



SECTION 1015

BITUMINOUS MATERIAL

1015.1 Scope. This specification covers bituminous material to be used in highway construction.

1015.2 Approval of Source. The contractor shall obtain approval of the source of bituminous material from the engineer before any shipments to the work site are made.

1015.3 Sampling, Testing and Acceptance Procedures .The supplier shall certify that the bituminous material complies with the specification requirements.

1015.3.1 Certification. The supplier shall furnish the truck driver a copy of the bill of lading, manifest or truck ticket to be available to MoDOT at the destination prior to unloading. The engineer at the source shall be furnished a copy. The bill of lading, manifest or truck ticket shall provide the following information regarding the shipment: type and grade of material, specific gravity at 60 F, net gallons, consignee, truck number, identification number, weight of truck before and after loading, destination, date loaded, name and location of the source, and a certification statement. The certification statement shall be signed by an authorized representative of the supplier and shall be substantially as follows:

"This certifies that the bituminous material in this shipment is in accordance with MoDOT specifications for the grade specified and the weights (masses) shown hereon were obtained on MoDOT approved scales and are correct within the specified scale requirements."

1015.3.2 Sampling. The engineer will at random observe the sampling and testing of truck shipments and tanks, and will select representative samples of the material being supplied for testing in the field or in the Central Laboratory. When test results certified by the supplier are not representative of the material being shipped, the source approval will be withdrawn. A source may be reinstated when proof is furnished that the deficiency has been corrected and adequate controls are in effect to guarantee delivery of material meeting specifications. Sampling and test methods for asphalt shall be as follows:

Property	Method	RC	MC	PG
Sampling	AASHTO T 40	X	X	X
Water	AASHTO T 55	X	X	X
Flash Point (Tag Open Cup)	AASHTO T 79	X	X	
Flash Point (Cleveland Open Cup)	AASHTO T 48			X
Viscosity, Centistokes	AASHTO T 201	X	X	
Distillation	AASHTO T 78	X	X	
Penetration	AASHTO T 49	X	X	
Ductility	AASHTO T 51	X	X	
Solubility in Trichlorethylene	AASHTO T 44	X	X	X
Ash in Bituminous Material	AASHTO T 111			
Viscosity (Rotational)	ASTM D 4402			X
Dynamic Shear	AASHTO 315			X
Rolling Thin Film Oven Test	AASHTO T 240			X
Pressure Aging Test	AASHTO R28			X
Creep Stiffness	AASHTO T 313			X
Direct Tension	AASHTO T 314			

1015.3.3 Sampling Equipment. The supplier shall furnish the required sampling equipment and shall sample the contents of the truck under the direction of the engineer. The supplier shall keep all sampling equipment clean and in good condition. Sampling devices on truck transports will be approved provided an adequately insulated valve is used with a pipe or nipple inserted a suitable distance into the tank.

1015.3.4 Truck Log. Each truck transport shall carry a log showing types of material and the dates hauled with respect to previous shipments, or the supplier shall furnish to the engineer such information with respect to the previous load.

1015.3.5 Intermediate Storage. Intermediate storage tanks for storage and transfer of material between the refinery or terminal and the point of acceptance shall be equipped for sealing and shall be reserved exclusively for MoDOT work. Use of any material from unsealed tanks will be subject to delay until material can be sampled, tested and approved.

1015.3.6 Other Transportation. At sources from which liquid bituminous material is being accepted by certification, the applicable requirements of the foregoing sections shall be followed for shipments of material in transportation units other than trucks. The certification and all information regarding each shipment shall be furnished to the engineer at the source.

1015.3.7 Railroad Shipments. For railroad shipments from refineries where inspection is not maintained by MoDOT, the supplier shall sample each car load at the source and submit the sample promptly to the Central Laboratory. A bill of lading or identification sheet shall accompany each sample and contain the following information: car number, type and grade of material, quantity represented, including gross gallons, temperature and net gallons at 60 F, destination of shipment, project number and consignee. A certification statement as specified in [Sec 1015.3.1](#) shall accompany each sample. Approval of the source may be withdrawn if samples submitted are not representative of the material shipped in the car.

1015.4 Proportioning and Blending Bituminous Material Constituents. All material shall be properly proportioned and thoroughly blended in suitable tanks prior to delivery to transportation equipment, or material may be proportioned and blended by use of automatic proportioning equipment. All automatic-proportioning blenders shall meet the approval of the engineer and shall be equipped with precision instruments, including electrically interlocked motors and automatic meters.

1015.5 Application Temperatures for Bituminous Material.

Bituminous Material	Temperature, Degrees Fahrenheit			
	Spraying		Mixing	
	Min	Max	Min	Max
Asphalt Binder				
PG 46-28	260	325	----	----
All Other Grades	285	350	275	350
Liquid Asphalt RC-MC				
Grade				
30	70	150	50	110
70	100	180	90	140
250	150	220	130	170
800	180	260	170	210
3000	210	290	200	240

Asphalt Emulsions				
RS-1	120	140	----	----
RS-2	125	185	----	----
SS-1	120	160	70	160
SS-1h	120	160	70	160
SS-1vh	160	180	140	160
CRS-1	125	185	----	----
CRS-2	125	185	----	----
CSS-1	120	160	70	160
CSS-1h	120	160	70	160
EA-90P	130	180	----	----
CRS-2P	130	180	----	----
CHFRS-2P	130	180	----	----

^a The minimum mixing temperature shall be lowered to 200 when a warm mix technology, as approved by the engineer, is used.

1015.5.1 Application temperatures of other grades of emulsions shall be as specified in the contract.

1015.5.2 The spraying temperature for non-modified PG 46-28 asphalt binder shall be 260 - 325 F, and for all other higher temperature non-modified performance grades, the spraying temperature shall be 285 - 350 F. The mixing and compaction temperatures for performance graded asphalt binder shall be determined by rotational viscosity testing as defined in ASTM D 4402.

1015.5.3 When material to be applied by pressure distributor is, due to refining or blending procedures, delivered at a temperature above the specified limits, the material may be applied at the higher temperature provided satisfactory application can be obtained at the specified rate and provided sufficient precaution is exercised with respect to the fire hazard.

1015.6 Measurement of Bituminous Material. Field weight or field volumetric determinations of the material actually incorporated into the work will be used for measurement of the quantity of bituminous material for payment. The volume of material supplied from intermediate storage tanks will be determined from the net weight of the material. The net weight will be determined from the gross weight of the loaded transport vehicle used to deliver the material to the project less the empty transport vehicle weight. The volume correction methods specified below will be used for determining the volume of bituminous material. Scales for determining the weight of bituminous material shall be in accordance with [Sec 310](#).

1015.6.1 Liquid Bituminous Material and Asphalt Binder - Volumetric Determination. Measurement of the material will be based on the volume at 60 F. The volume correction factors of ASTM D 1250, Table 24b, will be used for converting the material from the volume at the observed temperature to the volume at 60 F. The volume of uncalibrated distributors and tank trucks will be determined from the net weight of the material. The net weight will be determined from the gross weight of the loaded delivery vehicle less the empty delivery vehicle weight. For computing the volume in gallons from weight, the following formula will be used:

$$G = \frac{W}{SG \times 8.328}$$

where:

G = Volume in gallons at 60 F.

W = Weight of material in pounds.

SG = Specific Gravity of material at 60 F.

1015.6.2 Emulsified Asphalt. Measurement of the material will be based on the volume at 60 F using a coefficient of expansion of 0.0003 per degree F for converting the material from the volume at the observed temperature to the volume at 60 F.

SECTION 1015.10 PERFORMANCE GRADED ASPHALT BINDER.

1015.10.1 General. 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. The grade shall be as specified in the contract.

1015.10.2 Basis of Acceptance. Suppliers furnishing performance graded asphalt binders to MoDOT projects by certification shall be in accordance with AASHTO R 26, except as noted herein. To become pre-qualified to furnish material, a written request shall be sent to Construction and Materials, along with a copy of the supplier's QC plan. Split samples may be required. Changes in formulation, base stock or methods of manufacture of qualified performance graded binders shall be noted and may require requalification.

1015.10.2.1 Quality Control Plan Requirements. The QC plan shall be in accordance with AASHTO R 26 with the following exceptions and modifications:

- (a) The plan shall be written to cover multiple terminals or shipping facilities, in addition to the primary manufacturing facility, provided specific requirements for each location are clearly stated.
- (b) The plan shall state the lot size used to designate the frequency of QC and specification compliance testing for each performance grade to be supplied. The lot size will depend upon the method of manufacture and may be designated on a tank basis, or on a time basis in the case of binders that are blended into trucks or tanks or that are continually blended into "live" tanks.
- (c) For terminals or manufacturing facilities, the minimum reduced frequency of testing for QC or specification compliance shall be one series of tests every two weeks for "live" tanks or blenders and one series of tests every four weeks for "static" tanks that have had no material added between testing, per lot per grade of binder shipped.
- (d) Quality Control testing may be used to determine that binders being shipped from terminals or manufacturing facilities have not been contaminated, provided that such testing is shown to be of sufficient accuracy to detect contamination and to assure that material meets required specifications. Surrogate tests may be used for QC testing of non-modified performance graded binders.
- (e) Terminals or shipping facilities that blend performance graded binders from different sources, that blend to produce a different performance grade, or that blend to modify the properties of an existing performance grade shall perform complete AASHTO M 320 specification compliance testing.
- (f) The shipping facility shall document that each transport vessel was inspected prior to loading and was found to be acceptable for the material being shipped. The inspection shall be documented by a statement on the bill of lading or truck ticket, or by maintaining a record of transport vessel inspections at the shipping facility, which shall be available for review by MoDOT.

1015.10.2.2 Quality Control Plan Test Data. The facility shall retain test data of specification compliance and QC testing for five years. At a minimum, the name of the facility, the dates of testing activity, results of individual specification compliance and QC tests identified by blender or tank number, and the mean, minimum and maximum test result

for each specification compliance and QC test performed shall be readily available to MoDOT upon request.

1015.10.2.3 Approval of Laboratories. The supplier's primary testing laboratory shall be approved by MoDOT. The approval process will include split sample testing, and may include an on-site visit by department personnel. The primary testing laboratory shall be regularly inspected by the AASHTO Materials Reference Laboratory (AMRL). Any satellite testing laboratory operated by a supplier shall be inspected at the same frequency by the supplier's primary AMRL inspected laboratory staff, and a copy of the inspection report shall be forwarded to MoDOT.

1015.10.2.4 Failure to Comply. Failure to fulfill any of these requirements may result in disqualification of the performance graded binder supplier. If a primary manufacturing facility is disqualified, all terminals shipping performance graded binder manufactured at the primary facility and who are not performing AASHTO M 320 specification compliance testing will automatically be disqualified. In cases of dispute, test results obtained by MoDOT will be considered final.

1015.10.3 Characteristics. Performance graded asphalt binder shall be in accordance with AASHTO M 320 for the grade specified, except as follows. AASHTO T 111, *Inorganic Matter or Ash in Bituminous Materials*, may be substituted for AASHTO T 44, *Solubility of Bituminous Materials*, at the specification value indicated prior to the addition of ground tire rubber (GTR.) All blends containing GTR shall include 4.5 percent transpolyoctenamer rubber (TOR) by weight of the GTR. The direct tension test will be waived. The following additional requirements will apply:

Binder Characteristics		
Absolute Temperature Spread Between Upper and Lower Temperature for PG Binder Grade^a	Elastic Recovery^b, Percent, Minimum, AASHTO T 301	Separation Test^c, Percent Difference, Maximum, ASTM D 5976
86 C	-	-
92 C	55	10
98 C	65	10
104 C	75	10

^aTemperature Spread = Upper PG Temperature minus Lower PG Temperature.

^bElastic recovery test to be performed on the residue from the Rolling Thin Film Oven Test at 25 C and 10 cm elongation.

^cSeparation test to be performed in accordance with ASTM D 5976, except test upper and lower portions as original binder for G* value according to AASHTO T 315 except for GTR binders that require continuous agitation.

1015.10.3.1 In lieu of AASHTO M 320, AASHTO M 332 may be substituted eliminating the elastic recovery requirement, except for use with [Sec 413.30](#), Ultrathin Bonded Asphalt Wearing Surface. The equivalent grading will PG 64-22, Grade S for PG 64-22, Grade H for PG 70-22 and Grade V for PG 76-22. Specialty grades will be tested at the grade temperature for the desired characteristics, i.e. PG 58-28 for RAS mixtures.

1015.10.4 Characteristics for GTR. Ground tire rubber shall be ambient ground, free of wire or other contaminating materials and not contain more than 0.1 percent fabric. Cryogenically ground rubber may be used by demonstrating that the GTR is satisfactorily suspended during all phases of production and storage. The gradation of the GTR shall be as follows:

Ground Tire Rubber	
Sieve Size	Percent Passing by Weight
No. 8	100
No. 16	100-96
No. 30	100-90
No. 50	20 min.

1015.10.4.1 Modification Process. The percentage by weight of binder shall be included with each lot of material. Ground tire rubber modified asphalt binder shall be tested and certified in accordance with Sec 1015.10.2 and may be incorporated by any of the following methods:

1015.10.4.1.1 Blending at HMA Plant. All sampling and testing shall be performed in accordance the requirements for terminal blending including high and low temperature testing.

1015.10.4.1.2 Terminal Blending. Blending and certification shall be in accordance with [Sec 1015](#).

1015.10.5 Storage. Performance graded asphalt binder shall be furnished as a uniform mixture shipped directly to the project site from the asphalt binder supplier's permanent plant address or intermediate storage facility, suitable for direct use. Asphalt binder shall be capable of being stored at the project site without separation or settling. Automatic blending will be allowed at the terminal. Intermediate blending of asphalt binder and additives will not be allowed at the project site, unless the asphalt binder is sampled at a point in the operation which captures the final blended binder with all additives incorporated.

SECTION 1015.20 LIQUID BITUMINOUS MATERIAL.

1015.20.1 Basis of Acceptance. Suppliers electing to furnish liquid bituminous material to MoDOT projects by QC/QA certification shall furnish material in accordance with [Sec 1015.20.2](#). To become pre-qualified to furnish material, a written request shall be submitted to Construction and Materials, along with a copy of the supplier's QC plan. For source approval for any supplier of liquid bituminous material, split samples and an on-site laboratory inspection may be required. A manufacturer may forgo a formal QC plan and elect to perform full compliance testing, and certify each batch of material. If a manufacturer elects to forgo a formal QC Plan, all truck shipments shall be loaded from approved storage tanks that have been sampled, tested and certified by the supplier. If a manufacturer so elects, and automatic blending equipment is used, blender material will be approved for use provided the finished product is in accordance with this specification. At least one complete specification compliance test shall be conducted every two weeks on each grade of material furnished for MoDOT work from the blender. A certified copy of the test results shall be furnished to the engineer. For all liquid bituminous material, AASHTO T 111, *Inorganic Matter or Ash in Bituminous Materials*, may be substituted for AASHTO T 44, *Solubility of Bituminous Materials*, at the specification value indicated.

1015.20.2 Quality Control Plan Requirements. The QC plan shall be in accordance with the following:

- (a) The plan may be written to cover multiple terminals, shipping facilities, blending or manufacturing facilities.
- (b) The plan shall state the location, organization and responsible personnel for each facility, including the physical address and telephone contact information. In general, following the guidelines in AASHTO R 26 will be acceptable.

(c) The plan shall state the minimum testing frequency for all material supplied. At a minimum, each grade of material supplied to MoDOT shall have complete specification compliance testing conducted monthly. Polymer modified material shall have complete specification compliance testing conducted every two weeks. The manufacturer's internal QC testing frequency shall be approved by MoDOT prior to implementation. The manufacturer shall perform sufficient tests and at a frequency to ensure specification compliant material is being supplied to MoDOT at all times. For emulsified asphalt, QC testing on each batch, at a minimum, shall consist of viscosity, sieve test, determination of residue by either distillation or evaporation and an identifier test, if applicable, for that particular grade, either cement mixing, particle charge or demusibility. The manufacturer may elect to perform additional QC tests. For cutback material, QC testing shall be a minimum of the viscosity on a daily basis when material is being shipped to MoDOT work.

(d) In the event of a failing sample, the manufacturer shall follow the steps outlined in AASHTO R 26, Sec. 9.2. If a sample fails to comply with any specification requirement at the Central Laboratory, the manufacturer may only ship new material of that grade after full specification compliance testing. After the manufacturer has certified through specification compliance testing that three consecutive batches are in accordance with the material specification, the manufacturer may return to the testing frequency outlined in the QC/QA plan. If a second sample of the same grade from the same facility fails to comply with any specification requirement within the same calendar year, approval of that facility to supply that grade under QC/QA may be withdrawn. If approval for a grade is withdrawn, that material may only be supplied to MoDOT work after full certification compliance testing has been performed at the Central Laboratory. Re-approval to supply under the supplier's QC/QA Plan will occur only after three consecutive batches meet specifications after testing at the Central Laboratory. Failure of multiple grades from a single facility tested at the Central Laboratory may result in that facility being removed from approval to supply material to MoDOT. Reinstatement will occur only after all materials in question have been tested at the Central Laboratory and have met all specifications, and documentation from the supplier outlining the reason for the failures and what corrective measures have been taken are to the satisfaction of MoDOT.

(e) The shipping facility shall document that each transport vessel was inspected prior to loading and was found to be acceptable for the material shipped. The inspection shall be documented by a statement on the bill of lading or truck ticket, or by maintaining a record of transport vessel inspections at the shipping facility, which shall be available for review by MoDOT.

The results of QC/QA testing shall be retained by the supplier for a period of three years. A report containing all test results for any material shall be available to MoDOT upon request.

1015.20.3 Type RC Liquid Asphalt. Type RC liquid asphalt shall be produced by fluxing an asphaltic base with suitable petroleum distillates. The material shall show no separation or curdling prior to use and shall not foam when heated to the application temperature. The material shall be in accordance with AASHTO M 81, invoking Note 3 using penetration in lieu of viscosity for the grade specified in the contract.

1015.20.4 Type MC Liquid Asphalt. Type MC liquid asphalt shall be produced by fluxing an asphaltic base with suitable petroleum distillates. The material shall show no separation or curdling prior to use and shall not foam when heated to the application temperature. The material shall be in accordance with AASHTO M 82, invoking Note 4 using penetration in lieu of viscosity for the grade specified in the contract.

1015.20.5 Emulsified Asphalt. Non-polymer emulsified asphalt shall be in accordance with AASHTO M 140 or AASHTO M 208, for the type and grade specified in the contract.

1015.20.5.1 Polymer Modified Asphalt Emulsion – Seal Coat. Bituminous material for polymer modified asphalt shall be in accordance with the following:

Polymer Modified Asphalt Emulsion				
Test^a	CRS-2P		EA-90P	
	Min	Max	Min	Max
Viscosity, SSF @ 50 C	100	400	100	400
Storage Stability Test ^b , 24 hour, percent	----	1	----	1
Classification Test	Pass	----	----	----
Particle Charge Test	Positive	----	----	----
Sieve Test, percent	----	0.3	----	0.3
Demulsibility, 0.02 N CaCl ₂ , percent	----	----	30	----
Distillation:				
Oil distillate by volume of emulsion, percent	----	3	----	3
Residue from distillation ^c , percent	65	----	65	----
Tests on Residue from Distillation:				
Penetration, 25 C, 100 g, 5 sec	100	200	100	200
Ductility, 4 C, 5 cm/minute, cm	30	----	25	----
Ash ^d , percent	----	1	----	1
Float Test at 60 C, sec	----	----	1200	----
Elastic Recovery ^e , percent	58	----	58	----

^aAll tests shall be performed in accordance with AASHTO T 59 except as noted.

^bIn addition to AASHTO T 59, upon examination of the test cylinder, and after standing undisturbed for 24 hours, the surface shall show no appreciable white, milky colored substance and shall be a homogeneous brown color throughout.

^cAASHTO T 59 shall be modified to maintain a 399 F ± 10 F maximum temperature for 15 minutes.

^dPercent ash shall be determined in accordance with AASHTO T 111, *Ash in Bituminous Material*.

^eElastic recovery shall be determined as follows. Condition the ductilometer and samples to be treated at 50 F. Prepare the brass plate, mold and briquet specimen in accordance with AASHTO T 51. Keep the specimen at the specified test temperature of 50 F for 85 to 95 minutes. Immediately after conditioning, place the specimen in the ductilometer and proceed to elongate the sample to 20 cm at a rate of pull of 5 cm/min. After the 20 cm elongation has been reached, stop the ductilometer and hold the sample in the elongated position for 5 minutes. After 5 minutes, clip the sample approximately in half by means of scissors or other suitable cutting devices. Let the sample remain in the ductilometer in an undisturbed condition for one hour. At the end of this time period, retract the half sample specimen until the two broken ends touch. At this point note the elongation (x) in cm. Calculate the percent recovery by the following formula:

$$\% \text{ Recovery} = \frac{20 - X}{20} \times 100$$

Polymer Modified Asphalt Emulsion		
Test^a	CHFRS-2P	
	Min.	Max
Viscosity, SFS @ 50 C	100	400
Storage Stability Test, 24 hour, percent	---	1.0
Demulsibility, 35 ml 0.8% dioctyl sodium sulfosuccinate, percent	60	---
Sieve Test, percent	---	0.10

Particle Charge Test	Positive	
Distillation ^b		
Oil Distillate, by volume of emulsion, percent	---	0.5
Residue from distillation, percent	65	---
Tests on Residue from Distillation:		
Polymer content, weight, percent (solids based)	3.0	---
Softening Point, C	54	
Float test at 60 C, s	1800	---
Penetration, 25 C, 100 g, 5 s	80	130
Viscosity @ 60 C, Poise	1300	---
Solubility in Trichloroethylene, percent	95	---
Elastic Recovery ^c @ 10 C, percent	65	---

^aAll tests shall be performed in accordance with AASHTO T-59 except as noted.

^bAASHTO T59 shall be modified to maintain a 177 ± 5 C maximum temperature to be held for 20 minutes. Complete the total distillation in 60 ± 5 minutes from the first application of heat.

^cElastic recovery shall be determined as follows. Condition the ductilometer and samples to be treated at 10 C. Prepare the brass plate, mold, and briquet specimen in accordance with AASHTO T 51. Keep the specimen at the specified test temperature of 10 C for 85 to 95 minutes. Immediately after conditioning, place the specimen in the ductilometer and proceed to elongate the sample to 20 cm at a rate of pull of 5 cm/min. After the 20 cm elongation has been reached, stop the ductilometer and hold the sample in the elongated position for 5 minutes. After the 5 minutes, clip the sample approximately in half by means of scissors or other suitable cutting devices. Let the sample remain in the ductilometer in an undisturbed condition for one hour. At the end of this time period, retract the half sample specimen until the two broken ends touch. At this point note the elongation recovery (X) in cm. Calculate the percent recovery by the following formula:

$$\% \text{ Recovery} = \frac{20 - X}{20} \times 100$$

1015.20.5.1.1 Polymer Modified Asphalt Emulsion – Tack Coat. Bituminous material for polymer modified asphalt shall be in accordance with the following:

Slow Setting Polymer Modified Asphalt Emulsion ^a					
		SS-1HP		CSS-1HP	
Test on Emulsion	Method	Min	Max	Min	Max
Viscosity, Saybolt Furol @ 25°C (77°F), s	AASHTO T 59	20	100	20	100
Particle Charge Test		Negative		Positive	
Storage Stability Test ^b , 24 hr, percent	AASHTO T 59	--	1	--	1
Sieve Test, percent	AASHTO T 59	--	0.50	--	0.50
Residue by Distillation ^c , percent	AASHTO T 59	57		57	
Oil Distillate by Distillation, percent	AASHTO T 59	--	--	--	--
Test on Residue from Distillation					
Penetration 25°C, 100 g, 5 s	AASHTO T 49	40	90	40	90
Elastic Recovery ^d , 20 cm, 5 cm/min, 60 min, %	AASHTO T 301	30	--	30	--

Solubility Trichloroethylene ^c , %	in	AASHTO T 44	97.5	--	97.5	--
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^a The emulsified asphalt shall be in accordance with [Sec 1015.20.5](#) of the 2011 Missouri Standard Specifications for Highway Construction, except as indicated above, and shall be modified with a styrene-butadiene diblock or triblock copolymer or a styrene butadiene rubber.

^b In addition to AASHTO T 59, upon examination of the test cylinder, and after standing undisturbed for 24 hours, the surface shall show no appreciable white, milky colored substance and shall be homogeneous brown color throughout. The storage stability test may be waived provided the asphalt emulsion storage tank at the project site has adequate provisions for circulating the entire contents of the tank, provided satisfactory field results are obtained.

^c AASHTO T 59 shall be modified to use a lower distillation temperature of 177° C (350° F).

^d AASHTO T 301 shall be modified to allow the residue to be obtained from distillation as long as the distillation temperature is modified as stated above. The test on residue shall be conducted at a temperature of 10° C (50° F).

^e In lieu of performing AASHTO T 44, AASHTO T 111, Ash in Bituminous Material

1015.20.5.2 Asphalt Emulsion for Micro-Surfacing. Bituminous material for micro-surfacing shall be a polymer modified asphalt emulsion, grade CSS-lh, in accordance with the following table. The bituminous material shall show no separation after mixing. A minimum of 3.0 percent polymer content, by mass, of an approved polymer shall be milled into the asphalt emulsion at the time of manufacture of the emulsion. The emulsion shall be sampled in accordance with AASHTO T 40.

Micro-Surfacing Emulsion (MSE-1)			
	Min.	Max.	Test Method
Viscosity, Saybolt Furol at 77 F, s	20	100	AASHTO T 59
Storage stability test, 24 hr, percent	--	1 ^a	AASHTO T 59
Particle charge test positive ^b			AASHTO T 59
Sieve test, percent	--	0.50	AASHTO T 59
Residue, percent	62	--	AASHTO T 59
Tests on Residue from Distillation	Min.	Max.	Test Method
Penetration, 77 F, 100 g, 5 s,	40	90	AASHTO T49
Ductility, 25 C, 5cm/min, cm,	40	--	AASHTO T 51
Solubility in Trichloroethylene, %	97.50	--	AASHTO T 44

^aThe storage stability test may be waived provided the asphalt emulsion storage tank at the project site has adequate provisions for circulating the entire contents of the tank, and provided satisfactory field results are obtained.

^bIf the particle charge test is inconclusive, material having a maximum pH value of 6.7 will be acceptable.

1015.20.5.3 Scrub Seal Emulsion. Scrub seal emulsion shall be smooth and homogeneous, polymer modified, shall contain an asphalt rejuvenator and shall be in accordance with the following:

Scrub Seal Emulsion (SSE-1)			
	Min.	Max.	Test Method
Saybolt Furol Viscosity, SFS @ 77 F	30	100	AASHTO T 59
Storage Stability Test ^a , 24 hr., %	--	1 ^a	AASHTO T 59
Demulsibility, 35 ml of 0.02N, CaCl ₂ , %	--	60	AASHTO T 59

Sieve Test ^b , percent	--	0.3	AASHTO T 59
Residue by Distillation ^(c) @ 401 ± 10 F, %	60	--	AASHTO T 59
Oil Distillate by Volume, percent	--	3	AASHTO T 59
Tests on Residue from Distillation	Min.	Max.	Test Method
Penetration @ 77 F, 5 s, 100 g, dmm	100	300	AASHTO T 49
Float Test @ 140 F, s	1200	--	AASHTO T 50
Ash, percent	--	1	AASHTO T 111
Elastic Recovery, 10 C, 200 mm elongation, 60 min. recovery, percent	30	--	ASTM D 5976
Saturates ^d , percent	--	20	ASTM D 4124

Upon examination of the test cylinder after standing undisturbed for 24 hours, the surface shall show no white, milky colored substance and shall be a homogeneous brown color throughout.

^bA percentage of 0.30 will be acceptable for samples taken at the point of use or shipped to the Central Laboratory for testing.

^cASTM D 244 shall be modified to include a 205 ± 5 C maximum temperature to be held for 15 minutes.

^dASTM D 4124 shall be modified to use Alumina, CG - 20 Grade, available from Aluminum Company of America, Pittsburgh, PA.

1015.20.5.4 Hard Penetration Asphalt Emulsions (SS-1vh). The hard penetration asphalt emulsions shall be in accordance with the following:

Emulsion Properties of Hard Penetration Asphalt Emulsions (SS-1vh)			
Test on Emulsion	Method	Min.	Max.
Viscosity, Saybolt Furol @ 25° C (77° F), s	AASHTO T 59	20	100
Storage Stability Test ^a , 24 hr., percent	AASHTO T 59	--	1.0
Sieve Test, percent	AASHTO T 59	--	0.30
Residue by Distillation, percent	AASHTO T 59	50	--
Oil Distillate by Distillation, percent	AASHTO T 59	--	1
Test on Residue from Distillation	Method	Min.	Max.
Softening Point, ° F	AASHTO T 53	149	200
Penetration 25° C (77° F), 100 g, 5 s	AASHTO T 49	--	40
G* / sin delta @ 76° C – 10 rad/sec, kPa	AASHTO T 315	1.0	--
Solubility in Trichloroethylene ^b , %	AASHTO T 44	97.5	--

^a In addition to AASHTO T 59, upon examination of the test cylinder, and after standing undisturbed for 24 hours, the surface shall show no appreciable white, milky colored substance and shall be homogeneous brown color throughout. The storage stability test may be waived provided the asphalt emulsion storage tank at the project site has adequate provisions for circulating the entire contents of the tank, provided satisfactory field results are obtained.

^b In lieu of performing AASHTO T 44, AASHTO T 111, Ash in Bituminous Material, may be performed with a maximum allowable percent ash of 1.0 percent.

1015.20.6 Ultrathin Bonded Wearing Surface. Bituminous material for ultrathin bonded wearing surface shall be in accordance with the following.

1015.20.6.1 Asphalt Binder. The asphalt binder shall be in accordance with [Sec 1015.10](#), and specifically as follows:

Tests	Method	Min.	Max.
Separation Test, %	AASHTO PP-5		10
Elastic Recovery Test, %	ASTM D 6084	65	

1015.20.6.2 Polymer Modified Emulsion Membrane. The anionic or cationic emulsion shall be polymer modified and shall be in accordance with one of the following:

Anionic Polymer Modified Emulsion Membrane (PEM-1)				
Tests on Emulsion		Method	Min.	Max.
Viscosity, Saybolt Furol @122 F, s		AASHTO T 59	25	125
Storage Stability Test ^a , 24 h, percent		AASHTO T 59		1
Sieve Test ^b , percent		AASHTO T 59		0.3
Residue by Distillation ^c , percent		AASHTO T 59	63	
Oil Distillate by Distillation, percent		AASHTO T 59		2
Demulsibility, %	35 ml, 0.02 N CaCl ₂	AASHTO T 59	60	
Tests on Residue From Distillation				
Penetration		AASHTO T 49	90	150
Elastic Recovery, percent		AASHTO T 301	60	

Cationic Polymer Modified Emulsion Membrane (CPEM-1)				
Tests on Emulsion		Method	Min.	Max.
Viscosity, Saybolt Furol @122°F, s		AASHTO T 59	25	125
Storage Stability Test ^a , 24 h, percent		AASHTO T 59		1
Sieve Test ^b , percent		AASHTO T 59		0.3
Residue by Distillation ^c , percent		AASHTO T 59	63	
Oil Distillate by Distillation, percent		AASHTO T 59		2
Demulsibility, %	35 ml, 0.8% dioctyl sodium sulfosuccinate	AASHTO T 59	60	
Tests on Residue From Distillation				
Penetration		AASHTO T 49	90	150
Elastic Recovery, %		AASHTO T 301	60	

^aAfter standing undisturbed for 24 hours, the surface shall show no white, milky colored substance, but shall be a smooth homogeneous color throughout.

^bThe sieve test will be waived if successful application of the material has been achieved in the field.

^cAASHTO T 59 shall be modified to include a 400 F ± 10 F maximum temperature to be held for a period of 15 minutes.