Texas Update

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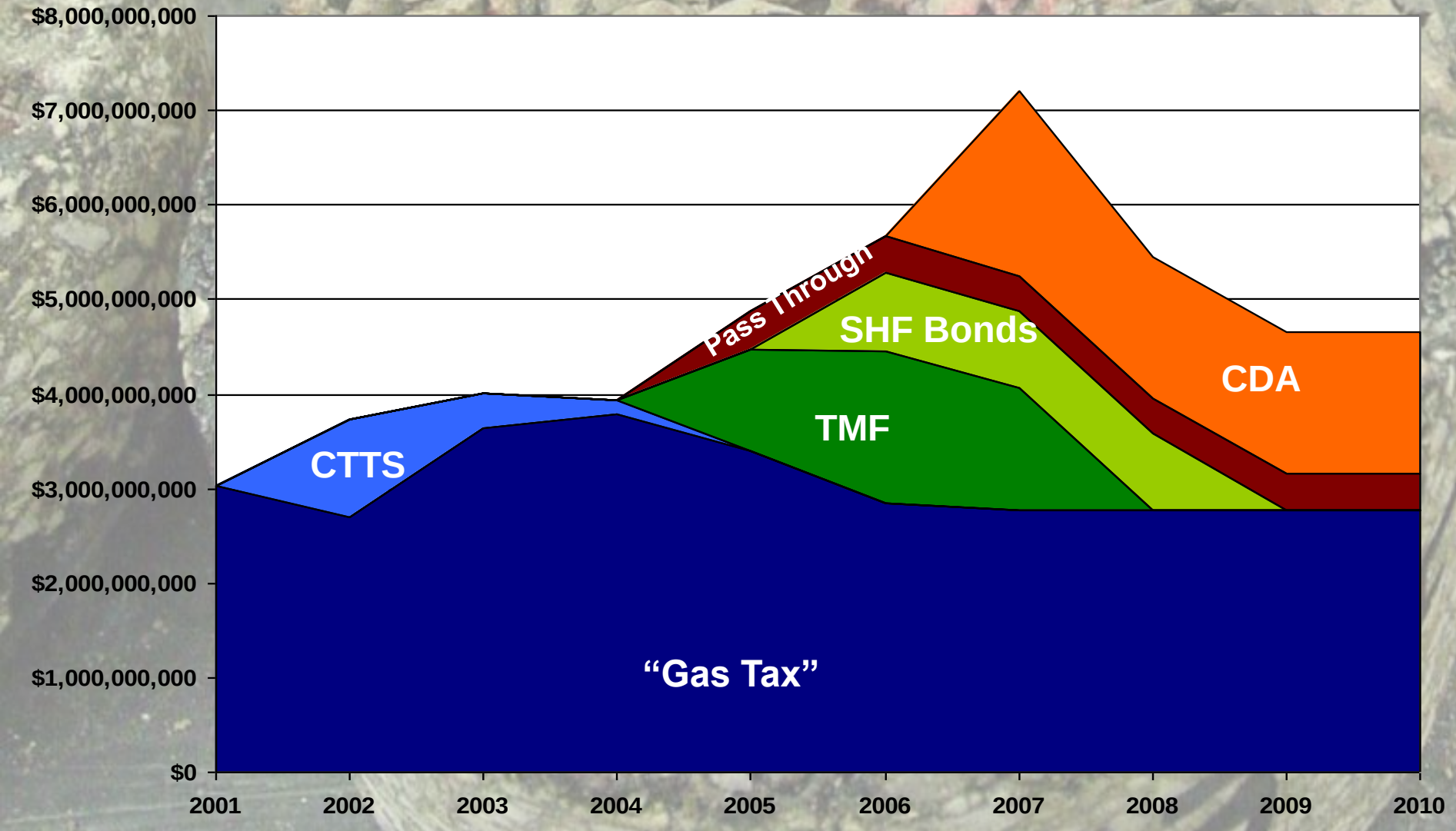
11 4:43PM

Texas News:

- Budget Crunch!
  - Lettings will be down.

Highway Contract Awards



Texas News:

- Budget Crunch!
  - Lettings will be down.
  - Research Budget cut 50%
  - Materials and Pavements cut 40%
  - Projects encouraged to economize
- TxDOT is officially not letting any new capacity projects!

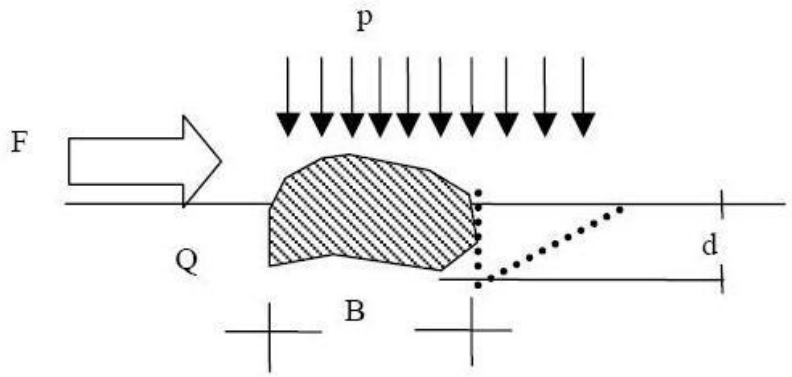
Performance Graded Binder Specs for Seal Coat

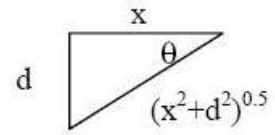
Why PG for Seal Coat?

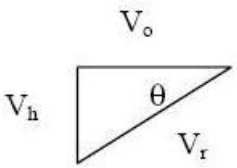
- Performance related specs are better
  - More systematic
  - Varying conditions are accounted for
  - Eliminates grade escalation
- Gets rid of the dual grading systems
- Modernizes the technology

Research

- Project 0-1710; Texas Transportation Institute
  - Modeled behavior of seal coats
  - Identified desirable properties
  - Drafted a spec
  - Followed up with field evaluation







$$Sin\theta = \frac{V_h}{V_r} = \frac{d}{\sqrt{x^2 + d^2}}$$

$$Cos\theta = \frac{V_o}{V_r} = \frac{x}{\sqrt{x^2 + d^2}}$$

$$Tan\theta = \frac{V_h}{V_o} = \frac{d}{x}$$

$$FV_o - pBV_h - pxV_h = QV_r\sqrt{x^2 + d^2} + QV_h d$$

$$FV_o - pB(V_o\frac{d}{x}) - px(V_o\frac{d}{x}) = \frac{QV_o}{x}(\sqrt{x^2 + d^2})^2 + Q(V_o\frac{d}{x})d$$

$$\frac{F}{dQ} = \frac{d}{x} + \frac{x}{d} + \frac{d}{x} + \frac{p}{Q}\frac{B}{d}\frac{d}{x} + \frac{p}{Q} \qquad F' = \frac{F}{dQ} \qquad x' = \frac{x}{d}$$

$$F' = x' + \frac{1}{x'}(2 + \frac{p}{Q}\frac{B}{d}) + \frac{p}{Q} \qquad \frac{\partial F'}{\partial x'} = 0$$

$$\frac{F}{dQ} = 2\left(2 + \frac{p}{Q}\frac{B}{d}\right)^{\frac{1}{2}} + \frac{p}{Q} \qquad F = \tau B$$

$$\frac{\tau}{Q}\frac{B}{d} = 2(2 + \frac{p}{Q}\frac{B}{d})^{\frac{1}{2}} + \frac{p}{Q}$$

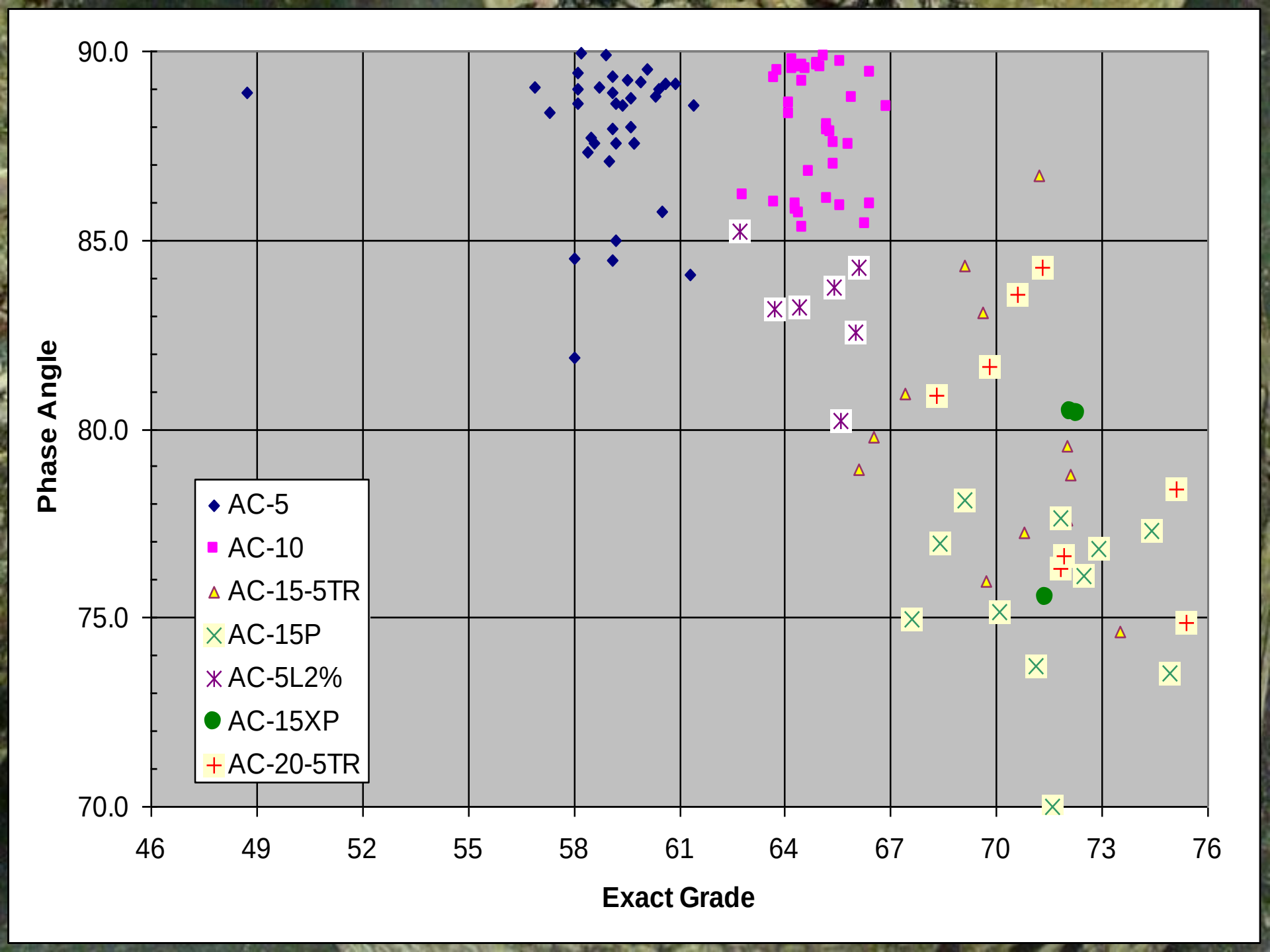
Figure 6. Failure Mechanism Analysis and Dimensionless Equation.

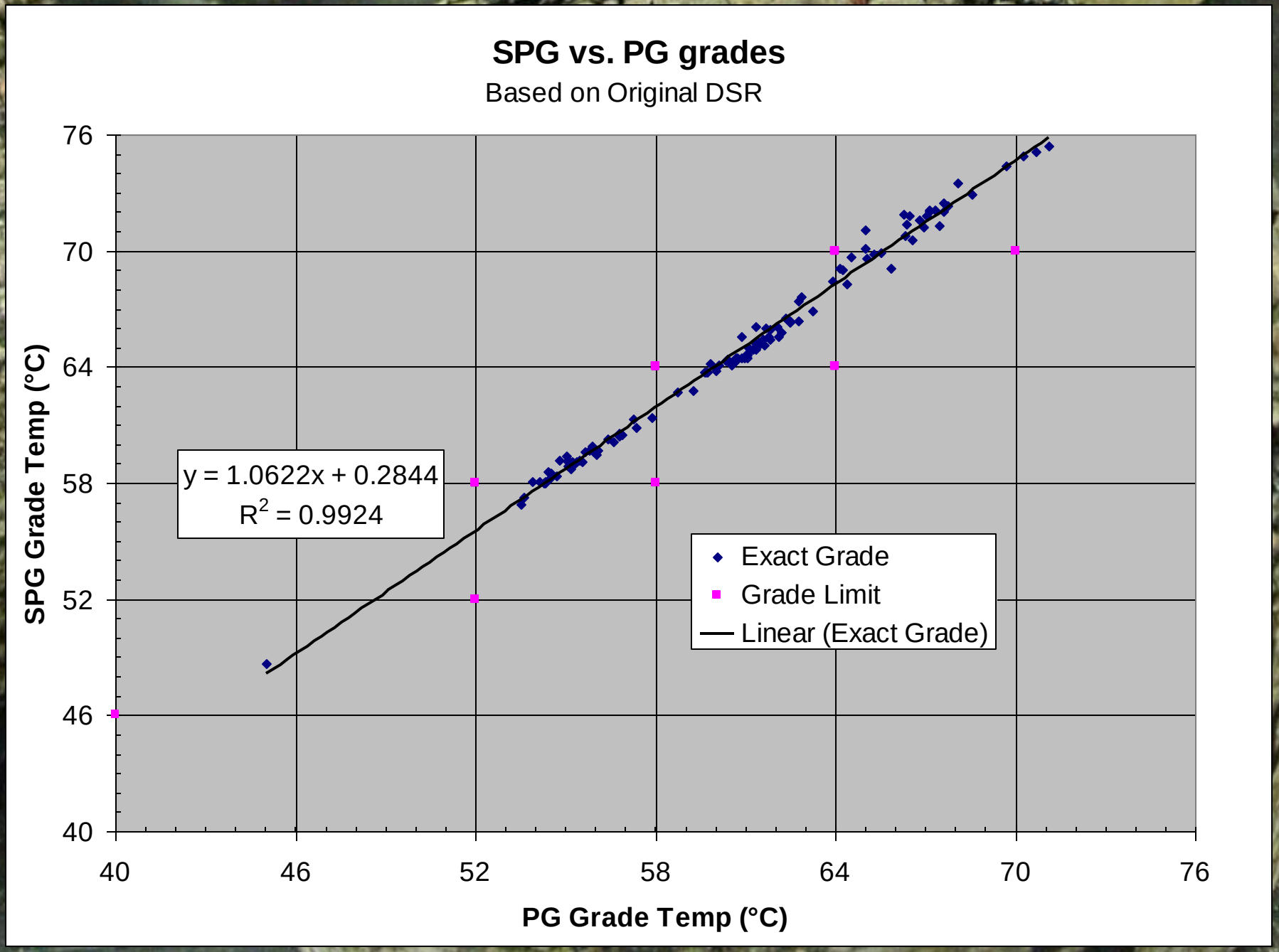
Table 1—Surface Performance-Graded Asphalt Binder Specification

Surface Performance Grade	SPG 46			SPG 52			SPG 58				SPG 64				SPG 70			SPG 76			SPG 82		
	-22	-28	-34	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28	-16	-22	-28	-16	-22	-28
Average seven-day maximum pavement surface design temperature, °C[a]	<46			<52			<58				<64				<70			<76			<82		
Minimum pavement surface design temperature, °C[a]	>-22	>-28	>-34	>-22	>-28	>-34	>-16	>-22	>-28	>-34	>-16	>-22	>-28	>-34	>-16	>-22	>-28	>-16	>-22	>-28	>-16	>-22	>-28
Original Binder																							
Flash point temp, T 48, minimum, °C	230																						
Viscosity, T 316: Maximum 0.15 Pa,s, test temp, °C[b]	205																						
Dynamic Shear, T 315: G*/sinδ, minimum 0.65 kPa, Test temp @ 10 rad/s, C	46			52			58				64				70			76			82		
Phase angle (δ), maximum, @ temp where G*/sinδ = 0.65 kPa[c]	-	-	80	-	-	80	-	-	80	80	-	80	80	80	80	80	80	80	80	80	80	80	80
Pressure Aging Vessel (PAV) Residue (R 28)[d]																							
PAV aging temperature, °C	100			100			100				100				100			100			100		
Creep stiffness, T 313: S, maximum 500 MPa, *m*-value, minimum 0.240, Test temp @ 8 s, C	-22	-28	-34	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28	-16	-22	-28	-16	-22	-28

Surface Performance Grade	SPG 46		
	-22	-28	-34
Average seven-day maximum pavement surface design temperature, °C[a]	<46		
Minimum pavement surface design temperature, °C[a]	>-22	>-28	>-34
Original Binder			
Flash point temp, T 48, minimum, °C	230		
Viscosity, T 316: Maximum 0.15 Pa*s, test temp, °C	205		
Dynamic Shear, T 315: G*/sinδ, minimum 0.65 kPa, Test temp @ 10 rad/s, C	46		
Phase angle (δ), maximum, @ temp where G*/sinδ = 0.65 kPa[c]	-	-	80
Pressure Aging Vessel (PAV) Residue (R 28)[d]			
PAV aging temperature, °C	100		
Creep stiffness, T 313: S, maximum 500 MPa, *m*-value, minimum 0.240, Test temp @ 8 s, C	-22	-28	-34

Comparison with Current Materials and Specs


90.0
85.0
80.0
75.0
70.0
Phase Angle
46
49
52
55
58
61
64
67
70
73
76
Exact Grade
AC-5
AC-10
AC-15-5TR
AC-15P
AC-5L2%
AC-15XP
AC-20-5TR


SPG vs. PG grades
Based on Original DSR
SPG Grade Temp (°C)
PG Grade Temp (°C)
76
70
64
58
52
46
40
40
46
52
58
64
70
76
y = 1.0622x + 0.2844
R2 = 0.9924
Exact Grade
Grade Limit
Linear (Exact Grade)

Field Trials

- Looked at 45 sections using traditional grades
- Graded the binders using SPG
- Compared to climate to predict performance
- Evaluated pavements over 2 years

Field Results

Table 11. Tabulated Summary of SPG-Field Performance Results.

	SPG – Field Performance	# of HSs	% of 45 Total HSs	
Good Correlation	Pass – Pass (SCI ≥ 70%)	31	69	78
	Fail – Fail (SCI < 70%)	4	9	
No Correlation	Pass – Fail (SCI < 70%)	4	9	22
	Fail – Pass (SCI ≥ 70%)	6	13	
Total		45	100	100

Future Work

- More field tests
- AASHTO Specification?
- Determine a suitable emulsion recovery procedure
- Work on adhesion

AIM HIGH

What's the worst that could happen?