FHWA’s Movement Toward Performance Engineered Mixture Design

AASHTO COMMITTEE ON MATERIALS AND PAVEMENTS ANNUAL MEETING
AUGUST 10, 2018
CINCINNATI, OHIO

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

Interactions with AASHTO Committees
# Key FHWA Materials & Pavement Contacts

<table>
<thead>
<tr>
<th>Policy &amp; Guidance</th>
<th>Research &amp; Development</th>
<th>Training, Technical Assistance and Technology Deployment</th>
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<tbody>
<tr>
<td>Office of Preconstruction, Construction &amp; Pavements Shay Burrows, Acting Director</td>
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<td>Resource Center Bernetta Collins, Director</td>
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<td>Infrastructure Materials Team Jack Youtcheff, Team Leader</td>
<td>Pavement &amp; Materials Technical Service Team Chris Wagner, Team Manager</td>
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<td>Pavement Design and Performance Team Latoya Johnson, Team Leader</td>
<td>Infrastructure Analysis &amp; Construction Team Katherine Petros, Team Leader</td>
<td>Long Term Infrastructure Performance Team Jean Nehme, Team Leader</td>
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Motivation for PEM & PEMD

- 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)?

- **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.*
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
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

- 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

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
• FWHA 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


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<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tr>
<td>1989-97</td>
<td>Superpave</td>
</tr>
<tr>
<td>1999</td>
<td>FHWA Implementation - Superpave Support &amp; Performance Models, Phase I - Becomes NCHRP 9-19</td>
</tr>
<tr>
<td>2001-11</td>
<td>NCHRP 9-29 Made the Simple Performance Tester for Superpave Mix Design Implementable</td>
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<tr>
<td>2002</td>
<td>NCHRP 9-19, Task C Simple Performance Test for Superpave Mix Design Developed</td>
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<tr>
<td>2008-18</td>
<td>FHWA Development of Asphalt Mixture Performance-Related Specifications Models</td>
</tr>
<tr>
<td>2008</td>
<td>2008 - TPF 5-178 AMPT Pooled Fund</td>
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<tr>
<td>2013-19</td>
<td>FHWA Develop and Deploy Performance Related Specifications (PRS) for Pavement Construction</td>
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<tr>
<td>2015</td>
<td>2015 – AASHTO TP107 Large Specimen Cyclic Fatigue</td>
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<tr>
<td>2017-20</td>
<td>FHWA Ruggedness and Interlaboratory Studies for Asphalt Mixture Performance Tester (AMPT) Cyclic Fatigue Test</td>
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<tr>
<td>August 2018</td>
<td>AASHTO COMP Submittal for AMPT Small Specimen Cyclic Fatigue &amp; Stress Sweep Rutting Tests</td>
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What’s Next?

• 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

Performance Engineered Mixes and Acceptance

- FHWA
- Agencies
- Industry
- Academia
## Contacts

### HEADQUARTERS

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### RESOURCE CENTER

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