WELCOME TO THE

PvD

AASHTOWare Pavement

ME Design

WEBINAR

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- **The webinar will start at 10:00am Central/11:00am Eastern**

FY 2021 Getting Started with the Local Calibration of AASHTOWare Pavement ME Design (PMED)

December 2, 2020

FY 2021 Getting Started with the Local Calibration of PMED

Moderator:

- Clark Morrison, North Carolina Department of Transportation; Chair
- Hari Nair, Virginia Department of Transportation; Co-chair

Presenters:

- Wouter Brink, ARA
- Harold Von Quintus, ARA

Presentation will be available for viewing on the ME-Design Resource website:
http://www.me-design.com

FY 2021 Getting Started with the Local Calibration of PMED

- Phones are being muted.
- Please post your questions in the Q&A box. This can be accessed by clicking on the Webex Q&A button.
- The presenters will answer all questions at the end of the webinar/demonstration as time permits.
- Questions not answered because of time, will be responded to separately.

Pavement ME Task Force Members

1. Clark Morrison, PE, North Carolina DOT, Chair
2. Ryan Fragapane, AASHTO Project Manager
3. Hari Nair, PE, Virginia DOT, Vice-Chair
4. Felix Doucet, Eng., Quebec MOT
5. David Holmgren, PE, Utah DOT
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9. Jeff Neal, PE, Kansas DOT, SCOA Liaison
10. Susanne Chan, Ontario MOT, TAC Liaison
11. Tom Yu, PE, FHWA Liaison

FY 2021 Webinar Series

- Getting Started with Local Calibration
  - Wednesday December 2, 2020
- Using the Calibration Assistance Tool (CAT) for Local Calibration
  - Wednesday December 16, 2020
- Design Examples – Using the Backcalculation Tool (BcT) and Designing for Multiple Asphalt Overlays
  - February 2021
- TBD

FY 2021 Getting Started with the Local Calibration of PMED

Poll 1: Questions 1 and 2

Prerequisites for this Webinar

- Prior experience using the PMED software
- Attended or reviewed past MEPDG/PMED webinars
- Familiar with or Reviewed AASHTO guide for the local calibration of the MEPDG

Learning Outcomes

1. List the common steps and data needed to prepare for local calibration of PMED.
2. Identify the data required to perform local calibration of PMED.
3. Understand the importance of pavement materials and traffic input libraries that reflect agency specific practices.
4. How to identify data anomalies and trends between distresses and pavement design features and/or material properties.

FY 2021 – Webinar 1: Getting Started with the Local Calibration of PMED

Outline of today's webinar:

1. Introduction
2. Review design practices
3. Review data needed for calibration
4. Review process for identifying and selecting pavement sections
5. Summary

Reminder:

- This webinar does NOT go into detail on performing local calibration.

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Introduction

What is local calibration?

Why is it important?

Where to start?

Introduction – What is local calibration?

Determining if MEPDG methodology reflects agency specific design practices

Determining if prediction models match field performance

Adjusting model coefficients to improve prediction accuracy

Introduction – What is local calibration?

- It’s not just about crunching numbers!
- Understand your data and how it relates to the PMED before you get started.
- If you start with default laboratory derived performance properties – understand what that means!

Introduction – Why is it important?

To ensure that the predicted distresses accurately represent field conditions

Use agency specific inputs such as traffic, materials, and climate

Introduction – Where to Start?

- Review local design practices
- Review all available data
- Identify and select pavement sections

Recurring themes:

- Know your data
- Input compatibility
- Base your decisions on day-to-day practices

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Review Pavement Design and Construction Practices

Agency Practices

- Design
- Materials
- Traffic

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Compatible??

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AASHTOWare Pavement ME Design

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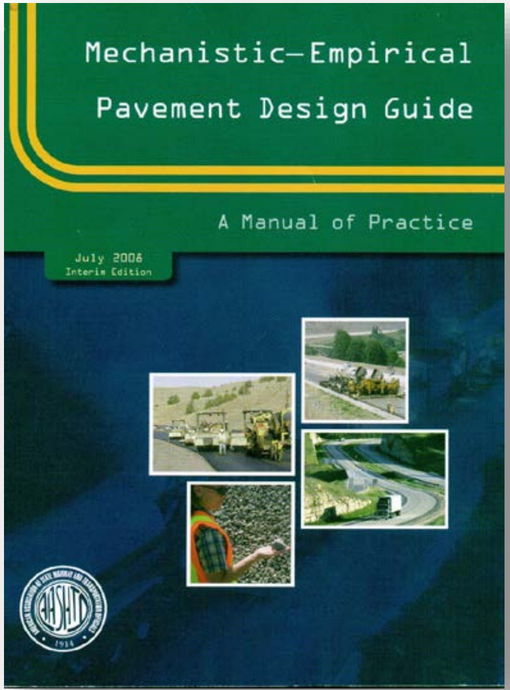


Pavement Design and Construction Practices

Identify and review design practices:

- Design Strategies
- Design life and distress limits
- Roadway classes
- Region specific policies
- Rehabilitation, maintenance and preservation practices

Pavement Design and Construction Practices

Table 7-1. Design Criteria or Threshold Values Recommended for Use in Judging the Acceptability of a Trial Design

Pavement Type	Performance Criteria	Threshold Value at End of Design Life
AC pavement and overlays	Alligator cracking (AC bottom-up cracking)	Interstate: 10% lane area Primary: 20% lane area Secondary: 35% lane area
	Total rut depth (permanent deformation in wheel paths)	Interstate: 0.40 in. Primary: 0.50 in. Others (<45 mph): 0.65 in.
	Transverse cracking length (thermal cracks)	Interstate: 500 ft/mi Primary: 700 ft/mi Secondary: 700 ft/mi
	IRI (smoothness)	Interstate: 160 in./mi Primary: 200 in./mi Secondary: 200 in./m
JPCP new, CPR, and overlays	Mean joint faulting	Interstate: 0.15 in. Primary: 0.20 in. Secondary: 0.25 in.
	Percent transverse slab cracking	Interstate: 10% Primary: 15% Secondary: 20%
	IRI (smoothness)	Interstate: 160 in./mi Primary: 200 in./mi Secondary: 200 in./mi
SJPCP overlays of flexible pavements	Percent longitudinal slab cracking	Interstate: 10 % slabs* Primary: 15 % slabs* Secondary: 20 % slabs*
CRCP new and overlays	Punchouts	Interstate: 10 Primary: 15 Secondary: 20
	IRI	Interstate: 160 in./mi. Primary: 200 in./mi. Secondary: 200 in./mi.

* Performance criteria levels need review by agency for adequacy.

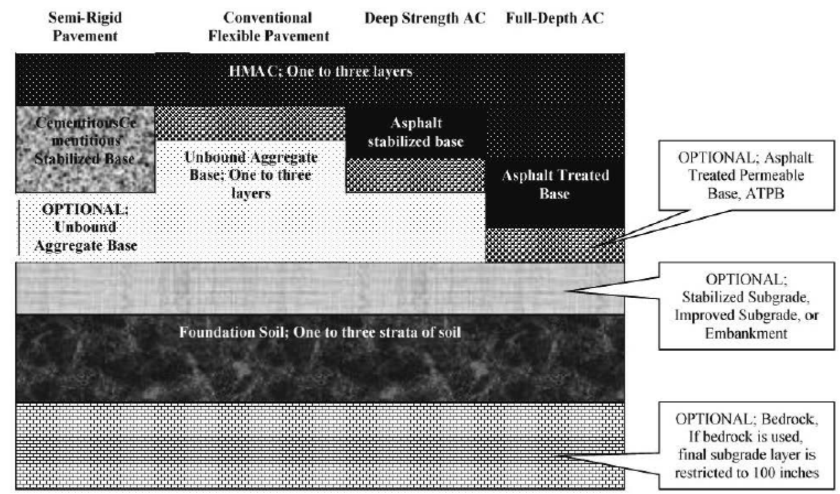


Figure 3-1. New (Including Lane Reconstruction) Flexible Pavement Design Strategies That Can Be Simulated with the AASHTOWare PMED (Refer to Subsection 11.1); Layer Thickness Not to Scale

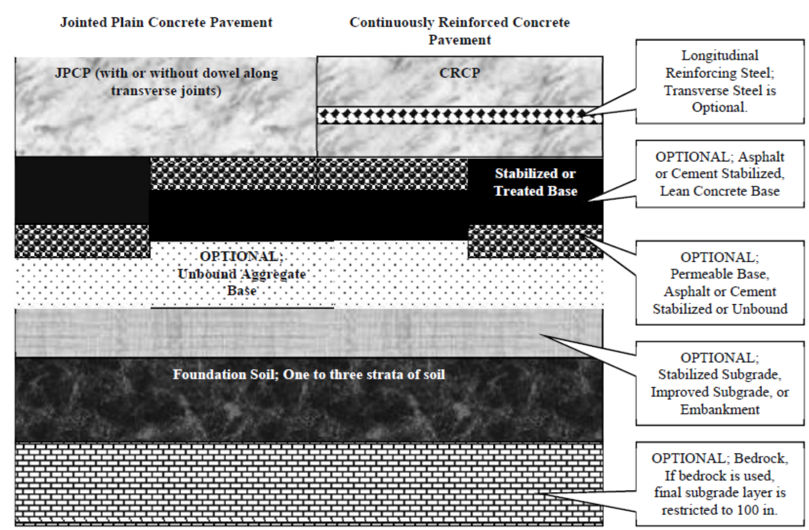


Figure 3-3. New (Including Lane Reconstruction) Rigid Pavement Design Strategies That Can Be Simulated with the AASHTOWare PMED (Refer to Subsection 11.2); Layer Thickness Not to Scale

Pavement Design and Construction Practices – Examples

Rehabilitation, maintenance and preservation practices

Definitions

- Maintenance
- Preservation
- Rehabilitation

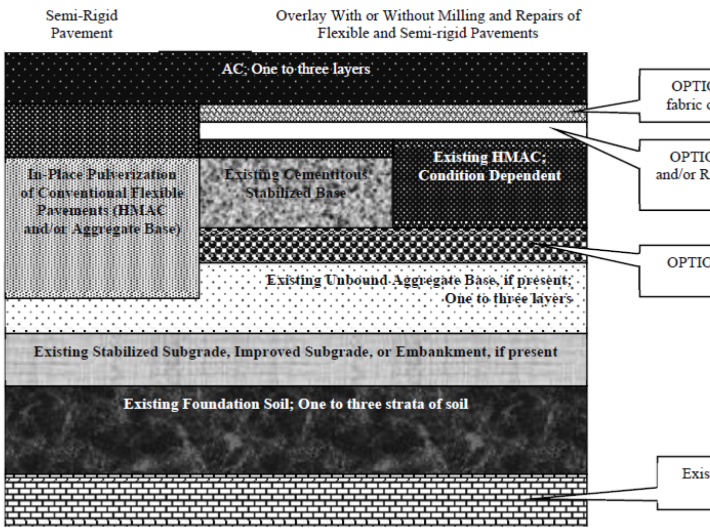
Triggers

- Predefined time increments?
- Observed limits?
- Compare to design life and failure criteria

Possible Implications

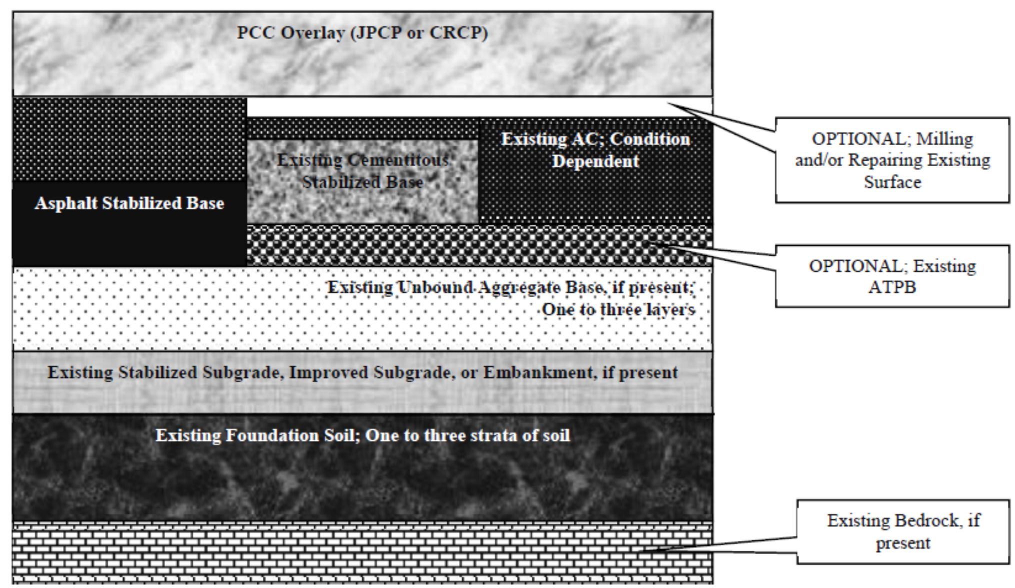
- Can limit the number of available pavement sections for calibration
- Available sections never reach expected design life or agency threshold criteria, biased calibration

Pavement Design and Construction Practices



3-2a. Rehabilitation Options for Existing Flexible and Semi-Rigid Paver

Figure 3-2. AC Overlay Design Strategies of Flexible, Semi-Rigid, and Rigid Pavem
Be Simulated with the AASHTOWare PMED (Refer to Subsection 12.2);
Not to Scale



Pavement Design and Construction Practices

Construction and site investigation practices

- Lab and field-testing procedures
- Site condition assessments
- Construction materials and requirements
- Structural layer thicknesses and material type databases

Lab Testing Protocols Example

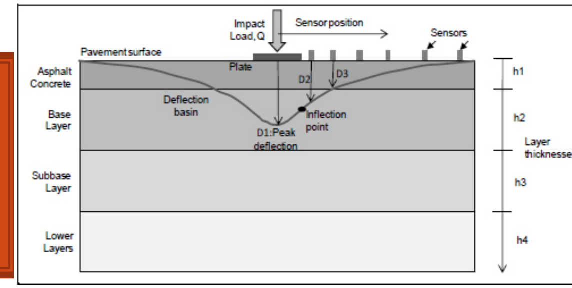
Design Type	Measured Property	Source of Data		Recommended Test Protocol and/or Data Source	Local Test protocols
		Test	Esti-mate		
New HMA	Dynamic modulus	X		AASHTO T 342	Enter local test procedures if available
	Tensile strength	X		AASHTO T 322	
	Creep Compliance	X		AASHTO T 322	
	Poisson's ratio		X	N/A	
	Effective asphalt content by volume	X		AASHTO T 308	
	Air voids	X		AASHTO T 166	
	Aggregate specific gravity	X		AASHTO T 84 and T 85	
	Gradation	X		AASHTO T 27	
	Unit Weight	X		AASHTO T 166	
	Voids filled with asphalt (VFA)	X		AASHTO T 209	

Key takeaway: Input compatibility!

Site Condition Assessments

Field Testing

Non-destructive testing (FWD)
- Backcalculate layer moduli



Cutting Cores
- Thickness verification
- Lab testing
- Cracked and intact locations

Subgrade Conditions:
- Resilient Modulus
- CBR
- DCP

Construction Materials Practices

- Focus on day-to-day practices
- What decisions do you make to select a material during the design?
  - Layer dependent?
  - Climate dependent?
  - Traffic level dependent?
  - Region specific?
- Important to know your practices and data!
  - It can help selecting your sections to avoid any bias

Pavement Management Data

Distress and performance data collection:

- Procedures and methods
  - Frequency of collection
  - Equipment

- Distress definitions and units

- Timeseries distress trends

- Compatibility with LTPP Distress Identification manual and PMED

Key points

- Know your design practices and day-to-day procedures
- Know where your input data comes from
- Focus on data compatibility
- Establish overall inference space based on available information

- Overall Outcomes:
  - Develop experimental design sampling matrix
    - Based on important design factors and conditions

Experimental design matrix examples

HMA Thickness (inches)	Granular Base Thickness (inches)*	Subgrade Type: Coarse-Grained Soils (AASHTO Class A-1 through A-3)	Subgrade Type: Fine-Grained Soils (AASHTO Class A-4 through A-7)
<8	<6	1	2
	≥6	3	4
≥8	<6	5	6
	≥6	7	8

*All projects had granular base. Note: An equivalent dense-graded aggregate base was assumed for permeable asphalt-treated bases (PATBs).

PCC Thickness (inches)	Dowel Diameter (inches)	Edge Support*	Subgrade and Base Type			
			Coarse-Grained Subgrade Soils (AASHTO Class A-1 through A-3)		Fine-Grained Subgrade Soils (AASHTO Class A-4 through A-7)	
			Lean Concrete Base	Granular or Asphalt-Treated Base	Lean Concrete Base	Granular or Asphalt-Treated Base
≤ 10	No dowels	None	1	2	3	4
		Yes	5	6	7	8
	Doweled	None	9	10	11	12
		Yes	13	14	15	16
> 10	No dowels	None	17	18	19	20
		Yes	21	22	23	24
	Doweled	None	25	26	27	28
		Yes	29	30	31	32

*Tied PCC and or widened lanes.

FY 2021 Getting Started with the Local Calibration of PMED

Poll 2: Questions 3 and 4

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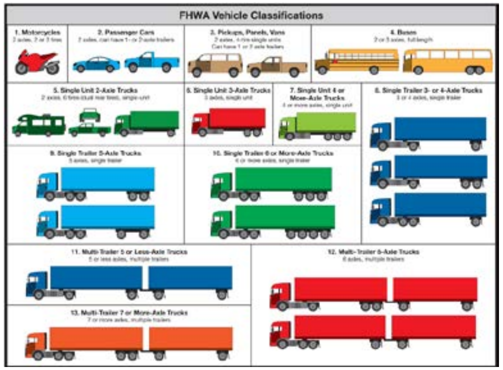
Data Needed for Calibration

- Individual Section
  - Structure
  - Site Conditions
  - Construction history
  - Traffic
  - Pavement Distresses
- Agency wide (All individual sections combined)
  - Summary statistics
    - mean, median
    - standard deviation
    - minimum, maximum

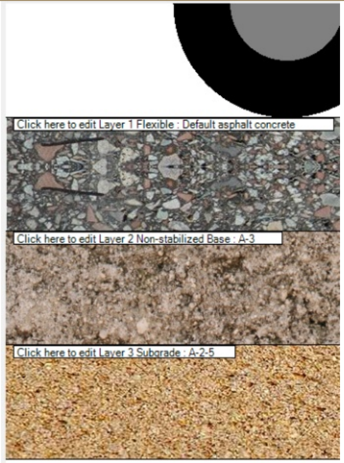
Traffic



Climate

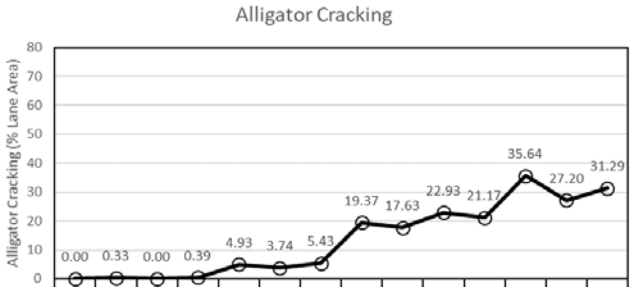
Field and Lab Testing

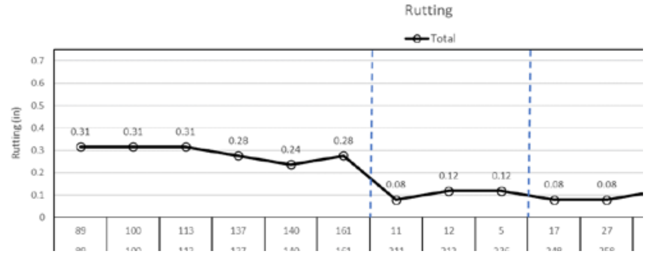
Structural Layer Properties



Pavement Section inputs and information

Measured Distresses





Construction History

2000 (Age: 0) – New Const.
2009 (Age: 9 yrs) – Crack Sealing
2013 (Age: 13 yrs) – Mill and Fill
2019 (Age: 19 yrs) – Reconstruction

Selecting Input Data:

- Possible sources you may have available:
  - Design drawings
  - Historical construction records
  - Field investigation or testing
  - Research studies

- When deciding on the level of effort to obtain inputs, consider the following:
  - How important is the input variable?
  - Where can I find the most accurate data for an input?
  - How confident am I that the data matches what is in the field?

Impact on Calibration

- Input selection can effect:
  - Confidence in prediction models
  - Bias (average difference between predicted and measured distress)
  - Standard error
  - Reliability

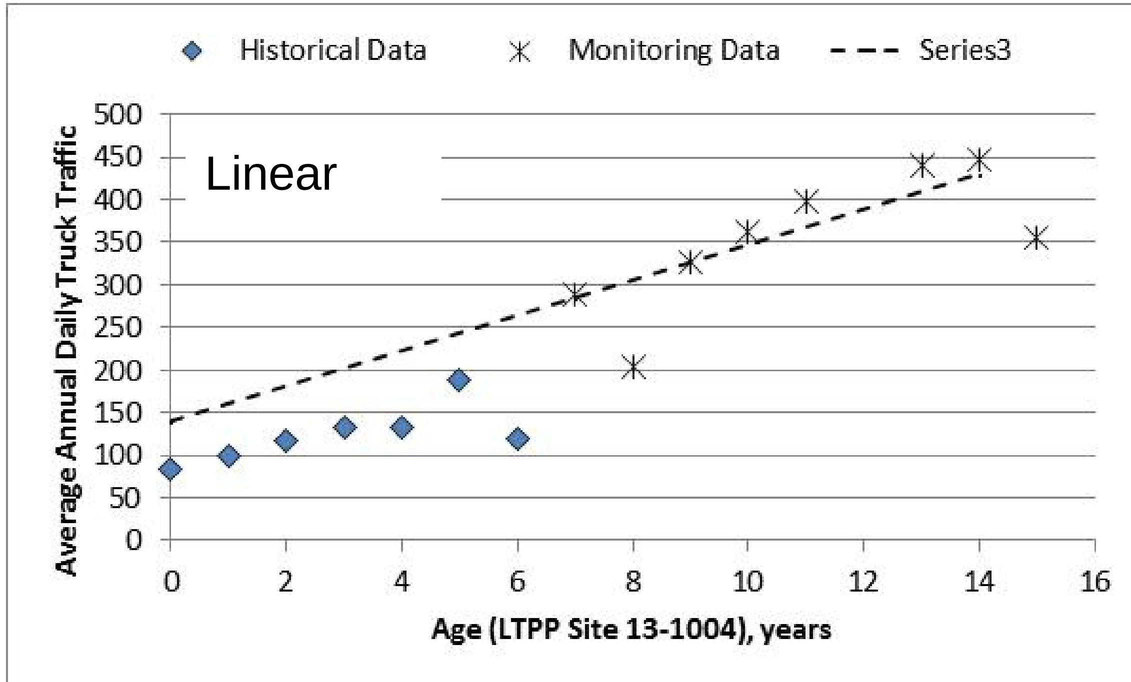
Input Compatibility Examples

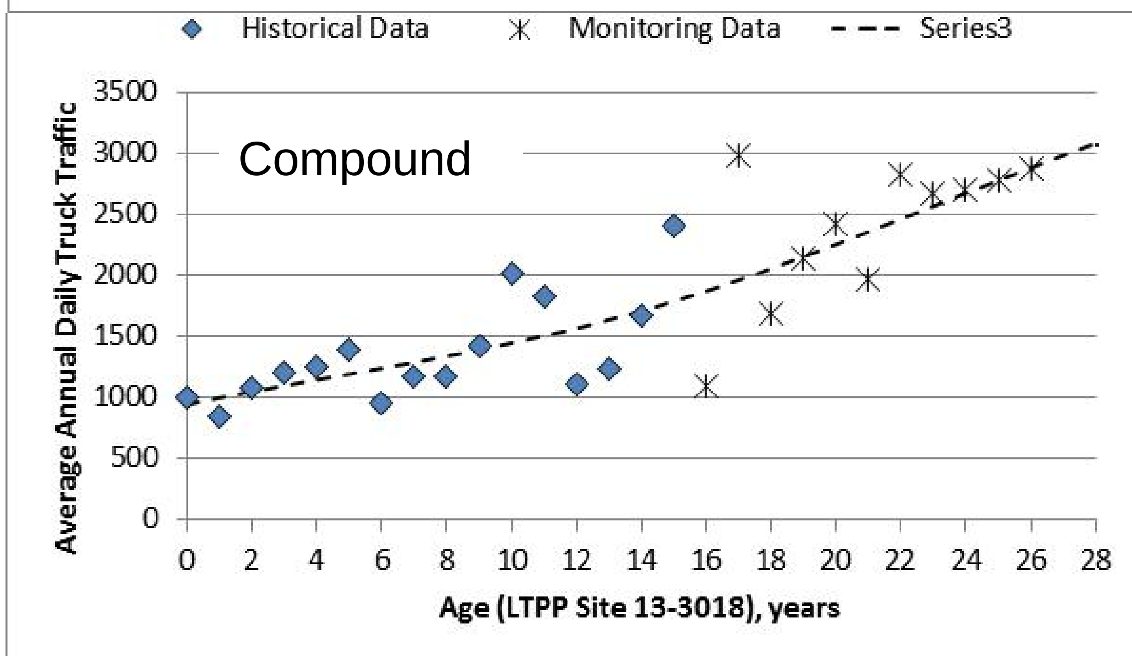
- Resilient modulus vs CBR/Rvalue/DCP relationships
  - Optimum moisture content vs in-situ moisture content
  - Backcalculated moduli vs Lab tested moduli
- Effective binder content by volume vs weight
- As-constructed air voids vs design air voids
- Know which inputs PMED cannot account for directly.

Determine Initial AADTT

Historical versus monitoring data (if available):

Focused on the monitoring data , supplemented with the historical data.





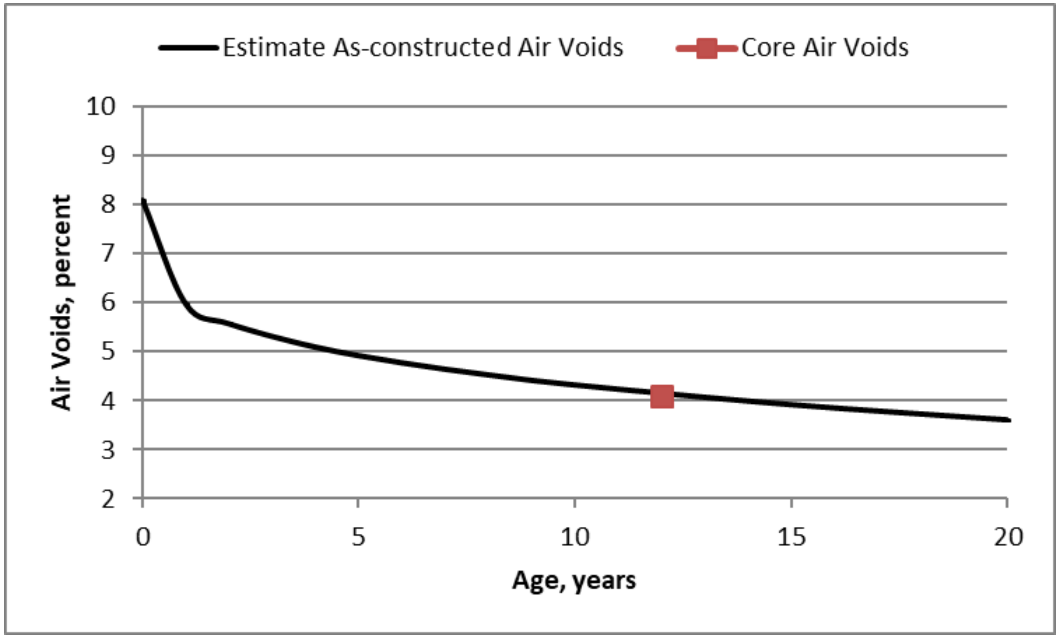
INPUT COMPATIBILITY

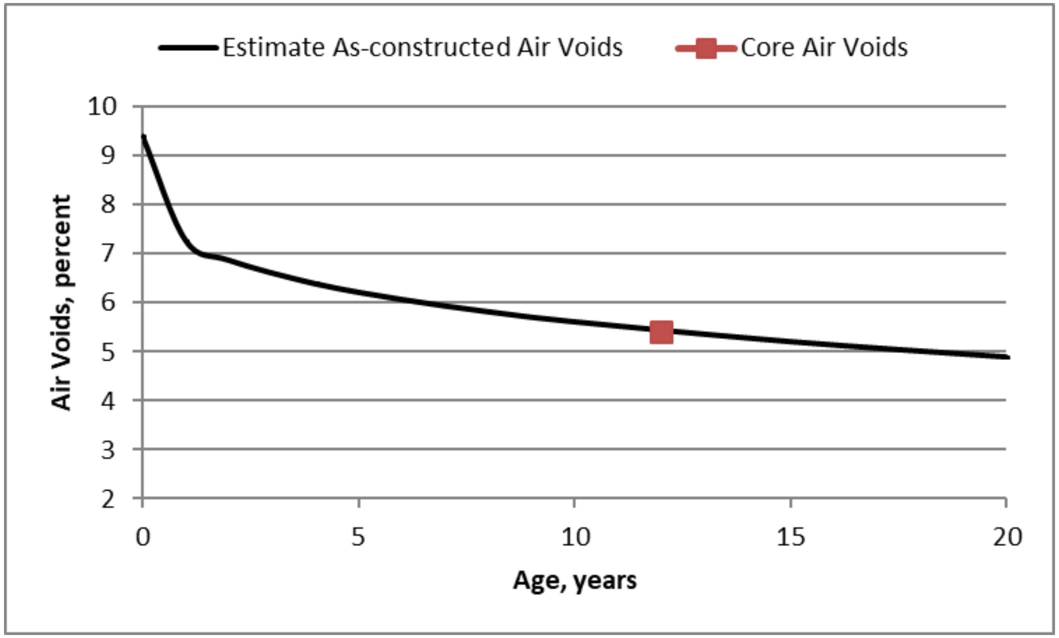
Determine Initial Air Voids

PMED requires air voids at time of construction.

Need to estimate as-constructed air voids when cores were not taken at the time of construction

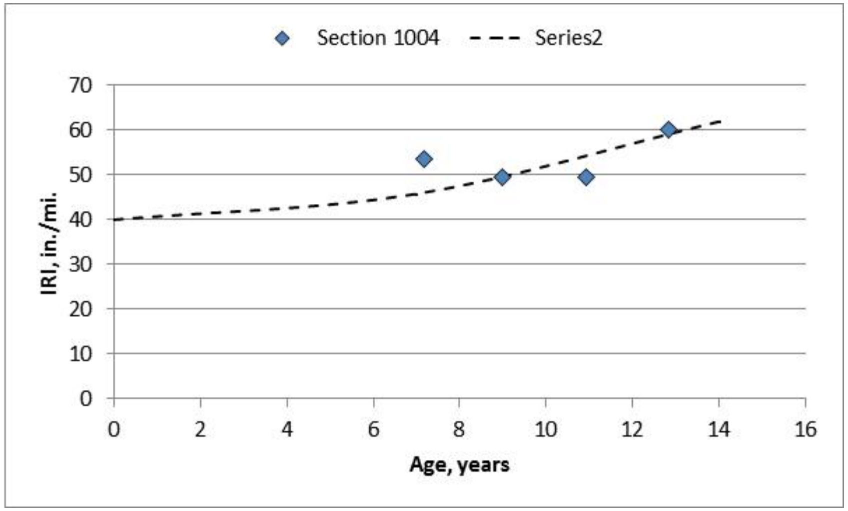
INPUT COMPATIBILITY

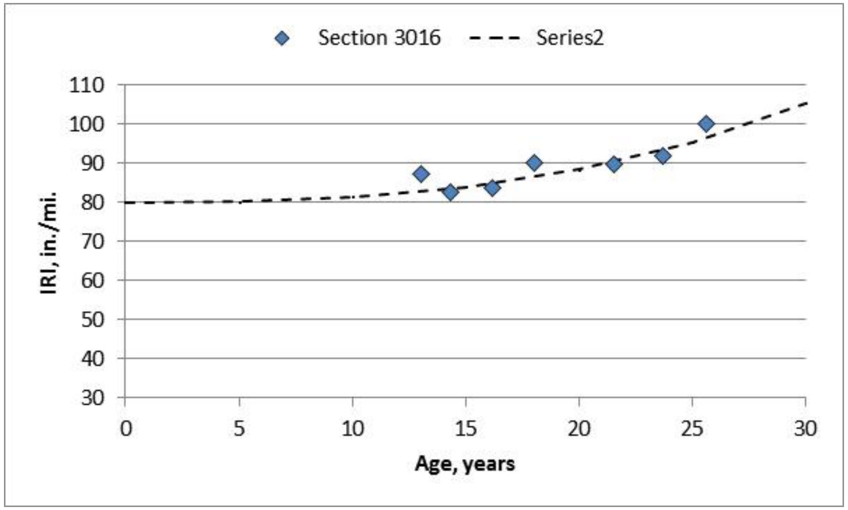


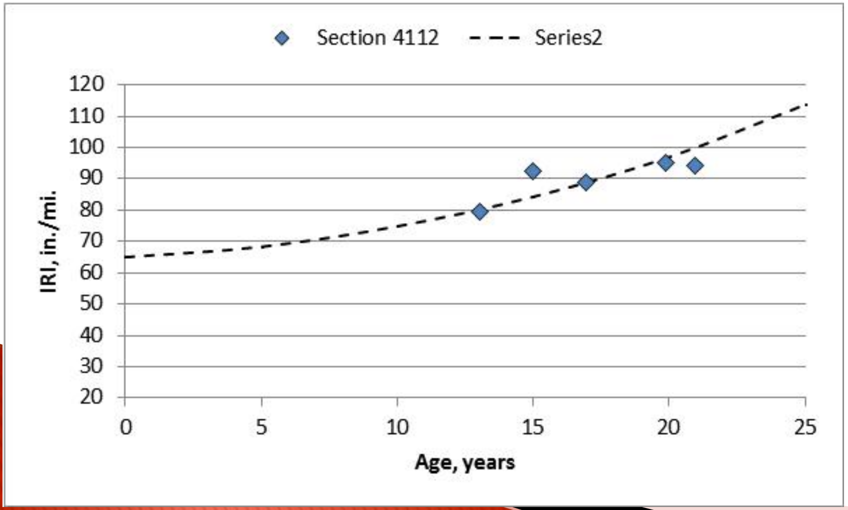


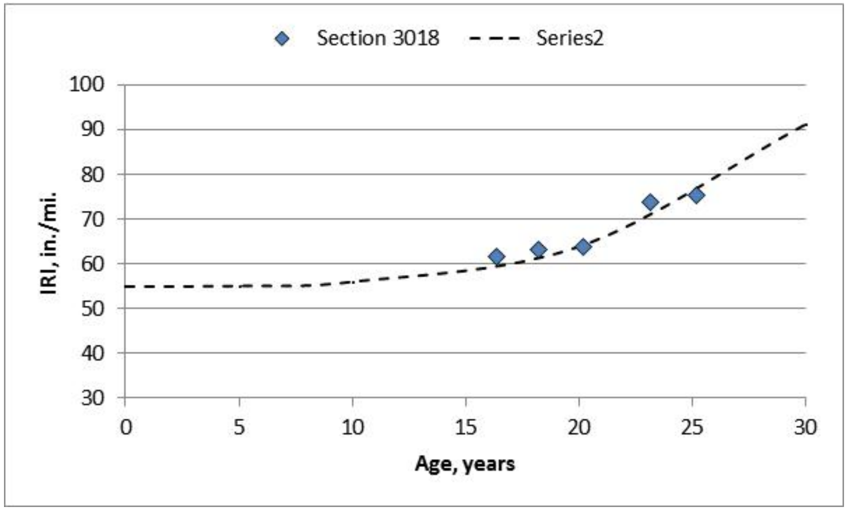
Estimate Initial IRI at Construction

INPUT COMPATIBILITY



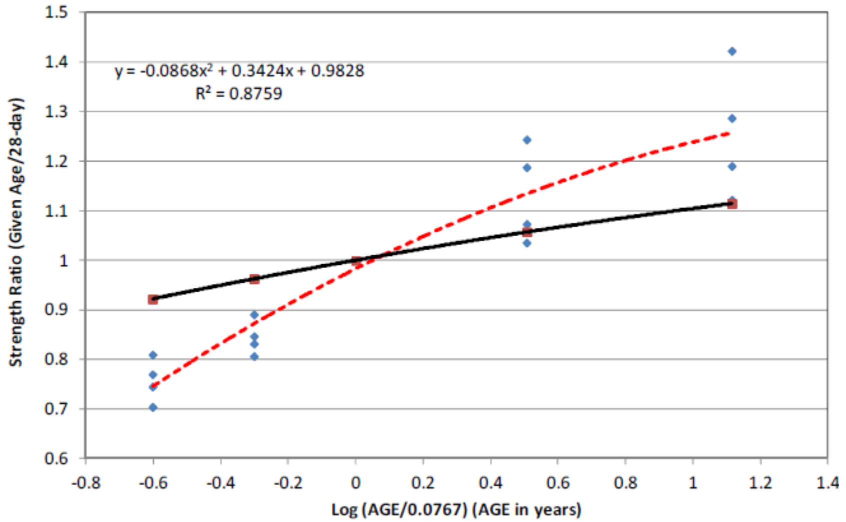






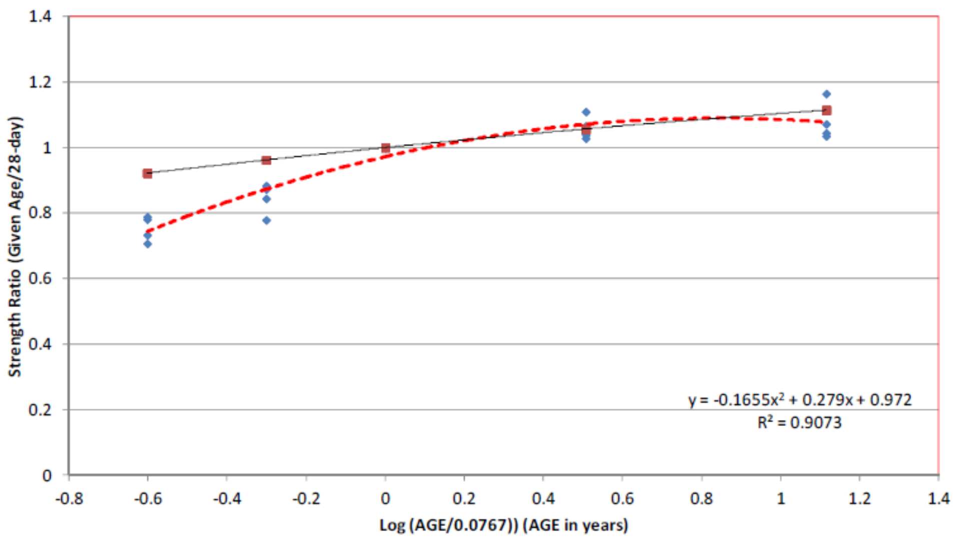
Estimate PCC properties at time of construction

Compressive strength gain



INPUT COMPATIBILITY

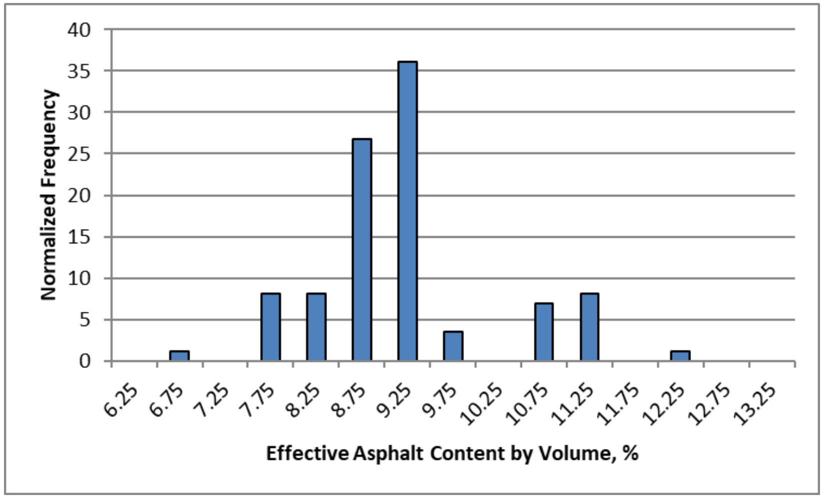
Flexural Strength Gain

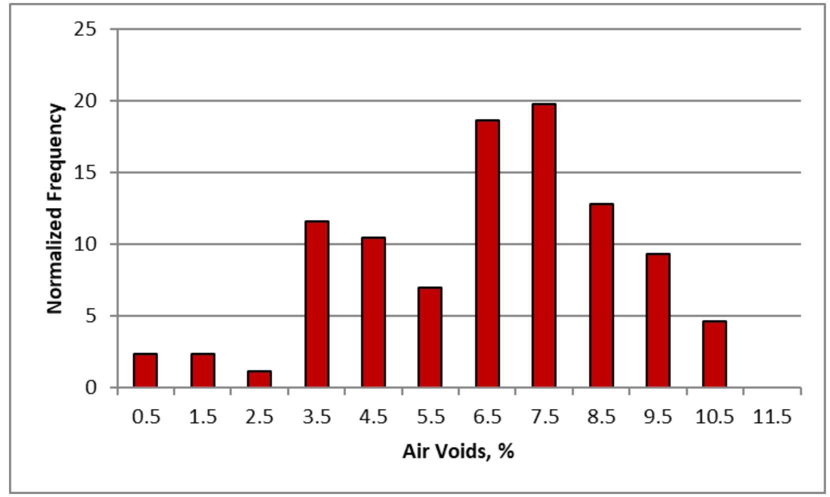


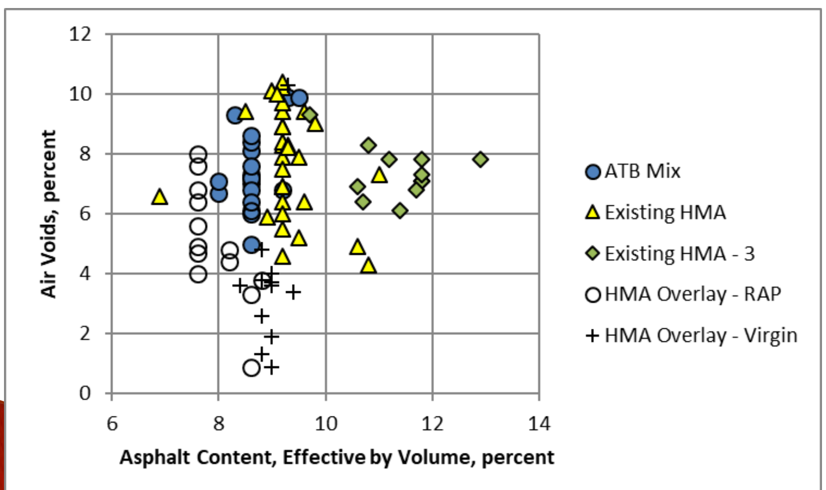
Examples – Agency wide summaries

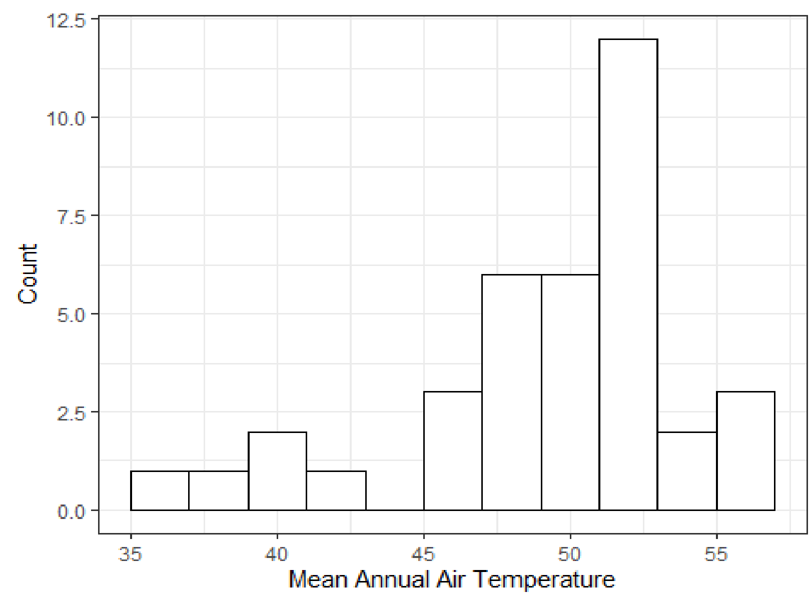
- Overview of the calibration dataset
- Can be used to establish input libraries
- Help identify any gaps in inputs
- Revise design practices if needed

Example Distributions

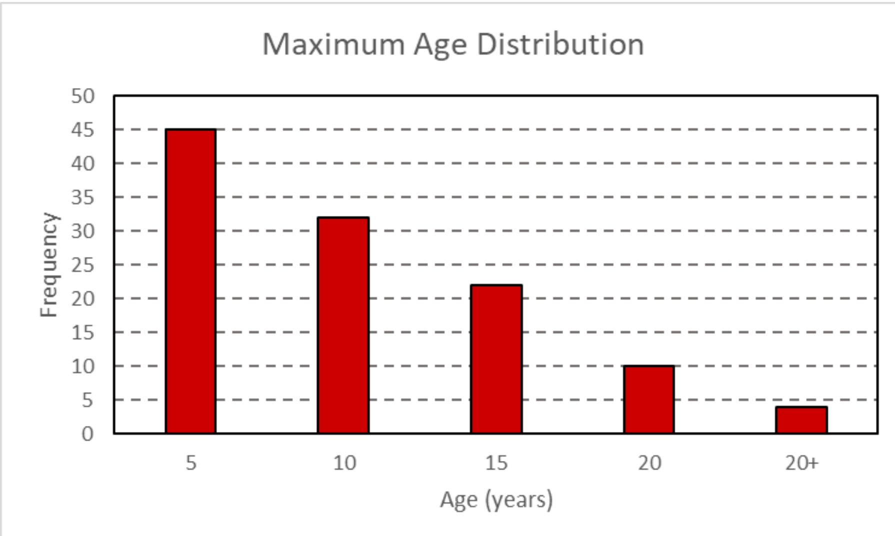


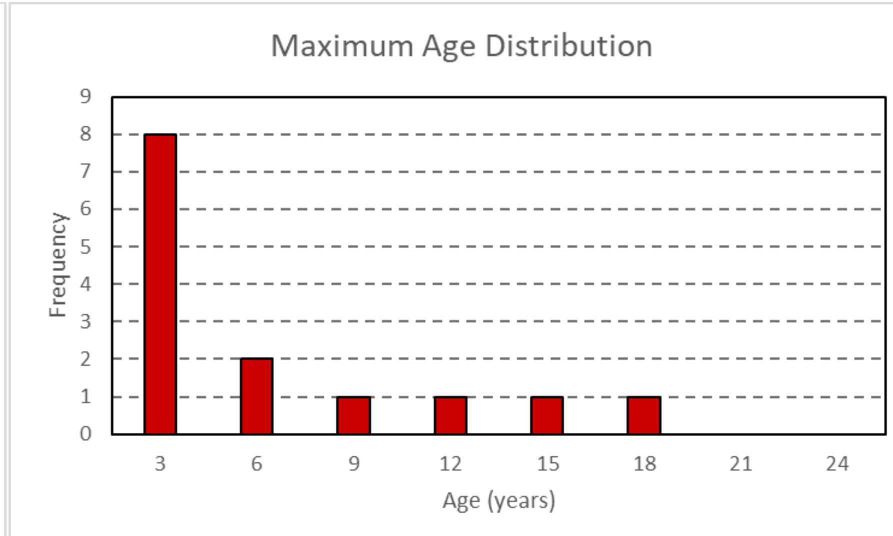


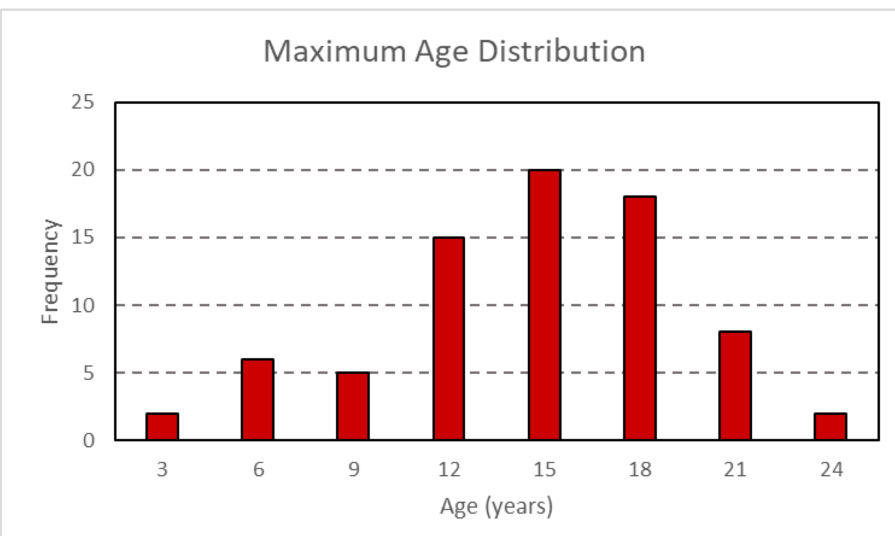




Example Distributions – Pavement Age



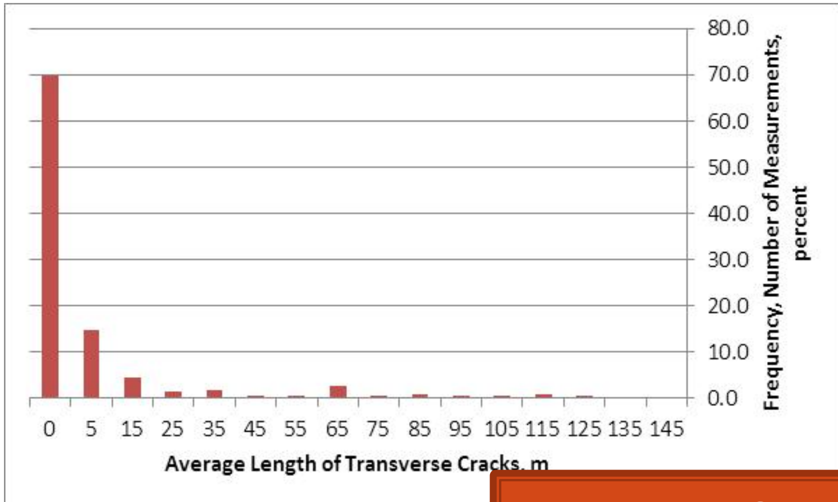


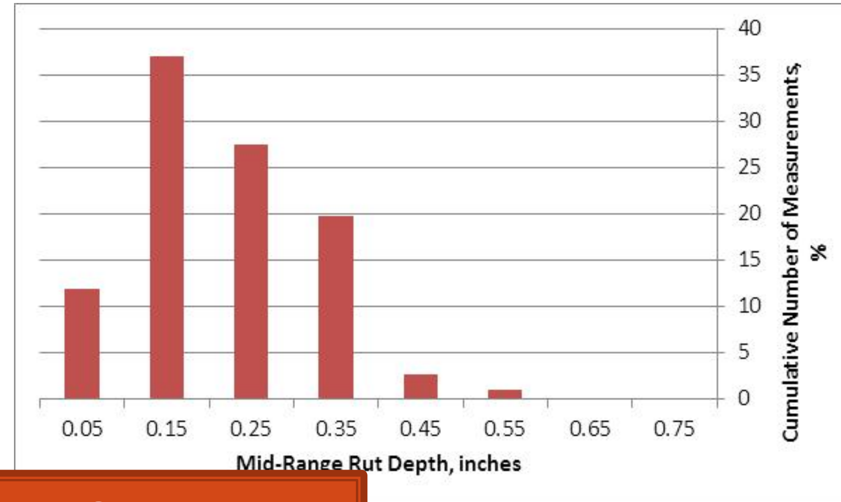


Which is preferred?

How can this impact the calibration?

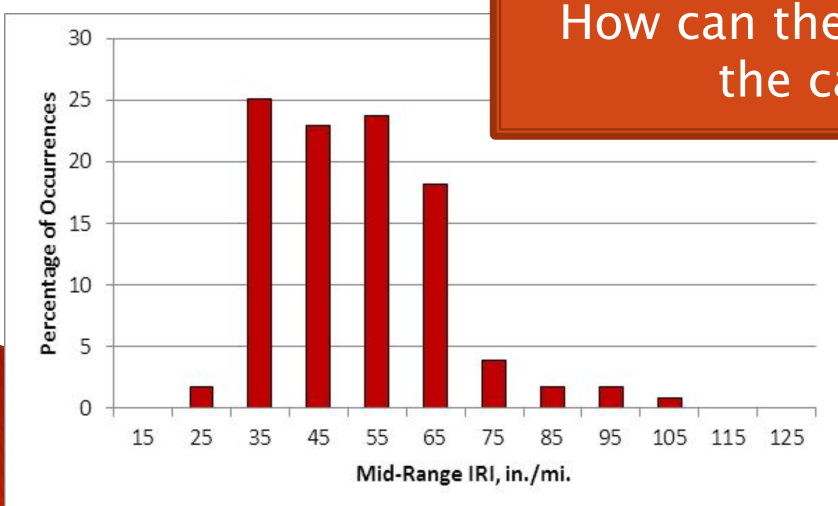
Example Distributions – Distresses

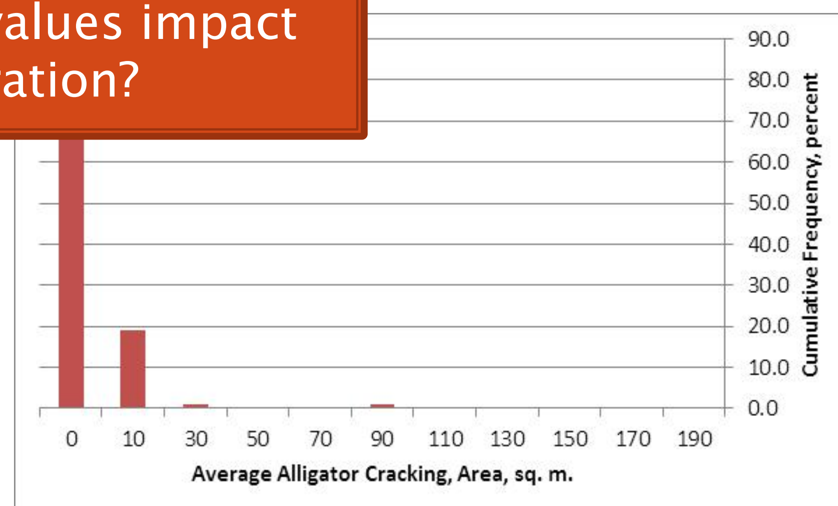




Significance?

How can these values impact the calibration?



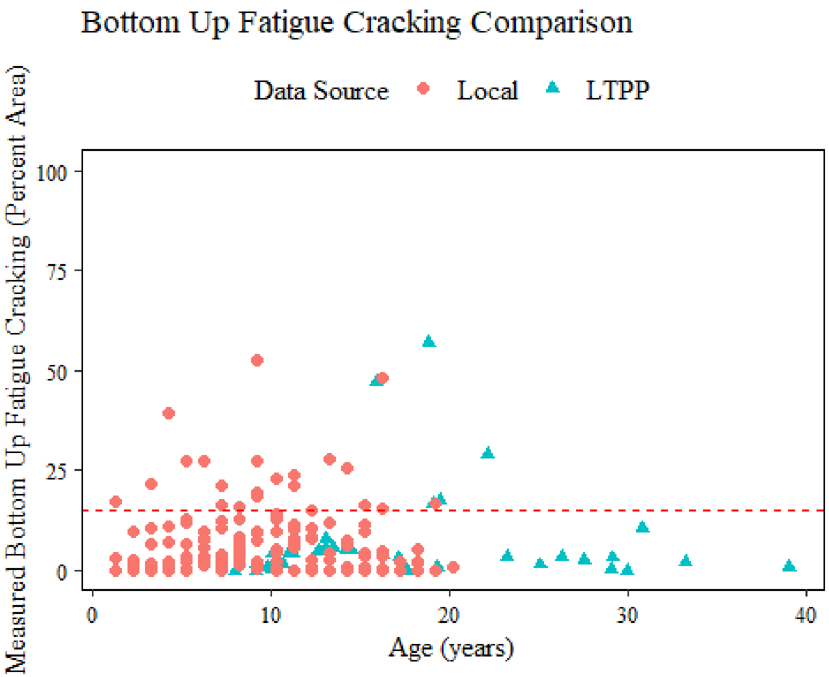


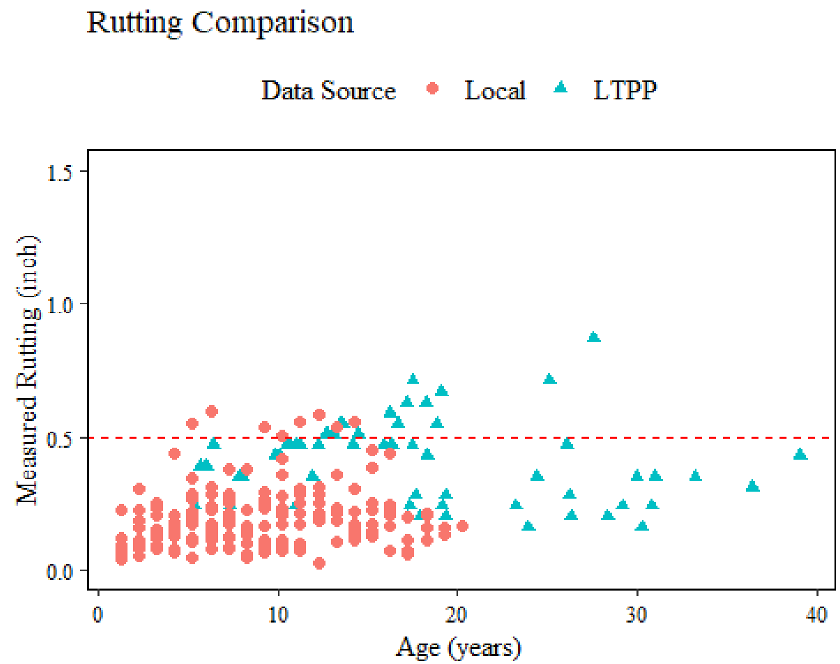
Distress or Performance Indicator	Design Criteria in MEPDG Manual of Practice*	Median Distress	Range	
			Minimum	Maximum
Rut Depth. Inches	0.4 to 0.5	0.2	0.04	0.55
Area Fatigue Cracking, %	10 to 20	[illegible]	[illegible]	28
Transverse Cracking, ft./mi.	500 to 700	[illegible]	[illegible]	3,700
IRI or Smoothness, in./mi.	160 to 200	50	27.6	112.7
*The design criteria listed above are for an interstate or primary arterial roadway.				

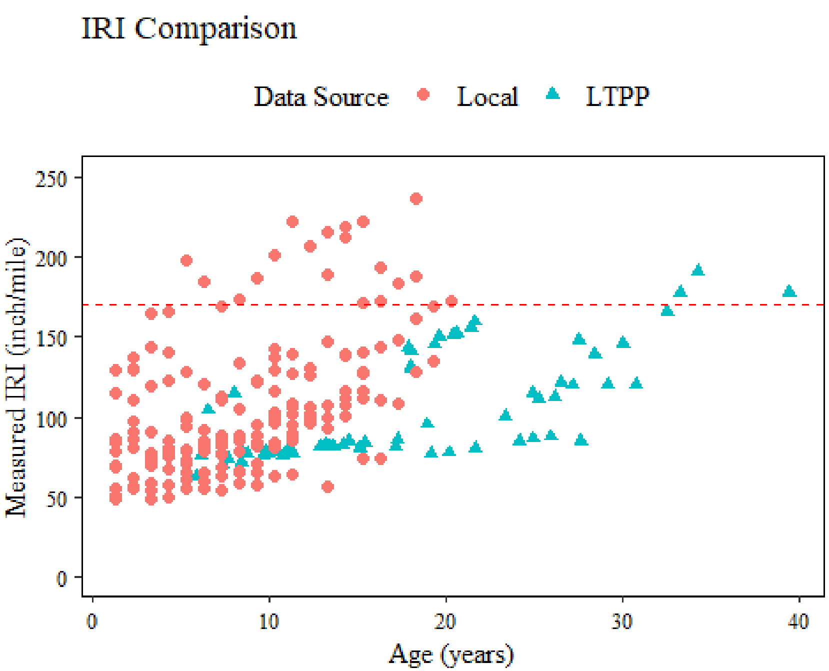
Compare

Pavement Type	Distress or Performance Indicator	Design Criteria in MEPDG Manual of Practice*	Median Distress	Range	
				Minimum	Maximum
JPCP	Transverse cracking, percent slabs cracked	10	0	0	28
	Transverse joint faulting, in	0.15	[illegible]	[illegible]	0.1417
	IRI, in/mi	160	[illegible]	[illegible]	124
New CRCP	CRCP Punchouts, number per mile	6	[illegible]	[illegible]	21.1
	IRI, in/mile	160	43	36	91

Compare



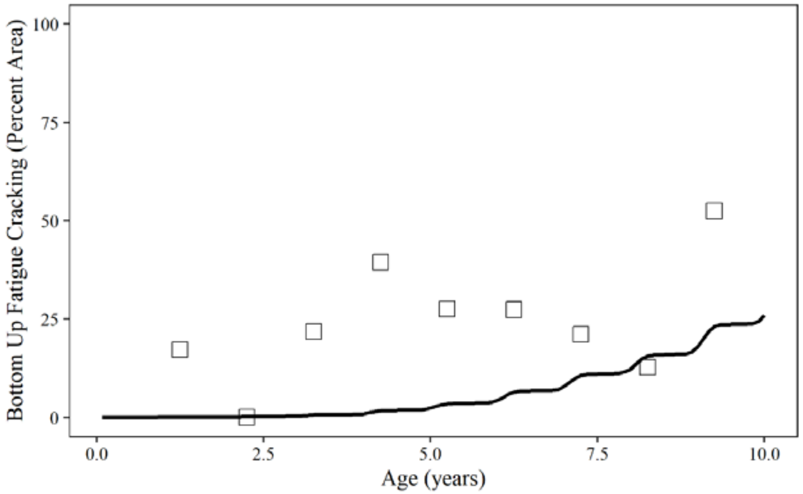


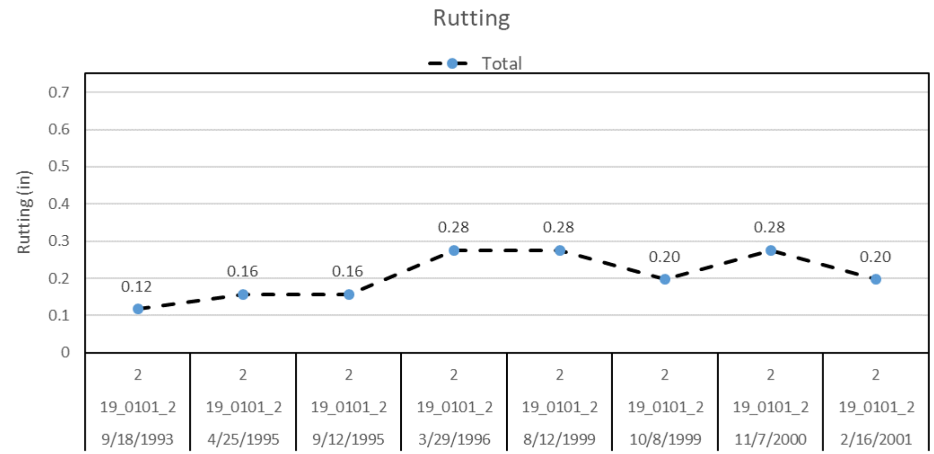


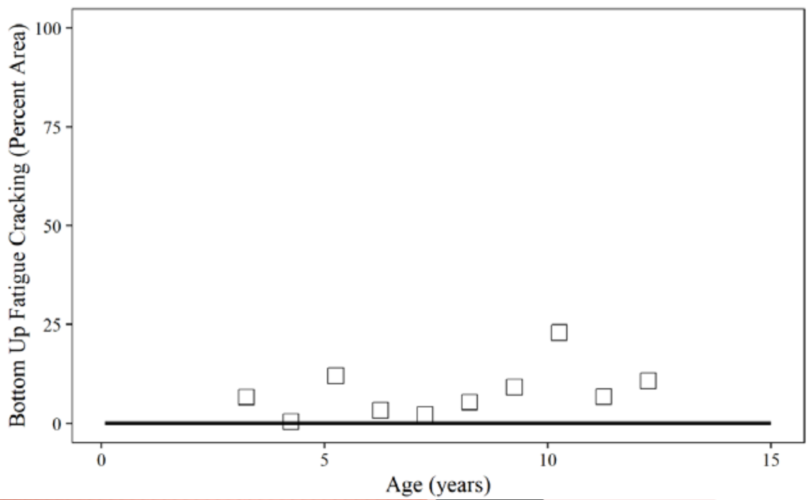
What percentage of your data exceeds agency defined thresholds?

How can this impact the calibration?

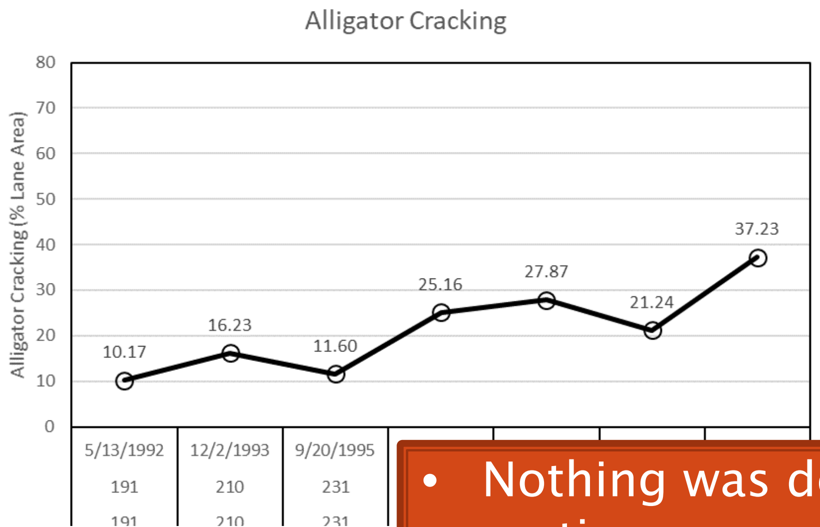
Example for Measured Distress Variability

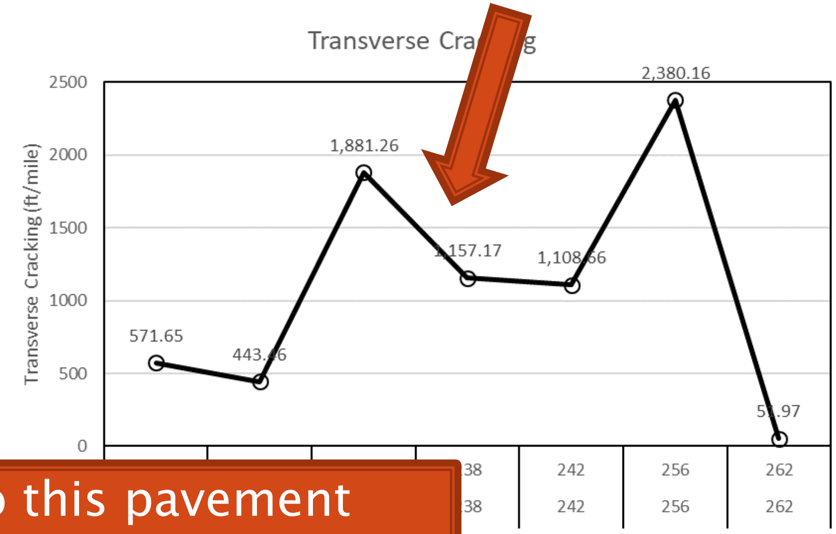




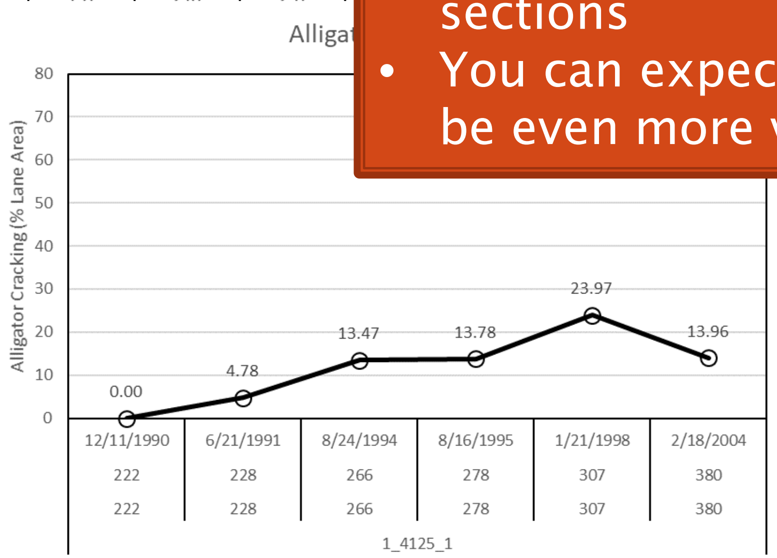


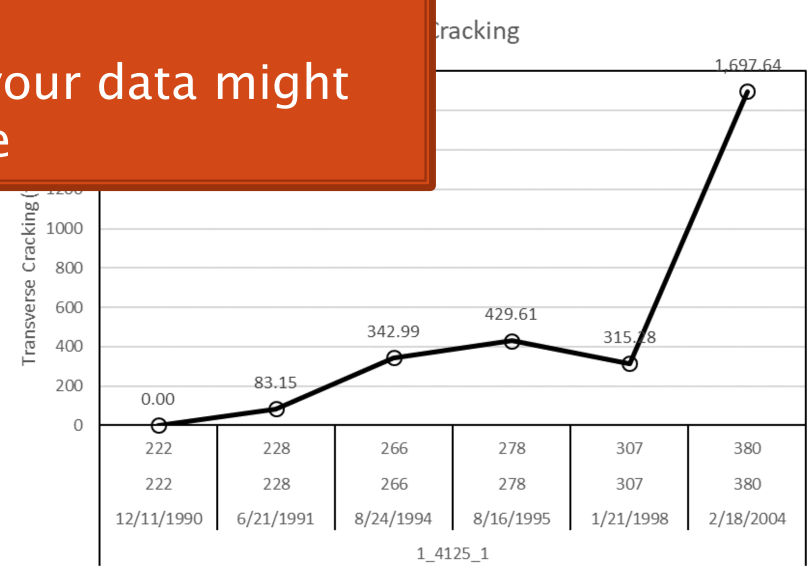
Example for Measured Distress Variability





- Nothing was done to this pavement sections
- You can expect that your data might be even more variable





Measured Distress Variability

- What do you do?
  - Can you explain the variability?
  - Is it an anomaly?
  - Is it an outlier?
  - Is it an error?

- What not to do
  - Arbitrarily remove datapoints to smooth the trend

Distress Data Compatibility and Conversion

- PMS data collection

PMED

- Units
- Distress definitions
- LTPP distress manual

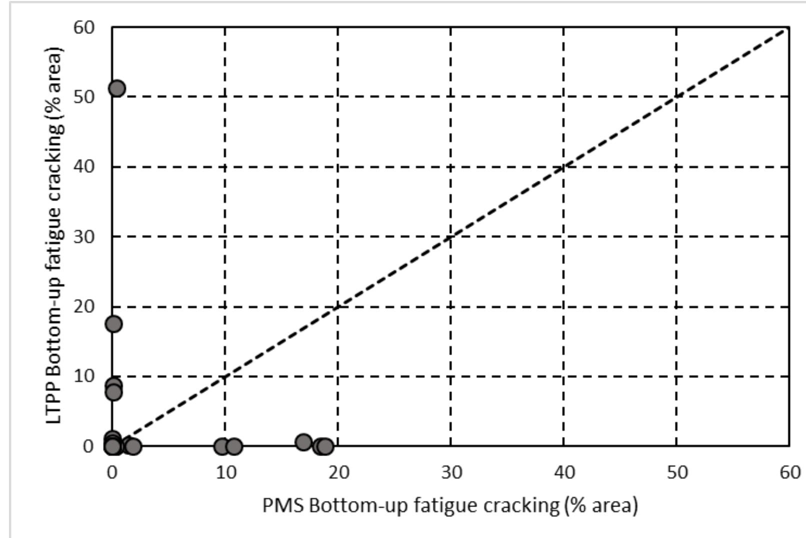
PMS

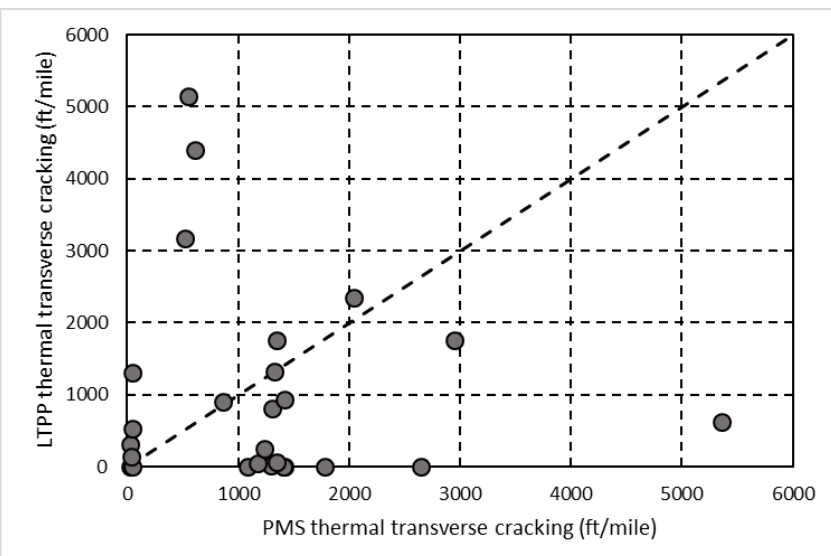
- Units
- Distress definitions
- Data collection methods
- Individual distresses or rating/index?

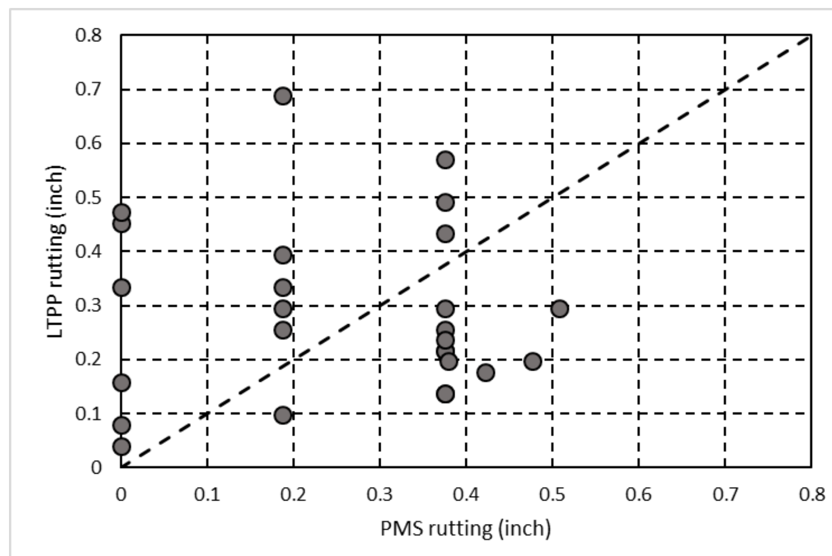
Distress Data Compatibility and Conversion

PMS data vs LTPP data for same pavement section?

How can this impact the calibration?







Key Points

- Know your data!
- Input compatibility!
- Input variability!
- Measured distress variability!
- Use MOP and Local Calibration Guide as a reference

FY 2021 – Webinar 1: Getting Started with the Local Calibration of PMED

Outline of today's webinar:

1. Introduction
2. Review design practices
3. Review data needed for calibration
4. Review process for identifying and selecting pavement sections
5. Summary

Identifying and Selecting sections

- Typical selection guidance

- Getting ready to use the Calibration Assistance Tool

Identifying and Selecting sections

- Majority of the work should already be done
  - Design practice review
  - Input data is available
  - Measured distress data is available
- Now the actual sections need to be selected.

Typical Selection Guidance

- Criteria for selecting sections:
  - Representative of design practices
  - Least amount of structural layers
  - Exhibit multiple distresses
  - Range of measured distresses to capture distress progression throughout life

Typical Selection Guidance

- Criteria for selecting sections:
  - With and without overlays
  - Non-conventional mixtures or layers
  - Number of condition surveys
  - At least 7-10 years since original construction

Key Takeaways

- Use the sampling matrix
- Try to have a similar number of sections in each cell of the design matrix (balanced design)
- Review distress data
- Make preliminary selections

Key Takeaways

- Collect input data for each section
- Focus on using best available input data
- Consider doing some additional lab and field investigations for most important inputs
- Create PMED input files once all pavement sections are selected and input data is available.
- Upload PMED input files and measured distress data to PMED

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Summary and Closing Thoughts

- Local calibration does NOT start with using the Calibration Assistance Tool
- KNOW YOUR DATA!
- Ensure that the selected inputs are COMPATIBLE
- Calibrated models are only as good as the input data that are used.

FY 2021 – Webinar 1: Getting Started with the Local Calibration of PMED

Remember:

Webinar 2: Using the Calibration Assistance Tool for Local Calibration

- December 16, 2020, 10:00am – 12:00pm (central)

Pavement ME Design Users Group Virtual Meeting:

- December 8 - 10, 2020

QUESTION AND ANSWER SESSION

We welcome comments & suggestions for future webinars; Send an email to pavementmedesign@ara.com.

Thank you for Attending the Webinar!

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