Business Owners and System Owners; Information can be found on the Department’s Information Services website:

   http://web.dot.state.ak.us/information_services.shtml

Storage & Archiving, Disseminating, and Retrieval

1. An electronic version of data sets and documents shall be stored on dedicated Department servers with full back-up and disaster recovery capabilities.

2. ADOT&PF shall use automated indexing software to provide easier and timelier access to data sets and documents that support Department business functions.

3. ADOT&PF data shall be accessible and shared as permitted (for authorized users).

4. Business and System Owners will research and define the data retention schedule for each system.
Use of Business Intelligence (BI) Tools

1. ADOT&PF shall implement use of COGNOS and eDocs across multiple business areas of the Department where appropriate to support performance management, asset management, planning and programming and other business functions.

2. An enterprise GIS plan shall be developed to document the office of responsibility for the enterprise geodatabase and to provide guidance and standards in the use of GIS data at ADOT&PF.

Use of Electronic Document Management System
eDocs is an electronic document system that ADOT&PF uses to store and organize data files and reports.

1. The current structure of eDocs will be reviewed and made easier to use for all electronic document storage needs for the Department.

2. All documentation regarding data and information management will be organized and stored in eDocs

Metadata

The following Standards are related to Metadata:

1. Metadata standards will be documented for each system in a data system catalog.

2. Metadata shall be defined for each data set and documented in or linked to a data set registry.

3. There shall be a central repository of metadata about each of the data items that are maintained and includes definitions, formats, sources, update cycles, and accuracy levels.

4. As appropriate and recommended by Data Governance Council, Metadata for GIS data shall adhere to the Federal Geographic Data Committee (FGDC) standard for GIS data (ISO 19115).

5. Metadata shall be kept current and accurate by a designated business or system owner at ADOT&PF.

6. Business and System Owners will collaborate to ensure current protocol is followed for inventory and metadata documentation for any new or significantly upgraded systems.
6.0 References

1. AASHTO Standing Committee on Planning, Subcommittee on Data, Core Data Principles Development, [http://planning.transportation.org/Pages/Data.aspx](http://planning.transportation.org/Pages/Data.aspx)


3. ADOT&PF Transportation Asset Management Information Systems and Data Research Project reports:
   - Task 2 - [Federal Requirements and Associated Research](http://planning.transportation.org/Pages/Data.aspx), Final Report, June 2013
   - Task 3 - [Other State Best Practices](http://planning.transportation.org/Pages/Data.aspx), July 2013
   - Task 4 - [Vision and Components Final Report](http://planning.transportation.org/Pages/Data.aspx), July 2013
   - Task 5 - [TAMIS Data Systems Evaluation](http://planning.transportation.org/Pages/Data.aspx), December 2013
   - Task 6 - [TAMIS Framework](http://planning.transportation.org/Pages/Data.aspx), December 2013
   - Task 7 - [TAMIS Gap Analysis Final Report](http://planning.transportation.org/Pages/Data.aspx), March 2014
   - Task 8 - [System Model Alternatives - Technical Memorandum](http://planning.transportation.org/Pages/Data.aspx), March 2014

4. AIIM (Association for Information and Image Management) is the global community of information professionals. - See more at [http://www.aiim.org/what-is-information-management](http://www.aiim.org/what-is-information-management).


7. Data Governance Program Guidelines (Draft) from Nevada DOT (2012)


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1.0 Introduction

The Data and Information Systems Catalog (DISC) is the data dictionary concept built as part of Alaska’s Transportation Asset Management Information System (TAMIS) project. Implementing DISC will support Data Governance by providing a database and a web-based data entry tool to build an enterprise inventory of all information systems and data sets, linking to data dictionaries where available.

An important step in managing data for Alaska Department of Transportation & Public Facilities (ADOT&PF) to support TAMIS is developing an inventory of data systems and data sets. An inventory of data systems and a more detailed catalog of data sets within systems supports data governance by centralizing information about systems and data. Once cataloged in DISC, data management professionals will be able to use the DISC reporting functions to analyze, research, and identify documented system and data issues, redundancies, solutions, and other details.

DISC is the starting point for a centralized dictionary of all data resources for ADOT&PF. There are currently two components of the DISC, the first is a catalog of systems, and the second is a registry of data sets. Priority information systems for TAMIS based on research accomplished in the TAMIS Data Systems Evaluation Report (TASK 5) were documented in DISC to demonstrate and test structure and functionality for the catalog of systems. Information collected as part of the TAMIS Data Systems Evaluation research (including roles and responsibilities, business case, and other pertinent information) was used to develop the structure and populate the first iterations of the application. The registry of data sets was built using similar framework as the system catalog, but designed to link to systems following specific workflow processes. A couple of test data sets were made up to test functionality.

1.1 ADOT&PF Data Governance Terms

Several terms used in this document are derived from current data governance efforts at ADOT&PF. These are:

**Asset Management** - The American Association of State Highway and Transportation Officials (AASHTO) defines asset management as 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 on quality information and well-defined objectives.”

AASHTO’s Asset Management Guide states “a mature asset management program is fueled by consistent, high quality, integrated data and processes for transforming data
into information that influences decision making at tactical, operational and strategic levels.”

**Business Owner** - A subject matter expert accountable for the data specifications, data quality and information delivery of specifically assigned business areas, subject areas, or databases.

**Data Business Plan (DBP)** – Documents business rules and data quality standards for the information systems that support TAMIS which will result in improved asset management decision-making at ADOT&PF.

**Data & IT Governance Council** - Established in the Data and IT Governance P&P, this council comprised of several division directors serves as the primary “governing body” for the management of data systems.

**Data & IT Governance Work Group** - ADOT&PF’s Data Governance Work Group is comprised of Business Owners and System Owners who provide expertise on business area data requirements, help establish business rules, and participate in the management of the Department’s Data Governance Manual.

**Data & IT Governance Policy & Procedure (P&P)** – Describes expectations for Data and IT Governance for all ADOT&PF employees. The P&P provides structure and authority for data related activities by:

- Supporting and enforcing the roles and responsibilities, data governance principles, practices, procedures, and standards described in the approved Data Governance Manual;
- Establishing the Data and IT Governance Council and Data and IT Governance Work Group;
- Formalizing Data Governance Principles to be applied at ADOT&PF

**Data Governance Manual (DGM)** - A manual to provide a single source of information for all staff on the standards, policies, and procedures regarding the use of data and data programs at ADOT&PF.

**System Owner** - Information System and Services Division professional(s) supporting the technical and functional aspects of data management and information delivery for specifically assigned business areas, subject areas, or databases.

**Transportation Asset Management Information System (TAMIS)** – a data system that encompasses both existing and future data in various systems, representing a collection of hardware, software, data, and processes that support comprehensive transportation asset management efforts at the agency. In practice, Alaska’s TAMIS will enable the collection, synthesis, and maintenance of data from multiple sources.

The remainder of this report describes each component of the application, and recommends actions and changes needed should the Department decide to adopt and implement the application.
2.0 Components and Management

Many data management efforts include a requirement to document data; commonly referred to as developing a data dictionary. *DAMA Dictionary of Data Management*¹ defines a data dictionary as “Any place where business and/or technical terms and definitions are stored.” According to DAMA, data dictionaries are usually focused on the names and definitions relating to physical data and related objects. The best example of a working data dictionary at ADOT&PF is the one developed for Management Reporting System (MRS). The MRS data dictionary describes tables of data, links to all items in each table, and allows for a definition for each specific item.

The DISC project started as an idea for a standard data dictionary for the department as part of the TAMIS project. Cambridge Systematics teamed up with members of the ADOT&PF Transportation Asset Management Data Integration TEAM (TAMDIT) to develop a tool and database structure for DISC based on the concepts and ideas for a data catalog introduced in the TAMIS project. As the TAMIS research project progressed and changed based on emerging needs for the Department, some of the structure and management of DISC has changed leaving the tool in an incomplete state. The basic framework is functional, but recommendations made in this report need to be implemented to align the structure with requirements in the latest TAMIS recommendations.

One of the most important lessons learned from the development of the DISC application is that it will be a huge undertaking to develop a detailed inventory of all data items ADOT&PF uses in a centralized location. Business areas are managing their data and systems in different ways which leads to data dictionaries in multiple formats and stages of development and upkeep. Whatever system ADOT&PF chooses to use to document all data resources in a central location, it needs to allow for documenting information systems, understanding what data is managed in each system, knowing who is responsible, and needs to have the capability to link to detailed data dictionaries where the exist.

The next section describes the different components of DISC and how they are designed to work together to create a centralized inventory of systems and data.

2.1 Information Systems

Task 5 of the TAMIS project resulted in a report assessing the current state of systems and data. The final report included a catalog of over 20 data systems

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¹ DAMA Dictionary of Data Management, 2nd Edition
that support asset management. As a starting point for the system registry, these have been documented in DISC with supporting information such as: ownership, technical requirements, business need, assessment criteria, and documentation. The application was designed with the intent that systems will only be documented in DISC by ISSD staff. This is to ensure quality and control of the inventory. Registered systems will then be made available for QA/QC review by the Data and IT Governance Work Group in the form of online reports (HTML) or if more appropriate, an export (Excel, PDF). The current data entry method is a web-based form and needs to be updated to reflect changes in the TAMIS Data Business Plan (DBP), Data Governance Manual (DGM) and Policies and Procedures (P&P) adopted by the Department. Proposed changes are described in the recommendations section of this report.

2.2 DATA SETS

A data set refers to a table or a group of joined tables used to describe a specific item of interest (e.g. eagle nests, signs, bridges, etc.). Separate from the system catalog, a data set catalog has been started. Conceptually, once the technical requirements are established, designated Business or System Owners could use the data set component of DISC to register any data set in the DISC database along with metadata such as business need, driving requirements, technical requirements, business owner, system owner and more. The manager of the System Catalog (ISSD Director) will be able to use recommendations and advice from the Data Governance Work Group to “link” registered data sets to systems as appropriate. The vision is that this will help to identify the correct “system of record” for key asset management data and also help avoid duplication and inefficiencies.

2.3 DATA ITEMS

DAMA Dictionary of Data Management 2nd Edition defines a data item as “An individual field in a data record representing a data attribute; often referred to as a column in a relational database table.” The data set registry will lead to the development of standards for creating data dictionaries for all data items by either linking to or by developing an automated electronic system for describing data items. Work will have to be done to evaluate current data dictionaries and to come to a consensus on a standard process for documenting all data items in each system. Based on research and interviews in the TAMIS Data Systems Evaluation, it has been found some systems have data dictionaries, but many are either hard to manage (not automated), have undefined methods or are not accessible to users.

The following sections describe current functionality and recommends necessary changes for the Information System Catalog and the Dataset Registry components of DISC.
3.0 Information System Catalog

The DISC Information System Catalog application currently resides on the internal ADOT&PF server at:

Information Systems: [http://web.dot.state.ak.us/nreg/datacatalog/](http://web.dot.state.ak.us/nreg/datacatalog/)

3.1 CURRENT FUNCTIONALITY

The main page of the web-based tool (Figure 1) features a list of the systems already cataloged that is sortable by column headings and searchable by keyword. When a user “clicks” on a system of interest, the system attributes area at the bottom of the page populates four tabs (Description, Criteria, Documentation, and Datasets) with information specific to the selected system.

Description - Documents metadata about system such as name, business case, business and system owners, department organization, and other technical documentation.

Criteria - Currently uses TAMIS Criteria described in the *TAMIS Data Systems Evaluation Report* (TASK 5). The initial intention was to help prioritize those systems for TAMIS, but might be irrelevant moving forward.

Documentation - Used to link to documentation about a system such as a user guide, manual, website or other. Documentation only works as a link to encourage staff to load their system documentation in eDocs.

Datasets - Used to “attach” registered datasets to a system.
3.2 Adding a System

To add a system, a user clicks the “+ Register a new system” link at the bottom of the list. A dialog box opens asking the user to enter the new system name (Figure 2).
Once the user complies and clicks the “OK” button, the “Update System” form opens allowing data entry on description, criteria, documentation, and datasets tabs.

**Description Tab**

The description form (Figure 3) gathers information about the system that might be useful for business and system owners when looking for specific information. One of the most important pieces of information is ownership. In this system, each information system will have an executive sponsor and be assigned data owners and stewards. The form accepts a unique position ID in place of a person’s name called the Position Control Number (PCN). This enables the tool to access another data system that tracks who is currently in the position, and shows their contact information in the web report for the system. Other information may include technical information about the system designed to help information technology professionals with hardware and software infrastructure to support the system.
The recommendations section of this chapter describes some necessary changes to the data entry forms to align the tool with the final versions of the Data Governance Manual and Data and IT Governance Policy and Procedure (P&P). Key changes are those that describe the data owners and other people responsible for the system.

**Criteria Tab**

When evaluating ADOT&PF’s information systems for possible inclusion in TAMIS, researchers interviewed several employees about the data they use to support their business areas. The criteria tab lists the questions used to determine a TAMIS Tier Score (1-3) which helped prioritize the systems identified for TAMIS.

The Tier level definitions used for TAMIS are the following:

**Tier 1** - A critical core system that supports enterprise asset management (integration) although the system itself is NOT an asset management system (e.g., Roadway Data System).

**Tier 1** – A critical, core system that supports asset management decisions.

**Tier 2** – A system that supports business area asset management decisions and interacts with other data systems.

**Tier 3** – A system that supports a business area, not directly related to asset management.

The criteria tab form (Figure 4) lists the TAMIS Criteria questions, and allows for a summarized answer from the results of the interviews, and the TAMIS Score.
Figure 4: Criteria Tab Form

Future iterations of the Information System Catalog might not need to include a criteria tab. If ADOT&PF decides to implement this tool, only designated persons in the Information Systems and Services Department (ISSD) would be entering and editing information about information systems and might not need to include criteria and prioritization information.

Documentation Tab

This tab form (Figure 5) is used to link to documentation about a system such as a user guide, report, or website. Clicking the “+ Add new” link provides a space to enter the name of the documentation and a link to it. The link approach encourages loading system documentation in a central document management system (eDocs) and utilizing the link to it instead of uploading documents. Future iterations could include a search function to locate the link to documentation.

Other documentation might include a link to a data dictionary for the system. This would allow for various formats of data dictionary documentation and access to them from a central location.

Figure 5: Documentation Tab Form

Datasets Tab

This form (Figure 6) links registered datasets to a system. Once the dataset registry is populated, users can use the “+ Attach a dataset to this system” link to get access to a drop-down list of registered datasets to choose from. Saving the
chosen dataset(s) makes a link to information entered about it available on the main information system catalog web page.

Figure 6: Datasets Tab Form

Chapter four describes the dataset registry component in more detail.

3.3 EDITING A SYSTEM

Editing information about a system works much like adding a system. To edit a system, users click the “Edit” link next to the system they want to edit in the list on the main page. The “Edit” link opens the populated data entry forms for updating. Once the changes are made, users will click the “Update” button and when finished, “Close Update Window”. The changes show up in the report usually within a few minutes.

3.4 RECOMMENDATIONS

ADOT&PF should consider the changes described in this section to align the Information Systems Catalog to the finalized Data Governance Manual and Data and IT Governance P&P. During development of TAMIS, DISC developers adapted the tool to incorporate changes and ideas for data management and allow for testing the functionality of the tool. The current configuration of DISC does not reflect the latest versions because ADOT&PF went through major changes to their organizational structure in the middle of the project. ADOT&PF staff assisting with development experienced a change in management and duties and could no longer focus on the tool. This report documents the purpose of DISC for staff and management understanding and the recommendations described in this section (if implemented) will make the tool usable for ADOT&PF as they develop a TAMIS and adopt new enterprise data governance strategies.

Table 1 lists the data fields used in the System Catalog component and the recommendation for each.

Table 1: System Catalog Recommendations

<table>
<thead>
<tr>
<th>Data Entry Field</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Name:</strong></td>
<td>Leave as is</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>Acronym:</strong></td>
<td>Leave as is</td>
</tr>
<tr>
<td><strong>Asset Class:</strong></td>
<td>Simplify. Rename to “Class” and create a drop-down list of classes to choose from (aviation, roadway, geotechnical, ferry, etc.)</td>
</tr>
<tr>
<td><strong>TAMIS Tier Score:</strong></td>
<td>Remove from System Catalog form; will not be necessary.</td>
</tr>
<tr>
<td><strong>System Web Page:</strong></td>
<td>Leave as is</td>
</tr>
<tr>
<td><strong>Business Purpose:</strong></td>
<td>Leave as is</td>
</tr>
<tr>
<td><strong>Division/Section:</strong></td>
<td>Rename to “Division” and create a drop-down of the actual divisions.</td>
</tr>
<tr>
<td><strong>Business Owner:</strong></td>
<td>Add - A business area should be identified for each system. This is sometimes a division but more commonly a section. (E.g. TGIS, STIP, Bridge)</td>
</tr>
<tr>
<td><strong>Data Owner:</strong></td>
<td>Change to “Executive Sponsor” and display above “Business Owner”.</td>
</tr>
<tr>
<td><strong>Data Steward:</strong></td>
<td>Rename to “Business Owner: Point of Contact” and ensure it is a PCN enabled field</td>
</tr>
<tr>
<td><strong>System Owner:</strong></td>
<td>Add - This could be ISSD or an outside vendor if they host and manage the system.</td>
</tr>
<tr>
<td><strong>System Owner: Point of Contact</strong></td>
<td>Add - Use a PCN lookup field and call it “System Owner: Point of Contact”</td>
</tr>
<tr>
<td><strong>System of Record:</strong></td>
<td>Remove System of Record in the System Catalog Component</td>
</tr>
<tr>
<td><strong>System of Record for What?:</strong></td>
<td>Remove System of Record in the System Catalog Component</td>
</tr>
<tr>
<td><strong>Type:</strong></td>
<td>Remove</td>
</tr>
<tr>
<td><strong>Developer:</strong></td>
<td>Call this “Developer/Contact Info” (used for person/vendor responsible for creating</td>
</tr>
<tr>
<td><strong>Operating System:</strong></td>
<td>Leave as is or adjust to be more usable for ISSD professionals</td>
</tr>
<tr>
<td><strong>Software Language:</strong></td>
<td>Leave as is or adjust to be more usable for ISSD professionals</td>
</tr>
<tr>
<td><strong>Version:</strong></td>
<td>Leave as is or adjust to be more usable for ISSD professionals</td>
</tr>
<tr>
<td><strong>Database:</strong></td>
<td>Leave as is or adjust to be more usable for ISSD professionals</td>
</tr>
<tr>
<td><strong>Network/Server Location:</strong></td>
<td>Leave as is or adjust to be more usable for ISSD professionals</td>
</tr>
</tbody>
</table>
4.0 Dataset Registry

The Dataset Registry links to the Information Systems Catalog but the intended users of the tool is a different audience. The vision while developing the tool was to create a web-based form that Business and System Owners could use to register data they are working with as a start to inventory of all datasets managed and/or funded by the department. Another possibility of the tool was to allow registration of proposed or needed datasets using criteria that would help data managers decide priorities on dataset requests. It is already a concern that data management efforts are overlapping or in silos, so requiring all business areas to register their data would help identify these inefficiencies and get the Data and IT Governance Work Group focused on solutions.

The DISC Dataset Registry application currently resides on the internal ADOT&PF server at:

Datasets: [http://web.dot.state.ak.us/nreg/datacatalog/datacat.cfm?ds_id=6001](http://web.dot.state.ak.us/nreg/datacatalog/datacat.cfm?ds_id=6001)

4.1 CURRENT FUNCTIONALITY

The functionality of the dataset registry works much like the Information Systems Registry. The main screen main screen of the dataset registry (Figure 7) shows a list of registered datasets that is sortable by name and asset class. As data is populated and different needs are identified for the tool, the web sort and search functions can be expanded to be more useful.
Because of the changes at ADOT&PF organizational structure, little data has been populated in this tool for testing, but like the system catalog, there are tabs for documenting specific information about the data that will help managers and that Data and IT Governance Work Group understand the intended use and know who is responsible. The three tabs at the bottom display attributes for description, criteria, and documentation when a dataset is selected from the list.

### 4.2 Registering a Dataset

Any staff working with or managing a dataset should be able to use this tool to register it. There are many datasets in use at ADOT&PF that were not identified as part of the TAMIS research but it is important for the Department to get a handle on the data inventory in order to be more efficient at data management. Allowing more users to register data will build an inventory of data and information about it that can be attached to Information Systems by system managers.

#### Description Tab

The Description tab form (Figure 8) is used to apply a name, description, asset class, business area and will identify people responsible for managing the dataset.
Criteria Tab

The criteria for Datasets was adapted from Data Management planning efforts happening in the Program Development Division. After many discussions, data managers came up with a list of criteria that would help them decide the priority of a data request. These were incorporated into the dataset registry because it is important to justify the need for including a dataset and also to document things like update cycle and other requirements. The questions are:

- Is there one or more state, federal or internal management requirements to collect and report this feature?
- Does the data feature support asset management or performance measures?
- How will the management of the data feature be funded?
- Who is requiring this data feature?
- Who developed (or will develop) data feature?
- How will the data feature be used?
- How often will the data feature be used? (e.g. daily, weekly, monthly, annually)
- What is the area of coverage? (e.g. Statewide, regional, local community, project)
- What is the update cycle? (e.g. daily, weekly, monthly, annually)
- How accurate or complete is the data feature? (estimated percent of data populated)
- What is the data collection method? (e.g. field collection, extract from another system)
- What format? (e.g. Excel, Oracle, MS Access, GIS)
- Will data be available to the public?
These questions are simple enough for the person managing the data to answer and the answers will help with evaluating the dataset for integration with other systems. Figure 9 shows the Dataset Criteria Tab Form.

**Figure 9: Dataset Criteria Tab Form**

Documentation

The Documentation for Datasets form (Figure 10) works almost exactly like it does for Information Systems. Users will be able to link to websites, documents in the central document management system (eDocs) or link to an online data dictionary for the dataset.

**Figure 10: Dataset Documentation Tab Form**

### 4.3 Editing a Dataset

Like the Information Systems Catalog, to edit a dataset, users click the “Edit” link next to the dataset they want to edit in the list on the main page. The “Edit” link opens the populated data entry forms for updating. Once the changes are made,
users will click the “Update” button and when finished, “Close Update Window”. The changes show up in the report usually within a few minutes.

4.4 **RECOMMENDATIONS**

Concerns have been raised during this project about allowing too many access to register data. Policies and business rules should establish a way for the registry to be populated by specific individuals from each business area, and in future iterations allow a way to add requests for new datasets to a workflow that will be reviewed by the Data and IT Governance Work Group for consideration. This section makes a few recommendations to align the tool with current data governance efforts and also suggests some changes that could be helpful for functionality of the tool.

A key recommendation is that the Data and IT Governance Work Group should meet to discuss how the tool would work best before implementing the following recommendations. The vision is that people from this group will be entering the initial inventory of datasets and managing incoming requests once inventory is established.

A few general recommendations are:

1. Name and introduce the tool as the “Dataset Registry” to be consistent with this documentation.
2. Work on ideas to be able to “see” datasets that are linked to an Information System so they cannot be attached to more than one by accident.
3. Review all criteria items for usefulness and figure out how answered would be scored and prioritized
4. Develop the PCN Lookup so that users can start typing a name to enter the PCN number in the database.

Table 2 lists the data fields currently used in the Dataset Registry component and the recommendation for each.

**Table 2: Dataset Registry Recommendations**

<table>
<thead>
<tr>
<th>Data Entry Field</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name:</td>
<td>Leave as is</td>
</tr>
<tr>
<td>Description:</td>
<td>Change to “Business Purpose”</td>
</tr>
<tr>
<td>Asset Class:</td>
<td>Simplify. Rename to “Class” and create a drop-down list of classes to choose from (aviation, roadway, geotechnical, ferry, etc.)</td>
</tr>
<tr>
<td>Division/Section:</td>
<td>Rename to “Division” and create a drop-down of the actual divisions.</td>
</tr>
<tr>
<td>Data Owner:</td>
<td>Change to “Executive Sponsor”</td>
</tr>
<tr>
<td><strong>Business Owner:</strong></td>
<td>Add - A business area should be identified for each system. This is sometimes a division but more commonly a section. (E.g. TGIS, STIP, Bridge)</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Data Steward:</strong></td>
<td>Call this “Business Owner: Point of Contact“ and ensure it is a PCN enabled field</td>
</tr>
<tr>
<td><strong>Data Custodian 1:</strong></td>
<td>Call this “Technical Contact“ and ensure it is a PCN enabled field</td>
</tr>
<tr>
<td><strong>Data Custodian 2:</strong></td>
<td>Remove</td>
</tr>
<tr>
<td><strong>Proposed for what system?</strong></td>
<td>Add - The decision to “link” data to systems should be made by the Data and IT Governance Work Group identified in the P&amp;P and Data Governance Manual. Users of this registry should be able to tell the reviewers where they think their data should be.</td>
</tr>
</tbody>
</table>

## 5.0 Conclusion

With a minimal amount of improvements the Data and Information Systems Catalog is a project worth completing that will help ADOT&PF get a better handle on the information systems and data they have invested in. As funding decreases and the need for data-driven decision-making tools is in greater demand, tools that help better manage systems and data will help the department leverage work that has already been accomplished in data management and identify priority areas for improvement.
References

1. ADOT&PF Transportation Asset Management Information Systems and Data Research Project reports:
   - Task 2 - [Federal Requirements and Associated Research](#), Final Report, June 2013
   - Task 3 - [Other State Best Practices](#), July 2013
   - Task 4 - [Vision and Components Final Report](#), July 2013
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   - Task 6 - [TAMIS Framework](#), December 2013
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   - Task 8 - [System Model Alternatives - Technical Memorandum](#), March 2014
   - Task 9 - [TAMIS Implementation Plan](#), September 2015
   - Task 11 - [TAMIS Data Business Plan](#), July 2015
   - Task 12 - [TAMIS Proof of Concept](#), June 2015
   - Task 13 - [Data Governance Manual](#), June 2015

