SECTION 112

PAVING ASPHALT BINDER

112.1 GENERAL: Paving asphalt binder for asphalt concrete (AC), bituminous treated base course construction (BTB), and plant mixed seal coat (PMSC), shall conform to the requirements of this specification. The CONTRACTOR shall be solely responsible for the binder supplied under this specification, its proportions and manufacture. The binder shall be supplied from a single source/supplier and be of a single formulation for the duration of either the authorized period of a job mix formula including the binder, or the project, as directed by the ENGINEER. The CONTRACTOR shall submit his qualifications in writing, and at least three references to whom he has supplied the same or similar binder, as directed by the ENGINEER.

112.2 REFERENCES

112.2.1 American Society For Testing and Materials, ASTM

D 5 Standard Test Method for Penetration of Bituminous Materials
D 8 Standard Definitions of Terms Relating to Materials for Roads and Pavements
D 92 Standard Test Method for Flash and Fire Points of Bituminous Materials
D 113 Standard Test Method for Ductility of Bituminous Materials
D 946 Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction
D 1754 Standard Test Method for Effect of Heat and Air on Asphaltic Materials (Thin Film Oven Test, TFOT)
D 2042 Standard Test Method for Solubility of Bituminous Materials in Organic Solvents
D 2171 Standard Test Method for Viscosity of Asphalt by Vacuum Capillary Viscometer
D 2170 Standard Test Method for Kinematic Viscosity of Asphalts
D 2872 Standard Test Method for Effect of Heat and Air on Asphaltic Materials (Rolling Thin Film Oven Test, RTFPT)
D 3381 Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction
D 4402 Standard Test Method for Viscosity Determinations of Unfilled Asphalt Using the Brookfield Thermosel Apparatus

112.2.2 American Association of State Highway and Transportation Officials, AASHTO

MP1 Standard Specification for Performance Graded Asphalt Binder
MP2 Specification for Superpave™ Volumetric Mix Design
TP1 Test Method for Determining Flexural Creep Stiffness of Asphalt Binder Using Bending Beam Rheometer (BBR)
TP3 Test Method for Determining Fracture Properties of Asphalt Binders in Direct Tension (DT)
TP5 Test Method for Determining Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)
T40 Practice for Sampling Bituminous Materials
PP1 Accelerated Aging of Asphalt Binder Using Pressure Aging Vessel (PAV)
PP5 Laboratory Evaluation of Modified Asphalt Systems
PP6 Grading or Verifying the Performance Grade of an Asphalt Binder
PP-28 Superpave™ Volumetric Design for HMA

112.2.4 This Publication:

SECTION 116 ASPHALT CONCRETE CONSTRUCTION
SECTION 307 PLANT MIXED BITUMINOUS TREATED BASE COURSE CONSTRUCTION
SECTION 329 PLANT MIXED SEAL COAT
SECTION 336 ASPHALT CONCRETE PAVEMENT

112.3 MATERIAL

112.3.1 An asphalt binder shall be either an asphalt cement, a blend of asphalt cement(s), or a blend of asphalt cement(s) and admixture(s), to be determined by the CONTRACTOR, complying with the requirements specified in either TABLE 112.A 60-70 PENETRATION GRADE BINDER SPECIFICATION, or TABLE 112.B AC-20 VISCOSITY GRADE BINDER SPECIFICATION, or TABLE 112.C PERFORMANCE GRADE (PG) BINDER SPECIFICATIONS.

112.3.2 The CONTRACTOR shall submit certified test results in writing, with the job mix formula submittal, that a binder complies with the specification. The certification shall include, but not be limited to:

(a) name of the supplier
(b) source(s) of base asphalt cement(s)
(c) type and source(s) of admixture(s)
(d) proportions of materials
(e) laboratory test results of the binder
(f) certification statement that the binder complies with the requirements of this specification.

A certification shall be submitted (1) for a binder used in the design of a job mix formula as a part of the

submittal, and, (2) during the life of an authorized job mix formula as scheduled herein.

112.4 SAMPLING AND TESTING

112.4.1.1 Quality assurance sampling and testing of asphalt binders shall be performed by the CONTRACTOR, at no cost to the OWNER, to verify compliance with the specification. A sample shall be taken at random during paving operations from a load(s) of material shipped as directed by the ENGINEER. The sample shall be tested by the CONTRACTOR to verify compliance with the specification requirements specified in either TABLE 112.A 60-70 PENETRATION GRADE BINDER SPECIFICATION, or TABLE 112.B AC-20 VISCOSITY GRADE BINDER SPECIFICATION, or TABLE 112.C PERFORMANCE GRADE (PG) BINDER SPECIFICATIONS. Test results shall be reported in writing to the ENGINEER by the CONTRACTOR. Non-complying sample test results shall be reported in to the ENGINEER within 24 hours of completion of the test(s). Complying sample test results shall be reported in writing to the ENGINEER, no later than ten working days after the date of sampling.

112.4.1.2 The binder sample used in the design of a job mix formula(s) shall be tested, and certified to comply with this specification. Written test results of the design sample binder tabulated with specifications with the certification of compliance shall be reported as specified herein and included in a job mix formula submittal.

112.4.2 A test report shall include, but not be limited to, (1) report date, (2) date of sampling, (3) bill of lading number of load sampled, (4) destination of load, (5) report of test results, (6) standard test identifications, (7) specification requirements, (8) statement of compliance, and certification signature. Failure to comply with quality assurance testing may result in rejection of either the binder, and/or the job mix formula, and/or the associated job mix placed on a project, as directed by the ENGINEER.

112.4.3.1 If non-complying material is identified, the paving program may be suspended for 24 hours, as directed by the ENGINEER, during which time the CONTRACTOR and the ENGINEER will meet to determine the impact of the non-compliance, and specify the necessary remedial action to be taken by the CONTRACTOR. Remedial action shall be either acceptance, or acceptance at a pay adjustment, or removal and replacement at no cost to the OWNER. The paving program may continue upon written authorization by the ENGINEER. The suspension of asphalt concrete construction period due to the identification of non complying binder shall be at no cost to the OWNER.

112.4.3.2 Production binder identified to be in non-compliance shall not be shipped to a project. Asphalt concrete batched and placed with non-complying binder shall be removed and replaced with complying material by the CONTRACTOR at no cost to the OWNER, as directed by the ENGINEER.

112.4.4.1 GRADE CORRELATION: TABLE 112.D defines binder correlation(s). A binder grade to the right of a respective binder grade in the same row may be substituted.

112.4.4.2 A job mix formula using either penetration or viscosity grade binders shall be designed using the Marshall procedure and specifications.

112.4.4.3 A job mix formula using a performance grade, PG, binder shall be designed using the gyratory (SUPERPAVE) procedure and specification.

112.4.4.4 Binder substitution in an authorized job mix formula shall not be allowed.

112.5 TEMPERATURES

112.5.1 The CONTRACTOR shall specify the temperature ranges for mixing and compaction of a job mix formula for a binder, minimum and maximum, ^{o}F. Temperature ranges for mixing and compaction shall be specified in a job mix formula submittal.

112.5.2 The CONTRACTOR shall specify the “release to traffic” temperature, ^{o}F. Release to traffic temperature shall be the maximum temperature at which the viscosity of a binder is greater than 200,000 cps as determined by ASTM D4402. Release to traffic temperature shall be specified in a job mix formula submittal.

112.6 MEASUREMENT AND PAYMENT

112.6.1 Asphalt binder is an ingredient of asphalt concrete (AC), bituminous treated base course construction (BTB), and plant mixed seal coat (PMSC). Binder shall be paid either as incidental to the above materials, or as specified in the CONTRACT, as directed by the ENGINEER.

TABLE 112.A - 60-70 PENETRATION GRADE BINDER SPECIFICATION (ASTM D 946) [1]

		CHARACTERISTIC	min	max	ASTM Procedure
I.		Original Binder			
	1	Penetration @ 25 ^{O}C, 100 g, 5 s, mm	60	70	D 5
	2	Flash Point (Cleveland open cup), ^{O}C	230		D 92
	3	Ductility @ 25 ^{O}C, 5 cm/min, cm	100		D 113
	4	Solubility in trichloroethylene , %	99.0		D 2042
II.		Asphalt after Thin Film Oven Test, TFOT			
	1	Retained penetration @ 25 ^{O}C, 100 g, 5 s, mm	52		D 5
	2	Ductility @ 25 ^{O}C, 5 cm/min, cm	50		D 113

[1] PG64-22 binders shall be used if 60-70 Penetration Grade and AC-20 Viscosity Grade binders are unavailable.

112.B AC-20 VISCOSITY GRADE BINDER (ASTM D 3381, TABLE 2) [1]

CHARACTERISTIC	min	max	Procedure
I. Original Binder			
1 Viscosity @ 60 ^{o}C, poises	1600	2400	ASTM D2171
2 Viscosity @ 135 ^{o}C, cSt	300	-	ASTM D2170
3 Penetration @ 25 ^{o}C, 100 g, 5 s	60	-	ASTM D5
4 Flash Point, , ^{o}C (Cleveland open cup)	230	-	ASTM D92
5 Solubility in trichloroethylene, %	99.0	-	ASTM D2042
II. Tests on Residue From Thin-Film Oven Test			ASTM D1754
1 Viscosity after TFOT @ 60 ^{o}C, poises	-	10,000	ASTM D2171
2 Ductility after TFOT @ 25 ^{o}C, 5 cm/min, cm	50	-	ASTM D113

[1] PG64-22 binders shall be used if 60-70 Penetration Grade and AC-20 Viscosity Grade binders are unavailable.

TABLE 112.C PERFORMANCE GRADE (PG) BINDER SPECIFICATIONS

	Performance Grade Binder Characteristic	PG70-22	PG76-28	Standard Procedure
A.	Original Binder			
1	Dynamic Shear, 1.0 kPa min, G*/sin d @10 $^{rad}/_{sec}$	70	76	AASHTO TP 5
2	Flash Point, min	230	230	ASTM D48
3	Viscosity, 3 Pa. s (3000 cP) max, @temp	135	135	ASTM D4402 [1]
B.	Rolling Thin Film Oven Test Residue, RTFOT (T 240), 1 minute			
1	Mass loss, 1% max	yes	yes	
2	Dynamic Shear, 2.20 kPa, min,G*/sin d @ 10 $^{rad}/_{sec}$	70	76	AASHTO TP 5
C.	Pressure Aging Vessel Residue, PAV (PP1), after RTFOT			
1	PAV Temperature	110	110	
2	Dynamic Shear: G*/sin d , max, 5,000 kPa, @10 $^{rad}/_{sec}$	28	28	AASHTO TP 5
3	Physical Hardening (report) [2]			
a.	Creep Stiffness: S, 300 Mpa , max, m-value, 0.300 minimum, @ 60 s	-12	-18	AASHTO TP 1 [3]
b.	Direct Tension: Failure strain, 1.0 % min @ 1.0 mm/min	-12	-18	AASHTO TP 3 [4]

Notes:

[1] This requirement may be waved if the binder supplier warrants that the supplied binder can be adequately pumped and mixed at temperatures that meet all safety standards.

[2] Physical Hardening - TP1 is performed on a set of asphalt beams according to Section 13.1 of TP 1, except the conditioning is extended to 24 hrs ±10 minutes at 10 ^{O}C above the minimum performance temperature. The 24 hour stiffness, S, and the m-value are reported for information purposes only.

[3] The physical hardening index "h" accounts for the physical hardening of the binder. It shall be determined and reported in the submittal for the proposed binder and each sample tested for compliance with TABLE 112.PG76-28.A. "h" is calculated as follows:

$$h = (S_{24} / S_{1})^{m1 / m24}.$$

"1" and "24" indicate 1 and 24 hours of conditioning of the tank asphalt. Conditioning and testing is conducted at the designated test temperature. Values should be calculated and reported. "S" is the creep stiffness after 60 sec loading time and "m" is the slope of the log creep stiffness versus the log time curve after 60 sec loading time.

[4] If the creep stiffness "S< 300 MPa, the direct tension test is not required. If 300 < S < 600 MPa, the direct tension failure strain requirement can be used in lieu of the creep stiffness requirement. The m-value requirement must be satisfied in both cases.

TABLE 112.D - ASPHALT BINDER CORRELATION(S)

Pen. Grade [1]	Visc. Grade[1]	Performance Grade [2]	
60-70	-	PG70-22	-
-	AC-20	PG70-22	-
-	-	PG70-22	PG76-28
-	-	-	PG76-28

[1] Marshall analysis/design

[2] Gyratory analysis/design