FHWA Performance Related Specifications for Asphalt Mixtures

Asphalt Mix ETG
Fall River, Ma

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Performance Specifications

Specifications that describe how the finished product should perform over time. *E-C173: Glossary of Transportation Construction Quality Assurance Terms

Specifications have Different Risks Perspective

![Graph showing the risk perspective for Owner and Contractor across different types of specifications.](image-url)
Performance Related Specifications

Predict life.
How much life was lost? Gained?
Performance Related Specifications

Predict Pavement Performance
How much life was lost? Gained?

Balanced Mix Design

Hit the target.
Walk away.
Calibrated to performance data.

Binder Content

a number

a number
Performance Prediction
(traffic – structure – climate)

Already has capability

Involved. Complicated.

Make it simpler

Going Forward
Involved. Complicated.

Make it simpler

Already has capability

Functionality has to be added

Simple…
Pass/Fail
Different materials?
Performance Life
Unknown?
Performance Related Specifications

Why PRS

Provides performance predictions; broad applicability

+ Performance models for specific distresses as a function of pavement age (time) can be associated with specific detailed pay tables for pavement life (Based on what that is worth to the States)

– Field calibration, software tools, and testing.

Balanced Mix Design

Straightforward and easier to execute

+ If the mix passes a set of criteria, it will have a (known?) higher probability of achieving expected “design” life with respect to distresses associated with those criteria

– Cannot be used to predict distresses as a function of pavement age (time)
AMPT + Performance Prediction

- Structure
- Traffic
- Climate

Fatigue Test
AASHTO TP107

Rutting Test
Triaxial Stress Sweep (TSS)

Predicted Rutting
Predicted Cracking
PRS Test Equipment & Protocols

• **AASHTO R 35 - SUPERPAVE VOLUMETRICS**

• **AASHTO TP 79** Standard Method of Test for Determining the Dynamic Modulus and Flow Number for Asphalt Mixtures Using the Asphalt Mixture Performance Tester (AMPT)
  – **AASHTO PP 60** Preparation of Cylindrical Performance Test Specimens Using the Superpave Gyratory Compactor

• **AASHTO TP 107** - Determining the Damage Characteristic Curve AND Energy-based Failure Criterion of Asphalt Mixtures from Direct Tension Cyclic Fatigue Tests
  – Alpha Fatigue Software
  – Excel Based data analysis – Early next year

• **Simplified Triaxial Stress Sweep (S-TSS)**
  – Will propose to be added to AASHTO TP 116 **Rutting Resistance of Asphalt Mixtures Using Incremental Repeated Load Permanent Deformation (iRLPD)**
  – Excel Based data analysis

• **Performance Acceptance Software (LVECD...)**
  – Structural performance prediction software
How PRS Works in a Project

1. Establish Performance Criteria
2. Identify AQC's and Target Values
3. Design AQC vs. As-Constructed AQC
4. Compare As-Built & As-Designed
5. Pay Factor

PRS Works in a Project:
- Planning
- Pay Factor
- Value of Performance – M&R

Model Performance

Design AQC vs. As-Constructed AQC
How PRS Works in Setting Up a Specification

1. **Pavement Design**
   - Establish Performance Criteria

2. **Planning**
   - Identify AQC's and Target Values
   - Incorporate Pay Tables Into Specifications & Project Letting

3. **Use Specifications**
   - Pay Factor
   - Pavement Construction, QA Sampling, and Testing
Shadow PRS Projects

• Asphalt
  – Maine – SHRP 2 R07
  – Western Federal Land – SHRP 2 R07
  – Missouri DOT – 2- Shadow projects with 3 mix designs
  – North Carolina DOT – SHRP2 R07

Seeking Additional Shadow Projects with DOTs

• Future $T^2$ of PRS
  – Videos/Techbrief(s)
  – Animated Whiteboards
  – Success story reports
PRS Parallel Success To Date

• Concrete
  – Illinois Toll Authority – Full Implementation of PRS
  – Wisconsin
  – Indiana

• Asphalt
  – QA
Implement the Green Initiatives and Watch the Prices Fall

### 13” JPCP

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<th>Quantity (Sq. Yds.)</th>
<th>Weighted Ave. Adj. Unit Price ($ / Sq. Yd.)</th>
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Challenges in PRS Acceptance

- Testing efficiency and simplicity – Completed/Continuous

- Standardization of test methods – Ongoing

- Reliability of performance prediction models - Ongoing

- Predictive relationships between AQCs and performance prediction model parameters - Ongoing

- Same principles and methods between mix design and PRS - Ongoing
FHWA Instructional Video – TP107

- https://www.youtube.com/playlist?list=PLyLyypK-v8li-KjQq-Z6Imad4v2o_LcR3b
FHWA Instructional Video – TP107

- Part 1. Reheating and Compacting
- Part 2. Coring and Cutting
- Part 3. Cleaning and Gluing LVDT Tabs
- Part 4. Platen Cleaning and Gluing
- Part 5. Running $|E^*| - $ See also NHI Training Course
- Part 6. Choosing the Strain Level
- Part 7. Attaching Specimen and Running Test
- Part 8. Post Processing alpha-Fatigue
- Part 9. Post Processing LVECD Structural Analysis
Testing for Fatigue Cracking in the Asphalt Mixture Performance Tester

This Technical Brief provides an overview of a fatigue characterization test method that can be conducted using an Asphalt Mixture Performance Tester (AMPT) device. This includes a description of the test as well as an introduction to how the test has evolved, what performance information the test provides about an asphalt mixture, and the accompanying stress-strain model.

Introduction

Over the last 20 years, advances have been made towards the development and implementation of a standardized performance tester for asphalt concrete. One such methodology is a provisional test method known as American Association of State Highway and Transportation Officials (AASHTO) Provisional Standard (TP) 107: Determining the Damage Characteristic Curve of Asphalt Mixtures from Direct Tension Cyclic Fatigue Tests (1) (or AMPT Cyclic Fatigue Test in this document) which utilizes a stress-strain model centered on the damage characteristic relationship, which is an inherent engineering property rather than an empirical index much like the difference between a soil’s resilient modulus and its California Bearing Ratio. This AMPT test procedure enables an enhanced and comprehensive understanding of the complicated fatigue cracking phenomenon because it can explain how a given asphalt mixture behaves in a pavement structure under varying stress or strain conditions. By bridging the gap between pavement structural design and mixture design, the AMPT Cyclic Fatigue Test can offer users and agencies a larger return on investment as it relates to minimizing distress in asphalt pavements.

Fatigue Cracking Concerns

Fatigue cracking of asphalt pavements is considered to be one of the most challenging issues facing pavement engineers today. The cause of these cracks, which are influenced by repeated (i.e., cyclic) loading over time can be tied to weak pavement foundations, insufficiently designed asphalt materials, or changes in strain tolerance of the mixture brought on by long-term field aging (2). Fatigue cracks of the asphalt layer propagate through the structure. The end result of cracks are water intrusion, rougher ride quality, worse fuel consumption, and traffic delays from rehabilitation efforts that cost users and agencies time, money, and resources. As transportation budgets continue to tighten, performance tests and specifications for asphalt mixture and structural design, and acceptance of construction are critical to enhancing pavement life, limiting costs, and maximizing available resources.
Thank You