Update: AMPT Specification and Test Standards

FHWA Mixture and Construction Expert Task Group
September 21, 2017
Bozeman, Montana

U.S. Department of Transportation
Federal Highway Administration

Agenda

- Equipment specification (draft)
- Small specimen standards (draft)
- Stress sweep rutting (draft)
- Cyclic fatigue (AASHTO TP 107)

AMPT

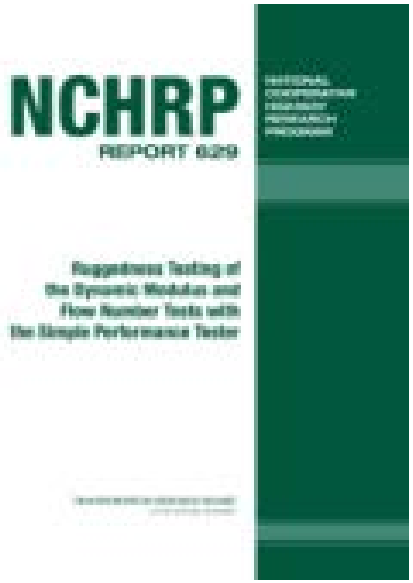
- Temperature range from about 4° to 70°C
- Computer-controlled device
  - Software built-in for various test procedures
- Fundamental tests
  - Stress and strain modeling
  - "Bulk testing"
  - Pavement ME or FlexPAVE™
- Kits available for other tests

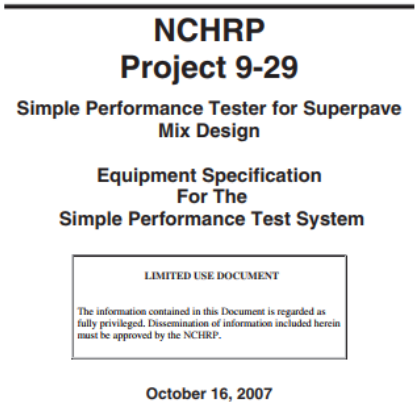
AMPT Implementation

- Transportation Pooled Fund Study (TPF(5)-178)
  - Purchase, installation of 29 AMPTs
  - NHI Course (over 80 trainees) – need to update
  - Interlaboratory study on effect of air voids
  - National workshop
- Test standard development, improvement, and revision
- Instructional videos, TechBriefs
- PRS shadow implementation (TFHRC-led)
- Mobile Asphalt Testing Trailer (MATT) projects/training
- User Groups at TRB and regional meetings

Current AMPT Equipment Specification

- Current specification – Appendix E of NCHRP Report 629





NCHRP
Project 9-29

Simple Performance Tester for Superpave Mix Design

Equipment Specification
For The
Simple Performance Test System

LIMITED USE DOCUMENT

The information contained in this Document is regarded as fully privileged. Dissemination of information included herein must be approved by the NCHRP.

October 16, 2007

Development of New Specification

- Update for additional test procedures
  - AASHTO T 378 (dynamic modulus (|E*|), flow number)
  - AASHTO TP 107 (cyclic fatigue)
  - AASHTO TP 116 (incremental repeated load permanent deformation)
  - These tests require additional data analysis for fundamental properties
- Collaborative group effort (55 reviewers)

AMPT Equipment Specification

- Specify tension-compression loading machine
- Reference to specific tests
- Range for temperature sensor increased
- Calibration of machine in tension recommended for TP 107 users
- Calibration and compliance checks included as Annexes
- Electrical requirements changed to 208 VAC

AMPT Equipment Specification

- Specify tension-compression loading
- Re… specific tests requiring addition… lysis
- Range for temp… nsor increased
- Calibration of machi… recommended for TP 10…
- Reference manual extended to in… tests

ETG REVIEW UPCOMING!

Small Specimen Standard Update

U.S. Department of Transportation
Federal Highway Administration

FHWA PRS Initiative

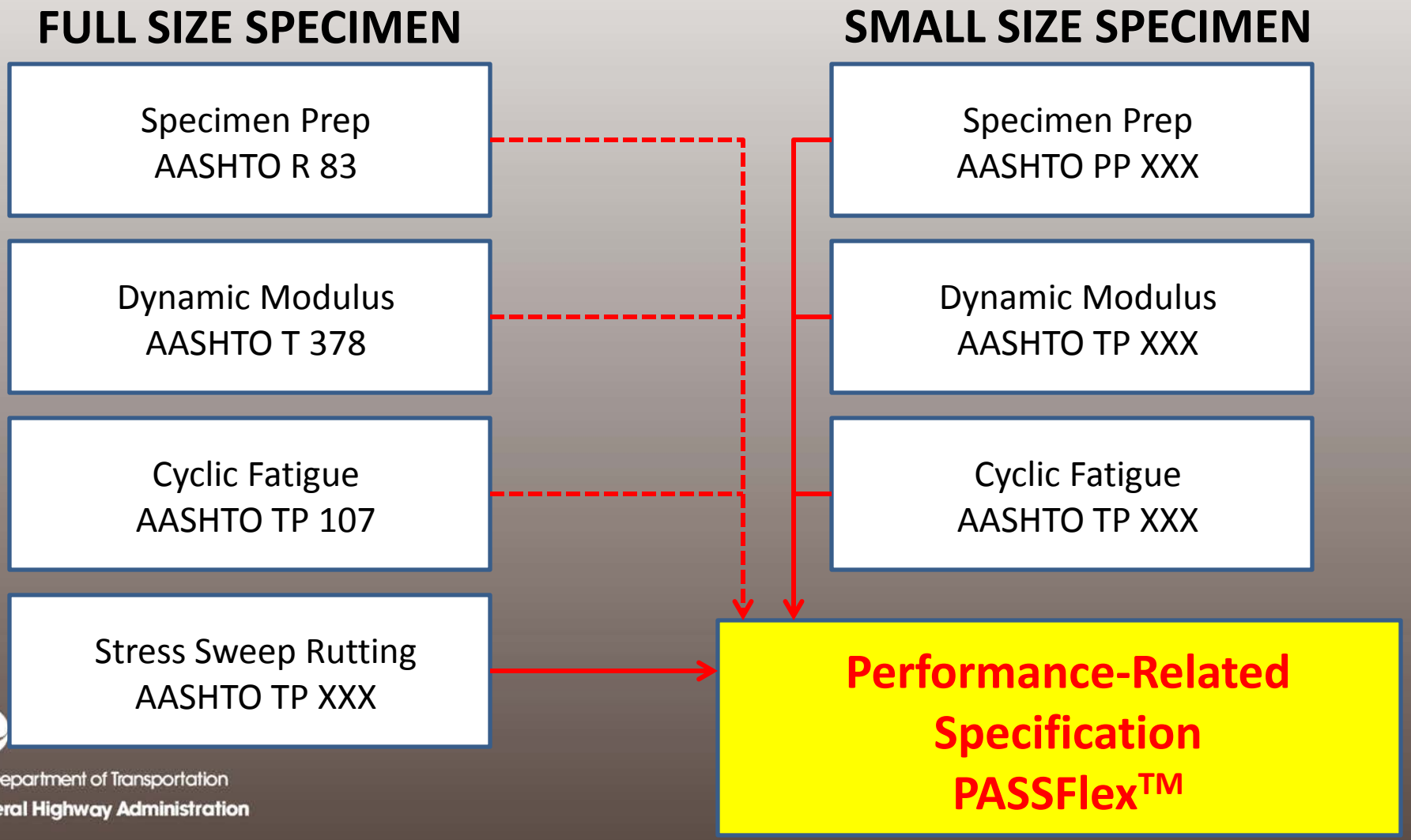
- Use of fundamental tests to capture variance between as-designed and as-built AQCs
- Asphalt Mixture Performance Tester (AMPT) used in performance-engineered mixture design (PEMD)
- Structural response model (stresses and strains)
- Performance volumetric relationships used in construction

FHWA PRS Initiative

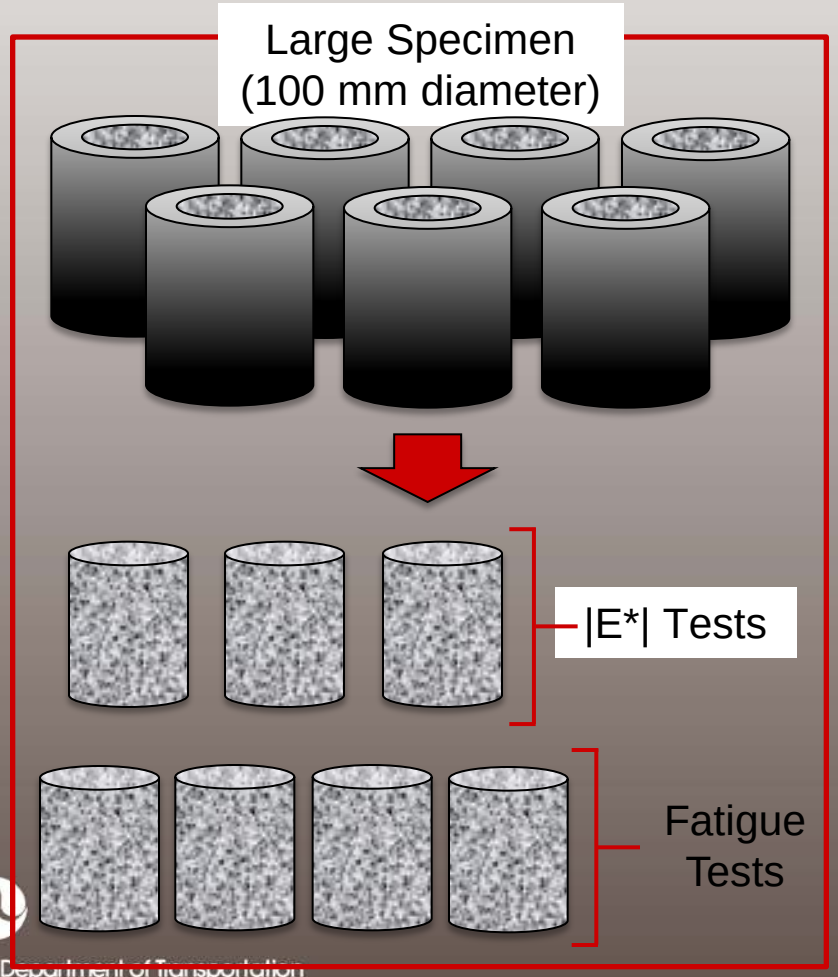
- f fundamental tests to capture
  ween as-designed and as-built
- As ance Tester
  (AMPT, ngineered
  mixture desig
- Structural response
  strains)
- Performance volumetric relation
  in construction

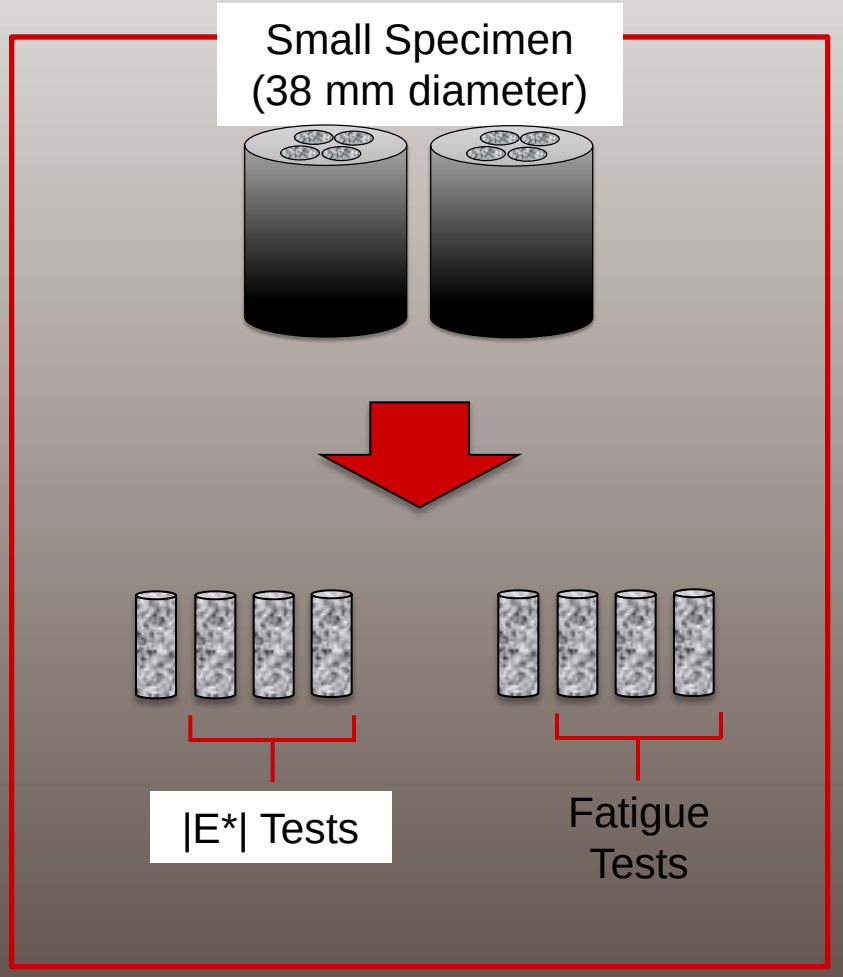
PERFORMANCE TESTING ONLY IN DESIGN PHASE!!!

Standardization of Test Methods



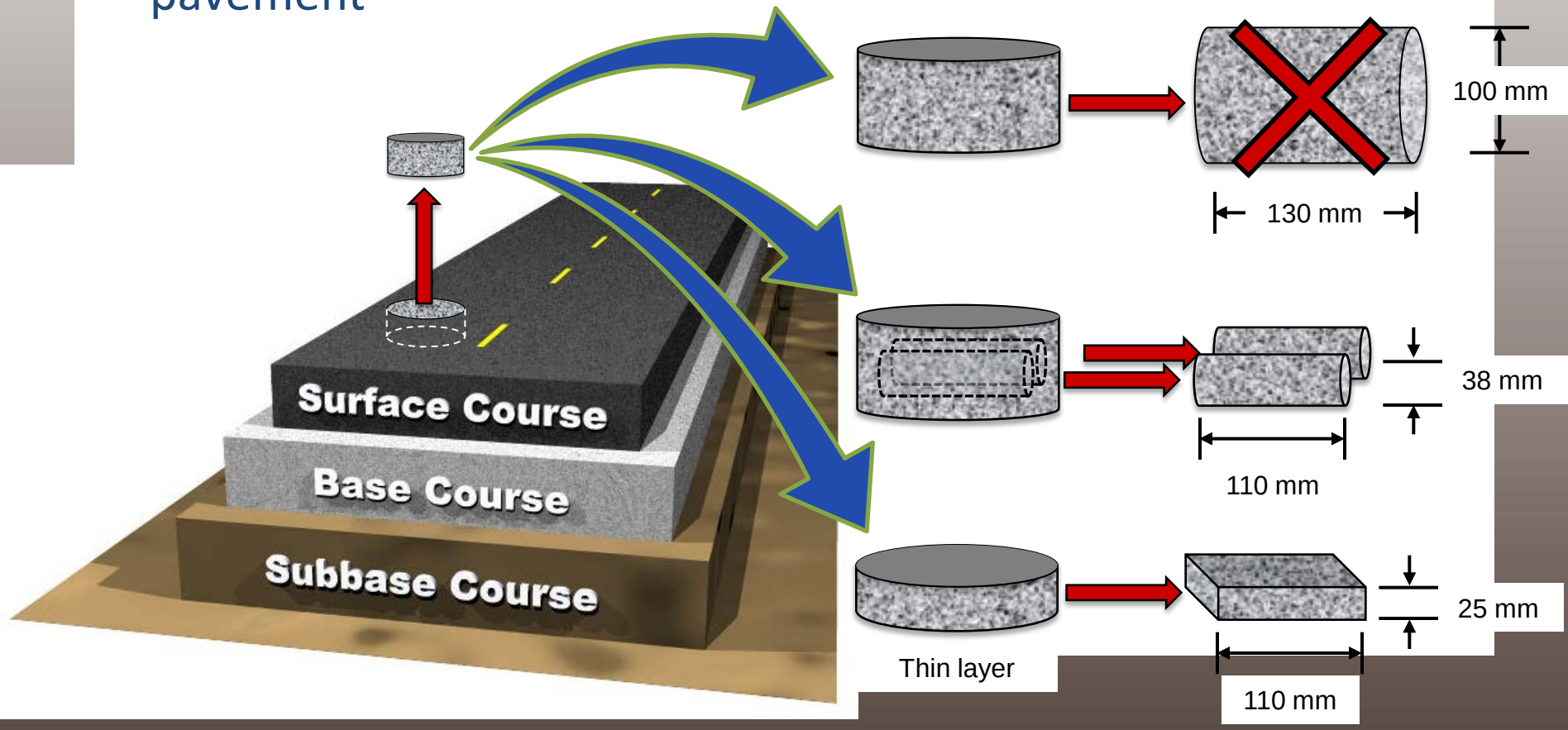
Small Specimen – Crash Course





Testing Specimen from Field Cores

- Asphalt concrete layers are generally thinner than 100 mm
- Allow for performance testing individual layers of as-built pavement



Draft Standard - Preparation

- Core 4 test specimens from one gyratory
  - Taken from 100 mm diameter area to minimize unfavorable air void distribution
- Based off AASHTO R 83 (formerly PP 60)
- Includes method to core 2 test specimens from one field core
- Use full size specimen to target mass for desired air voids

Draft Standard – Dynamic Modulus

- Target 50-75 microstrain
- Data quality indicators the same
- Appendix for 50 mm and prismatic test specimens
- Generally recommended at temperatures of 45°C and below

Draft Standard – Cyclic Fatigue

- Decreased seating load
  - 0.01 kN compared to 0.09 kN
- 5-minute epoxy recommended
  - compared to 16 h for full-size
- Used for mixtures up to 25 mm NMAS
- Ruggedness testing to begin
  - ILS afterwards

Draft Standard – Stress Sweep Rutting

- 2 temperatures
  - Low temp – 0.4 s load, 1.6 s rest
  - High temp – 0.4 s load, 3.6 s rest
- 10 psi confinement
- 3 loading blocks of 200 cycles each at varying deviatoric stress levels
- Data used in shift model for permanent deformation

Draft Standard – Stress Sweep Rutting

temperatures

– Hig mp – 0.4 s load, 1.6 s rest

– Hig 4 s load, 3.6 s rest

- 10 psi conf
- 3 loading blocks of each at varying deviatoric stress
- Data used in shift model for per deformation

ETG REVIEW UPCOMING!

Testing Efficiency and Simplicity AASHTO TP 107 Revisions

- Submitted to AASHTO COMP TS 2d
- Add failure criterion
- Simplification of language
- AMPT-specific
- Removal of spreadsheet derivation
- New strain selection guidance
- Instructional videos
- Output template provided for FlexMAT™
- Ruggedness and ILS

Testing Efficiency and Simplicity
AASHTO TP 107 Revisions

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OUT FOR FULL BALLOT THIS FALL!

AMPT Users Group

- National/International
  - Biannual meetings
    - Summer meting: FHWA update, FlexPAVE™ demo, maintenance and tuning issues
  - Discussion of issues, best practices, future efforts
  - 164 members, 28 DOTs

U.S. Department of Transportation
Federal Highway Administration

Office of Asset Management,
Pavements, & Construction

Asphalt Technology Guidance Program (ATGP)

Long-Life Asphalt Pavement for the 21st Century

U.S. Department of Transportation
Federal Highway Administration

Solutions to Agency Needs

- Project-Specific Workplans
  - Material Characterization
    - High RAP/RAS, GTR, SMA, PRS…
  - Mix Design Replication and Testing
  - Mix Production Testing
  - Performance Prediction
  - Training and Demonstration

Thank you!

- Questions?
- Contact information
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  - 202.366.1286
  - david.mensching@dot.gov

Testing Efficiency and Simplicity (2) Small-Specimen Geometry

	Large Specimen	Small Specimen
Steel Putty	Devcon 10110	Devcon 10240
Working Time	10 – 20 min.	5 min.
Functional Cure	16 hours	1 hour
Amount of Putty (per specimen)	100 g	3 g

Small Specimen History

- Witczak et al. (2000) AAPT
  - Minimum height-to-diameter ratio of 1.5
  - 70, 100, and 150 mm diameter tested
  - |E*|, permanent deformation considered
- Kutay et al. (2009) TRR
  - 38 mm diameter, 100 mm height specimens
  - Field core testing by horizontally coring
  - Cyclic fatigue results statistically equal (C vs. S curve)
- Li and Gibson (2013) AAPT
  - 38 mm diameter, 110 mm height
  - Cyclic fatigue results statistically equal (modulus reduction)
  - Small specimen slightly softer |E*| at high temperatures
  - 5 test specimens per gyratory specimen

Small Specimen History

- Bowers et al. (2015) AAPT
  - 50 mm diameter, cored horizontally
  - Modulus differs most at 54.4°C and with 19.0 and 25.0 mixtures
- Castorena et al. (2017) NCHRP IDEA N-181
  - Test procedures developed
  - Recommend 4 test specimens per gyratory specimen
  - Cyclic fatigue results statistically equal