Florida Department of Transportation

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DENVER J. STUTLER, JR.
SECRETARY

November 2, 2005

Mr. Donald Davis
Program Operations Engineer
Federal Highway Administration
545 John Knox Road, Suite 200
Tallahassee, Florida 32303

Re: Office of Design, Specifications
Section 916
Proposed Specification: 9160000.D01

Dear Mr. Davis:

We are submitting, for your approval, two copies of a proposed Supplemental Specification for Bituminous Materials.

This change was proposed by Gale Page of the State Materials Office to expand Quality Control Plan requirements.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via Email to SP965DB or duane.brautigam@dot.state.fl.us.

If you have any questions relating to this specification change, please call Duane F. Brautigam, State Specifications Engineer at 414-4110.

Sincerely,

Signature on file

Duane F. Brautigam, P.E.
State Specifications Engineer

DFB/jf
Attachment
cc: General Counsel
Florida Transportation Builders' Assoc.
State Construction Engineer

~~916~~ **BITUMINOUS MATERIALS.**

(REV ~~7-28-03~~*11-2-05*) ~~(FA 1-13-04) (7-04)~~

SECTION 916 (Pages 785-797) is deleted and the following substituted:

SECTION 916

BITUMINOUS MATERIALS

916-1 Superpave PG Asphalt Binder:

916-1.1 Requirements: Superpave PG asphalt binders, identified as PG 64-22, PG 67-22, and PG 76-22, shall meet the requirements of 916-1.2, AASHTO M-320 and the following additional requirements:

1. The mass loss AASHTO T-240 shall be a maximum of 0.5% for all grades.

2. The spot test AASHTO T-102 with standard naphtha shall be negative for all grades. *As an exception, a positive spot will be accepted if the PAV Residue (AASHTO R-28) at 110 ºC meets all the requirements for the particular grade.*

3. The smoke point FM 5-519 shall be a minimum of 125ºC for all grades.

4. The intermediate test temperature at 10 rad/s. for the Dynamic Shear Rheometer test AASHTO T-315 shall be 25ºC for all grades.

5. An additional high temperature grade of PG 67 is added for which the high test temperature at 10 rad/sec for the Dynamic Shear Rheometer test AASHTO T-315 shall be 67ºC.

6. All PG asphalt binders having a high temperature designation of PG 67 or lower shall be prepared without modification.

7. All PG asphalt binders having a high temperature designation higher than PG 67 shall be produced with a styrene-butadiene-styrene (SBS) or styrene-butadiene (SB) elastomer polymer modifier and resultant binder shall meet all requirements of this Specification; in addition the phase angle at 76ºC (AASHTO T-315) shall be less than or equal to 75 degrees.

8. The maximum viscosity AASHTO T-202 shall be 2400 poises for PG 64-22 and 3600 poises for PG 67-22.

All hot mix asphalt (except hot mix asphalt containing 20% RAP or greater) shall contain Superpave PG asphalt binder grade PG 67-22 unless otherwise specified in the plans and/or Specifications for the hot mix asphalt product.

For all PG binder used in all hot mix asphalt, silicone shall be added to the PG binder at the rate of 25 cm^3 of silicone mixed to each 5,000 gal. of PG binder. If a disbursing fluid is used in conjunction with the silicone the resultant mixture containing the full 25 cm^3 of silicone shall be added in accordance with the manufacturer's recommendation. The blending of the silicone with the PG binder shall be done by the supplier prior to the shipment.

All PG binder to be used in asphalt rubber binder for Friction Course mixes and other hot mix asphalt products containing RAP shall contain 0.5% heat stable anti-strip additive by weight of PG binder unless specifications for the hot mix asphalt product requires testing by FM 1-T 283 and the test results indicate it is not required, or

the mixture contains hydrated lime. Where FM 1-T 283 indicates an anti-strip additive is required, it shall be from 0.25 to 0.75%. The anti-strip additive shall meet the requirements of 916-5. The anti-strip additive shall be introduced into the PG binder by the supplier during loading.

Where PG binder is used in mixes containing reclaimed asphalt pavement (RAP), the requirements of 334-2.3.4 must also be met.

916-1.2 Qualified Products List: The Superpave PG asphalt binders supplied under this Specification shall be one of the products included on the Qualified Products List as specified in 6-1. Any marked variation from the original test values for a material below the established limits or evidence of inadequate quality control or field performance of a material will be considered to be sufficient evidence that the properties of the material have changed, and the material will be removed from the Qualified Products List.

For each binder grade, the supplier may be required to submit to the State Materials Office a split sample of material representative of test results submitted with the Product Evaluation Application. In addition, for modified binders, the original PG binder grade, the modifier product designation, and amount added shall be indicated. Suppliers shall not ship any PG binder until notified that the product is on the Qualified Products List and an approved Quality Control Program meeting the requirements of 916-1.3 has been implemented.

916-1.3 Quality Control Program: The supplier of Superpave PG asphalt binder shall *at a minimum* have a Quality Control Program meeting the requirements of ~~AASHTO PP 26 as specifically defined in~~ this Specification *which is based on AASHTO R-26. The Quality Control Program shall be submitted in electronic format to the State Materials Office for approval*.

The requirements for the Quality Control program apply to the supply location of PG binders for the use on Florida Department of Transportation projects. The supply location of PG binder may represent refinery production, terminal distribution, blending, processing and/or modification location ~~in accordance with AASHTO M 320 and these Specifications~~. *Rack blending (blending from ~~2~~two tank sources) will be permitted to meet the requirements for a PG asphalt binder product. Any special handling requirements such as rack blending and manufacture of polymer modified asphalt shall be described in the Quality Control program.* The requirements of these Specifications *for a Quality Control Program* do not apply to Recycle Agents at this time.

916-1.3.1 Identification of Personnel and Supply Locations: The supplier's primary and secondary representatives *responsible for Quality Control* shall be identified by name, title, address, telephone, fax and e-mail address. *At least one of the representatives shall be located at the supply location.* The supply locations shall be identified by name, address and telephone.

916-1.3.2 Specification Compliance and Quality Control Testing: Specification Compliance Testing shall consist of complete testing of each PG binder shipped in accordance with AASHTO M-320 and 916-1.1 of these Specifications. *Results of Specification Compliance Testing shall be available to the supplier within ~~5~~five working days of sampling.* Specification Compliance Testing shall be conducted by a testing laboratory that participates at least annually in the AMRL Reference Sample

Testing Program. *The primary testing lab and any other labs to be used for Specification Compliance Testing shall be identified in the suppliers Quality Control Program.* The ~~testing laboratory shall forward their~~ results from each AMRL proficiency Sample *for each testing laboratory shall be forwarded by the supplier for each supply location in electronic format* to the State Materials Office. Acceptable performance in the AMRL proficiency Sample Testing Program shall be a minimum of 3 for each test. A rating of less than 3 shall require identification of appropriate action on the part of the supplier *and be* acceptable to the State Materials Engineer.

Quality Control testing as a minimum shall consist of testing a representative sample of each PG binder shipped by the supplier in accordance with either:

(1) AASHTO T-202 Standard Test Method for Viscosity of Asphalts by Vacuum Capillary Viscometer or

(2) AASHTO T-315 Test Method for Determining Rheological Properties of Asphalt Binder using a Dynamic Shear Rheometer (DSR).

Results of Quality Control Testing shall be available to the supplier within ~~5~~five hours of sampling. The Quality Control testing and location where the test will be done shall be identified in the suppliers Quality Control Program.

916-1.3.3 *Frequency of* Sampling and Testing: *Sampling of PG binders shall be done in accordance with AASHTO T-40. Initial* Specification Compliance test results shall be *required* ~~provided to the State Materials Office~~ for each PG binder grade for each *new LOT of material*~~incoming bulk shipment to the supplier~~ which will be further subjected to Quality Control Testing in accordance with 916-1.3.2. *A new LOT will occur when the material in a tank changes and the Specification Compliance Test may no longer be representative of the material in the tank. This may be due to an incoming bulk shipment of material, change in refinery run, the manufacture of a product, or a blend of material in a tank.* ~~In addition the following~~*Additional testing is as follows*:

(1) Any PG binder shipped to a Department project during any one *calendar* month shall be tested at least *once during that month*~~monthly~~ for Specification Compliance in accordance with 916-1.3.2.

(2) When being shipped to Department projects, samples shall be obtained by the supplier and tested for Quality Control testing in accordance with 916-1.3.2. A single one quart representative sample of each PG binder shall be obtained and tested by the supplier *each calendar week*~~weekly~~; for each rack blended PG binder, *additional* representative samples shall be obtained daily. Each Quality Control sample *and additional daily rack blended samples* shall be *adequately identified and* retained not less than eight weeks ~~by~~ *at* the ~~supplier~~*supply location*. Any PG binder not shipped to Department projects is not required to be sampled or tested.

(3) Split samples of any PG binder will be provided when requested by a representative of the Department. In this situation three representative one quart samples will be obtained by the supplier under the direction of the Department. One sample will be submitted to the State Materials Office, one will be tested by the supplier for Specification Compliance and one will be tested by the supplier for Quality Control. The method of obtaining the three representative one quart samples is to obtain a single gallon sample, which is then stirred and poured into three one quart cans. When split

samples are requested by the Department, the results from both parties will be made available within ten working days.

(4) For each rack blended PG binder, identify minimum daily Process Control Testing in the QC Plan.

916-1.3.4 Reporting: A monthly report by the supplier containing Specification Compliance and Quality Control Test results *for each PG binder LOT* shall be submitted *by the supplier in electronic format using the form provided by the Department* to the State Materials Office *within ~~7~~seven days following the end of the calendar month*. Test results for split samples shall also be included. Process Control Test results shall not be included. *Copies of these monthly reports and supporting test reports shall be available at the supply location for a minimum of 3 years.*

The report shall consist of the Specification compliance testing and Quality Control Testing of the following as applicable by these Specifications.

SUPERPAVE PG ASPHALT BINDER		
Test and Method	Conditions	Specification Minimum/Maximum Value
Original Binder		
Superpave PG Asphalt Binder Grade		Report
Qualified Products List Number		Report
Polymer Modifier Type	~~As Required~~*(PG76-22 Only)*	Report
Spot Test, AASHTO T102	Standard with Naphtha Solvent	Negative for all grades
Solubility, AASHTO T44	in Trichlorethylene	Minimum 99.0%
Smoke Point, FM 5-519	COC	Minimum 260ºF (125ºC)
Flash Point, AASHTO T48	COC	Minimum 450ºF (230°C)
Rotational Viscosity, ASTM D4402	275ºF (135°C)	Maximum 3 Pa-s
Absolute Viscosity, AASHTO T202	140ºF (60ºC)	As Required for Quality Control Testing
Dynamic Shear Rheometer, AASHTO T315	$G^*/\sin\delta$, Test Temperature @ 10 rad/sec, ~~°F (~~°C~~)~~ Phase Angle, δ, (PG 76-22 Only)	Minimum 1.00 kPa ~~≤~~*Maximum* 75 degree*s*
Rolling Thin Film Oven Test Residue (AASHTO T240)		
Rolling Thin Film Oven, AASHTO T240	Mass Loss%	Maximum 0.50
Dynamic Shear Rheometer, AASHTO T315	$G^*/\sin\delta$, Test Temperature @ 10 rad/sec, ~~°F (~~°C~~)~~	Minimum 2.20 kPa

Pressure Aging Vessel Residue (AASHTO ~~PP1~~*R-28*) at ~~212ºF (~~100ºC~~)~~		
Dynamic Shear Rheometer, AASHTO T315	G^* sin δ, ~~Test Temperature @~~ 10 rad/sec~~,~~. @ ~~77°F (~~25°C~~)~~	Maximum 5000 kPa
Creep Stiffness, AASHTO T313	S (Stiffness), ~~Test Temperature~~ @ 60 sec~~,~~. ~~10°F (~~@ -12°C~~)~~ ~~m~~*M*-value, ~~Test Temperature~~ @ 60 sec~~,~~. ~~10°F (~~@ -12°C~~)~~	Maximum 300 Mpa Minimum 0.300
Pressure Aging Vessel Residue (AASHTO R-28) at 110ºC (Positive Spot Only)		
Dynamic Shear Rheometer, AASHTO T315	*G^* sin δ, 10 rad/sec. @ 25 ºC*	*Maximum 5,000 kPa*
Creep Stiffness, AASHTO T313	*S (Stiffness), @ 60 sec. @ -12 ºC* *M-value, @ 60 sec. @ -12 ºC*	*Maximum 300 Mpa* *Minimum 0.300*

916-1.3.5 Notification and Evaluation: In the event that a Specification Compliance test is outside specification requirements or a Quality Control test is outside limits established by the supplier as part of his Quality Control Program shipments of that product to Department projects will cease immediately and the Contractor and the State Materials Office will be notified and the product retested *for Specification Compliance* (resampling as appropriate). *Where the retest for Specification Compliance meets all requirements, shipments of that product may resume.* Where off-specification material has been shipped and the retest confirms the original test, the Contractor and State Materials Office will be informed of the steps taken to achieve specification compliance on the product shipped.

Where off-specification materials has been shipped, further shipment of that product to Department projects shall remain suspended until the cause of the problem is evaluated and corrected by the supplier to the satisfaction of the State Materials Engineer.

916-1.3.6 Certification and Verification:

The supplier shall furnish ~~a~~ certification *on the bill of lading* for each shipment of PG binder delivered to a Department project *that* ~~indicating~~ *includes: the quantity,* the Superpave PG asphalt binder grade *(including QPL number)*, *PG binder LOT, a statement* that ~~it~~ *the binder* ~~has been produced~~*is* in conformance with 916-1 and the suppliers Quality Control Program, and the *quantity of* silicone and anti-strip agent addition as applicable, including product designation *(QPL number as applicable)* ~~and amount~~. Any special handling or temperature requirements shall be indicated on the certification and are solely the responsibility of the Contractor to follow.

The Department may sample and test PG binder from *the suppliers storage tank,* the delivery vehicle, and/or Contractors storage tank to verify and determine compliance with this and other specification requirements. Where these tests identify material outside specification requirements, the State Materials Engineer may require the supplier to cease shipment of that *PG binder* product. Further shipment of that

PG binder product to Department projects may remain suspended until the cause of the problem is evaluated and corrected by the supplier as necessary to the satisfaction of the State Materials Engineer.

916-2 Recycling Agents.

916-2.1 Requirements: The asphalt recycling agent *(RA)* shall be an asphalt cement *(PG asphalt binder)* or an asphalt cement blended (as necessary) with a softening agent or flux oil, and shall meet the following requirements:

RECYCLING AGENTS		
Test	Conditions	Recycling Agent Minimum/Maximum Value
Viscosity –P (Pa·s)	140ºF [60ºC]	Target Viscosity ± 20%
Viscosity Ratio (Residue from Thin Film Oven Test)	Visc. 140ºF [60ºC] after TFOT / Visc. 140ºF [60ºC] before TFOT	maximum 3
Smoke Point	COC	minimum 260ºF [125ºC]
Flash Point	COC	minimum 400ºF [205ºC]
Solubility	in Trichlorethylene	minimum 97.5%

Rack blending of recycling agents (blending from ~~2~~two RA tank sources) will be permitted to meet a required target viscosity value.

Silicone shall be added to the recycling agent at a rate of 25 cm^3 for each 5,000 gallons [19 m^3] of recycling agent. If a dispersing fluid is used in conjunction with the silicone, the resultant mixture containing the full 25 cm^3 shall be added, in accordance with the manufacturer's recommendation. The blending of silicone mixture with the residue shall be done by the supplier prior to shipment.

The recycling agent shall contain 0.5% heat-stable anti-strip additive by weight of asphalt from an approved source. The anti-strip additive shall meet the requirements of 916-5. The anti-strip additive shall be introduced and mixed into the recycling agent~~, or emulsified recycling agent,~~ at the terminal.

Where a recycling agent is used in mixes containing reclaimed asphalt pavement (RAP), the requirements of 334-2.3.4 must also be met.

916-2.2 Sampling and Reporting: *Sampling of recycling agents shall be done in accordance with AASHTO T-40. Initial Specification Compliance test results shall be required for each new LOT of material. A new LOT will occur when the material in a tank changes and the Specification Compliance Test may not be representative of the material in the tank. This may be due to an incoming bulk shipment of material, change in refinery run, the manufacture of a product, or a blend of material in a tank.*

A monthly report by the supplier containing Specification Compliance Test results for each RA LOT shall be submitted by the supplier in electronic format using the form provided by the Department to the State Materials Office within ~~7~~seven days following the end of the calendar month. Copies of these monthly reports and

supporting test reports shall be available at the supply location for a minimum of ~~3~~three years.

916-2.~~2 Sampling and~~3 Certification *and Verification*: The supplier shall furnish ~~a~~ certification *on the bill of lading for each shipment of recycling agent delivered to a Department project* ~~indicating~~ *that includes: the quantity, the RA target viscosity, the RA LOT(s), a statement that the RA is in conformance*~~compliance~~ with ~~the above specification~~*916-2, and the quantity of silicone and anti-strip agent addition, including product designation (QPL number as applicable).* ~~for all recycling agents delivered to the project.~~

~~For each shipment delivered to the asphalt terminal, the asphalt supplier shall submit a test report to the State Materials Office to include all properties specified for a particular recycling agent. The test results may be from a sample taken from the storage tank(s) after delivery or from a random sample taken from the barge or rail car(s).~~

The Department may sample and test recycling agents from the suppliers storage tank, the delivery vehicle, and/or Contractors storage tank to verify and determine compliance with this and other specification requirements. Where these tests identify material outside specification requirements, the State Materials Engineer may require the supplier to cease shipment of RA binder from that RA LOT(s). Further shipment of RA binder from that RA LOT(s) to Department projects may remain suspended until the cause of the problem is evaluated and corrected by the supplier as necessary to the satisfaction of the State Materials Engineer.

916-3 Cut-Back Asphalts.

916-3.1 Requirements: Rapid-curing, cut-back asphalt shall conform with the requirements of AASHTO M 81, except that the penetration range shall be from 60-120 instead of 80-120.

For Grade RC-3000, in addition to the requirements shown in Table 1 of AASHTO M 81 the following values shall be added to the requirements for Distillation Test:

Distillate, Percentage by Volume of Total Distillate to 680ºF [360ºC]	Grade RC-3000 Maximum
to 320ºF [160ºC]	0
to 374ºF [190ºC]	10
to 437ºF [225ºC]	40

All other requirements for the distillation test (and for other properties included in the table) shall be as shown in Table 1 of AASHTO M 81.

Medium-curing, cut-back asphalt shall conform with the requirements of AASTHO M 82.

916-3.2 Sampling, ~~and~~ Certification, *and Verification*: *Sampling of cut-back asphalts shall be done in accordance with AASHTO T-40.* For each tank of cut-back asphalt delivered to or prepared at the asphalt terminal, the asphalt supplier shall submit a sample to the State Materials Office for testing before use. A pretest number will then be assigned by the State Materials Office which shall be furnished with all cut-back asphalt

delivered to the project. The pretest number shall be valid for six months from the date of issue.

The Department may sample and test pre-tested cut-back asphalt from the suppliers storage tank, the Contractors transport tank and/or distributor to verify and determine compliance with this and other specification requirements. Where these tests identify material outside specification requirements, the State Materials Engineer may require the supplier to cease shipment of that pretested cut-back asphalt product. Further shipment of that pretested cut-back asphalt product to Department projects may remain suspended until the cause of the problem is evaluated and corrected by the supplier as necessary to the satisfaction of the State Materials Engineer.

916-4 ~~Emulsions~~*Emulsified Asphalts*.

916-4.1 Requirements: Anionic Emulsified Asphalt shall meet the requirements of AASHTO M 140 with the exception that the cement mix test will be waived when the asphalt is used in non-mix application, such as tack coats and primes. Cationic Emulsified Asphalt shall meet the requirements of AASHTO M 208. Additional emulsions permitted by specifications shall meet the following requirements:

HIGH FLOAT EMULSIONS		
Test	Conditions	Asphalt Emulsion Grade AE-60 Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	122ºF [50ºC]	75/400 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Sieve Test		maximum 0.10%
Demulsibility	50 mL $CaCl_2$ 0.10 N	minimum 75%
Residue by Distillation		minimum 65%
Oil Portion	500ºF. Dist. [260ºC. Dist.]	maximum 1% by volume
Tests on Residue:		
Penetration (0.1 mm)	77ºF [25ºC], 100 g, 5 seconds	minimum 40
Absolute Viscosity	140ºF [60ºC]	minimum 3,200 poise [320 Pa·s]
Ductility	77ºF [25ºC], 50 mm/minute	minimum 400 mm
Float Test	140ºF [60ºC]	minimum 1,200 seconds
Solubility	in Trichlorethylene	minimum 97.5%

Test	Conditions	Asphalt Emulsion Grade AE-90 Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	122ºF [50ºC]	75/400 seconds
Settlement	5 days (a)	maximum 5%

Storage Stability	24 hour (b)	maximum 1%
Sieve Test		maximum 0.10%
Demulsibility	50 mL $CaCl_2$ 0.10 N	minimum 75%
Residue by Distillation		minimum 65%
Oil Portion	500ºF. Dist. [260ºC. Dist.]	maximum 2% by volume
Tests on Residue:		
Penetration (0.1 mm)	77ºF [25ºC], 100 g, 5 seconds	minimum 70
Absolute Viscosity	140ºF [60ºC]	minimum 1,600 poise [160 Pa·s]
Ductility	77ºF [25ºC], 50 mm/minute	minimum 400 mm
Float Test	140ºF [60ºC]	minimum 1,200 seconds
Solubility	in Trichlorethylene	minimum 97.5%

Test	Conditions	Asphalt Emulsion Grade AE-150
		Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	122ºF [50ºC]	75/400 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Sieve Test		maximum 0.10%
Demulsibility	50 mL $CaCl_2$ 0.10 N	minimum 75%
Residue by Distillation		minimum 65%
Oil Portion	500ºF. Dist. [260ºC. Dist)]	maximum 3% by volume
Tests on Residue:		
Penetration (0.1 mm)	77ºF [25ºC], 100 g, 5 seconds	minimum 125
Absolute Viscosity	140ºF [60ºC]	minimum 800 poise [80 Pa·s]
Ductility	77ºF [25ºC], 50 mm/minute	minimum 400 mm
Float Test	140ºF [60ºC]	minimum 1,200 seconds
Solubility	in Trichlorethylene	minimum 97.5%

Test	Conditions	Asphalt Emulsion Grade AE-200
		Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	122ºF [50ºC]	minimum 45 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Sieve Test		maximum 0.10%
Demulsibility	50 mL $CaCl_2$ 0.10 N	minimum 75%
Residue by Distillation		minimum 62%
Oil Portion	500ºF. Dist. [260ºC. Dist)]	maximum 8% by volume

Tests on Residue:		
Penetration (0.1 mm)	77ºF [25ºC], 100 g, 5 seconds	minimum 150
Absolute Viscosity	140ºF [60ºC]	minimum 400 poise [40 Pa·s]
Ductility	77ºF [25ºC], 50 mm/minute	
Float Test	140ºF [60ºC]	minimum 1,200 seconds
Solubility	in Trichlorethylene	minimum 97.5%
(a) The test requirement for settlement may be waived when the emulsified asphalt is used in less than five days. (b) The 24-hour (one day) storage stability test may be used instead of the five day settlement test.		

SPECIAL MS-EMULSION		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	77ºF [25ºC]	minimum 45 seconds
Storage Stability	24 hour	maximum 1%
Sieve Test	50 mL $CaCl_2$ 0.10 N	maximum 0.10%
Demulsibility		minimum 65%
Residue by Distillation		minimum 62%
Naphtha Content	500ºF. Dist. [260ºC. Dist]	maximum 8% by volume
Tests on Residue:		
Penetration (0.1 mm)	77ºF [25ºC], 100 g, 5 seconds	minimum 50
Ductility	77ºF [25ºC], 50 mm/minute	minimum 400 mm
Absolute Viscosity	140ºF [60ºC]	minimum 800 poise [80 Pa·s]
Solubility	in Trichloroethylene	minimum 97.5%
Maximum application temperature shall be 170ºF [75ºC].		

EMULSIFIED ASPHALT GRADE CRS-2H		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc.	122ºF [50ºC]	100/400 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Demulsibility	35 mL 0.8% Sodium Dioctyl Sulfosuccinate (c)	minimum 40%
Particle Charge		positive
Sieve Test		maximum 0.1%
Residue		minimum 65%
Tests on Residue:		
Penetration (0.1 mm)	77ºF [25ºC], 100 g, 5 seconds	80/140
Ductility	77ºF [25ºC], 50 mm/minute	minimum 400 mm
Solubility	in Trichloroethylene	minimum 97.5%
(a) The test requirement for settlement may be waived when the emulsified asphalt is used in less than five days. (b) The 24-hour (one day) storage stability test may be used instead of the five day settlement test. (c) The demulsibility test shall be made within 30 days from date of shipment.		

ASPHALT EMULSION PRIME (AEP)		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc.	77ºF [25ºC]	20/150 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Sieve Test		maximum 0.1%
Residue		minimum 55%
Naphtha Content	500ºF. Dist [260ºC. Dist.]	maximum 12% by volume
Tests on Residue:		
Penetration (0.1 mm)	77ºF [25ºC], 100 g, 5 seconds	40/200
Ductility	77ºF [25ºC], 50 mm/minute	minimum 400 mm
Solubility	in Trichloroethylene	minimum 97.5%
(a) The test requirement for settlement may be waived when the emulsified asphalt is used in less than five days. (b) The 24-hour (one day) storage stability test may be used instead of the five day settlement test.		

ASPHALT EMULSION GRADE RS-1		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	77ºF [25ºC]	20/100 seconds
Storage Stability	24 hour	maximum 1%
Demulsibility	35 mL 0.02N $CaCl_2$ (a)	minimum 60%
Sieve Test		maximum 0.10%
Residue by Distillation		minimum 55%
Naphtha Portion	500ºF. Dist [260ºC. Dist.](b)	maximum 3% by volume
Tests on Residue From Distillation Test:		
Penetration (0.1 mm)	77ºF [25ºC], 100 g, 5 seconds	minimum 60
Viscosity	140ºF [60ºC]	minimum 1,600 poise [160 Pa·s]
Ductility	77ºF [25ºC], 50 mm/minute	minimum 400 mm
Solubility	in Trichloroethylene	minimum 97.5%
(a) The demulsibility test shall be made within 30 days from the date of shipment. (b) When RS-1 has been modified to include naphtha, the 24-hour storage stability test will be waived.		

EMULSION PRIME (RS TYPE)		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc.	77ºF [25ºC]	minimum 75 seconds
Storage Stability	24 hour	maximum 1.0%
Sieve Test		maximum 0.1%
Naphtha Content		5/15% by volume

Residue		minimum 55%
Tests on Residue:*		
Penetration (0.1 mm)	77ºF [25ºC], 100 g, 5 seconds	minimum 50
Viscosity	140ºF [60ºC]	minimum 800 poise [80 Pa·s]
Solubility	in Trichloroethylene	minimum 97.5%
* Residue by distillation shall be in accordance with AASHTO T 59 except that the maximum temperature shall be 329 ± 10ºF [165 ± 5ºC] and the sample shall be maintained at this temperature for 20 minutes.		

EPR-1 PRIME (e)		
Tests	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc.	77ºF [25ºC]	6/24 seconds
Storage Stability	24 hour	maximum 0.5%
Sieve Test (a)		maximum 0.1%
Residue by Distillation (b)		minimum 20%
Particle Charge Test (c)		positive
Test on Residue: (d)		
Flash Point	COC	minimum 410ºF [210ºC]
Viscosity	cSt-140ºF [60ºC]	600/1000 [0.00060/0.00100 m2/s]
(a) Distilled water shall be used in place of 2% sodium oleate solution. (b) Residue by distillation shall be in accordance with AASHTO T 59 with the exception that a 50 g sample is heated to 300ºF [149ºC] until foaming ceases, then cooling immediately and calculating results. (c) Caution: this material has a positive particle charge, and therefore should not be mixed with materials having a negative particle charge. (d) Residue by distillation shall be in accordance with AASHTO T 59 except that the maximum temperature shall be 329 ± 10ºF [165 ± 5ºC] and the sample shall be maintained at this temperature for 20 minutes. (e) EPR-1 Prime shall not be diluted and in the event that EPR-1 Prime is not used in a 12-hour period, the material shall be thoroughly mixed by circulation or other suitable means prior to it's use.		

916-4.2 ~~Sampling~~ *Sampling,*~~and~~ Certification*, and Verification*: For each tank of emulsified asphalt delivered to or prepared at the asphalt terminal, the asphalt supplier shall submit a sample to the State Materials Office for testing before use. A pretest number will then be assigned by the State Materials Office which shall be furnished with all emulsified asphalt delivered to the project. The pretest number shall be valid for six months from the date of issue.

The Department may sample and test pretested emulsified asphalt from the suppliers storage tank, the Contractors transport tank and/or distributor to verify and determine compliance with this and other specification requirements. Where these tests identify material outside specification requirements, the State Materials Engineer may require the supplier to cease shipment of that pretested emulsified asphalt product. Further shipment of that pretested emulsified asphalt product to Department projects may remain suspended until the cause of the problem is evaluated and corrected by the supplier as necessary to the satisfaction of the State Materials Engineer.

916-5 Liquid Anti-strip Agents:

916-5.1 Requirements: Liquid anti-strip agents shall be tested by the Department in accordance with FM 5-508. Tensile strength ratios will be calculated for the following two conditions and expressed as percentages: 1) conditioned mixture without anti-strip to unconditioned mixture without anti-strip and 2) conditioned mixture with anti-strip to unconditioned mixture without anti-strip. A 20% gain in tensile strength ratio for condition #2 as compared to condition #1 shall be required.

916-5.2 Qualified Products List: Liquid anti-strip agents supplied under this Specification shall be one of the products included on the Qualified Products List (QPL) as specified in 6-1. Liquid anti-strip agents meeting the criteria in 916-5.1 will be considered for inclusion on the Department's (QPL). For each liquid anti-strip agent, the supplier will submit to the State Materials Office one pint of a representative sample of liquid anti-strip agent when submitting the Product Evaluation Application. Liquid anti-strip agents must be requalified on an annual basis. If the liquid anti-strip agent has been modified then a new sample shall be submitted to the Department and tested per 916-5.1.

916-5.3 Mix Design Verification: Inclusion of a liquid anti-strip agent on the QPL does not guarantee that the anti-strip will be approved for use in an asphalt mixture. Specifications may require subsequent moisture susceptibility testing per FM 1-T 283 for the particular mix design. Results from this testing may indicate the need for a larger dosage rate of anti-strip agent (up to 0.75% maximum) or a different anti-strip agent to meet the specification requirements.

BITUMINOUS MATERIALS.
(REV 11-2-05)

SECTION 916 (Pages 785-797) is deleted and the following substituted:

SECTION 916

BITUMINOUS MATERIALS

916-1 Superpave PG Asphalt Binder:

916-1.1 Requirements: Superpave PG asphalt binders, identified as PG 64-22, PG 67-22, and PG 76-22, shall meet the requirements of 916-1.2, AASHTO M-320 and the following additional requirements:

1. The mass loss AASHTO T-240 shall be a maximum of 0.5% for all grades.

2. The spot test AASHTO T-102 with standard naphtha shall be negative for all grades. As an exception, a positive spot will be accepted if the PAV Residue (AASHTO R-28) at 110 ºC meets all the requirements for the particular grade.

3. The smoke point FM 5-519 shall be a minimum of 125ºC for all grades.

4. The intermediate test temperature at 10 rad/s. for the Dynamic Shear Rheometer test AASHTO T-315 shall be 25ºC for all grades.

5. An additional high temperature grade of PG 67 is added for which the high test temperature at 10 rad/sec for the Dynamic Shear Rheometer test AASHTO T-315 shall be 67ºC.

6. All PG asphalt binders having a high temperature designation of PG 67 or lower shall be prepared without modification.

7. All PG asphalt binders having a high temperature designation higher than PG 67 shall be produced with a styrene-butadiene-styrene (SBS) or styrene-butadiene (SB) elastomer polymer modifier and resultant binder shall meet all requirements of this Specification; in addition the phase angle at 76ºC (AASHTO T-315) shall be less than or equal to 75 degrees.

8. The maximum viscosity AASHTO T-202 shall be 2400 poises for PG 64-22 and 3600 poises for PG 67-22.

All hot mix asphalt (except hot mix asphalt containing 20% RAP or greater) shall contain Superpave PG asphalt binder grade PG 67-22 unless otherwise specified in the plans and/or Specifications for the hot mix asphalt product.

For all PG binder used in all hot mix asphalt, silicone shall be added to the PG binder at the rate of 25 cm^3 of silicone mixed to each 5,000 gal. of PG binder. If a disbursing fluid is used in conjunction with the silicone the resultant mixture containing the full 25 cm^3 of silicone shall be added in accordance with the manufacturer's recommendation. The blending of the silicone with the PG binder shall be done by the supplier prior to the shipment.

All PG binder to be used in asphalt rubber binder for Friction Course mixes and other hot mix asphalt products containing RAP shall contain 0.5% heat stable anti-strip additive by weight of PG binder unless specifications for the hot mix asphalt product requires testing by FM 1-T 283 and the test results indicate it is not required, or

the mixture contains hydrated lime. Where FM 1-T 283 indicates an anti-strip additive is required, it shall be from 0.25 to 0.75%. The anti-strip additive shall meet the requirements of 916-5. The anti-strip additive shall be introduced into the PG binder by the supplier during loading.

Where PG binder is used in mixes containing reclaimed asphalt pavement (RAP), the requirements of 334-2.3.4 must also be met.

916-1.2 Qualified Products List: The Superpave PG asphalt binders supplied under this Specification shall be one of the products included on the Qualified Products List as specified in 6-1. Any marked variation from the original test values for a material below the established limits or evidence of inadequate quality control or field performance of a material will be considered to be sufficient evidence that the properties of the material have changed, and the material will be removed from the Qualified Products List.

For each binder grade, the supplier may be required to submit to the State Materials Office a split sample of material representative of test results submitted with the Product Evaluation Application. In addition, for modified binders, the original PG binder grade, the modifier product designation, and amount added shall be indicated. Suppliers shall not ship any PG binder until notified that the product is on the Qualified Products List and an approved Quality Control Program meeting the requirements of 916-1.3 has been implemented.

916-1.3 Quality Control Program: The supplier of Superpave PG asphalt binder shall at a minimum have a Quality Control Program meeting the requirements of this Specification which is based on AASHTO R-26. The Quality Control Program shall be submitted in electronic format to the State Materials Office for approval.

The requirements for the Quality Control program apply to the supply location of PG binders for the use on Florida Department of Transportation projects. The supply location of PG binder may represent refinery production, terminal distribution, blending, processing and/or modification location. Rack blending (blending from two tank sources) will be permitted to meet the requirements for a PG asphalt binder product. Any special handling requirements such as rack blending and manufacture of polymer modified asphalt shall be described in the Quality Control program. The requirements of these Specifications for a Quality Control Program do not apply to Recycle Agents at this time.

916-1.3.1 Identification of Personnel and Supply Locations: The supplier's primary and secondary representatives responsible for Quality Control shall be identified by name, title, address, telephone, fax and e-mail address. At least one of the representatives shall be located at the supply location. The supply locations shall be identified by name, address and telephone.

916-1.3.2 Specification Compliance and Quality Control Testing: Specification Compliance Testing shall consist of complete testing of each PG binder shipped in accordance with AASHTO M-320 and 916-1.1 of these Specifications. Results of Specification Compliance Testing shall be available to the supplier within five working days of sampling. Specification Compliance Testing shall be conducted by a testing laboratory that participates at least annually in the AMRL Reference Sample Testing Program. The primary testing lab and any other labs to be used for Specification Compliance Testing shall be identified in the suppliers Quality Control Program. The

results from each AMRL proficiency Sample for each testing laboratory shall be forwarded by the supplier for each supply location in electronic format to the State Materials Office. Acceptable performance in the AMRL proficiency Sample Testing Program shall be a minimum of 3 for each test. A rating of less than 3 shall require identification of appropriate action on the part of the supplier and be acceptable to the State Materials Engineer.

Quality Control testing as a minimum shall consist of testing a representative sample of each PG binder shipped by the supplier in accordance with either:

(1) AASHTO T-202 Standard Test Method for Viscosity of Asphalts by Vacuum Capillary Viscometer or

(2) AASHTO T-315 Test Method for Determining Rheological Properties of Asphalt Binder using a Dynamic Shear Rheometer (DSR).

Results of Quality Control Testing shall be available to the supplier within five hours of sampling. The Quality Control testing and location where the test will be done shall be identified in the suppliers Quality Control Program.

916-1.3.3 Frequency of Sampling and Testing: Sampling of PG binders shall be done in accordance with AASHTO T-40. Initial Specification Compliance test results shall be required for each PG binder grade for each new LOT of material which will be further subjected to Quality Control Testing in accordance with 916-1.3.2. A new LOT will occur when the material in a tank changes and the Specification Compliance Test may no longer be representative of the material in the tank. This may be due to an incoming bulk shipment of material, change in refinery run, the manufacture of a product, or a blend of material in a tank. Additional testing is as follows:

(1) Any PG binder shipped to a Department project during any one calendar month shall be tested at least once during that month for Specification Compliance in accordance with 916-1.3.2.

(2) When being shipped to Department projects, samples shall be obtained by the supplier and tested for Quality Control testing in accordance with 916-1.3.2. A single one quart representative sample of each PG binder shall be obtained and tested by the supplier each calendar week; for each rack blended PG binder, additional representative samples shall be obtained daily. Each Quality Control sample and additional daily rack blended samples shall be adequately identified and retained not less than eight weeks at the supply location. Any PG binder not shipped to Department projects is not required to be sampled or tested.

(3) Split samples of any PG binder will be provided when requested by a representative of the Department. In this situation three representative one quart samples will be obtained by the supplier under the direction of the Department. One sample will be submitted to the State Materials Office, one will be tested by the supplier for Specification Compliance and one will be tested by the supplier for Quality Control. The method of obtaining the three representative one quart samples is to obtain a single gallon sample, which is then stirred and poured into three one quart cans. When split samples are requested by the Department, the results from both parties will be made available within ten working days.

(4) For each rack blended PG binder, identify minimum daily Process Control Testing in the QC Plan.

916-1.3.4 Reporting: A monthly report by the supplier containing Specification Compliance and Quality Control Test results for each PG binder LOT shall be submitted by the supplier in electronic format using the form provided by the Department to the State Materials Office within seven days following the end of the calendar month. Test results for split samples shall also be included. Process Control Test results shall not be included. Copies of these monthly reports and supporting test reports shall be available at the supply location for a minimum of 3 years.

The report shall consist of the Specification compliance testing and Quality Control Testing of the following as applicable by these Specifications.

SUPERPAVE PG ASPHALT BINDER		
Test and Method	Conditions	Specification Minimum/Maximum Value
Original Binder		
Superpave PG Asphalt Binder Grade		Report
Qualified Products List Number		Report
Polymer Modifier Type	(PG76-22 Only)	Report
Spot Test, AASHTO T102	Standard with Naphtha Solvent	Negative for all grades
Solubility, AASHTO T44	in Trichlorethylene	Minimum 99.0%
Smoke Point, FM 5-519	COC	Minimum 260ºF (125ºC)
Flash Point, AASHTO T48	COC	Minimum 450ºF (230°C)
Rotational Viscosity, ASTM D4402	275ºF (135°C)	Maximum 3 Pa-s
Absolute Viscosity, AASHTO T202	140ºF (60ºC)	As Required for Quality Control Testing
Dynamic Shear Rheometer, AASHTO T315	$G^*/\sin\delta$, Test Temperature @ 10 rad/sec, °C Phase Angle, δ, (PG 76-22 Only)	Minimum 1.00 kPa Maximum 75 degrees
Rolling Thin Film Oven Test Residue (AASHTO T240)		
Rolling Thin Film Oven, AASHTO T240	Mass Loss%	Maximum 0.50
Dynamic Shear Rheometer, AASHTO T315	$G^*/\sin\delta$, Test Temperature @ 10 rad/sec, °C	Minimum 2.20 kPa
Pressure Aging Vessel Residue (AASHTO R-28) at 100ºC		
Dynamic Shear Rheometer, AASHTO T315	$G^*\sin\delta$, 10 rad/sec. @ 25°C	Maximum 5000 kPa

Creep Stiffness, AASHTO T313	S (Stiffness), @ 60 sec. @ -12°C M-value, @ 60 sec. @ -12°C	Maximum 300 Mpa Minimum 0.300
Pressure Aging Vessel Residue (AASHTO R-28) at 110ºC (Positive Spot Only)		
Dynamic Shear Rheometer, AASHTO T315	$G^*\sin\delta$, 10 rad/sec. @ 25°C	Maximum 5,000 kPa
Creep Stiffness, AASHTO T313	S (Stiffness), @ 60 sec. @ -12°C M-value, @ 60 sec. @ -12°C	Maximum 300 Mpa Minimum 0.300

916-1.3.5 Notification and Evaluation: In the event that a Specification Compliance test is outside specification requirements or a Quality Control test is outside limits established by the supplier as part of his Quality Control Program shipments of that product to Department projects will cease immediately and the Contractor and the State Materials Office will be notified and the product retested for Specification Compliance (resampling as appropriate). Where the retest for Specification Compliance meets all requirements, shipments of that product may resume. Where off-specification material has been shipped and the retest confirms the original test, the Contractor and State Materials Office will be informed of the steps taken to achieve specification compliance on the product shipped.

Where off-specification materials has been shipped, further shipment of that product to Department projects shall remain suspended until the cause of the problem is evaluated and corrected by the supplier to the satisfaction of the State Materials Engineer.

916-1.3.6 Certification and Verification:

The supplier shall furnish certification on the bill of lading for each shipment of PG binder delivered to a Department project that includes: the quantity, the Superpave PG asphalt binder grade (including QPL number), PG binder LOT, a statement that the binder is in conformance with 916-1 and the suppliers Quality Control Program, and the quantity of silicone and anti-strip agent addition as applicable, including product designation (QPL number as applicable). Any special handling or temperature requirements shall be indicated on the certification and are solely the responsibility of the Contractor to follow.

The Department may sample and test PG binder from the suppliers storage tank, the delivery vehicle, and/or Contractors storage tank to verify and determine compliance with this and other specification requirements. Where these tests identify material outside specification requirements, the State Materials Engineer may require the supplier to cease shipment of that PG binder product. Further shipment of that PG binder product to Department projects may remain suspended until the cause of the problem is evaluated and corrected by the supplier as necessary to the satisfaction of the State Materials Engineer.

916-2 Recycling Agents.

916-2.1 Requirements: The asphalt recycling agent (RA) shall be an asphalt cement (PG asphalt binder) or an asphalt cement blended (as necessary) with a softening agent or flux oil, and shall meet the following requirements:

RECYCLING AGENTS		
Test	Conditions	Recycling Agent Minimum/Maximum Value
Viscosity –P (Pa·s)	140ºF [60ºC]	Target Viscosity ± 20%
Viscosity Ratio (Residue from Thin Film Oven Test)	Visc. 140ºF [60ºC] after TFOT / Visc. 140ºF [60ºC] before TFOT	maximum 3
Smoke Point	COC	minimum 260ºF [125ºC]
Flash Point	COC	minimum 400ºF [205ºC]
Solubility	in Trichlorethylene	minimum 97.5%

Rack blending of recycling agents (blending from two RA tank sources) will be permitted to meet a required target viscosity value.

Silicone shall be added to the recycling agent at a rate of 25 cm^3 for each 5,000 gallons [19 m^3] of recycling agent. If a dispersing fluid is used in conjunction with the silicone, the resultant mixture containing the full 25 cm^3 shall be added, in accordance with the manufacturer's recommendation. The blending of silicone mixture with the residue shall be done by the supplier prior to shipment.

The recycling agent shall contain 0.5% heat-stable anti-strip additive by weight of asphalt from an approved source. The anti-strip additive shall meet the requirements of 916-5. The anti-strip additive shall be introduced and mixed into the recycling agent at the terminal.

Where a recycling agent is used in mixes containing reclaimed asphalt pavement (RAP), the requirements of 334-2.3.4 must also be met.

916-2.2 Sampling and Reporting: Sampling of recycling agents shall be done in accordance with AASHTO T-40. Initial Specification Compliance test results shall be required for each new LOT of material. A new LOT will occur when the material in a tank changes and the Specification Compliance Test may not be representative of the material in the tank. This may be due to an incoming bulk shipment of material, change in refinery run, the manufacture of a product, or a blend of material in a tank.

A monthly report by the supplier containing Specification Compliance Test results for each RA LOT shall be submitted by the supplier in electronic format using the form provided by the Department to the State Materials Office within seven days following the end of the calendar month. Copies of these monthly reports and supporting test reports shall be available at the supply location for a minimum of three years.

916-2.3 Certification and Verification: The supplier shall furnish certification on the bill of lading for each shipment of recycling agent delivered to a Department

project that includes: the quantity, the RA target viscosity, the RA LOT(s), a statement that the RA is in conformance with 916-2, and the quantity of silicone and anti-strip agent addition, including product designation (QPL number as applicable).

The Department may sample and test recycling agents from the suppliers storage tank, the delivery vehicle, and/or Contractors storage tank to verify and determine compliance with this and other specification requirements. Where these tests identify material outside specification requirements, the State Materials Engineer may require the supplier to cease shipment of RA binder from that RA LOT(s). Further shipment of RA binder from that RA LOT(s) to Department projects may remain suspended until the cause of the problem is evaluated and corrected by the supplier as necessary to the satisfaction of the State Materials Engineer.

916-3 Cut-Back Asphalts.

916-3.1 Requirements: Rapid-curing, cut-back asphalt shall conform with the requirements of AASHTO M 81, except that the penetration range shall be from 60-120 instead of 80-120.

For Grade RC-3000, in addition to the requirements shown in Table 1 of AASHTO M 81 the following values shall be added to the requirements for Distillation Test:

Distillate, Percentage by Volume of Total Distillate to 680ºF [360ºC]	Grade RC-3000 Maximum
to 320ºF [160ºC]	0
to 374ºF [190ºC]	10
to 437ºF [225ºC]	40

All other requirements for the distillation test (and for other properties included in the table) shall be as shown in Table 1 of AASHTO M 81.

Medium-curing, cut-back asphalt shall conform with the requirements of AASTHO M 82.

916-3.2 Sampling, Certification, and Verification: Sampling of cut-back asphalts shall be done in accordance with AASHTO T-40. For each tank of cut-back asphalt delivered to or prepared at the asphalt terminal, the asphalt supplier shall submit a sample to the State Materials Office for testing before use. A pretest number will then be assigned by the State Materials Office which shall be furnished with all cut-back asphalt delivered to the project. The pretest number shall be valid for six months from the date of issue.

The Department may sample and test pre-tested cut-back asphalt from the suppliers storage tank, the Contractors transport tank and/or distributor to verify and determine compliance with this and other specification requirements. Where these tests identify material outside specification requirements, the State Materials Engineer may require the supplier to cease shipment of that pretested cut-back asphalt product. Further shipment of that pretested cut-back asphalt product to Department projects may remain suspended until the cause of the problem is evaluated and corrected by the supplier as necessary to the satisfaction of the State Materials Engineer.

916-4 Emulsified Asphalts.

916-4.1 Requirements: Anionic Emulsified Asphalt shall meet the requirements of AASHTO M 140 with the exception that the cement mix test will be waived when the asphalt is used in non-mix application, such as tack coats and primes. Cationic Emulsified Asphalt shall meet the requirements of AASHTO M 208. Additional emulsions permitted by specifications shall meet the following requirements:

HIGH FLOAT EMULSIONS		
Test	Conditions	Asphalt Emulsion Grade AE-60
		Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	122ºF [50ºC]	75/400 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Sieve Test		maximum 0.10%
Demulsibility	50 mL $CaCl_2$ 0.10 N	minimum 75%
Residue by Distillation		minimum 65%
Oil Portion	500ºF. Dist. [260ºC. Dist.]	maximum 1% by volume
Tests on Residue:		
Penetration (0.1 mm)	77ºF [25ºC], 100 g, 5 seconds	minimum 40
Absolute Viscosity	140ºF [60ºC]	minimum 3,200 poise [320 Pa·s]
Ductility	77ºF [25ºC], 50 mm/minute	minimum 400 mm
Float Test	140ºF [60ºC]	minimum 1,200 seconds
Solubility	in Trichlorethylene	minimum 97.5%

Test	Conditions	Asphalt Emulsion Grade AE-90
		Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	122ºF [50ºC]	75/400 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Sieve Test		maximum 0.10%
Demulsibility	50 mL $CaCl_2$ 0.10 N	minimum 75%
Residue by Distillation		minimum 65%
Oil Portion	500ºF. Dist. [260ºC. Dist.]	maximum 2% by volume
Tests on Residue:		
Penetration (0.1 mm)	77ºF [25ºC], 100 g, 5 seconds	minimum 70
Absolute Viscosity	140ºF [60ºC]	minimum 1,600 poise [160 Pa·s]
Ductility	77ºF [25ºC], 50 mm/minute	minimum 400 mm

Float Test	140ºF [60ºC]	minimum 1,200 seconds
Solubility	in Trichlorethylene	minimum 97.5%

Test	Conditions	Asphalt Emulsion Grade AE-150 Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	122ºF [50ºC]	75/400 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Sieve Test		maximum 0.10%
Demulsibility	50 mL $CaCl_2$ 0.10 N	minimum 75%
Residue by Distillation		minimum 65%
Oil Portion	500ºF. Dist. [260ºC. Dist)]	maximum 3% by volume
Tests on Residue:		
Penetration (0.1 mm)	77ºF [25ºC], 100 g, 5 seconds	minimum 125
Absolute Viscosity	140ºF [60ºC]	minimum 800 poise [80 Pa·s]
Ductility	77ºF [25ºC], 50 mm/minute	minimum 400 mm
Float Test	140ºF [60ºC]	minimum 1,200 seconds
Solubility	in Trichlorethylene	minimum 97.5%

Test	Conditions	Asphalt Emulsion Grade AE-200 Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	122ºF [50ºC]	minimum 45 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Sieve Test		maximum 0.10%
Demulsibility	50 mL $CaCl_2$ 0.10 N	minimum 75%
Residue by Distillation		minimum 62%
Oil Portion	500ºF. Dist. [260ºC. Dist)]	maximum 8% by volume
Tests on Residue:		
Penetration (0.1 mm)	77ºF [25ºC], 100 g, 5 seconds	minimum 150
Absolute Viscosity	140ºF [60ºC]	minimum 400 poise [40 Pa·s]
Ductility	77ºF [25ºC], 50 mm/minute	
Float Test	140ºF [60ºC]	minimum 1,200 seconds
Solubility	in Trichlorethylene	minimum 97.5%
(a) The test requirement for settlement may be waived when the emulsified asphalt is used in less than five days. (b) The 24-hour (one day) storage stability test may be used instead of the five day settlement test.		

SPECIAL MS-EMULSION

Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	77ºF [25ºC]	minimum 45 seconds
Storage Stability	24 hour	maximum 1%
Sieve Test	50 mL $CaCl_2$ 0.10 N	maximum 0.10%
Demulsibility		minimum 65%
Residue by Distillation		minimum 62%
Naphtha Content	500ºF. Dist. [260ºC. Dist]	maximum 8% by volume
Tests on Residue:		
Penetration (0.1 mm)	77ºF [25ºC], 100 g, 5 seconds	minimum 50
Ductility	77ºF [25ºC], 50 mm/minute	minimum 400 mm
Absolute Viscosity	140ºF [60ºC]	minimum 800 poise [80 Pa·s]
Solubility	in Trichloroethylene	minimum 97.5%
Maximum application temperature shall be 170ºF [75ºC].		

EMULSIFIED ASPHALT GRADE CRS-2H		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc.	122ºF [50ºC]	100/400 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Demulsibility	35 mL 0.8% Sodium Dioctyl Sulfosuccinate (c)	minimum 40%
Particle Charge		positive
Sieve Test		maximum 0.1%
Residue		minimum 65%
Tests on Residue:		
Penetration (0.1 mm)	77ºF [25ºC], 100 g, 5 seconds	80/140
Ductility	77ºF [25ºC], 50 mm/minute	minimum 400 mm
Solubility	in Trichloroethylene	minimum 97.5%
(a) The test requirement for settlement may be waived when the emulsified asphalt is used in less than five days. (b) The 24-hour (one day) storage stability test may be used instead of the five day settlement test. (c) The demulsibility test shall be made within 30 days from date of shipment.		

ASPHALT EMULSION PRIME (AEP)		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc.	77ºF [25ºC]	20/150 seconds
Settlement	5 days (a)	maximum 5%
Storage Stability	24 hour (b)	maximum 1%
Sieve Test		maximum 0.1%
Residue		minimum 55%
Naphtha Content	500ºF. Dist [260ºC. Dist.]	maximum 12% by volume

Tests on Residue:		
Penetration (0.1 mm)	77ºF [25ºC], 100 g, 5 seconds	40/200
Ductility	77ºF [25ºC], 50 mm/minute	minimum 400 mm
Solubility	in Trichloroethylene	minimum 97.5%
(a) The test requirement for settlement may be waived when the emulsified asphalt is used in less than five days. (b) The 24-hour (one day) storage stability test may be used instead of the five day settlement test.		

ASPHALT EMULSION GRADE RS-1		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc	77ºF [25ºC]	20/100 seconds
Storage Stability	24 hour	maximum 1%
Demulsibility	35 mL 0.02N $CaCl_2$ (a)	minimum 60%
Sieve Test		maximum 0.10%
Residue by Distillation		minimum 55%
Naphtha Portion	500ºF. Dist [260ºC. Dist.](b)	maximum 3% by volume
Tests on Residue From Distillation Test:		
Penetration (0.1 mm)	77ºF [25ºC], 100 g, 5 seconds	minimum 60
Viscosity	140ºF [60ºC]	minimum 1,600 poise [160 Pa·s]
Ductility	77ºF [25ºC], 50 mm/minute	minimum 400 mm
Solubility	in Trichloroethylene	minimum 97.5%
(a) The demulsibility test shall be made within 30 days from the date of shipment. (b) When RS-1 has been modified to include naphtha, the 24-hour storage stability test will be waived.		

EMULSION PRIME (RS TYPE)		
Test	Conditions	Minimum/Maximum
Tests on Emulsion:		
Saybolt Furol Visc.	77ºF [25ºC]	minimum 75 seconds
Storage Stability	24 hour	maximum 1.0%
Sieve Test		maximum 0.1%
Naphtha Content		5/15% by volume
Residue		minimum 55%
Tests on Residue:*		
Penetration (0.1 mm)	77ºF [25ºC], 100 g, 5 seconds	minimum 50
Viscosity	140ºF [60ºC]	minimum 800 poise [80 Pa·s]
Solubility	in Trichloroethylene	minimum 97.5%
* Residue by distillation shall be in accordance with AASHTO T 59 except that the maximum temperature shall be 329 ± 10ºF [165 ± 5ºC] and the sample shall be maintained at this temperature for 20 minutes.		

EPR-1 PRIME (e)		
Tests	Conditions	Minimum/Maximum

Tests on Emulsion:		
Saybolt Furol Visc.	77ºF [25ºC]	6/24 seconds
Storage Stability	24 hour	maximum 0.5%
Sieve Test (a)		maximum 0.1%
Residue by Distillation (b)		minimum 20%
Particle Charge Test (c)		positive
Test on Residue: (d)		
Flash Point	COC	minimum 410ºF [210ºC]
Viscosity	cSt-140ºF [60ºC]	600/1000 [0.00060/0.00100 m2/s]

(a) Distilled water shall be used in place of 2% sodium oleate solution.
(b) Residue by distillation shall be in accordance with AASHTO T 59 with the exception that a 50 g sample is heated to 300ºF [149ºC] until foaming ceases, then cooling immediately and calculating results.
(c) Caution: this material has a positive particle charge, and therefore should not be mixed with materials having a negative particle charge.
(d) Residue by distillation shall be in accordance with AASHTO T 59 except that the maximum temperature shall be 329 ± 10ºF [165 ± 5ºC] and the sample shall be maintained at this temperature for 20 minutes.
(e) EPR-1 Prime shall not be diluted and in the event that EPR-1 Prime is not used in a 12-hour period, the material shall be thoroughly mixed by circulation or other suitable means prior to it's use.

916-4.2 Sampling, Certification, and Verification: For each tank of emulsified asphalt delivered to or prepared at the asphalt terminal, the asphalt supplier shall submit a sample to the State Materials Office for testing before use. A pretest number will then be assigned by the State Materials Office which shall be furnished with all emulsified asphalt delivered to the project. The pretest number shall be valid for six months from the date of issue.

The Department may sample and test pretested emulsified asphalt from the suppliers storage tank, the Contractors transport tank and/or distributor to verify and determine compliance with this and other specification requirements. Where these tests identify material outside specification requirements, the State Materials Engineer may require the supplier to cease shipment of that pretested emulsified asphalt product. Further shipment of that pretested emulsified asphalt product to Department projects may remain suspended until the cause of the problem is evaluated and corrected by the supplier as necessary to the satisfaction of the State Materials Engineer.

916-5 Liquid Anti-strip Agents:

916-5.1 Requirements: Liquid anti-strip agents shall be tested by the Department in accordance with FM 5-508. Tensile strength ratios will be calculated for the following two conditions and expressed as percentages: 1) conditioned mixture without anti-strip to unconditioned mixture without anti-strip and 2) conditioned mixture with anti-strip to unconditioned mixture without anti-strip. A 20% gain in tensile strength ratio for condition #2 as compared to condition #1 shall be required.

916-5.2 Qualified Products List: Liquid anti-strip agents supplied under this Specification shall be one of the products included on the Qualified Products List (QPL) as specified in 6-1. Liquid anti-strip agents meeting the criteria in 916-5.1 will be considered for inclusion on the Department's (QPL). For each liquid anti-strip agent, the supplier will submit to the State Materials Office one pint of a representative sample of liquid anti-strip agent when submitting the Product Evaluation Application. Liquid anti-

strip agents must be requalified on an annual basis. If the liquid anti-strip agent has been modified then a new sample shall be submitted to the Department and tested per 916-5.1.

916-5.3 Mix Design Verification: Inclusion of a liquid anti-strip agent on the QPL does not guarantee that the anti-strip will be approved for use in an asphalt mixture. Specifications may require subsequent moisture susceptibility testing per FM 1-T 283 for the particular mix design. Results from this testing may indicate the need for a larger dosage rate of anti-strip agent (up to 0.75% maximum) or a different anti-strip agent to meet the specification requirements.