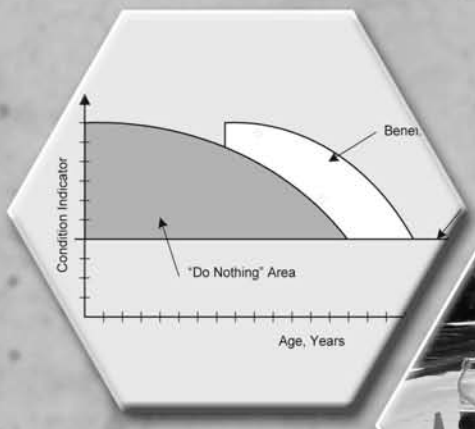
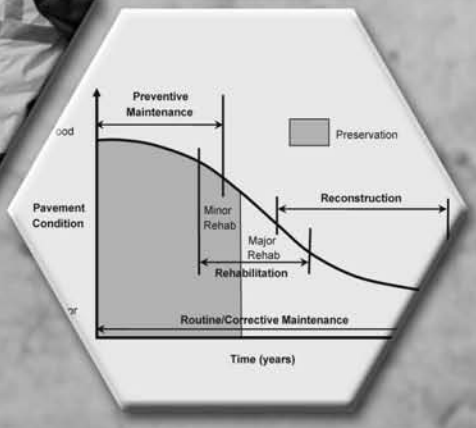
SECOND EDITION 2012

PAVEMENT MANAGEMENT GUIDE





AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

AASHTO

THE VOICE OF TRANSPORTATION

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ABSTRACT

The American Association of State Highway and Transportation Officials (AASHTO) has supported the development and use of pavement management since the early 1980s. In 1990, AASHTO published the *AASHTO Guidelines for Pavement Management Systems*, which introduced the concepts and outlined the components of a pavement management system, and documented the steps to implement a computerized system. In 2001, AASHTO published the *Pavement Management Guide*, which covered pavement management concepts in much more detail.

While many of the topics included in the 2001 *Pavement Management Guide* are still relevant today, there are several significant advancements that have taken place since its publication. For instance, there is an increased emphasis on pavement preservation programs and there are advancements that have taken place in terms of data quality and integration issues. There are also recent initiatives that are impacting the types of data required by pavement management. The increased importance of performance measurement and asset management principles will further influence the practice and future of pavement management.

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EXECUTIVE SUMMARY

IMPORTANCE OF PAVEMENT MANAGEMENT

In light of an economic environment in which funding constraints force managers to do as much as possible with the dollars provided, transportation agencies have sought methods of managing their roads, bridges, and other highway assets using systematic processes based on reliable data. Defined in 1993 by the American Association of State Highway and Transportation Officials (AASHTO) as "a set of tools or methods that assist decision-makers in finding optimum strategies for providing, evaluating, and maintaining pavements in a serviceable condition over a period of time," pavement management has been used by federal, state, and local transportation agencies to perform the following activities:

- Assess both current and future pavement conditions.
- Estimate funding needs to achieve targeted condition levels.
- Identify pavement preservation and rehabilitation recommendations that optimize the use of available funding.
- Illustrate the consequences of different investment levels and treatment strategies on both short- and long-term pavement conditions.
- Justify and secure increased funding for pavement maintenance and rehabilitation.
- Evaluate the long-term impacts of changes in material properties, construction practices, or design procedures, or some combination thereof, on pavement performance.

The idea of managing transportation assets effectively is not new. In fact, state DOTs have been managing roads, bridges, and other highway assets since public road departments were first established in this country. Today's agencies understand the typical life cycle of a pavement and recognize the need for periodic preservation, rehabilitation, and reconstruction activities. However, as these agencies seek ways to preserve their transportation investments, they are doing so in an environment that offers tremendous challenges from both internal and external forces. These challenges can often have long-lasting impacts on the manner in which an agency manages its transportation assets. For instance, agencies are facing severe funding reductions and pressure from elected officials and the traveling public to improve efficiency and to demonstrate that funds are being used wisely. There is increased pressure to streamline organizations and, as a result, institutional knowledge, which has been the backbone of transportation agencies for many years, is diminishing as experienced workers retire or leave government employment. There is also more competition for available funding and some agencies are responding by outsourcing or privatizing the maintenance of a portion of their network. Additionally, increased pressure for improved accountability in the use of public funds is causing agencies to establish performance-based metrics that

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allow agencies to defend funding requests and to document how funds have been used and what benefits have been gained.

As a result of these pressures, stewards of transportation agencies have placed more of an emphasis on preserving their existing assets and better linking investment decisions to agency priorities and performance data. This has led to a shift in the way agencies think about asset investments, with more consideration for the interrelationship between funding decisions. This shift has fueled the development and acceptance of data-driven management as a way of preserving the investment in transportation assets. Since pavements represent one of the largest single transportation investments, the efficient management of pavements is a high priority within these agencies. As a result, pavement management has become increasingly important to address these needs.

INTRODUCTION TO THE NEW PAVEMENT MANAGEMENT GUIDE

AASHTO has supported the development and use of pavement management since the early 1980s. In 1990, AASHTO published the *AASHTO Guidelines for Pavement Management Systems* (AASHTO 1990), which introduced the concepts of pavement management, explained the differences between network- and project-level analyses, outlined the components of a pavement management system, and documented the steps to implement a computerized system. In 2001, AASHTO published the *Pavement Management Guide* (AASHTO 2001), which covered pavement management in much more detail.

This updated *Pavement Management Guide* contains the nine chapters listed below:

Chapter 1: Introduction to the Guide
Chapter 2: Managing Transportation Assets Effectively
Chapter 3: Inventory Data Collection and Data Integration
Chapter 4: Pavement Condition Assessment
Chapter 5: Pavement Performance Modeling
Chapter 6: Project and Treatment Selection
Chapter 7: Using and Presenting Pavement Management Results
Chapter 8: Implementation Activities
Chapter 9: Future Directions

Chapters 2 through 5 provide the foundation for understanding pavement management. Chapter 2 begins with the premise that pavements are an important asset that have a significant value and represent a major investment. It emphasizes the importance of establishing a link to asset management principles by introducing the five core questions that every agency should be able to answer about its pavements, bridges, and other roadway appurtenances to manage them cost-effectively. In addition, this chapter introduces the components of a pavement management system; the use of pavement management at the project, network, and strategic levels; and the differences between the types of information used at each of the three decision levels. Finally, Chapter 2 introduces the benefits of using pavement management to support agency decisions.

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Once the fundamental principles of managing assets have been established, the guide then addresses several basic pavement management components, including the establishment of an inventory and the types of data integration issues that arise when sharing data (in Chapter 3), the assessment of pavement condition (in Chapter 4), and pavement performance modeling (in Chapter 5). Chapter 3 discusses the importance of the availability and accessibility of reliable inventory and condition information for pavement management. Because of the number of sources of pavement management data, data integration and data sharing are critical to the success of pavement management. This chapter introduces several methods of integrating pavement management data, including the use of a Geographic Information System for data storage, retrieval, analysis, and presentation. The chapter also identifies strategies for managing data effectively.

Chapter 4 introduces the importance of a consistent and reliable method of assessing pavement conditions as the basis for all pavement management recommendations. The chapter introduces a variety of methods to assess the structural and functional condition of a pavement, including surface characteristics (such as pavement distress, longitudinal profile and roughness, and surface texture and friction), subsurface characteristics, and structural evaluation. Various methods of conducting network-level pavement condition surveys are presented, and methods of developing pavement condition indices are introduced.

This chapter also presents some of the current changes that may influence the types of pavement condition data that are being collected and the frequency with which surveys are conducted. For instance, new Highway Performance Monitoring System (HPMS) reporting requirements include cracking, rutting, and faulting. The new mechanistic-empirical design procedures that have recently been developed require calibration of the performance models using pavement management data. Additionally, new technology is being developed that may influence an agency's ability to assess pavement structural condition at a network level. These, and other types of changes, are forcing agencies to periodically revisit their data collection activities to determine whether adjustments are needed to continue to meet changing agency demands.

Chapter 5 introduces some of the different methods used to develop pavement performance models that are used in pavement management to demonstrate the impact of different funding scenarios, to determine the best use of available funds, and to estimate changes in resource needs to address pavement deficiencies. Several methods of developing pavement performance methods are introduced, including deterministic, probabilistic, Bayesian, and subjective approaches. Methods of evaluating the reliability of the models are also provided.

One of the more common methods of developing pavement performance models discussed in Chapter 5 is the family modeling approach, in which condition data for pavement sections with similar characteristics are grouped together to determine a representative model to signify the typical deterioration pattern for the data set. The use of certain characteristics to group pavements into families reduces the number of variables used directly in the model (e.g., reduced to a single variable) and reduces the specificity required of the data. This simplifies the modeling process by reducing the data demands for developing the models. Since a family model represents a general performance trend for a group of pavements, the chapter also introduces a method of shifting the family performance model to predict the condition of an individual section.

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Chapter 5 concludes with a discussion of the use of performance models beyond the traditional applications of pavement management. This section discusses the use of performance models to evaluate new designs and mixes, to determine the benefit of using preventive maintenance treatments, to support a forensic analysis, to estimate Remaining Service Life, and to calibrate mechanistic-empirical pavement design models.

At its most basic level, a pavement management system is used to identify and prioritize pavement preservation and rehabilitation projects. Chapter 6 introduces and illustrates methods used to develop both treatment and impact rules. The treatment rules used in pavement management describe the conditions under which a treatment is considered feasible and impact rules describe the pavement performance that might be expected following the application of a treatment. Special considerations for developing treatment rules for preventive maintenance treatments are also presented in Chapter 6.

The chapter also introduces three common methods of project and treatment selection under constrained conditions: ranking, multi-year prioritization, and optimization. A multi-year prioritization approach, which includes incremental benefit-cost and marginal cost-effectiveness analyses, is currently the most commonly used approach for project and treatment selection at the state highway level.

The chapter concludes with a discussion of the importance of coordinating pavement management with maintenance and operations, especially as pavement preservation programs increase in popularity and size. Strategies for strengthening the links between pavement management and maintenance are also provided.

Chapter 7 presents methods for using pavement management results to support agency decisions. First, it presents strategies for using pavement management results to determine pavement needs, to determine the consequences associated with different strategies, and to identify projects and treatments that make the best use of available funding. In addition, the chapter describes the use of pavement management information for allocating funding, for establishing performance targets, and for long-term planning activities. The chapter concludes with suggestions for effective use of pavement management information in presentations.

The steps involved in the implementation of a pavement management system are introduced in Chapter 8. It discusses the different types of software available and the typical steps that agencies will follow as they move forward with their pavement management implementation. The chapter also addresses some of the institutional issues that agencies face as they adopt pavement management practices and the importance of transition planning.

The guide concludes with Chapter 9, which presents a summary of some of the evolving issues that should be addressed to keep pavement management viable into the future. These issues include national initiatives in sustainability and livability that are influencing the types of data that should be considered in making pavement preservation and rehabilitation recommendations. Other considerations that are impacting pavement management, such as support for the calibration of mechanistic-empirical pavement design models and increased privatization of highway maintenance activities, are explored.

The guide's Appendices include a glossary of common terms and acronyms and a useful list of references sorted by topic area.

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Appendix C: Index

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