The Minuses of Plus Specifications

AMAP, Las Vegas
February, 2005

Ken Grzybowski
PRI Asphalt Technologies, Inc.
Tampa, FL

STATE: ARKANSAS	**MATERIALS:** Re: Section 404, Design and Quality Control of Asphalt Mixtures
DATE: 2004	**Web Address:** www/ahtd.state.ar.us/contract/progcon/general/stdspecs.htm
Materials Engineer: Jerry Westerman	**Email Address:** jerry.westerman@ahtd.state.ar.us

ASPHALT BINDER:

404.01 (b)	**Description:**	Shall comply with requirements of AASHTO M 320, Table 1, except Direct Tension requirements are deleted and shall be from sources that have executed a certification agreement with the Department.
	PMA's:	PG 70-22 & PG 76-22 shall be straight run binders that are modified using SB, SBS or SBR
	Exclusions:	None , other than type of polymer modifier

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grades)**		
			64-22	**70-22**	**76-22**
ORIGINAL:					
Flash Point, °C		T 48	230 min.		
Rotational Viscosity, Pa s	135°C	T 316	3.0 max.		
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature		
RTFOT RESIDUE:					
Mass Loss, %		T 240	1.0 max.		
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature		
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi		
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	25°C	28°C	31°C
Creep Stiffness	S, 300MPa	T 313	-12°C		
	m Value, 0.300				
PG PLUS REQUIREMENTS: YES					
ORIGINAL:					
Elongation Recovery $_{25°C}$, %		T 301	---	40	50
Polymer	Type	--	No	SBR, SB, SBS	
Notes:					

1. If Anti-Strip needed, a heat stable liquid anti-strip additive from QPL shall be added at the rate of 0.5 - 0.75% by weight of asphalt binder as determined by laboratory analysis.

STATE: MICHIGAN	**MATERIALS:** Re: Section 904 - Asphaltic Material
DATE: 2004	**Web Address:** www.michigan.gov/mdot
Materials Engineer: Tim Crook	**Email Address:** crookt@michigan.gov

ASPHALT BINDER:

Section 904.03 A	**Description:**	Furnish asphalt binder that is homogeneous, free of water, and that does not foam when heated to the maximum temperature in Table 904-5 for the material being used.
	PMA's:	The modified asphalt binder shall be smooth, homogenous and comply with the requirements shown in Table 1 or Table 2. If polymers and modifiers other than styrene-butadiene-styrene (SBS) or styrene-butadiene rubber (SBR) are used for asphalt binder modifications, approval from MI DOT will be needed.
	Exclusions:	Used motor oil.

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grades) (Not Modified)**									
			52-34	**52-28**	**58-34**	**58-28**	**58-22**	**64-34**	**64-28**	**64-22**	**70-28**	**70-22**
ORIGINAL:												
Flash Point, °C		T 48	230 min.									
Rotational Viscosity, Pa s	135°C	T 316	3 max.									
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature									
RTFOT RESIDUE:												
Mass Loss, %		T 240	1.0 max.									
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature									
PAV RESIDUE		R 28	90°C; 20 hrs; 300 psi		100°C; 20 hrs; 300 psi							
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	13°C	16°C		19°C	22°C	19°C	22°C	25°C		28°C
Creep Stiffness	S, 300 MPa	T 313	-24°C	-18°C	-24°C	-18°C	-12°C	-24°C	-18°C	-12°C	-18°C	-12°C
	m Value, 0.300											
Direct Tension, Strain, Min., °C		T 314	NA									
PG PLUS REQUIREMENTS: YES - see Tables 1 & 2 Below for PMA's												
Solubility in TCE; %	T 44	99.0										

NOTE:

Anti-foam agent = dimethyl polysiloxane type silcione, 1000 cSt Viscosity; any other requires DOT preapproval.

Table 1: Requirements for Styrene-Butadiene-Styrene (SBS) Modified Binders

PROPERTY		Test Method AASHTO or Other	Asphalt Grade: PG 58-34(P), PG 64-28(P), PG 70-22(P), PG 70-28(P)	Asphalt Grade: PG 64-34(P), PG 76-22(P), PG 76-28(P)
ORIGINAL:[1]				
Separation of Polymer, R&B SP; °C		ASTM D 5892	≯2	
Force Ratio, 50 mm/min., 300 mm elongation	4°C	AASHTO T 300	≮0.30	≮0.35
RTFOT RESIDUE:[1]				
Elastic Recovery %, 100 mm elongation, and cut immediately	25°C	AASHTO T 301	≮60	≮70
NOTES:				
[1.] Report DSR values for G*/sin, and the phase angle at the high grade temperature on the original and on the RTFOT residue for informational purposes.				

Table 2: Requirements for Styrene-Butadiene-Rubber (SBR) Modified Binders

PROPERTY		Test Method AASHTO or Other	Asphalt Grade: PG 58-34(P), PG 64-28(P), PG 70-22(P), PG 70-28(P)	Asphalt Grade: PG 64-34(P), PG 76-22(P), PG 76-28(P)
ORIGINAL:[1]				
Separation of Polymer, R&B SP; °C		ASTM D 5892	≯2	
Toughness, 500 mm/min., Newton Meters, (in-lbs)	25°C	ASTM D 5801	≮12.5 (110)	≮12.5 (110)
Tenacity, 500 mm/min.,Newton Meters, (in-lbs)	25°C	ASTM D 5801	≮8.5 (75)	≮8.5 (75)
RTFOT RESIDUE:[1]				
Elastic Recovery %, 100 mm elongation, cut immediately	25°C	AASHTO T 301	≮40	≮50
NOTES:				
[1.] Report DSR values for G*/sin, and the phase angle at the high grade temperature on the original and on the RTFOT residue for informational purposes.				

MAGNITUDE

- 34 States with Plus Specs
- 14 States Straight M 320
- 21 Pluses
- 4 Duel / Hybrid
- The Winner! - M 320 with 13 Pluses

Overview							
State Binder Specifications - Requirements Complementing AASHTO M 320							
State	Duel Spec.	Prescription	Exclusions	Homogeneity[1]	Elastomeric Prop.[2]	PG Prop.[3]	Conventional[4]
Alabama		x	x				
Alaska					x		x
Arizona		x		x			x
Arkansas		x			x		
California	x				x		
Colorado			x		x		
Connecticut							
Delaware							
District of Columbia							
Florida		x		x	x		x
Georgia		x	x	x	x		x
Hawaii							
Idaho			x		x		
Illinois		x			x		
Indiana							
Iowa							
Kansas			x	x	x		
Kentucky				x	x		
Louisiana				x	x	x	
Maine							
Maryland							
Massachusetts							
Michigan		x	x	x	x		
Minnesota							
Mississippi	x						
Missouri		x					
Montana					x		
Nebraska			x		x		
Nevada	x	x		x	x		
New Hampshire							
New Jersey					x		
New Mexico						x	
New York			x		x		
North Carolina							
North Dakota							
Ohio		x		x	x		
Oklahoma	x			x	x		
Oregon							
Pennsylvania			x	x	x		
Rhode Island							
South Carolina		x	x				
South Dakota			x		x		
Tennessee		x		x	x		x
Texas					x		
Utah					x	x	
Vermont							
Virginia					x		
Washington State							
West Virginia							
Wisconsin							
Wyoming			x		x		

States (AASHTO M 320): Connecticut; Delaware; District of Columbia; Hawaii; Indiana; Iowa; Maine; Massachusetts; Minnesota; Missouri; New Hampshire; North Carolina; North Dakota; Oregon; Rhode Island; Vermont; Washington West Virginia; Wisconsin

State Classifications

- 13 - AASHTO M 320 States
  - CT, DL, D/C, HI, IN, IA, ME, MA, MO, NH, NC, OR, VT, WI
- 17 - PRESCRIPTIONS: typically, SBR, SBS, GTR
  - AL, AZ, AR, FL, GA, IL, MA, MI, MS, NJ, NV, NVCC, OH, OK, RI, SC, TN

The Exclusions

- 12 - Air Blown / Oxidized
  - AL, GA, KS, IL, MD, MN, NE, NY, OH, PA, SC, SD
- 11 – Acid
  - CO, IA, ID, KS, MD, NE, NY, PA, SD, RI, WY
- 4 – Used Motor Oil
  - MI, NY, PA, SD
- 1 – Alkaline
  - CO

The Pluses
(Elastormerics)

16 – Elastic Recovery – RTFOT

CO, IL, KS, LA, MI, NE, NJ, NY, OH, OK, PA, RI, SD, TX, UT, VA

9 – Elastic Recovery – ORIGINAL

AZ, AR, ID, KY, NVCC, RI, TN, WV, WY

The Pluses

(Elastomerics - Homogeneity)

- 8 – Separation / Compatibility
  - GA, IL, KS, LA, MI, OH, OK, PA
- 6 – Solubility
  - FL, GA, KY, LA, NVCC,OK
- 4 – Sieve
  - NV, NVCC, OH, TN

The Pluses
(Elastomerics)

- 7 - Toughness & Tenacity
  - AK, CO, IL, MI, NV,NVCC, OH
- 3 – Force Ratio & Ductility
  - IL, LA, MI

The Pluses
(Elastomerics)

- 2 – DSR
  - LA, OK
- 6 – Phase Angle
  - AR, FL, GA, NV, OH, SC, UT
- 4 – DTT
  - CO(ref), NM?,NVCC, UT
- 1 – CCT
  - MD?

The Pluses
(Conventional)

- 4 - Softening Point
  - AK, AZ, OK,TN
- 3 - Penetration
  - NVCC, OH, OK
- 3 - Absolute Viscosity
  - FL, NVCC, TN
- 2 – Ductility
  - OK, NVCC
- 2 – Kinematic Viscosity
  - DL, OK

The Pluses
(Others)

- 3 - Spot Test
  - FL, LA, OK
- 1 - Smoke Point
  - FL
- 1 – Resilience
  - AZ
- 1 – Chemical Modification
  - RI
- 1 – Recovered Properties
  - NV CC
- 1 – Polymer Content
  - AL

The Minuses

- Mostly Empirical
  - No correlation to performance
- Varied Purposes
- Prescription vs Performance
  - Inhibits Innovation
- Multiple Test Methods
  - ER at least 9 methods
- Inconsistent Parameters
  - SBR vs SBS

The Minuses

- Logistical Nightmare for Suppliers
- Increased Costs
  - QC/QA
- Confusing
- Lack of Significance

QUESTIONS

STATE: ALABAMA	**MATERIALS:** Re: Section 804, Asphalt Materials; 804.02 Performance Grade Binders, (PGAB)
DATE: 2004	**Web Address:** www.dot.state.al.us
Materials Engineer: Larry Lockett	**Contact Info:** Charlie Walker; walkerc@dot.state.al.us

ASPHALT BINDER:

804.01	**Description:**	Products from approved producers, participating in and meeting requirements of ALDOT - 243, ACCEPTANCE PROGRAM FOR ASPHALT MATERIALS and listed on LIST 1-4, PRODUCERS OF ASPHALT PRODUCTS, of the Department's 'Materials Sources', and Devices With Special Acceptance Requirements Manual.
804.02:	**PGAB:**	Prepared by refining of asphaltic petroleum. Refined asphalt binder shall be homogeneous, free of water, shall not foam when heated to 347°F (175°C) and conform to requirements of AASHTO M 320.
	Exclusions:	Air Blown or Oxidized Asphalt

PROPERTY		**Test Method AASHTO**	**Requirements by Performance Grade, PG (Common Grades)**			
			Table 1	**Table 2** [1]	**Table 3**	**Table 4**
			58-22	**64-22** [1]	**67-22**	**76-22**
ORIGINAL:						
Flash Point, °C		T 48	230 min.			
Rotational Viscosity, Pa s	135°C	T 316	3 max.			
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature			
RTFOT RESIDUE:						
Mass Loss, %		T 240	1.0 max.			
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature			
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi			
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	22°C	25°C	26.5°C	
Creep Stiffness	S, 300 MPa	T 313	-12°C			
	m Value, 0.300					
PG PLUS REQUIREMENTS: YES						
ORIGINAL:						
Polymer	Type	AL DOT 408 [2]	No	SBR, SB, SBS [3]	No	SBR, SB, SBS [3]
	Qty [4]			1.5% min. solids [4]		2.5% min. solids [4]

NOTES:

[1] made by modifying a PG 58-22 or by blended from a PG 76-22

[2] Infrared Trace, determine Styrene and Butadiene peaks and polymer percentage at appropriate loading submitted to DOT prior to use

[3] Article 811.01: must be listed (SBR, SB, SBS allowed); variations accepted w/ approval; written certification required before use; specifications apply for SBR's; see 811.02 Styrene Butadiene Ruber (SBR) for Hot Mix Asphalt or 811.03 SBR Latex for Asphalt Surface Treatments

[4] submitted annually or as requested, determined by AL DOT 408, Infrared Trace

STATE: ALASKA	**MATERIALS:** Re: Section 702 Asphalt Materials
DATE: 2004	**Web Address:** www.dot.state.ak.us
Materials Engineer: Newt Bingham	**Email Address:** newton.bingham@dot.state.ak.us

ASPHALT BINDER:

702-2.01	**Description:**	Meet AASHTO M 320.
	Exclusions:	None stated.

PROPERTY		Test Method AASHTO or Other	Requirements by Performance Grade, PG (Common Grades)	
			58-28	64-28
ORIGINAL:				
Flash Point, °C		T 48	230 min.	
Rotational Viscosity, Pa•s	135°C	T 316	3 max.	
Dynamic Shear, kPa (G* /sin ☒10 rad./sec.)	1.0 min.	T 315	At grade temperature	
RTFOT RESIDUE:				
Mass Loss, %		T 240	1.0 max.	
Dynamic Shear, kPa (G* /sin ☒10 rad./sec.)	2.20 min.	T 315	At grade temperature	
PAV RESIDUE		R 28	100°C; 20 hours; 300 psi	
Dynamic Shear, kPa (G* ☙sin ☒10 rad./sec.)	5,000 max.	T 315	19°C	22°C
Creep Stiffness	S, ≤ 300 MPa	T 313	-18°C	
	m Value, ≥ 0.300			
Direct Tension, (1mm/min.) , % Strain		T 314	No Requirement	
PG PLUS REQUIREMENTS: YES				
ORIGINAL:				
Softening Point, °F		T 53	☙120	
Toughness & Tenacity	Toughness, in-lbs	CP L 2210[1]	110	
	Tenacity, in-lbs		75	
NOTES: None				

1. Alaska DOT Test Method.

STATE: ARIZONA	**MATERIALS:** Re: Section 1005 - Bituminous Materials for Surface (1005PG, 6/05/03)
DATE: 2005	**Web Address:** www.dot.state.az.us
Materials QA: Gregg Inman	**Email Address:** ginman@azdot.gov

ASPHALT BINDER:

1005-3.01	**Description:**	Shall be a Performance Grade (PG) asphalt binder conforming to requirements of AASHTO M 320. Pressure Aging Temperature shall be XXX °C. One gallon sample required w/ C of A, 7 days before production of asphalt concrete. If Binder found non-compliant, asphalt concrete to be evaluated.
	PGAB:	Prepared by refining of asphaltic petroleum. Refined asphalt binder shall be homogeneous, free of water, shall not foam when heated to 347°F (175°C), and conform to requirements of AASHTO M 320. PG 76-22 TR+ shall contain a minimum of 8% crumb rubber and a minimum of 2% SBS.
	Exclusions:	None

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grades)**					
			58-28	**64-28**	**64-22**	**70-10**	**76-16**	**76-22 TR+**
ORIGINAL:								
Flash Point, °C		T 48	230 min.					
Rotational Viscosity, Pa·s	135°C	T 316	3 max.					
Dynamic Shear, kPa (G*/sin δ)	1.0 min.	T 315	At grade temperature					
RTFOT RESIDUE:								
Mass Loss, %		T 240	1.0 max.					
Dynamic Shear, kPa (G*/sin δ)	2.20 min.	T 315	At grade temperature					
PAV RESIDUE: (20 hr; 300 psi)		R 28	100°C			110°C		
Dynamic Shear, kPa (G*·sin δ)	5,000 max.	T 315	19°C	22°C	25°C	34°C		31°C
Creep Stiffness	S, 300 MPa	T 313	-18°C	-18°C	-12°C	0°C	-06°C	-12°C
	m Value, 0.300							
PG PLUS REQUIREMENTS: YES								
ORIGINAL: PG 76-22TR+ Only: 9% GTR Terminally Blended								
Solubility in TCE, %		D 2042	---					≥ 97.5
Dynamic Shear, Phase Angle, °		T 315						≤ 75
Elastic Recovery, %	10°C	T 301						≥ 55
Softening Point, °C		D 36						≥ 60
CRA Specifications: PG Compliant Base Asphalt + Ground Tire Rubber								
Rotational Viscosity, Pa·s	350°F	T 316	**CRA Type 1 PG 64-16**		**CRA Type 2 PG 58-22**		**CRA Type 3 PG 52-28**	
			1.5 - 4.0					
Penetration, 200 g, 60 sec., 0.1 mm, min.	39.2°F	D 5	10		15		25	
Softening Point, °C		D 36	57		54		52	
Resilience, %, min.	77°F	D 5329	25		20		15	

STATE: CALIFORNIA	**MATERIALS:** Re: Section 92
DATE: 2004	**Web Address:** www.california.gov
Materials Engineer: Terrie Bressette	**Email Address:** terrie.bressette@dot.ca.gov

ASPHALT BINDER:

92-1.03	Description:	'Certificates of Compliance' shall accompany each shipment of asphalt to each job. Certificates shall include: shipment #; type of material; SG; refinery; consignee; destination; quantity; PO #; date; statement of compliance.
	PMA's:	
	Exclusions:	None stated.

PROPERTY		Test Method AASHTO or Other	Requirements by Performance Grade, PG (Common Grades)				
			1	4	6a	6b	7
ORIGINAL:							
Penetration, dmm (100 g, 5 s)	25°C	T 49	~~≥~~25	~~≥~~20	----		
Flash Point, °C		T 48	230 min.				
Absolute Viscosity, Pa·s (x 10^{-1})	60°C	T 202	~~≥~~800	~~≥~~2,800	~~≥~~2,000		~~≥~~1,100
Kinematic Viscosity, m^2 / s (x 10^{-6})	135°C	T 201	---		~~≥~~2,000		
Solubility in TCE, %		T 44	~~≥~~99.0		Report		
RTFOT RESIDUE:							
Mass Loss, %		T 240	Report [6]	Report	~~≤~~0.60		
Absolute Viscosity, Pa·s (x 10^{-1})	60°C	T 202	2,500 - 5,000	~~≤~~4,000	~~≥~~5,000		~~≥~~3,000
Kinematic Viscosity, m^2 / s (x 10^{-6})	135°C	T 201	~~≥~~275	~~≥~~350	~~≥~~275		
Ductility, cm (5cm / min.)	25°C	T 51	~~≥~~75	~~≥~~50	~~≥~~60		~~≥~~75
PAV RESIDUE	or	R 28	90°C	100°C; 20 hrs; 300 psi			110°C
TILT OVEN RESIDUE$_{113°C}$, for hrs:		Note 7	18	36			72
SSD ~~≥~~115 (SSV)-50.6		Note 9					25°C
Creep Stiffness	S, ≤ 300 MPa	T 313	-06°C		-24°C	-30°C	-06°C

NOTES:

1. RTFO means AASHTO T 240 or ASTM D 2827.
2. Absolute Viscosity $_{60°C}$ of PBA 6A, 6b and 7 will be determined at 1 sec $^{-1}$ using ASTM D 4957 with Asphalt Institute Vacuum Capillary Viscometers.
3. Where actual limits (e.g., 2,500 -5,000) are indicated, the actual test results shall be part of the certified test results or furnished with the Certification of Compliance.
4. Actual results of the test shall be part of the certified copy of test results and when PBA 6a, 6b, or 7 is used an additional statement verifying an acceptable Flash Point shall be included with the Certification of Compliance.
5. Actual results of the test shall be part of the certified copy of test results and when PBA 6a, 6b, or 7 is used an additional statement verifying an acceptable Mass Loss shall be included with the Certification of Compliance.
6. Where 'Report' is indicated there is no requirement. However, the actual results shall be part of the certified test results or furnished with the Certification of Compliance.
7. 'Tile Oven Residue' means the asphalt obtained using California Test 374, Method B; 'Method for Determining Asphalt Durability Using California Tilt Oven Durability Test.
8. SSD = Shear susceptibility of Delta SSV = Shear Susceptibility of Viscosity.
9. California Test 381.

PROPERTY		Test Method AASHTO or Other	GGB Grades			
			1	2	3	4
ORIGINAL:						
Flash Point, °C		T 48	230 min.			
Brookfield Viscosity, Pa·s	135°C	ASTM D 4402	2 max.			
Dynamic Shear; SSD 30x (0.6+SS)[3]	°C	T 48	25			
RTFOT RESIDUE:						
Mass Loss, %		T 240	0.60			
Dynamic Shear, G*/sin , kPa	2.20 min.	CA Test 381 Part 3	70°C	64°C		58°C
PAV RESIDUE		R 28	110°C	100°C; 20 hrs; 300 psi		
SSD 115 (SSV)-50.8		Note 9	25°C			
Creep Stiffness	S, 300MPa	T 313	-12°C		-18°C	-24°C
	m Value, 0.300					

PROPERTY		Test Method AASHTO or Other	Modified Binder (MB)Grades for Asphalt-Rubber Hot Mix			
			MB-4	MB-5	MB-6	MB-7
ORIGINAL:						
Dynamic Shear; SSD 30x (0.6+SS)[3], °C		CT 381	25			
RTFOT RESIDUE:						
Delta 97 - 6 (log G*) and G* / sin 4.0 kPa (10 rad/sec.)		CT 381	64°C			
PAV RESIDUE	or	R 28	100°C; 20 hrs; 300 psi			110°C
TILT OVEN RESIDUE$_{113°C}$, for hrs:		Note 7	36			72
Creep Stiffness	S, 300 MPa	T 313	-08°C	-19°C	-30°C	-08°C
Dynamic Shear; (10 rad/sec.)	100 MPa	CT 381	-09°C	-02°C	-13°C	-09°C
Creep Stiffness	S, 000 MPa	T 313				
SSD 115 (SSV)-50.6		CT 381	25			

Steam Refined Paving Asphalts:

PROPERTY		Test Method AASHTO	Viscosity-Graded				
			AR 1000	AR 2000	AR 4000	AR 8000	AR 16000
ORIGINAL:							
Flash Point, °C		T 48	≥205	≥215	≥225	≥230	≥235
Solubility in TCE, %		T 44	≥99.0				
Penetration, dmm (100 g, 5 s)	25°C	T 49	Needed for Calculation of % of Original Pen - see below				
RTFO RESIDUE:		**CA T 346** [1]					
Absolute Viscosity, Pa·s (x 10^{-1})	60°C	T 202	750-1,250	1,500 - 2,500	3,000 - 5,000	6,000 - 10,000	12,000 - 20,000
Kinematic Viscosity, m^2 / s (x 10^{-6})	135°C	T 201	≥140	≥200	≥275	≥400	≥550
Penetration, dmm (100 g, 5 s)	25°C	T 49	≥65	≥40	≥25	≥20	
Ductility, mm (5cm / min.)	25°C	T 51	≥1,000 [3]		≥750		
CALCULATIONS:							
% of Original Penetration [2]		Calc.	--	≥40	≥45	≥50	≥52

NOTES:

[1] TFO (AASHTO TM T 170) may be used but RTFO shall be referee method.

[2] Original and RTFO Residue Penetration determined by AASHTO T 49.

[3] If ductility is ≥1000 mm the material will be acceptable if its ductility at 15°C is ≥1000 mm ???

STATE: COLORADO	**MATERIALS:** Re: Section 702 Superpave PG Binders, CDOT's Std Spec. for Road & Bridge Construction
DATE: 2004	**Web Address:** www.colorado.gov
Materials Engineer: Tim Aschenbrener	**Email Address:** tim.aschenbrener@dot.state.co.us

ASPHALT BINDER:

702.01 (b)	**Description**:	Supplier must be certified in accordance with CP 11. Samples of PG Binder for acceptance shall be sampled on the project as stated in the Schedule of Field Materials Manual.
702.01 (a)	**PMA's**	
	Exclusions:	Asphalt shall not be Acid or Alkaline modified. Shall not contain any used oils that have not been re-refined or reprocessed. No modifiers shall be added that do not comply w/ Environmental rules and regulations including 40 CFR Part 261.6(a)(3)(v) and 266/Subpart C. Modifiers shall not be carcinogenic.

PROPERTY		Test Method AASHTO or Other	Requirements by Performance Grade, PG (Common Grades)				
			58-28	58-34	64-22	64-28	76-28
ORIGINAL:							
Flash Point, °C		T 48	230 min.				
Rotational Viscosity, Pa s	135°C	TP 48	3 max.				
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature				
RTFOT RESIDUE:							
Mass Loss, %		CP - 2215	1.0 max.				
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature				
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi				
Dynamic Shear, kPa (G* • sin 10 rad./sec.)	5,000 max.	T 315	19°C	16°C	25°C	22°C	28°C
Creep Stiffness	S, ~~≤~~300MPa	T 313	-18°C	-24°C	-12°C	-18°C	
	m Value, ~~≥~~0.300						
Direct Tension	1.0 min.	T 314					
PG PLUS REQUIREMENTS: YES							
ORIGINAL:							
Ductility, (5 cm/min.), cm	4°C	T 51	--	--	--	~~≥~~50	--
Toughness & Tenacity — Toughness, N-m (in-lbs)	110°C	CP L 2210	--	--	--	12.4	--
Toughness & Tenacity — Tenacity, N-m(in-lbs)	75°C	CP L 2210	--	--	--	8.5	--
Acid or Base Modification [2]		CP L 2214	Pass				
RTFOT PROPERTIES:							
Elastic Recovery, %	25°C	CP L 2211 A	--	--	--	--	~~≥~~50
Ductility, cm (5 cm/min.)		T 51	--	--	--	~~≥~~20	--

Notes:

[1] Direct Tension measurements are required when needed to show conformance to MP 1

[2] The Department will test for acid and alkaline modification during binder certification process. Thereafter, the Department will randomly test for acid and alkaline modification.

STATE: CONNECTICUT	**MATERIALS:** Re: Section M.04, Bituminous Concrete Materials
DATE: 2004	**Web Address:** www.dot.state.ct.us
Materials Engineer: Keith Lane	**Email Address:** keith.lane@po.state.ct.us

ASPHALT BINDER:

M.04.01 (d)	**Description:**	Meet AASHTO M 320.
	PMA's	An SBS modifier has been used on a special project to product a PG 76-22.
	Exclusions:	None.

PROPERTY		Test Method AASHTO or Other	Requirements by Performance Grade, PG (Common Grades)		
			58-28	**64-22**	**64-28**
ORIGINAL:					
Flash Point, °C		T 48	230 min.		
Rotational Viscosity, Pa s	135°C	T 316	3 max.		
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature		
RTFOT RESIDUE:					
Mass Loss, %		T 240	1.0 max.		
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature		
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi		
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	19°C	25°C	22°C
Creep Stiffness	S, ≤ 300 MPa m Value, ≥ 0.300	T 313	-18°C	-12°C	-18°C
Direct Tension, (1 mm/min.) % Strain		T 314	No Requirement		

PG PLUS REQUIREMENTS: MP 1A is only being used to evaluate the DT Critical Cracking Specification. Acid modification may be being used by suppliers to meet some grades. Absolute Viscosity is still being used to control the percentage of RAP in the HMA and silo storage times.

STATE: DELAWARE	**MATERIALS:** Re: Section 810 Asphalt Cement
DATE: 2004	**Web Address:** www.deldot.net
Materials Engineer: Jim Pappas	**Email Address:** jpappas@mail.dot.state.de.us

ASPHALT BINDER:

810	**Description:**	Asphalt Cement shall be prepared by refining of crude petroleum using methods conforming to industry standards. Asphalt Cement shall conform to requirements of AASHTO M 320.
	PMA's	PMA must state on truck ticket, contains polymer
	Exclusions:	

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grades)**			
			58-28	**64-22**	**70-22**	**76-22**
ORIGINAL:						
Flash Point, °C		T 48	230 min.			
Rotational Viscosity, Pa s	135°C	T 316	3 max.			
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature			
RTFOT RESIDUE:						
Mass Loss, %		T 240	1.0 max.			
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature			
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi			
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	19°C	25°C		31°C
Creep Stiffness	S, 300MPa	T 313	-18°C	-12°C		
	m Value, 0.300					
Direct Tension, (1mm/min) % Strain		T 314	No Requirement			
PG PLUS REQUIREMENTS: Yes						
ORIGINAL:						
Rotational Viscosity, Pa s	165°C	T 316	Report - 2nd rotational viscosity required for Mix & Compaction Temperatures for non-modified binders			--

STATE: DISTRICT OF COLUMBIA	**MATERIALS:** Re: Section 802 - Bituminous Materials
DATE: 2004	**Web Address:** www.ddot.dc.gov
Materials Engineer: Wasi Kahn	**Contact Info:** wasi.khan@dc.gov

ASPHALT BINDER:

Section 802	**Description:**	Asphalt binder shall conform to all the requirements of AASHTO M 320 and meet the performance grading within the following table unless otherwise noted in the contract.
	PMA's:	None.
	Exclusions:	None.

PROPERTY		**Test Method AASHTO**	**Requirements by Performance Graded, PG (Common Grades)**	
			64-22	**70-22**
ORIGINAL:				
Specific Gravity	15.6°C	ASTM D 70	Report	
Flash Point, °C		T 48	230 min.	
Rotational Viscosity, Pa s	135°C	T 316	3 max.	
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature	
RTFOT RESIDUE:				
Mass Loss, %		AASHTO T 240	1.0 max.	
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature	
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi	
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	25°C	28°C
Creep Stiffness, kPa (60 sec.)	S, 300 MPa	T 313	-12°C	
	m Value, 0.300			
Direct Tension, % Strain		T 314	NA	
PG PLUS REQUIREMENTS: NO				

STATE: FLORIDA	**MATERIALS:** Re: Section 916 Bituminous Materials; 916-1 SUPERPAVE™ PG, Asphalt Binder
DATE: 2004	**Web Address:** www.dot.state.fl.us
Materials Engineer: Gale Page, P.E.	**Email Address:** gale.page@dot.state.fl.us

ASPHALT BINDER:

916-1.1	**Description:** PG 64-22; 67-22 & 76-22	1. Mass Loss, AASHTO T 240, maximum 0.5% for all grades. 2. Spot Test, AASHTO T 102; negative for all grades (standard naphtha). 3. Smoke Point, FM 5-519, shall be minimum 125°C for all grades. 4. PAV DSR tested at 25°C for all grades. 5. PG 67-22, Original & RTFOT DSR's tested at 67°C. 6. PG 67-22 and lower grades prepared w/o modification. 7. Grade greater than PG 67-22 shall be produced w/ SBS or SB elastomer polymer and must have Phase Angle ≯75°. 8. All HMA Binders, must add silicon @ 25 cm^3 per 5,000 gals, by supplier. 9. All Friction Course (Rubber) & RAP binders must contain 0.25-0.75% QPL listed Anti-Strips, added by supplier at loading.
916-1.2	**Qualified Products List:**	Binders supplied shall be one of products included on QPL as specified in 6-1.3. Any marked variation from original test values below established limits or evidence of inadequate QC or field performance may result in removal from QPL.
	PMA's:	Original PG binder grade, modifier product designation, and the amount added shall be indicated. Modified w/ SBS or SB elastomer polymer; Original DSR $_{76°C}$ Phase Angle ≯ 75°.
916-1.3	**QC Program:**	Supplier shall have a QC program meeting requirements of AASHTO PP-26.
	Exclusions:	None noted.

PROPERTY		**Test Method AASHTO**	**Requirements by Performance Grade, PG (Common Grade)**		
			64-22	**67-22**	**76-22**
ORIGINAL:					
Flash Point, °C		T 48	230 min.		
Rotational Viscosity, Pa s	135°C	T 316	3 max.		
Dynamic Shear, kPa (G* /sin ⊠10 rad./sec.)	1.0 min.	T 315	At grade temperature		
RTFOT RESIDUE:					
Mass Loss, %		T 240	0.5 max.		
Dynamic Shear, kPa (G* /sin ⊠10 rad./sec.)	2.20 min.	T 315	At grade temperature		
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi		
Dynamic Shear, kPa (G* sin ⊠10 rad./sec.)	5,000 max.	T 315	25°C		
Creep Stiffness	S, ≯300 MPa	T 313	-12°C		
	m Value, ≮0.300				
Direct Tension, % Strain		T 314	NA		
PG PLUS REQUIREMENTS: YES					
ORIGINAL:					
Spot Test		T 102	NEGATIVE		
Smoke Point		FM 5-519	≮125°C		
Dynamic Shear, Phase Angle		T 315	--		≯75° $_{76°C}$
Solubility, %		T 44	≮99.0		
Absolute Viscosity		T 202	Report		

STATE: GEORGIA	**MATERIALS:** Re: Section 820 - Asphalt Cement; 820.01 SUPERPAVE™ Asphalt Binder
DATE: 2004	**Web Address:** www.dot.state.ga.us
Materials Engineer: Georgene Geary	**Email Address:** georgene.geary@dot.state.ga.us

ASPHALT BINDER:

820.01	**Description:** All Grades	Shall be homogeneous, free from water and shall not foam when heated to 175°C. Blending to produce specified grade shall result in uniform, homogeneous blend with no separation. Must be production materials (Straight-Run).
	PMA's:	SBS & SB Only.
	Exclusions:	Air Blown's.

PROPERTY		Test Method AASHTO or Other	Requirements for Performance Grade, PG				
			58-22 [1]	64-22	67-22	76-22	Surface Treatment [2] ('PG 64-22')
ORIGINAL:							
Flash Point, °C		T 48	230 min.				
Rotational Viscosity, Pa s	135°C	T 316	3 max.				
Dynamic Shear, kPa (G* /sin ⊠10 rad./sec.)	1.0 max.	T 315	At grade temperature				
RTFOT RESIDUE:							
Mass Loss, %		T 240	0.5 max.				
Dynamic Shear, kPa (G* /sin ⊠10 rad./sec.)	2.20 min.	T 315	At grade temperature				
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi				
Dynamic Shear, kPa (G* sin ⊠10 rad./sec.)	5,000 max.	T 315	22°C	25°C		31°C	25°C
Creep Stiffness	S, 300 MPa	T 313	-12°C				
	m Value, 0.300						
Direct Tension, % Strain		T 314	NA				
PG PLUS REQUIREMENTS: YES							
ORIGINAL:							
Dynamic Shear, Phase Angle, °		T 315	----			75° 76°C	75° 64°C
Separation, 163°C, 48 hrs, top / bottom		PP 5	--				4°C
Solubility in TCE; %		D 2042	---				96

Notes:

1. PG 58-22 may be used as Tack Coat or in Bituminous Surface Treatment. T-179 may be accepted in lieu of T 240. If modified , the composite materials shall be thoroughly blended at the supply facility. Homogeneous - no separation, report DTT.

2. Base AC to meet PG 52-22 prior to modification, must be straight run & not air blown. Minimum 5% GTR free of steel, fiber & moisture, specific gravity of 1.15 0.05. Pass through Etnyne #4 nozzle. Additives, oils, extenders to have prior approval.

STATE: HAWAII	**MATERIALS:** Re: Section 702 - Bituminous Material
DATE: 2004	**Web Address:** www.state.hi.us/dot
Materials Engineer: Casey Abe	**Email Address:** casey.abe@hawaii.gov

ASPHALT BINDER:

702	**Description:**	Performance graded asphalt binder shall conform to AASHTO M 320 (07/30/03)
	PMA's	None stated.
	Exclusions:	None stated.

PROPERTY		Test Method AASHTO	Requirements by Performance Grade, PG (Common Grades)
			64-16
ORIGINAL:			
Flash Point, °C		T 48	230 min.
Rotational Viscosity, Pa s	135°C	T 316	3 max.
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature
RTFOT RESIDUE:			
Mass Loss, %		T 240	1.0 max.
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature
PAV RESIDUE		R 28	100°C, 20 hrs; 300 psi
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	28°C
Creep Stiffness	S, 300MPa	T 313	-6°C
	m Value, 0.300		
Direct Tension, (1 mm/min.) % Strain		T 314	No Requirement
PG PLUS REQUIREMENTS: NO			

STATE: IDAHO	**MATERIALS:** Re: Section 702 - Asphalt
DATE: 2004	**Web Address:** www.itd.idaho.gov
Materials Engineer: Jeff Miles	**Email Address:** jeff.miles@itd.idaho.gov

ASPHALT BINDER:

702-01	Description:	Shall conform to M 320, except when polymer specified or sum of grade designated temperatures exceeds 90. RTFOT Elastic Recovery @ 25°C (AASHTO-AGC-ARTBA Jt. Committee Task Force 31, Appendix 31) ~~@~~50%
	PMA's:	All PG's
	Exclusions::	Use liquid anti-strip (indirectly limiting the use of acid).

PROPERTY		Test Method AASHTO or Other	Requirements by Performance Grade, PG (Common Grades)						
			58-34	58-28	64-34	64-28	64-22	70-28	76-28
ORIGINAL:									
Flash Point, °C		T 48	230 min.						
Rotational Viscosity, Pa ~~@~~s	135°C	T 316	3 max.						
Dynamic Shear, kPa (G* /sin ☒10 rad./sec.)	1.0 min.	T 315	At grade temperature						
RTFOT RESIDUE:									
Mass Loss, %		T 240	1.0 max.						
Dynamic Shear, kPa (G* /sin ☒10 rad./sec.)	2.20 min.	T 315	At grade temperature						
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi						
Dynamic Shear, kPa (G* ~~@~~sin ☒10 rad./sec.)	5,000 max.	T 315	16°C	19°C		22°C	25°C		28°C
Creep Stiffness	S, ~~≥~~300 MPa m Value, ~~@~~0.300	T 313	-24°C	-18°C	-24°C	-18°C	-12°C	-18°C	
Direct Tension, % Strain		T 314	NA						
PG PLUS REQUIREMENTS: YES									
RTFOT RESIDUE:									
Elastic Recovery, %	25°C	ID 331[1]	≥ 50						
NOTES:									
1. Elastic Recovery procedure: straight sided molds, 10 cm elongation, cut immediately.									

STATE: ILLINOIS	**MATERIALS:** Re: Section 1009. Bituminous Materials
DATE: 2004	**Web Address:** www.dot.state.il.us
Materials Engineer: Eric Harm	**Email Address:** harme@dot.il.gov

ASPHALT BINDER:

1009.05 (a)	**Description**	Shall be uniform in character, appearance and consistency. Shall be free from water and shall not foam when heated to any temperature below the actual flash point; comply with requirements.
1009.05 (B)	**PMA's:**	Elastomers shall be added to base asphalt They shall be either SB diblock, or triblock co-polymer without oil extension or an SBR . Smooth, homogeneous and comply with requirements.
	Exclusions:	AIR BLOWN, Other Modifiers, Asphalt modification at Mixture Plants

PROPERTY		**Test Method AASHTO**	**Requirements by Performance Grade, PG (Common Grades) (Not Modified)**						
			46-28	**52-28**	**58-28**	**58-22**	**64-28**	**64-22**	**70-22**
ORIGINAL:									
Flash Point, °C		T 48	230 min.						
Rotational Viscosity, Pa s	135°C	T 316	3 max.						
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature						
RTFOT RESIDUE:									
Mass Loss, %		T 240	1.0 max.						
Dynamic Shear, kpa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature						
PAV RESIDUE: (20 hrs, 300 psi)		R 28	90°C		100°C				
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	13°C	16°C	19°C	22°C		25°C	28°C
Creep Stiffness	S, 300 MPa,	T 313	-18°C			-12°C	-18°C	-12°C	
	m Value, 0.300								

PG PLUS REQUIREMENTS: No, see next page for PMA's.

Notes:

1. RAP not permitted in SUPERPAVE™ Bitumen.

MODIFIED BINDERS - PG + REQUIREMENTS:

PROPERTY		Test Method AASHTO or Other	Requirements by Performance Grade, PG (Common Grades) (Modified)									
			Table 1					Table 2				
			SBS					SBR				
			64-28	70-22	70-28	76-22	76-28	64-28	70-22	70-28	76-22	76-28
ORIGINAL:												
Flash Point, °C		T 48	230 min.									
Rotational Viscosity, Pa s	135°C	T 316	3 max.									
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature									
RTFOT RESIDUE:												
Mass Loss, %		T 240	1.0 max.									
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature									
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi									
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	22°C	28°C	25°C	31°C	28°C	22°C	28°C	25°C	31°C	28°C
Creep Stiffness	S, ≤ 300 MPa	T 313	-18°C	-12°C	-18°C	-12°C	-18°C		-12°C	-18°C	-12°C	-18°C
	m Value, ≥ 0.300											
PG PLUS REQUIREMENTS: YES												
ORIGINAL:												
Separation of Polymer, °C (°F) SP Difference Top - Bottom		IL DOT[1]	2 (4)									
Force Ratio (f_2 / f_1) (50 mm / min., 300 mm elongation)	4°C	T 300	0.3			0.35		Not Required				
Toughness & Tenacity, N-m (in-lbs) — Toughness	25°C	ASTM D 5801	Not Required					12.5 (110)				
Tenacity								8.5 (75)				
RTFOT RESIDUE												
Elastic Recovery, % 100 mm Elongation	25°C	T 51 [2]	60			70		40			50	

[1] Heat sample until sufficiently fluid to pour (avoid localized overheating).
Strain the melted sample through 300 m (50 mesh) and stir thoroughly.
Pour 50 grams into thin wall aluminum tube having approx dimension of 25 mm diameter x 140 mm length.
Place sealed tube vertically in oven @ 163 6°C, allow to stand undisturbed for 48 1 hr.
Remove and immediately place vertically in freezer at -7 6°C for 4 hrs.
Remove from freezer, cut tube into three equal lengths.
Place top & bottom into marked beakers and heat in a 163°C 6°C oven until sufficiently fluid.
Remove pieces of aluminum tube, stir thoroughly, follow AASHTO T 53 for SP determination

[2] 50 mm/min., 300 mm elongation

[3] Except: replace V inserts w/ straight sided inserts.
Elongate sample to 100 mm and immediately cut, after 1 hr in bath, bring together to just touch, measure , record as A. The % Elastic Recovery ®) = 100 - A

STATE: INDIANA	**MATERIALS:** Re: Section 902 - Asphalt Materials
DATE: 2004	**Web Address:** www.indot.state.in.us
Materials Engineer: Dave Andrewski	**Email Address:** dandrewski@indot.state.in.us

ASPHALT BINDER:

902.01	**Description:**	Asphalt is defined as a cementatious material obtained from petroleum processes. Asphalt shall be sampled and tested in accordance with the applicable requirements of 902.02. PG asphalt binders shall be in accordance with the table below.
1009.05 (b)	**PMA's:**	None stated.
	Exclusions:	None stated.

PROPERTY		Test Method AASHTO	Requirements by Performance Grade, PG (Common Grades)					
			58-28	64-28	64-22	70-28	70-22	76-22
ORIGINAL:								
Flash Point, °C		T 48	230 min.					
Rotational Viscosity, Pa s	135°C	T 316	3 max.					
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature					
RTFOT RESIDUE:								
Mass Loss, %		T 240	1.0 max.					
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature					
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi					
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	19°C	22°C	25°C		28°C	31°C
Creep Stiffness	S, 300 MPa	T 313	-18°C		-12°C	-18°C	-12°C	
	m Value, 0.300							
Direst Tension, % Strain		T 314	NA					
PG PLUS REQUIREMENTS: NO								

STATE: IOWA	**MATERIALS:** Re: Section 4137 Asphalt Binder
DATE: 2004	**Web Address:** www.dot.state.ia.us
Materials Engineer: Michael Heitzman	**Email Address:** michael.heitzman@dot.state.ia.us

ASPHALT BINDER:

4137.01	**Description:**	Shall meet requirements for the type and grade specified in the contract document.
	PMA's:	None stated.
4137.02	**Exclusions:**	Modification by additional of acids will not be allow.

PROPERTY		Test Method AASHTO	Requirements by Performance Grade, PG (Common Grades)							
			52-34	52-28	58-28	58-22	64-28	64-22	70-22	76-22
ORIGINAL:										
Flash Point, °C		T 48	230 min.							
Rotational Viscosity, Pa s	135°C	T 316	3 max.							
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature							
RTFOT RESIDUE:										
Mass Loss, %		T 240	1.0 max.							
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature							
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi							
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	13°C	16°C	19°C	22°C		25°C	28°C	31°C
Creep Stiffness	S, 300 MPa	T 313	-24°C	-18°C		-12°C	-18°C	-12°C		
	m Value, 0.300									
Direct Tension, % Strain		T 314	NA							
PG PLUS REQUIREMENTS: NO										

STATE: KANSAS	**MATERIALS:** Re: Section 1200 - Performance Graded Binder
DATE: 2004	**Web Address:** www.ksdot.org
Materials Engineer: Lon Ingram	**Email Address:** Richard Schwartz, Chief Chemist; RichardT@ksdot.org

ASPHALT BINDER:

Section 1200,1.0	**Description:**	This specification covers performance graded binders (PGAB) developed to significantly improve the ability of the pavement to resist low temperature cracking and high temperature rutting.
Section 1200, 2.0 SP 90P/M-197)	**PMA's:**	All PG above a PG 64-22 be polymer modified. Supplier determines polymer. Perform all tests after adding 0.5% high molecular weight amine anti-stripping agent (by mass) to the PGAB.
	Exclusions:	Acid, Air Blown.

Table 1

PROPERTY		Test Method AASHTO or Other	Requirements by Performance Grade, PG (Common Grades) (Modified)[3]							
			64-28	70-22	70-28	70-34	76-22	76-28	82-22	82-28
ORIGINAL:										
Flash Point, °C		T 48	230 min.							
Rotational Viscosity, Pa s	135°C	T 316	3 max.							
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature							
RTFOT RESIDUE:										
Mass Loss, %		T 240	1.0 max.							
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature							
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi							
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	22°C	28°C	25°C	22°C	31°C	28°C	34°C	31°C
Creep Stiffness	S, 300MPa m Value, 0.300	T 313	-18°C	-12°C	-18°C	-24°C	-12°C	-18°C	-12°C	-18°C
Direct Tension, % Strain		T 314	NA							
PG Plus Requirements: YES										
ORIGINAL: Section 1200 Performance Graded Asphalt Binder, Table 1 (Special Provision 90P/M-197)										
Separation[1]		ASTM D 5976	2 max.							
RTFOT RESIDUE:										
Elastic Recovery[2]		ASTM D 6084	45		65	70	65	75		

NOTES:

1. Separation: @ 163°C, 48 hours, Difference in R&B Softening Point, Top & Bottom
2. Elastic Recovery: @ 25°C, 10 cm Elongation, % min.
3. Contractor may substitute performance graded asphalt which meets or exceeds the upper and lower grade designation for which is specified. For example: a PG 64-22 or PG 58-28 for a specified PG 58-22.

ASPHALT BINDER[1]:

Section 1200	**Description:**	Complete AASHTO Specification Compliance.
	PMA's:	Not applicable - see Table 1 for PMA's.
	Exclusions:	No Plant Site or In-Line Blending; Acid , Air Blown's.

PROPERTY		Test Method AASHTO or Other	Requirements by Performance Grade, PG (Common Grades) (Non-Modified)				
			58-22	64-28	64-22	70-22	76-22
ORIGINAL:							
Flash Point, °C		T 48	230 min.				
Rotational Viscosity, Pa•s	135°C	T 316	3 max.				
Dynamic Shear, kPa (G* /sin δ 10 rad./sec.)	1.0 min.	T 315	At grade temperature				
RTFOT RESIDUE:							
Mass Loss, %		T 240	1.0 max.				
Dynamic Shear, kPa (G* /sin δ 10 rad./sec.)	2.20 min.	T 315	At grade temperature				
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi				
Dynamic Shear, kPa (G* •sin δ 10 rad./sec.)	5,000 max.	T 315	22°C		25°C	28°C	31°C
Creep Stiffness	S, ~~3~~300MPa	T 313	-12°C	-18°C	-12°C		
	m Value, ~~0~~.300						
PG Plus Requirements: Yes: QC Requirements[2]							
ORIGINAL:							
Viscosity, P	60°C	--	Report				
Penetration, dmm	25°C	--	Report				
Rotational Viscosity, Pa•s	165°C	T 315	Report				
NOTES:							

1. Asphalt Cement (AC) allowed.
2. Any other short-term test(s), producer has found to provide useful information for QC is permitted.

STATE: KENTUCKY	**MATERIALS:** Re: Section 806 - Asphalt Materials
DATE: 2004	**Web Address:** www.transportation.ky.gov
Materials Engineer: Allen Myers	Email Address: allen.myers@ky.gov

ASPHALT BINDER:

Section 806	**Description:**	Provide PG binders conforming to AASHTO M 320, except the intermediate Dynamic Shear will be tested @ 25°C for all material. Additionally, the material must have a minimum solubility of 99.0% when tested according to AASHTO T 44. All binders are to be homogeneous blends.
1009.05 (b)	**PMA's:**	Only organic, non-particulate modifiers. Elastic Recovery required. Circulated and agitated as specified by supplier.
	Exclusions:	No Plant Site or In-Line Blending.

PROPERTY		**Test Method AASHTO**	**Requirements by Performance Grade, PG (Common Grades)**	
			64-22	**76-22**
ORIGINAL:				
Flash Point, °C		T 48	230 min.	
Rotational Viscosity, Pa s	135°C	T 316	3 max.	
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature	
RTFOT RESIDUE:				
Mass Loss, %		T 240	1.0 max.	
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature	
PAV RESIDUE			100°C; 20 hrs; 300 psi	
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	25°C	
Creep Stiffness	S, 300MPa	T 313	-12°C	
	m Value, 0.300			
Direct Tension, % Strain		T 314		
PG PLUS REQUIREMENTS: YES				
ORIGINAL:				
Solubility in TCE, %		T 44	99.0	
Elastic Recovery, %	25°C	T 301	---	75

STATE: LOUISIANA	**MATERIALS:** Re: Section 1002 - Asphalt Materials
DATE: 2004	**Web Address:** www.dotd.state.la.us
Materials Engineer: Chris Abadie, P.E.	**Email Address:** ChrisAbadie@dotd.state.la.us

ASPHALT BINDER:

Section 1002	**Description**	Asphalt shall be prepared by the refining of petroleum. Asphalt shall be uniform in character, free from water, and shall not foam when heated to 350°F (177°C).
1009.05 (b)	**PMA's:**	PG + requirements
	Exclusions:	None stated.

PROPERTY		Test Method AASHTO or Other	Requirements by Performance Grade, PG (Common Grades)			
			58-28	64-22	70-22PM [5]	76-22PM [5]
ORIGINAL:						
Flash Point, °C		T 48	230 min.			
Rotational Viscosity, Pa s	135°C	T 316	3 max.			
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature			
RTFOT RESIDUE:						
Mass Loss, %		T 240	1.0 max.			
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min	T 315	At grade temperature			
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi			
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	19°C	25°C	28°C	31°C
Creep Stiffness	S, 300MPa	T 313	-18°C	-12°C		
	m Value, 0.300					
Direct Tension, % Strain		T 314	NA			
PG PLUS REQUIREMENTS: YES						
ORIGINAL:						
Solubility, %		T 44	99.0			
Separation of Polymer [1],, °C		DOTD TR 326	----			2
Force Ductility Ratio [2] (f_2/f_1,)		T 300	------			0.30
Force Ductility [3], kg		T 300	----			23
RTFOT:						
Elastic Recovery [4], % min.		T 301	--	--	40	60
Ductility, cm (5 cm/min.)	25°C	T 51	--	--	100	--

NOTES:

[1] Separation: SP difference in R&B from Top to Bottom; 163°C, 48 hours

[2] Force Ratio: @ 4°C, 5 cm/min., f_2 @ 30 cm elongation)

[3] Force Ductility: @ 4°C, 5 cm/min., 30 cm elongation,

[4] Elastic Recovery: @ 25°C, 10 cm elongation,

[5] Required in top lifts of all HMA construction for roadways

STATE: MAINE	**MATERIALS:** Re: Div 400 Pavements,402.02-Materials, Section 702.01 Asphalt Cements
DATE: 2004	**Web Address:** www.state.me.us/mdot
Materials Engineer: Bruce Yeaton	**Email Address:** bruce.yeaton@state.me.us

ASPHALT BINDER:

Section 702.01	**Description:**	Performance Graded Asphalt Binder shall conform to the requirements of AASHTO M 320.
	PMA's:	None stated.
	Exclusions:	None stated.

PROPERTY		Test Method AASHTO	Requirements by Performance Grades, PG (Common Grades)	
			58-34	64-28
ORIGINAL:				
Flash Point, °C		T 48	230 min.	
Rotational Viscosity, Pa s	135°C	T 316	3 max.	
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature	
RTFOT RESIDUE:				
Mass Loss, %		T 240	1.0 max.	
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature	
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi	
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	16°C	22°C
Creep Stiffness	S, 300 MPa	T 313	-24°C	-18°C
	m Value, 0.300			
Direct Tension, % Strain		T 314	NA	
PG PLUS REQUIREMENTS: NO				
Notes:				
1. Sections 401.05: PGAB shall be PG 64-28; except for mixtures 15-25% RAP, the PGAB shall be PG 58-34				

STATE: MARYLAND	**MATERIALS:** Re: Section 904 - Performance Graded Asphalt Binders and Hot Mix Asphalt
DATE: 2004	**Web Address:** www.mdot.state.md.us
Materials Engineer: Larry Michael	**Email Address:** Gloria Burke, OMT Asphalt Team; gburke@sha.state.md.us

ASPHALT BINDER:

Section 904.02	Description:	PG asphalt binders for mixes containing all virgin materials, recycled asphalt pavement materials, or roofing shingles from manufacturing waste shall conform to AASHTO M 320, Table 1, for the specified performance grade.
	PMA's:	Neat asphalt with elastomer polymer modifier when needed
	Exclusions:	Acid, Air Blown's.

PROPERTY		Test Method AASHTO	Requirements by Performance Graded, PG (Common Grades)			
			64-28	64-22	70-22	76-22
ORIGINAL:						
Flash Point, °C		T 48	230 min.			
Rotational Viscosity, Pa s	135°C	T 316	3 max.			
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature			
RTFOT RESIDUE:						
Mass Loss, %		T 240	1.0 max.			
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature			
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi			
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	22°C	25°C	28°C	31°C
Creep Stiffness	S, ~~300~~MPa	T 313	-18°C	-12°C		
	m Value, ~~0~~.300					
Direct Tension		T 314	Report on C of A			
Critical Cracking Temperature		PP 42	Report on C of A			
PG PLUS REQUIREMENTS: YES - Requires Critical Cracking Temperature Determination & Reporting						

STATE: MASSACHUSETTS	**MATERIALS:** Re: Section M3 - Bituminous Materials
DATE: 2004	**Web Address:** www.state.ma.us.mhd/home
Materials Engineer: Clement Fung	Email Address: Clement.Fung@MHD.state.ma.us

ASPHALT BINDER:

Section M3	**Description:**	Common Binder grades used in Massachusetts are 64-28 for less than 25% RAP and 52-34 for 25% to 40% RAP. SBR used as modifier prescription and no PG+ requirements in use. Follow M 320.
1009.05 (b)	**PMA's:**	None stated.
	Exclusions:	Currently exclusions of all additions unless approved by Department.

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grades, PG (Common Grades)**	
			52-34	**64-28**
ORIGINAL:				
Flash Point, °C		T 48	230 min.	
Rotational Viscosity, Pa s	135°C	T 316	3 max.	
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature	
RTFOT RESIDUE:				
Mass Loss, %		T 240	1.0 max.	
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature	
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi	
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	13°C	22°C
Creep Stiffness	S, ~~3~~300MPa	T 313	-24°C	-18°C
	m Value, ~~0~~.300			
Direct Tension, % Strain		T 314	NA	
Critical Cracking Temperature		PP 42	--	
PG PLUS REQUIREMENTS: NO				

STATE: MINNESOTA	**MATERIALS:** Re: 2360/2350 Combined Specification, December 9,2003
DATE: 2004	**Web Address:** www.dot.state.mn.us
Materials Engineer: John Garrity	**Email Address:**Jim McGraw, Chemical Lab Director;James.McGraw@dot.state.mn.us

ASPHALT BINDER:

Section 3151	**Description:**	Binders shall meet requirements of PG asphalt binder testing tolerance.
	PMA's:	None stated.
	Exclusions:	Air Blown materials w/o DOT Approval; Tankage shall not be used for distillate fuels.

PROPERTY		**Test Method AASHTO**	**Requirements by Performance Grade, PG (Common Grades)**						
			58-34	**58-28**	**64-34**	**64-28**	**70-34**	**70-28**	**76-28**
ORIGINAL:									
Flash Point, °C		T 48	230 min.						
Rotational Viscosity, Pa s	135°C	T 316	3 max.						
Dynamic Shear, kPa (G* / Sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature						
RTFOT RESIDUE:									
Mass Loss, %		T 240	1.0 max.						
Dynamic Shear, kPa (G* / Sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature						
PAV RESIDUE		R 28	100°C; 200 hrs; 300 psi						
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	16°C	19°C		22°C		25°C	28°C
Creep Stiffness	S, 300 MPa, max. m Value,0.300 min.	T 313	-24°C	-18°C	-24°C	-18°C	-24°C	-18C	-18°C
Direct Tension, Strain, Min., °C		T 314	NA						
PG PLUS REQUIREMENTS: Coming in January 2005									

NOTES:

1. Anti-Strip when added can not reduce the PG.
2. Mix & Compaction Temperatures to be furnished by binder supplier.

STATE: MISSISSIPPI	**MATERIALS:** Re: Section 702 - Bituminous Material
DATE: 2004	**Web Address:** www.mdot.state.ms.us
Materials Engineer: Richard Sheffield	**Email Address:** sheffield@mdot.state.ms.us

ASPHALT BINDER:

Section 702.02	**Description:**	Asphalt cement shall be homogeneous, free of water and shall not foam when heated to a temperature of 175°C. Except for use in hot mix asphalt, asphalt cement of the grade specified shall conform to the requirements of 702.12, Table I or II.
	PMA's:	The bituminous material used in polymer modified hot mix asphalt shall conform to AASHTO M 320 (MP 1), PG 76-22; PG 82-22 or as specified made by adding a polymer modifier (must meet requirements of Subsection 702.08.3) to a PG 67-22. Polymer shall be SBS, SBR, or equal approved by Engineer. Crumb Rubber if used must meet DOT specifications.
	Exclusions:	None stated.

PROPERTY		**Test Method AASHTO**	**Requirements by Performance Grade, PG (Common Grades)**			
			58-28	**67-22**	**76-22**	**82-22**
ORIGINAL:						
Flash Point, °C		T 48	230 min.			
Rotational Viscosity, Pa s	135°C	T 316	3 max.			
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature			
RTFOT RESIDUE:						
Mass Loss, %		T 240	1.0 max.			
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature			
PAV RESIDUE		R 28	100°C; 20 hrs			
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	19°C	26.5°C	31°C	34°C
Creep Stiffness	S, MPa, 300	T 313	-18°C	-12°C		
	m Value; 0.300					
Direct Tension, % Strain		T 314	Not Required			

PG PLUS REQUIREMENTS: YES		
Polymer Required	No	Yes
Polymer Type & Percentage Required	NA	Yes
Temperature - Viscosity Curve	NA	Yes

NOTES:

AC Specifications co-exist, Table I & II: AC-5, AC-10, AC-13, AC-20, AC-30, AC-40; Spot Test, SP & SG required all grades.

STATE: MISSOURI	**MATERIALS:** Re: Section 1015 - Bituminous Material
DATE: 2004	**Web Address:** www.modot.state.mo.us
Materials Engineer: Ken Fryer	**Email Address:** fryerl@mail.modot.state.mo.us

ASPHALT BINDER:

Section 1015	**Description:**	Performance-graded asphalt binder shall be an asphalt-based binder produced from petroleum residue either with or without the addition of non-particulate organic modifiers. Performance-graded asphalt binder shall be tested in accordance and comply with the requirements of AASHTO M 320 for the grade specified. The physical hardening and direct tension tests are waived.
	PMA's:	None stated.
	Exclusions:	None stated.

PROPERTY		**Test Method AASHTO**	**Requirements by Performance Grade, PG (Common Grades)**		
			64-22	**70-22**	**76-22**
ORIGINAL:					
Specific Gravity	15.6°C	ASTM D 70	Report		
Flash Point, °C		T 48	230 min.		
Rotational Viscosity, Pa s	135°C	T 316	3 max.		
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature		
RTFOT RESIDUE:					
Mass Loss, %		T 240	1.0 max.		
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature		
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi		
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	25°C	28°C	31°C
Creep Stiffness	S, 300MPa	T 313	-12°C		
	m Value, 0.300				
Direct Tension, Strain, Min., °C		T 314	Waived		
PG PLUS REQUIREMENTS: NO					

STATE: MONTANA	**MATERIALS:** Re: Section 702.02
DATE: 2004	**Web Address:** www.mdt.state.mt.us
Materials Engineer: Matthew Weber	**Email Address:** maweber@mt.gov

ASPHALT BINDER:

Section 702.02	**Description**	Meet requirements of Table 702-9
	PMA's:	None stated.
	Exclusions:	None stated.

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grades)**				
			58-28	**64-22**	**64-28**	**64-34**	**70-28**
ORIGINAL:							
Specific Gravity	15.6°C	ASTM D 70	Report				
Flash Point, °C		T 48	230 min.				
Rotational Viscosity $_{135°C}$, Pa s	135°C	T 316	3 max.				
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature				
RTFOT RESIDUE:							
Mass Loss, %		T 240	1.0 max.				
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature				
PAV RESIDUE		R 28	100°C; 20 hrs, 300 psi				
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	19°C	25°C	22°C	19°C	25°C
Creep Stiffness	S, ~~300~~ MPa m Value, ~~0~~.300	T 313	-18°C	-12°C	-18°C	-24°C	-18°C
Direct Tension, Strain, Min., °C		T 314	Not Required				
PG PLUS REQUIREMENTS: YES							
RTFOT RESIDUE:							
Ductility, cm (5 cm/min.)	25°C	T 51	--	~~3~~0	~~3~~0	--	~~3~~0

STATE: NEBRASKA	**MATERIALS:** Re: Section 503 Performance Graded Binder
DATE: 2004	**Web Address:** www.dor.state.ne.us
Materials Engineer: Laird Weishahn	**Email Address:** lweishah@dor.state.ne.us

ASPHALT BINDER:

Section 503 503.6.e.2	**Description:**	Performance graded binder, as specified in the contract items shall be in accordance with the PG+ specifications as noted and AASHTO M 320 with the exception of Direct Tension. Mix & Compaction temperatures required.
	PMA's:	SBS, SB & SBR permitted. Type used required in Certification. Blending binders with different types not allowed. Must be heat and storage stable and shall not separate when handled and stored per suppliers recommendations.
	Exclusions:	Acid Treatment, if Air Blown / Oxidized (statement required on Certifications).

PROPERTY		**Test Method AASHTO**	**Requirements by Performance Grade PG (Common Grades)**	
			64-28	**70-28**
ORIGINAL:				
Specific Gravity	15.6°C	ASTM D 70	Report	
Flash Point, °C		T 48	230 min.	
Viscosity, Pa s	135°C	T 316	3 max.	
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature	
RTFOT RESIDUE:				
Mass Loss, %		T 240	1.0 max.	
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature	
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi	
Dynamic Shear, kPa (G* • sin 10 rad./sec.)	5,000 max.	T 315	22°C	25°C
Creep Stiffness	S, 300 MPa	T 313	-18°C	
	m Value, 0.300			
Direct Tension, Strain, Min., °C		T 314	NA	

PG PLUS REQUIREMENTS: YES				
ORIGINAL:				
Dynamic Shear, Phase Angle, °		T 315	77 64°C	75 70°C
RTFOT RESIDUE:				
Elastic Recovery, %	25°C	T 301	60	70

NOTES:

Anti-Strip added at 0.5%, can not result in G*/sin drop of more than 25%. Mix and Compaction Temperatures required.

STATE: NEVADA - CLARK COUNTY	**MATERIALS:** Re: Section 703 - Bituminous Materials
DATE: 2004	**Web Address:** www.nevadadot.com
Materials Engineer: Dean Weitzel	**Email Address:** dweitzel@dot.state.nv.us

ASPHALT BINDER:

Section 702.2.2.01	**Description:**	This Section covers asphalt cements, which have been prepared from crude petroleum by suitable methods. The asphalt cements shall be homogenous, free from water ans shall not foam when heated to 175°C. Blending of asphalt cements to produce a specified performance grade shall result in a uniform, homogenous blend with no separation.
	PMA's:	Modified binders shall be blended at the source of supply and delivered as a completed mixture to the job site. It shall not be transported via railroad car. Only elastomeric (SBS, SB, SBR, SEBS) rubber shall be added to the neat asphalt cement, to produce a binder that complies with the following requirements (Table 1A).
	Exclusions:	None stated.

TABLE 1:

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grades)**		
			64-22 Not Modified	**76-22 Modified**	**64-34 Modified**
ORIGINAL:					
Flash point, °C		NDOT T716	230 min.		
Rotational Viscosity Pa·s	135°C	T 316	3 max.		
Dynamic Shear, kPa (G*/sin δ 10 rad./sec.)	1.0 min.	T 315	At grade temperature		
RTFOT RESIDUE:					
Mass Loss, %		NDOT T728	0.5 max.		
Dynamic Shear, kPa (G*/sin δ 10 rad./sec.)	2.20 min.	T 315	At grade temperature		
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi		
Dynamic Shear, kPa (G*•sin δ 10 rad./sec.)	5,000 max.	T3 15	25°C	31°C	19°C
Creep Stiffness	S, ≤ 300 MPa	T 313	-12°C		-24°C
	m Value, ≥ 0.300	T 313			
Direct Tension	1.0 min.	T 314			
PG PLUS REQUIREMENTS: YES					
ORIGINAL:					
Ductility (5 cm/min.), cm	4°C	NDOT T746	Report		
Sieve		NDOT T730	Pass		
Toughness & Tenacity, in-lbs (N.M)	Toughness	NDOT T745	--	150 (16.95)	75
	Tenacity			100 (11.30)	50
Viscosity, P	60°C	NDOT T727	2,000 - 4,000	--	
Penetration, dmm	25°C	T 49	50	--	
Solubility in TCE, %		T 44	99.0		
Elastic Recovery, % IF T&T FAILS	25°C	T 301	--	58	
RTFOT RESIDUE:		NDOT T728			
Ductility (1 cm/ min.), cm	4°C	NDOT T746	Report		
Penetration, dmm	25°C	T 49	25	---	

TABLE IA:

PROPERTY		Test Method AASHTO or Other	Requirements for Viscosity-Graded Asphalt Cement	
			AC-30	AC-40
Viscosity (140°F), Poises	60°C	T 202	2,400 - 3,600	3,200 - 4,800
Kinematic Viscosity (275°F), cSt	135°C	T 201	350 min.	400 min.
Penetration (77°F), 100 g, 5 sec.	25°C	T 49	50 min.	40 min.
Flash Point , °C (°F)		T 48	232 min. (450 min.)	
Solubility, %		T 44	≥99.0	
Ductility (39.2°F), 1 cm/min., cm	4°C	NDOT T746	??	??
Sieve		NDOT T730	Pass	
RTFOT RESIDUE:				
Loss on heating, %		NDOT T728	0.5 Max.	
Viscosity (140°F), Poises	60°C	NDOT T738	1,200 max. (12,000 max.)	1,600 max. (16,000 max.)
PAV RESIDUE:		R 28	100°C, 20 hrs, 300 psi	
Creep Stiffness	S, ≤ 300 MPa	T 313	-12°C	
	m Value, ≥ 0.300			
Direct Tension	1.0 min.	T 314		

TABLE 1B:

PROPERTY		Test Method AASHTO or Other	Requirements for In-Place Viscosity-Graded Asphalt Cement	
			AC-30	AC-40
Viscosity (140 °F), Poises	60°C	T 202	≥12,000	≥16,000
Kinematic Viscosity (275 °F), Cs	135°C	T 201	≥450	≥550
Penetration (77°F), 100 g, 5 sec.	25°C	T 49	≥20	
Ductility (77°F), 5 cm/min., cm	25°C		≥40	≥25
Ductility (39.2°F), 1 cm/min., cm	4°C	NDOT T746	Report	
PAV RESIDUE:		R 28	100°C, 20 hrs, 300 psi	
Creep Stiffness	S, ≤ 300 MPa	T 313	-12°C	
	m Value, ≥ 0.300			
Direct Tension		T 314		

TABLE 1C:

PROPERTY		Test Method AASHTO or Other	Requirements for In-Place Performance Graded Asphalt Cement		
			64-22 Not Modified	76-22 Modified	64-34 Modified
ORIGINAL:					
Dynamic Shear, kPa (G*/sin ⊠10 rad./sec.)	2.20 min.	T 315	At grade temperature		
Ductility (1 cm/min), cm	4°C	NDOT T746	Report		
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi		
Dynamic Shear, kPa (G*• sin ⊠10 rad./sec.)	5,000 max.	T3 15	25°C	31°C	19°C
Creep Stiffness	S, ≤ 300 MPa	T 313	-12°C		-24°C
	m Value, ≥ 0.300	T 313			
Direct Tension	1.0 min.	T 314			

STATE: NEVADA	**MATERIALS:** Re: Section 703 - Bituminous Materials
DATE: 2004	**Web Address**: www.nevadadot.com
Materials Engineer: Dean Weitzel	**Email Address:** dweitzel@dot.state.nv.us

ASPHALT BINDER:

Section 703.03.02	**Description:**	This Section covers asphalt cements, which have been prepared from crude petroleum by suitable methods. The asphalt cements shall be homogenous, free from water and shall not foam when heated to 175°C. Blending of asphalt cements to produce a specified performance grade shall result in a uniform, homogenous blend with no separation.
	PMA's:	Modified binders shall be blended at the source of supply and delivered as a completed mixture to the job site. It shall not be transported via railroad car. Only elastomeric (SBS, SB, SBR, SEBS) rubber shall be added to the neat asphalt cement, to produce a binder that complies with the following requirements (Table 1A). Blend the PG 64-28NV and PG 76-22NV at the source of supply and deliver as a completed mixture to the job site. Do not transport PG 64-28NV by railroad car.
	Exclusions:	None stated**.**

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grades)**	
			64-28NV	**76-22NV**
ORIGINAL:				
Flash point, °C		Nev. T716	230 min.	
Viscosity, Pa•s	135°C	T 316	3 max.	
Dynamic Shear, kPa G*/sin δ 10 rad./sec.)	1.0 min.	T 315	At grade temperature	
RTFOT RESIDUE:				
Mass Loss, %		Nev. T728	0.5 max.	
Dynamic Shear, kPa G*/sin δ 10 rad./sec.)	2.20 min.	T 315	At grade temperature	
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi	
Dynamic Shear, kPa G*•sin δ 10 rad./sec.)	5,000 max.	T3 15	22°C	31°C
Creep Stiffness	S, ≤ 300 MPa	T 313 (a)	-18°C	-12°C
	m Value, ≥ 0.300	T 313 (a)		
Direct Tension, Failure Strain, (1.0 mm/min), %	1.0 min.	T 314 (a)		
PG PLUS REQUIREMENTS: Yes				
ORIGINAL:				
Ductility (5 cm/min.), cm	4°C	Nev. T746	50	20
Sieve		Nev. T730	Pass	
Toughness & Tenacity	Toughness, in-lbs	Nev. T745	110	----
	Tenacity, in-lbs	Nev. T745	75	
Polymer Content, %		NV	--	3 (b)
RTFOT RESIDUE:		Nev T728		
Ductility (5 cm/min.), cm	4°C	Nev. T746	25	10

NOTES:

a) The m-value requirement and the direct tension failure strain requirement must be satisfied in all cases. If the creep stiffness is between 300 and 600 MPa, the direct tension failure strain requirement may be used in lieu of the creep stiffness requirement.

b) Certificates of compliance provided for the material shall certify that the minimum polymer content is present.

TABLE I & II: Specification for Viscosity-Graded Asphalt Cement at 60°C (140°F) (Grading based on original asphalt)

PROPERTY		Test Method AASHTO or Other	VISCOSITY GRADE					
			Table I			Table II		
			AC-2.5	AC-5	AC-10	AC-20	AC-30	AC-40
Viscosity (140℉), Pa·s (Poises)	60°C	Nev. T738	20-30 (200-300)	40-60 (400-600)	80-120 (800-1200)	160-240 (1600-2400)	240-360 (2400-3600)	320-480 (3200-4800)
Kinematic Viscosity (275℉), mm^2/s (cSt)	135°C	T 201	125 min. (125 min.)	175 min. (175 min.)	250 min. (250 min.)	300 min. (300 min.)	350 min. (350 min.)	400 min. (400 min.)
Penetration (77℉), 100 g, 5 sec	25°C	T 49	220 min.	140 min.	80 min.	60 min.	50 min.	40 min.
Flash Point , ℃ (℉)		T 48	163 min. (325 min.)	177 min. (350 min.)	219 min. (425 min.)	232 min. (450 min.)	232 min. (450 min.)	232 min. (450 min.)
Solubility, %		T 44	99.0 min.					
Ductility (39.2℉), 1 cm/min., cm	4°C	Nev. T746	50 min.	25 min.	15 min.	5 min.	---	---
Sieve		Nev. T730	Pass					
RTFOT RESIDUE:								
Loss on heating, %		Nev. T728	---	1.0 max.	0.5 max.			
Viscosity, Pa·s (140℉, Poises)	60°C	Nev. T738	100 max. (1000 max.)	200 max. (2000 max.)	400 max. (4000 max.)	800 max. (8000 max.)	1200 max. (12000 max.)	1600 max. (16000 max.)

TABLE III: Specification for Polymerized Viscosity-Graded Asphalt Cement at 60℃ (140℉) (Grading based on original asphalt)

PROPERTY		Test Method AASHTO or Other	VISCOSITY GRADE: AC-20P
ORIGINAL:			
Viscosity, Pa·s (140 ℉, Poises)	60°C	Nev. T727	210 min. (2,100 min.)
Kinematic Viscosity, mm^2/s (275 ℉, cSt)	135°C	Nev. T729	475-3,000 (475-3,000)
Flash point, ℃ (℉)		Nev. T716	232 min. (450 min.)
Ductility (39.2℉), 5 cm/min., cm	4°C	Nev. T746	50 min.
Toughness & Tenacity, N·m (Inch·lbs)	Toughness	Nev. T745	12.43 min. (110 min.)
	Tenacity	Nev. T745	8.47min. (75 min.)
Sieve		Nev. T730	Pass
RTFOT RESIDUE:			
Viscosity, Pa·s (140℉, poises)	60°C	Nev. T727	300 min.(3,000 min.)
Ductility (39.2℉), 5 cm/min., cm	4°C	Nev. T746	25 min.
Loss on heating, %		Nev. T728	0.5 max.

STATE: NEW HAMPSHIRE	**MATERIALS:** Re: Section 401 - Bituminous Materials
DATE: 2004	**Web Address:** www.state.nh.us/dot
Materials Engineer: Alan Perkins	**Email Address:** aperkins@dot.state.nh.us

ASPHALT BINDER:

Section 401	**Description:**	Bituminous materials used for asphalt cement binder shall meet the properties specified in AASHTO M 320. The grade of asphalt cement binder to be used will be specified in a Special Provision contained in the Proposal.
	PMA's:	None stated.
	Exclusions:	None stated.

PROPERTY		**Test Method AASHTO**	**Requirements by Performance Grade, PG (Common Grade)**			
			64-28	**64-22**	**70-22**	**76-28**
ORIGINAL:						
Flash Point, °C		T 48	230 min.			
Rotational Viscosity, Pa s	135°C	T 316	3 max.			
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature			
RTFOT RESIDUE:						
Mass Loss, %		T 240	1.0 max.			
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature			
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi			
Dynamic Shear, kPa (G* • sin 10 rad./sec.)	5,000 max.	T 315	22°C	25°C	28°C	
Creep Stiffness	S, ~~3~~300 MPa	T 313	-18°C	-12°C		-18°C
	m Value, ~~0~~.300					
Direct Tension		T 314	NA			
PG PLUS REQUIREMENTS: NO						

STATE: NEW JERSEY	**MATERIALS:** Re: Section 904-01 - Asphalt Binder
DATE: 2004	**Web Address:** www.state.nj.us
Materials Engineer: Eileen Sheehy	**Email Address:** eileen.sheehy@dot.state.nj.us

ASPHALT BINDER:

Section 904.01	**Description:**	Asphalt binder shall conform to AASHTO M 320 "Standard Specifications for Performance Graded Asphalt Binder." Grade 64-22 shall be used except that an asphalt of softer grade may be directed to be used when the mixture contains RAP and except where otherwise specified.
	PMA's:	When specified, PG 76-22 asphalt binder shall be storage-stable, pre-blended, homogeneous, polymer modified asphalt binder using Styrene-Butadiene (SB) or Styrene-Butadiene-Styrene (SBS) formulations with the rolling thin film oven test (RTFOT) residue having a minimum Elastic Recovery (ASTM D 6084) of 50% when tested for 60 minutes @ 77°F and 2 inches/minute elongation. A written certification of compliance shall be furnished for the polymer modified asphalt binder and shall be submitted according to Subsection 106.04.
	Exclusions:	None stated.

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grades)**	
			64-22	**76-22**
ORIGINAL:				
Specific Gravity	15.6°C	ASTM D 70	Report	
Flash Point, °C		T 48	230 min.	
Rotational Viscosity, Pa s	135°C	T 316	3 max.	
Dynamic Shear, kPa (G* / sin kPa, 10 rad./sec.)	1.0 min.	T 315	At grade temperature	
RTFOT RESIDUE:				
Mass Loss, %		T 240	1.0 max.	
Dynamic Shear, kPa (G* / sin kPa, 10 rad./sec.)	2.20 min.	T 315	At grade temperature	
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi	
Dynamic Shear, kPa (G* • sin kPa, 10 rad./sec.)	5,000 max.	T 315	25°C	31°C
Creep Stiffness	S, 300 MPa	T 313	-12°C	
	m Value, 0.300			
Direct Tension, % Strain	1.0 min.	T 314		
PG PLUS REQUIREMENTS: YES				
RTFOT RESIDUE:				
Elastic Recovery, %	25°C	D 6084	---	50
NOTES:				
ASTM D 6084; Strain Rate = 2 in./min.; cut hold 1 hour				

STATE: NEW MEXICO	**MATERIALS:** Re: Section 402 - Bituminous Materials
DATE: 2004	**Web Address:** www.nmshtd.state.nm.us
Materials Engineer: John Tenison	**Email Address:** john.tenison@nmshtd.state.nm.us

ASPHALT BINDER:

Section 402	**Description:**	Performance-graded asphalt binder shall meet the requirements of AASHTO M 320, Standard Specification for Performance-Graded Asphalt Binder.
	PMA's:	None stated.
	Exclusions:	None stated.

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grade)**						
			58-28	**64-28**	**64-22**	**70-28**	**70-22**	**76-22**	**82-22**
ORIGINAL:									
Specific Gravity	15.6°C	ASTM D 70	Report						
Flash Point, °C		T 48	230 min.						
Rotational Viscosity, Pa s	135°C	T 316	3 max.						
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature						
RTFOT RESIDUE:									
Mass Loss, %		T 240	1.0 max.						
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature						
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi						
Dynamic Shear, kPa (G* • sin 10 rad./sec.)	5,000 max.	T 315	19°C	22°C	25°C		28°C	31°C	34°C
Creep Stiffness	S, 300 MPa	T 313	-18°C		-12°C	-18°C	-12°C		
	m Value, 0.300								
Direct Tension, % Strain	1.0 min.	T 314							
PG PLUS REQUIREMENTS: NO									

STATE: NEW YORK	**MATERIALS:** Re: Section 401-2.04 - Bituminous Materials
DATE: 2004	**Web Address:** www.dot.state.ny.us
Materials Engineer: Zoeb Zavery	**Email Address:** zzavery@dot.state.ny.us

ASPHALT BINDER:

Section 401-2.04	**Description:**	Use the Performance-Graded Binder (PG) in the production of these mixtures that meet the AASHTO M 320 Standard Specification for Performance-Graded Asphalt Binder. The temperature of PG Binder delivered to the HMA Production Facility will not exceed 175°C, unless the PG Binder supplier recommends it.
	PMA's:	
	Exclusions:	Acid, used motor oil, air blown, etc.

PROPERTY		**Test Method AASHTO**	**Requirements by Performance Grade, PG (Common Grade)**		
			64-28	**70-22**	**76-22**
ORIGINAL:					
Specific Gravity	15.6°C	ASTM D 70	Report		
Flash Point, °C		T 48	230 min.		
Rotational Viscosity, Pa s	135°C	T 316	3 max.		
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature		
RTFOT RESIDUE:					
Mass Loss, %		AASHTO T 240	1.0 max.		
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature		
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi		
Dynamic Shear, kPa (G* • sin 10 rad./sec.)	5,000 max.	T 315	22°C	28°C	31°C
Creep Stiffness	S, ~~3~~300 MPa	T 313	-18°C	-12°C	
	m Value, 0.300				
Direct Tension		T 314	NA		
PG PLUS REQUIREMENTS: Yes					
RTFOT RESIDUE:					
Elastic Recovery, %	25°C	T 301	NA	60	70
NOTES:					
Elastic Recovery to 100 mm, cut immediately.					

STATE: NORTH CAROLINA	**MATERIALS:** Re: Section 1020-2 - Asphalt Binder
DATE: 2004	**Web Address:** www.dot.state.nc.us
Materials Engineer: Chris Bacchi	**Email Address:** cbacchi@dot.state.nc.us

ASPHALT BINDER:

Section 1020-2	**Description:**	Performance-graded asphalt binder shall meet the requirements of AASHTO M 320.
	PMA's:	None stated.
	Exclusions:	None stated.

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grades)**		
			64-22	**70-22**	**76-22**
ORIGINAL:					
Specific Gravity	15.6°C	ASTM D 70	Report		
Flash Point, °C		T 48	230 min.		
Rotational Viscosity, Pa s	135°C	T 316	3 max.		
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature		
RTFOT RESIDUE:					
Mass Loss, %		T 240	1.0 max.		
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature		
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi		
Dynamic Shear, kPa (G* • sin 10 rad./sec.)	5,000 max.	T 315	25°C	28°C	31°C
Creep Stiffness	S, 300MPa	T 313	-12°C		
	m Value, 0.300				
Direct Tension, Strain, Min., °C		T 314	NA		
PG PLUS REQUIREMENTS: NO					

STATE: NORTH DAKOTA	**MATERIALS:** Re: Section 818.02 - Asphalt Cement
DATE: 2004	**Web Address:** www.state.nd.us/dot
Materials Engineer: Joe Davis	**Email Address:** jdavis@state.nd.us

ASPHALT BINDER:

Section 818.02	**Description:**	1. Penetration-Graded Asphalt Cement will comply with AASHTO M 20. 2. Viscosity-Graded Asphalt Cement will comply with AASHTO M 226, Table 2. 3. Performance-Graded (PG) Asphalt Cement will comply with AASHTO M 320.
	PMA's:	None stated.
	Exclusions:	None stated.

PROPERTY		**Test Method AASHTO**	**Requirements by Performance Grade, PG (Common Grade)**			
			58-34	**58-28**	**64-28**	**70-28**
ORIGINAL:						
Flash Point, °C		T 48	230 min.			
Rotational Viscosity, Pa s	135°C	T 316	3 max.			
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature			
RTFOT RESIDUE:						
Mass Loss, %		T 240	1.0 max.			
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature			
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi			
Dynamic Shear, kPa (G* • sin 10 rad./sec.)	5,000 max.	T 315	16°C	19°C	22°C	25°C
Creep Stiffness	S, 300 MPa m Value, 0.300	T 313	-24°C	-18°C		
Direct Tension, Strain, Min., °C		T 314	NA			
PG PLUS REQUIREMENTS: Yes in 2005						

STATE: OHIO	**MATERIALS:** Re: Section 908 - Bituminous Materials
DATE: 2004	**Web Address:** www.dot.state.oh.us
Materials Engineer: Dave Powers	**Email Address:** david.powers@dot.state.oh.us

ASPHALT BINDER:

Section 908	**Description:**	The PG Binder shall be homogenous, free from water and deleterious materials, and shall not foam when heated to 350°F (175°C). The asphalt binder (before modification or after modification if liquid modified used) shall be proven fully compatible with a negative result by means of the Spot Test per AASHTO T 102 using standard naphtha solvent. If standard naphtha shows a positive results, a retest using 35% Xylene/65% Heptane (volume) may be used. The PG Binder shall be at least 99% soluble as determined by ASTM D 5546 or D 2042. Any insoluble component shall be substantially free of fibers and have discrete particles less than 75um. Flash Point shall be 500°F (260°C) min. Mass Loss on RTFOT of final PG grade binder shall be 0.5% max. PG 58-28 shall have a minimum Viscosity (ASTM D 2171 @ 60°C) of 800 Poise and PG 64-22 shall have a Penetration (ASTM D 5) between 55 & 75. Direct Tension testing is not required, unless otherwise required in this specification.
	PMA's:	A PGM Binder shall meet the requirements of Table A and shall be obtained through modification of a non-oxidized, neat asphalt binder by using a styrene butadiene latex rubber compound (SBR polymer) or a styrene butadiene styrene polymer block copolymer (SBS polymer).
	Exclusions:	Air Blown Asphalts for PMA's

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grade)**				
			58-28	**64-22**	**64-28**	**70-22PM***	**76-22PM***
ORIGINAL:							
Specific Gravity	15.6°C	ASTM D 70	Report				
Flash Point, °C		T 48	260 min.				
Viscosity, Pa s,	135°C	T 316	3 max.				
Dynamic Shear, kPa (G* / sin 10 rad./sec)	1.0 min.	T 315	At grade temperature				
RTFOT RESIDUE:							
Mass Loss, %		T 240	0.5 max.				
Dynamic Shear, kPa (G* / sin 10 rad./sec)	2.20 min.	T 315	At grade temperature				
PAV RESIDUE		R 28	100°C; 20hrs; 300 psi				
Dynamic Shear, kPa (G* • sin 10 rad./sec)	5,000 max.	T 315	19°C	25°C	22°C	28°C	31°C
Creep Stiffness	S, 300MPa m Value, 0.300	T 313	-18°C	-12°C	-18°C	-12°C	
Direct Tension, % Strain		T 314	NA				
PG PLUS REQUIREMENTS: YES							
Viscosity, Poise,	60°C	ASTM D 2171	800	----			
Penetration,100g, 5 sec, dmm	25°C	ASTM D 5	--	55-75	--	--	--
Dynamic Shear, Phase Angle, °		T 315	------			80 70°C	76 76°C
Separation[a], Softening Point Difference, °F		--	------			10	
Homogeneity [b], lumps nor particles on 50 mesh		--	------			None	
RTFOT RESIDUE:							
Elastic Recovery, 10 cm, %	25°C	ASTM D 113	----			65	75

NOTES:

[a] Separation: (340°F, 48 hours)

[b] Homogeneity: 400g, 177°C, 2.5 hrs

*Required to report actual high and low pass temperature, shall not grade out to -28°C grade. (PG 70-22PM test @ 70 & 76, -12 & -18°C; PG 76-22PM test @ 76 & 82, -12 & -18°C).

Table A
Material Requirements for PGM Binder

Test / Requirement	SBR Polymer		SBS Polymer		Notes
Final PG Binder Grade	70-22 (a)	70-22 (b)	70-22 (a)	776-22 (a)	c
Actual Pass Temperatures	Report				i
RTFOT Mass Loss, %	≤ 0.5				d
Phase Angle °	≥76		≥80	≥76	d
Elastic Recovery, %	--		≥65	≥75	e
Toughness, in lb	≥118		----		f, d
Tenacity, in lb	≥68				f, d
Elongation, in	≥20		----		f, d
Ductility, in	≥28		----		j, d
Separation, °F	≥10	--	≥10		g
Homogeneity	--		None Visible		h, d

NOTES:

a. Pre-blended PGM binder with a base binder of at least -22 grade or stiffer.
b. Post blended PGM binder make from neat Supplement 1032 certified or preapproved standard PG binder grade and rubber solids amount equal to or above 3.5 percent by weight of total binder to achieve the PG binder grade.
c. As required by 908.052.
d. PGM binder.
e. ASTM D 113, 10 cm @ 25°C on RTFO material.
f. ASTM D 5801, 50 cm/min. @ 25°C.
g. Softening Point difference of top and bottom of frozen sealed aluminum tube conditioned at 340°F for 48 hours. Compatibility of polymer and neat binder is sole responsibility of supplier. PGM binder shall be formulated to retain dispersion for 3 days minimum. Failure in the field to retain dispersion for this time will mean automatic removal from Supplement 1032 certification.
h. Heat a minimum 400 gram sample at 177°C for 2.5 -3.0 hours. Pour entire sample over a hot No. 50 (300 um) sieve at 340°F. Look for retained polymer lumps.
i. Actual high and low temperature achieved by PGM binder beyond required grade, but shall not grade out to the next standard PG binder grade for low temperature.
j. ASTM D 113 @ 4°C, 1 cm/min.

STATE: OKLAHOMA	**MATERIALS:** Re: Section 708.03 - Asphalt Materials
DATE: 2004	**Web Address:** www.okladot.state.ok.us
Bituminous Engineer: Danny Gierhart	**Email Address:** dgierhart@odot.org

ASPHALT BINDER:

Section 708.03	**Description:**	Additional requirements for asphalt cement. PG 64-22 OK, PG 70-28 OK, & PG 76-28 OK shall meet the requirements for PG 64-22, PG 70-28, & PG 76-28 as shown in AASHTO M 320. Additionally, they must meet the requirements as shown below.
	PMA's:	Requirements for Type IV Polymer Modified Asphalt Cement, see Table 3D. Type IV is normally produced by modifying conventional asphalt cements with 5% ground tire rubber and styrene block copolymers.
	Exclusions:	None stated.

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grade)**		
			64-22OK	**70-28OK**	**76-28OK**
ORIGINAL:					
Specific Gravity	15.6°C	ASTM D 70	Report		
Flash Point, °C		T 48	230 - 288		
Rotational Viscosity, Pa s	135°C	T 316	3 max.		
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	1.0 - 2.5	T 315	At grade temperature		
RTFOT RESIDUE:					
Mass Loss, %		T 240	1.0 max.		
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	2.20 - 5.5 min.	T 315	At grade temperature		
PAV RESIDUE		R 28	100°C; 20hrs; 300 psi		
Dynamic Shear, kPa (G* • sin 10 rad./sec.)	5,000 max.	T 315	25°C		28°C
Creep Stiffness	S, 300 MPa	T 313	-12°C	-18°C	
	m Value, 0.300				
Direct Tension, % Strain		T 314	NA		
PG PLUS REQUIREMENTS: YES					
Separation, SP %, Top & Bottom		ASTM D 5976	10		
Solubility in Trichloroethylene		T 44	99.0		
Spot Test		T 102	Negative	--	--
RTFOT RESIDUE:					
Elastic Recovery, %	25°C	ASTM D 6084	n/a	65	75

Table 3D:

Grade Test		**AC 15-5TR[1]**	
		Min.	**Max.**
ORIGINAL BINDER:			
Penetration, 100 g, 5 sec.	25°C	75	125
Viscosity, Poise	60°C	1,500	--
Viscosity, cSt	135°C	--	2,000
Ductility, 5 cm/min., cm	4°C	40	--
Elastic Recovery, 10 cm, 5 cm/min., % recovery after 1 hour	25°C	55	--
Softening Point, °C		45	--
Separation, R&B Difference, °C		--	2.2
Solubility in Trichloroethylene		98	--
RTFOT RESIDUE:			
Retained Penetration, 100 g, 5 sec./Orig.	25°C	60	--
Storage Temperature, °C		150	190
Application Temperature, °C		150	190

NOTES:

[1] Current supplier has recently stopped making AC 15-5TR and is now supplying AC 20-5TR. OK DOT is currently going through the process of creating and approving a new specification for AC 20-5TR. This specification is in "draft" status. It specifies a minimum SBS content of 3%. The 5% ground tire rubber requirement remains unchanged. There are several differences in the new draft specification other than a minor tweaking of viscosity requirements and softening point. The new specification incorporates several SUPERPAVE Binder tests such as DSR and BBR tests. Cannot send copy of the specification until it is removed from "draft" status.

STATE: OREGON	**MATERIALS:** Re: Standard Specifications for Asphalt Materials - 2003
DATE: 2004	**Web Address:** www.odot.state.or.us
Materials Engineer: Bruce Patterson	**Email Address:** bruce.m.patterson@odot.state.or.us

ASPHALT BINDER:

Section	**Description:**	The asphalt cement furnished under this specification shall be petroleum asphalt prepared by the refining of crude petroleum and, when necessary, by the addition of modifiers designed to provide the asphalt characteristics specified. It shall be homogenous and free from water, and it shall not have been distilled at a temperature high enough to injure by burning or high enough to produce flecks of carbonaceous matter. It shall meet the requirements of AASHTO M 320, Standard Specification for Performance-Graded Asphalt Binder, at the time of use when tested according to the methods specified.
	PMA's:	None stated.
	Exclusions:	None stated.

PROPERTY		**Test Method AASHTO**	**Requirements by Performance Grade, PG (Common Grades)**				
			64-28	**64-22**	**70-22**	**70-28**	**76-22**
ORIGINAL:							
Specific Gravity	15.6°C	ASTM D 70	Report				
Flash Point, °C		T 48	230 min.				
Rotational Viscosity, Pa s	135°C	T 316	3 max.				
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature				
RTFOT RESIDUE:							
Mass Loss, %		T 240	1.0 max.				
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature				
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi				
Dynamic Shear, kPa (G* • sin 10 rad./sec.)	5,000 max.	T 315	22°C	25°C	28°C	25°C	31°C
Creep Stiffness	S, ~~300~~ MPa	T 313	-18°C	-12°C		-18°C	-12°C
	m Value, ~~0~~.300						
Direct Tension		T 314	NA				
PG PLUS REQUIREMENTS: NO							

STATE: PENNSYLVANIA	**MATERIALS:** Re: Section 409 - Bituminous Materials
DATE: 2004	**Web Address:** www.dot.state.pa.us
Materials Engineer: Dean Maurer	**Email Address:** dmaurer@state.pa.us

ASPHALT BINDER:

Section 409	**Description:**	PA DOT only recognizes one standard grade of PG 76-22. It is in fact required to be neat asphalt binder modified with SB or SBS polymers only. Consistent with previous point, Acid, Oxidation, and any other modifiers are not permitted (with the exception of anti-strip agents).
	PMA's:	None stated.
	Exclusions:	None stated.

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grades)**		
			58-28	**64-22**	**76-22**
ORIGINAL:					
Specific Gravity	15.6°C	ASTM D 70	Report		
Flash Point, °C		T 48	230 min.		
Viscosity, Pa s	135°C	T 316	3 max.		
Dynamic Shear, kPa G* / sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature		
RTFOT RESIDUE:					
Mass Loss, %		AASHTO T 240	1.0 max.		
Dynamic Shear, kPa G* / sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature		
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi		
Dynamic Shear, kPa G* • sin 10 rad./sec.)	5,000 max.	T 315	19°C	25°C	31°C
Creep Stiffness	S, 300 MPa m Value, 0.300	T 313	-18°C	-12°C	
Direct Tension		T 314	NA		
PG PLUS REQUIREMENTS: YES					
ORIGINAL:					
Separation, Softening Point Difference, 48 hours, °C	163°C	ASTM D 5892	---		2.2
RTFOT RESIDUE:					
Elastic Recovery, 10 cm, %	25°C	ASTM D 113	---		60
NOTES:					
See Bulletin 25					

STATE: RHODE ISLAND	**MATERIALS:** Re: Section M.03.02 Materials
DATE: 2004	**Web Address: www.dot.state.ri.us**
Materials Engineer: Mike Byrne	**Email Address:** mpbyrne@dot.state.ri.us

ASPHALT BINDER:

Section M.03.02	**Description:**	This Specification covers performance graded asphalt cement for use in pavement construction. The asphalt cement shall be homogeneous, free from water, and shall not foam when heated to 175°C (347°F). The asphalt cement shall be sampled and tested in accordance with and meet all the requirements of AASHTO MP 1A for PG 64-28 binder.
	PMA's:	None stated.
	Exclusions:	None stated.

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grade)**
			64-28
ORIGINAL:			
Specific Gravity	15.6°C	ASTM D 70	Report
Flash Point, °C		T 48	230 min.
Viscosity, Pa ♦s	135°C	T 316	3 max.
Dynamic Shear, kPa (G* / sin ☒10 rad./sec.)	1.0 min.	T 315	At grade temperature
RTFOT RESIDUE:			
Mass Loss, %		T 240	1.0 max.
Dynamic Shear, kPa (G* / sin ☒10 rad./sec.)	2.20 min.	T 315	At grade temperature
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi
Dynamic Shear, kPa (G* • sin ☒10 rad./sec.)	5,000 max.	T 315	22°C
Creep Stiffness	S, ☠300 MPa	T 313	-18°C
	m Value, ☠0.300		
Direct Tension		T 314	NA
PG PLUS REQUIREMENTS: NO			

STATE: SOUTH CAROLINA	**MATERIALS:** Re: Section 401.02 - Asphalt Binder & Additives
DATE: 2004	**Web Address:** www.dot.state.sc.us
Materials Engineer: Milt Fletcher	**Email Address:** fletchermo@dot.state.sc.us

ASPHALT BINDER:

Section 401.02	**Description:**	Asphalt binder (asphalt cement) shall conform to all the requirements of AASHTO M 320 and meet the performance grading within the following table unless otherwise noted in the contract.
	PMA's:	Polymer Modified Asphalt Binder shall be a neat asphalt binder modified with an elastomer polymer to produce a binder that complies wit the requirements of a PG 76-22 as specified in AASHTO M 320. The neat asphalt shall meet the requirements for PG 64-22 or PG 67-22 and be production "straight run" materials that have not been "air-blown." The elastomer polymer shall be a styrene-butadiene (SB), styrene-butadiene-styrene (SBS) or styrene-butadiene-rubber (SBR).
	Exclusions:	Air Blown for PMA's.

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grade)**	
			64-22	**76-22**
ORIGINAL:				
Specific Gravity @ 15.6°C	15.6°C	ASTM D 70	Report	
Flash Point, °C		T 48	230 min.	
Rotational Viscosity, Pa s	135°C	T 316	3 max.	
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature	
RTFOT RESIDUE:				
Mass Loss, %		T 240	1.0 max.	
Dynamic Shear, kPa (G* /sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature	
PAV RESIDUE		R 28	100°C; 20hrs; 300 psi	
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	25°C	31°C
Creep Stiffness	S, 300 MPa	T 313	-12°C	
	m Value, 0.300			
Direct Tension, % Strain		T 314	NA	
PG PLUS REQUIREMENTS: NO				

STATE: SOUTH DAKOTA	**MATERIALS:** Re: Section 890.2 (D) - Asphalt Materials
DATE: 2004	**Web Address:** www.sddot.com
Materials Engineer: Rick Bowen	**Email Address:** rick.bowen@state.sd.us

ASPHALT BINDER:

Section 890.2 (D)	**Description:**	Performance-Graded Asphalt Binder shall conform to AASHTO Performance Graded Binder Specifications M 320 and the Combined State Binder Group Method of Acceptance for Asphalt Binders available from the SD DOT Bituminous Engineer.
	PMA's:	The asphalt binder shall, if necessary, be blended at the terminal with permissible additives styrene-butadiene styrene (SBS) or styrene-butadiene rubber (SBR) necessary to meet the specifications. The type of modifier supplied shall be listed on the certificate of compliance.
	Exclusions:	Air blown asphalts, acid modifiers, and other modifiers will not be allowed.

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grades)**					
			58-34	**64-34**	**64-22**	**64-28**	**70-34**	**70-28**
ORIGINAL:								
Specific Gravity	15.6°C	ASTM D 70	Report					
Flash Point, °C		T 48	230 min.					
Rotational Viscosity, Pa s	135°C	T 316	3 max.					
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature					
RTFOT RESIDUE:								
Mass Loss, %		T 240	1.0 max.					
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature					
PAV RESIDUE		R 28	100°C; 230 hrs; 300 psi					
Dynamic Shear, kPa (G* • sin 10 rad./sec.)	5,000 max.	T 315	16°C	19°C	25°C	22°C		25°C
Creep Stiffness	S, 300 MPa	T 313	-24°C		-12°C	-18°C	-24°C	-18°C
	m Value, 0.300							
Direct Tension, % Strain		T 314	NA					
PG PLUS REQUIREMENTS: YES								
RTFOT RESIDUE								
Elastic Recovery, %, 100 mm, cut immediately, min.	25°C	T 301	60		--	60		

STATE: TENNESSEE	**MATERIALS:** Re: Subsection 904.04
DATE: 2004	**Web Address:** www.tdot.state.tn.us
Materials Engineer: Gary Head	**Email Address:** gary.head@state.tn.us

ASPHALT BINDER:

Section 904.01	**Description:**	Asphalt cement shall conform to the requirements of AASHTO M 320 for PG 64-22. When asphalt cement PG 70-22 or PG 76-22 is specified, the asphalt cement shall conform to AASHTO M 320.
	PMA's:	Modification of the asphalt shall be accomplished by properly blending styrene butadiene (SB), styrene-butadiene-styrene (SBS) or styrene butadiene rubber (SBR) to a PG 64-22 base asphalt
	Exclusions:	None stated.

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grade)**			
			64-22	**70-22**	**76-22**	**76-22PM**
ORIGINAL:						
Specific Gravity	15.6°C	ASTM D 70	Report			
Flash Point, °C		T 48	230 min.			
Viscosity, Pa s	135°C	T 316	3 max.			
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature			
RTFOT RESIDUE:						
Mass Loss, %		T 240	1.0 max.			
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature			
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi			
Dynamic Shear, kPa (G* • sin 10 rad./sec.)	5,000 max.	T 315	25°C	28°C	31°C	
Creep Stiffness	S, 300MPa	T 313	-12°C			
	m Value, 0.300					
Direct Tension		T 314	NA			
PG PLUS REQUIREMENTS: YES						
ORIGINAL:						
Viscosity, Contractor Plant Testing	135°C	T 316	--	650-3,000	1,000-3,000	1,000-3,000
Ring & Ball Softening Point, °C (°F) min.		T 53	--	53 (128)	57 (135)	57 (135)
Elastic Recovery, %	10°C	ASTM D 6084	--	40	58	
Screen Test, lumps / particles		TN	--	0		
NOTES:						
Elastic Recovery, 20 cm, cut 5 min., 1 hr,						
Screen Test: 1000 grams, No. 10 Sieve, 135°C, lumps/particles)						

STATE: TEXAS	**MATERIALS:** Re: Section 300 - Asphalt Materials
DATE: 2004	**Web Address:** www.dot.state.tx.us
Materials Engineer: Darren Hazlett	**Email Address:** dhazlet@dot.state.tx.us

ASPHALT BINDER:

Section 300	**Description:**	Performance-Graded Asphalt Binders must be smooth and homogeneous, show no separation when tested in accordance with Tex-540-C, and meet Table 17 requirements.
	PMA's:	Separation testing is not required if: a modifier is introduced separately at the mix plant either by injection in the asphalt line or mixer; the binder is blended on site in continuously agitated tanks; or binder acceptance is based on field samples taken from an in-line sampling port at the hot mix plant after the addition of modifiers.
	Exclusions:	None stated.

Table 17:

PROPERTY		**Test Method AASHTO**	**Requirements by Performance Grade, PG (Common Grades)**																		
			58			**64**				**70**				**76**				**82**			
			-22	**-28**	**-34**	**-16**	**-22**	**-28**	**-34**	**-16**	**-22**	**-28**	**-34**	**-16**	**-22**	**-28**	**-34**	**-16**	**-22**	**-28**
ORIGINAL:																					
Specific Gravity	15.6°C	ASTM D 70	Report																		
Flash Point, °C		T 48	230 min.																		
Rotational Viscosity, Pa s	135°C	T 316	3 max.																		
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	1. min.	T 315	At grade temperature																		
RTFOT RESIDUE:																					
Mass Loss, %		Tex 541-C	1.0 max.																		
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature																		
PAV RESIDUE		R 28	100°C; 20hrs; 300 psi																		
Dynamic Shear, kPa (G* • sin 10 rad./sec.)	5,000 max.	T 315	25	22	19	28	25	22	19	28	25	22	19	28	25	22	19	28	25	22	
Creep Stiffness	S, ~~300~~ MPa	T 313	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	
	m Value, ~~0.300~~																				
Direct Tension	1.0 min.	T 314																			
PG PLUS REQUIREMENTS: YES																					
RTFOT RESIDUE:																					
Elastic Recovery, % min.	25°C	T 301	----	30		----	30	50	--	30	50	60		30	50	60	70	50	60	70	
NOTES:																					
ER: 100 mm, cut immediately																					

STATE: UTAH	**MATERIALS:** Re: Section 02745 - Asphalt Materials
DATE: 2004	**Web Address:** www.sr.ex.state.ut.us
Materials Engineer: Cameron Patterson	**Email Address:** cameronpetersen@utah.gov

ASPHALT BINDER:

Section 02745	**Description:**	Supply PGAB's under the Approved Supplier Certification (AC) System. Refer to the UDOT Minimum Sampling and Testing Guide, Section 509, Asphalt Binder Management Plan. As specified in AASHTO M 320 for all PGAB's having algebraic differences less than 92 degrees between the high and low design temperatuers. As specified in Tables 1, 2, 3, 4, 5, 6, 7, & 8 for all PGAB's having algebraic differences equal to or greater than 92 degrees between the high and low design temperatures.
	PMA's:	None stated.
	Exclusions:	None stated.

Table 17:

PROPERTY		Test Method AASHTO or Other	Requirements by Performance Grade, PG (Common Grades)							
			58-34	**64-28**	**64-34**	**70-22**	**70-28**	**70-34**	**76-22**	**76-28**
ORIGINAL:										
Specific Gravity	15.6°C	ASTM D 70	Report							
Flash Point, °C		T 48	260 min.							
Rotational Viscosity,Pa s	135°C	T 316	3 max.							
Dynamic Shear, kPa (G* / sin ⊠10 rad./sec.)	1.30min.	T 315	At grade temperature							
RTFOT RESIDUE:										
Mass Loss, %		--	Not required							
Elastic Recovery, % min.	25°C	T 301	65	65	70	65	70	75	70	75
Dynamic Shear, kPa (G* / sin ⊠10 rad./sec.)	2.20 min.	T 315	At grade temperature							
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi							
Dynamic Shear, kPa (G* • sin ⊠10 rad./sec.)	5,000 max.	T 315	16°C	22°C	19°C	28°C	25°C	22°C	31°C	28°C
Creep Stiffness	S, ≤300 MPa	T 313	-24°C	-18°C	-24°C	-12°C	-18°C	-24°C	-12°C	-18°C
	m Value, ≥0.300									
Direct Tension	Strain, %	T 314	1.5 min.							
	Failure Stress, MPa		4.0 min.							
	Temp, °C		-24	-18	-24	-12	-18	-24	-12	-18
PG PLUS REQUIREMENTS: YES										
ORIGINAL:										
DSR Phase Angle, °, max.		T 315	74	74	71	74	71		71	
RTFOT RESIDUE:										
Elastic Recovery, % min.	25°C	T 301	65	65	70	65	70	75	70	75
NOTES:										
Elastic Recovery: 100 mm, cut immediately										

STATE: VERMONT	**MATERIALS:** Re: Section 702 - Asphalt Materials
DATE: 2004	**Web Address:** www.dot.state.vt.us
Materials Engineer: Donald Lathrop	**Email Address:** donald.lathrop@state.vt.us

ASPHALT BINDER:

Section 702	**Description:**	The asphalt cement shall be homogenous, free from water and shall not foam when heated to 175°C (350°F). The various grades of asphalt cement shall be performance grade (PG) as specified in AASHTO M 320. Specific requirements for the specified grade of asphalt cement shall be as designated in Table 702.02A.
	PMA's:	None stated.
	Exclusions:	None stated.

PROPERTY		**Test Method AASHTO**	**Requirements by Performance Grade, PG (Common Grade)**				
			58-28	**58-34**	**64-28**	**64-34**	**70-28**
ORIGINAL:							
Specific Gravity	25°C	T 228	Report				
Flash Point, °C		T 48	230 min.				
Rotational Viscosity, Pa s	135°C	T 316	3 max.				
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature				
RTFOT RESIDUE:							
Mass Loss, %		T 240	1.0 max.				
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature				
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi				
Dynamic Shear, kPa (G* • sin 10 rad./sec.)	5,000 max.	T 315	19°C	16°C	22°C	19°C	25°C
Creep Stiffness	S, 300MPa	T 313	-18°C	-24°C	-18°C	-24°C	-18°C
	m Value, 0.300						
Direct Tension		T 314	NA				
PG PLUS REQUIREMENTS: NO							

STATE: VIRGINIA	**MATERIALS:** Re: Section 210 - Asphalt Materials
DATE: 2004	**Web Address:** www.dot.state.va.us
Materials Engineer: Michael Wells	**Email Address:** michael.wells@vdot.virginia.gov

ASPHALT BINDER:

Section 210	**Description:**	Asphalt materials shall conform to the requirements of Section 210 except asphalt cement materials shall be Performance Graded (PG) conforming to the requirements of AASHTO Provisional Specification M 320.
	PMA's:	Type (M) asphalt mixtures shall consist of mixes incorporating a neat asphalt material with polymer modification meeting the requirements of a PG 76-22 and have a Rolling Thin Film Oven Test residue Elastic Recovery @ 77°F of a minimum of 70%.
	Exclusions:	None stated.

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grade)**		
			64-22	**70-22**	**76-22**
ORIGINAL:					
Specific Gravity	15.6°C	ASTM D 70	Report		
Flash Point, °C		T 48	230 min.		
Viscosity, Pa ♦s	135°C	T 316	3 max.		
Dynamic Shear, kPa G* / sin ☒10 rad./sec.)	1.0 min.	T 315	At grade temperature		
RTFOT RESIDUE:					
Mass Loss, %		T 240	1.0 max.		
Dynamic Shear, kPa (G* / sin ☒10 rad./sec.)	2.20 min.	T 315	At grade temperature		
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi		
Dynamic Shear, kPa (G* ♦sin ☒10 rad./sec.)	5,000 max.	T 315	25°C	28°C	31°C
Creep Stiffness	S, ♣300 MPa	T 313	-12°C		
	m Value, ♣0.300				
Direct Tension		T 314	--		
PG PLUS REQUIREMENTS: YES					
RTFOT RESIDUE:					
Elastic Recovery, %	25°C	T 301	---		♣70

STATE: WASHINGTON STATE	**MATERIALS:** Re: Section 9-02 - Bituminous Materials
DATE: 2004	**Web Address:** www.wsdot.wa.gov
Materials Engineer: Dennis Duffy	**Email Address:** duffy@wsdot.wa.gov

ASPHALT BINDER:

Section 9-02	**Description:**	All Performance Graded Binders not included in this chart shall be determined by Table 1 "Performance Graded Asphalt" Specification Chart in AASHTO M 320.
	PMA's:	None stated.
	Exclusions:	None stated.

Table 17:

PROPERTY		Test Method AASHTO or Other	Common Performance Graded (PG) Asphalt Cement										
			58-22	58-28	58-34	64-22	64-28	64-34	70-22	70-28	70-34	76-22	76-28
ORIGINAL:													
Specific Gravity	15.6°C	ASTM D 70	Report										
Flash Point, °C		T 48	260 min.										
Rotational Viscosity, Pa s	135°C	T 316	3 max.										
Dynamic Shear, kPa (G* / sin δ 10 rad./sec.)	1.0 min.	T 315	At grade temperature										
RTFOT RESIDUE:													
Mass Loss, %		--	1.0 max.										
Dynamic Shear, kPa (G* / sin δ 10 rad./sec.)	2.20 min.	T 315	At grade temperature										
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi										
Dynamic Shear, kPa (G* • sin δ 10 rad./sec.)	5,000 max.	T 315	22°C	19°C	16°C	25°C	22°C	19°C	28°C	25°C	22°C	31°C	28°C
Creep Stiffness	S, ~~≤~~300 MPa	T 313	-12°C	-18°C	-24°C	-12°C	-18°C	-24°C	-12°C	-18°C	-24°C	-12°C	-18°C
	m Value, ~~≥~~0.300												
Direct Tension, % Strain		T 314	NA										
PG PLUS REQUIREMENTS: NO													

STATE: WEST VIRGINIA	**MATERIALS:** Re: Section 705.5 - Bituminous Materials
DATE: 2004	**Web Address:** www.wvdot.com
Materials Engineer: Richard Genthner	**Email Address:** rgenthner@dot.state.wv.us

ASPHALT BINDER:

Section 705.5	**Description:**	Performance graded binders shall conform to the requirements of AASHTO M 320.
	PMA's:	None stated.
	Exclusions:	None stated.

PROPERTY		Test Method AASHTO or Other	Requirements by Performance Grade, PG (Common Grade)				
			58-28	64-28	64-22	70-22	76-22
ORIGINAL:							
Specific Gravity	15.6°C	ASTM D 70	Report				
Flash Point, °C		T 48	230 min.				
Viscosity, Pa s	135°C	T 316	3 max.				
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	1.0 min.	T 315	At grade temperature				
RTFOT RESIDUE:							
Mass Loss, %		T 240	1.0 max.				
Dynamic Shear, kPa (G* / sin 10 rad./sec.)	2.20 min.	T 315	At grade temperature				
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi				
Dynamic Shear, kPa (G* sin 10 rad./sec.)	5,000 max.	T 315	19°C	22°C	25°C	28°C	31°C
Creep Stiffness	S, 300MPa	T 313	-18°C		-12°C		
	m Value, 0.300						
Direct Tension		T 314	NA				
PG PLUS REQUIREMENTS: YES							
Elastic Recovery, %	25°C	T 301	NA				70
NOTES: At this time, have not specified a particular modifier for 76-22.							

STATE: WISCONSIN	**MATERIALS:** Re: Section 401-2.3 - Bituminous Materials
DATE: 2004	**Web Address:** www.dot.state.wi.us
Materials Engineer: John Volker	**Email Address:** john.volker@dot.state.wi.us

ASPHALT BINDER:

Section 401-2.3	**Description**	The bituminous material shall conform to the requirements of AASHTO M 320, Performance Graded (PG) binder designation.
	PMA's:	None stated.
	Exclusions:	None stated.

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grades)**					
			58-34	**58-28**	**64-34**	**64-28**	**64-22**	**70-28**
ORIGINAL:								
Specific Gravity @ 15.6°C	15.6°C	ASTM D 70	Report					
Flash Point, °C		T 48	230 min.					
Viscosity, Pa ✎s	135°C	T 316	3 max.					
Dynamic Shear, kPa (G* / sin ☒10 rad./sec.)	1.0 min.	T 315	At grade temperature					
RTFOT RESIDUE:								
Mass Loss, %		T 240	1.0 max.					
Dynamic Shear, kPa (G* / sin ☒10 rad./sec.)	2.20 min.	T 315	At grade temperature					
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi					
Dynamic Shear, kPa (G* • sin ☒10 rad./sec.)	5,000 max.	T 315	16°C	19°C		22°C	25°C	
Creep Stiffness	S, ✎300 MPa	T 313	-24°C	-18°C	-24°C	-18°C	-12°C	-18°C
	m Value, ✎0.300							
Direct Tension		T 314	NA					
PG PLUS REQUIREMENTS: NO								

STATE: WYOMING	**MATERIALS:** Re: Section 400 - Bituminous Materials
DATE: 2004	**Web Address:** www.dot.state.wy.us/
Materials Engineer: Bruce Morganstern	**Email Address:** bruce.morgenstern@dot.state.wy.us

ASPHALT BINDER:

Section 400	**Description:**	The Performance Grade Asphalt Binder shall consist of an asphalt binder that is produced from petroleum residue either with or without the addition of polymer modifiers. The base asphalt binder shall be homogeneous, free from water and deleterious materials, and shall not foam when heated to 350°F.
	PMA's:	May be any polymer dissolved dispersed or reacted in AC to enhance performance. May not be carcinogenic. No fibers or other discrete particles ≥250 microns in size
	Exclusions:	Acid.

PROPERTY		**Test Method AASHTO or Other**	**Requirements by Performance Grade, PG (Common Grades)**						
			58-34	**58-28**	**64-34**	**64-28**	**64-22**	**70-22**	**76-22**
ORIGINAL:									
Specific Gravity @ 15.6°C	15.6°C	ASTM D 70	Report						
Flash Point, °C		T 48	230 min.						
Viscosity, Pa·s	135°C	T 316	3 max.						
Dynamic Shear, kPa (G* / sin δ)	1.0 min.	T 315	At grade temperature						
RTFOT RESIDUE:									
Mass Loss, %		T 240	1.0 max.						
Dynamic Shear, kPa (G* / sin δ)	2.20 min.	T 315	At grade temperature						
PAV RESIDUE		R 28	100°C; 20 hrs; 300 psi						
Dynamic Shear, kPa (G* • sin δ)	5,000 max.	T 315	16°C	19°C		22°C	25°C	28°C	
Creep Stiffness	S, ~~≤~~300 MPa m Value, ≥0.300	T 313	-24°C	-18°C	-24°C	-18°C	-12°C		
Direct Tension		T 314	NA						
PG PLUS REQUIREMENTS: YES									
ORIGINAL:									
Elastic Recovery, %	25°C	D 6084	≥60	--	≥60		---	≥60	
NOTES:									
Elastic Recovery: required on all grades where difference between high and low grades is 90+									