SHRP PG Graded Asphalts

- What are they?
- What do the numbers mean?
- What is the right grade for you?

SHRP PG Grade Asphalts

- Grading system based on climate
- Example > PG64-22 (°C)
- 64 (147°F) = Average 7 day max. pavement design temp.
- High temp. for control of rutting.
- -22 (-7°F) = Minimum pavement design temp.
- Low temp. for control of thermal cracking.

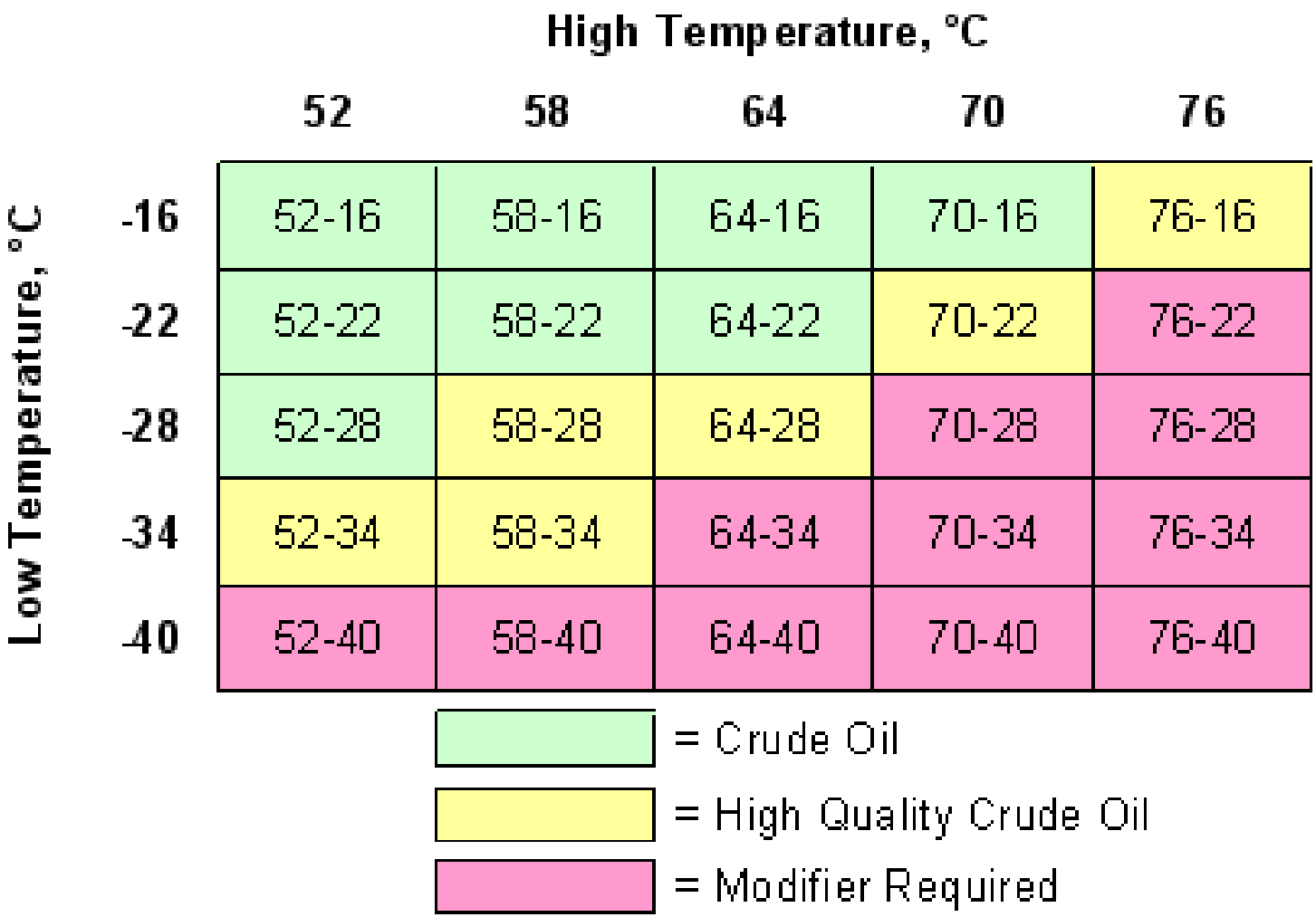
SHRP PG Graded Asphalts

- Graded in 6 degree increments
- Each 6 degree change is called a bump
- PG58-28 bumps to PG64 -28 etc.

SHRP PG Graded Asphalts are cumulative

- Each grade exceeds the characteristics of the previous grade.
- Ex. PG64-22 exceeds PG58-22 in rutting resistance.
- EX. PG58-28 exceeds PG 58-22 in thermal cracking resistance.
- Ex. PG64-28 exceeds PG58-22 in both rutting resistance and thermal cracking resistance.

How your PG Grade is made



90 Degree rule

- If you add the top and bottom number and they exceed 90
- Your product is most likely modified or upgraded from commodity asphalt
- 58-28 = 58+28 or 86 (Not modified)
- 68-28 = 68+28 or 96 (Likely modified)
- If it's a PG+ spec its modified

PG + Grades

- Generally spreads above 90 degrees and they include an Elastic Recovery specification
- Idaho – 50% ER
- Oregon – 50% ER (also sometimes allows some Non ER 90+ grades)
- Washington – 60% ER
- Elastic Recovery test stretches the AC sample, cuts it and measures how much the strings return to the original shape.
- Some Other states use Ductility specs etc.

What are the specifications for PG64-28

- Original Binder tests
  - Flash point > 230 °C
  - Rotational Viscosity < 3.00 @ 135 °C
  - DSR > 1 @ 64 °C
- RTFO tests
  - Mass loss < 1.0%
  - DSR > 2.2 @ 64 °C
  - ER* > 60% @ 25 °C
    - For PG+ in Washington only

PG64-28 Specifications Cont.

- PAV tests
  - DSR < 5000 kPa @ 22 °C
    - this temp is diff for each grade (see chart)
- BBR Results
  - m value > 0.30 @ -18 °C =-28 + 10
  - Stiffness < 300 @ -18 °C =-28 + 10

PG Grading Chart Example

Performance Grade	PG 46			PG 52							PG 58					PG 64					
	34	40	46	10	16	22	28	34	40	46	16	22	28	34	40	10	16	22	28	34	40
Average 7-day Maximum Pavement Design Temperature, °C*	≤ 46			≤ 52							≤ 58					≤ 64					
Minimum Pavement Design Temperature, °C*	-34	-40	-46	-10	-16	-22	-28	-34	-40	-46	-16	-22	-28	-34	-40	-10	-16	-22	-28	-34	-40
ORIGINAL BINDER																					
Flash Point Temp, T 48, Minimum (°C)	230																				
Viscosity, ASTM D 4402* Maximum, 3 Pa*s, Test Temp °C	135																				
Dynamic Shear, TP 5[C] G*/sinδ, Minimum, 1.00 kPa Test Temp @ 10 rad/s, °C	46			52							58					64					
ROLLING THIN FILM OVEN RESIDUE (T 240)																					
Mass Loss, Maximum, percent	1.00																				
Dynamic Shear, TP 5: G*/sinδ, Minimum, 2.20 kPa Test Temp @ 10 rad/s, °C	46			52							58					64					
PRESSURE AGING VESSEL RESIDUE (PP 1)																					
PAV Aging Temperature, °C*	90			90							100					100					
Dynamic Shear, TP 5: G*/sinδ, Maximum, 5000 kPa Test Temp @ 10 rad/s, °C	10	7	4	25	22	19	16	13	10	7	25	22	19	16	13	31	28	25	22	19	16
Physical Hardening*	Report																				
Creep Stiffness, TP 1 Determine the critical cracking temperature as described in PP 42	-24	-30	-36	0	-6	-12	-18	-24	-30	-36	-6	-12	-18	-24	-30	0	-6	-12	-18	-24	-30
Direct Tension, TP 3 Determine the critical cracking temperature as described in PP 42	-24	-30	-36	0	-6	-12	-18	-24	-30	-36	-6	-12	-18	-24	-30	0	-6	-12	-18	-24	-30

What are we Telling you

- Original Binder spec
  - The oil as it is received
- Rolling Thin Film Oven Residue
  - How the asphalt behaves after running through the hot plant
- Pressure Aging Vessel Residue
  - Physical hardening of the asphalt in the elements

Supplier Cert.

Western States Asphalt, Inc.

Certificate of Analysis

Lot#: SC.7.15.2015.6428.60ER **Specification:** WSDOT **Product:** PG 64-28 60ER **Sample Date:** 7.15.1
Collection Point: Tank 23 **Tested Date:** 7.15.1
BOL # **Key #**
Project Name:

Test Parameter	Test Method	Result	Agency Min	Agency Ma
Flash Point, COC	AASHTO T-48			
Flash Point, COC	3.10.2015	310° C+	230° C+	
Rotational Viscosity @ 135° C	AASHTO T-316			
Rotational Viscosity		.780		3.000
Original DSR @ 64° C	AASHTO T-315			
G*/Sin(delta)		1.70 kPa	1.00 kPa	
Loss on Heating	AASHTO T-240			
Mass Loss		.4403%		1.000
RTFO DSR @ 64° C	AASHTO T-315			
G*/Sin(delta)		3.65 kPa	2.20 kPa	
ELASTIC RECOVERY @ 25° C	AASHTO T-301			
Elastic Recovery %		75.0%	60%	
PAV (Pressure Aging Vessel)	AASHTO R-28			
PAV Temp		100° C		
PAV DSR @ 22° C	AASHTO T-315			
G*Xsin(delta)		2130 kPa		5000 kPa
BBR @ -18° C	AASHTO T-313			
BBR m-Value		.337	0.300	
BBR Stiffness		187		300 MPa

Test data reported herein has been secured by reliable testing procedures. As we have no knowledge of, or control ove the conditions that may affect the use of material from which the samples were taken, we assume no responsibility in furnishing this data other than to warrant that they represent reliable measurements of the properties of the sample received and tested.

Certified By: Aaron Payne

Title: Lab Technician

Date: 7.16.2015

Coming Soon?

- A Change to WSDOT PG + Grading System. Maybe other agencies?
- No more Elastic Recovery
- Multiple Creek Stiffness (MSCR)
- No additional Equipment needed
- Uses the DSR to determine Mid range characteristics
- Currently Being Evaluated

Agency Test Report

Washington State Department of Transportation
State Materials Laboratory
PO Box 47365 Olympia WA 98504 / 1655 S. 2nd Ave Tumwater WA 98512
Paving Asphalt Test Report

Work Order : 008732 **Sample ID :** 0000011a764
Section : COLFAX TO DRY CREEK - PAVING
State Route No : 195 **Lab Number :** PG0150252
Project Engineer : Simonson, Chad **Bid Item No :** 017.03
Org Code : 464307 **Date Received :** 7/30/2015
Local Agency No :

Material: PG 64-28 - 9-02.1(4)A - 2014
Supplier: Western States Asphalt Manufacturer: Exxon
Acceptance No: 6 Date Sampled: 7/20/2015
Certificate No : 138868

ORIGINAL PROPERTIES :	RESULTS :	SPECIFICATION :
ROTATIONAL VISCOSITY @ 135° C,Pas	0.6	3 MAXIMUM
DYNAMIC SHEAR @ 64°C, kPa	1.64	1.00 MINIMUM
C.O.C. FLASH POINT, C		
RTFO AGED PROPERTIES :		
MASS LOSS AFTER RTFO, %	0.14	1.00 MAXIMUM
ELASTIC RECOVERY, %	72	60 MINIMUM
DYNAMIC SHEAR @ 64°C, kPa	3.51	2.20 MINIMUM
MSCR @ 3.2 kpa @ 64°C	22.70	REPORT ONLY
Jnr @ 3.2 kpa @ 64°C	1.82	REPORT ONLY
DIFFERENCE Jnr, %	55.67	REPORT ONLY
MSCR and Jnr testing performed at PG base grade temperature		
PAV AGED PROPERTIES :		
PAV AGING TEMPERATURE 100° C		
DYNAMIC SHEAR @ 22°C, kPa	2700	5000 MAXIMUM
BENDING BEAM RHEOMETER @ -18°C		
"S", MPa	156	300 MAXIMUM
"m"	0.326	0.300 MINIMUM

Result Code: Meets Specifications

Remarks :

Kurt R. Williams, P.E.
State Materials Engineer
Steven J. Davis
Bituminous Materials Engineer
Date : 8/7/2015
Phone : (360) 709-5424

Billing Code
T119 - 3
T120 - 1
T121 - 1
T124 - 1
T130 - 1
T131 - 1
T117 - 1

Grades might look like this

WSDOT Eastside Currently

- 64-28 Non ER
- 64-28 60ER Base Grade
- 70-28 60ER = 1 Bump
- 76-28 60ER = 2 Bumps

WSDOT Eastside under MSCR

- 64-28 S
- 64-28 H
- 64-28 V
- 64-28 E
- Subject to Change

How do you determine the right grade for your project?

“LTPPBind”

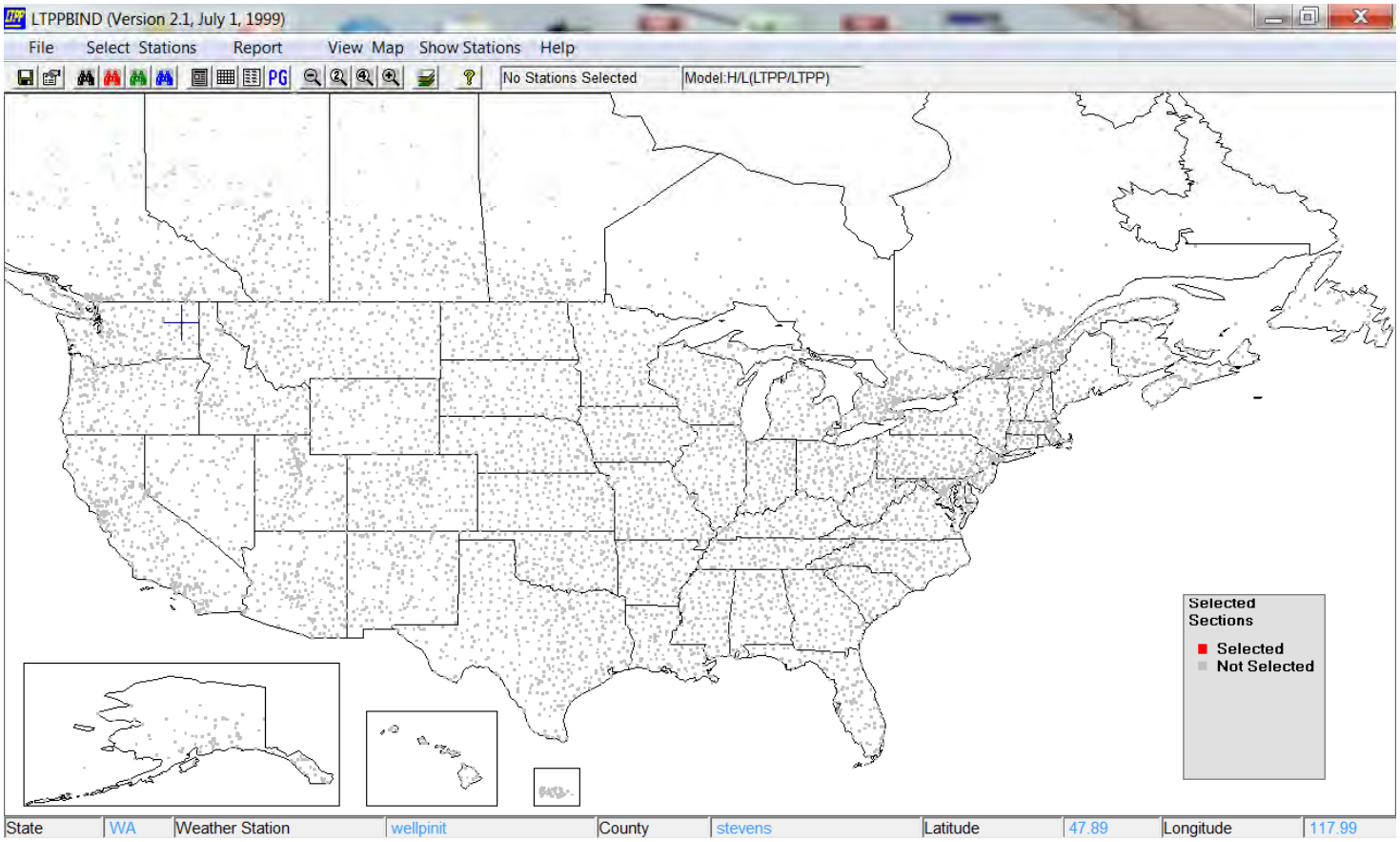
- Windows based software for selection of performance graded asphalt binders.
- Available free from the Federal Highway Administration.
- http://tfhrc.gov/

“LTTPBind”

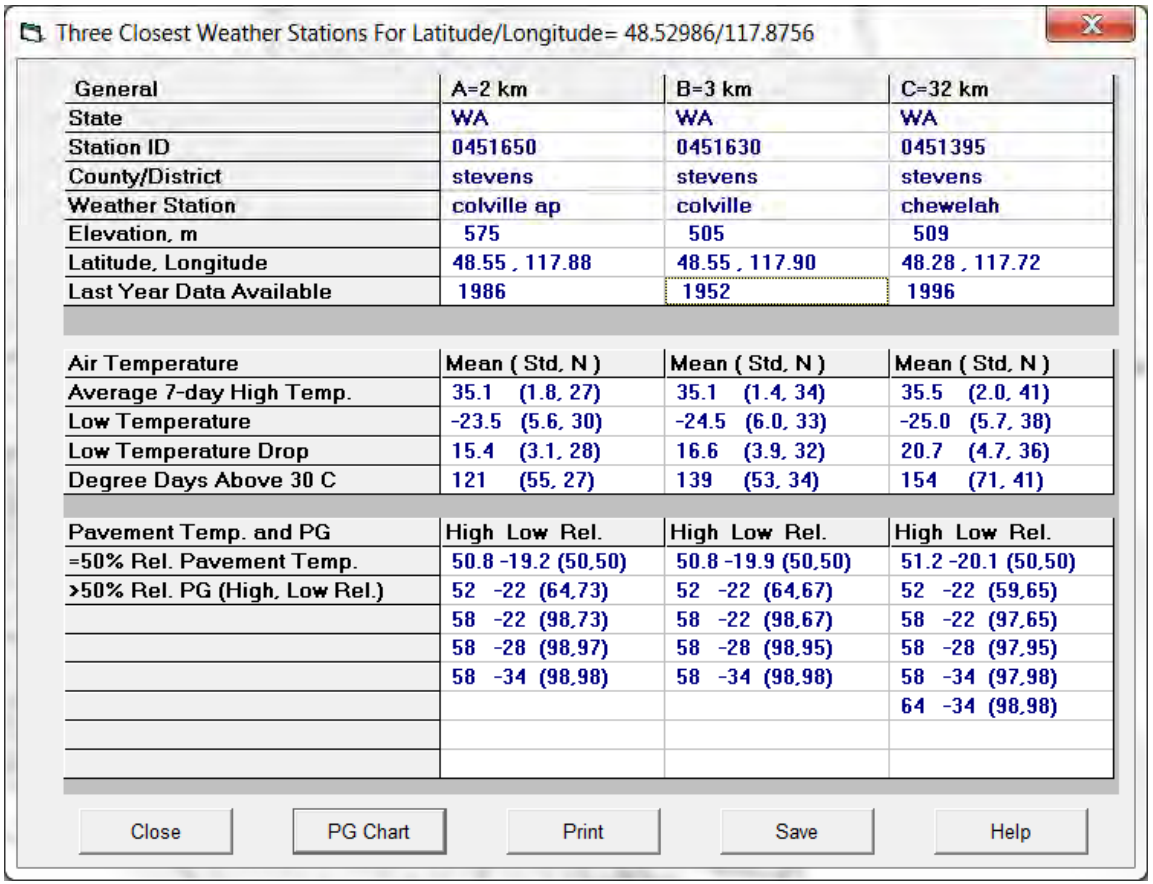
- Use this software to determine correct grade
  - Determine correct base grade
  - Determine ESAL’s
  - Determine Traffic Speed

LTTP Bind will determine the proper bumps needed to accommodate your traffic conditions.

Find your nearest weather station



You can compare the three closest Stations



Three Closest Weather Stations For Latitude/Longitude= 48.52986/117.8756

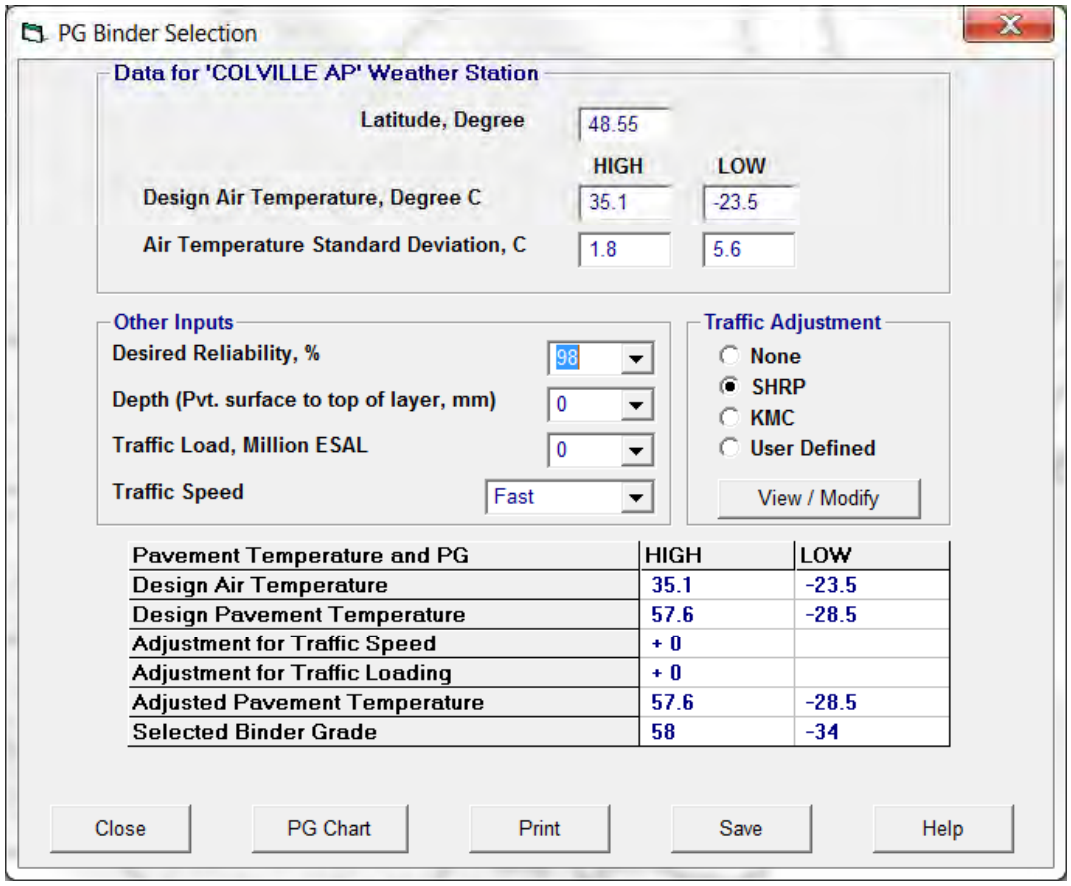
General	A=2 km	B=3 km	C=32 km
State	WA	WA	WA
Station ID	0451650	0451630	0451395
County/District	stevens	stevens	stevens
Weather Station	colville ap	colville	chewelah
Elevation, m	575	505	509
Latitude, Longitude	48.55 , 117.88	48.55 , 117.90	48.28 , 117.72
Last Year Data Available	1986	1952	1996

Air Temperature	Mean (Std, N)	Mean (Std, N)	Mean (Std, N)
Average 7-day High Temp.	35.1 (1.8, 27)	35.1 (1.4, 34)	35.5 (2.0, 41)
Low Temperature	-23.5 (5.6, 30)	-24.5 (6.0, 33)	-25.0 (5.7, 38)
Low Temperature Drop	15.4 (3.1, 28)	16.6 (3.9, 32)	20.7 (4.7, 36)
Degree Days Above 30 C	121 (55, 27)	139 (53, 34)	154 (71, 41)

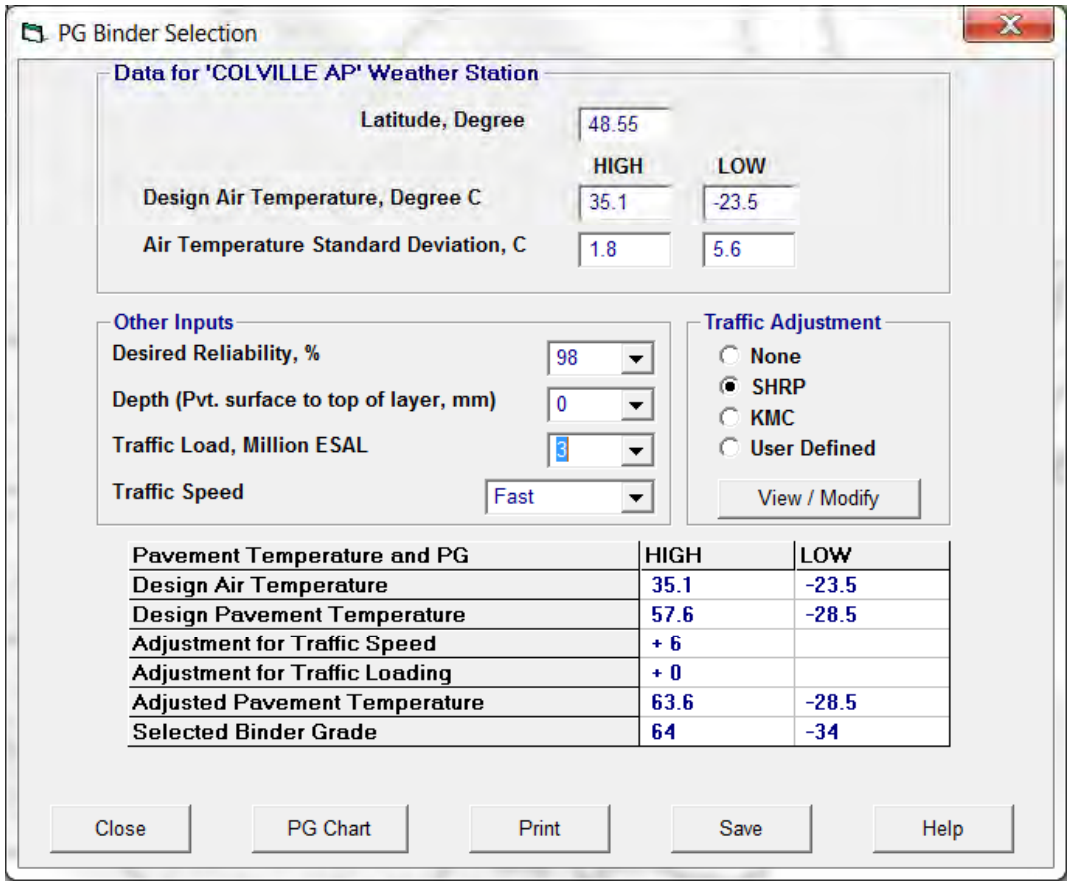
Pavement Temp. and PG	High Low Rel.	High Low Rel.	High Low Rel.
=50% Rel. Pavement Temp.	50.8 -19.2 (50,50)	50.8 -19.9 (50,50)	51.2 -20.1 (50,50)
>50% Rel. PG (High, Low Rel.)	52 -22 (64,73)	52 -22 (64,67)	52 -22 (59,65)
	58 -22 (98,73)	58 -22 (98,67)	58 -22 (97,65)
	58 -28 (98,97)	58 -28 (98,95)	58 -28 (97,95)
	58 -34 (98,98)	58 -34 (98,98)	58 -34 (97,98)
			64 -34 (98,98)

Close | PG Chart | Print | Save | Help

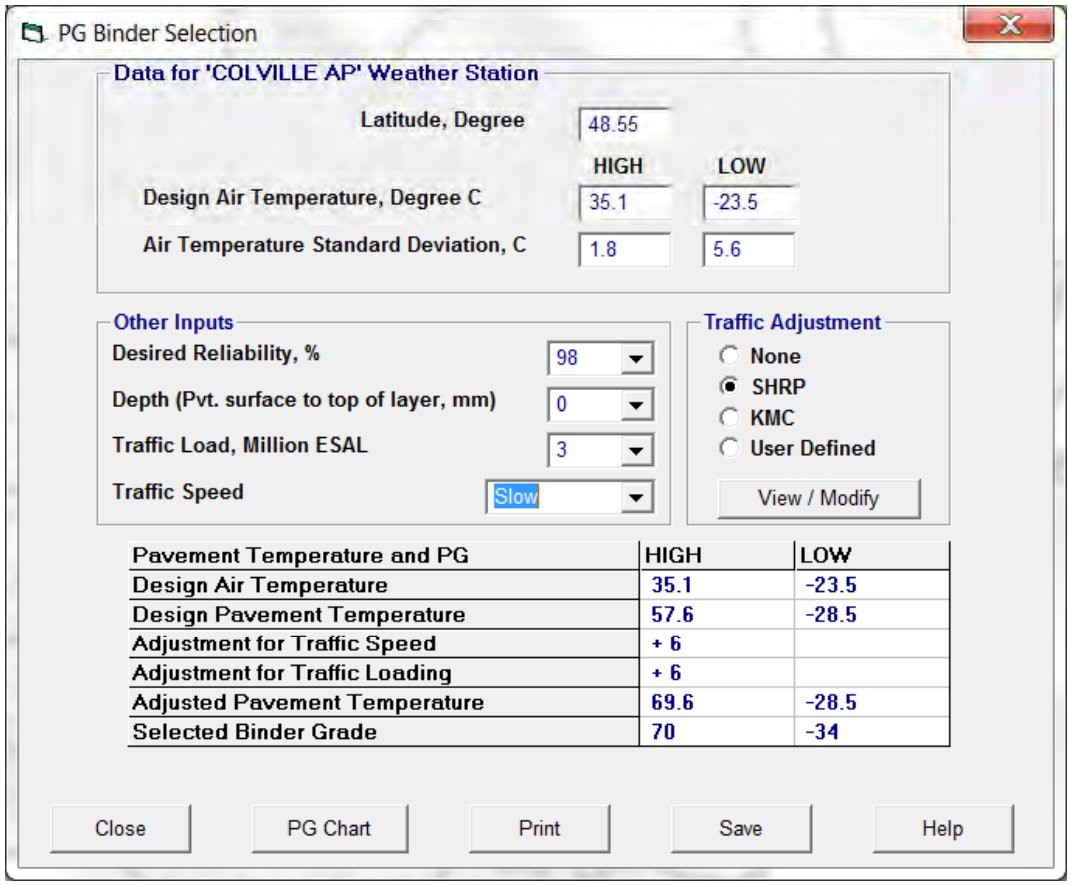
What's the base grade?
98% Reliability



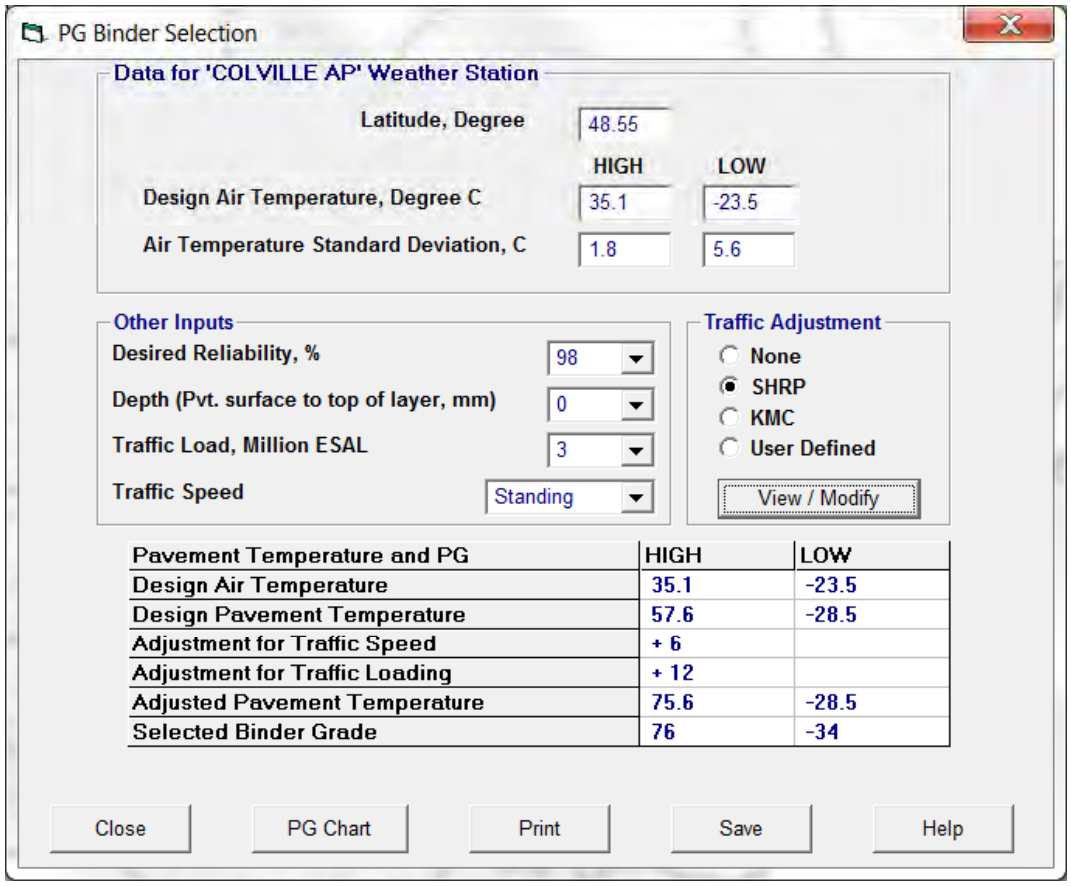
Lets increase the traffic load



Lets slow down the traffic



Lets really stress the pavement with stopped traffic



Other Mix Design Concerns

- Don’t forget that not only is the proper PG grade important in your mix design but also the number of gyrations used in the design.
- Higher Traffic counts require more gyrations to be used in the design.
  - Too few gyrations used in a high traffic design can result in an overly rich mix susceptible to excessive post compaction, flushing and rutting.
  - Conversely, too many gyrations used in a low traffic design can result in a dry mix susceptible to raveling.

Caution

- Higher grades can be inserted into a mix and outperform lessor grades, however,
- Just because a grade exceeds another does not mean you can just replace it without a new mix design.
- Each grade has different viscosities and formulas that can affect mix design.
- You may want your supplier to have a separate mix design to ensure quality.

Old vs. New

⌘PBA-6	similar to	PG 64-28+
⌘AC20	similar to	PG 64-22
⌘AR4000W	similar to	PG 58/64-22
⌘AC10	similar to	PG 58-28

Old vs. New

- Use what works for you.
- If you had success with a grade in the past you don't have to change. Use the PG grade similar to your old grade.
- If you did not, look at the options that SHRP PG grading and your supplier have available to give you.
- PG grading is only a tool past history is still very important.

- Thanks

- Questions ?
- Stephen Van De Bogert
- Western States Asphalt LLC
- 509-994-2462