Update on the M-E Pavement Design Guide

Southeastern States

Pavement Management and Design Conference

May 8, 2006

Project 1-40: Facilitating the Implementation of the M-E Pavement Design Guide

Goals:

- Prepare an interim M-E pavement design guide for possible JTCP adoption.

- Advance the guide and software to a routine-use AASHTO product.

Project 1-40: Facilitating the Implementation of the M-E Pavement Design Guide

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)

Project 1-40: Facilitating the Implementation of the M-E Pavement Design Guide

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).
- Version 1.0 of the M-E Design Guide Software (1-40E, JTCP; FY 2007).

Project 1-40: Facilitating the Implementation of the M-E Pavement Design Guide

Key Tasks:

- Practical Guide to M-E Pavement Design and Recommended Manual of Practice (1-40H, FY 2007—Other Funding Options).
- Support Lead States Activities (1-40J).
- Workshop on M-E Pavement Design Guide (1-40J)—September 2006

Project 1-40A: Independent Review of the Recommended Mechanistic-Empirical Pavement Design Guide and Software

- 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.

Project 1-40A: Independent Review of the Recommended Mechanistic-Empirical Pavement Design Guide and Software

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

Project 1-40A: Independent Review of the Recommended Mechanistic-Empirical Pavement Design Guide and Software

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.

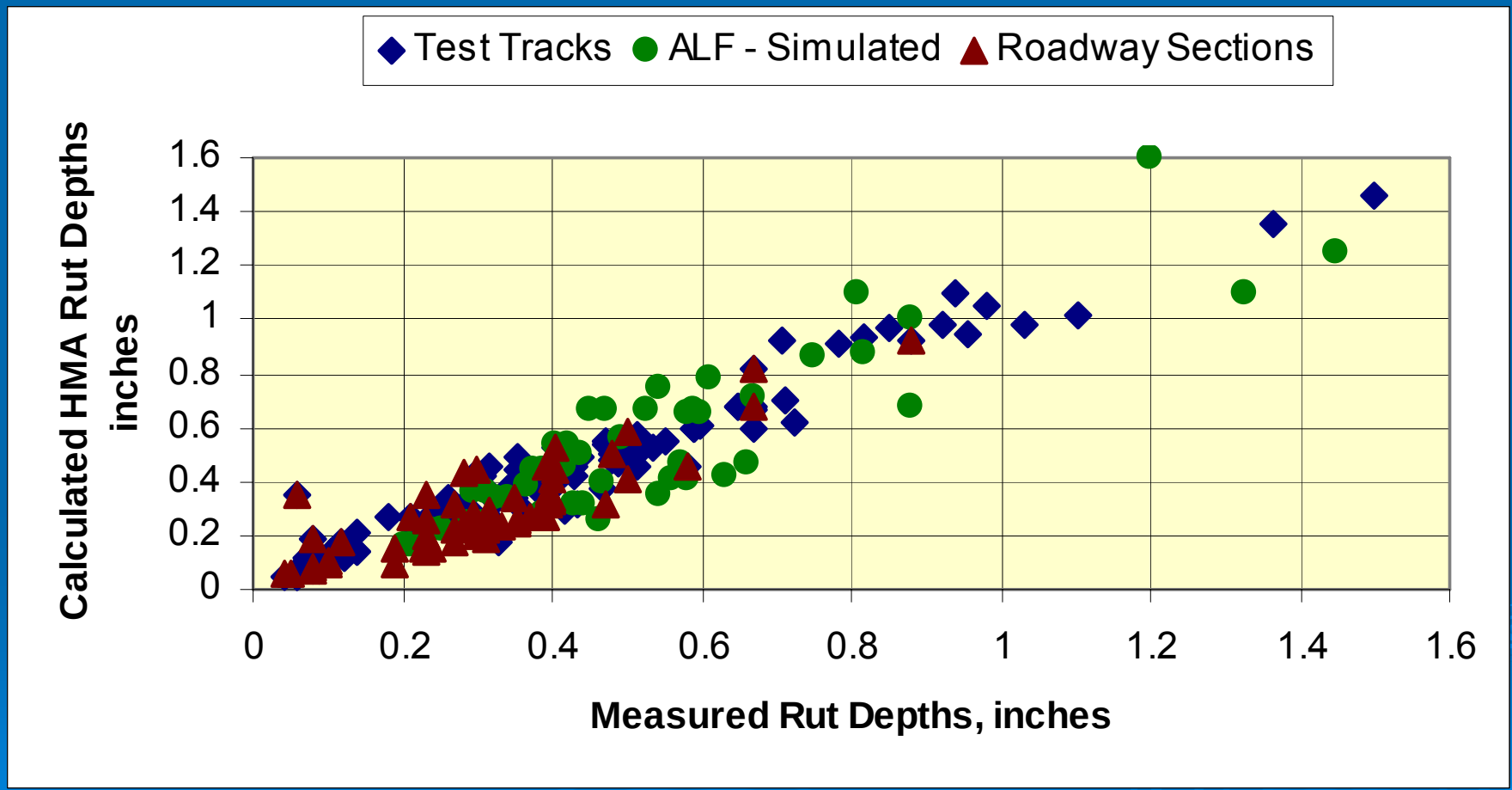
1-40B PCC Recommendations

- 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



Overall Summary – HMA Rutting

Facility	R-squared		Standard Error	
	9-30	1-40B	9-30	1-40B
Full-Scale Test Tracks	0.47	0.85	0.158	0.0319
ALF Sections		0.81		0.0420
Roadway Sections		0.76		0.0741

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

Applied Research Associates and Arizona State University—Demonstrated Today!

VERSION 0.8, November 2005

- Extensive corrections and upgrades.
- 9-year weather files.
- Available online at www.trb.org/mepdg/.
- Bug reporting and tracking database at www.aratracker.com.

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.

Project 1-40D: M-EPDG Software Version 0.9

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?