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Balanced Mix Design Validation Strategies & Regional Efforts

Thomas Harman
Senior Research Engineer

PAPA

Have an Idea, Thought, Comment???

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zoom

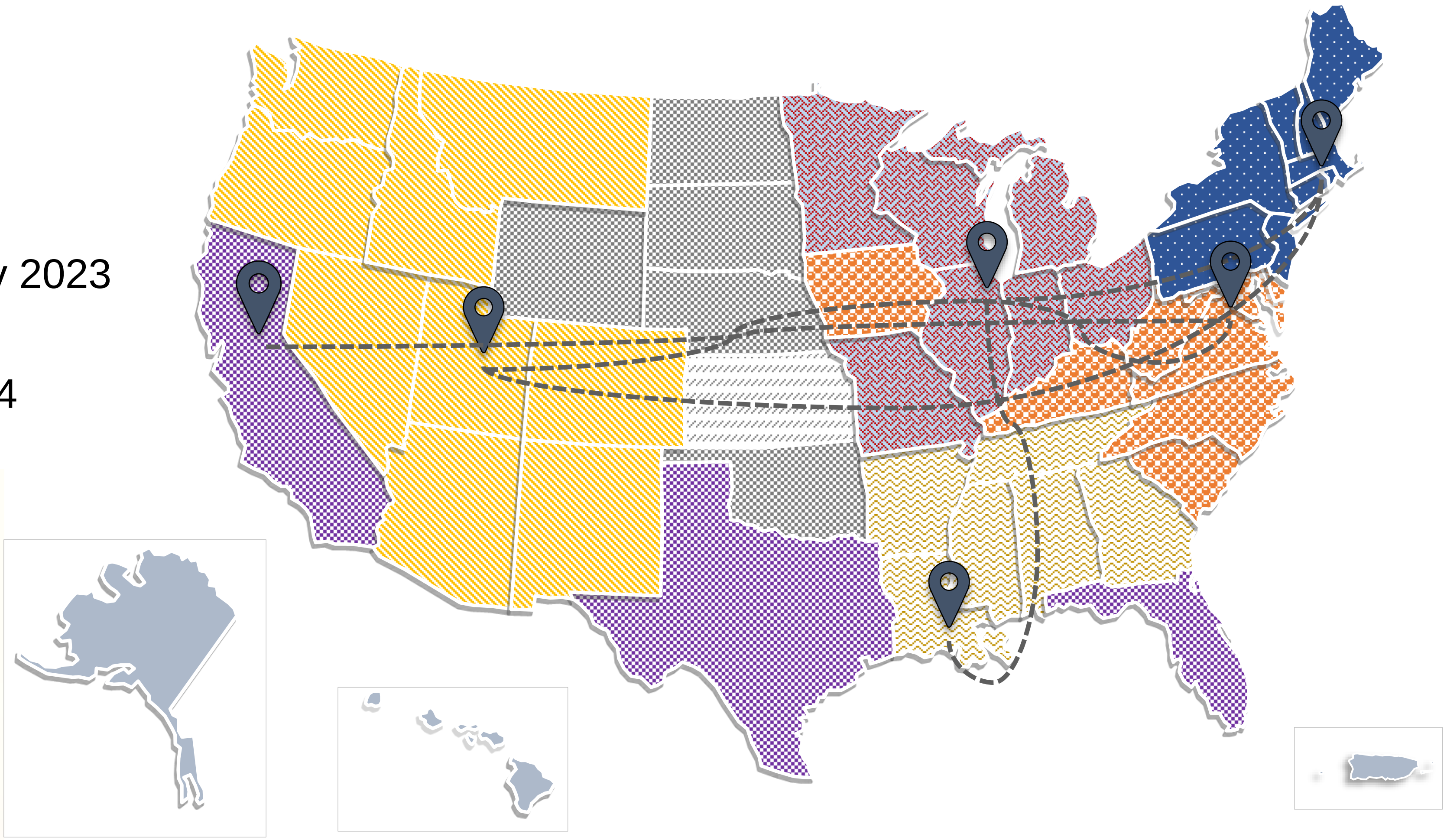
Image: Ginger Boo

Image: ChatGPT 4o

BMD Peer-to-Peer Exchange Participants

ASPHALT | INNOVATE | ENLIGHTEN | IMPLEMENT

- Meeting Location
- Southeast, Mar 2023
- North Central, Mar 2023
- Northeast, Mar 2023
- Rocky Mountain West, Nov 2023
- Midwest, Dec 2023
- Mid-Atlantic Plus, Nov 2024
- Mega-States, Jun 2025




PEER-TO-PEER EXCHANGES
BALANCED MIX DESIGN
BEST PRACTICES
BMD

AIEI

State DOT Key Challenges

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- Management (M)
- Technical (T)
- Overlapping (TM)

Microsoft Stock Image

T1-BMD Test Validation

Lack of a standard validation framework and timely data collection; need for linking laboratory BMD test results with field performance.

Validation, using multiple strategies, builds credibility and confidence in BMD tests and their criteria.

- Create a test validation framework.
- Conduct validation experiments and leverage peer knowledge.
- Monitor in-service performance and refine BMD test criteria.
- Collect and store field samples for future testing.

Validation

Image: ChatGPT 4o

In 1939, how did Bruce Marshall establish his Criteria for Stability?

500 pounds minimum light traffic
1,800 pounds minimum for heavier traffic

A. Laboratory Study: Various Asphalt-Aggregate Combinations

B. Benchmarking of Good and Bad In-Service Pavements

C. Empirical Thresholds through Trial and Error

D. Empirically Adjusted over Time

E. All the Above

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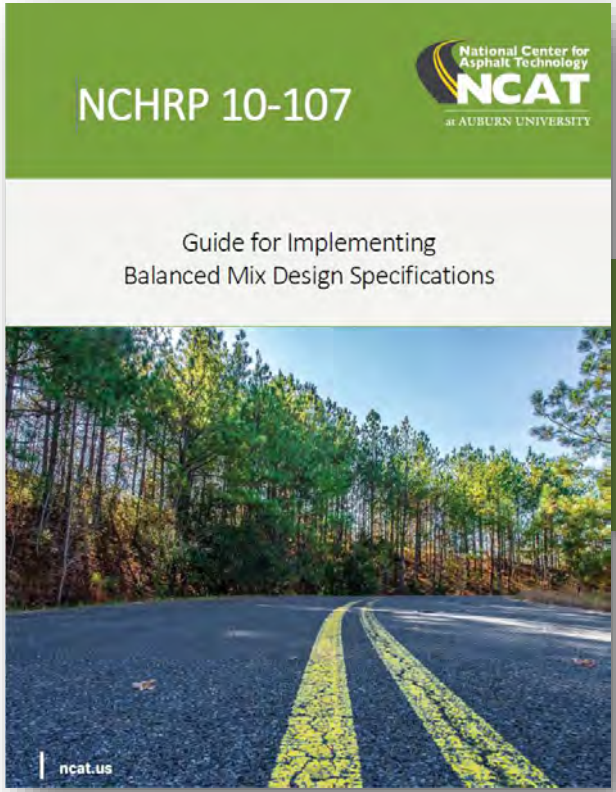
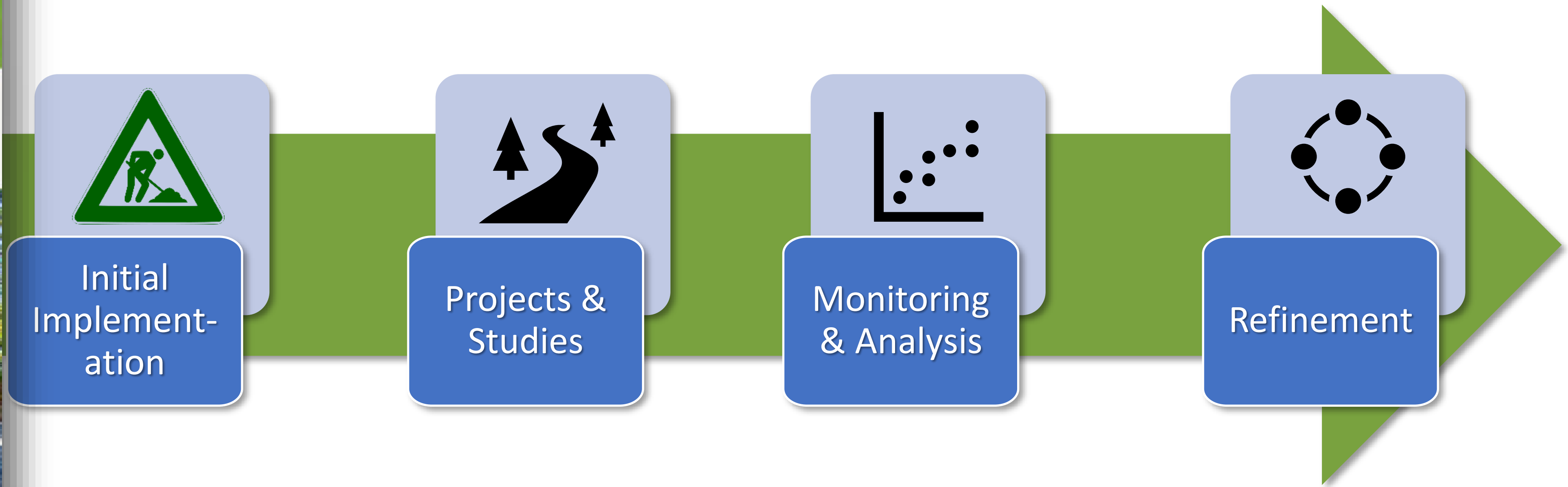
Beyond the Guide





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Consortium for Asphalt Pavement Research and Implementation

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pennsylvania
DEPARTMENT OF TRANSPORTATION

CAPRI Project Focus

1. Support Agencies in making informed decisions,

2. Accelerating Implementation, and

3. Optimizing pavement performance criteria.

Project Co-PIs

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NCAT Lead Researcher

National Center for Asphalt Technology NCAT at Auburn University

CAPRI Consortium for Asphalt Pavement Research and Implementation

Today's Conversation

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- What are the BMD Validation Strategies
- How do they work together
- Highlight a few of the Case Studies

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Seven Validation Strategies

Benchmarking
- Baseline metrics
- Assesses proposed BMD tests

Modeling with Laboratory Data
- ME models
- Transform functions (|E*| → HWTT)

Heavy Vehicle Simulation (HVS)/Accelerated Loading Facilities (ALF)
- Accelerated, controlled loading

Closed Test Tracks
- Enable monitoring & simultaneous testing
- E.g., NCAT Test Track, MnROAD

Open Road Test Sections
- Real World
- Time-intensive

Pilot Projects
- Real World
- Practical data under actual conditions

Forensic Studies
- Mixes with known field performance
- Assess BMD tests and criteria

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Validation Techniques for Setting BMD Test Criteria

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Foreword

Balanced Mix Design (BMD) validation means that laboratory test results have a strong and defensible relationship to actual field performance. Establishing validated thresholds is critical—if criteria are too loose, premature pavement failures or reduced performance may occur; if too stringent, viable mixtures may be eliminated, driving up costs. Clear, data-driven validation provides the balance needed for durable and cost-effective pavements.

The development and validation of test criteria for asphalt mixtures are critical to the successful implementation of BMD, ensuring long-term pavement durability, cost-effectiveness, and sustainability. Strategies such as benchmarking, open road test sections, modeling, heavy vehicle simulation (HVS), accelerated loading facilities (ALF), test tracks, pilot projects, and forensic studies each offer unique strengths and limitations. No single strategy fully addresses the diverse requirements posed by varying pavement types, traffic conditions, and environmental factors. Agencies must, therefore, strike a balance between rigorous evaluation and practical considerations, including time constraints and available resources. Integrating multiple Strategies can enhance confidence in the validation of outcomes while reducing risk.

This document provides concise guidance on available validation Strategies, highlights their advantages and challenges, and provides a framework for implementation. Supported by real-world case studies from state departments of transportation (DOTs) and other relevant agencies, this resource provides practical insights into successful validation strategies for BMD performance tests. Regardless of the strategy, three principles apply: (1) no single strategy is sufficient—multiple strategies should be combined, (2) validation takes time, so efforts should start early, and (3) criteria must encompass both acceptable and unacceptable performance ranges.

Validation Strategies

The strategies are presented in order of increasing cost and complexity, from initial screening tools to large-scale field efforts. All strategies involve testing mixtures with selected or proposed laboratory tests, like the Hamburg Wheel Tracking Test (HWTT) to assess rutting resistance or the Indirect Tensile Asphalt Cracking Test (IDEAL-CT) to assess cracking resistance.

Benchmarking involves testing existing mixtures with selected or proposed tests. This provides agencies with a set of baseline metrics and assesses if the test(s) differentiate between typical mixes used by the agency. It is cost-effective and relatively quick. This strategy is best used for early-stage validation of mix designs and establishing initial thresholds for specific tests. However, initial thresholds lack field validation and must be refined.

Modeling with Laboratory Data involves leveraging laboratory tests and mechanistic-empirical (ME) models to predict performance based on mechanical properties, often with transform functions developed to correlate predictions with BMD index tests. This strategy is rapid and cost-effective, enabling simulation of various traffic and environmental scenarios while integrating lab-based index test results. However, its accuracy relies on quality input data and may oversimplify complex field interactions. It is best suited for preliminary evaluations, optimizing validation plans by linking ME predictions to test outcomes, and supporting other validation strategies by forecasting long-term performance.

Heavy Vehicle Simulation (HVS)/Accelerated Loading Facilities (ALF) employ mobile or stationary equipment to apply controlled, repetitive loading to pavement sections, simulating years of traffic in a matter of months. This strategy accelerates pavement distress and bridges the gap between laboratory and field conditions; however, it is expensive and does not fully capture the diverse field conditions or aging effects. It's best for evaluating mix performance under high-traffic conditions, validating specific failure modes, and testing experimental or innovative mixes in controlled settings.

Closed Test Tracks involve dedicated facilities where pavement sections are subjected to controlled traffic loading to evaluate performance under realistic yet managed conditions. They enable the monitoring and simultaneous testing of multiple mix designs, but are costly to operate and may not fully reflect the diverse field conditions. Test tracks are best for validating high-traffic or heavy-load applications and supporting large-scale research, such as studies at NCAT or MnROAD. A key advantage is their ability to accelerate traffic loading, thereby shortening the validation timeframe.

Open Road Test Sections entail constructing full-scale pavement sections on actual roadways to evaluate performance under real, yet consistent, traffic and environmental conditions over time. They provide valuable real-world data reflecting local conditions and long-term behavior, but are time-intensive, costly, and subject to variability in traffic, climate, and potential variations in support conditions. This strategy is best for validating mix designs for high-traffic or critical roadways. (See: CAPRI Report)

Pilot Projects implement new BMD mixtures on a small scale in real-world settings to assess performance before widespread adoption. They offer practical data under actual conditions and reduce risk, but require extended monitoring and are often subject to variability in traffic, climate, and potential variations in support conditions. Pilot projects are ideal for testing mixes, validating performance in specific climates, and building stakeholder confidence. Some pilot projects may involve substantial tonnages, depending on the scope.

Forensic Studies involve replicating mixtures of known field performance in the lab, both good and bad, to assess criteria. The availability of similar materials, binders, and aggregates can limit the ability to replicate original conditions, and results may be influenced by variability in construction practices or environmental factors. Forensic studies are best suited for investigating premature pavement failures.

Each Strategy offers unique advantages, but no single strategy fully addresses the diverse needs of asphalt mix validation (see Table 1). Benchmarking and modeling are cost-effective for initial screening and risk reduction, while open road test sections, test tracks, HVS/ALF, along with pilot projects, provide more robust data at higher costs and time commitments. The choice of Strategies depends on factors such as mix type, traffic conditions, environmental factors, agency resources, and project timelines. Combining multiple Strategies (e.g., benchmarking for initial screening, followed by pilot projects with open road or test track sections) can enhance confidence in performance criteria while balancing practical constraints.

Proposed Validation Framework

In 2023-24, the Federal Highway Administration (FHWA) hosted seven regional BMD peer exchanges (link to TechBrief). The primary motivation for State DOTs to move to BMD is that ***volumetrics do not always yield optimal performance***. The Proposed Validation Framework demonstrates how the various validation strategies can work together (see Figure 1). It is organized into four phases, ensuring harmony between cost, time, and robust validation. This enables DOTs to confidently adopt BMD criteria tailored to specific traffic, environmental, and material conditions.

In the **assessment** phase, State DOTs evaluate current pavement performance and benchmark existing mixtures using proposed or selected BMD tests to establish baseline metrics. This step identifies gaps in current volumetric-based designs and informs the selection of appropriate tests. *"Assessment" = "Selecting the Right Tests"*.

The **setting initial criteria** phase leverages literature reviews, benchmarking data from mixtures with known performance, and can also include mechanistic-empirical modeling to establish initial performance thresholds.

Implementation Framework

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Assessment

- Current Performance (PMS)
- Current Mixes (Benchmarking)

Setting Initial Criteria

- Literature Review
- Benchmarking
- Modeling with Lab Data

Initial Validation

- Open Road
- Closed Test Tracks
- HVS/ALF
- Pilot Projects
- Forensic Studies

Monitoring / Refining

- Long-term Monitoring
- Additional Projects / Studies
- Regional Collaboration
- Return on Investment (ROI)

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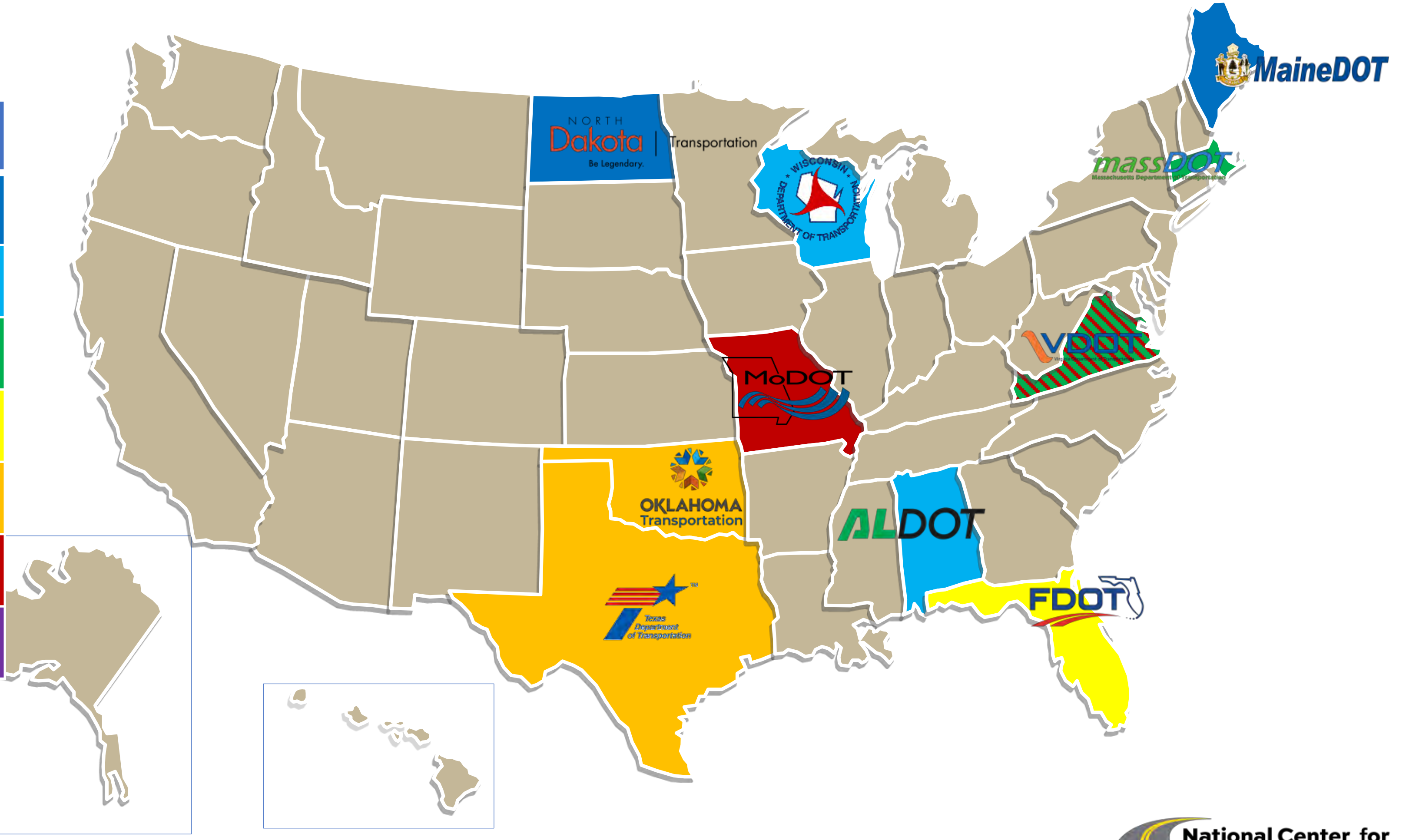
Advantages, Disadvantages, and Limitations of Validation Strategies.

Advantages	Bench-marking	Modeling with Lab Data	HVS/ALF	Closed Test Tracks	Open-Road Test Section	Pilot Project	Forensic Study
Real-world Traffic					✓	✓	✓
Real-world Environmental Conditions					✓	✓	✓
Long-Term Data Collection					✓	✓	
Relative Cost	$	$	$$	$$	$$$	$$$	$
Effectiveness	★	★★	★★	★★★	★★★★	★★★	★★
Accelerated Testing			✓	✓			
Controlled Environment			✓	✓			
Controlled and Repeatable Loading			✓	✓			
Comprehensive Data			✓	✓	✓		
Disadvantages							
Slow Data Accumulation					X	X	
Limited Control	X		X		X	X	X
Spatial Variability					X	X	X
Limited Representation of Real-World Conditions		X	X	X			
Limited Flexibility	X	X		X		X	X
Complexity and Cost							
Granularity of Data	X	X				X	X
Data Accuracy		X					X
Tie to Field Performance	X	?	X				

CAPRI Case Studies (13)

Case Study	Agencies
Benchmarking	ND ME
Open Road	AL WI
Modeling	MA VA
HVS/ALF	FHWA FL
Test Track	OK TX
Pilot Projects	MO VA
Forensic	New England



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Benchmarking

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Validation Techniques for Setting BMD Test Criteria

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Case Study: *MaineDOT Benchmarking*

Assessment
Setting Initial Criteria

Objectives

Maine Department of Transportation (MaineDOT) is proactively advancing performance-based mix design (Balanced Mix Design, BMD) to improve rutting and cracking performance by aligning lab results with observed field outcomes across Maine's varying climates and traffic spectra. This case study highlights the MaineDOT benchmarking efforts to assess existing mixes with candidate tests and establish initial criteria. *Their goal was to select appropriate tests that were reasonably fast, repeatable, and matched perceived field performance.*

Benefit

MaineDOT initiated benchmarking in 2015 (expanded in 2019) to build a broad, representative baseline of performance for field-produced mixes across binder grades, nominal maximum aggregate sizes (NMAS), reclaimed asphalt pavement (RAP) contents, and traffic levels, supporting a transition toward BMD.

Background

The benchmarking covers all mixture designs and randomly selected designs over several years, ensuring broad representation without targeting specific variables.

Methodology

MaineDOT

Rick B.

Assessment

Setting Initial Criteria

Benchmarking

Methodology

MaineDOT's benchmarking methodology…

1. ***Performance Tests Evaluated:*** HWTT, IDEAL-CT, Cyclic Fatigue Test / Stress Sweep Rutting (SSR) AMPT, HT-IDT, IDEAL-RT.
2. ***Sampling/Handling and Data Collection:*** MaineDOT collected samples from plant production, reheating for testing without further aging to reflect field conditions.
3. ***Analysis and Factors Considered:*** 3 binder grades, binder source and modification (polymer-modified vs. unmodified), mix type, NMAS, volumetric properties, aggregate source and RAP content, traffic levels.
4. ***Participation in Round Robin Testing:*** FHWA and NCAT, round-robin work quantified inter-lab reproducibility and compared production /compaction scenarios.

Benchmarking

Test	Key Metrics	Implementation Decision
HWTT	SIP, Rut Depth at 20,000 passes	Adopt for rutting/moisture screening; criteria to be refined with local performance comparisons.
IDEAL-CT	CT_{Index}	Adopt for cracking screening with provisional lower bounds; continue to tune by climate subzones and project performance.
Cyclic Fatigue (AMPT)	Apparent Damage Capacity (S_{app})	Not for routine use (due to test duration/cost) and unclear value for screening.
SSR (AMPT)	Rutting Resistance	Pilot only / Not for routine use due to duration.
IDEAL-RT	RT_{Index}	Adopt as a rapid QA/production check; develop compatibility rules with HWTT outcomes.

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Benchmarking

MaineDOT

Challenges and Opportunities

- **Buy-in (DOT & Industry):**
  - DOT leadership expressed caution around pilot costs and schedule risk.
  - Industry highlighted training needs to integrate BMD testing into QC plans.
  - Focused communication and hands-on training can reduce perceived risk.
- **Time/cost of advanced tests:** AMPT cyclic fatigue and SSR require extended durations (1 to 2 weeks), impacting decision timelines. MaineDOT is prioritizing rapid tests (IDEAL-CT/IDEAL-RT/HWTT) for screening purposes.
- **Validation Across Scenarios**: Correlating lab results with field performance under differing conditions remains a priority; ongoing collaboration with FHWA's Mobile Asphalt Technology Center supports this need.

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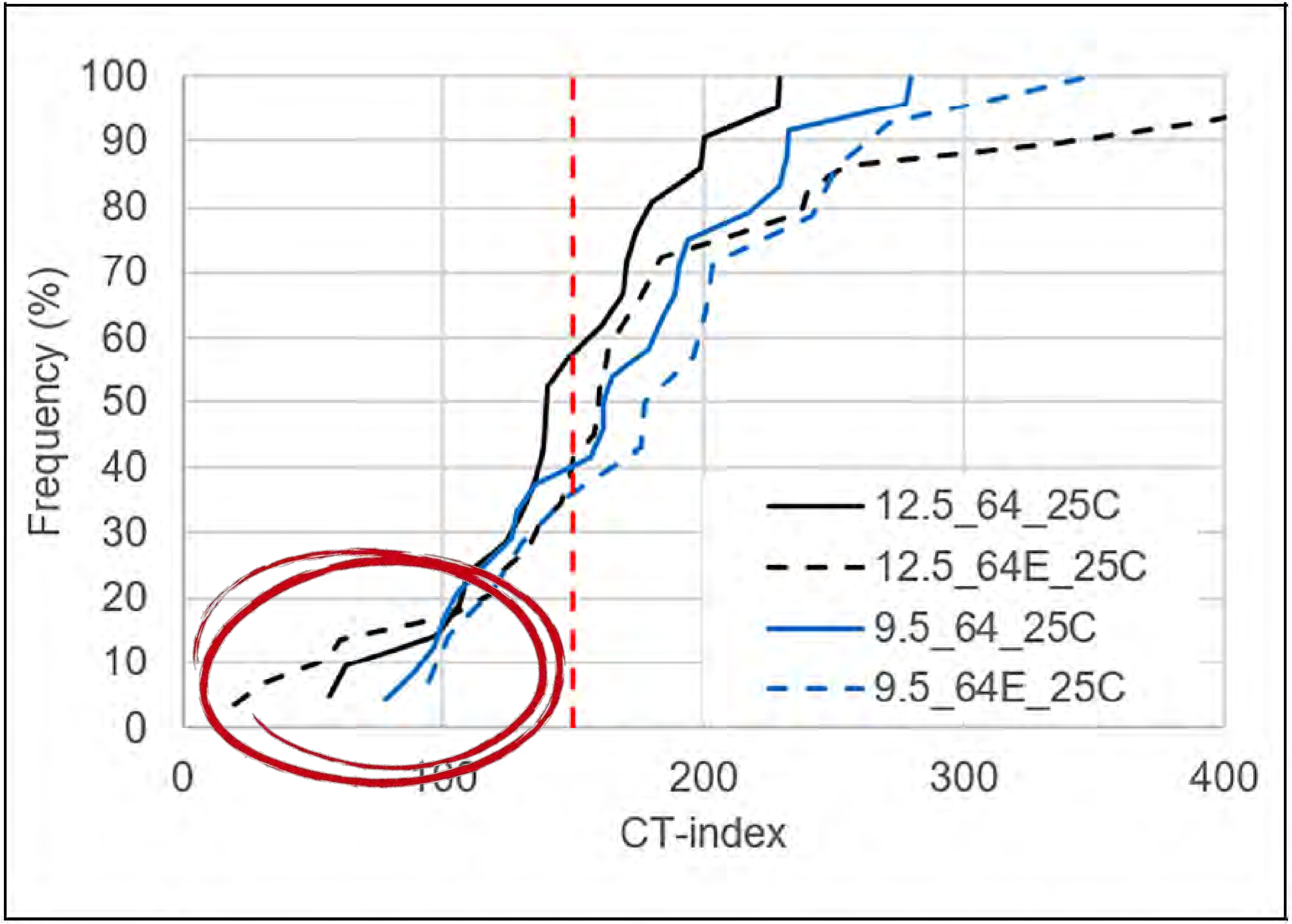

Excerpt:
Figure 6. Cumulative Distribution of IDEAL-CT (CT_{Index})

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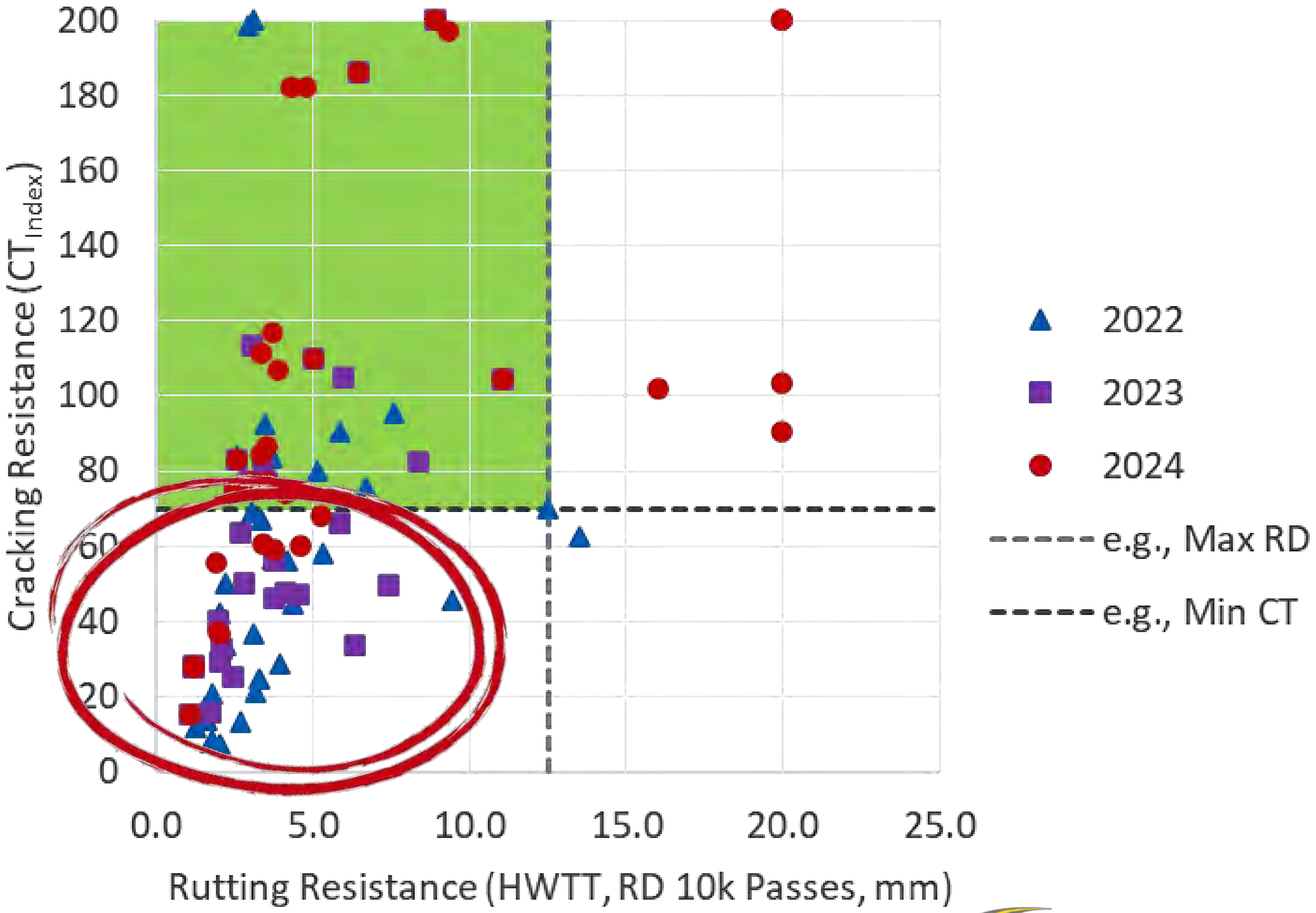
MaineDOT

"Balanced Mix Design Benchmarking of Field-Produced Asphalt Mixtures in Maine, U.S.," Veeraragavan et al., 2021.

Benchmarking

NORTH Dakota | Transportation
Be Legendary.

- **Challenges/Logistics**
  - Equipment Setup Costs.
  - Staff Training.
  - Sample Collection.
  - Data Management.



Tyler W.

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Modeling (PMED)

massDOT
Massachusetts Department of Transportation

UMass Dartmouth

Texas A&M Transportation Institute

BMD Approach A: Assessing CT_{Index} Criterion of 90 min.

Tests
- HWTT
- IDEAL-CT

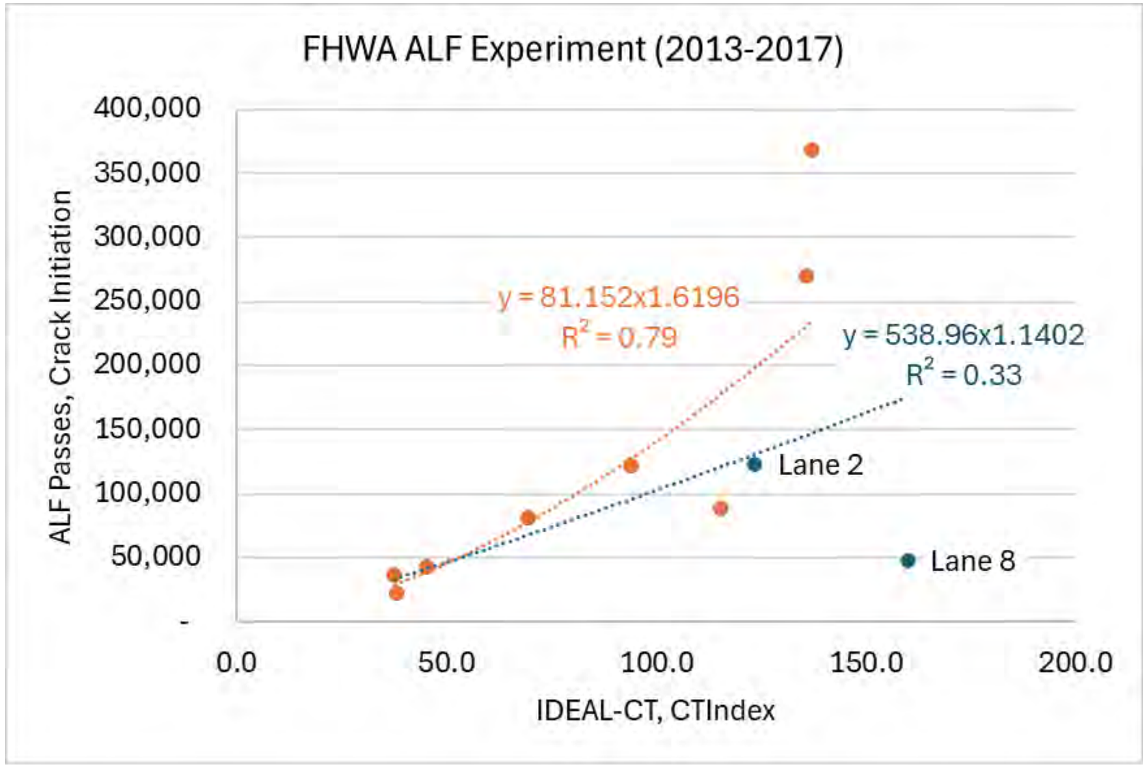
Aging
- STA
  4h @ 135°C
- LTA
  20h @ 110°C

Production Tolerances
- OBC ↓ Limit
- w/ ↑ gradation limit
- w/ ↓ gradation limit

Modeling
- 21 Plant Mixes
- Dynamic Modulus |E*|
- PMED Validation

Walaa M.

FHWA ALF… NCHRP IDEA Projects



Lane No.	1	2	3	4	5	6	7	8	9	11
Binder PG	64-22	58-28	64-22	64-22	64-22	64-22	58-28	58-28	64-22	58-28
RBR, %	Control	40 RAP	20 RAS	20 RAP	40 RAP	20 RAP	20 RAS	40 RAP	20 RAP	40 RAP
WMT		Foamed		Evotherm					Foamed	Evotherm

U.S. Department of Transportation Federal Highway Administration

Texas A&M Transportation Institute

IDEA Innovations Deserving Exploratory Analysis Programs

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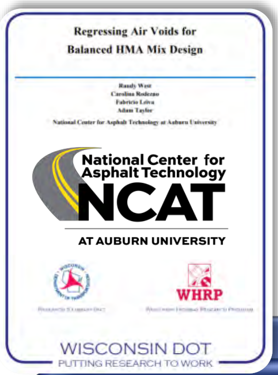
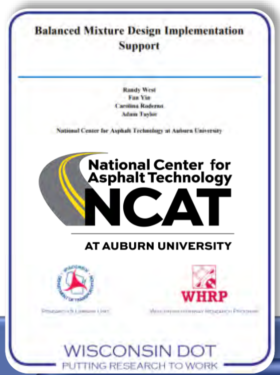
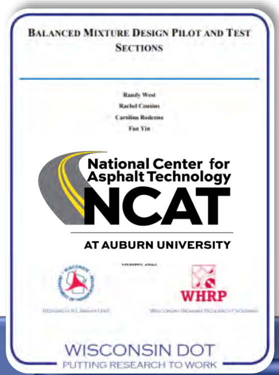
Wisconsin is a Leader in Asphalt Research and BMD!







Regressed Air Voids 2016-18

BMD Implementation 2020-21

BMD Pilot & Test Sections 2023-24

Benchmarking ΔTc↓ & GRP↑ 2025

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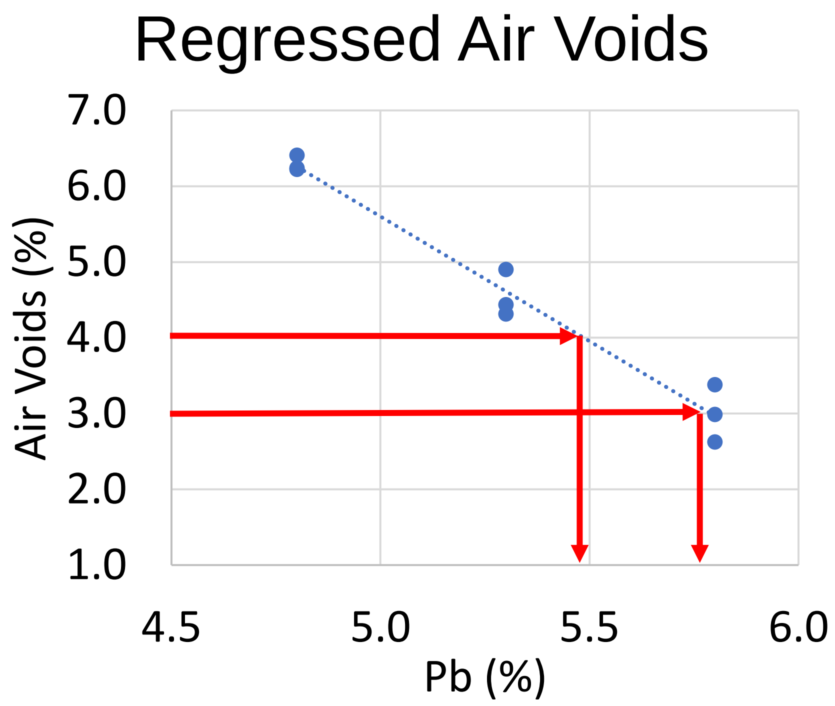
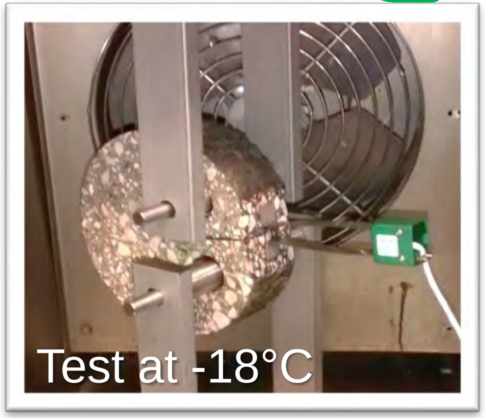
Regressing Air Voids for BMD

2016-18 (PI – Dr. Randy West)

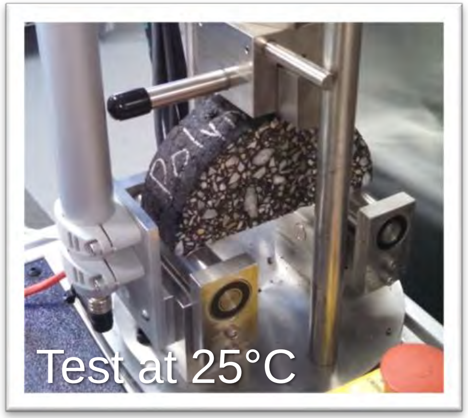
- 6 JMFs, 40-75-100 N_{design}, PG 58-28/-34, 15-37% RAP, 0-3% RAS
- Regressing 4.0 to 3.0% V_a increases P_b by 0.3 to 0.4%



Hamburg
(AASHTO T 324)



DCT
(ASTM D7313)



IFIT
(AASHTO TP 124)

BMD Implementation Support
Primary Criteria for DCT, IDEAL-CT, HWTT

- Interview Mix Designers
- Benchmarking/BMD Modifications
- Economic Analysis
- Proposed WisDOT Specs… Continue Regressed Air Voids &…

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Specimen testing with (from left to right) DCT, IDEAL-CT and HWTT.

Randy, Fan, Adam, Carolina

BMD Mix Optimization Strategies (attempted)

To Improve…	Strategy
Cracking	Add additional binder
	Remove/limit RAS
	Add rejuvenator (RA)
	Lower LT-PG grade
Rutting	Higher MSCR grade
Stripping	Add liquid anti-strip (LAS)

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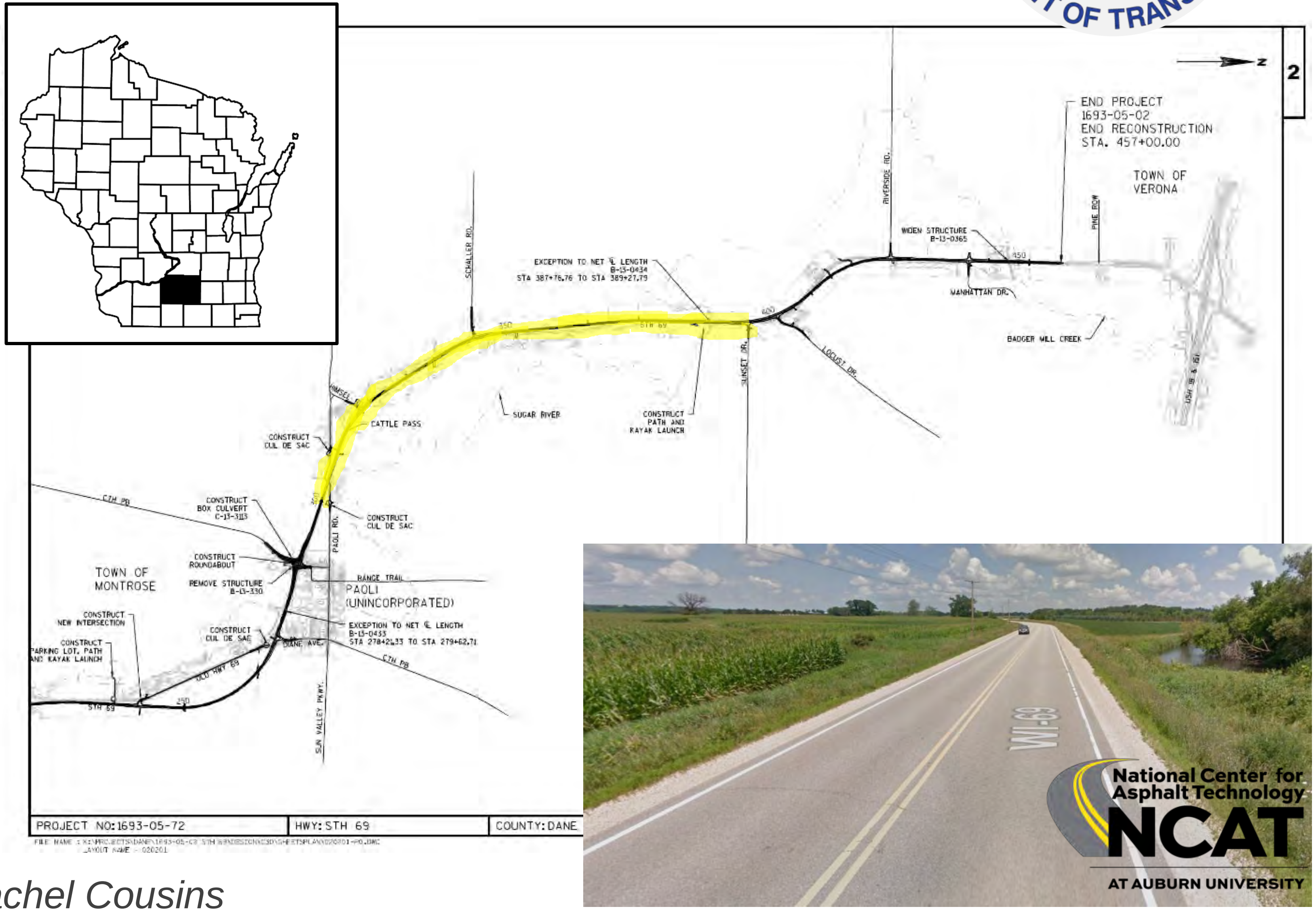
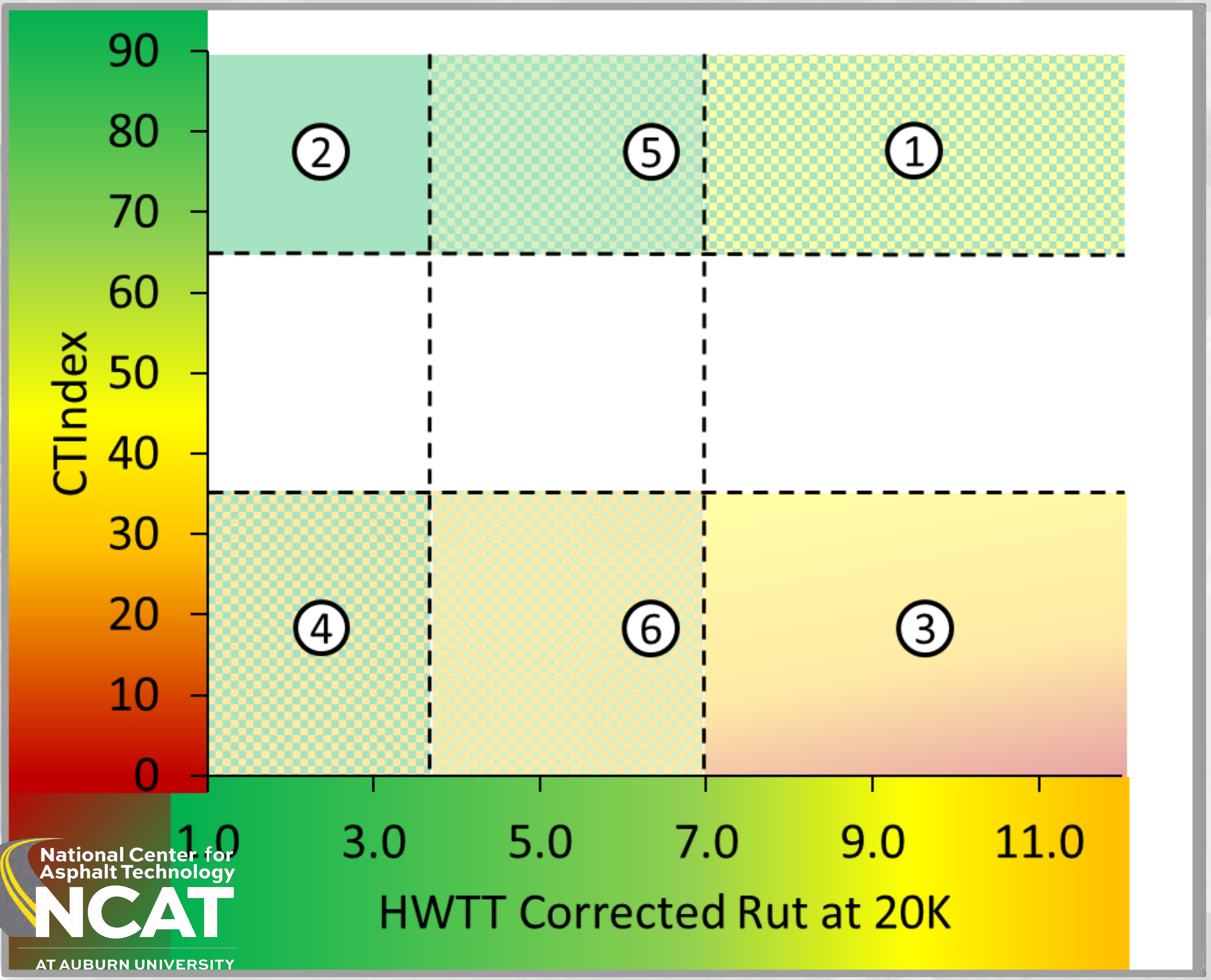
BMD Open Road Test Sections
STH 69, Dane County, South of Verona



Randy, Fan, Carolina, Grant, Matt, and Rachel Cousins

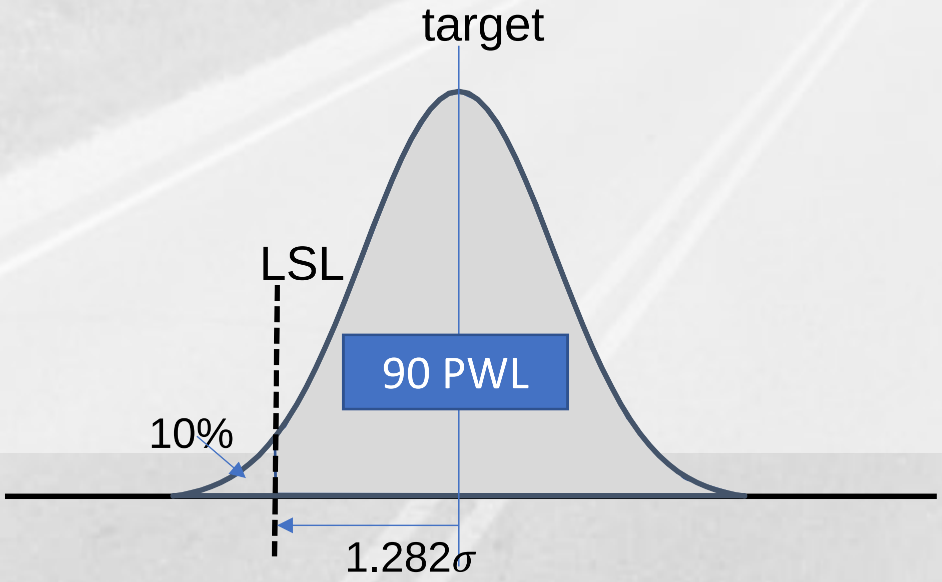
BMD Open Road Test Sections
STH 69, Dane County, South of Verona



"Outcomes from this project advanced implementation of BMD for WisDOT, as well as provided valuable lessons learned on how to build test sections."
– Tirupan Mandal, WisDOT

10 Shadow Projects
Exploring BMD test variability

- Recommendations
  - Investigate lab-to-lab differences
  - Formal training on BMD tests
  - Continue monitoring shadow projects…



Pilot Projects

Industry-Agency-Academia Partnership
✓ Quarterly Meetings
✓ Technical Team Meetings
✓ BMD Group

Year	Location	Number	Mixes	Polymer/Modifiers	BMD Tests	Sample Prep
2021	Route 740	4 mixes	DG	SBS, PPA, GTR, WP	HWTT, TSR, CT_{Index}	LMLC, PMPC w/o RH
2022	Statewide	16 projects 25+ mixes	DG SMA	SBS, GTR/WP	HWTT, TSR, CT_{Index} for QA	PMPC w/o RH; LMLC QA
2023	I-155	9 mixes	6 DG 3 SMA	SBS, PPA, GTR, WP, LDPE, HDPE	HWTT- SIP, TSR, CT_{Index}, RT_{Index}, DCT	LMLC, PMPC, PMLC w/o RH & RH
2024	Statewide	14+ projects	DG SMA	SBS, PPA, GTR, WP expanded use	QA: CT_{Index}, RT_{Index}, TSR, SIP	PMPC w/o RH, LMLC round-robin

MoDOT Joint Special Provision JSP 2401 Performance Test Criteria (2025)

Mix Type	Min. CT_{Index}	Min. $CT_{Index\ (LTA)}$
Non-SMA	50	Info. Only
SMA	135	Info. Only

PG Grade	Min. RT_{Index}	HWTT Min.	Max. Rut Depth
58H-28 / 64-22	50	7,500 passes	0.38 in.
64H-22 / 70-22	65	15,000	
64V-22 / 76-22	80	20,000	

Long-Term Aged (LTA) loose mix aged 20 hours at 115°C

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MoDOT
MAPIL Mizzou Asphalt Pavement & Innovation Lab

Pilot Projects

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- Monitor sections to correlate lab results and field performance.
- Expand statewide implementation using refined JSP 2401.
- **Urgent need for a long-term aging criterion for the CT_{Index}.**
- Refine the current RT_{Index} criteria based on HWTT.
- Replace the current TSR requirements with the HWTT SIP.

Jason B.
Dale W.
Bill B.

MAPA MISSOURI ASPHALT PAVEMENT ASSOCIATION

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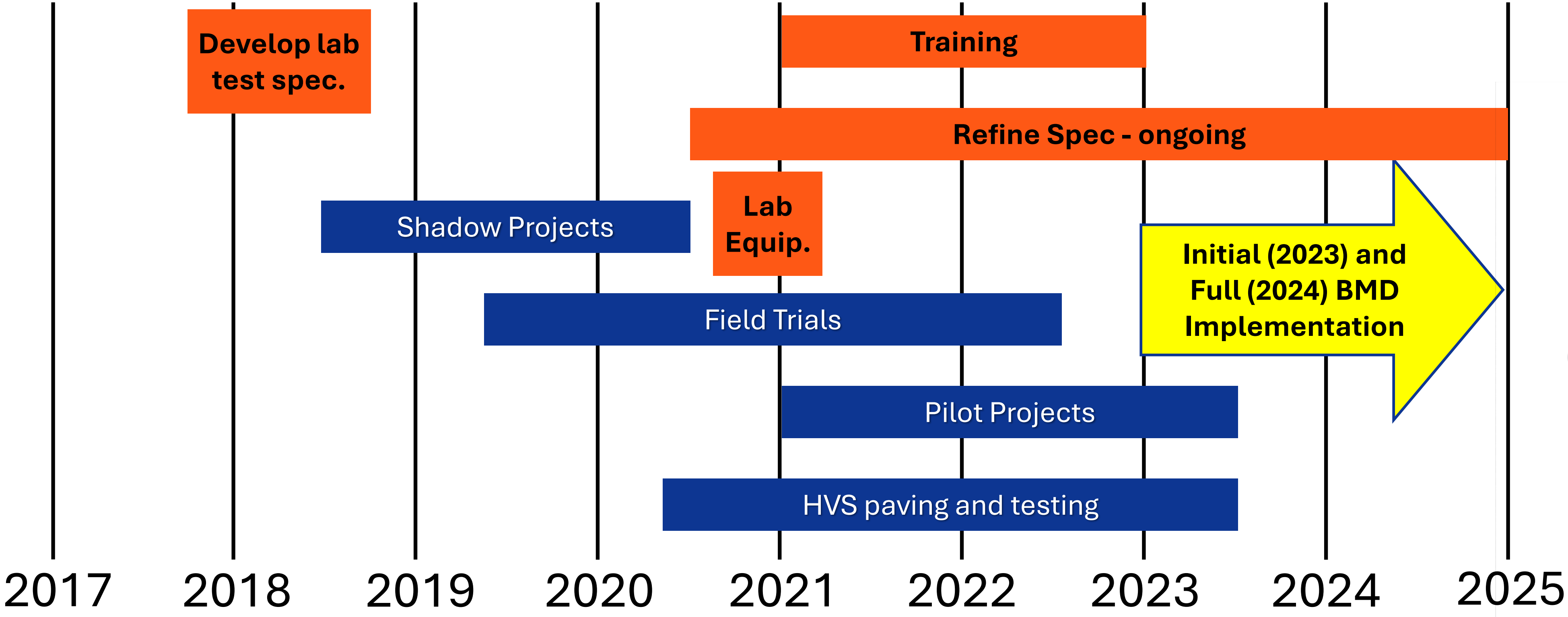
MAPIL Mizzou Asphalt Pavement & Innovation Lab

Pilot Projects++

Challenges

- **RAP variability**
- **Limited lab capacity and differing equipment**
- **Logistics** (material cooling, target air-void hit rate)



Stacey D.

VDOT Virginia Department of Transportation

VTRC Virginia Transportation Research Council

VECAT

VIRGINIA TECH TRANSPORTATION INSTITUTE

Forensic Study

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1. Which laboratory tests best correlate with observed field performance?
2. How can forensic analysis of failed and successful pavements inform threshold setting?
3. How can the potential effects of moisture-induced damage be quantified on pavement service life?

Chris D.

- **ITS** ratio/value Lottman & MIST™
- **DCT** Disk-shape Compact Tension
- **SCB** Semi-Circular Bend
- **UPV** Ultrasonic Pulse Velocity
- **|E*|** MIST
- **HWTT**

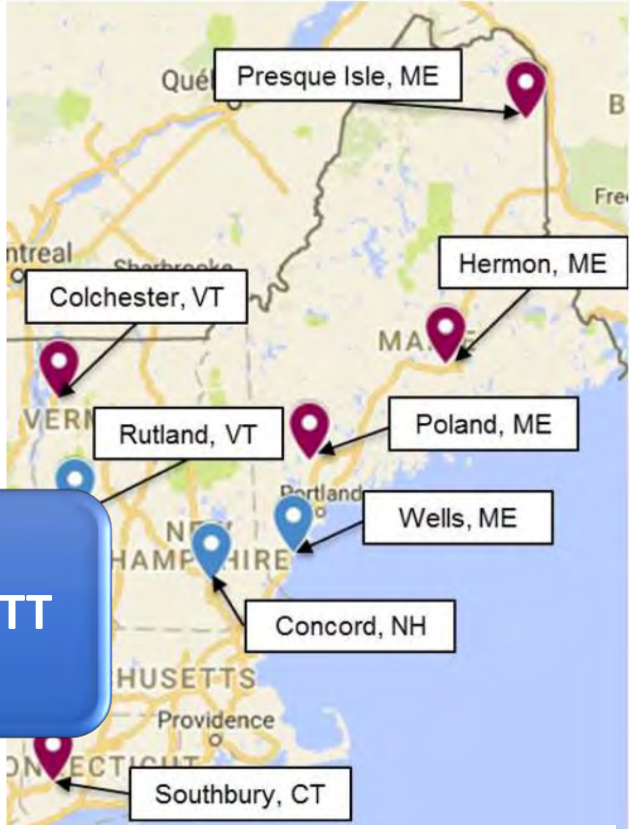

Figure 1. Study Mix Locations
Blue: Good, Red: Poor

ConnDOT MaineDOT massDOT New Hampshire DOT RIDOT VERMONT AGENCY OF TRANSPORTATION University of New Hampshire WPI U.S. Department of Transportation Federal Highway Administration

Forensic Study

- ✓ New England agencies should not rely on AASHTO T 283
- ✓ **HWTT is recommended to be pursued and adopted**
- ✓ UPV can be used as a low-cost, non-destructive screening tool during mix design
- ✓ MIST is also recommended on a routine basis during mix design and evaluation

ITS ratio Lottman & MIST → **ITS** value & MIST → **DCT** Disk-shape Compact Tension → **SCB** Semi-Circular Bend → **UPV** Ultrasonic Pulse Velocity → **|E*|** MiST → **HWTT**

Presque Isle, ME · Colchester, VT · Rutland, VT · Concord · Southbury, CT

Implementation Framework

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Assessment

- Current Performance (PMS)
- Current Mixes (Benchmarking)

Setting Initial Criteria

- Literature Review
- Benchmarking
- Modeling with Lab Data

Initial Validation

- Open Road
- Closed Test Tracks
- HVS/ALF
- Pilot Projects
- Forensic Studies

Monitoring / Refining

- Long-term Monitoring
- Additional Projects / Studies
- Regional Collaboration
- Return on Investment (ROI)

PennDOT BMD Implementation

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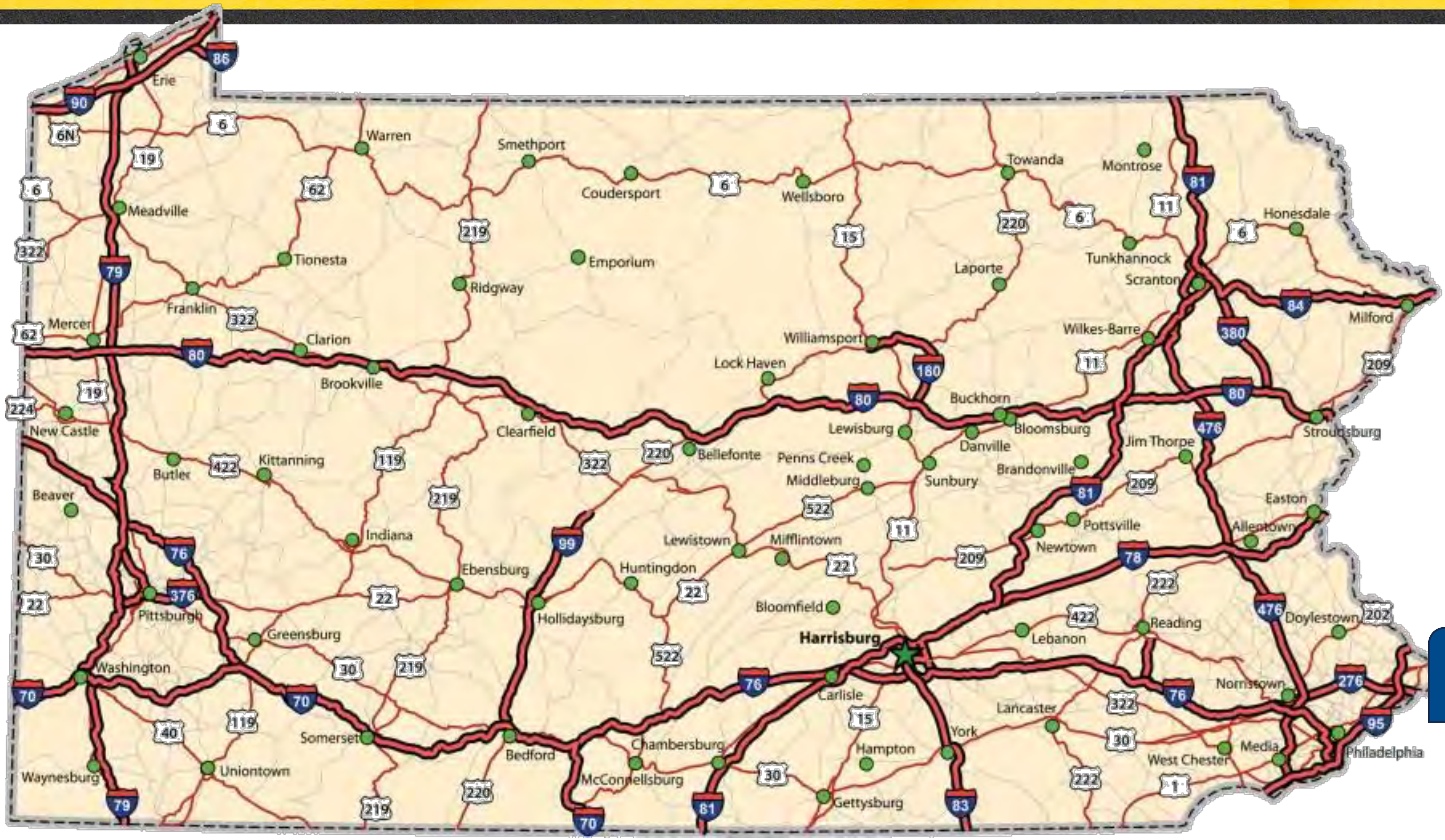

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YOU ARE HERE

Pre-Implementation

Preliminary Test Criteria for Mix Approval

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Traffic (Million ESALs)	HWTT			IDEAL-CT	AASHTO R 114*
	Max RD 20,000 Passes	SIP Min Passes	Min Passes at 12.5mm RD	CT_{Index}	ΔTc
< 3	≤ 15 mm	n/a	n/a	> 70	> -5.0°C
	> 15 to ≤ 20	≥ 14,000	10,000		
3 to < 10	≤ 10	n/a	n/a	> 80	
	>10 to ≤ 15	≥ 14,000	12,000		
	>15 to ≤ 20	≥ 16,000	14,000		
≥ 10	≤ 10	n/a	n/a	> 90	
	>10 to ≤ 12	16,000	15,000		

* Only applies to JMFs with a total RBR ≥ 0.35

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Lots of Resources

Training Opportunities

- ✓ **BMD Implementation Workshop**
- ✓ **High-Reclaimed Asphalt Pavement (RAP) Mixture Strategies**

Thoughts

State Participants Key Takeaways (1/3)

ASPHALT | INNOVATE | ENLIGHTEN | IMPLEMENT

- Start with a Plan
- Define Your "Why"
- Identify Champions
- Account for Staffing Needs
- Invest in Training

8 Tasks for Implementation

ASPHALT | INNOVATE | ENLIGHTEN | IMPLEMENT

TechBrief

The Asphalt Pavement Technology Program is an integrated national effort to improve the long-term performance and cost effectiveness of asphalt pavements. Managed by the Federal Highway Administration working with State highway agencies, industry and academia, the program's primary goals are to reduce congestion, improve safety, and foster technology innovation. The program was established to develop and implement guidelines, methods, procedures, and other tools for use in asphalt pavement materials selection, mix design, testing, construction, and quality control.

Office of Preconstruction, Construction, and Pavements
FHWA-HIF-22-048
Date: April 2022

U.S. Department of Transportation
Federal Highway Administration

Balanced Asphalt Mix Design: Eight Tasks for Implementation

Introduction

Balanced Mix Design (BMD) is described as an "asphalt mix design using performance tests on appropriately conditioned specimens that address multiple modes of distress taking into consideration mix aging, traffic, climate, and location within the pavement structure."[1] Goals for implementation of BMD may differ among State Departments of Transportation (DOTs). Initially, some may wish only to add performance tests as part of mix design approval, whereas others may want to replace many existing criteria with new performance test criteria for mix design approval as well as for quality assurance (QA). To learn more regarding the details of BMD and implementation efforts, FHWA conducted virtual site visits between April and September 2020 and interviews of seven early adopter State DOTs, along with material producers, consultants and paving contractors that serviced the agencies. The participating State DOTs were California DOT (Caltrans); Illinois DOT (IDOT); Louisiana DOT and Development (LaDOTD); Maine DOT (MaineDOT); New Jersey DOT (NJDOT); Texas DOT (TxDOT); and Virginia DOT (VDOT).

Successful practices documented from these virtual site visits were collected and synthesized into an overall process of implementing BMD as part of mix design approval and QA. This effort suggested eight major tasks based on concurrent activities (e.g., BMD regional workshops[3], BMD implementation guide[4]). The tasks and the associated subtasks are presented in Table 1. These tasks are meant to summarize the suggested activities that a State DOT may need to undertake to implement a BMD program. Not all tasks may be applied or considered by a State DOT depending on its organizational structure, staffing level, workspace, annual asphalt tonnage, as well as industry experiences and practices. Use of the tasks is not a Federal requirement.

Although there are logical sequences for some of the tasks, there are some cases where tasks may be conducted in parallel or in a different order without any negative consequences. For instance, several activities can occur in multiple inter-related tasks or subtasks. The following sections describe the various tasks for BMD implementation.

FHWA TechBrief: FHWA-HIF-22-048

Task		Sub Task	Description
1	Motivations and Benefits of Performance Specifications		
2	Overall Planning	2.1	Identification of Champions
		2.2	Establishing a Stakeholders Partnership
		2.3	Doing Your Homework
		2.4	Establishing Goals
		2.5	Mappin
		2.6	Identifyi
		2.7	Develop
3	Selecting Performance Tests	3.1	Identifyi
		3.2	Identifyi
		3.3	Validatir
4	Performance Testing Equipment: Acquiring, Managing	4.1	Acquirir
		4.2	Managir
		4.3	Conduct
		4.4	Evaluati
		4.5	Conduct
5	Establishing Baseline Data	5.1	Reviewi
		5.2	Conduct
		5.3	Conduct
		5.4	Analyzir
		5.5	Determi
6	Specifications and Program Development	6.1	Samplin
		6.2	Pay Adju
		6.3	Develop
		6.4	Conduct
		6.5	Final An
7	Training, Certifications,	7.1	Develop
		7.2	Establisl
8	Initial Implementation		

State Participants Key Takeaways(2/3)

ASPHALT | INNOVATE | ENLIGHTEN | IMPLEMENT

- Start Validation Early
- Transition Mindset
- Collaborate with Industry
- Leverage Peer Resources
- Utilize Existing Funding

State Participants Key Takeaways(3/3)

- Build a Strong Data System
- Encourage Regional Collaboration
- Plan for Setbacks

Wrap Up

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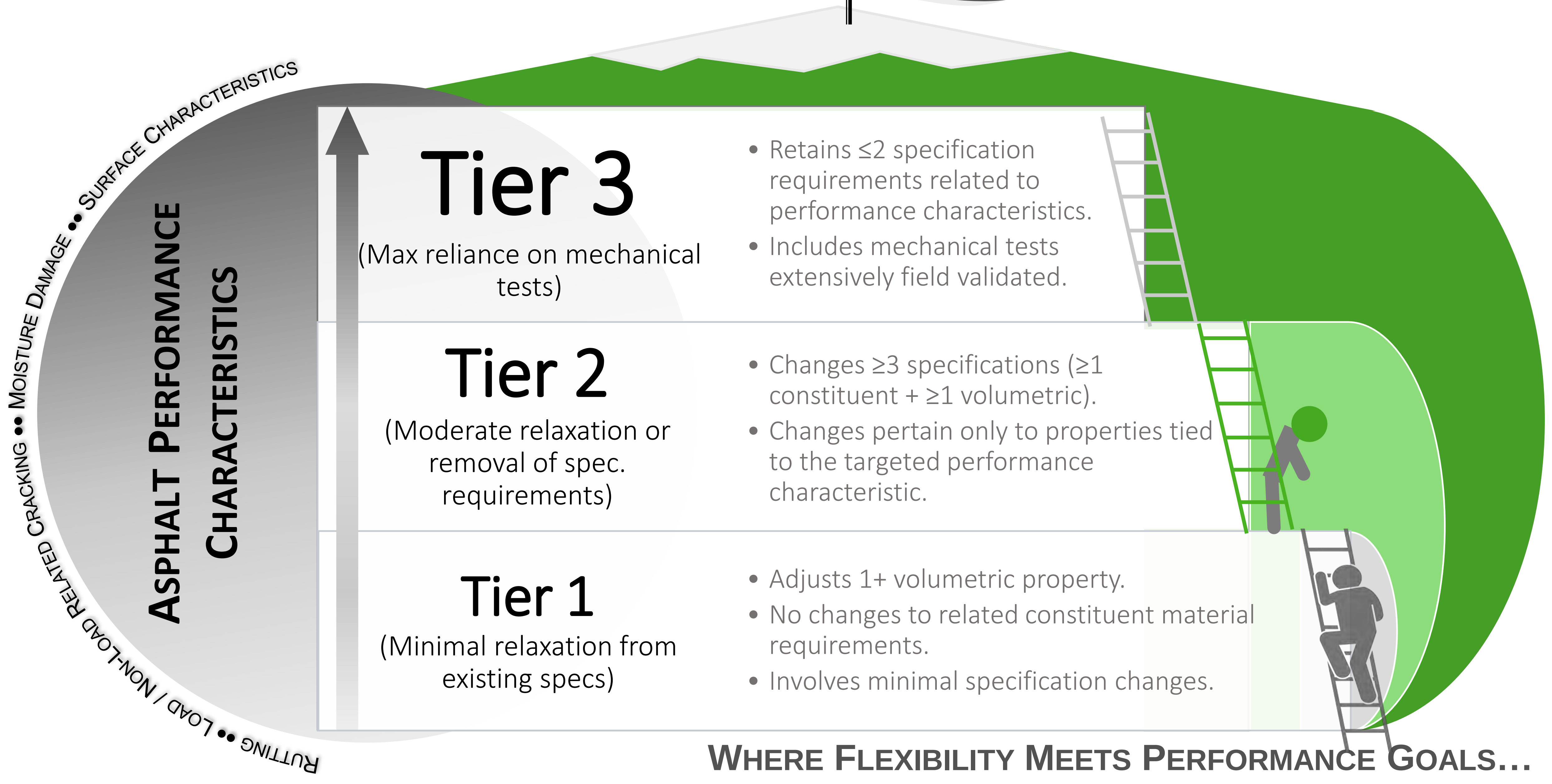
What are Your Takeaways?

- ✓ Validation is more than 1 Thing
- ✓ There are 7 Validation Strategies
- ✓ BMD will continue to evolve…
- ✓ Are you part of the solution?

Balanced Mix Design (BMD) Tiered System



Q & A

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War Eagle!

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Thanks, Y’all!