



Guidelines for Maintenance Management Systems



American Association of State Highway and Transportation Officials



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Guidelines for **Maintenance Management Systems**



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Executive Summary

Transportation managers are constantly challenged to improve services, save money, and meet ever-increasing customer expectations. Meeting these challenges is not easy. With an aged transportation system, many highway agencies find that maintenance needs exceed available funding. In the expanding information culture, citizens want to know how their road user taxes are being used and rightfully expect to have their demands considered. Each year, traffic volumes continue to increase. At a time when maintenance programs should be growing to meet increased demands, tight budgets and political pressure to trim government funds are working toward the opposite effect.

Maintenance managers must have the tools to meet these challenges effectively. Within the past five years, a sea change in management thinking has occurred. New business processes for setting performance targets and measuring outcomes have emerged. Better techniques for obtaining customer input and linking customer expectations to work effort and budgets have been developed. Maintenance quality rating systems provide managers with data to evaluate system performance. Technologies have continued to improve, and they have become more affordable.

In light of these new developments, a number of state highway agencies have undertaken major initiatives to implement new and improved maintenance management systems (MMS). A comprehensive MMS can help managers at all organizational levels meet the growing challenges. Major benefits that can be attained with MMS include the following:

- Maintenance quality rating systems help define asset conditions, maintenance levels of service, and program outcomes in customer-oriented terms.
- With limited budgets, managers can decide between competing needs. MMS can help managers conduct trade-off analysis to determine the maximum benefits attainable with available funding.
- Using customer input data, MMS can link customer expectations with desired outcomes and results.
- Applying performance-based budgeting techniques, MMS can link desired outcomes to resource and budget needs.
- Using “what if” analysis, managers can assess the consequences of shifting funds between competing program objectives.

Implementing MMS requires a transportation agency to make a major commitment in new technologies, business process reengineering, and training. A new MMS initiative requires the agency’s time, money, and energy. Each agency will need to determine the

type of system that best fits its needs, management style, and culture. With an up-front effort to identify the type of MMS needed, the agency can compare the cost to implement MMS with the expected benefits and paybacks.

This guide is intended to help managers understand the key components and elements of a modern MMS, one that will help meet the maintenance challenges of the 21st century. Properly designed and implemented, a modern MMS will help transportation agencies accomplish the following:

- Improve customer service
- Increase maintenance efficiencies
- Maintain highway assets at the overall lowest life-cycle cost.

Chapter 1

Introduction

Managing the nation's highway and transportation system has become increasingly more important in recent decades. Completion of the Interstate system, increasing demands for performance accountability, and the aging infrastructure have led to the need for a greater focus on maintenance. Responding to the increased demands, new maintenance management concepts, business practices, and technologies have emerged. This guide has been developed to help agencies assess their current situation, identify feasible improvement opportunities, and set a course for implementing an effective maintenance management system (MMS) in the 21st century.

PURPOSE OF THE GUIDE

The term “maintenance management” refers to all of the actions that managers undertake in their daily responsibilities of overseeing the maintenance program. A “maintenance management system” is the set of tools, technologies, and processes that help the managers make better decisions and manage more effectively.

The basic objective of this guide is to provide a high-level vision for an effective MMS in today's environment. It is meant to help managers at all organizational levels understand how good management practices can benefit the agency. It outlines the key MMS principles, presents a framework for MMS implementation, and describes system features and integration requirements. It discusses new and emerging technologies that can enable more effective and efficient maintenance operations.

Since this is a high-level guide, it does not provide the details of each MMS element and technology application. The intent is to introduce the concepts and features of a fully modern MMS and describe how those features can be applied to every facet of maintenance management. The specific design of each MMS element and feature must fit the unique requirements of each agency.

SCOPE OF MMS

Operations and maintenance, O&M, is distinguished from project planning and development because the infrastructure is already in place. The infrastructure life cycle is shown in Figure 1 on the next page.

Certainly technical maintenance considerations should be an integral part of the planning and design processes. However, MMS focuses on keeping the infrastructure in optimum

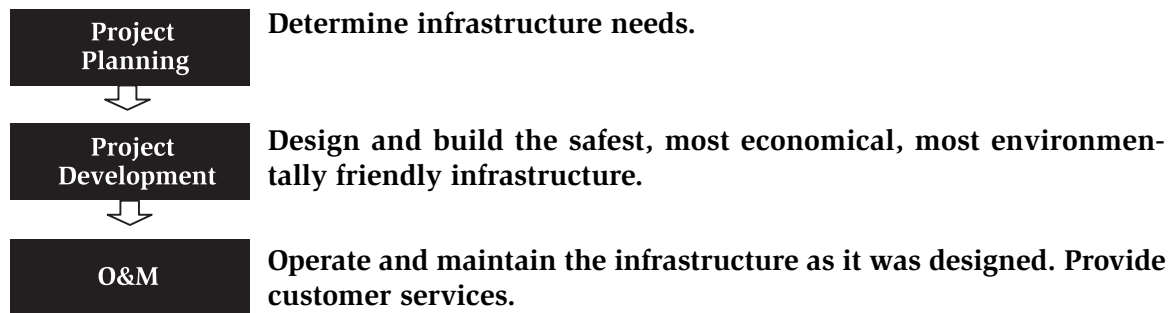


FIGURE 1. Infrastructure Life Cycle

condition after it is built and providing good customer service. In this respect, this guide does not address major projects such as pavement overlays and bridge reconstruction. These projects are more appropriately addressed with the aid of Pavement and Bridge Management Systems. (See companion guides developed for these systems.) However, the need to integrate MMS with other infrastructure management systems is apparent, and this guide discusses the need and importance of MMS integration.

Fundamentally, MMS deals with managing the routine maintenance and operations of the transportation system. MMS provides managers with the business processes, management tools, and technologies to maintain a safe, efficient, and convenient transportation system over the life of the assets. This guide outlines the type of MMS that will help each agency achieve these goals.

The guide promotes MMS as a management approach. As such, it focuses heavily on business process. Business process and technology should not be viewed as mutually exclusive endeavors. Rather they should be viewed in an iterative fashion so that maximum benefits can be achieved when business practices are re-engineered.

INTENDED USERS

Many levels of the organization will find this guide beneficial in deciding how to proceed with MMS. Table 1 shows how different organizational levels can use this guide.

TABLE 1. Users of the MMS Guide

Senior Management	• Understand how MMS can improve service levels and reduce O&M costs. • Determine payback and benefits from MMS development and implementation. • Understand the basic business need for MMS.
Division/Program Managers	• Understand features of modern MMS. • Assess MMS requirements.
Field Operations Managers	• Understand how MMS can be applied to everyday management decisionmaking. • Determine how business practices and technologies can be used complementarily.
IT and MMS Development Group	• Understand the basic MMS development approach. • Understand options for system development. • Understand how software and technology should support business processes. • Understand the business needs for the MMS. • Understand how integration of other management systems plays an integral part in MMS.

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Chapter 2

Maintenance Management Principles

Maintenance is an essential part of providing road users with a safe, comfortable, and efficient transportation system. Maintenance investments prolong asset life, preserve the infrastructure, and result in overall lower life-cycle cost. Effective service delivery assures that customers have access to a dependable transportation system, enhancing quality of life, and promoting efficient commerce.

MMS can provide a powerful business tool for improving maintenance efficiency and increasing service levels. With a customer-oriented focus, MMS assures effective stewardship of taxpayer dollars.

VALUE OF MAINTENANCE IN HIGHWAY AGENCIES

The nation's highway system would quickly deteriorate to unacceptable conditions if not for good maintenance practices. Many states have recognized this need and have formally implemented a "maintain first" policy. The reasoning behind this policy is, "Why build infrastructure if the current system cannot be maintained in a safe and efficient state?" There are many benefits in assuring that maintenance programs are appropriately funded, as discussed below.

Protecting the Investment of Public Dollars

Each year state, local, and Federal agencies invest billions of dollars for new and expanded infrastructure. From a business perspective, it would be foolish to allow the infrastructure to go without maintenance. Over the long run, underfunded maintenance programs contribute to overall higher costs of providing a transportation system.

The question becomes, "How much money should be invested in maintenance?" An effective MMS can help answer this question. Today, we are able to set performance targets for maintenance and translate those targets into a maintenance program. The maintenance program can specify the funding and resource requirements for a chosen level of service. Upper management and budget decision makers can determine the optimum maintenance funding required to keep the system safe and efficient and to keep overall O&M costs at minimum levels over the life cycle of the assets.

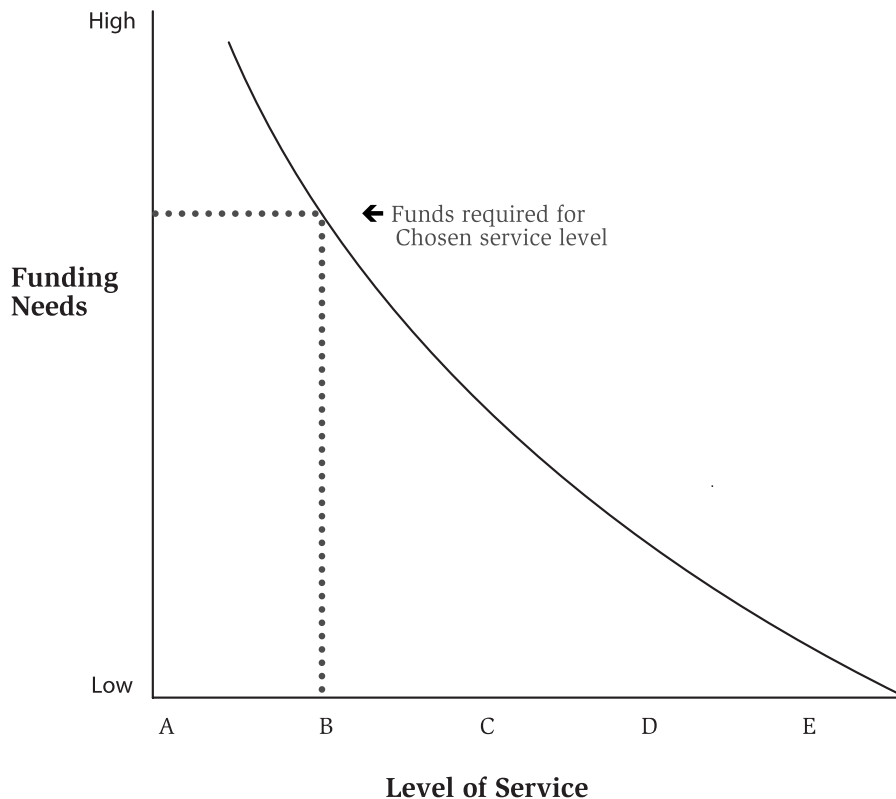


FIGURE 2. LOS vs. Funding

Providing a Safe Highway System

While it is important to protect the public's investment, it is also important to provide a safe transportation system. Maintenance levels directly impact user safety. Typical maintenance activities affecting safety include:

- Providing smooth hazard-free riding surfaces
- Keeping traffic control and safety devices in good operating order
- Implementing effective snow removal and emergency response programs
- Providing unobstructed views to motorists through vegetation management programs.

With MMS, maintenance managers can plan and execute maintenance programs geared to the specific needs of the local highway system. MMS allows managers to monitor results using outcome-based measures to determine the appropriate levels of funding and resources needed.

Maintaining Efficiency, Convenience, and Mobility

In addition to safety concerns, user costs are also important in planning and designing highways. Transportation systems promoting unimpeded traffic flow contribute to economic vitality and quality of life. Maintenance plays a large part in long-term transportation efficiency, convenience, and mobility.

With a customer-oriented approach, a modern MMS can provide the ability to link customer input with desired performance targets and outcomes. Through proper planning and execution, maintenance managers can determine the level of investment in maintenance activities to keep the system operating at maximum performance, helping to meet customer expectations for mobility and efficiency.

Other Benefits and Values

Effective maintenance programs provide value in many other ways, such as the following:

- Environmental protection,
- Outcome-based accountability,
- Linking of customer input to program strategies,
- Increased service levels,
- Reduced O&M costs,
- User-friendly information for performance measurement, and
- Identification of efficiencies and best practices.

RELATIONSHIP TO ASSET MANAGEMENT

A number of agencies have begun to apply asset management principles to aid in making infrastructure investment decisions. The definition below provides the definition of asset management as promoted by FHWA.

Definition of Asset Management

“Asset Management is a strategic approach to maximizing the benefits from resources used to preserve, operate, and expand the transportation infrastructure.”

Asset management and MMS are closely related, with the same key objectives of cost-effective infrastructure maintenance and operation. Asset management generally tends to be more strategic; that is, it deals with investment decisions across asset classes and programs. Both systems employ the same general management principles and contain elements for:

- Performance Objectives,
- Asset Inventory,
- Condition Assessment,
- Investment Analysis,

- Planning, Programming, and Budgeting,
- Program Implementation, and
- Performance Monitoring.

At its full implementation, a modern MMS, as with asset management, deals with infrastructure management in a broader scope than traditional MMS's. Asset management cuts across planning, development, maintenance, and financial functions to conduct investment analysis and trade-off decisions, considering maintenance costs, mobility, and safety. Maintenance management is a key element of asset management and deals with infrastructure that is already in place.

A key distinction between asset management and maintenance management occurs at the customer service interface. Maintenance organizations provide many services that do not involve maintaining or preserving assets. Examples of such services include wild flower programs, courtesy patrols, and emergency response. Even though these activities have no direct link to maintaining or preserving assets, they provide a vital public service. The MMS allows agency managers to understand customer expectations for these services and make strategic trade-off decisions between asset preservation and service delivery.

ROLE OF MAINTENANCE MANAGEMENT SYSTEMS

MMS's will play a critical role in helping agencies function as high-performance organizations in the 21st century. MMS will fulfill this role by enabling agencies to better achieve the following key objectives:

- Protect the public investment in transportation infrastructure,
- Deliver customer-oriented maintenance programs,
- Promote efficient use of resources,
- Improve maintenance service levels,
- Provide a safe, comfortable, and convenient highway system, and
- Determine budget levels needed to deliver desired levels of service.

To accomplish these objectives, MMS cannot be an isolated stand-alone system. The large public expenditures for maintenance programs dictate a systematic and business-like approach in managing maintenance programs and services. Application of MMS principles requires integration with enterprise-wide management systems and programs. The role of MMS in the overall highway management process includes the following:

- Support decision makers at all organizational levels—senior management, budget decision makers, and front-line operational managers;
- Assist managers in determining outcomes from various investment and funding scenarios;

- Optimize maintenance expenditures by developing annual work programs that achieve the highest Level of Service (LOS) within available funding;
- Manage resources at field and statewide levels based on adopted annual work programs;
- Provide field managers with strategic and tactical tools to execute the maintenance program efficiently and deliver quality customer service;
- Provide managers at all levels with information to track results by geographic area, program area, and time period;
- Provide trend analysis to assess the system performance over time;
- Interface with other agency management systems to share data and reduce agency-wide data collection, storage, and processing costs; and
- Provide performance and results data for agency reporting to the governor, legislature, and public.

The high-performance transportation agency of the future will embrace customer service as the guiding principle for its maintenance program. MMS will provide the agency with the tools needed to link customer input with program objectives.

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