

Guide for the Local Calibration of the Mechanistic-Empirical Pavement Design Guide

November 2010

Total Fatigue Cracking

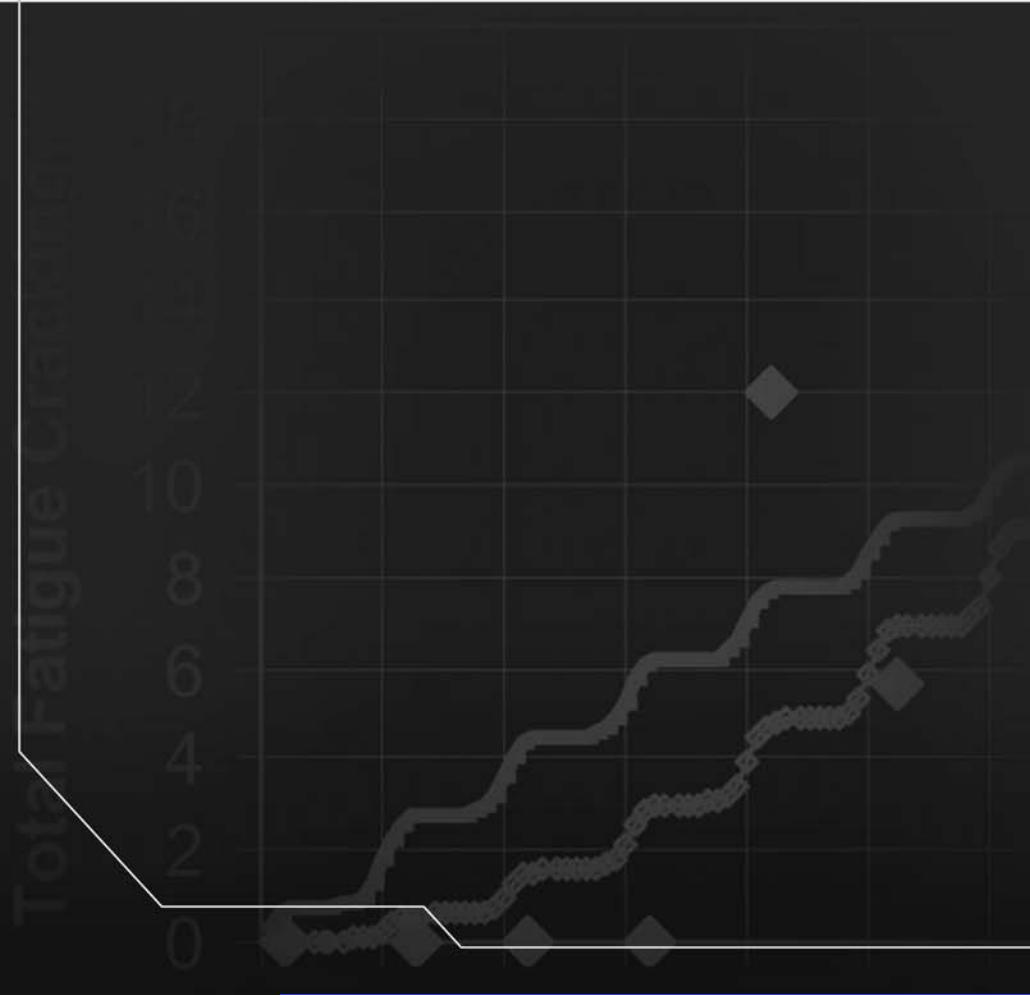


This is a preview. Click here to purchase the full publication.



Guide for the Local Calibration of the Mechanistic-Empirical Pavement Design Guide

November 2010



This is a preview. Click [here](#) to purchase the full publication.

© 2010, by the American Association of State Highway and Transportation Officials. All rights reserved. This book, or parts thereof, may not be reproduced in any form without written permission of the publisher. Printed in the United States of America.

Publication Code: LCG-1
ISBN: 978-1-56051-449-7

This is a preview. Click [here](#) to purchase the full publication.

American Association of State Highway and Transportation Officials

Executive Committee 2009/2010

President: Larry L. "Butch" Brown, Sr., Mississippi
Vice President: Susan Martinovich, Nevada
Secretary-Treasurer: Carlos Braceras, Utah

REGIONAL REPRESENTATIVES

REGION I

Joseph Marie, Connecticut, One-Year Term
Gabe Klein, District of Columbia, Two-Year Term

REGION II

Dan Flowers, Arkansas, One-Year Term
Mike Hancock, Kentucky, Two-Year Term

REGION III

Nancy J. Richardson, Iowa, One-Year Term
Thomas K. Sorel, Minnesota, Two-Year Term

REGION IV

Paula Hammond, Washington, One-Year Term
Amadeo Saenz, Jr., Texas, Two-Year Term

NON-VOTING MEMBERS

Immediate Past President: Allen Biehler, Pennsylvania
AASHTO Executive Director: John Horsley, Washington, DC

Joint Technical Committee on Pavements

2008/2009

Chair: David Nichols, Missouri
Vice Chair: Judith Corley-Lay, North Carolina
Secretary: Pete Stephanos, FHWA

REGION I

Delaware

Robin Davis (Design)

Maryland

Tim Smith (Materials)

New York

Wes Yang (Design)

Vacant (Design)

Vacant Design

REGION II

Alabama

Larry Lockett (Materials)

Arkansas

Phillip McConnell (Design)

Louisiana

Jeff Lambert (Design)

North Carolina

Judith Corley-Lay (Vice Chair)

South Carolina

Andy Johnson (Design)

Kentucky

Paul Looney (Design)

REGION III

Kansas

Andy Gisi (Design)

Minnesota

Curt Turgeon (Materials)

Missouri

Jay F. Bledsoe (Design)

Missouri

David Nichols (Chair)

Ohio

Aric Morse (Design)

Iowa

Chris Brakke (Design)

REGION IV

California

Bill Farnbach (Design)

Colorado

Richard Zamora (Design)

Oklahoma

Jeff Dean (Design)

Wyoming

Rick Harvey (Materials)

Vacant (Design)

Preface

This guide is to provide guidance to calibrate the *Mechanistic-Empirical Pavement Design Guide* (MEPDG) software to local conditions, policies, and materials and to conduct the local calibration process. The guide does not provide guidance for determining the inputs and running the MEPDG software. A separate document, the *Mechanistic-Empirical Pavement Design Guide—A Manual of Practice*, provides guidance for using the MEPDG software to analyze and design new pavements and rehabilitation strategies. The *Manual of Practice* is referenced throughout this guide.

Version 1.0 of the MEPDG software is currently available. It should be noted that version 2.0 of the MEPDG software is in the process of being developed. Version 2.0 may include different transfer functions for selected distresses based on the results and recommendations from other on-going NCHRP projects. If any of the transfer functions are revised, the *Guide for Local Calibration* and the *Mechanistic-Empirical Pavement Design Guide—A Manual of Practice* for the MEPDG software may need to be revised accordingly.

This is a preview. Click [here](#) to purchase the full publication.

Table of Contents

1.0 INTRODUCTION	1-1
2.0 TERMINOLOGY AND DEFINITION OF TERMS	2-1
2.1 Statistical Terms	2-1
2.2 MEPDG Calibration Terms	2-3
2.3 Hierarchical Input Level Terms	2-3
2.4 Distress or Performance Indicator Terms	2-4
3.0 SIGNIFICANCE AND USE	3-1
4.0 DEFINING ACCURACY OF MEPDG PREDICTION MODELS	4-1
4.1 Calibration	4-1
4.2 Validation	4-3
4.3 General Approach to Local Calibration-Validation	4-4
4.3.1 Traditional Approach—Split-Sample	4-4
4.3.2 Jack-knife Testing—An Experimental Approach to Refine Model Validation	4-4
5.0 COMPONENTS OF THE STANDARD ERROR OF THE ESTIMATE	5-1
5.1 Distress/IRI Measurement Error	5-2
5.2 Estimated Input Error	5-3
5.3 Model or Lack-of-Fit Error	5-3
5.4 Pure Error	5-3
6.0 STEP-BY-STEP PROCEDURE FOR LOCAL CALIBRATION	6-1
7.0 REFERENCED DOCUMENTS AND STANDARDS.....	7-1
7.1 Referenced Documents	7-1
7.2 Test Protocols and Standards	7-1
APPENDIX: EXAMPLES AND DEMONSTRATIONS FOR LOCAL CALIBRATION	A-1
A1. Background	A-1
A2. New Flexible Pavements and Rehabilitation of Flexible Pavements	A-2
A2.1 Demonstration 1—PMS Data and Local Calibration	A-2
A2.1.1 Description of PMS Segments	A-2
A2.1.2 Step-by-Step Procedure	A-2
A2.2 Demonstration 2—LTPP Data and Local Calibration	A-34
A2.2.1 Description of LTPP Test Sections Used in Demonstration.....	A-34
A2.2.2 Step-by-Step Procedure	A-35
A2.3. Summary for Local/Regional Calibration Values	A-62
A2.3.1 Comparison of Results: PMS Segments and LTPP SPS Test Sections	A-62
A2.3.1.1 Alligator (Fatigue) Cracking Transfer Function	A-63
A2.3.1.2 Rut Depth Transfer Function	A-64
A2.3.1.3 Thermal Cracking Transfer Function	A-65
A2.3.1.4 IRI Regression Model	A-66
A2.3.2 Application of Results from Local Calibration Process for Pavement Design	A-66

This is a preview. Click here to purchase the full publication.

A2.4 Attachments.....	A-68
A2.4.A Attachment A—Description of PMS Segments	A-68
A2.4.A.1 HMA Full-Depth New Construction/Reconstruction Projects	A-68
A2.4.A.2 HMA Overlay of Flexible Pavement Projects.....	A-72
A2.4.B Attachment B—Plots of Time-History Performance Data	A-73
A2.4.B.1 Full-Depth HMA, New Construction	A-74
A2.4.B.2 HMA Overlays of Flexible Pavements, Rehabilitation	A-80
A2.4.C Attachment C—Description of LTPP Projects	A-84
A2.4.C.1 Full-Depth and Conventional New Construction—LTPP SPS-1 Projects.....	A-84
A2.4.C.2 HMA Overlays of Flexible Pavement—LTPP SPS-5 Projects	A-85
A2.4.D Attachment D—Plots of Time-History Performance Data for the LTPP SPS Projects	A-86
A2.4.D.1 Full-Depth and Conventional HMA, New Construction	A-86
A2.4.D.2 HMA Overlays of Flexible Pavements, Rehabilitation.....	A-90
A3. New Rigid Pavements—Jointed Plain Concrete Pavements.....	A-94
A3.1 Demonstration 3—LTPP and PMS Data and Local Calibration.....	A-94
A3.1.1 Description of LTPP And PMS Segments.....	A-94
A3.1.2 Step-by-Step Procedure.....	A-94
A3.2 Attachments.....	A-117
A3.2.A Attachment A—Description of MODOT LTPP and PMS JPCP Segments	A-117
A3.2.A.1 Design (Analysis) Life	A-117
A3.2.A.2 Analysis Parameters	A-118
A3.2.A.3 Traffic	A-119
A3.2.A.4 Climate	A-124
A3.2.A.5 Pavement Surface Layer Thermal Properties	A-124
A3.2.A.6 Design Features for JPCP Sections	A-124
A3.2.A.7 Pavement Structure Definition	A-126
A3.2.B Attachment B—Plots of Time-History Performance Data	A-126

List of Figures

Figure 1-1.	Conceptual Flow Chart of the Three-Stage Design/Analysis Process for the MEPDG.....	1-2
Figure 6-1.	Flow Chart of the Procedure and Steps Suggested for Local Calibration; Steps 1 Through 5.....	6-2
Figure 6-2.	Flow Chart of the Procedure and Steps Suggested for Local Calibration; Steps 6 Through 11	6-3
Figure A2-1.	General Location of the Roadway Segments Selected for Demonstrating the Local Validation-Calibration Process Using Kansas PMS Data	A-8
Figure A2-2.	Comparison of Predicted and Measured Rut Depths Using the Global Calibration Values and Local Calibration Values of Unity	A-16
Figure A2-3.	Comparison of Predicted and Measured Fatigue Cracking Using the Global Calibration Values and Local Calibration Values of Unity.....	A-17
Figure A2-4.	Comparison of Predicted Thermal Cracking and Measured Transverse Cracking Using the Global Calibration Values and a Local Calibration Value of Unity.....	A-17
Figure A2-5.	Comparison of Predicted and Measured IRI Using the Global Calibration Values and Local Calibration Values of Unity	A-18
Figure A2-6.	Comparison of the Intercept and Slope Estimators to the Line of Equality for the Predicted and Measured Rut Depths Using the Global Calibration Values	A-19
Figure A2-7.	Comparison of the Intercept and Slope Estimators to the Line of Equality for the Predicted and Measured IRI Using the Global Calibration Values	A-20
Figure A2-8.	Comparison of Predicted and Measured Rut Depths Using the Subgrade and HMA Local Calibration Values for the PMS Segments ..	A-26
Figure A2-9.	Comparison of Measured and Predicted Values of Fatigue Cracking Using Different Value for the C_2 and β_{f1} Parameters for PMS Segments FDAC-C-3 and FDAC-S-4	A-27
Figure A2-10.	Comparison of Predicted and Measured Fatigue Cracking Using the Local Calibration Values for the PMS Segments.....	A-28
Figure A2-11.	Comparison of Predicted Thermal Cracking and Measured Transverse Cracking Using the Local Calibration Value for the PMS Segments.....	A-30
Figure A2-12.	Comparison of Predicted and Measured IRI Values Using the Global Calibration Values	A-31
Figure A2-13.	Comparison of the Standard Error of the Estimate for the Global-Calibrated and Local-Calibrated Transfer Function	A-32
Figure A2-14.	Rut Depths Measured Over Time for the Kansas SPS-1 Project	A-38