# 2020 OAPC Asphalt Technical Symposium Webinar

## FHWA's Movement Towards Performance Engineered Mix Design

**ONTARIO ASPHALT PAVEMENT COUNCIL • JUNE 16, 2020**

**LESLIE MYERS MCCARTHY, PH.D., P.E.**
**SENIOR ASPHALT PAVEMENT ENGINEER**
**FEDERAL HIGHWAY ADMINISTRATION – HQ**
**OFFICE OF PRECONSTRUCTION, CONSTRUCTION AND PAVEMENTS**

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

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

# Overview

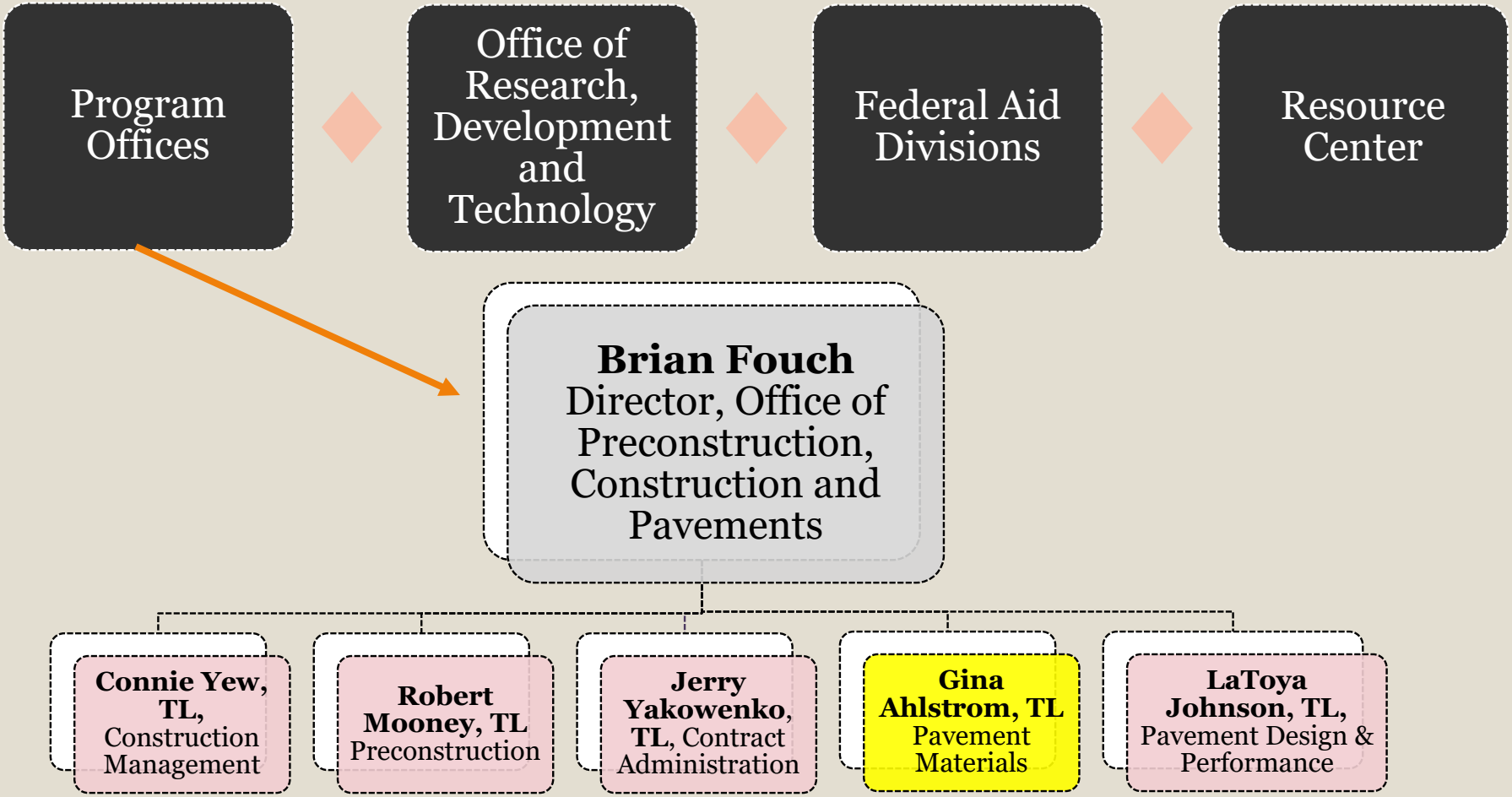
## FHWA

- 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

# Federal Highway Administration (FHWA)



# 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

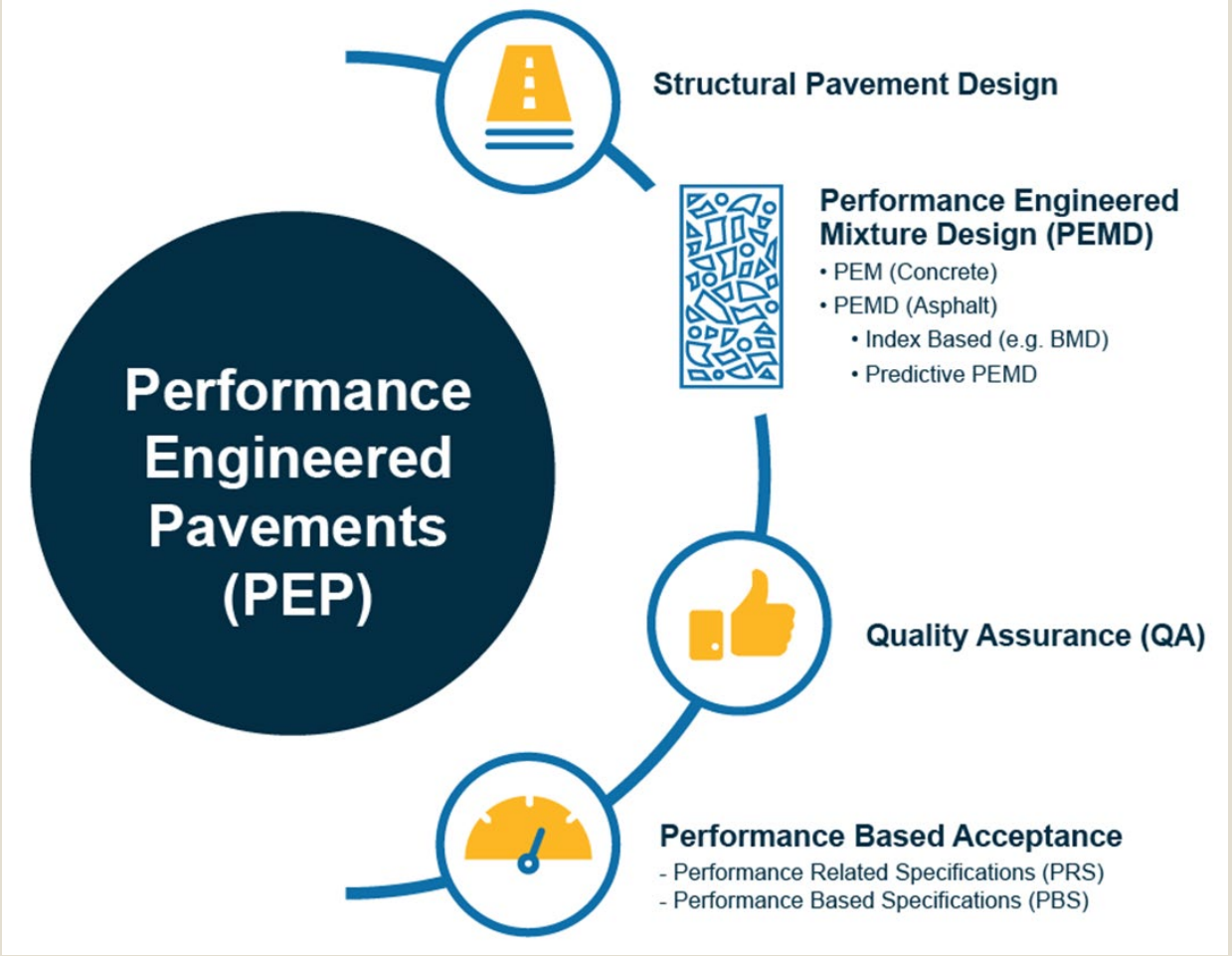
## Highlights of FHWA Performance Engineered Pavements

For more information contact:

Richard Duval
(202) 515-1030
Richard.Duval@dot.gov

# Performance Engineered Pavements (PEP)

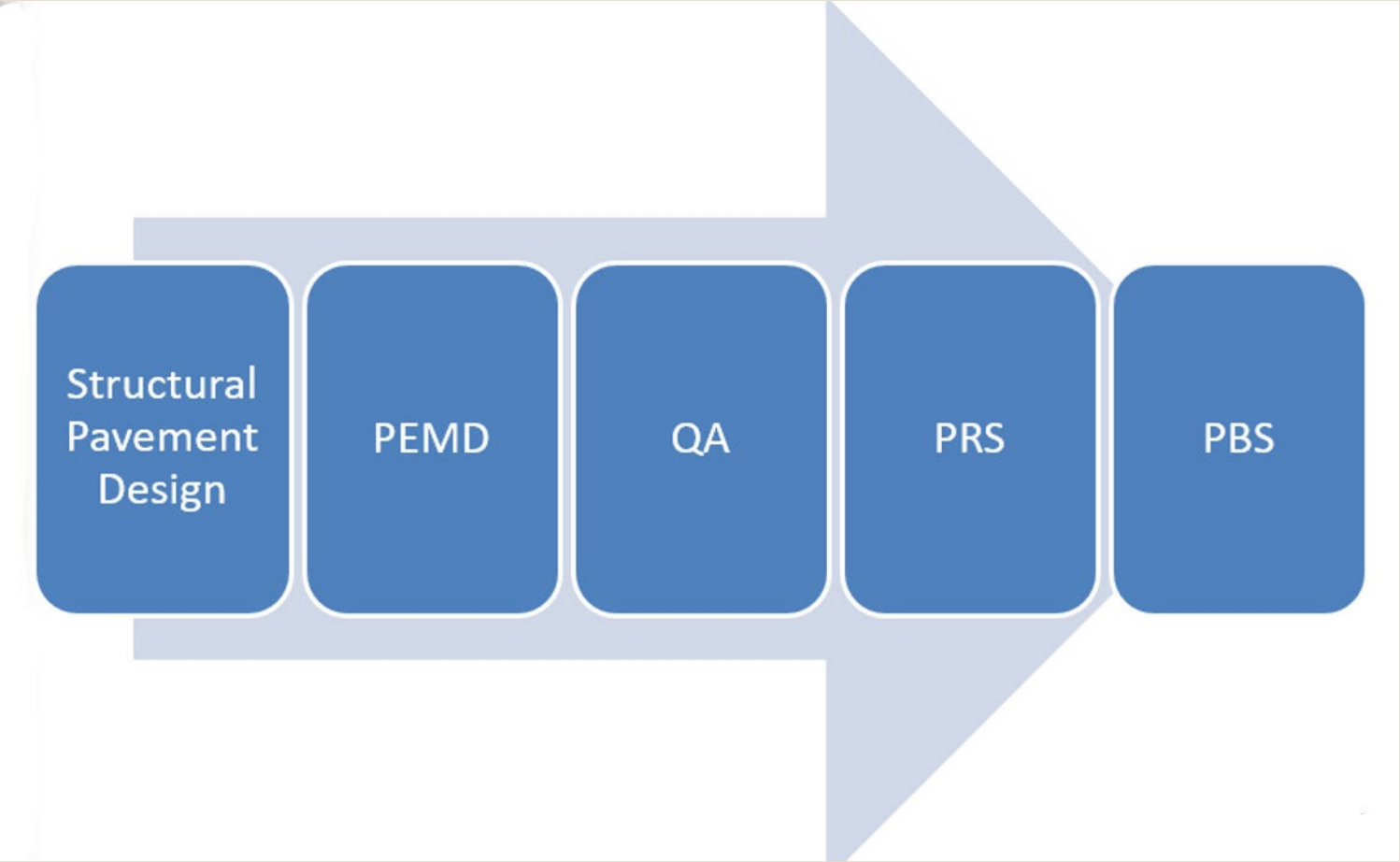
- Vision: incorporate the goal of long term performance into the structural pavement design, construction and materials acceptance



# 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



# 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)

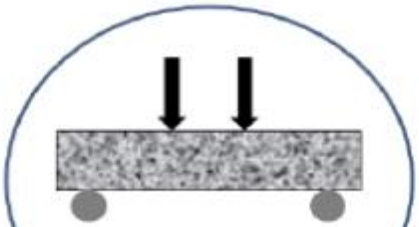
- Design and field control of mixtures around engineering properties related to performance
- **Move toward index-based testing approaches and then to a more fundamental-engineering properties approach**
- Mix designs accepted on passing performance indices in combination with volumetric targets (Go/No-Go)
- 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

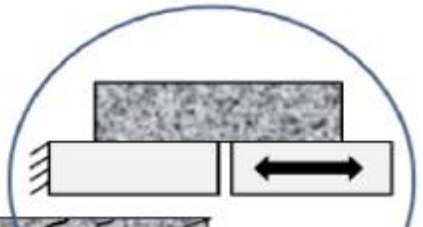
# PEMD: Index-Based Tests for Rutting and Cracking

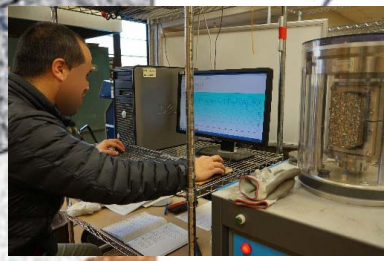


• Four-point Bending

Disc Shaped Compact Tension

• Texas Overlay Test



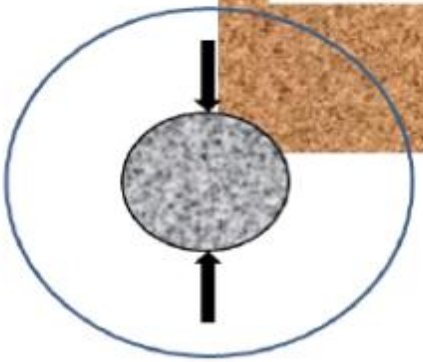


Asphalt Mixture Performance Test (AMPT)

Fatigue

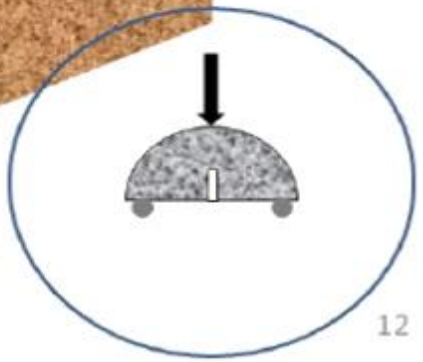
Thermal

Reflective



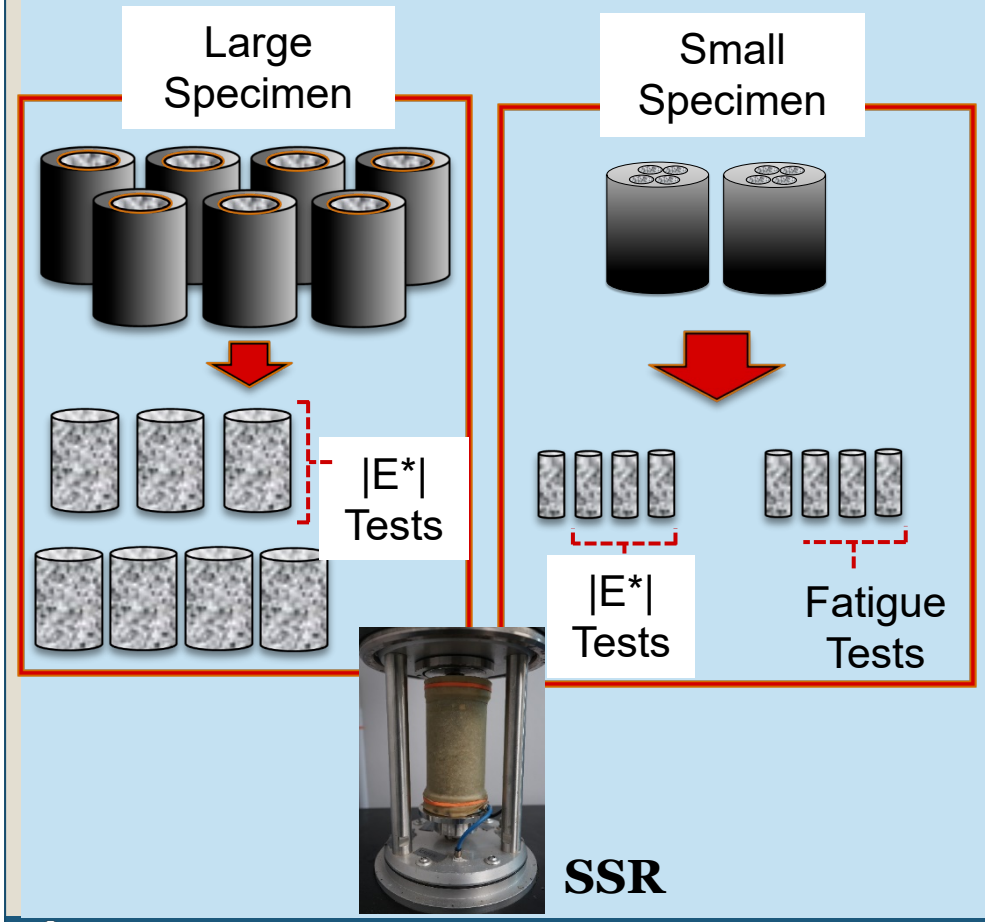
• Indirect Tension

• Semi-Circular Bending



# PEMD: Predictive Tests for Rutting and Cracking

## Asphalt Mixture Performance Tester (AMPT)




Four Point Bending Beam Fatigue

Disk Shaped Compact Tension

Indirect Tension

# PEP & Quality Assurance


- 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 1/3$^{rd}$ from state representatives and 1/5$^{th}$ from academia and industry each at the end of Year two

# Contact Us

Ideas on technologies or practices to deploy? Trends that you've observed?

Let us know!

Leslie Myers McCarthy, Ph.D., P.E.

(202) 981-2875

**FHWA-MATC@dot.gov**