



TEXAS DEPARTMENT OF TRANSPORTATION



PG ASPHALT AND SEAL COAT

A Match Made in Heaven (?)

Outline

1 Current Specification System – Rationale and Weaknesses

2 PG/SPG system basics

3 Benefit of SPG

4 Current Implementation Efforts

Current Specifications

- “Viscosity Graded” – viscosity is the primary test
- “Penetration Graded” – pen is the primary test
- Grade name may tell you the viscosity or pen, such as:
 - AC-20-5TR = 2,000 P viscosity
 - AES-300 = 300 pen minimum
- Or not:
 - SS-1 = slow setting emulsion
 - CRS-2 = cationic rapid setting
 - CHFRS-2P = ???
- May include modifiers
 - SBS; styrene-butadiene-styrene block copolymer
 - Latex
 - TR; highly digested tire rubber

Why would we change? – Weaknesses of Current Spec

- Hodgepodge of materials
 - Hard to compare one to another
 - Makes it hard to select alternates
- Not tied to performance
 - Materials may meet but not perform
 - Very hard to equate material failures with quality
 - Hard to make adjustments for field conditions
 - Doesn't capture low temperatures.
- Takes lots of experience to make material choices.

PG Asphalt to the Rescue – What is it?

- Grading System Based on Climate

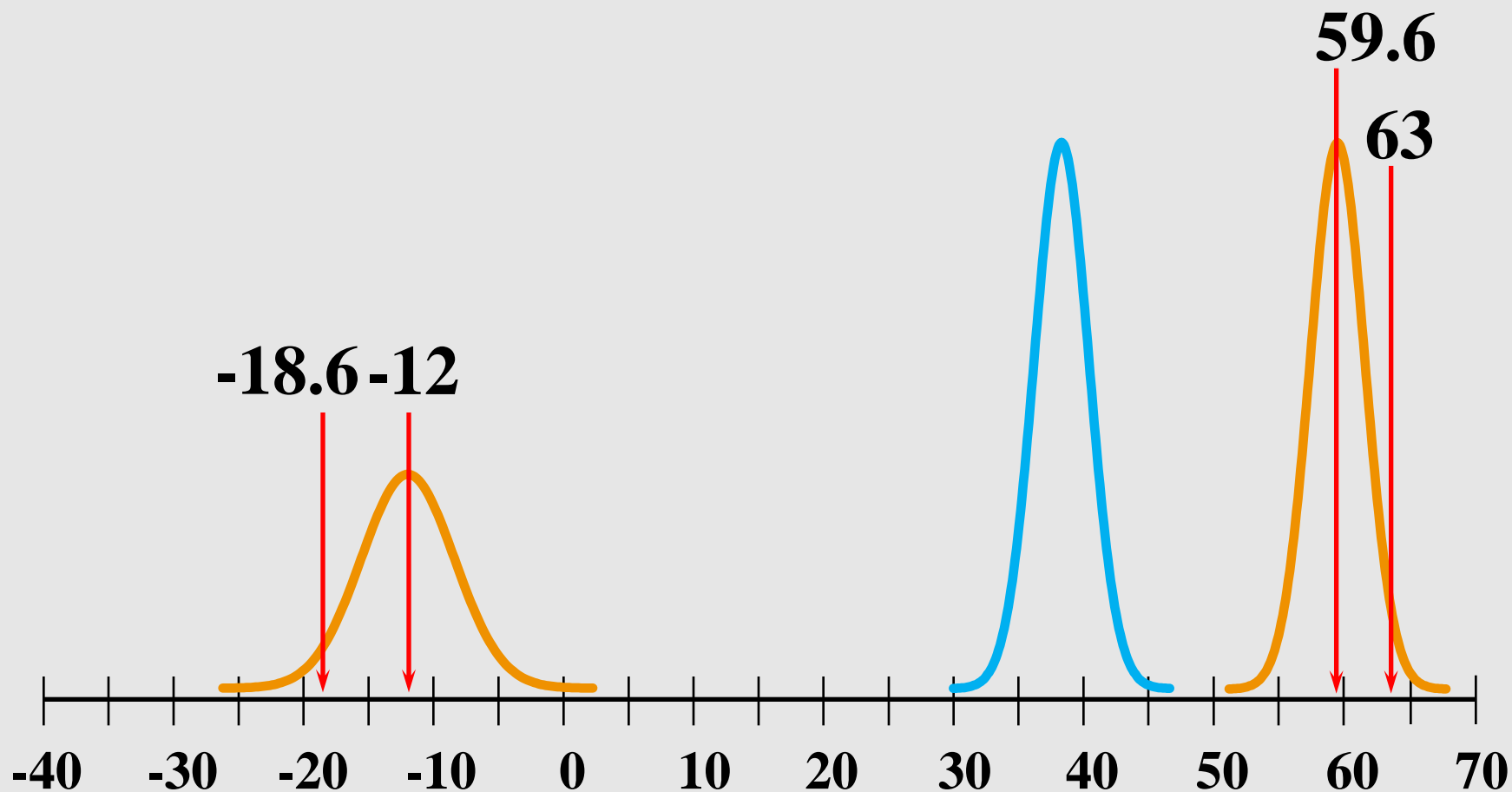
PG 52-40

**Performance
Grade**

**Average 7-day
max pavement
design temp**

**Min pavement
design temp**

PG Binders – Climate Span



Pavement Temperature (°C), D/FW, Texas

PG Binders – Desired Properties

- Summer/Early Life
 - Binder needs to be stiff.
 - Prevents rutting, flushing, or tracking.
- Winter/Late Life
 - Binder needs to be flexible.
 - Prevents brittle failure or cracking.
- Need to be able to install it.
- These desirable behaviors are the same, regardless of the application!

SPG spec- Advantages

- Systematic
 - Same basic tests are used for all types of binders.
- Performance related
 - Test parameters tailored to seal coat behavior.
- Specifically tied to climate
 - Including low temperature
- Easy to adjust for pavement/traffic conditions
 - “Grade bumping”
- New materials are easier to integrate.
 - Wide spectrum of properties
 - Apple to apples comparison of binder types

SPG spec – more advantages

- Makes the tier system easier.
 - Basic climate gives you tier 3
 - Bump up a tier: add PG-plus test
 - Bump up a tier: adjust the grade span
 - Works just like HMAC
- Streamlines testing
 - One system instead of 3 or 4
 - Smaller number of test methods
 - Similar equipment simplifies calibration, training
 - Can double up testing on some grades
- Binders in general are easier to understand

DEVELOPMENT OF SPG

- TxDOT Research Project 0-1710 (45 field sections)
- TxDOT Research Project 0-6616 (30 field sections)
- NCHRP Research Project 14-17 (3 field sections)
- SPG spec for chip seal binders ***in service***
 - Method B for emulsion residue recovery
 - + shear strain sweep with new threshold
 - X m-value
 - MSCR not added
- SPG specification part of system to be used ***with***
 - design guidelines
 - quality control procedures
 - construction techniques

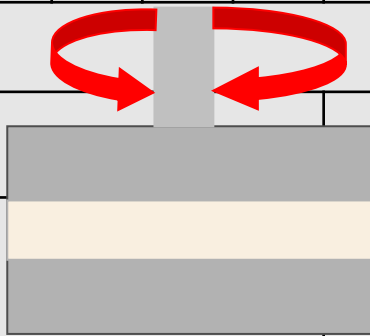
RECOMMENDED SPG

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

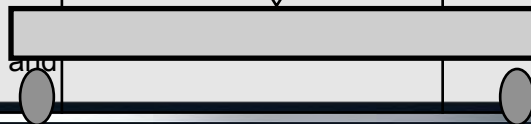
Dynamic Shear, AASHTO TP5
 $G^*/\sin\delta$ Minimum: 0.65 kPa
 Test Temperature @10 rad/s, °C

Shear Strain Sweep
 % strain @ $0.8G_i^*$, Minimum: 17.5
 Test Temperature @10 rad/s linear loading from 1-50% strain, 1 sec delay time with measurement of 20-30 increments, °C



Pressure Aging Vessel (PAV) Residue (AASHTO PP1)

PAV Aging Temperature, °C	100						
Creep Stiffness, AASHTO T 313/ASTM D6648 S, Maximum: 500 MPa Test Temperature @ 8s, °C	-12	-18	-24	-30	-12	-18	-30
Shear Strain Sweep G_i^* , Maximum: 2.5 MPa Test Temperature @10 rad/s linear loading at 1% strain and 1 sec delay time, °C							



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
<i>Original Binder</i>				
<u>G*/Sinδ</u> Min: <u>0.65 kPa</u> Test Temperature @ 10rad/s, °C	67			
Shear Strain Sweep @ 0.8G_i* Min: <u>17.5% strain</u> Test Temperature @ 10rad/s w/ 1-50%, °C	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
<i>Pressure Aging Vessel (PAV) Residue (AASHTO PP1)</i>				
PAV Aging Temperature, °C	100			
<u>S</u> , Max: <u>500 MPa</u> Test Temperature @ 8s, °C	-12	-18	-24	-30
Shear Strain Sweep G_i^* , Max: 2.5 MPa Test Temperature @10 rad/s, 1% strain, °C	25			

Current TTI Implementation Project - Tasks

- Determine SPG grades for current binders

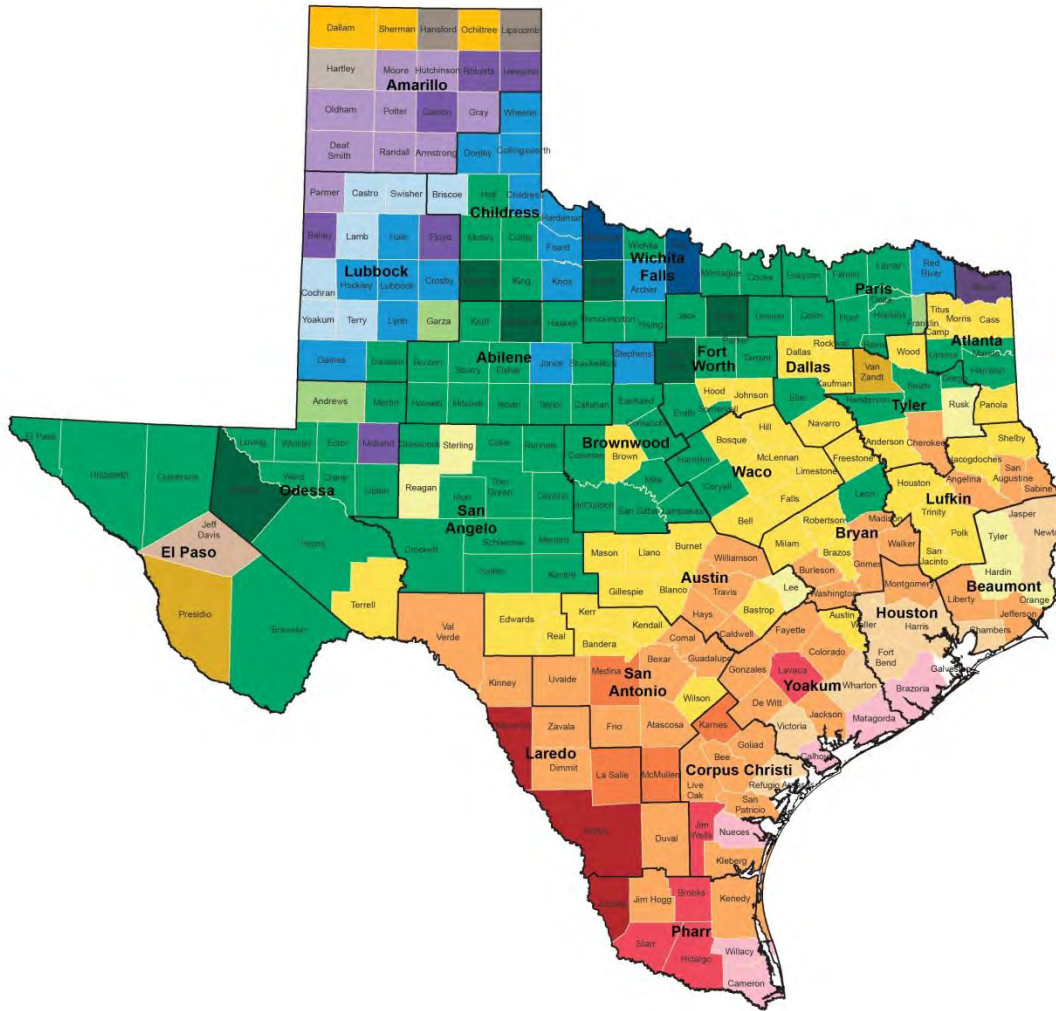
Binder	SPG Grades	Districts
AC20-5TR	70-13, 67-16, 70-16, 73-16, 76-16, 79-16, 67-19, 70-19	AMA, ATL, BMT, BRY, BWD, FTW, LBB, LFK, PAR, SAT, SJT, TYL, WAC
AC15P	73-13, 70-19, 73-19, 73-22	CRP, LFK, PHR, SAT, WAC
CRS-2P	70-10, 70-16, 76-16, 76-19	BMT, BWD, LFK, PAR, WAC
CRS-2	64-10, 67-13	BWD
AC10	64-16,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

Current TTI Implementation Project - Tasks

- Determine climate demand
 - Generate from NOAA weather databases
 - Select grade ranges to manage the number of grades

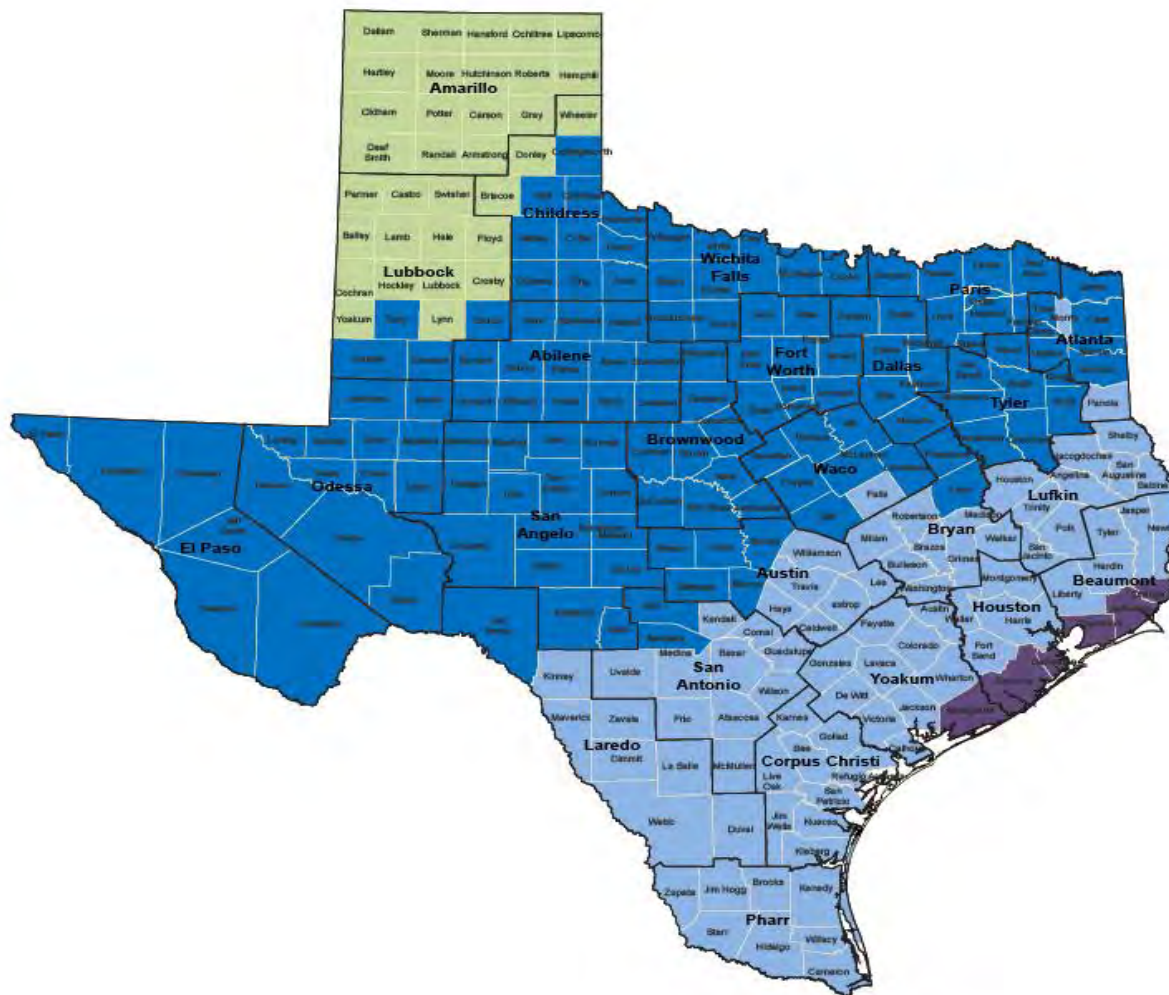
Climate Demand for SPG by County

- 70-10 ●
- 67-10 ●
- 64-10 ●
- 61-10 ○
- 70-13 ●
- 67-13 ●
- 64-13 ●
- 70-16 ●
- 67-16 ●
- 64-16 ●
- 70-19 ●
- 67-19 ●
- 64-19 ●
- 61-19 ●
- 70-22 ●
- 67-22 ●
- 64-22 ●
- 67-25 ●
- 64-25 ●
- 67-28 ●
- 64-28 ●



Climate Demand – More Practical?

- 64-16 ●
- 70-16 ●
- 70-22 ●
- 70-28 ●



Current TTI Implementation Project - Tasks

- Shadow implementation
 - Take samples from DW seal coat
 - Grade binders
 - Compare to climate – predict performance
 - Monitor performance
 - See how we did
 - Tweak spec
 - Wax on, wax off

Implementation – Current Progress

- TTI has collected lots of samples
- Grading is underway
- Monitoring for first round is underway
- TxDOT plan note showing spec

- Hopeful schedule – SW implementation in 2016?

?????