

PAVEMENT ASSET MANAGEMENT

RALPH HAAS and W. RONALD HUDSON

with LYNNE COWE FALLS



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Pavement Asset Management

**Ralph Haas and W. Ronald Hudson
with Lynne Cowe Falls**



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Dedication

This book is dedicated to the many practitioners, educators and researchers who have made a difference in advancing pavement management over the past five decades. We name a few in the following, with apologies to other deserving individuals whom we have unintentionally missed, and with recognition of the many planning, design, materials, construction and maintenance people who have contributed in various ways but could not all be realistically listed.

Fred Finn, Consultant; Roger Leclerc, Washington State DOT; Paul Irick, TRB; Bill Carey, TRB; Frank Botelho, FHWA; Frank McCullough, UT Austin; Roger Smith, Texas A & M; Katie Zimmerman, ApTech Consultants; Sue McNeil, U Delaware; Charlie Duggan, Connecticut DOT; Mo Shahin, Corps of Engineers; Harold Von Quintus, Applied Research Associates, Inc.; Stuart Hudson, Agile Assets Consultants; Gerardo Flintsch, Virginia Tech; Oscar Lyons, Arizona DOT; Dale Petersen, Utah DOT; Waheed Uddin, U Mississippi; Gary Elkins, AMEC Environment & Infrastructure; Harvey Treybig, ARE Consultants; George Way, Arizona DOT; Eric Perrone, Agile Assets Consultants; Mike Darter, U Illinois; Charles Pilson, Agile Assets Consultants; Bob Lytton, Texas A & M; Dave Luhr, Washington State DOT; Joe Mahoney, U Washington; Judith Corley Lay, N Carolina DOT; Linda Pierce, ApTech Consultants; Billy Connor, Alaska DOT

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RH, WRH and LCF

Preface

Pavement Management Systems by Haas and Hudson (1978) laid a foundation for using the systems methodology in a pavement management context. *Modern Pavement Management* by Haas, Hudson, and Zaniewski (1994)¹ built on the concepts of the original book but was a complete update of the original book. While there have been many advances in pavement engineering and management concepts since 1994, the basic structure of the pavement management process is largely intact. Therefore, the purpose of this book on *Pavement Asset Management* is to reflect current pavement engineering and management concepts and practice.

Although the concept of applying the systems method to pavement engineering and management has existed for several decades, there is still a need to make the case for adopting pavement management systems. Subsequent years saw pavement management systems broadly accepted and implemented by agencies and organizations with responsibilities for designing, constructing, and maintaining pavement structures. In fact the management systems concept has been and continues to be broadly implemented to the entire transportation and indeed civil infrastructure, as described in *Public Infrastructure Asset Management* by Uddin, Hudson and Haas (2013).²

Initial pavement management systems focused on the pavement design problem, i.e. what is the “best” pavement solution for a specific section of road. However, it was soon recognized that the systems method could be applied for selecting and programming what, where, and when projects should be selected for the optimum allocation of funds to a network

1 Haas, R., W.R. Hudson and J.P. Zaniewski, *Modern Pavement Management*, Krieger Press, Florida, 1994.

2 Uddin, W., W.R. Hudson, R.C.G. Haas, *Public Infrastructure Asset Management*, Second Edition, McGraw Hill Education Publications, New York, 2013.

of pavements managed by an agency. The two applications of the systems method to pavement management were termed “project” and “network” level pavement management. Subsequently, the capability of within-project alternatives was added to recognize that some network level systems were capable of identifying optimal levels of resources over time and between the different pavement strategies, but it did not have a mechanism for the actual selection of the timing and location of specific treatments. The confluence of pavement engineering at the project level and the management problem at the network level results in what may best be termed as good engineering-management.

To some extent, the separation of pavement design and management into discrete elements was an artifact of the technology available in the 1980s and 1990s. Specifically, the data and analysis methods needed for a project level design system were too complex, computer intensive, and time consuming for application at the network level. With the evolution of technology, the pavement design and engineering-management system process may be viewed as a continuum that ranges from the greatest level of data detail needed for a research project to the greatest level of aggregation, which is suitable for programming decisions at the national level.

Extension of the continuum concept in the pavement design and engineering-management process is complex and difficult to fully understand by any individual; hence, engineers and managers face the conundrum of selecting the content and level of detail needed in a text about pavement management systems. For example, there is no intention to make this a pavement design textbook. On the other hand, knowledge of pavement design is necessary for understanding the broader pavement engineering-management process at both the project and network levels.

In many areas of the overall pavement engineering-management process, we have made arbitrary decisions as to the level of detail presented in both the original books of 1978 and 1994, and in this book. This is necessary as the subject is too extensive to be fully treated in one book. The intention is to provide a holistic treatment of the process, with sufficient information on the various related topics for understanding and using the PMS process.

When the original books were published in 1978 and 1994, there was a need for a comprehensive document about pavement management systems. Relatively limited resources were available to engineers, managers, and educators about pavement management. Few organizations were actively pursuing and implementing pavement management systems at that time. To expand knowledge, the Federal Highway Administration

sponsored a pavement management workshop for state highway agencies in Phoenix, Arizona, and Charlotte, North Carolina, in 1981. But in general, pavement management was not widely understood and embraced by administrators of highway agencies, the pavement engineering community, and academicians. In the intervening years there has been a plethora of publications about pavement management. There is now so much information (some good, some erroneous) about pavement management systems that it is difficult for a student or professional to know where to start and how to approach understanding, development, and use of pavement engineering-management systems.

This book is intended to present relevant current and new information needed for studying and applying pavement management systems.

Many people have contributed to this book. We have attempted to recognize as many as possible but will undoubtedly miss some, for which we apologize. Likewise, we have tried to condense or summarize some of the material as much as possible. Any resulting errors are the sole responsibility of the authors and not the contributors.

Recognition and special thanks are due to Dr. John Zaniwski who contributed in the early stages of this book including the outline and Sections of Part Two, but John was unable to join us as a co-author.

Special thanks are also due to Jan Zeybel and Shelley Bacik for their diligent and patient work on the many drafts of our manuscript. Thanks also to our Editor, Hank Zeybel, for his strong editorial work to produce a copy edited final draft, and to our publisher Phil Carmical of Scrivener with whom we were fortunate to be able to work in Austin, Texas.

Technical material has been contributed by Roger Smith and his team, and by Alan Kercher, Katie Zimmerman, Steve Seeds, Maggie Covault, Mike McNerney, Charles Pilson, Eric Perrone, Stuart Hudson and his team. Their contributions are very much appreciated.

Thanks are also due to the many hundreds of persons who have contributed to the advancement of PMS through development, use, implementation, and research over the last half century. Many are referenced in the book. We regret the inadvertent admission of any others.

Ralph Haas

W. Ronald Hudson

Lynne Cowe Falls

Contents

Preface	xix
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Part One: The Evolution of Pavement Management

1 Introduction	3
2 Birth and Teen Years of Pavement Management (1967–1987)	5
2.1 Network Level PMS	8
2.2 The Impact of Lack of Understanding of Software Requirements	9
2.3 Lessons Learned from the Early Development Years	10
2.4 Basic Requirements for an Effective and Comprehensive PMS	11
3 Pavement Management Development from 2010	15
3.1 Data Aggregation and Sectioning	16
3.2 Private Investment	16
3.3 Parallel International Developments	17
3.4 Administrative and Public Awareness of PMS	17
3.5 Education	18
3.6 Improvements in Computers and Software Development	19
3.7 Other Compatible Management Systems	19
3.8 Expansion of PMS Concerns	20
4 Setting the Stage	21
References for Part One	23

Part Two: Data Requirements

5 Overview of Pavement Management Data Needs	27
5.1 Classes of Data Required	27
5.2 The Importance of Construction and Maintenance History Data	28

5.3	The Importance of Performance Related Pavement Evaluation	30
5.4	Objectivity and Consistency in Pavement Data Acquisition and Use	30
5.5	Combining Pavement Evaluation Measures	30
6	Inventory Data Needs	31
6.1	Purpose of Inventory Data	31
6.2	Types of Inventory Data	31
6.3	Selection and Referencing of Pavement Management Sections	32
6.4	Collecting and Processing Section and Network Data	33
6.5	Traffic and Truck Load Data	34
7	Characterizing Pavement Performance	35
7.1	The Serviceability-Performance Concept	35
7.2	Pavement Roughness	35
7.3	Equipment for Evaluating Roughness	36
7.4	Toward a Universal Roughness Standard	37
7.5	Calibration Needs and Procedures	39
7.6	Relating Roughness to Serviceability	45
7.7	Applications of Roughness Data	47
8	Evaluation of Pavement Structural Capacity	49
8.1	Basic Considerations	49
8.2	Nondestructive Measurement and Analysis	49
8.2.1	Deflection Measurements	50
8.2.2	Moving Measurement of Deflections	51
8.2.3	Ground Penetrating Radar	55
8.3	Destructive Structural Evaluation	58
8.4	Structural Capacity Index Concepts	58
8.5	Network versus Project Level Applications of Structural Capacity Evaluation	64
8.5.1	Staged Measurements	65
9	Evaluation of Pavement Surface Distress Condition Surveys	67
9.1	Purposes of Surface Distress Surveys	67
9.2	Manual Methods for Distress Surveys	67
9.3	Automated Survey Methods	69
9.4	Types of Distress	70

9.5	Examples of Distress Survey Procedures	70
9.5.1	PAVER™ Distress Surveys	70
9.5.2	FHWA Network Distress Collection Protocols	72
9.5.3	Cracking Measurements	74
9.6	Equipment for Distress Evaluation	74
9.6.1	Comparison of Vendor Performance	75
9.6.2	Synthesis of Pavement Distress Collection Techniques, 2004	76
9.7	Summary of Pavement Distress Scores Used by State DOTs	80
9.7.1	Rating Scales and Levels of Acceptability	82
9.8	Example Equipment: Fugro, Roadware-ARAN	83
9.9	Example Equipment: Service Provider-Pathway Services Inc.	85
9.10	Application of Distress Data	87
10	Evaluation of Pavement Safety	89
10.1	Major Safety Components	90
10.2	Skid Resistance Evaluation	90
10.3	Basic Concepts of Skid Resistance and the Importance of Pavement Texture	91
10.4	Methods of Measuring and Reporting Skid Resistance	93
10.4.1	Skid Measuring Equipment and Testing Protocols	94
10.5	Change of Skid Resistance with Time, Traffic, and Climate (Weather/Season)	95
10.6	Including Friction Management in a Pavement Management System	95
11	Combined Measures of Pavement Quality	103
11.1	Concept of Combined Measures	103
11.2	Examples of Combined Indexes	104
11.3	Developing Combined Indexes	105
11.3.1	Example Combined Index from Minnesota	105
12	Data Base Management	109
12.1	Introduction	109
12.2	Factors that Characterize the Present State of Data Base Management	109
12.3	Some Evolutionary Features of Data Base Management	111
12.4	Data Base Management Systems and Key Components	112
12.5	Advantages of Integrated Data Base Management Systems	114

12.6	Examples of Integrated Data Base Management	115
12.7	Success Factors for Effective Data Base Management	118
13	Communicating the Present Status of Pavement Networks	121
13.1	Introduction	121
13.2	Performance Measures	122
13.3	Performance Measurement and Strategic Level Pavement Management	123
13.4	Performance Measure Categories	124
13.5	Example Report on the State of a Road Network in Terms of International Roughness Index	131
13.6	Example Report on the State of a Road Network in Terms of Asset Value	133
13.7	Example Report on a State Timeline of "Good" Pavement	136
	References for Part Two	137
 Part Three: Determining Present and Future Needs and Priority Programing of Rehabilitation and Maintenance		
14	Establishing Criteria	147
14.1	Reasons for Establishing Criteria	147
14.2	Measures to which Criteria can be Applied	147
14.3	Factors Affecting Limits, and Some Examples	148
14.4	Effects of Changing Criteria	148
15	Prediction Models for Pavement Deterioration	151
15.1	Clarification of Performance and Deterioration Prediction	151
15.2	Parameters or Measures to be Predicted	152
15.2.1	Deterioration Prediction Model Approaches and Variables	152
15.3	Basic Types of Prediction Models and Examples	157
15.3.1	Performance Prediction Approach in the Mechanistic Empirical Pavement Design Guide (MEPDG)	158
16	Determining Needs	159

17 Rehabilitation and Maintenance Alternatives	161
17.1 Identification of Alternatives	161
17.1.1 Pavement Preservation	162
17.1.2 Examples of Combined Rehabilitation and Preventive/Preservation Treatment Alternatives at the Network Level	163
17.2 Decision Processes and Expert Systems Approaches to Identifying Feasible Alternative	163
17.3 Deterioration Modeling of Rehabilitation and Maintenance Alternatives	169
17.4 Costs, Benefits, and Cost-Effectiveness Calculations	169
18 Priority Programing of Rehabilitation and Maintenance	171
18.1 Basic Approaches to Establishing Alternatives and Policies	171
18.2 Selecting a Length of Program Period	172
18.3 Basic Functions of Priority Programming	172
18.4 Priority Programing Methods	173
18.4.1 Mathematical Programming for Optimization Method	173
18.4.2 Genetic Algorithms and Evolutionary Algorithms as an Optimization Tool	174
18.4.3 Neural Networks as an Optimization Tool	175
18.5 Examples and Comparisons	175
18.6 Budget Level Evaluation and Specific Standards	175
18.7 Final Program Selection	176
19 Developing Combined Programs of Maintenance and Rehabilitation	177
19.1 Example Results of a Combined Program	179
19.1.1 Example Results of a Combined Program Using the World Bank's HDM-4 Model	179
19.2 Summary	179
References for Part Three	183

Part Four: Structural Design and Economic Analysis: Project Level

20 A Framework for Pavement Design	187
20.1 Introduction	187
20.2 Focus on the MEPDG	188

20.3	Basic Structural Response Models	189
20.4	Characterization of Design Inputs	190
20.4.1	Materials Inputs	193
20.4.2	Traffic Load Inputs	193
20.4.3	Environmental Inputs	194
20.4.4	Interactions	194
20.5	Variability, Reliability and Risk in Pavement Management	195
20.5.1	Variance in Pavement Design	195
20.5.2	Formulation of Pavement Reliability	195
20.5.3	Reliability Concept in the MEPDG	196
20.6	Generating Alternative Design Strategies	197
20.6.1	Generating Structural Design and Overlay Alternatives Example	197
20.6.2	Materials Alternatives	197
20.6.3	Construction and Maintenance Policy Alternatives	197
20.6.4	Pavement Evaluation	198
20.6.5	Alternative Designs in the MEPDG	199
21	The MEPDG Process for Pavement Design	201
21.1	Introduction	201
21.2	Calibration Issues	203
21.3	MEPDG Software	204
21.4	Levels of Use in the MEPDG	205
21.5	Good Design is Not Enough - Life Cycle Pavement Management is Also Needed	206
21.6	Summary of the MEPDG for Flexible Pavements	206
21.6.1	Basic Mechanistic Principles	206
21.6.2	Design Inputs in MEPDG	207
21.6.3	Traffic Inputs for MEPDG	207
21.6.4	Climate Inputs	208
21.6.5	Pavement Performance	208
21.6.6	Problems Observed in Implementing MEPDG in State DOTs	209
22	The MEPDG for Design of New and Reconstructed Rigid Pavements	211
22.1	Introduction	211
22.2	Overview of the Design Process	212
22.3	Processing of Inputs for the Design Analysis	214
22.4	Structural Response Models	214

23 Rehabilitation of Existing Pavements	217
23.1 Introduction	217
23.2 MEPDG Suggested Evaluation Data for Pavement Rehabilitation	218
23.3 MEPDG Rehabilitation Design with HMA	219
23.4 MEPDG Rehabilitation Design with PCC	221
23.5 Concrete Pavement Restoration (CPR) of JPCP	222
23.6 Models, Algorithms, and Transfer Functions of the MEPDG	225
23.7 Quality of Calibration Data and Factor Adjustments	225
23.8 AASHTO Manual of Practices	227
24 MEPDG in Practice	229
24.1 Use of the Guide in Pavement Management	229
24.2 MEPDG Offers a Roadmap to Improvement	230
24.3 MEPDG Research Team's Perspective on Guide Improvements	230
24.4 Practical Experience with MEPDG Flexible Pavement Models	232
24.5 Use of MEPDG for Rehabilitation and Overlay Design	233
24.6 Mechanistic-Empirical Pavement Design Software	234
24.7 Summary	234
25 Economic Evaluation of Alternative Pavement Design Strategies and Selection of an Optimal Strategy	237
25.1 Introduction	237
25.2 Consideration of Environmental Costs in Selecting Alternative Strategies	238
25.3 Weighing Costs versus Environmental Benefits	238
25.4 Unique and/or Unpredictable Cost Factors	239
25.5 User Costs	240
25.6 Selection of an Optimal Strategy	240
25.7 Summary	241
References for Part Four	242

Part Five: Implementation of Pavement Management Systems

26 Steps and Key Components of Implementation	249
26.1 Recognize Need for Change	250
26.2 User Interface Design/User Experience Design	250

26.3	Education/Training	252
26.4	Staffing	252
26.5	Agency Input	253
26.6	Training in Software Use	253
27	Role of Construction	255
27.1	Construction Linked to Planning and Programming	256
27.2	Construction Linked to Project Level Design and Expected Life Cycle Performance	256
27.3	Construction Linked with Maintenance and Evaluation	256
27.4	Information Flows from and to Construction	257
27.5	Role of Construction in Public-Private Partnerships (PPP's)	257
28	Role of Maintenance	259
28.1	Maintenance Linked to Other Phases of Pavement Management	260
28.2	Pavement Preservation in Maintenance	260
28.2.1	The National Center for Pavement Preservation (NCPPI)	264
28.3	Maintenance Management Systems Related to PMS	265
29	Research Management	267
29.1	Some Key Elements of Research Management	268
29.2	Issues and Examples	269
	References for Part Five	271
 Part Six: Examples of Working Systems		
30	Basic Features of Working Systems	275
31	Network Level Examples of Pavement Management	279
31.1	Review of COTS PMS Vendors	281
31.2	Vendor Background	284
31.3	Guidelines to Available PMS Software	285
31.4	Evaluation of Available Information on Leading PMS Providers	289
31.4.1	Stantec	289
31.4.2	AgileAssets Inc	290
31.4.3	Information from AgileAssets' Clients	290

31.4.4	Deighton Associates Limited Software, dTIMS-base CT	291
31.4.5	Information from Deighton Clients	293
31.5	Summary	294
32	Project Level Examples of PMS Software	295
33	HDM-4 the Upgraded World Bank Model	297
33.1	HDM-4 Applications	299
33.1.1	Functions of HDM-4 within the Management Cycle	299
33.1.2	HDM Systems Structure	300
33.1.3	Program Analysis	301
33.1.4	Project Analysis	302
33.2	Summary	302
34	City and County Pavement Management Systems	305
34.1	Lisbon, Portugal	307
34.2	City of San Antonio, Texas	307
34.3	Metro Nashville PMS Selection Process	309
34.4	Pavement Management in Johannesburg, South Africa	309
34.5	City of Henderson, Nevada	311
34.6	GIS Based Pavement Management System—Fountain Hills Arizona	312
35	Airport Pavement Management	313
35.1	PAVER and MicroPAVER	313
35.1.1	Airport Pavement Inventory	314
35.1.2	Airport Pavement Inspection	315
35.1.3	Performance Modeling and Condition Analysis	315
35.1.4	Airport Pavement Work Planning	315
35.2	USDOT Federal Aviation Administration Support and Use of PMS	316
35.2.1	Detailed Pavement Management Applications	316
35.2.2	Implementation of GAPEMS at Denver International Airport	317
35.2.3	Appraisal of other Airport Pavement Management Systems	318
35.2.4	Application of GIS/GPS in Shanghai Airport Pavement Management System	318
35.3	Arizona Airports Pavement Management System	318

35.4	Washington State Airport Pavement Management System	319
35.5	Summary	320
	References for Part Six	321

Part Seven: Looking Ahead

36	Analyzing Special Problems	327
36.1	Calibration of Pavement Design Methods	327
36.2	Superpave Evaluation	328
36.3	Warm Mix Asphalts	328
36.4	Corridor Analysis	329
36.5	Improved Pavement Performance Models	329
36.6	Geographic Areas of Heavy Damage	330
36.7	Analysis of Heavy Load Corridors	331
36.8	Summary	331
37	Applications of Expert Systems Technology	333
38	New and Emerging Technologies	335
38.1	Predicted Advances in PMS	335
38.2	Geographic Information Systems (GIS)	335
38.3	New Software, Hardware, Data Bases, and Personal Computers	336
38.3.1	Computer Hardware	336
38.3.2	Personal Computers	336
38.4	New Measurement Technologies	336
38.4.1	Integrated Survey Vehicle	336
38.4.2	High Speed Structural Evaluation	337
38.4.3	Direct Imaging and Analysis Techniques	338
38.4.4	Automated Testing Procedures	338
38.4.5	Interface with Other Systems	338
38.4.6	Nanotechnology	338
38.5	Summary	339
39	Institutional Issues and Barriers Related to Pavement Management Implementation	341
39.1	Introduction	341
39.2	Summary	343