2020 OAPC Asphalt Technical Symposium Webinar

FHWA’s Movement Towards Performance Engineered Mix Design

ONTARIO ASPHALT PAVEMENT COUNCIL • JUNE 16, 2020

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Unless otherwise noted, FHWA is the source for all images.
Overview

FHWA

• Introduction to the Program
• Initiatives for Pavement Performance
• Formation of Asphalt Technical Focus Group (TFG)
Acronyms

- AMPT: Asphalt Mixture Performance Tester
- BMD: Balanced Mix Design
- FAST Act: Fixing America’s Surface Transportation Act
- CFLHD: FHWA Central Federal Lands Highway Division
- |E*|: Dynamic Modulus test in AMPT
- MAP-21: Moving Ahead for Progress in the 21st Century Act
- MATC: Mobile Asphalt Technology Center
- ME: Mechanistic Empirical
- NCHRP: National Cooperative Highway Research Program
- P&M: Pavement and Materials Team
- P&M-TFG: Pavement and Materials Technical Feedback Group
- PBS: Performance Based Specifications
- PEM: Performance Engineered Mixtures
- PEMD: Performance Engineered Mixture Design
- PEP: Performance Engineered Pavements
- PRS: Performance-Related Specifications
- QA: Quality Assurance
- RSI: Rutting Strain Index
- Sapp: Apparent Fatigue Damage parameter
- SHRP: Strategic Highway Research Program
- SSR: Stress Sweep Rutting
- TFG: Technical Feedback Group
- TWG: Technical Working Group
Pavement and Materials: Who We Are

• *(Starting with back row) Richard Duval:* program coordination for PEMD & PRS

• **Tim Aschenbrener:** asphalt pavements, Asphalt QA, increased density, asphalt recycling

• **Leslie Myers McCarthy:** flexible pavements, asphalt materials, Mobile Asphalt Technology Center

• **Mike Praul:** concrete pavements and materials, concrete QA, Mobile Concrete Technology Center

• **Sam Tyson:** long-life concrete pavement strategies, concrete repair strategies, concrete recycling and industrial byproducts
Pavement and Materials: What We Do

- All things Asphalt Materials
- All things Concrete Materials
- Technologies for pavements and materials
- Movement toward Performance Engineered Mixture Design - Asphalt and Concrete
- Accelerated Implementation and Deployment of Pavement Technologies Program (under FAST Act)
Initiatives for Pavement Performance

Highlights of FHWA Performance Engineered Pavements

For more information contact:

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Performance Engineered Pavements (PEP)

- Vision: incorporate the goal of long term performance into the structural pavement design, construction and materials acceptance
Motivation for PEP

- 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
PEP Quality Assurance Continuum

- Structural Pavement Design
- PEMD
- QA
- PRS
- PBS
Goals for PEP

- Long-term durability & performance
- Increased accountability of funding
- Premature failure & mechanisms
- Performance testing into mixture design process
- Reclaimed, recycled, and innovative products?
- Performance quality characteristics in agency QA Program
Programmatic Focus

- Performance Engineered Mixture Design (PEMD)
Performance-Engineered Mixture Design (PEMD)

- Design and field control of mixtures around engineering properties related to performance
- **Move toward index-based testing approaches and then to a more fundamental-engineering properties approach**
- Mix designs accepted on passing performance indices in combination with volumetric targets (Go/No-Go)
- Two indices:
  - $S_{app}$ – fatigue resistance
  - Permanent strain – rutting resistance (RSI) through the SSR test
- Upcoming NCHRP 10-107 report to detail steps to implement a performance test
PEMD Approaches

PEMD in asphalt includes a predictive and index-based approach

- **Predictive approach** uses performance test(s) with Mechanistic-Empirical (ME) prediction models
- **Index-based approach** is independent of ME modeling
- PEMD supplements volumetric mixture design by using performance tests
- PEMD uses performance tests to indicate mixture quality and long-term performance
PEMD: Index-Based Tests for Rutting and Cracking

- Disc Shaped Compact Tension
- Texas Overlay Test
- Four-point Bending
- Indirect Tension
- Semi-Circular Bending
- Fatigue
- Thermal
- Reflective

Asphalt Mixture Performance Test (AMPT)
PEMD: Predictive Tests for Rutting and Cracking

Asphalt Mixture Performance Tester (AMPT)

- Large Specimen
  - $|E^*|$ Tests
- Small Specimen
  - $|E^*|$ Tests
  - Fatigue Tests

- Four Point Bending Beam Fatigue
- Disk Shaped Compact Tension
- Indirect Tension

SSR
Performance tests in an agency’s QA program are necessary to verify the approved design is received in production.

Incentives and disincentives based on performance quality characteristics reward higher quality and performance.

Implementation Considerations:
- Project type and scope that warrant performance testing specifications,
- Index based or in a performance predictive approach
- Roles and responsibilities of the agency and contractor
- Performance testing frequencies, production controls, and acceptance limits
PEP Next Steps

- FHWA encourages performance engineering in mixture designs and durability testing into the mixture design evaluation, verification, and acceptance process.
- Performance engineering and durability testing should be tailored to the expected traffic and environment that pavement will be exposed.
- Evaluate performance tests available to address local failure mechanisms, local materials, climate, and traffic.
- Performance testing on pilot projects.
- Project selection suggestions for performance testing specification.
- Incorporate performance testing into the QA Program.
Asphalt Technical Focus Group

Cottonwood Pass, Colorado
Courtesy FHWA-CFLHD
Current Stakeholder Feedback Groups

- Asphalt Technical Feedback Group (TFG)
- Concrete Technical Feedback Group (TFG)
- Pavement Preservation Technical Feedback Group (TFG)
- Sustainable Pavements Technical Working Group (TWG)
- ME User Group
- P&M Stakeholder Workshops
Technical Feedback Group Members

- **Will** - Convene representatives from stakeholder groups
- **Will** - Provide input and feedback to FHWA on FHWA programs and activities
- **Will** - Discuss national needs and interests

- **Will Not** - Serve as an advisory group
- **Will Not** - Direct FHWA programs or activities
- **Will Not** - Provide a consensus opinion
- **Will Not** - Develop documents or deliverables
Asphalt P&M-TFG Charter

- **Purpose:** The Asphalt Pavement and Materials Technical Feedback Group (Asphalt P&M-TFG) is created to focus on program-level challenges and opportunities concerning the performance of asphalt pavements. The Asphalt P&M-TFG will provide technical input and information to the FHWA; however, it will not direct FHWA programs or activities. Topics for discussion may include but are not limited to, the following:

  - PEMD Design and Analysis
  - PRS and PBS Specifications
  - Performance Modeling and Distress Prediction
  - Optimized Pavement Design
  - Life-Cycle Cost Analysis
  - Material Testing, Analysis, and Quality Assurance
  - Construction and Inspection Technologies
  - Relationships among Design, Construction, and Pavement Performance
  - Research, Innovation, and Deployment Gaps and Needs Assessment
Role of Representatives to Asphalt P&M TFG

- 10 State, 5 Academics, 6 Industry
- Active & timely participation is critical for effective feedback
- Provide input on agenda themes, information, and presentations for all subsequent Asphalt TFG meetings
- Identify needs and gaps, and assist as champions for asphalt pavement and materials performance technologies
- FHWA will rotate approximately a 1/3rd from state representatives and 1/5th from academia and industry each at the end of Year two
Ideas on technologies or practices to deploy? Trends that you’ve observed? Let us know!

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