

# **Integrating Transportation Data with an Asset Management System**

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**Highway Database Management**

**Alaska Department of Transportation and Public Facilities**



# Integrating Transportation Data With An Asset Management System

Transportation Research Board  
Washington, DC  
Poster Session 514  
January 13, 2004

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**Abstract – The Alaska Department of Transportation and Public Facilities (ADOT&PF) is developing an asset management system, the Maintenance Management System (MMS), as a tool for Department planning, budgeting, resource allocation, and reporting. The MMS focuses on tracking the Department's assets and resources, assessing maintenance needs, and providing quality control for Maintenance and Operations activities. Performance measures are central to the MMS design and are being included in the MMS development. The ADOT&PF Program Development Division is developing an asset inventory program and an interface between the Department's legacy transportation database, the Highway Analysis System, and the MMS. The interface will include a geospatial database for road centerline and asset coordinates.**

**Providing data support for the MMS presented four distinct challenges:**

- Integrating MMS with other transportation data systems
- Establishing asset inventory and data collection standards
- Using a common linear reference system
- Integrating road centerline and asset data in a common geographic information system environment

**The HAS and MMS database integration will enable the Department to track assets spatially, produce detailed asset reports, conduct performance measure evaluations, and provide asset location in both a linear reference system (route/milepoint) and a geographic information system location reference.**



## Introduction

The Alaska Department of Transportation and Public Facilities (ADOT&PF) is developing an asset management system, the Maintenance Management System (MMS), as a tool for Department planning, budgeting, resource allocation, reporting, and electronic time sheets. The ADOT&PF Maintenance and Operations (M&O) Division, in association with Booz Allen Hamilton, is leading the MMS development. In addition to having the traditional asset management features, the MMS will have specific modules to support needs assessment, quality assurance, and performance measures.

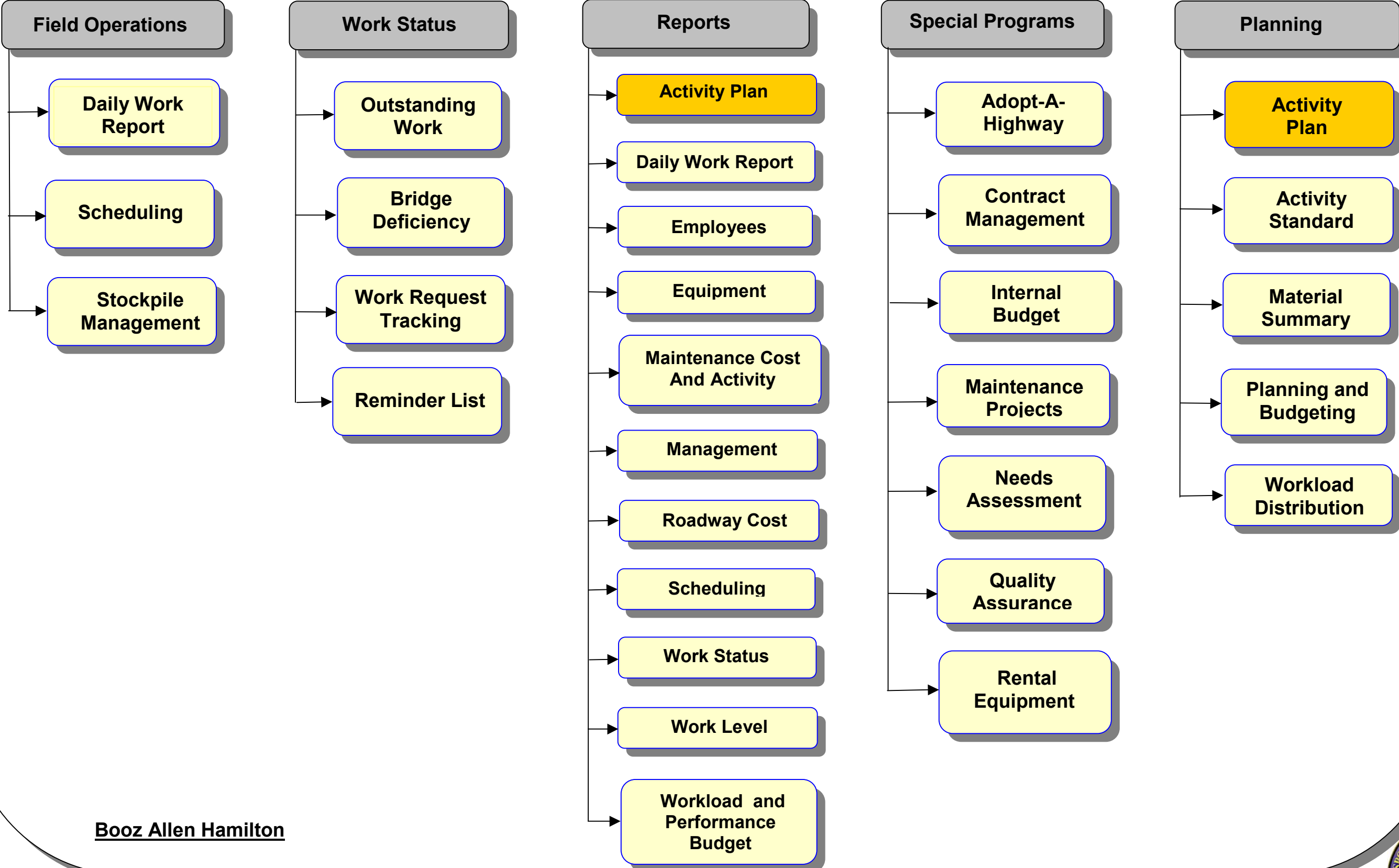
Performance measures are central to the MMS design. The MMS focuses on tracking the Department's assets and resources, assessing maintenance needs, and providing quality control of M&O activities. Thirty-five Department performance standards, which will be used for budgeting and planning M&O work activities, are being developed as part of the MMS design and are reflected in the MMS design modules. The ADOT&PF Program Development Division is developing an asset inventory program and an interface between the Department's legacy transportation database, the Highway Analysis System (HAS), and the MMS. HAS will maintain the MMS asset attribute and location (route/milepoint) information and will link to the MMS through the M&O organization structure codes. HAS will provide the road network and asset inventory data to populate the MMS relational database.

ADOT&PF is using Navstar Mapping Corporation's Roadmapper system to collect and update the state road centerline and linear reference system (LRS) data. The inventory program includes the location and attributes for transportation features (linear and point) and maintenance assets. The Roadmapper system is composed of four components: differential GPS, dead-reckoning sensors, voice data entry system, and a data processing software subsystem. The centerline and transportation features output from the system contain both geographic coordinates and LRS location information.

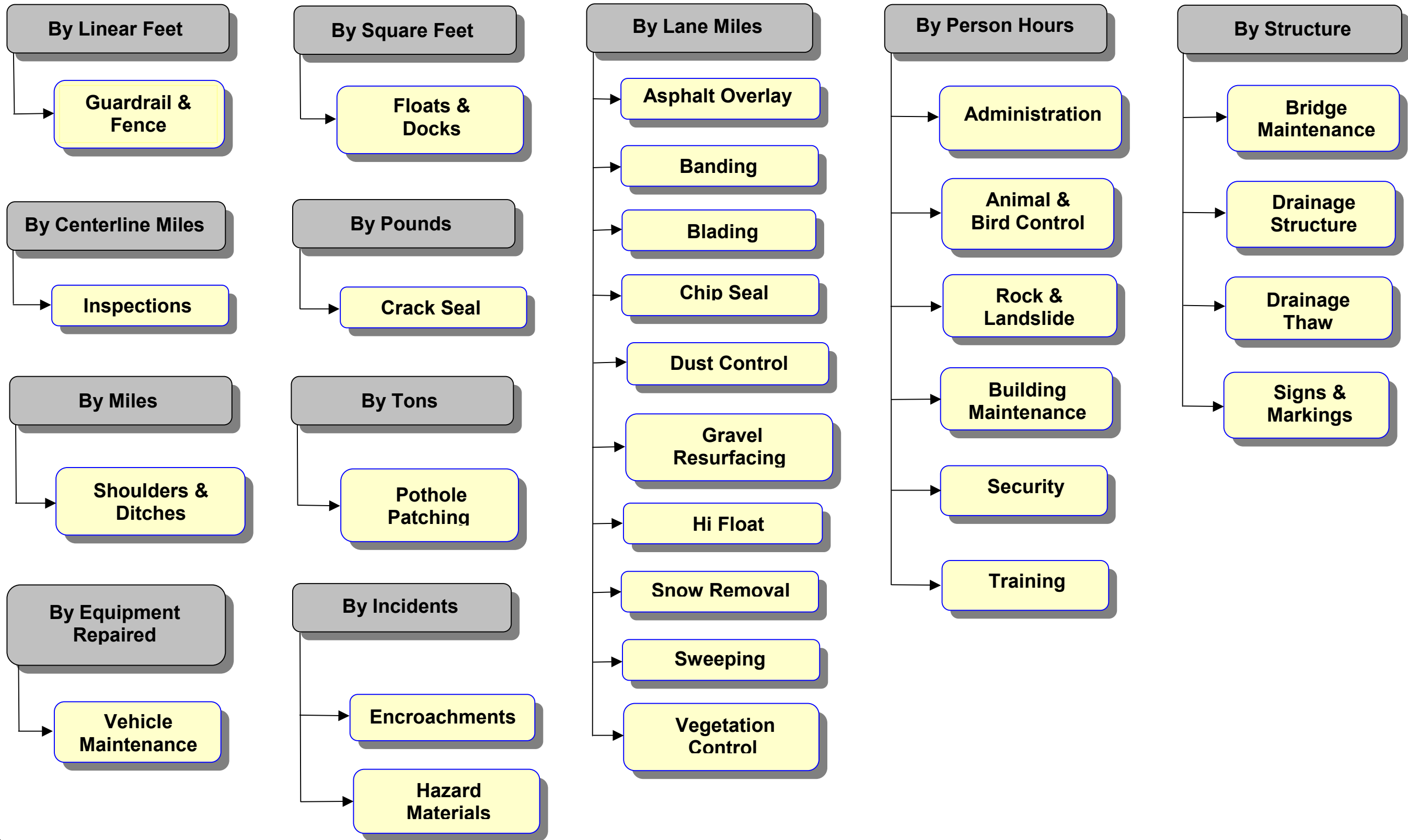
Output from the Roadmapper system is the basis of a new reference network that is being developed in a geospatial database. The reference network and geospatial database will serve as a foundation for GIS/LRS development within the Department. Moving the storage and management of the centerline and LRS data into a GIS environment will enable the Department to track features and assets through geographic coordinates and/or LRS values. Additionally, the GIS environment will provide display and analysis tools and improves data distribution.



# Alaska Maintenance Management System (MMS) – Detailed Design

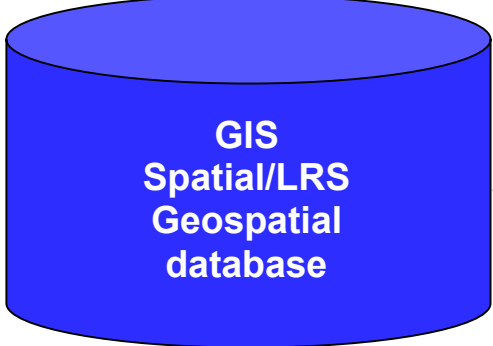


# Alaska Maintenance Management System (MMS) – Performance Standard Activities

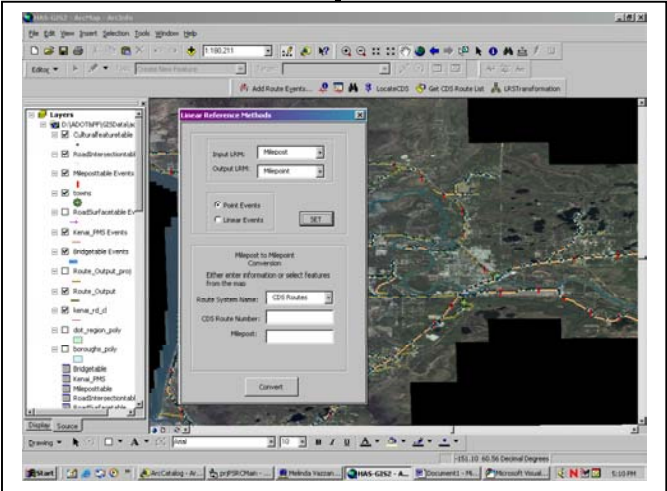


# Data Support for the Maintenance Management System Performance Measures

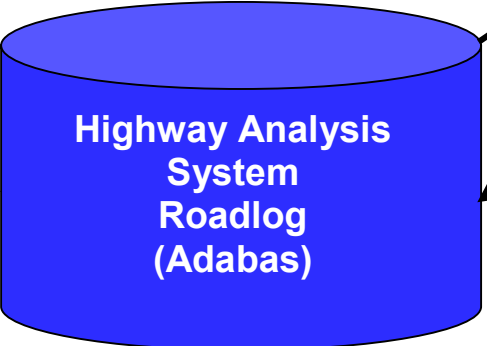
**Road Inventory**  
DGPS Road Centerlines  
Transportation Features  
Assets and Facilities



**GIS Interface**  
ArcIMS  
ArcView



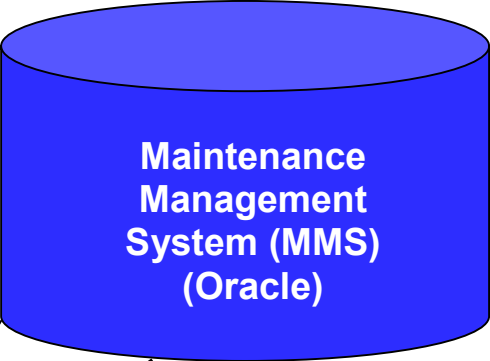
Synchronization



**Mainframe User Interface Updates Reports**

Data Extracts

Asset Updates



## **Challenges to Data Support for the Maintenance Management System** **Performance Measures**

### **Integrating transportation data systems – data collection, storage, and analysis**

- **Maintenance Management System (MMS)**
- **Highway Analysis System**
- **Geographic Information System**
- **Transportation Information Systems**
  - **Road Weather Information System (RWIS)**
  - **Alaska Traveler Information System (ATIS)**

### **Establishing asset inventory and data collection standards**

- **Data requirements for MMS features and assets**
- **Data elements and definitions**
- **Coordination between MMS development staff and transportation database staff**
- **Accuracy vs cost – centerline coordinates and asset locations**
- **Safe and efficient data collection procedures**

### **Using a common linear reference system**

- **Collect data in a linear reference system – point and linear measures tied to the legacy database road network**
- **Provide locations based on fixed features (e.g., milepost, bridge decking, intersection) for multiple location reference methods**

### **Integrating road centerline and asset data in a common geospatial database**

- **Store and manage, particular location referencing, in a centralized database**
- **Map-based queries, analysis, and display tools on computer workstation and the web**
- **Asset data spatial coordinates based on LRS and road centerline coordinates**



## Integrating Transportation Data Systems Performance Measures

### Highway Analysis System

The Highway Analysis System (HAS) is ADOT&PF's legacy transportation database. HAS provides the road network, route definitions, transportation features, maintenance assets, and transportation data in a linear reference system (route/milepoint). Maintenance & Operations personnel use HAS for:

- location of maintenance assets
- attributes of maintenance assets
- reports by organization structure code, House District, ADOT&PF region, maintenance responsibility, and maintenance level of service.

### Geographic Information System (GIS)

The HAS – GIS Interface Project will integrate GIS technology with the legacy mainframe database, the Highway Analysis System (HAS). The Project will provide 3 – 5 year targeted upgrade strategies that can:

- unify the processing, management, maintenance, and output of transportation and road centerline network data in an integrated system.
- improve data access, display, analysis, and output.
- establish HAS as a foundation for linear reference-based GIS with ADOT&PF.

Maintenance  
Management  
System

### Alaska Traveler Information System

The Condition Acquisition and Reporting System/511 (CARS/511) traveler information system is a web-based database for reporting, monitoring, and sharing with key partners real-time situations that affect the transportation system (ferries and roads). Maintenance and Operations input and monitor situations that include:

- Emergency incidents (floods, earthquakes, avalanches)
- Road and lane closures
- Construction & maintenance activities
- Road conditions and reports

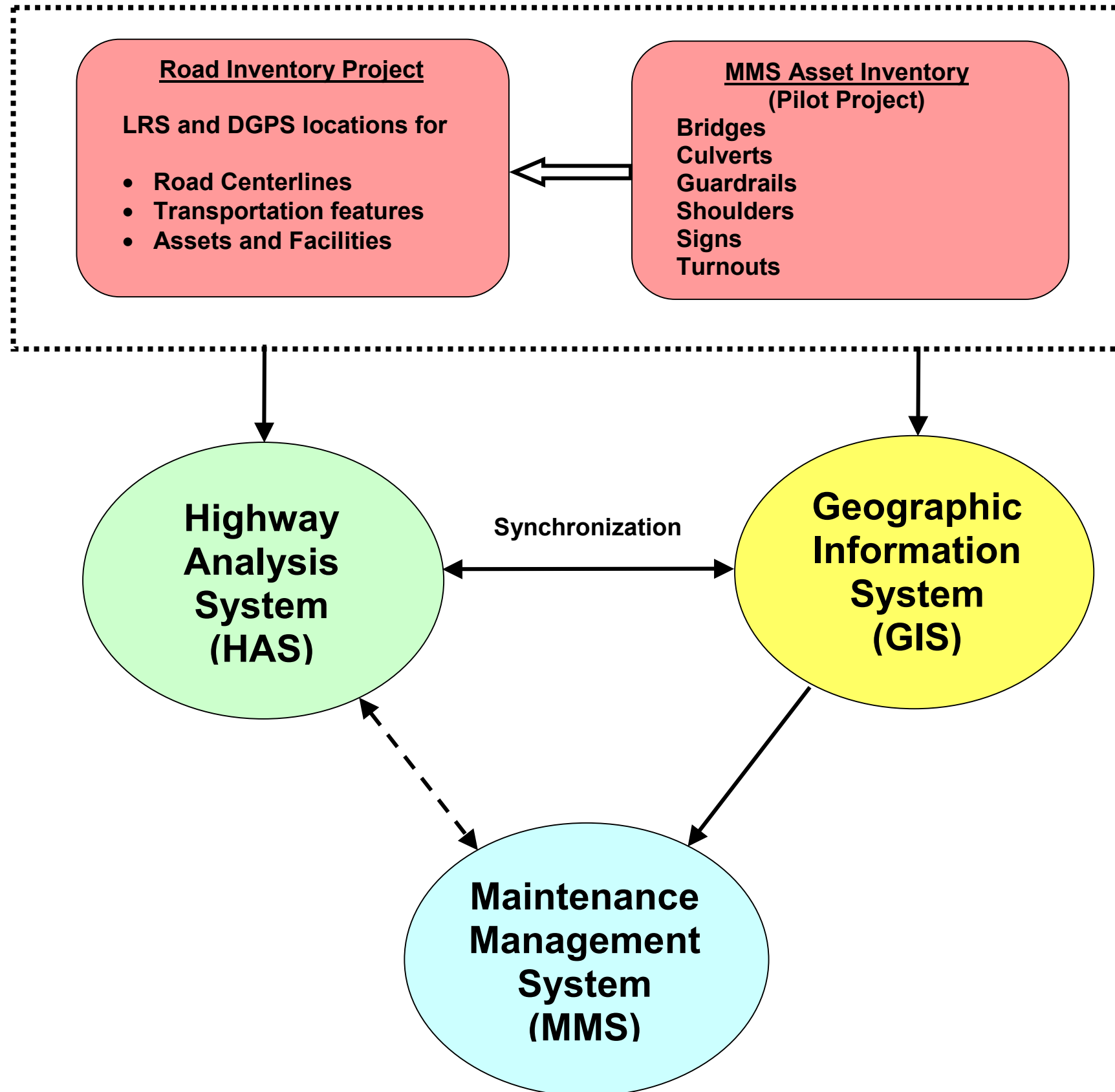
### Road Weather Information System

ADOT&PF is deploying 31 RWIS sites around the state. Sites provide atmospheric, surface, sub-surface, and video environmental data. Maintenance & Operations use real-time RWIS weather information for:

- winter weather maintenance actions (safety & efficiency)
- winter weather maintenance efficiency (time & materials)
- reduced exposure to hazardous roadway conditions
- input to the Maintenance Decision Support

Maintenance  
and  
Operations

**Establishing Asset Inventory and Data Collection Standards**  
**Performance Measures**



**Establishing A Common Reference Location**  
**3.1 Performance Measures**  
**LRS GIS Elements**

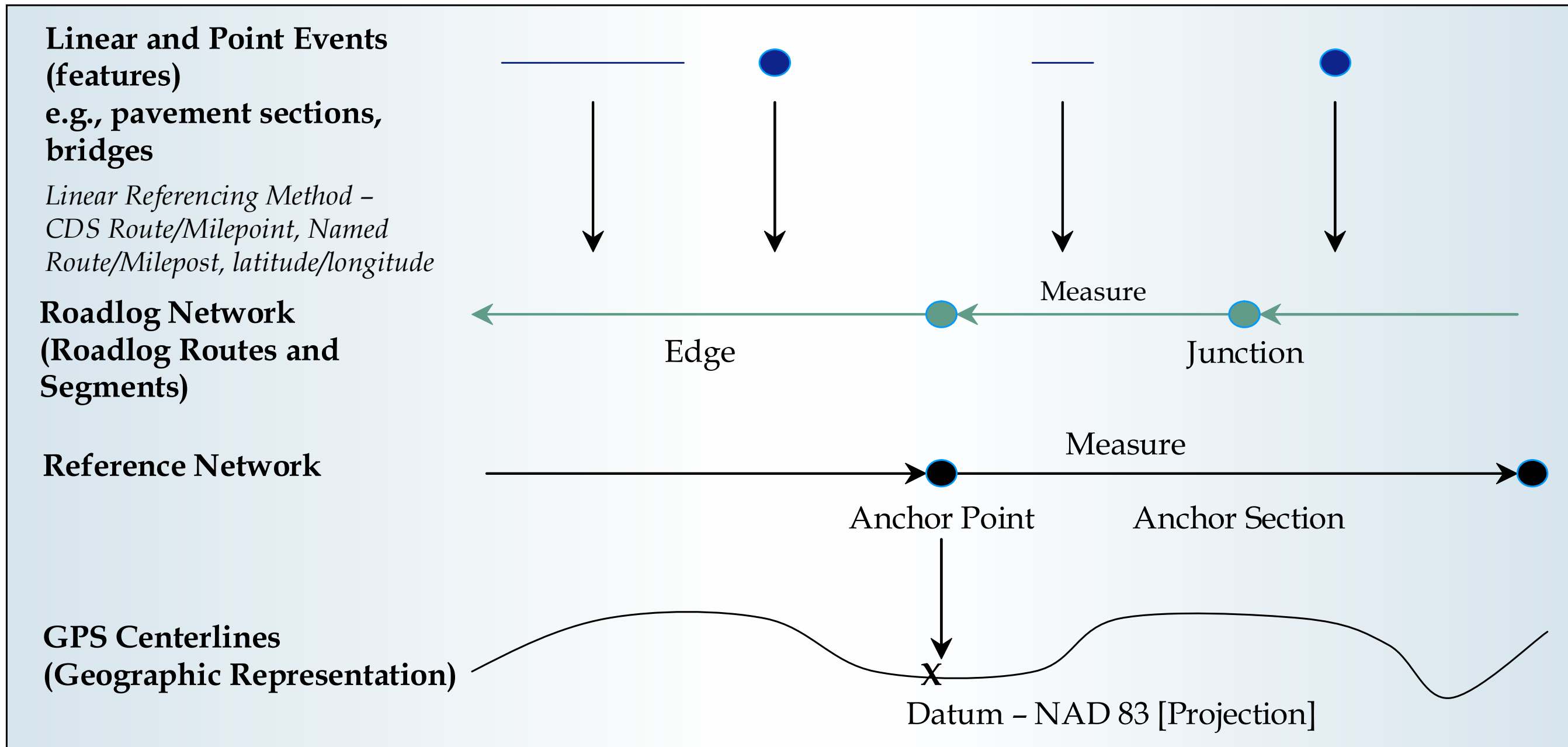


Figure 3.1, ADOT&PF HAS – GIS Implementation Plan  
 Cambridge Systematics, Inc, December 2003



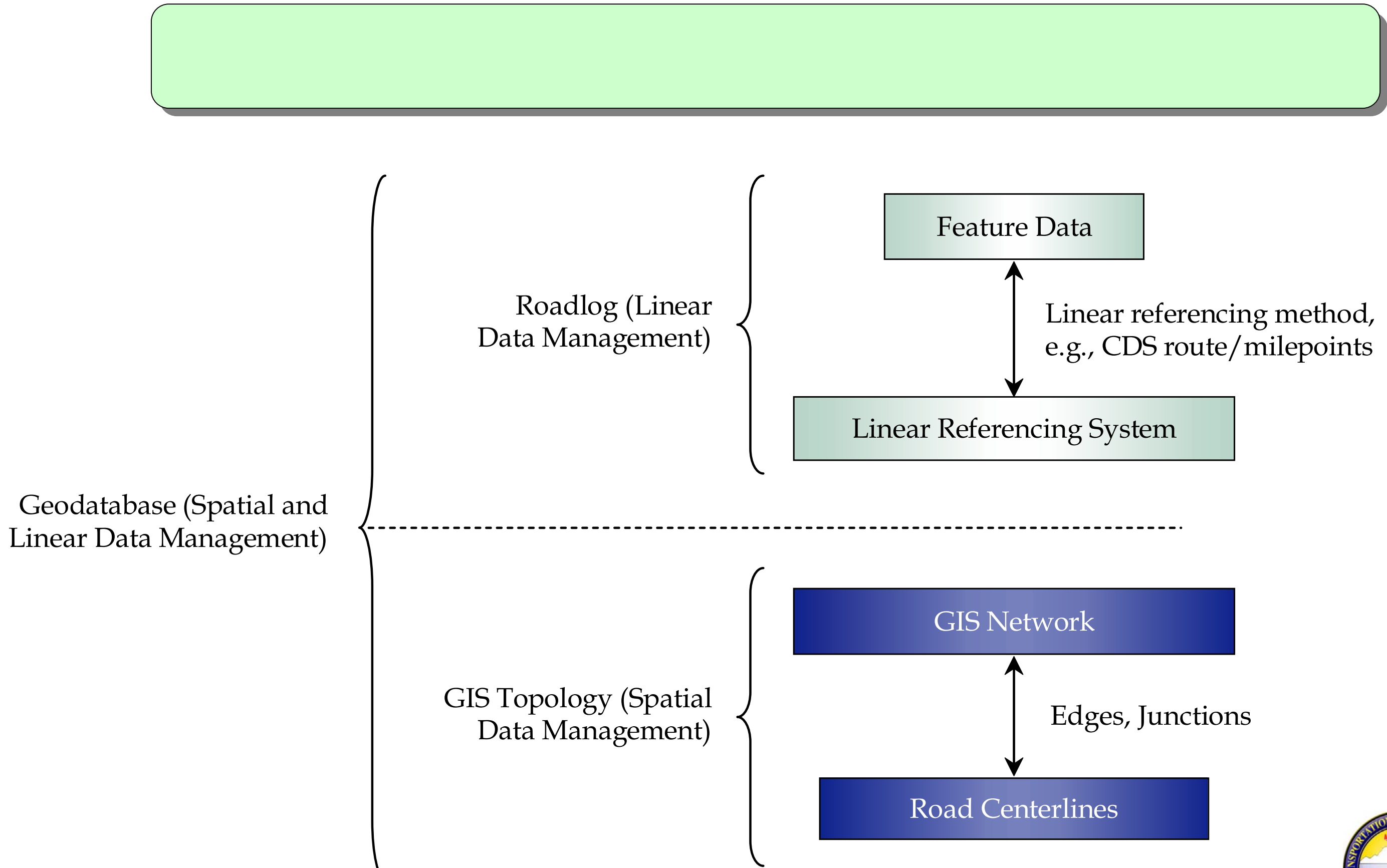


Figure 3.4, ADOT&PF HAS – GIS Implementation Plan  
Cambridge Systematics, Inc, December 2003



## Conclusions

**Data from multiple sources/systems must be integrated in the databases and communicated to users**

- **New data sources - Road Weather Information Systems and Advanced Traveler Information Systems**
- **Legacy transportation databases (mainframe and data warehouses)**
- **Asset management systems – inventory and database experts must be part of system design**
- **Geographic Information Systems – user needs must be clearly understood**

**For performance measures to be effective and meaningful, there must be strong coordination between the field inventory and database staff; maintenance & operations decision-makers; and the users:**

- **Data element definition and field collection standards**
- **Common location referencing system**
- **Multiple locating referencing methods based on fixed features**
- **Centralized database to store and manage data**
- **Geographic information system capability to input and display the road network, transportation data, and maintenance assets.**

**Management commitment to support Maintenance Management System development**

- **Field data collection equipment procurement**
- **Data collection contracting services**
- **Hardware and software for data processing, storage, and access**
- **Geodatabase development and integration with the legacy transportation databases**

