Seal Coat Binder Performance Specifications

Amy Epps Martin

87th Annual Transportation Short Course
October 2013

OUTLINE

- Motivation, Objective, & History
- Recommended SPG Specification
- Implementation Project

MOTIVATION & OBJECTIVE

- Need to improve seal coat binder specs
  - replace empirical tests (penetration, ductility) with performance-related tests applicable to both unmodified and modified binders
  - consider temperatures that cover entire ***in service*** range that are tied to specific climate
  - consider aging during critical 1st year
  - reduce variability in grades
- Developed Surface Performance-Grade (SPG) spec for seal coat binders ***in service***
- Validated with 75 TX highway sections

TxDOT 0-1710 (3.5 yr+ project, 9/99 – 3/03) Superpave Binder Tests for Surface Treatment Binders

Traditional Specification for Surface Treatment Binder RESIDUE Inadequate

•Develop Performance-Based Specification & Grade Selection Process for Surface Treatment Binder RESIDUE
- **•Surface Treatment Distresses & Conditions**
- **•Superpave Equipment**
- **•Qualitative Performance Rankings & Corresponding Environmental Conditions**

•Validate Specification
- **•Laboratory Measured Binder SPG Grade**
- **•Observed Field Performance on 45 Highway Sections**

NCHRP 14-17 (2.5 yr+ project @ A&M, 4/08 – 12/09) Manual for Emulsion-Based Chip Seals for Pavement Preservation

•Provide technology-based *tools* that promote sound engineering decisions and reduce the subjectivity in chip seal design and construction processes
•Create a *manual* which describes how to design and construct chip seals with a very high confidence level in the success of the resulting project

•A&M: Emulsion residue recovery, chemical & rheological binder characterization for 5 emulsions + 3 Highway Sections

TxDOT 0-6616 (2 year project, 9/10-8/12) Validate Surface Performance-Graded (SPG) Specification for Surface Treatment Binders

Improve SPG Specification

•Standardize Emulsion Residue Recovery Method

•Explore Exclusive Use of DSR – Predict S, m-value

•Evaluate Additional Performance Parameters

•Further Field Validate SPG Thresholds on 30 Highway Sections

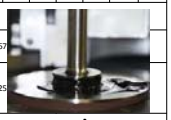
Emulsion Task Force (ETF) of FHWA Pavement Preservation ETG (formed 08, ~30 members, 2 X per year)

- Review Ongoing Research & Integrate Work
- Recommend / Propose / Evaluate Research Needs
- Advance Development of Performance-Based Methods & Specifications
- Facilitate Implementation / Adoption of Standards through AASHTO/ASTM
- Share Info w/Other ETGs

Texas A&M Transportation Institute

RECOMMENDED SPG

with AASHTO PP 72-11 Method B	Performance Grade											
	SPG 64				SPG 67				SPG 70			
	-13	-16	-19	-22	-13	-16	-19	-22	-13	-16	-19	-22
Average 7-day Maximum Surface Pavement Design Temperature, °C	<64				<67				<70			
Minimum Surface Pavement Design Temperature, °C	>-13	>-16	>-19	>-22	>-13	>-16	>-19	>-22	>-13	>-16	>-19	>-22
Original Binder												
Dynamic Shear, AASHTO TP5 G*/Sinδ Minimum: 0.65 kPa Test Temperature @10 rad/s, °C	64				67							
Shear Strain Sweep % strain @ 0.8G*, Minimum: 17.5 (25) Test Temperature @10 rad/s linear loading from 1-50% strain, 1 sec delay time with measurement of 20-30 increments, °C	25											
Pressure Aging Vessel (PAV) Residue (AASHTO PP1)												
PAV Aging Temperature, °C	100				100							
Creep Stiffness, AASHTO T 313/ASTM D6648 S, Maximum: 500 MPa (m-value, Minimum: 0.24) Test Temperature @ 8s, °C	-13	-16	-19	-22	-13	-16						
Shear Strain Sweep G_i^*, Maximum: 2.5 MPa Test Temperature @10 rad/s linear loading at 1% strain and sec delay time, °C	25				25							



RECOMMENDED SPG

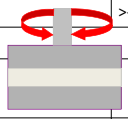
with AASHTO PP 72-11 Method B	Performance Grade SPG 67			
	-13	-16	-19	-22
Avg 7-day Max Surface Pavement T, °C	<67			
Min Surface Pavement T, °C	>-13	>-16	>-19	>-22

- Method B for Emulsion Residue Recovery
  - Thin Film on Silicone Mat
  - 60 °C for 6 hrs

Texas A&M Transportation Institute

RECOMMENDED SPG

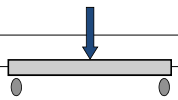
	Performance Grade SPG 67			
	-13	-16	-19	-22
	<67			
	>-13	>-16	>-19	>-22
Original Binder				
$G^*/Sin\delta \geq 0.65$ kPa Test Temperature @ 10rad/s, °C	67			
$0.8G_i^* \geq 17.5\%$ strain Test Temperature @ 10rad/s w/ 1-50%, °C	25			



Texas A&M Transportation Institute

RECOMMENDED SPG

	Performance Grade SPG 67			
	-13	-16	-19	-22
	<67			
	>-13	>-16	>-19	>-22
PAV Residue				
$S \leq 500$ MPa Test Temperature @ $8s$, °C	-13	-16	-19	-22
$G_i^* \leq 2.5$ MPa Test Temperature @10 rad/s, 1% strain, °C	25			



OR Predict S from DSR Frequency Sweeps @6 °C

Texas A&M Transportation Institute

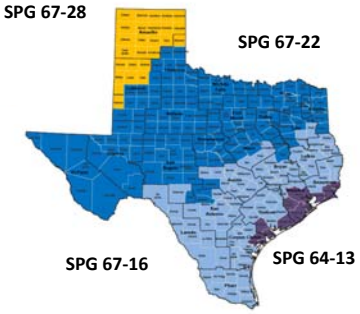
IMPLEMENTATION PROJECT

- 4 Years
- Implement SPG specification statewide to replace Seal Coat Binder Selection Table & Item 300 for seal coat binders ***in service***
- Task 1 - Conduct Technical Briefings for Industry & TxDOT twice a year

Texas A&M Transportation Institute

IMPLEMENTATION PROJECT

- Task 2 - Document SPG Grade Requirements & Identify 2 Districts for 2014 Implementation
- Task 3 – Finalize SPG for 2014



IMPLEMENTATION PROJECT

- Task 4 – Produce Seal Coat Binder Utilization Map
- Task 5 – Monitor Field Performance of Selected 2013 Field Sections

Binder	SPG Grades	Districts
AC20-5TR	70-13, 67-16, 70-16, 73-16, 76-16, 79-16, 67-19, 70-19	AMA, ATL, BMT, BRY, BWD, FTW, LBB, LFK, PAR, SAT, SJT, TYL, WAC
AC15P	73-13, 70-19, 73-19, 73-22	CRP, LFK, PHR, SAT, WAC
CRS-2P	70-10, 70-16, 76-16, 76-19	BMT, BWD, LFK, PAR, WAC
CRS-2	64-10, 67-13	BWD
AC10	64-16, 64-19	AMA, CHS, SJT
AC10-2TR		AMA, BWD, LBB, ODA, SAT, SJT, WFS, YKM

IMPLEMENTATION PROJECT

- Task 6 – Finalize SPG for 2015
  - Check DSR+SAT for T_{low} properties
  - Check PAV = 1 year aging
  - Consider 3 vs 6 °C, single $T_{max,}$ traffic effects
  - Evaluate field performance monitoring + embedment depth + binder characterization
    - 2013: ten 6616 sections + 20 new sections
    - 2014: 20 sections @ 1 yr + 10 new sections in 2 districts
    - 2015: 10 sections @ 1 yr + 20-25 new statewide sections
    - 2016: 20-25 statewide sections @ 1 yr

IMPLEMENTATION PROJECT

- Task 7 - Implement SPG in 2 Districts in 2014
- Task 8 – Finalize SPG Based on Feedback from TxDOT & Industry
- Task 9 – Implement Statewide in 2015, Estimate Economic Impact, & Document Implementation

THANK YOU