

FHWA's Movement Toward Performance Engineered Mixture Design

**AASHTO COMMITTEE ON MATERIALS
AND PAVEMENTS ANNUAL MEETING
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CINCINNATI, OHIO**



U.S. Department of Transportation
Federal Highway Administration
Office of Infrastructure

CHERYL ALLEN RICHTER, Ph.D.
GINA M. AHLSTROM

Federal Highway Administration Transitions

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- Leadership
- Interactions with AASHTO Committees



Key FHWA Materials & Pavement Contacts

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Policy & Guidance	Research & Development	Training, Technical Assistance and Technology Deployment
Office of Preconstruction, Construction & Pavements Shay Burrows, Acting Director	Office of Infrastructure Research & Development Cheryl Richter, Director	Resource Center Bernetta Collins, Director
Pavement Materials Team Gina Ahlstrom, Team Leader	Infrastructure Materials Team Jack Youtcheff, Team Leader	Pavement & Materials Technical Service Team Chris Wagner, Team Manager
Pavement Design and Performance Team Latoya Johnson, Team Leader	Infrastructure Analysis & Construction Team Katherine Petros, Team Leader	
	Long Term Infrastructure Performance Team Jean Nehme, Team Leader	

Motivation for PEM & PEMD

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- Increase in premature deterioration
- MAP-21 and FAST ACT legislation focus on performance
 - Transportation Performance Management
- Desire by public agencies and industry to move toward performance
 - Optimize mixture designs for traffic, climate, environment
 - Improved durability
 - Sustainability- recycled materials, reducing footprint, etc.
 - Innovative materials
- SHRP-SUPERPAVE original program intent – focus on performance and not fully realized
- Testing technology advancements
- Changes in agency and industry skills and personnel levels



What is Performance Engineered Mixtures Design (PEM or PEMD)?

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- **PEM Acronym used for Concrete**
 - PEM is concrete mixtures that are **engineered** to meet or exceed the design requirements, are predictably durable, with increased sustainability.
- **PEMD Acronym used for Asphalt**
 - PEMD is a process that seeks to achieve the combination of binder, aggregate, and mixture proportions that will meet laboratory performance test criteria for a diverse number of pavement distresses for a given level of traffic, climate, and pavement structure.
- No matter how you define PEM/PEMD, the goal is the same: **Design and field control of mixtures around engineering properties related to performance.**



Performance Engineered Mixtures (PEM) - CONCRETE

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- **Key characteristics:**
 - Design and field control of mixtures around engineering properties related to performance
 - Development of usable and sound performance specifications
 - Development of usable and sound test procedures
 - Incorporation of this knowledge into an implementation system such as performance-driven QA specifications



Performance Engineered Mixture Design (PEMD)- ASPHALT

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- **Key characteristics:**
 - Design and field control of mixtures around engineering properties related to performance
 - Move from index based approaches and towards a more fundamental engineered approach
 - Develop performance test procedures
 - Develop performance specifications
 - Starting point – Asphalt Mixture Performance Tester (AMPT) index testing approach and/or Performance Volumetric relationship (PVR) acceptance program.



The End Goal for BOTH

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- Performance Related Specifications (PRS)
- Performance testing in the field
- Validate models and refine mixtures via construction QA and asset performance monitoring



The Journey to PEM - Concrete

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2008-2012

- Concerns about concrete durability; new tests and completed research

2013-2016

- ETG develops PEM framework; Engage National Concrete Consortium

2017

- AASHTO publishes PP 84-17 (through 3c)

February 2018

- FHWA announces PEM implementation demo funds
- Development of PP84 Durability Tests

2013

- FHWA established an Expert Task Group (ETG)

2016

- Draft Standard Practice (PP 84-17) presented to Concrete Tech Sections

2017

- TPF-5(368) established to support PEM development and implementation

August 2018

- PP 84 update presented to Tech Section 3c
- Submittal of first phase of performance tests



The Journey to PEM - Asphalt

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2002

- NCHRP 9-19, Task C Simple Performance Test for Superpave Mix Design Developed

2008-18

- FHWA Development of Asphalt Mixture Performance-Related Specifications Models
- 2008 - TPF 5-178 AMPT Pooled Fund

2017-20

- FHWA Ruggedness and Interlaboratory Studies for Asphalt Mixture Performance Tester (AMPT) Cyclic Fatigue Test

1989-97

- Superpave

1999

- FHWA Implementation -Superpave Support & Performance Models, Phase I - Becomes NCHRP 9-19

2001-11

- NCHRP 9-29 Made the Simple Performance Tester for Superpave Mix Design Implementable

2013-19

- FHWA Develop and Deploy Performance Related Specifications (PRS) for Pavement Construction
- 2015 – AASHTO TP107 Large Specimen Cyclic Fatigue

August 2018

- AASHTO COMP Submittal for AMPT Small Specimen Cyclic Fatigue & Stress Sweep Rutting Tests

What's Next?

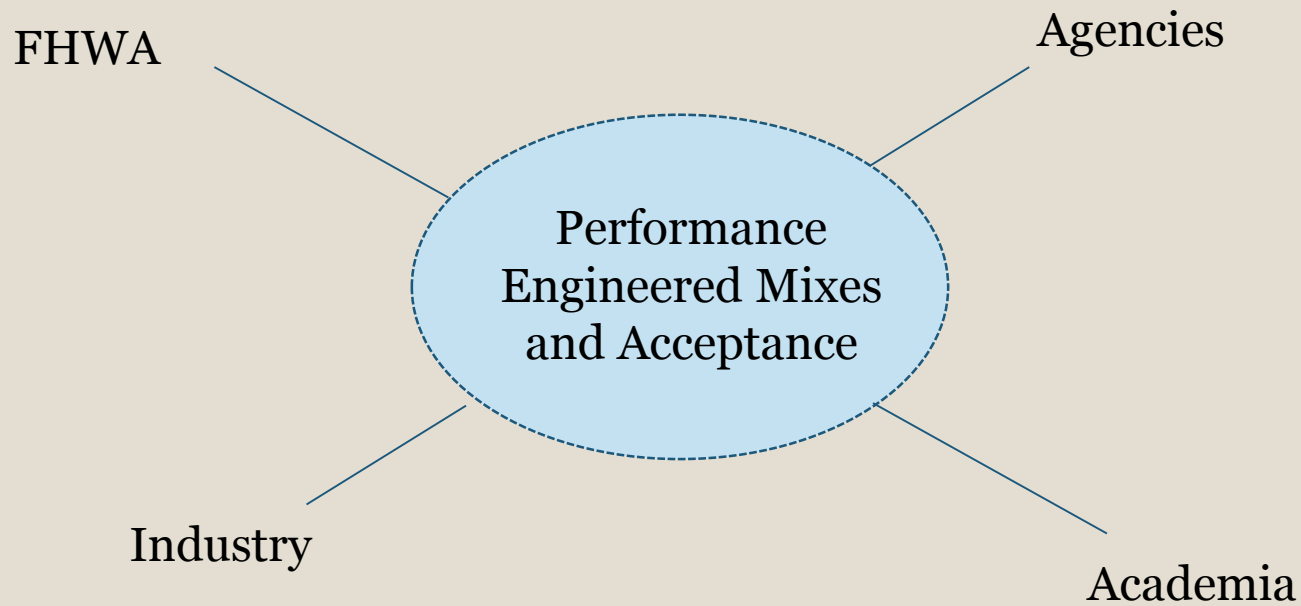
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- Implement shadow testing on field projects to:
 - Increase state and industry familiarity with PEM/PEMD-AMPT/PRS concepts and new tests
 - Gather field data to refine new tests and continue to develop testing technologies that support PEM/PEMD-AMPT/PRS concepts
 - Provide actual experience to help develop practical specifications
- Training for both engineers and technicians on new tests
- Develop performance specifications
- Pooled Fund Projects Ongoing- AMPT, PEM (concrete)



A Coordinated Approach to Implementation

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Contacts

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HEADQUARTERS

Gina Ahlstrom- Pavement Materials
Team Leader
Gina.Ahlstrom@dot.gov

Mike Praul- PEM-Concrete Technical
Coordination
Michael.Praul@dot.gov

Richard Duval- Asphalt/Concrete
Pavement Performance Coordination,
AMPT Pooled Fund
Richard.Duval@dot.gov

RESOURCE CENTER

Chris Wagner – Pavement & Materials
Team Lead
Chris.Wagner@dot.gov

Bob Conway – Pavement & Materials
Engineer
Robert.Conway@dot.gov

RESEARCH –TFHRC

Katherine Petros- Infrastructure Analysis
& Construction Team Leader
Katherine.Petros@dot.gov

Matt Corrigan- PRS Research
Matthew.Corrigan@dot.gov

Jack Youtcheff- Infrastructure Materials
Team Leader
Jack.Youtcheff@dot.gov

Ahmad Ardani- PEM-Concrete Research
Ahmad.Ardani@dot.gov

Dave Mensching- Asphalt Materials
Research
David.Mensching@dot.gov

