Update on the M-E Pavement Design Guide

Southeastern States
Pavement Management and Design Conference

May 8, 2006

Goals:

- Prepare an interim M-E pavement design guide for possible JTCP adoption.
- Advance the guide and software to a routine-use AASHTO product.

Key Work Elements:

- Independent review of the design guide and software (1-40A, 95% completed)
- Guidance for local and regional calibration (1-40B, in progress).
- Verification and local recalibration of HMA and PCC performance models (1-40B, completed)

Key Tasks:

- Version 0.9 (Stage I) of the M-E Pavement Design Software (1-40D, completed)
- Version 0.9 (Stage II) of the M-E Pavement Design Software (1-40D, in progress-Fall 2006).

Key Tasks:

- Support Lead States Activities (1-40J).

- Assess reasonability, soundness, completeness of concepts, process, and procedures.
- Appraise consistency and sensitivity of results.
- Evaluate design reliability methodology.
- Compare predicted performance to historical results.

- **Flexible design**: Marshall Thompson.
- **Rigid design**: Ernest Barenberg.
- **Reliability, composite pavement design, and final summary report**: Stephen Brown.
- **Low-volume road design**: Lynne Irwin.

Milestones:

- December 2005: panel review of draft reports completed.
- March 2006: draft low-volume road design and 1-40A summary reports.
- April 2006: project panel decision on report publication—Summarize in Research Digests.
Project 1-40B: Local Calibration Guidance for the Recommended Mechanistic-Empirical Pavement Design Guide and Software

- Verify initial calibration error with independent data sets – PCC and HMA pavements.
- Local calibration of global prediction equation to reduce residual error and bias – HMA pavements.
- Prepare guidance for highway agencies for local calibration of the prediction models.
- Draft AASHTO recommended practice and case studies.
1-40B Findings: JPCP

- **JPCP faulting model:**
  - Under predicts faulting (bias).
  - Reasonable $R^2$ and SEE.

- **JPCP cracking model:**
  - Low $R^2$. SEE is moderate.
  - Model predictions not biased (except MnRoad way over prediction of cracking).

- **JPCP IRI model:**
  - Reasonable $R^2$ and SEE, no bias.
1-40B Findings: CRCP

- CRCP crack spacing model:
  - Slightly under predicts for VA sections.

- CRCP crack width model:
  - Appears reasonable for VA sections.

- CRCP punchout model:
  - Predicts adequately with low error and no bias

- CRCP IRI model:
  - Somewhat under predicts. Prediction error is low.
1-40B PCC Recommendations

- Correct JPCP faulting model bias through local/regional recalibration.

- Slab cracking: Review thermal stress computation algorithms related to JPCP cracking. Fix potential anomalies and recalibrate cracking model as needed.
1-40B PCC Recommendations

- Review CRCP crack spacing model. Fix potential anomalies and recalibrate punchout model as needed.

- Recalibrate CRCP IRI model after including transverse cracking as an input.
HMA Rut Depth Predictions Using Local Calibration

![Graph showing HMA Rut Depth Predictions](image-url)

- **Test Tracks**
- **ALF - Simulated**
- **Roadway Sections**
## Overall Summary – HMA Rutting

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<tr>
<th>Facility</th>
<th>R-squared</th>
<th>Standard Error</th>
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<td>Full-Scale Test</td>
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<tr>
<td>Roadway Sections</td>
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Total Rut Depth: Predictions in Unbound Materials

- Verification runs confined to sections with trenches to quantify the measurable rutting within each pavement layer and foundation.
- Finding – program over predicts the rutting in unbound layers.
- No simple method to revise predictions – thus, local calibration confined to HMA.
Project 1-40D: Produce Software
Version 0.9


VERSION 0.8, November 2005

➤ Extensive corrections and upgrades.
➤ 9-year weather files.
➤ Available online at www.trb.org/mepdg/.
**Project 1-40D: Produce Software**

**Version 0.9**

V. 0.9, STAGE 1: ~ Spring 2006

- All performance models recalibrated with LTPP data through 2004.
- Improved CRCP and HMA thermal cracking models.
- Improved ICM with better moisture content and soil saturation predictions for unbound layers and subgrade.
Project 1-40D: M-EPDG Software Version 0.9

- Special axle configuration module added.
- Improved Level 3 default values for unbound layers.
- Layer “discontinuity” problems in flexible pavement design resolved.
- Nodal spacing reduced and mesh fineness increased in rigid pavement design.
V. 0.9, STAGE 2: ~ Fall 2006

- User-defined transfer functions.
- Option for modified calibration coefficients from 1-40B.
- Data-transfer interface with TrafLoad program.
- Output and display of selected structural response (intermediate stresses, strains).
9-30A: Rutting Performance Model for HMA Mix and Structural Design

- Performance models workshop (Dec 2005).
- Sample and test HMA materials from 30-40 field sections per M-E PDG Level 1.
- Verify and recalibrate M-E PDG rutting distress model with measured data.
- Support M-E Distress Prediction Models (M-E_DPM) database.

(ARA, Inc., completion November 2008)
M-E Pavement Design Guide Workshop

- Fall 2006
- Invited Participants ≈ 100
- Travel Support—One Person for Each AASHTO Member Agency
- September 2006
- Location: Chicago, IL
- Version 0.90 Stage II Software
Thanks!

Any Questions?