ITEM 702 ASPHALT MATERIAL

Acceptance. The City may accept asphalt binders 702.01 and liquid asphalts 702.02, 702.03, and 702.04 for shipment to and immediate use in construction projects. The City will accept these materials according to City Supplement 1032.

702.00 Application Temperatures. Apply asphalt materials, according to the temperature ranges specified in Table 702.00-1.

TABLE 702.00-1

Type and Grade of Material	Application Temperature Range °F (°C)	
	Spray	Mix
MC-30	50 to 120 (10 to 49)	---
MC-70	75 to 150 (24 to 66)	---
MC-250	100 to 225 (38 to 107)	100 to 225 (38 to 107)
MC-800	150 to 250 (66 to 121)	150 to 225 (66 to 107)
MC-3000	225 to 275 (107 to 135)	200 to 250 (93 to 121)
All Emulsions	50 to 160 (10 to 71)	50 to 140 (10 to 60)
Asphalt Primer for Waterproofing	50 to 80 (10 to 27)	---
Asphalt for Waterproofing	300 to 350 (149 to 177)	---
CBAE 350, CBAE 350 SP	100 to 150 (38 to 66)	100 to 150 (38 to 66)
CBAE 800, CBAE 800 SP	125 to 175 (52 to 79)	125 to 175 (52 to 79)
Primer 20	60 to 120 (16 to 49)	---
Primer 100	75 to 125 (24 to 52)	---
Asphalt Binders	350 (177) Max.	325 (163) Max.
Asphalt Binders-Polymer modified with SB, SBR, or SBS	375 (190) Max	350 (177) Max.

702.01 Asphalt Binders.

General. According to AASHTO M 320-05 except as follows.

PG Binders with the suffix "M" (e.g., PG 70-22M, PG 76-22M) will meet the requirements of Table 702.01-1. When making a PG 64-28 thru modification, ensure it meets the test requirements of Table 702.01-1.

Do not use an independent laboratory owned or operated, in whole or part, by the binder supplier, Contractor, or affiliates of either.

Materials and Manufacture. Replace the requirements of AASHTO M 320-05 Section 5 "Materials and Manufacture" Section with the following:

5.1 Supply PG Binder from the refining of crude petroleum, or combination of asphalt binders from the refining of crude petroleum, or asphalt binders and suitable liquid from the refining of crude petroleum, and possible organic modifiers for performance enhancement. The City will consider material from the crude refining stream as neat. The Contractor may use liquid from crude refining for adjustments, but do not use liquid from crude refining for the purpose of substitution of crude refined asphalt binder in a PG Binder. In the event of a failure investigation where asphalt binders exhibit unusual properties, the City may request that a supplier requested by the

Laboratory to provide information about the makeup of a PG Binder. Failure to cooperate will mean removal from City Supplement 1032 certification.

5.2 The City will accept a modifier dissolved, dispersed or reacted in asphalt binder to improve its performance consisting of any organic material of suitable manufacture proven compatible with asphalt binder (does not separate appreciably in routine storage). The City defines performance enhancement as a decrease in the temperature susceptibility of the asphalt binder while maintaining or improving desirable properties in a neat asphalt binder such as coatability, adhesiveness and cohesiveness. Limit modifiers to no more than 6.0 percent by PG Binder weight.

5.3 The City must approve the use of previously used materials in a PG Binder. Since no standard test procedures exist for reprocessed materials, because developers of the original tests did not have the use of such materials in mind, the City will choose appropriate test methods for review. City approval will not relieve the binder supplier from full responsibility for content and use of any previously used material in a PG Binder nor guarantee suitable performance enhancement as defined above. The detected presence in a PG Binder sample of any unapproved previously used material will mean immediate removal from City Supplement 1032 certification. Limit approved reprocessed materials to 6.0 percent by PG Binder weight.

5.4 Provide a homogeneous PG Binder, free from water and deleterious materials that will not foam when heated to 350 ºF (175 ºC). Prove the asphalt binder, before modification or after modification if liquid modifier used, is 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 result, the City will allow a retest using reagent grade 35 percent Xylene/ 65 percent Heptane (volume).

5.5 Provide a 99.0 percent soluble PG Binder as determined by ASTM D 5546 or D 2042. The City will not accept any insoluble component containing fibers or discrete particles greater than 75 μm.

5.6 Ensure a minimum flash point of 500 ºF (260 ºC) minimum. Ensure a 0.5 percent maximum mass loss on RTFO of the final PG Binder grade.

5.7 Ensure a Penetration (ASTM D5) of no more than 75 for PG 64-22.

5.8 The City will not require Direct Tension testing, unless otherwise required in this specification.

Requirements for PG Modified Binder. Furnish PG Modified Binder according to the requirements of Table 702.01-1 by modifying a non-oxidized, non-air blown, neat asphalt binder by using a styrene butadiene latex rubber compound (SBR polymer) or a styrene butadiene styrene polymer block copolymer (SBS polymer). Provide a certification from the polymer supplier that the polymer used meets a minimum 68 percent by weight butadiene content. Perform SBS polymer modification prior to shipment to the asphalt concrete mixing plant (preblend). Perform SBR polymer modification at the asphalt concrete mixing plant (postblend) or prior to shipment to the asphalt concrete mixing plant (preblend).

For each project, obtain a handling guide from the PG Modified Binder supplier specifying temperature, circulation, shelf life, and other requirements for assuring the

PG Modified Binder will perform as desired. Give this handling guide to the Engineer and place a copy in the plant control room and plant laboratory.

If PG Modified Binder is retained at the asphalt concrete mixing plant for more than two weeks before use or beyond the supplier recommended shelf life, whichever is less, a top and bottom sample test (material property difference between samples taken from the top and bottom of the storage tank) will be performed by the Laboratory on samples retrieved by the Contractor at the Engineer's direction. Do not use material on hand until approved.

TABLE 702.01-1

MATERIAL REQUIREMENTS FOR PG MODIFIED BINDER

Test / Requirement	**SBR Polymer**		**SBS Polymer**		**Note**
Final PG Binder Grade	70-22M (a, b)	64-28 (b)	70-22M (a)	76-22M (a)	c
Final PG Binder Grade			64-28 (a)		
Actual Pass Temperatures	Report		Report		i
RTFO Mass Loss, percent max	. 0.5		. 0.5	0.5	d
Phase Angle, max	76		80	76	d
Elastic Recovery, min			65	75	e
Toughness, in lb	118	105			f, d
Tenacity, in lb	70	80			f, d
Elongation, in, min	20	20			f, d
Ductility, in, min	28	28			j, d
Separation, F max	10		10		g
Homogeneity			None Visible		h, d

a. Preblended Binder with a base binder of at least -22 grade or stiffer for 70-22M and 76-22M.
b. Post blended Binder made from neat City 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. Without Direct Tension, graded with actual pass temperatures
d. PG Modified Binder
e. ASTM D 6084, 10cm @ 77 ºF (25 ºC), hold 5 min. before cutting, on RTFO material
f. ASTM D 5801, 50cm/min @ 77 ºF (25 ºC)
g. Softening point difference of top and bottom of tube sample conditioned at 340 ºF (171 ºC) for 48 hours. Compatibility of polymer and neat binder is sole responsibility of supplier. Formulate PG Modified Binder to retain dispersion for 3 days minimum.
h. Heat a minimum 400 gram sample at 350 ºF (177 ºC) for 2.5-3 hours. Pour entire sample over a hot No 50 (300 µm) sieve at 340ºF (171 ºC). Look for retained polymer lumps.
i. Actual high and low temperature achieved by PG Modified Binder beyond required grade, but will not grade out to the next standard PG Binder grade for low temperature.
j. ASTM D 113, @ 39 ºF (4 ºC), 1 cm/min

702.02 Cut-Back Asphalt. Provide medium curing cut-back asphalt according to AASHTO M 82. Instead of viscosity on the residue, the penetration in note 2 (AASHTO M 82) will govern.

702.03 Cut-Back Asphalt Emulsions. Prepare emulsions by compounding a suitable volatile solvent and water with 702.01 asphalt to produce emulsions according to Table 702.03-1.

TABLE 702.03-1

	CBAE-350	**CBAE-350 Special**	**CBAE-800**	**CBAE-800 Special**	**Primer 20**	**Primer 100**
Kinematic Viscosity at 60 °C, Centistokes	350-700	350-700	800-1600	800-1600	20-40	100-200
Water Content[1], %	4-12	4-12	4-12	4-12	3-8	3-8
Volatile Solvent[1], %	12-25	12-25	10-20	10-20		
Asphalt Content[1], %	67+	67+	72+	72-	45+	60-
Adhesion Test[1]	[2]	[2]	[2]	[2]		
Wet Stone Coating Test[1]		[2]		[2]	[2]	[2]
Stripping Test[1]		[2]		[2]		
	Tests on Residue From Distillation					
Penetration at 25 °C	80-150	80-150	80-150	80-150	100-200	100-200
Ductility at 25 °C, in cm	100+	100+	100+	100+	100+	100+
Total Binder (Sol. in CSx), %	99+	99+	99+	99+	99+	99+
[1] Perform tests according to ODOT Supplement 1014.						
[2] Meets						

702.04 Emulsified Asphalts. Provide emulsified asphalts according to AASHTO M 140 or AASHTO M 208.

702.05 Asphalt Primer for Waterproofing. Provide asphalt primer for waterproofing according to ASTM D 41.

Furnish materials according to the City's QPL.

702.06 Asphalt for Waterproofing. Provide asphalt for waterproofing according to ASTM D 312, Type III.

Furnish materials according to the City's QPL.

702.07 Asphalt Emulsion MWS. Prepare asphalt emulsion MWS from a base material according to 702.01, except vary the penetration to meet the float test and penetration specified below. Ensure that the emulsion coats the aggregate readily, thoroughly, and uniformly. Ensure that the specified characteristics do not change during transportation or normal storage and that the emulsion satisfies the following criteria when tested according to AASHTO T 59:

Saybolt furol viscosity at 77 °F (25 °C), seconds	50+ [1]
Asphalt residue, percent	68+
Settlement, 7 days, percent	5-
Sieve test	0.1-
Coating test	[2]
Oil distillate, percent	7-
Withstand freezing to	-10 ºF (-23 °C) [3]
Particle charge	Negative
Penetration, 77 °F (25 °C) [6]	[4]
Float test at 140 °F (60 °C), seconds [6]	1200+ [5]
Total bitumen soluble CS_2 [6]	97.5+
Ash content, percent [6]	2.0-
[1] Pumpable.	
[2] Use aggregates to test the emulsion from sources standardized by the Laboratory. Use aggregates consisting of 100 percent passing a 3/8 inch (9.5 mm) sieve and 0 percent passing a 1/4 inch (6.3 mm) sieve. Wash the standard reference aggregates with distilled water until free of dust, and dry them. Weigh 3.280 ounces (93 grams) of the dry graded reference aggregate into a suitable container. Weigh 0.247 ounces (7 grams) of the emulsion onto the aggregate in the container, and vigorously mix the contents for 5 minutes. After mixing, thoroughly coat the stone. Completely immerse the mixture in tap water, and immediately pour off the tap water. Ensure a 90 percent coating of the aggregate surface area.	
[3] When shipped after October 1 and before April 15, except emulsion stored and mixed at temperatures of emulsion, aggregate, and atmosphere above 40 °F (5 °C).	
[4] Select the penetration within the following ranges of the designation specified:	
[5] AASHTO T 50, except immediately pour residue from distillation into the float collar at 500 °F (260 °C); or if the residue has been allowed to cool, heat it again to 500 °F (260 °C) and pour it into the float collar..	
[6] Test on residue from distillation.	

Designation	Penetration at 77 °F (25 °C)
MWS 300	300+
MWS 150	150 to 300
MWS 90	90 to 150
MWS 60	60 to 90

702.13 SBR Asphalt Emulsion. Provide material consisting of asphalt emulsion SS-1, SS-1h, CSS-1 or CSS-1h per 702.04 and City Supplement 1032, blended with SBR emulsion per 702.14, to produce a residual mixture of asphalt binder and SBR solids having a composition of 97.0 ±0.3 percent asphalt binder and 3.0 ±0.3 percent SBR solids by weight.

Furnish a certification to the Engineer and signed by the contractor containing the following:

A. The weight of SBR emulsion blended with the asphalt emulsion.

B. The weight of asphalt emulsion blended with the SBR emulsion.

C. The SBR emulsion manufacturer certification per 702.14.

D. The percent of asphalt binder in the asphalt emulsion (residue by distillation).

E. The percent of SBR solids in the SBR emulsion.

F. The percent of SBR solids in the mixture of asphalt binder residue and SBR solids.

G. Name of Certified asphalt emulsion producer and asphalt emulsion.

Determine the weight of the SBR emulsion needed for addition to a designated weight of asphalt emulsion to provide the percent of SBR solids in the mixture of asphalt residue and SBR solids using the following formula:

$$X = \frac{0.0309(B)(W)}{(A)}$$

where:

X = pounds (kilograms) of SBR emulsion

A = percent SBR solids in the SBR emulsion

B = percent of asphalt residue of the asphalt emulsion

W = pounds (kilograms) of the asphalt emulsion

For field blending, thoroughly mix the asphalt emulsion and SBR emulsion as follows before application: Add to the distributor the asphalt emulsion and the required amount of the SBR emulsion of the appropriate SBR emulsion type (i.e. cationic or anionic). Heat and circulate the distributor contents for at least 30 minutes to ensure complete blending. Re-circulate the distributor contents for 10 minutes just prior to application. If the distributor has set for 12 hours without circulation, repeat the heating and circulating of the distributor contents for 30 minutes prior to application.

Draw samples of the mixed SBR and asphalt emulsion after mixing the materials as indicated above.

702.14 SBR Emulsion. Use a cold polymerized Styrene Butadiene synthetic rubber (SBR)emulsion in latex form specifically compounded for use in asphalt binders and asphalt emulsions. Ensure the manufacturer of the SBR emulsion furnishes a written certification of the total SBR solids content of the SBR emulsion and actual test results showing compliance with both of the following requirements:

A. SBR emulsion:

Type of SBR Emulsion:	**Anionic**	**Cationic**
SBR solids Styrene Butadiene Ratio	27+5:73+5	27+5:73+5
Total SBR solids, % by weight	60-72	60-72
SBR solids Residual Styrene, % by weight	0.1 max	0.1 max
Ash, % of total SBR solids by weight	3.5 max	3.5 max
pH	9-11	4-6
Viscosity, Brookfield Units, Model RVF, spindle No 2 @20 RPM@ 77° F (25 ºC)	2000 max	2000 max

B. Combination of 3.0 – 4.0 % SBR solids with 96.0 – 97.0 % PG 64-22 meeting 702.01 by weight:

Toughness inch-pounds (N×m), Min 133 (15)
Tenacity, inch-pounds (N×m), Min .80 (9)

702.16 POLYMER EMULSIFIED BINDER

Emulsion (ASTM D 244)	**Type A (b)**	**Type B (b,c,g)**
Saybolt Furol Viscosity	100-400 (50 ºC)	20-100 (25 ºC)
Storage stability, 24 hrs., % difference, max (a)	1	1
Demulsibility, 35 ml of 0.8% Dioctyl Sodium Sulf., min	50	60
Demulsibility, 35 ml of 0.02N, CaCl2, %, min		60
Sieve test, (distilled water), %, max	0.1	0.05
Distillation to 190 ºC, residue % solids (d) symbol	68	63
Oil distillate, %, max	2	2
Distillation Residue		
Penetration, 100g, 5 sec @77 ºF(25ºC) ASTM D 5	70-100	90-150
Softening point, ° C, min ASTM D 36	60	
Solubility in TCE, %, min ASTM D 2042 or D 5546	97.5	97.5
Elastic Recovery, 50 ºF (10º C), %, min ASTM D 113, (e),(j)	70	58
Toughness/Tenacity, 77 ºF (25º C), 50 cm/min, Nm ASTM D 5801 (f)	report 16.0/ 9.0	
Ductility, 39 ºF (4º C),1cm/min, min ASTM D 113, (f)	70	

Notes:

(a) After standing undisturbed for 24 hours, the surface should show a smooth homogeneous color throughout with no white, milky colored substance.
(b) CRS-2P, test within 20 days of shipment.
(c) HFRS-2P, test within 20 days of shipment.
(d) Maximum of 374 ºF (190 ºC) held for 15 minutes.
(e) Straight molds. Hold at test temperature for 90 minutes. Place in ductilometer and elongate 10 cm at 5 cm/min. Hold for 5 minutes and cut. After 1 hour retract the broken ends to touch and note elongation in cm (X). Percent Recovery = ((10-X)/10) x 100.
(f) SBR
(g) SBS, SB

702.17 Crack Sealant

A. Type I Crack Sealant. Conform to 705.04

B. Type II Crack Sealant. Provide a mixture of PG 64-22 certified binder (City Supplement 1032) and polyester fibers (recycled fibers not permitted) according to the following requirements:

Denier; ASTM D 1577* ..... 3.0 to 6.0
Length ..... 0.25 0.02 inch (6.35 0.51mm)
Crimps; ASTM D 3937..... None
Tensile str, min. ASTM D2256* 70,000 psi (483 Mpa)
Specific gravity ..... 1.32 to 1.40
Minimum melting temperature..... 475 ºF (256 ºC)
Ignition temperature..... 1000 ºF (538 ºC) min.

* Obtain this data prior to cutting the fibers.

Use fiber and fiber manufacturer from the City's Qualified Products List.

Combine materials so that fibers make up a minimum of 5.0 percent by total weight of the asphalt binder. Provide combined materials according to the following properties:

Strength (at break)	at 72 ºF (22 ºC)	350 psi (2.4 MPa) min.
	at 0 ºF (-18 ºC)	500 psi (3.5 MPa) min.
Elongation (at break)	at 72 ºF (22 ºC)	50 percent min.
	at 0 ºF (-18 ºC)	20 percent min.

The City will permit the option for using premixed and prepackaged Type II crack sealant provided (1) the Contractor provides fibers and the fiber binder according to the requirements as shown and, (2) the Contractor provides fiber binder according to the manufacturer's specifications. Furnish certified test data from the fiber binder manufacturer annually to the Laboratory, and when requested by the Laboratory. Furnish a letter of certification with each shipment stating that the material complies with specification requirements.

C. Type III Crack Sealant. Provide a mixture of PG 64-22 certified binder (City Supplement 1032) and polypropylene fibers (recycled fibers not permitted) according to the following requirements:

Denier; ASTM D 1577*	15 3
Length,	0.39 0.08 inch (9.9 2.0 mm)
Crimps; ASTM D 3937	None
Tensile strength, min, ASTM D 2256*	40,000 psi (276 MPa)
Specific gravity	0.91 0.04
Minimum melting point	320 ^{0}F (160 ^{0}C)

* Obtain this data prior to cutting the fibers.

Use fiber and fiber manufacturer from the City's Qualified Products List.

Combine materials so that fibers make up a minimum of 7.0 percent by total weight of the asphalt binder. Provide combined materials according to the following properties:

Strength (at break)	at 72 ºF (22 ºC)	350 psi (2.4 MPa) min.
	at 0 ºF (-18 ºC)	500 psi (3.5 MPa) min.
Elongation (at break)	at 72 ºF (22 ºC)	50 percent min.
	at 0 ºF (-18 ºC)	20 percent min.

D. Type IV Crack Sealant. Provide a prepackaged, preapproved mixture of modified binder according to the following properties and minimum 2.0 percent polyester fibers (recycled fibers not permitted) according to the following properties. Place sealant with a manufacturer's representative for the fiber binder on site to ensure proper application and conditions.

Modified binder:

Cone penetration, 77 ^{0}F(25 ^{0}C)	50-90
Flow, 140 ^{0}F (60 ^{0}C)	1.0 cm max
Resilience, 77 ^{0}F (25 ^{0}C)	25-60 percent
Ductility, 77 ^{0}F (25 ^{0}C)	40 cm min
Bond, 0 ^{0}F (-18 ^{0}C), 100 percent ext. Pass	5 cycles
Impact, 0 ^{0}F (-18 ^{0}C)	Pass
Compression recovery	0.40 min

Recommended pour temperature..... 380 ^{0}F (193 ^{0}C)
Safe heating temperature ..... 410 ^{0}F (210 ^{0}C)

Fiber must meet requirements for Type II polyester fiber. Use fiber and fiber manufacturer from the City's Qualified Products List.

Safe heating temperature ..... 400 ^{0}F (204 ^{0}C)
Softening point..... 190 ^{0}F (88 ^{0}C)
Viscosity, 400^0 F(225 ^{0}C) .....3000 cp min
Cone penetration, 77 ^{0}F(25 ^{0}C)..... 25-45
Workability
Capable of melting and application through a pressure feed, indirect heated and agitated melter
Flexibility* .....Pass

* 1 inch (25mm) sample at -20 ^{0}F(-30 ^{0}C), 90 degree bend, 10 sec

Use crack sealant and crack sealant manufacturer from the City's Qualified Products List