FHWA Research - Performance Engineered Mix Design (PEMD) and Performance-Specifications for Construction (PRS) for Asphalt Pavements

ASPHALT MIX ETG

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Why is FHWA Pursuing Performance Testing? SHRP/SUPERPAVE

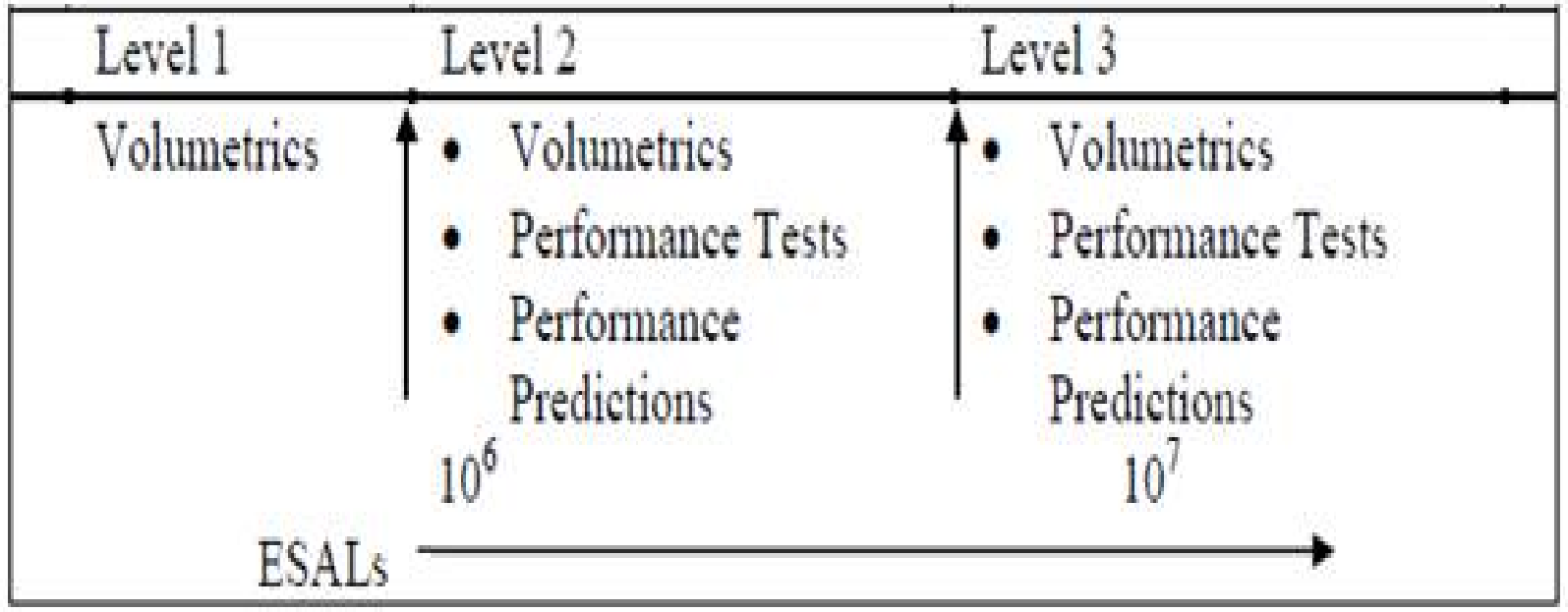
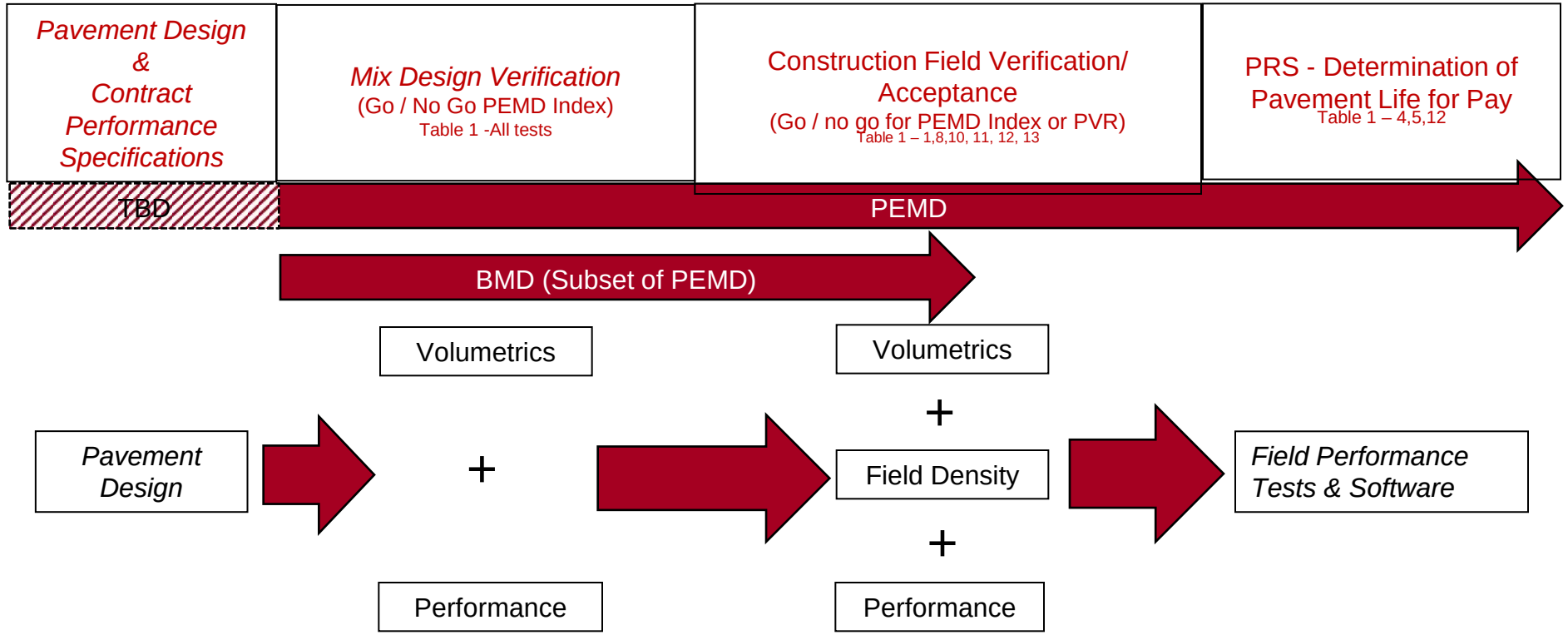


Figure 21 Hierarchical Organization of the Superpave Mix Design and Analysis

From the implementation of SHRP/SUPERPAVE and subsequent years the following questions

- How can I extend pavement life?
  - Specification development/targets
  - Exceeding performance thresholds
  - Optimizing asset management plan
- How can I measure performance upfront?
  - Effect of Newer Mixes, RAP, WMA, etc., and model different pavement structure
  - Laboratory testing and conditioning
    - Fundamental
    - Index-based
    - Lots of tests

PEMD and Performance Specifications for Construction(PRS)



Note: "Performance" Tests conducted during mix design may vary from those used during field verification for PEMD.

PEMD/AMPT "for now" uses Index & Performance Volumetric Relationship (PVR) for determination of acceptance.

PEMD/AMPT ultimate goal is to use the equipment for mix design and field verification/acceptance. Improvement of test procedures and processes for effective use.

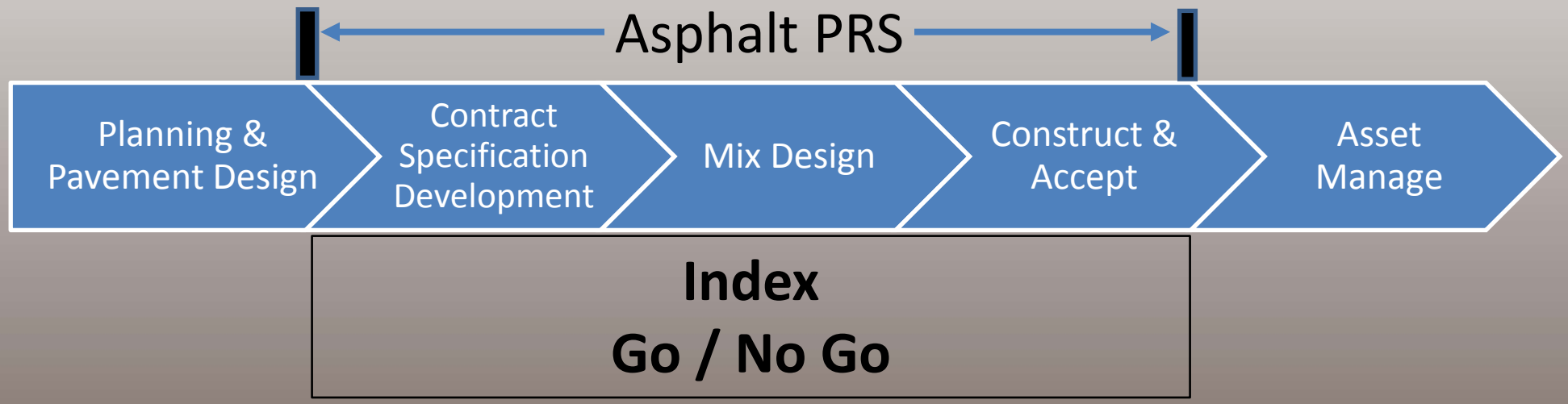
TBD - Collaborative effort with industry, AASHTO, and FHWA

PEMD Test Methods
Index and Predictive Performance

Distress	#	Performance Test	AASHTO/ASTM Test Designation	Index Performance Test	Predictive Performance Test
Stability/Rutting	1	Marshall Stability[2]	T 245	X	
	2	Hamburg	T 324	X	
	3	Asphalt Pavement Analyzer	TP 63	X	
	4	AMPT Flow Number[1]	T 378	X	X
	5	AMPT Stress Sweep Rutting[1]	TP in 2018	X	X
Durability/Cracking	6	Four Point Bending	T 321	X	X
	8	Illinois Flexibility Index[2]	TP 124	X	
	9	Texas Overlay	Tx-248-F	X	
	10	Indirect Tension[2]	T 322	X	
	11	Semi-Circular Bending[2]	D8044	X	
	12	AMPT Cyclic Fatigue[1]	TP 107	X	X
		AMPT Cyclic Fatigue (Small Specimen)[1,2]	TP in 2018	X	X
	13	IDEAL CT[2]		X	
	14	Disk-Shaped Compact Tension	D7313	X	X
Moisture Damage/Stripping	15	TSR	T 283	X	
	16	Hamburg	T 324	X	
	17	Dynamic Modulus Ratio	T 378	X	

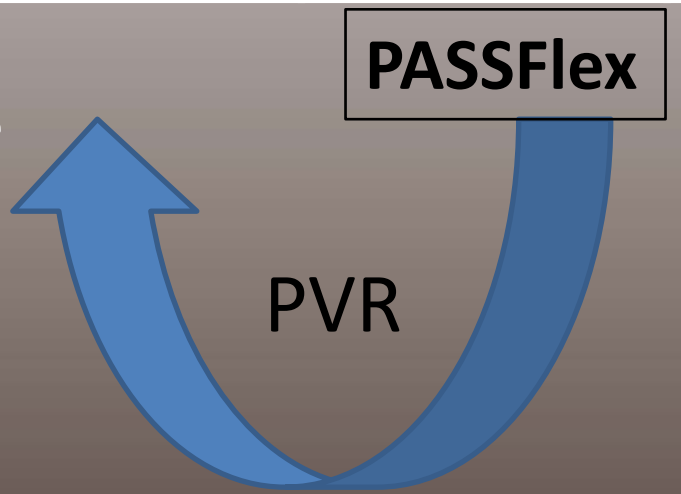
1. AMPT suite of tests & Dynamic Modulus
2. Indicates field usage

Continuum of Performance
Indexed AMPT Performance Test >> PRS

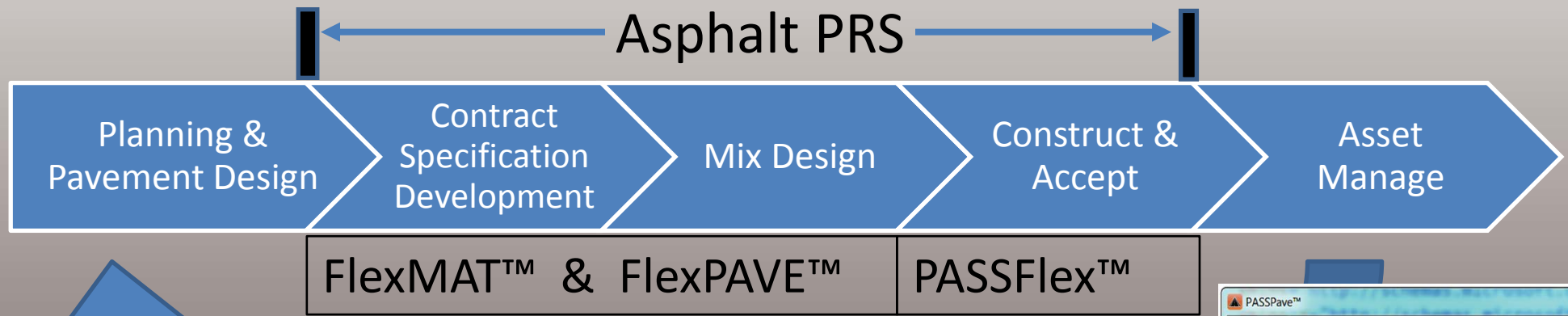


Continuum of Performance
AMPT >> PVR >> PRS

FHWA is developing through shadow projects the guidance for using Performance Volumetric Relationship (PVR) at the same time the AMPT index can be used. This provides states the connection to still use volumetrics in construction for acceptance.



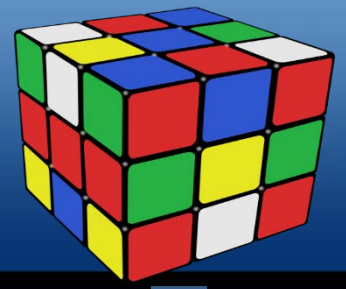
Continuum of Performance
PEMD/AMPT >> PRS + Software



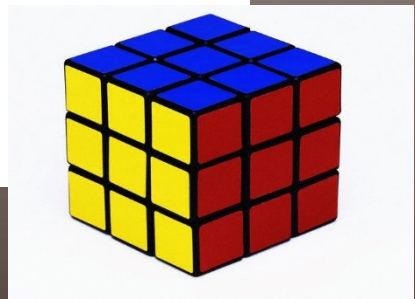
FlexMAT™ and FlexPAVE™ Available

- FlexMAT™ – Excel spreadsheet
  - Analyzes AMPT Tests
  - Import files directly
  - Output → FlexPAVE™
- FlexPAVE™ – performance prediction tool
  - Pavement/Mixture design
  - Simulate as-design and as-built performance

Status of PRS



- Testing efficiency and simplicity
  - Completed/Continuous
- Standardization of test methods
  - Ongoing
- Completeness of performance prediction models
  - Continuous
- Performance volumetric relationships
  - Ongoing
- Same principles and methods between mix design and PRS
  - Ongoing > See Testing



What is the Performance Continuum currently at FHWA R&D?

- Current Contracts
  - Develop and Deploy
    - PVR & Guidance, Software, Transfer Functions, PRS
    - Testing time and ease of use for AMPT suite of tests for field usage
  - Marketing
    - Document Success
    - https://youtu.be/mBlPoIFhPVs

What is the Performance Continuum future at FHWA R&D?

- Future Contract
  - Guidance for implementation of PRS
  - Level 1 PEMD/AMPT PRS
  - Level 2 PEMD Index Base
  - Transfer Function for PEMD PRS
  - Comparison of PEMD Tests
  - Advance in a collaborative approach for FLEXPave™ PRS models utilizing existing calibrations for AASHTOware Pavement ME™.

Program Mission

- Provide guidance, leadership, and technology for the delivery of long life pavements.
- Advance new and improved technologies and innovations into common practice.
- Raise awareness, assist, support, and provide guidance to FHWA field offices, State Highway Agencies, and their industry partners.

Program Objective

- Provide Support to National Initiatives
  - Performance-Engineered Mixture Design (PEMD)
  - Increased Pavement Density
  - Development of New QA Concepts for HMA
  - Understanding Asphalt Rubber Testing
  - Binder Performance Testing
- Provide assistance with state-specific issues
  - Technical guidance
  - Forensics

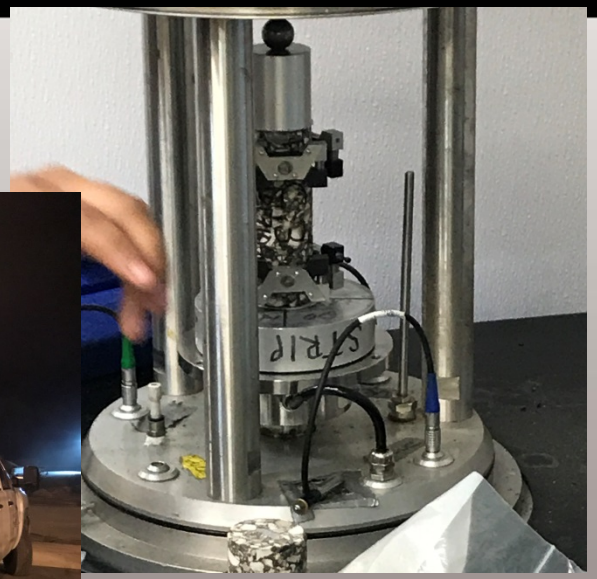
Technical Workshops

Images FHWA

Training

Training with Maryland State Highway Administration

Field visits



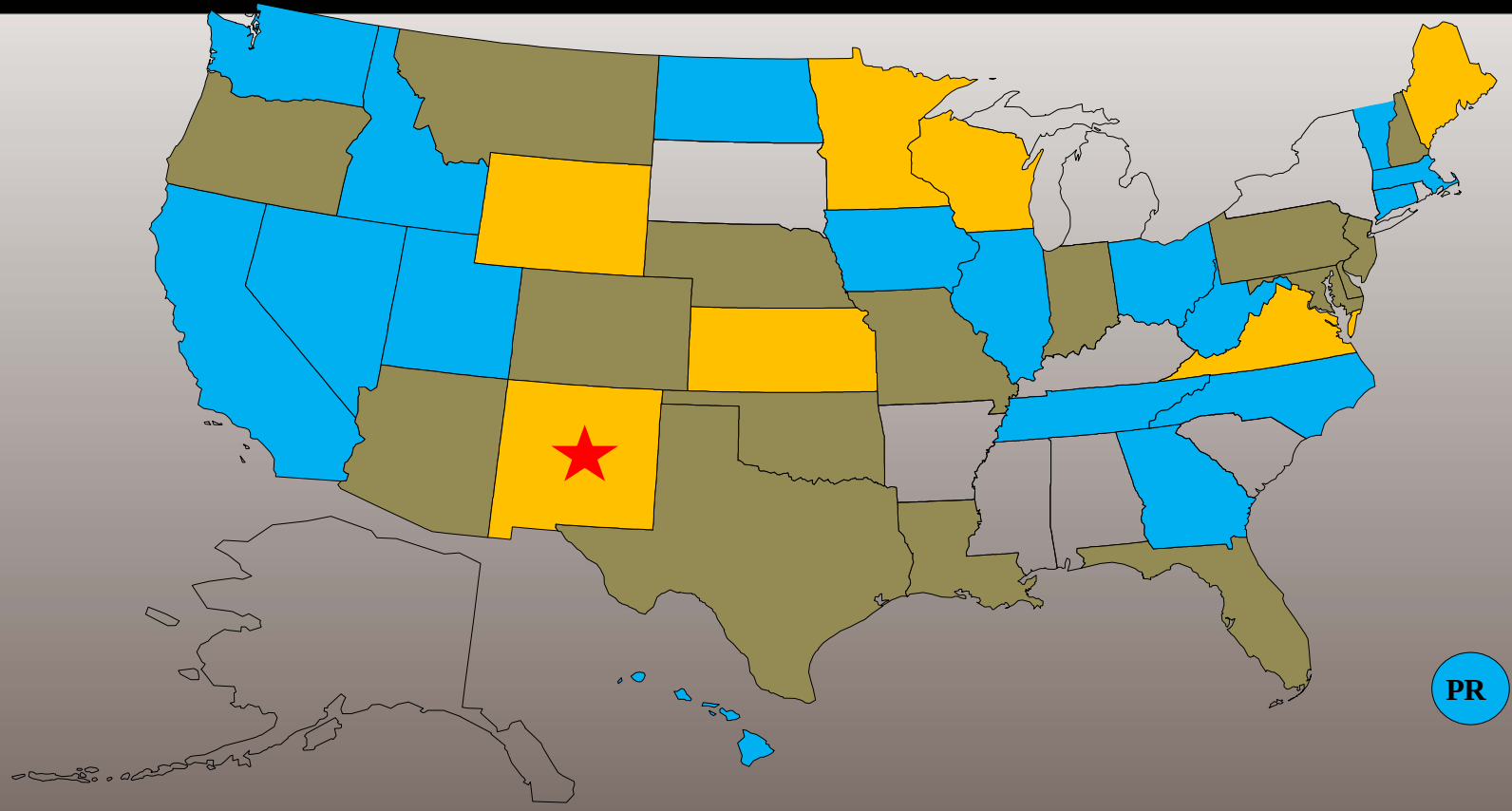
Field Visit Tasks

- Kickoff meeting
- Open house
- Hands-on training
- Mix design replication
- Shadow QA testing
- AMPT testing
- Binder grading
- Binder performance testing

Other MATT Activities

- Conferences
- Expert Task Group Support
- NCHRP Panels and Project Participation
- Division Office Rotational Assignments

MATT visits since 2007



U.S. Department of Transportation
Federal Highway Administration

Deployment Status: AMPT

- Advancement of performance-engineered mixture design as support for TFHRC Shadow Projects
  - ME, MD, MO, ON, Western Federal Lands (2017)
- Transition to small specimen testing and standard refinement
- Training – OK, MD, MO, VT, CT since December 2016
  - **Resulting in shadow projects** for MD, MO

Deployment Status: Asphalt Rubber

- **Seven** projects between 2013 to 2015.
- Collaboration with **four State DOTs** to evaluate their specifications based on project results.
- Working with FHWA ETG to develop AASHTO standard for asphalt rubber testing.

Data Available

- Encourage all to request MATT Program data
- Readily available data from 2006 onwards:
  - Alabama
  - Arizona
  - Colorado
  - Delaware
  - Florida
  - Indiana
  - Kansas
  - Louisiana
  - Maine
  - Maryland
  - Minnesota
  - Missouri
  - Montana
  - New Hampshire
  - New Jersey
  - New Mexico
  - Oklahoma
  - Oregon
  - Pennsylvania
  - South Dakota
  - Texas
  - Virginia
  - Wisconsin

Thank You – Questions?

Contact David Mensching, david.mensching@dot.gov, to discuss a visit!

Thank you!

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