LTPP SPS-10:
Warm Mix Asphalt Experiment

FHWA Asphalt Mixture ETG
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Baton Rouge, LA

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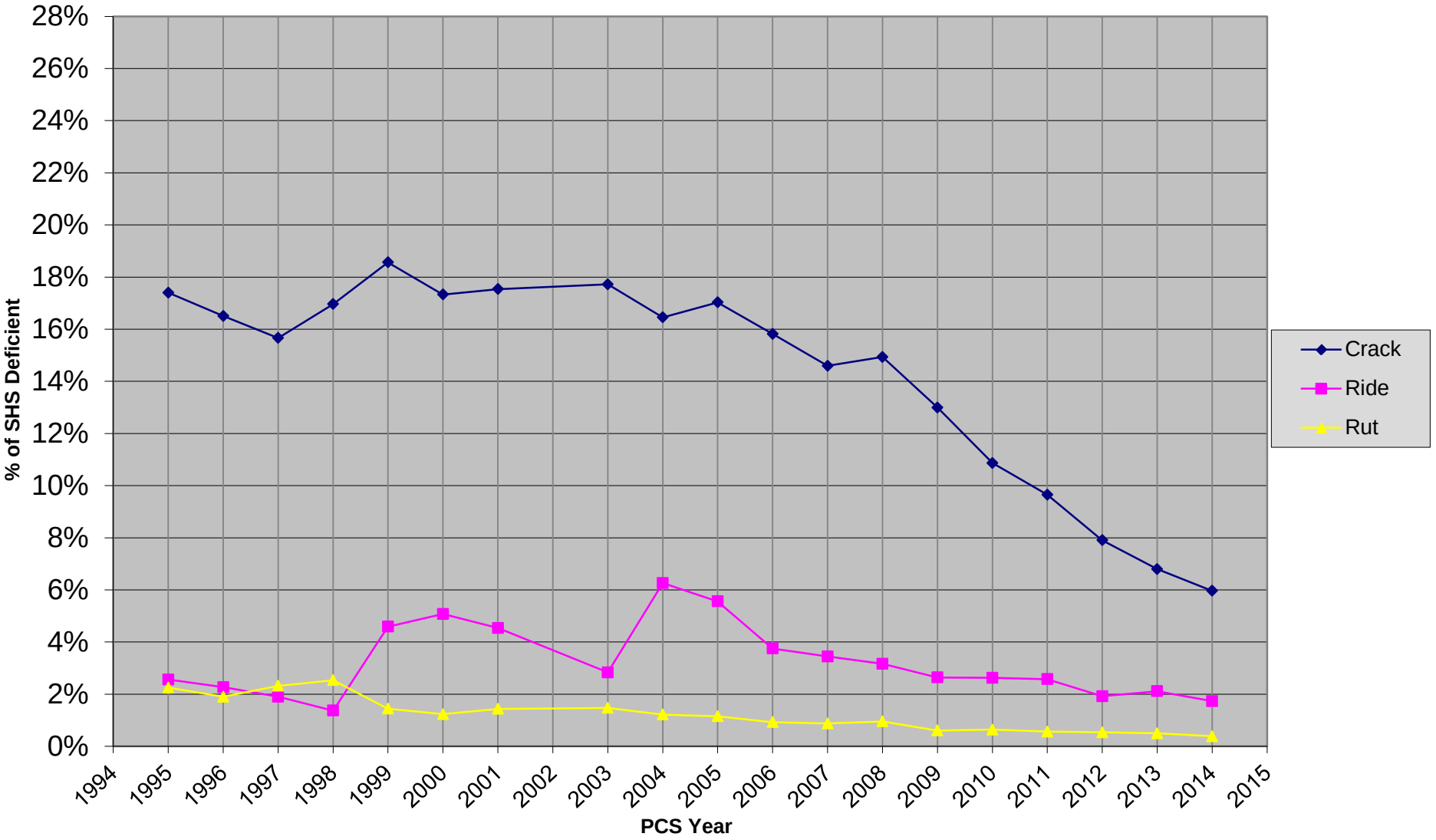
Federal Highway Administration

LTPP
LONG TERM Pavement PERFORMANCE

Florida Pavement Performance



Objectives

- Long-term performance of WMA relative to HMA
- Capture data on WMA with RAP

Experimental Design

WMA Technology			Wet				Dry			
			Freeze		No Freeze		Freeze		No Freeze	
			High	Low	High	Low	High	Low	High	Low
Core Test Sections on Project										
HMA (Control)	WMA (Foaming Process)	WMA (Chemical Additive)	2	2	2	2	2	2	2	2

Moisture
Temperature
Traffic

SPS-10 Requirements

- Overview
  - AC overlay of existing AC pavements
  - 2” to 4” overlay thickness
  - Dense graded mix
  - RAP content 10-25% (binder replacement)
  - 1 HMA control test section
  - 2 WMA test sections
    - Foaming Process
    - Chemical Additive
  - Tack Coats between lifts

Experiment Layer Requirements

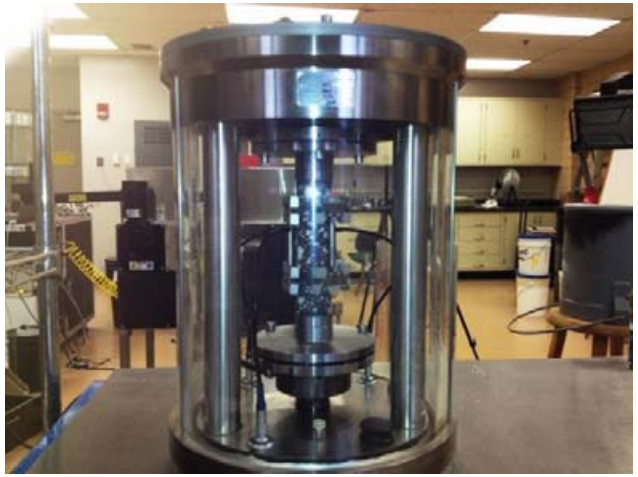
- Mix design/binder grade selection based on Agency's standard practice
- Overlay thickness selected by Agency's standard practice
- Uniformity between HMA and WMA
  - Same binder source/grade
  - Same aggregate source/gradations
  - Mix design/JMF

Supplemental Sections

- Agencies can build additional test sections that will be monitored as part of the LTPP program
  - Varying levels of RAP
  - Additional WMA technologies
  - Layer thickness variation
  - Open or gap graded mixtures
  - Varying aggregate sources/absorption levels
  - Other variables of interest to Agency

Tests on Experiment Layer

- Dynamic Modulus – Small-scale AMPT (TP 79)
  - 0, 6, 12 and 18 months after construction
- 38 mm diameter x 110 mm height specimens
  - Re-cored horizontally from 6” diameter core
  - Otherwise in accordance with AASHTO TP79



Tests on Experiment Layer (cont.)

- Binder Testing – DSR, BBR, MSCR
  - Tank Binder
  - Extracted binder at 0, 6, 12 and 18 months
- Hamburg Wheel Tracker
  - Initial time period only
- Basic Mix Characterization
  - BSG, G_{mm}, P_b, G_{se}, G_b, aggregate gradation

Tests on Existing AC Layers

- Dynamic Modulus – Small-scale AMPT (TP 79)
- Binder Testing – DSR, BBR, MSCR
- Hamburg Wheel Tracker
- Basic Mix Characterization
  - BSG, G_{mm}, P_b, G_{se}, G_b, aggregate gradation

All tests performed at initial time period only

ETG Recommendations

- Supplementary Tests:
  - Based on NCHRP Research Digest 370
  - "Guidelines for Project Selection and Materials Sampling, Conditioning, and Testing in WMA Research Studies"


February 2012

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Research Results Digest 370

GUIDELINES FOR PROJECT SELECTION AND MATERIALS SAMPLING, CONDITIONING, AND TESTING IN WMA RESEARCH STUDIES

This digest summarizes the results of a "Workshop to Coordinate Key WMA Research Projects" sponsored by NCHRP Project Panels 9-43, 9-47, and 9-49 in conjunction with the AASHTO Highway Subcommittee on Materials, the Federal Highway Administration, and the National Asphalt Pavement Association. The workshop was held on May 13, 2011 at the National Academies' Arnold and Mabel Beckman Center, Irvine, CA.

The notes on which this digest is based were prepared by Mr. Tom Baker, Washington State Department of Transportation; Messrs. Matthew Corrigan and John Bukowski, Federal Highway Administration; Dr. Jon Epps, Texas Transportation Institute; Dr. David Newcomb, formerly of the National Asphalt Pavement Association; and Dr. Edward Harrigan, National Cooperative Highway Research Program.

INTRODUCTION

Warm mix asphalt (WMA) refers to asphalt mixtures produced at temperatures at least 50°F cooler than those typically used in the production of hot mix asphalt (HMA). The goal of WMA is to produce mixtures with similar strength, durability, and performance characteristics as HMA using substantially reduced production temperatures. Important environmental and health benefits are associated with reduced production temperatures, including lower greenhouse gas emissions, lower mix plant fuel consumption, and reduced exposure of workers to asphalt fumes. Lower production temperatures also can potentially improve pavement performance by reducing binder aging, providing added time for mixture compaction, and allowing improved compaction during cold weather paving.

The first WMA pavements were constructed in Europe in 1995 and in North America in 2004. Since that time, WMA production has substantially grown in the United States. For example, the FHWA estimates that 10% of the 358 million tons of asphalt mix placed nationwide in 2010 was WMA.

As the use of WMA has widened, so have the number of WMA technologies available to the industry. In 2011, 30 or more WMA technologies were available, classified into three broad categories: (1) those using organic additives, including waxes; (2) those using chemical additives; and (3) those using water-based foaming processes. Moreover, as these numbers suggest, WMA has rapidly moved from use in pilot and experimental projects to more routine, large-scale use. At present, at least 30 state departments of transportation (DOTs) have established specifications permitting the use of WMA.

This rapid growth in use of WMA use naturally raises questions about WMA pavement construction processes and the pavements' long-term durability and

TRANSPORTATION RESEARCH BOARD

Supplementary Tests

Rutting	
Flow Number (AMPT)	AASHTO TP 79
Hamburg Test	AASHTO T 324 (Note: Prepare specimens at air voids content of 7±1% and conduct test at standard conditions: 50°C under water.)
APA	AASHTO T 340
Modulus	
Dynamic Modulus (AMPT)	AASHTO PP 61
Fatigue Cracking	
Beam Fatigue	AASHTO T 321
Overlay Test	TxDOT Method: Tex-248-F, *Test Procedure for Overlay Test*, February 2014
Simplified Viscoelastic Continuum Damage (S-VECD)	AASHTO TP 107
Superpave Indirect Tension Test (IDT)	University of Florida
Semi-Circular Bending Test at Intermediate Temperatures	Louisiana Transportation Research Center (LTRC)
Thermal (Low Temperature) Cracking	
IDT Creep Compliance and Strength	AASHTO T 322
Semi-Circular Bending Test	AASHTO TP 105
Disk Shaped Compact Tension – DC(T) Test	ASTM D7313

Supplementary Tests

Durability	
Moisture Sensitivity	AASHTO T 283 (Note: 1 Freeze/Thaw cycle)
Hamburg Test	AASHTO T 324 (Note: Prepare specimens at air voids content of 7±1% and conduct test at standard conditions: 50°C under water.)
Other	
G_{mm}	AASHTO T 209
Volumetric Properties	AASHTO R 35
Gyratory Compaction to N_{design}	AASHTO T 312

Additional information on these recommended tests can be found at the following location:

http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rrd_370.pdf

ETG Recommendations

- Supplementary Test Sections:
  - Variable Density Levels
  - WMA produced at HMA temperatures
  - Other WMA technologies
  - High Recycle Binder Ratio (>0.25) Mixes

Current Status

- The White Paper developed by the Asphalt ETG was distributed to each Highway Agency.
- 17 SPS-10 projects have been nominated by Highway Agencies.
  - 8 have been accepted and approved;
  - 2 have been rejected.
  - The remainder of projects nominated are currently under evaluation by FHWA.
- FHWA is actively meeting with other agencies to recruit additional projects.
- Two projects will be constructed this fall. One each in New Mexico and Texas.

Status

- All of the final report, guidelines, and supporting documentation will be submitted for publication by the end of September which includes:
  - Experimental Design
  - Nomination Guidelines
  - Materials Sampling and Testing Guidelines (including testing protocols and materials tracking system)
  - Construction Data Collection Requirements
  - Long term performance monitoring Requirements

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