

Empirical SHRP+ Specifications versus Performance-Related Models

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Overview

- Current Status of SuperPave Specs and the so-called SHRP+ Specifications
- Why are Users Specifying SHRP+ Specs?
- Are SHRP+ Specs a Good Thing?
- How do We Improve the SuperPave Specs without Proliferating the Specifications or adding too much Complexity?
- Where are the Holes in the existing PG Spec?
- Summary

Current Status of SuperPave Specs and the so-called SHRP+ Specifications

- Most States in the Western, Central and Southern United States as well as some of the Canadian Provinces are now using SHRP+ specifications.
- Empirical, non-performance based tests include:
 - T & T
 - Ductility
 - Force Ductility
 - Elastic Recovery

Current Status of SuperPave Specs and the so-called SHRP+ Specifications

■ Examples are:

- TX - Elastic Recovery
- OK - Elastic Recovery
- IL - Force Ductility
- UT - T&T
- NV - T&T, Ductility

■ Many other states are now contemplating implementing SHRP+ specifications for their high performance binder grades.

Why are Users Specifying SHRP+ Specs?

- Current SuperPave specifications do not capture the field performance adequately.
 - Polymer-modified PG70-22 versus conventional, “blown” PG70-22 or chemically “treated” binders
- Users are concerned about “aphaltdoids” and Zupaphalts
 - “Recycled” engine oil bottoms
 - Acid treated systems
 - Tall oil-modified systems

Why are Users Specifying SHRP+ Specs

- User wants a specific type of modification
 - Excellent field performance history with elastomeric modifiers versus plastomeric

Are SHRP+ Specs a Good Thing?

Pros

- Empirical evidence appears to support notion that modified systems of equivalent grading perform better.
- Agency can assure that systems with proven performance history are used.

Are SHRP+ Specs a Good Thing?

■ Contrasts

- Evolution of proprietary specs that call for a specific modifier type or group rather than a performance level.
- Empirical tests do NOT correlate with performance and are generally descriptive.
- Descriptive specs have unintended implication that impact base AC choice rather than modifier.

Are SHRP+ Specs a Good Thing?

■ Contrasts

- Choices often arbitrary and difficult to justify.
- The usage of new innovative materials and technologies is stymied.
- Testing requirements (equipment, time and number) are potentially significantly increased.
- Every agency has their specific flavor.
 - Sometimes more than one flavor in a given state, e.g., TX and NV.

Are SHRP+ Specs a Good Thing?

Unintended Results

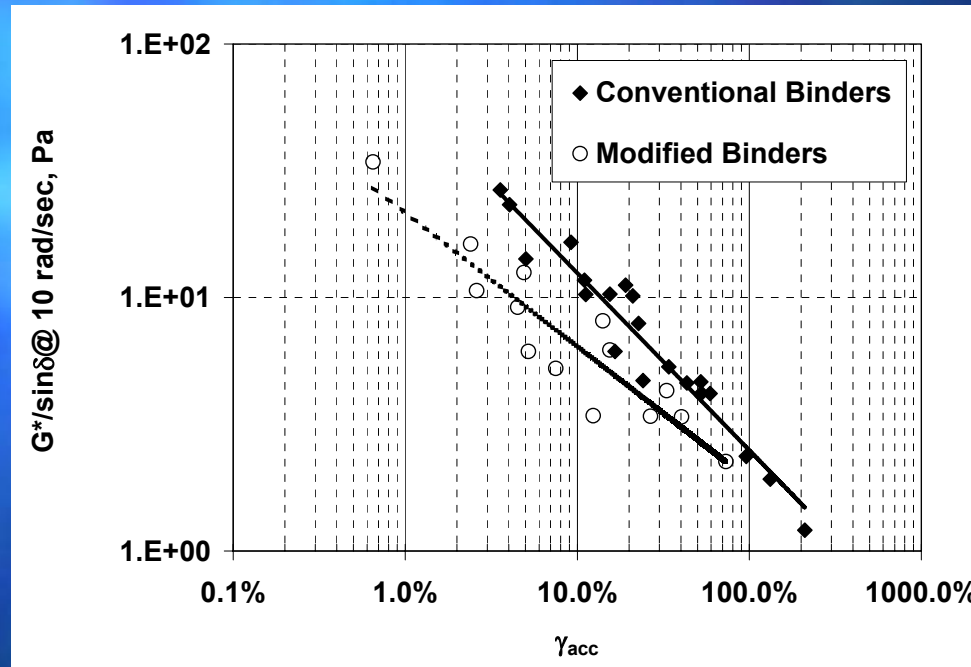
	<i>Sample ID</i>	SN1	SN2
	<i>Laboratory</i>	DLS	
<i>Component</i>		Base A	Base B
Base Asphalt		95.15%	96.68%
Elastomer Content, (%)		4.50%	3.00%
SPA Content, %		0.20%	0.20%
Sulfur Content, %		0.15%	0.12%
G* Orig at 64 C		1.35	5.10
δ Orig at 64 C		72.4	50.9
G*/sin δ Orig at 64 C		1.42	6.57
G* RTFO at 64 C		3.19	9.68
δ RTFO at 64 C		63.9	43
G*/sin δ RTFO at 64 C		3.55	14.19
BBR S(60) at MPa at -24C		256	65
BBR m-value(60) at -24C		0.298	0.320
Toughness, lbs in		113	45
Tenacity, lbs in		94	32

How do We Improve the SuperPave Specs without Proliferating the Specifications or adding too much Complexity?

- Use existing hardware.
- Possibly modify tools and/or software.
- Don't make test too time consuming.
- Don't use tests that have poor repeatability or reproducibility.
- Eliminate non-meaningful tests.

Where are the Holes in the existing PG Specification?

■ High Temperature - Permanent Deformation



Where are the Holes in the existing PG Specification?

■ High Temperature

- $G^*/\sin \delta$ does not properly rank PMAs vs conventional ACs.
- Repeated creep test cumbersome and potentially difficult to implement.
- Zero shear viscosity (ZSV) appears to do a better job.

Where are the Holes in the existing PG Specification?

■ High Temperature Continuation.

- Zero shear viscosity (ZSV) ranks field projects properly.

Cons:

- Is not dependent upon loading time. Doesn't tell the WHOLE story.
- Computation needs to be simplified.

Pros:

- Works with existing equipment.
 - Relatively fast.
- Add phase angle to spec.

High Temperature NV I-80

Binder	Field Performance	$G^*/\text{Sin}(\delta)$	ZSV	Repetitive Creep
PG 64-22	2	1	2	2
AC20P	1	2	1	1

High Temperature Mississippi I55

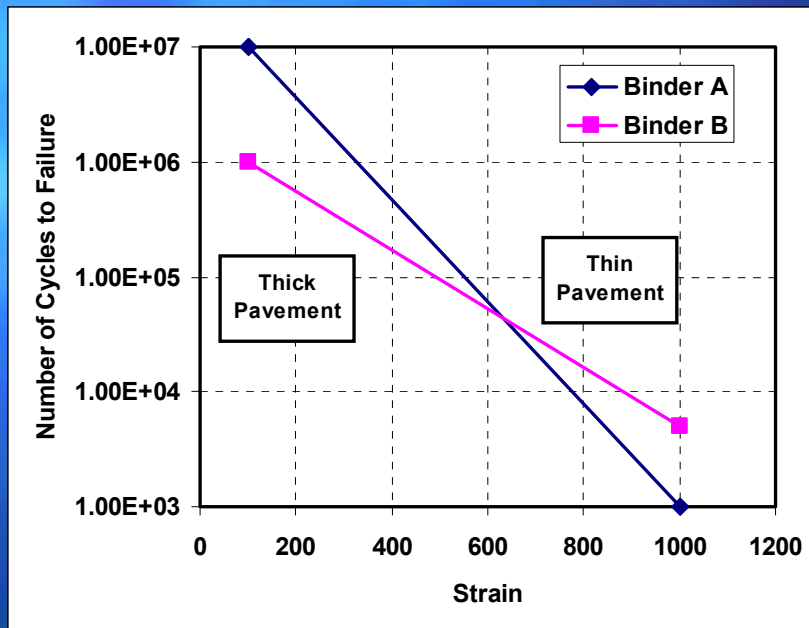
Binder	Field Performance	$G^*/\sin(\delta)$	ZSV
ASR (SBR)	4	3	4
CSR (Control)	5	3	5
GSR (SealoFlx)	1	1	1
PSR (SBS)	3	3	3
TSR (SB)	1	2	2

Where are the Holes in the existing PG Specification?

- Intermediate Temperature - Load Induced Fatigue
 - $G^* \times \sin \delta$ does not capture fatigue performance.
 - NCHRP 9-10 fatigue test is cumbersome and possibly test artifact.
 - As a substitute test we need:
 - Need strain tolerance test for overlays and inlays.
 - Possibly a modified DTT test.
 - Need low deflection binders for structural layers.
 - Minimum G^* at T_{int} .

Where are the Holes in the existing PG Specification?

■ Intermediate Temperature - Load Induced Fatigue



Where are the Holes in the existing PG Spec?

■ Low Temperature - Thermal Fatigue

- T_{cr} does not capture thermal fatigue.
- Low T strength is critical parameter as well as range of transition from brittle to ductile.

- $\Delta T = T_{2.5\%} - T_{cr}$

■ Possible spec:

- $T_{cr} < T_{spec}$
- $\Delta T < 3C$
- $\sigma^* > 5MPa$

Summary

- Modifications of PG grading necessary and user driven.
- Unified approach needed.
- Simple performance-related tests can be easily implemented.
- Unified AASHTO spec needed to stop proliferation.
- Specs are purchase specs not performance predictors.