FHWA Performance Related Specifications for Asphalt Mixtures

Asphalt Mix ETG
Fall River, Ma

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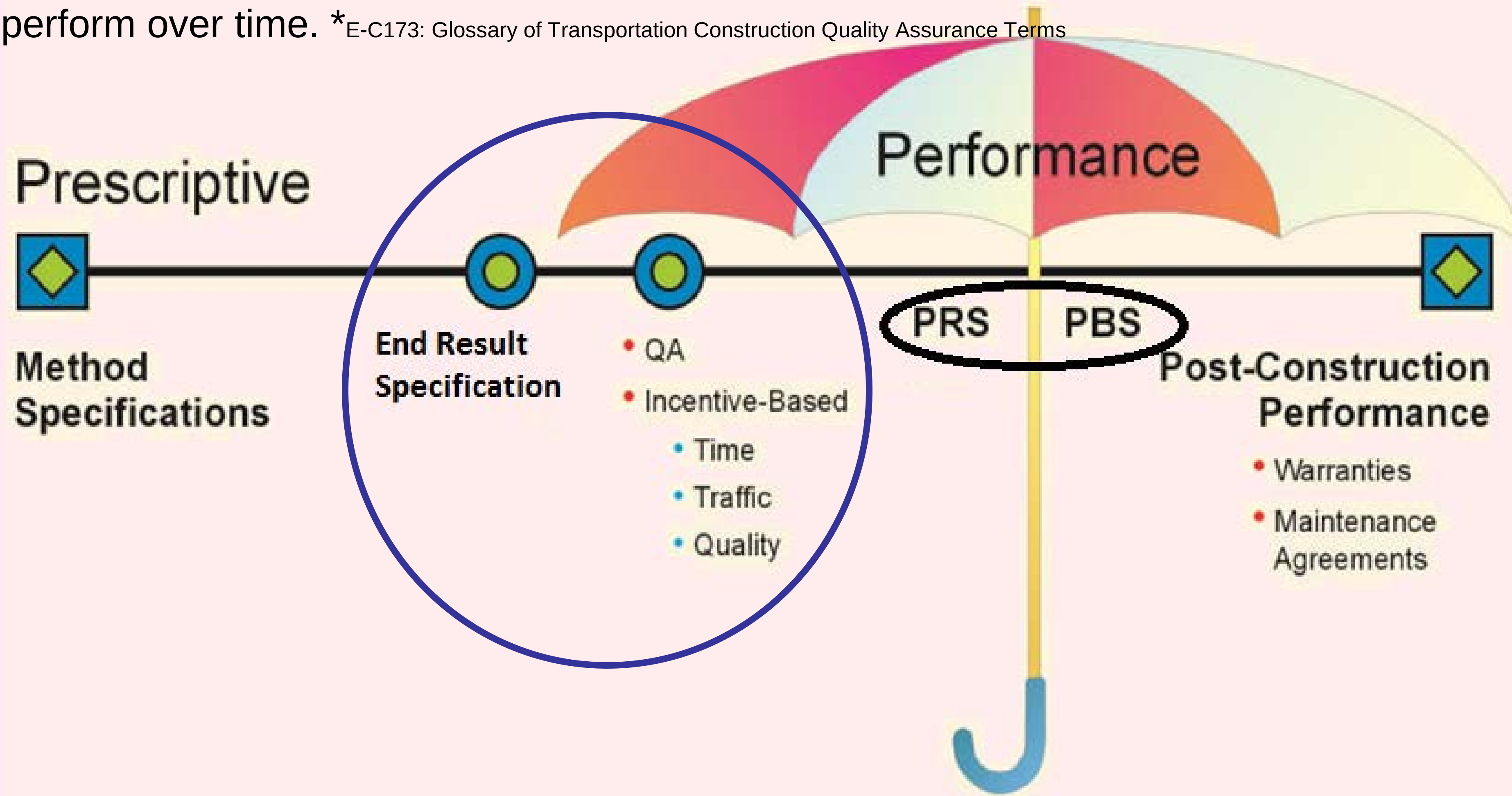
FHWA-TFHRC
McLean, VA
Richard B. Duval, PE
Richard.Duval@dot.gov

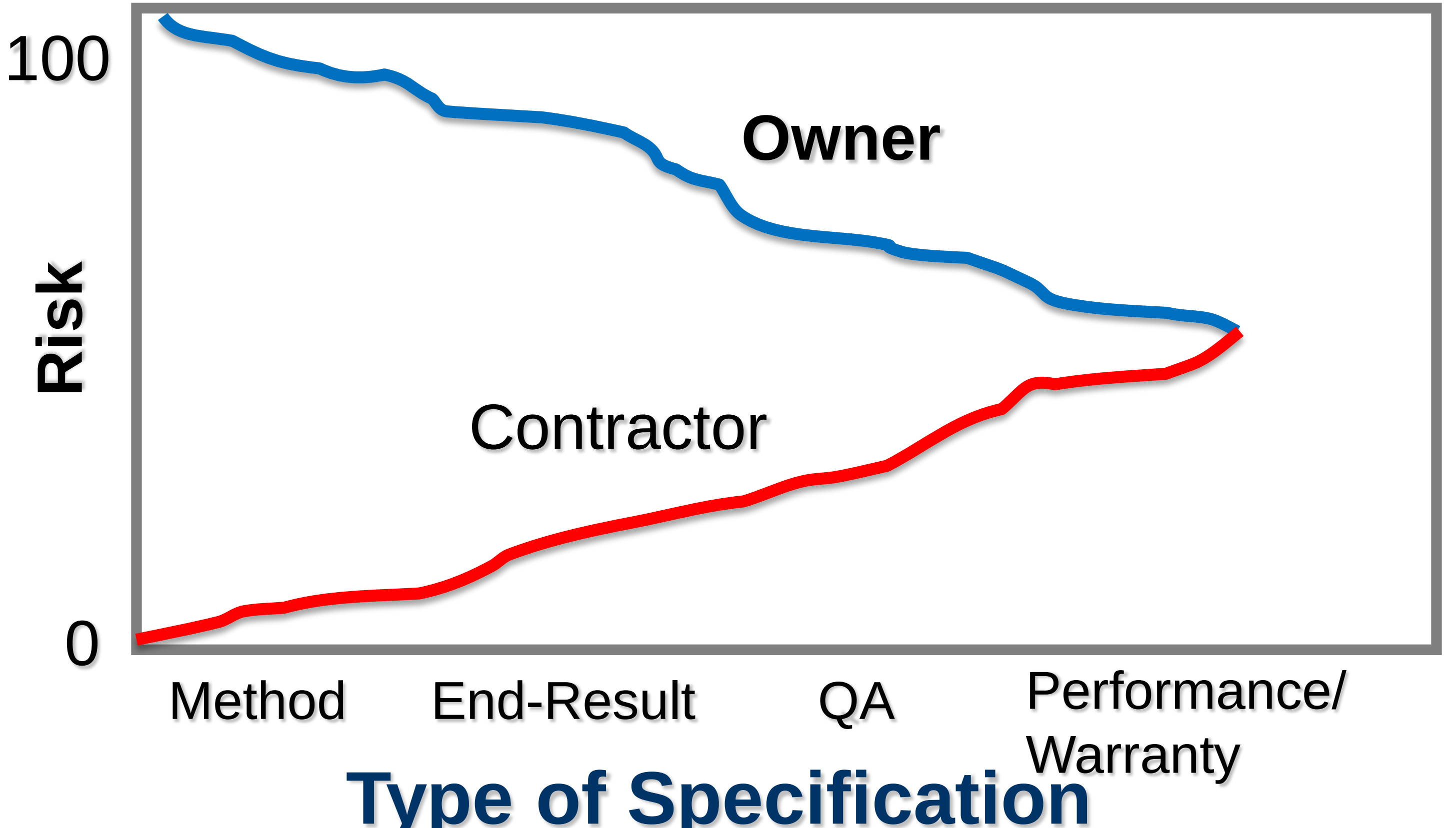
Performance Specifications

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



Scott et al. 2013. Performance Specifications for Rapid Highway Renewal. SHRP2 R07.

Specifications have Different Risks Perspective

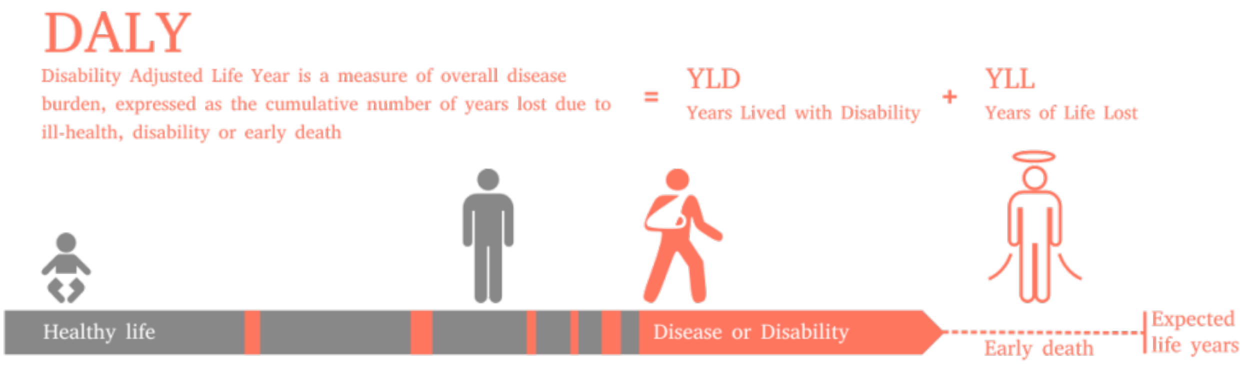


https://en.wikipedia.org/wiki/Disability-adjusted_life_year

Performance Related Specifications

Predict life.
How much life was lost? Gained ?

https://en.wikipedia.org/wiki/Disability-adjusted_life_year



Going Forward

Performance Related Specifications

Balanced Mix Design

Predict Pavement Performance
How much life was lost? Gained ?

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

Binder Content

a number

a number

Performance Prediction

(traffic – structure – climate)

Going Forward

Involved. Complicated.

Already has capability

Make it simpler

Performance Prediction

(traffic – structure – climate)

Going Forward

Already has capability

Involved. Complicated.

Make it simpler

Functionality has to be added

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

Performance Related Specifications

Why PRS

Going Forward

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

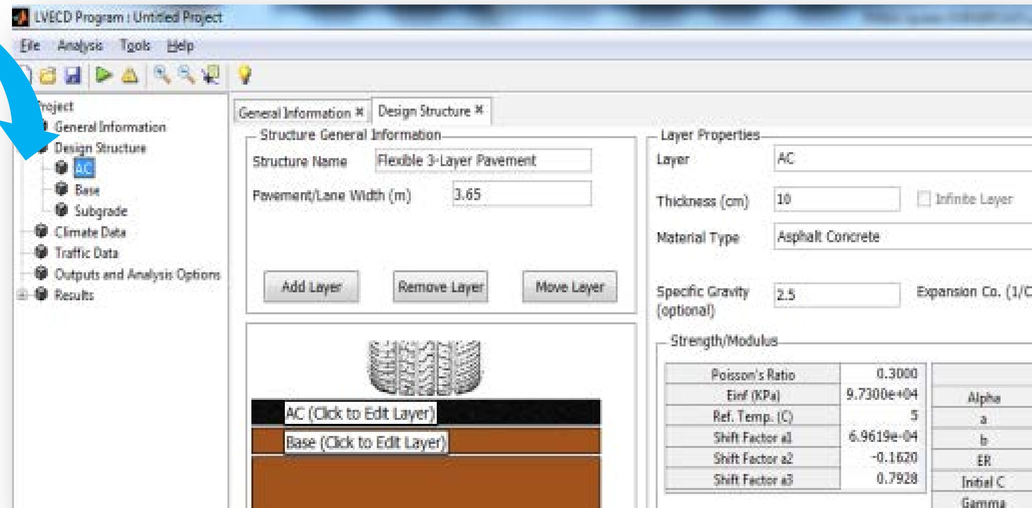
Straightforward and easier to execute

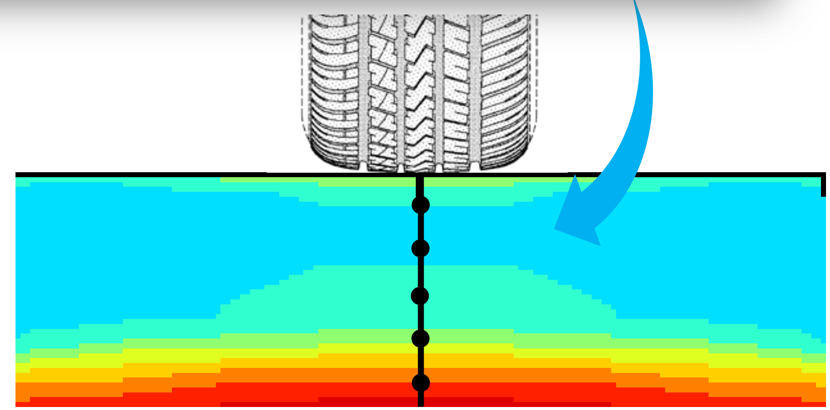
\+ If the mix passes a set of criteria, it will have a (known?) higher probability of achieving expected “design” life with respect to distresses associated with those criteria

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

AMPT + Performance Prediction

✓ **Structure** ✓ **Traffic** ✓ **Climate**





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

Pavement Design

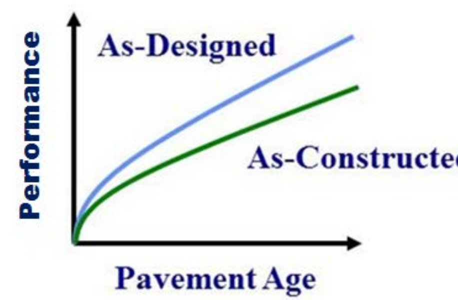
Planning

Establish Performance Criteria

Identify AQCs and Target Values

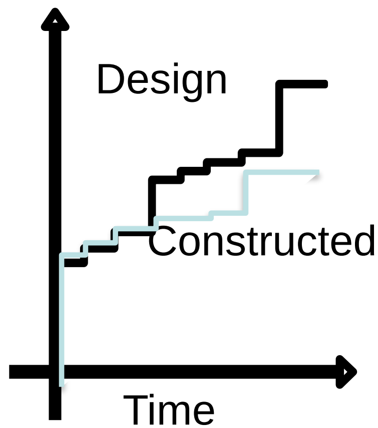
SOFTWARE

Design AQC vs. As-Constructed AQC



Model Performance

Value of Performance – M&R



Compare As-Built & As-Designed

Pay Factor

How PRS Works in Setting Up a Specification

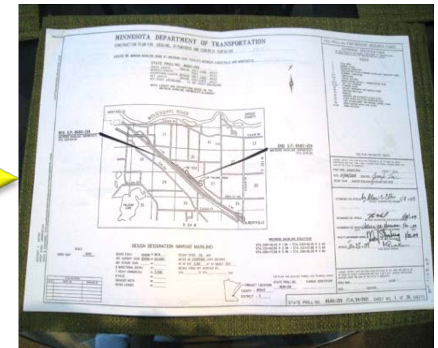
Pavement Design

Establish Performance Criteria

Planning

Identify AQCs and Target Values

Incorporate Pay Tables Into Specifications & Project Letting



Use Specifications

Pavement Construction, QA Sampling, and Testing

Pay Factor

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

Item	Years of Construction	Quantity (Sq. Yds.)	Weighted Ave. Adj. Unit Price ($ / Sq. Yd.)
13" JPCP Single Lift	2007-2009	1,048,390	$70.92
13" JPCP Composite	2013 - 2014	69,483	$50.90
13" JPCP Single Lift (PRS)	2015	841,205	$58.17
13" JPCP Single Lift (PRS)	2016	521,707	$50.95

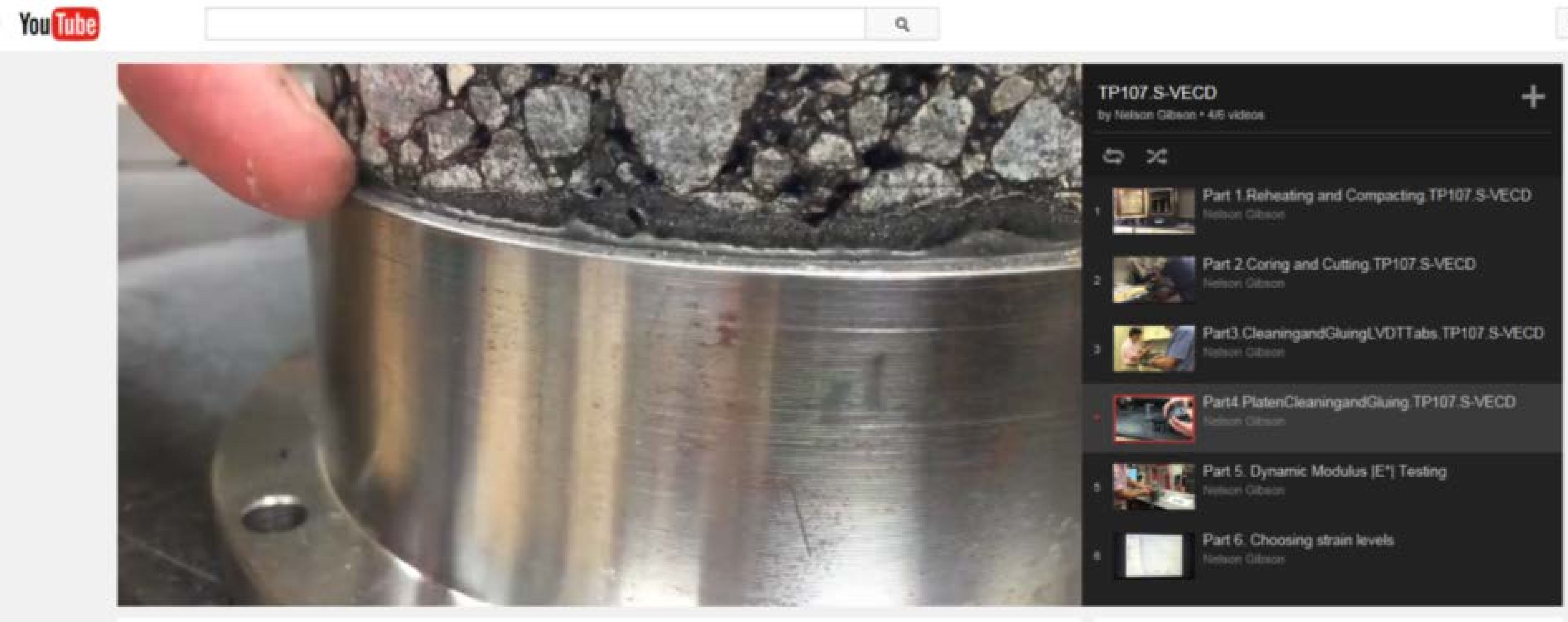
Illinois Tollway

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=PLyLypK-v8li-KjQq-Z6lmad4v2o_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

TechBrief

The Asphalt Pavement Technology Program is an integrated, national effort to improve the long-term performance and cost effectiveness of asphalt pavements. Managed by the Federal Highway Administration through partnerships with state highway agencies, industry and academia the program's primary goals are to reduce congestion, improve safety, and foster technology innovation. The program was established to develop and implement

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