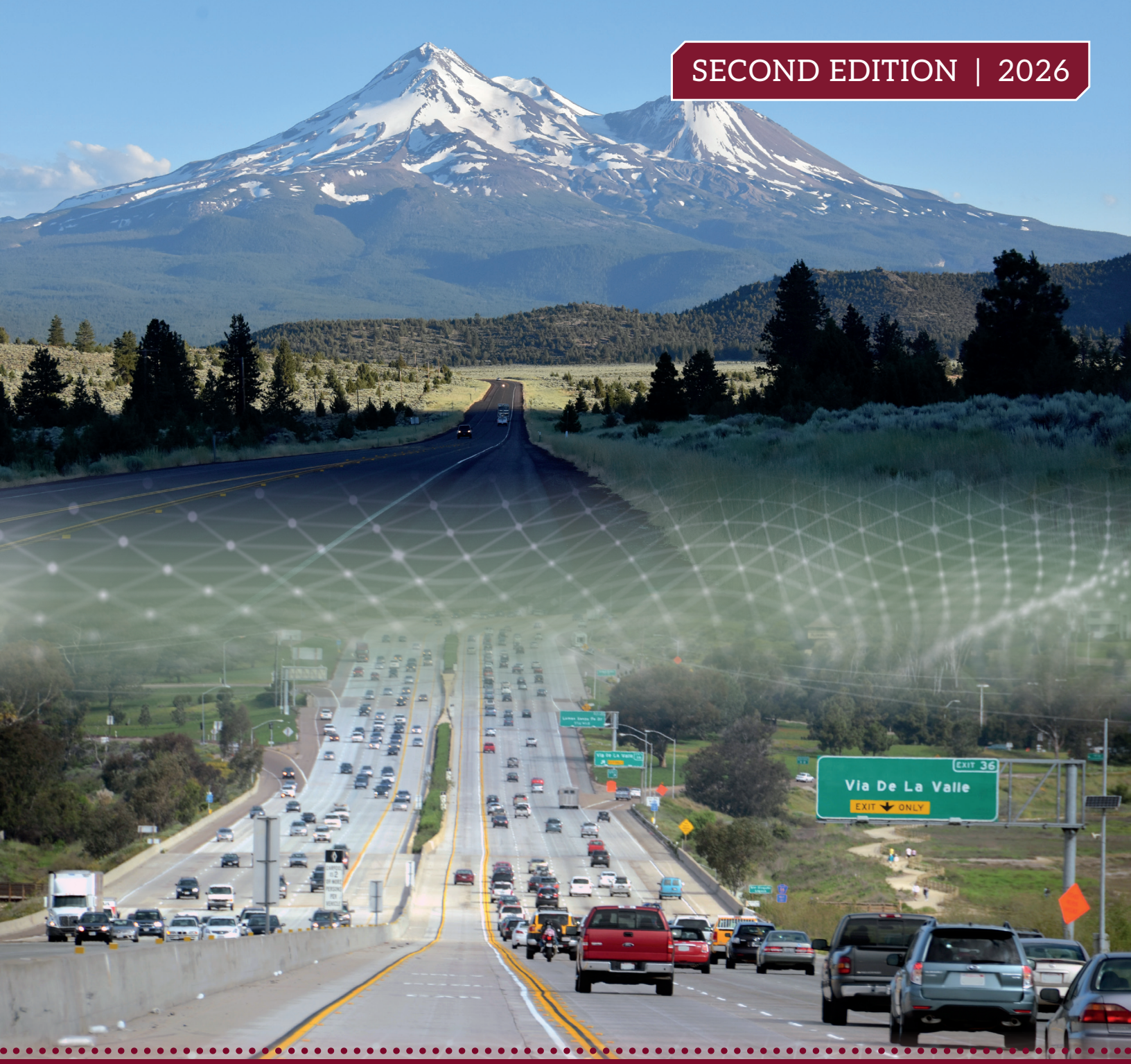
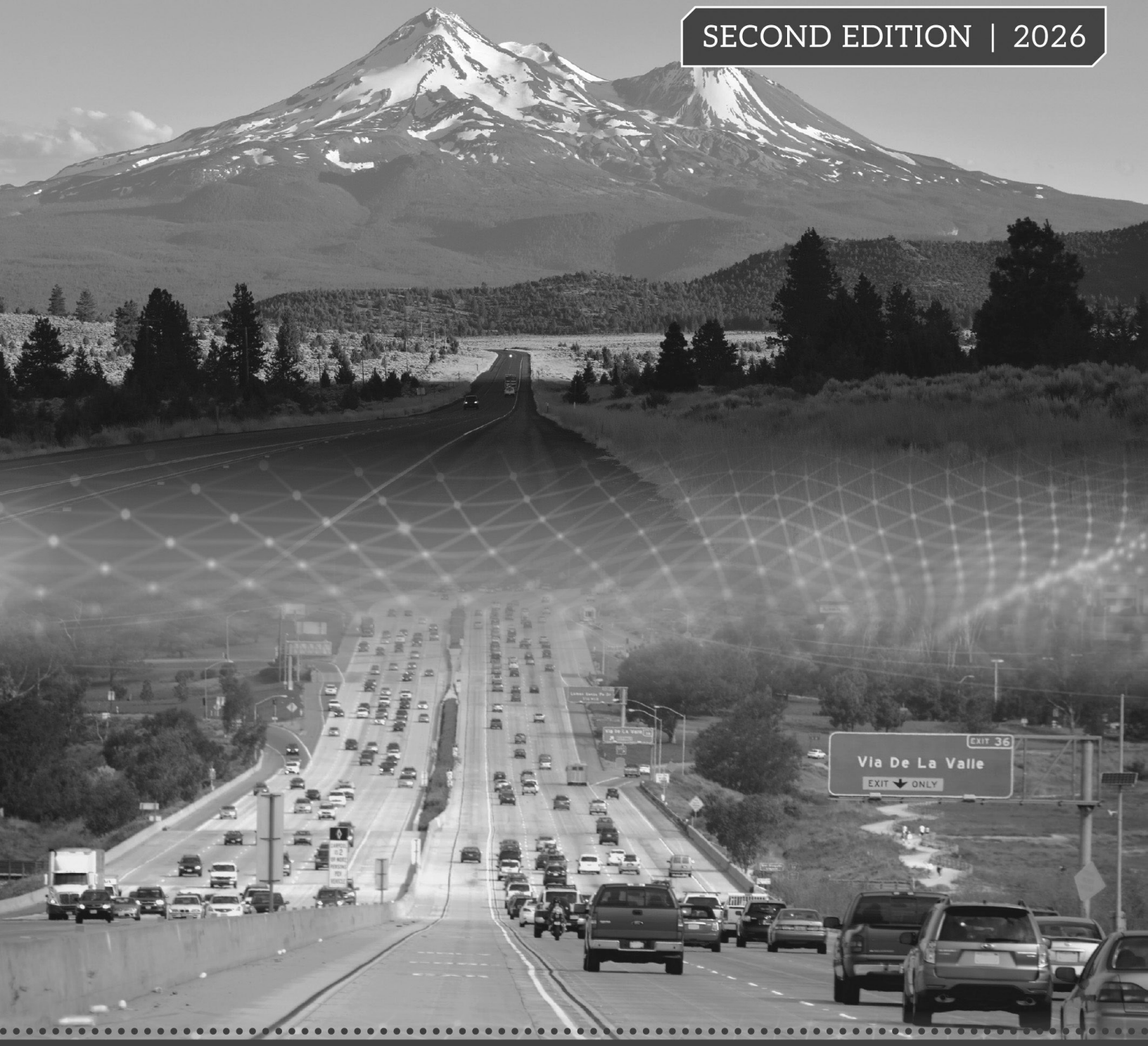
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Guide to Pavement Design, Construction, and Management

AASHTO | American Association of State Highway and Transportation Officials

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Preface

This Guide provides guidance for all aspects of pavement design to the engineering practitioner. The Pavement Guide is meant to be a "one-stop shop" for pavement engineering.

Chapter 1 provides a general overview of the Handbook. The fundamentals of pavement design are discussed in Chapters 2 through 5. The reader is informed about various pavement types and their corresponding material components in Chapters 2 and 3, respectively. Chapter 4 is an in-depth discourse on the structural pavement design analysis for each pavement type, with particular attention paid to mechanistic-empirical (M-E) techniques. The impact of surface properties on friction, ride, and safety are thoroughly explained in Chapter 5.

Chapter 6 discusses pavement-type selection strategies, whether the pavement is being newly constructed from the ground up or undergoing some type of restoration. Life-cycle costs are considered for selection optimization.

Methods of construction for various pavement types are covered in the Chapter 7, including detailed guidance for both materials and construction specifications. Special emphasis is placed on quality management and its essential role for successful project completion.

The testing and evaluation of existing pavements are the subjects of Chapters 8 and 9. Visual distress surveys, nondestructive testing, and sampling and testing comprise the data acquisition techniques outlined for making educated assessments of pavement condition.

Chapters 10 and 11 detail treatments for existing pavements ranging from non-structural pavement preservation to structural rehabilitation. Performance expectations for each treatment are summarized.

Managing pavements at all hierarchical levels is the focus of Chapter 12. Transitioning from distress data types and their collection protocol to database analysis methods, the outline is given for design life optimization.

Chapter 13 ends the Handbook with thoughtful discussion of the pavement caretaker's role in selecting and reusing materials for environmentally sustainable design.

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Chapter 1

INTRODUCTION

1.1. General

Transportation agencies are responsible for the design, construction, maintenance, and management of highway pavements. Though pavement engineers are faced with a number of challenges, a primary challenge is that of change. The clearest example of this change is the approach to pavement analysis described in the *Mechanistic-Empirical Pavement Design Guide—A Manual of Practice* (hereafter referred to as AASHTO MEPDG) (AASHTO, 2020). Over a period of approximately 10 years in the early 2000s, the fundamental approach to pavement design changed from a procedure that was modeled from the observed performance at test tracks constructed in the 1950s to one based on modeling the performance of pavement structures based on axle load spectra, climate, and intrinsic material properties. However, it was not just design procedures that changed. Construction practices also changed, with the emphasis shifting to accelerated construction, the use of sustainable materials, and the provision of safer and quieter pavement surfaces. In pavement maintenance and management, the leading edge of this change consists of a more proactive approach to managing a pavement network and the consideration of pavements as one important element of a system of transportation assets that must be managed. This proactive approach to managing assets involves integrating pavement investment decisions with other agency needs for better and more fiscally responsible and transparent decision making.

The focus of this Pavement Guide is on documenting knowledge on a broad range of pavement engineering-related topics. The information contained in the Pavement Handbook cites the most relevant AASHTO publications as well as relevant documents published by the National Cooperative Highway Research Program (NCHRP) and the Federal Highway Administration (FHWA).

The Pavement Guide covers the following topics:

1. **Introduction**—Overview of the document.
2. **Pavement Types**—Brief discussion and overview of asphalt, concrete, composite, and gravel pavements.
3. **Pavement Materials**—Discussion of the various materials used in pavement construction, including soil, aggregate, asphalt binders and modifiers, hydraulic cement binders and modifiers, and asphalt mix design and selection, as well as hydraulic cement concrete mix design and selection.
4. **Pavement Structural Design**—Discussion of purpose and fundamental concepts of pavement design including a history of AASHTO pavement design procedures and mechanistic-empirical pavement design.

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5. **Pavement Surface Characteristics**—Discussion of pavement surface characteristics related to profile, texture, friction, porosity, hydroplaning potential, splash/spray, and tire–pavement noise.
6. **Pavement Type Selection**—Discussion of where to apply (new, reconstruction, or rehabilitation), identification of alternative strategies, life-cycle cost analysis components (such as analysis period, discount rate, agency and user costs, computational approach), and FHWA RealCost software (FHWA, 2023).
7. **Pavement Construction**—Discussion of the importance of quality construction and materials; quality management (quality control, quality assurance, and independent assurance); qualifying construction materials; and construction and materials specifications.
8. **Pavement Evaluation**—Discussion of the types and purpose of pavement evaluations, including condition and distress, surface and subsurface drainage, field sampling and testing, and surface characteristics testing.
9. **Pavement Structural Testing and Analysis**—Discussion of structural assessment and characterization including nondestructive testing, destructive sampling and testing, backcalculation and related analysis, application decisions, and distinction for what is needed on network and project-level applications.
10. **Pavement Preservation Treatments**—Discussion of pavement preservation concepts and purposes, scope of preservation activities, benefits of preservation, and description of preservation treatments and usage.
11. **Pavement Rehabilitation Strategies**—Discussion of pavement rehabilitation concepts and purposes, and the scope of rehabilitation activities, as well as a description of rehabilitation treatments and usage.
12. **Pavement Management**—Discussion of the importance of pavement management; pavement management levels (such as strategic, network, and project-level); and pavement management components (including inventory, database, condition assessment, analysis models, analysis tools, reporting, and feedback loop).
13. **Pavement Sustainability**—Discussion on sustainability concepts; the scope of their application; reduction in energy consumption; reduction in material consumption; reduction in air, water, and noise pollution; and sustainability assessment (economic, environmental, and societal).

The target users of the Pavement Guide range from entry-level technicians to engineers or academia to the well-experienced pavement engineer. The Pavement Guide provides brief and concise information on an extensive list of pavement-related topics, with links and references to more detailed information and reports that are readily available via the Internet. In this manner, a relatively short period of time can be spent on obtaining general, but concise, information on any given pavement-related topic; however, including links or references to other more in-depth information will allow further explanation based on the needs of the end user.

1.2. References

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