The Asphalt Pavement Alliance Presents:

A Five-Part Webinar Series On Mechanistic Empirical Pavement Design Guide (MEPDG) Implementation Specific to Asphalt Pavements

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- **Today's Webinar: Part-2**
  - Local Calibration
- **Speaker:**
  - Kevin Hall, PhD., P.E.
  - Professor and Head of the Department of Civil Engineering at the University of Arkansas
- **Moderator:**
  - Mike Kvach, APA

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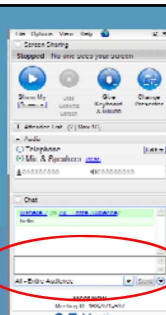
Webinar Protocol:



- **Audio Quality**
  - Headset Recommended
  - External Speakers May Cause an Echo / Feedback
- **Questions & Answers**
  - Chat Box – Make sure to change the drop-down menu to "Organizer Only"
- **Recorded Webinars**
  - www.asphaltfacts.com/webinars/
  - Click on: "Five-Part Series on MEPDG Implementation Specific to Asphalt Pavements"

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The Asphalt Pavement Alliance Presents:

A Five-Part Webinar Series On Mechanistic Empirical Pavement Design Guide (MEPDG) Implementation Specific to Asphalt Pavements

Part 1: Pavement Design, Where We've Come From and What We're Trying to Accomplish

Part 2: Local Calibration

Part 3: Individual Distress Models

Part 4: Major Inputs – Where Do They Come From & How Do We Get Them?

Part 5: Moving Beyond Data Input (Advanced)

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Part 2:
Local Calibration

- **Speaker:**

  Kevin Hall, PhD., P.E.
  Professor and Head of the Department of Civil Engineering at the University of Arkansas

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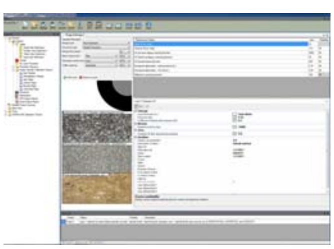
Local Calibration of Pavement-ME™



Kevin D. Hall, Ph.D., P.E.
Professor and Head, Dept. of Civil Engineering
21st Century Leadership Chair in Civil Engineering

Dave Newcomb, Ph.D., P.E.
Senior Research Engineer
TTI / Texas A&M University

Pavement-ME™ Webinar Series
Presentation #2
Asphalt Pavement Alliance
September 5, 2013

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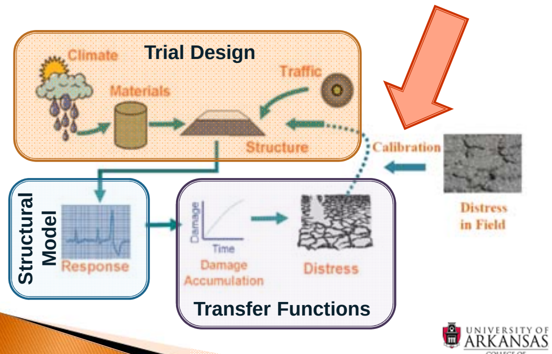
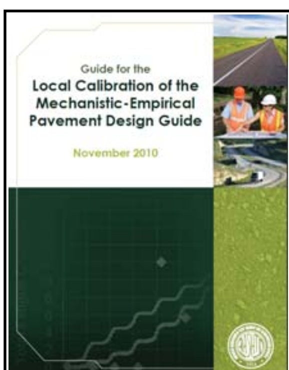
M-E Design Concept



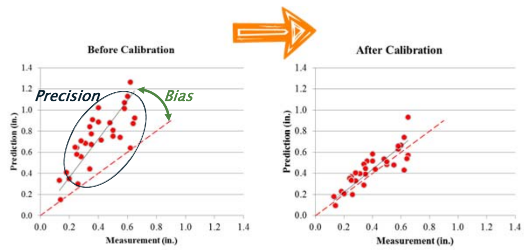


"The calibration and validation of the performance prediction model is a ***mandatory step****…to establish confidence in the design and analysis procedure and facilitate its acceptance and use."*

Calibration*:* the mathematical process through which total (residual) error – the difference between observed and predicted values of distress – is minimized.

Validation*:* the process to confirm that the calibrated model can produce robust and accurate predictions for cases other than those used for model calibration.

Calibration Concept



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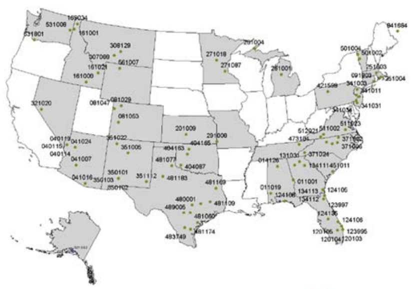
National Calibration of the MEPDG

Primarily LTPP; some WesTrack and MnRoad



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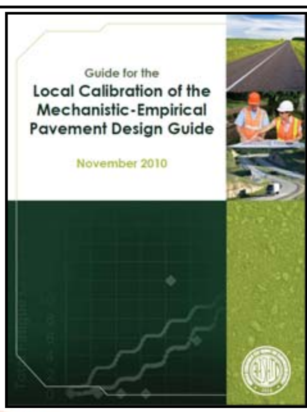

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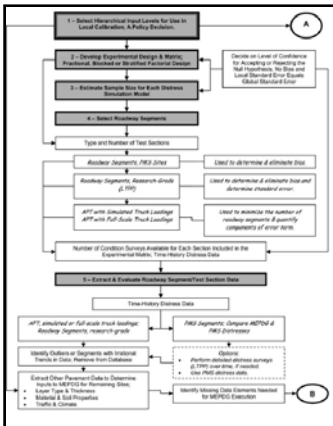

Figure 6-1. Flow Chart of the Procedure and Steps Suggested for Local Calibration; Steps 1 Through 5

1. Select Hierarchical Input Level for Each Input Parameter
2. Develop Experimental Design and Matrix
3. Estimate Sample Size for Each Distress Model
4. Select Roadway Segments
5. Extract and Evaluate Roadway Segment/Test Section Data

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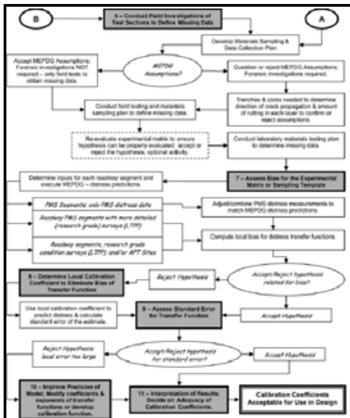

Figure 6-2. Flow Chart of the Procedure and Steps Suggested for Local Calibration; Steps 6 Through 11

6. Conduct Field Investigations of Test Sections to Define Missing Data
7. Assess Bias for the Experimental Matrix
8. Determine Local Calibration Coefficient to Eliminate Bias of Transfer Function
9. Assess Standard Error for Transfer Function
10. Improve Precision of Model: *modify coefficients and exponents of transfer functions*
11. Interpretation of Results: *decide on adequacy of calibration coefficients*

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Local Calibration: Items to Note
Selecting Calibration Sections

- Sample size (minimum)
  - Distortion (total rutting or faulting) — 20 roadway segments
  - Load-related cracking — 30 roadway segments
  - Non-load-related cracking — 26 roadway segments
  - Reflection cracking (HMA only) — 26 roadway segments
- Roadway Segment / Condition Surveys
  - At least 3 condition surveys available for a roadway segment
  - Condition surveys cover at least 10 years
  - Increased number of surveys for higher levels of distress
  - Range of distress magnitudes – minor to "close to" design criteria
  - Distress definitions/measurements consistent with MEPDG *(Data Collection Guide for Long Term Pavement Performance)*
- Use Existing Roadways *IF POSSIBLE*
  - If data unavailable, shift to new construction; begin monitoring plan

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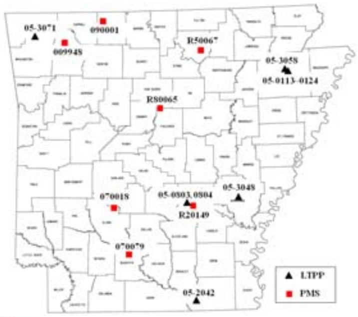
Arkansas Calibration



38 Sections

- 18 LTPP
- 20 PMS

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Arkansas Calibration

Base Type	HMA Thickness			No. of Sections
	Thin (<4")	Intermediate	Thick (>8")	
Unbound		0113,0114,0804, 070079G,070079A 07007P	R20149G,R20149P, 090001G,090001A 090001P,090048G, 090048A,090048P, 070018G,070018A 070018P	17
Asphalt Treated Base	0803	0115,0116,0117, 0118,0119,0120, 0121,0122,0123, 0124,80065G, R80065A,R80065P, R50067G,R50067A R50067P		17
Cement Treated Base		2042,3048,3058, 3071		4
Total Sections	1	26	11	38

Underlined sections randomly selected for validation;
"G" = good; "A" = average; "P" = poor;

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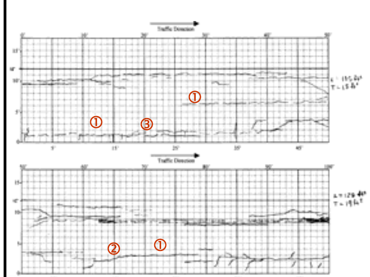
KEY: Good Data!



Manual Distress Surveys:

① what is a longitudinal crack?

② what is an alligator (fatigue) crack – especially in its early form?

③ do you KNOW what is under your pavement?

TRAFFIC!

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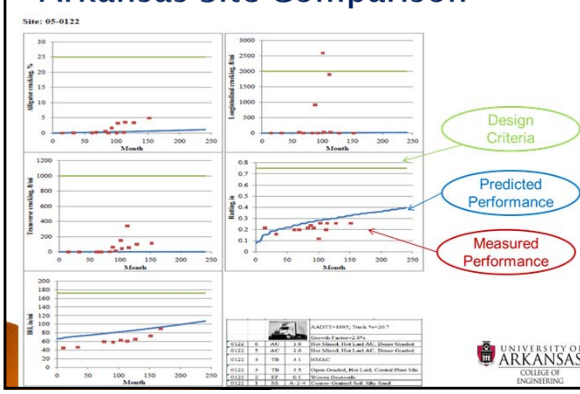
KEY: Good Data!

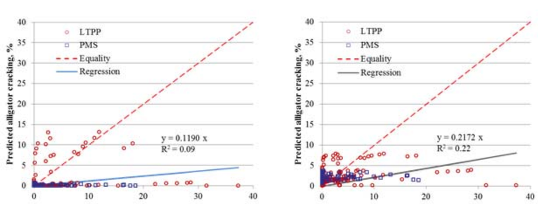
Where does this rutting occur?
-- asphalt surface only?
-- all asphalt layers?
-- base layers?
-- subgrade?
-- ALL?

How do you know???

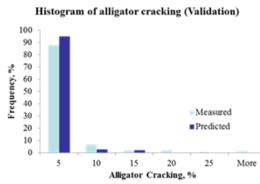
Arkansas Site Comparison

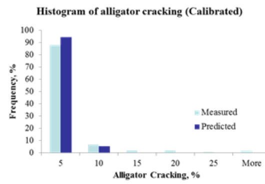


Arkansas: Alligator Cracking

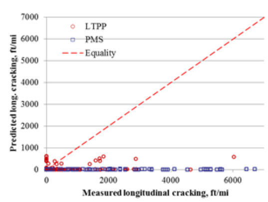


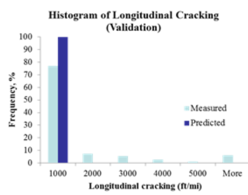
Arkansas: Alligator Cracking



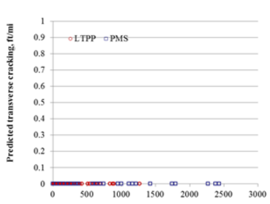


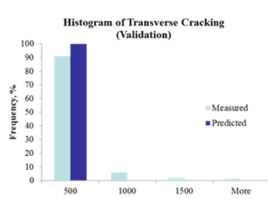
Arkansas: Longitudinal Cracking



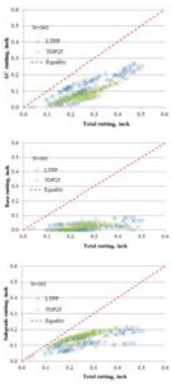


Arkansas: Transverse Cracking





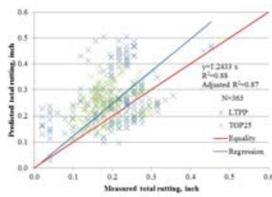
Arkansas: Rutting



AC ☑

BASE

SUBGRADE ☑



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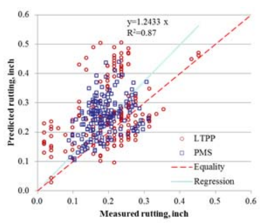
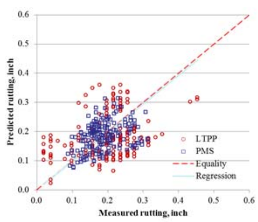
Arkansas: Total Rutting





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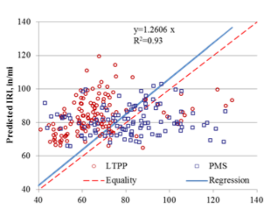
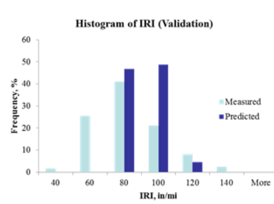
Arkansas: Smoothness (IRI)





MEPDG default Initial IRI: 63 in/mile
Arkansas initial IRI (LTPP and Top 25): 70 in/mile

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Local Calibration: Arkansas

No change (MEPDG (2011) and Pavement-ME™)

Calibration Factor	Default	MEPDG (2011)	Pavement-ME™
Alligator cracking			
C1	1.0	0.654	0.654
C2	1.0	0.263	0.263
C3	6000	6000	6000
AC rutting			
βr1	1.0	0.68	0.68
βr2	1.0	1.0	1.0
βr3	1.0	1.0	1.0
Base rutting			
βs1	1.0	1.0	1.0
Subgrade rutting			
βs2	1.0	0.85	0.85

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Case Study: Bella Vista Bypass, Bella Vista, Arkansas

General Specifications:

- Future 1-49 (interstate stds)
- 18.9 miles
- 4 – 12^{ft} lanes
- 60^{ft} depressed median
- 4^{ft} inside shoulders
- 10^{ft} outside shoulders
- Average elevation 1263^{ft} above sea level

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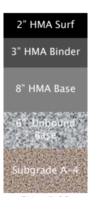
Case Study

Using Local Calibration

Distr Type	Distress @ Reliab Level		Reliability %		Pass or Fail
	Target	Pred	Target	Achiev	
Term IRI	172	155.5	90	96.45	Pass
Total Rut	0.75	0.61	90	99.8	Pass
Allig Crk %	25	3.22	90	100	Pass
Thrm Crk	1000	27.17	90	100	Pass
Top Down	2000	285.8	90	100	Pass
AC Rut	0.25	0.24	90	92.96	Pass



SN = 5.92

Using National Calibration

Distr Type	Distress @ Reliab Level		Reliability %		Pass or Fail
	Target	Pred	Target	Achiev	
Term IRI	172	159.6	90	95.23	Pass
Total Rut	0.75	0.72	90	93.92	Pass
Allig Crk %	25	1.47	90	100	Pass
Thrm Crk	1000	27.17	90	100	Pass
Top Down	2000	270.9	90	100	Pass
AC Rut	0.25	0.32	90	64.21	FAIL

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Let’s take a quick peek at
PvD
AASHTOWare
Pavement
ME Design
AASHTO
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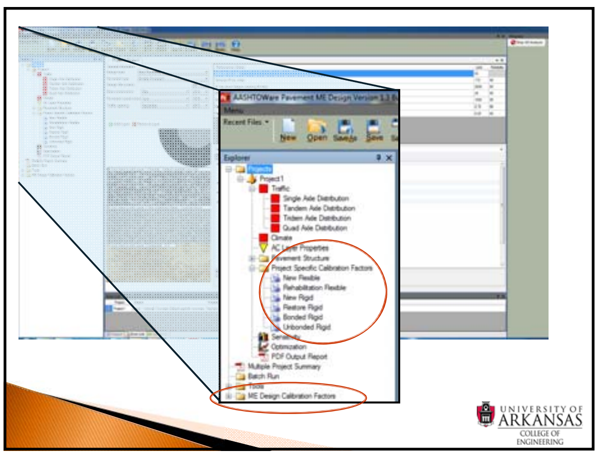
Explorer
Projects
Project1
Traffic
Single Axle Distribution
Tandem Axle Distribution
Tridem Axle Distribution
Quad Axle Distribution
Climate
AC Layer Properties
Pavement Structure
Project Specific Calibration Factors
New Flexible
Rehabilitation Flexible
New Rigid
Restore Rigid
Bonded Rigid
Unbonded Rigid
Optimization
PDF Output Report
Multiple Project Summary
Batch Run
Tools
ME Design Calibration Factors
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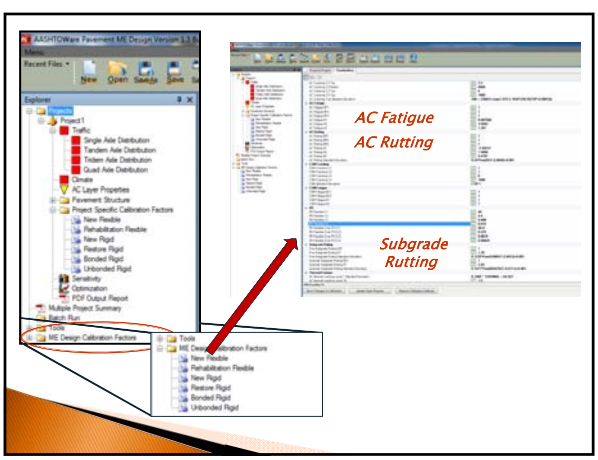
AC Fatigue
AC Rutting
Subgrade Rutting
Explorer
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Project1
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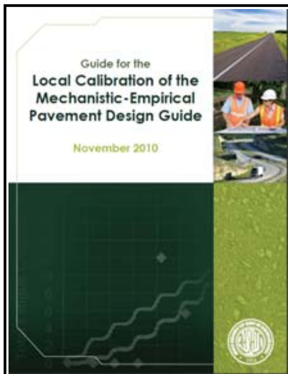

SUMMARY:

"The calibration and validation of the performance prediction model is a ***mandatory step****...to establish confidence in the design and analysis procedure and facilitate its acceptance and use."*

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QUESTIONS?

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Thank You!

Next Webinar: Thursday, September 5th

Part 3: Individual Distress Models

Register at: www.asphaltfacts.com/webinars/

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