



## **DIVISION II – MATERIALS**

### **SPECIAL PROVISION COPIED NOTES (SPCNs), SPECIAL PROVISION (SPs) and SUPPLEMENTAL SPECIFICATIONS (SSs)**

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———— **STANDARD 200 SERIES SPCNs, SPs and SSs** ————

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**GUIDELINES — FOR PROJECTS REQUIRING CRUSHED GLASS TO BE A SEPARATE PAY ITEM. A SEPARATE PROJECT-SPECIFIC SPCN MUST BE INCLUDED THAT SPECIFIES FOR WHAT AND WHERE THE CRUSHED GLASS IS USED.**

(c200b00-0708) **CRUSHED GLASS** - When not incorporated into the measurement and payment of other items by specification, crushed glass will be measured and paid for at the contract unit price per ton, which shall be full compensation for furnishing, placing, manipulating and compacting. Deliveries of crushed glass shall conform to Section 109.01(a) of the Specifications.

Payment will be made as follows:

<b>Pay Item</b>	<b>Pay Unit</b>
Crushed glass	Ton
1-17-08c (SPCN)	

**GUIDELINES – USE WITH ASPHALT PLANT MIX IN BRISTOL, SALEM, AND STAUNTON DISTRICTS.**

(c211hg0-1209) **POLISHING AGGREGATE IN ASPHALT CONCRETE - Section 211—Asphalt Concrete** of the Specifications is amended as follows:

**Section 211.02—Materials** is amended by replacing (e) with the following:

Fine or coarse aggregate that tend to polish under traffic will not be permitted in any final surface exposed to traffic except as permitted within the limits of Section 211.04(a) and (b) of the Specifications and as designated by the Engineer or as permitted elsewhere in these Specifications.

**Section 211.04—Asphalt Concrete Mixtures** is amended by replacing (a) and (b) with the following:

Asphalt concrete mixtures shall conform to the requirements of Table II-14 and the following:

- (a) **Types SM-9.0A, SM-9.0D, SM-9.0E, SM-9.5A, SM-9.5D and SM-9.5E asphalt concrete** shall consist of crushed stone, crushed slag, or crushed gravel and fine aggregate, slag or stone screenings or a combination thereof combined with asphalt cement.

**NOTE:** For all surface mixes, except where otherwise noted, no more than 5 percent of all aggregate retained on the No. 4 sieve and no more than 20 percent of the total aggregate may be polish susceptible. At the discretion of the Engineer, a SM-9.5AL may be specified and polish susceptible aggregates may be used (without percentage limits).

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- (b) **Types SM-12.5A, SM-12.5D, SM-12.5E, IM-19.0A, IM-19.0D, and IM-19.0E asphalt concrete** shall consist of crushed stone, crushed slag, or crushed gravel and fine aggregate, slag or stone screenings or a combination thereof combined with asphalt cement.

**NOTE:** At the discretion of the Engineer, an intermediate mix may be designated as either a SM-19.0A or SM-19.0D. For SM-12.5 and SM-19.0 surface mixes, no more than 5 percent of the aggregate retained on the No. 4 sieve may be polish susceptible. All material passing the No. 4 sieve may be polish susceptible. No more than 35 percent of the total aggregate composition (polish and non-polish susceptible) shall be passing the No. 8 sieve. At the discretion of the Engineer, a SM-12.5AL may be specified and polish susceptible aggregates may be used (without percentage limits).

10-7-09 (SPCN)

**GUIDELINES — USE WHEN REQUESTED BY THE DESIGNER.**

S208B00-0708

VIRGINIA DEPARTMENT OF TRANSPORTATION  
SPECIAL PROVISION FOR  
**CRUSHED HYDRAULIC CEMENT CONCRETE (CHCC)**  
(USED AS SUBBASE AND AGGREGATE BASE MATERIAL)

January 14, 2008c

**SECTION 208—SUBBASE AND AGGREGATE BASE MATERIAL** of the Specifications is amended as follows:

**Section 208.02—Materials** is replaced with the following:

- (a) **Subbase material** may consist of any mixture of natural or crushed gravel, crushed stone or slag, crushed hydraulic cement concrete (CHCC), natural or crushed sand; with or without soil mortar. Subbase material may be used in a stabilized or unstabilized form.
- (b) **Aggregate base material** may be designated as Type I or Type II as follows: **Type I** shall consist of crushed stone, crushed slag, crushed hydraulic cement concrete (CHCC), crushed gravel or any combination of these material: with or without soil mortar or other admixtures. Crushed gravel shall consist of particles of which at least 90 percent by weight of the material retained on the No. 10 sieve shall have at least one face fractured by artificial crushing. **Type II** shall consist of gravel, stone, or slag screening; fine aggregate and crushed coarse aggregate; sand-clay-gravel mixtures; crushed hydraulic cement concrete; or any combination of these materials; with or without soil mortar or other admixtures. Aggregate base materials Type I or II may be used in a stabilized or unstabilized form.
- (c) **Crushed Hydraulic Cement Concrete** shall not be used as Subbase or aggregate base material when any subsurface drainage system, such as standard underdrains (UD-4 or UD-5) and /or a stabilized open graded aggregate drainage layer (OGDL) is present, except when the CHCC is cement stabilized.

**Section 208.03(b) Atterberg Limits** is amended to add the following:

**Plasticity:** Subbase and aggregate base materials shall be either non-plastic (PI=0) or shall conform to the requirements of Table II-11 of the Specifications when tested in accordance with VTM-7. If the material is classified as non-plastic (PI=0), in accordance with VTM-7, the Liquid Limit requirement will be waived. Exceptions to this provision are noted as follows:

1. 100% CHCC and 20% or less CHCC Blends will be tested and subject to penalty as noted in Table II-11 of the Specifications for the plasticity index, excluding Liquid Limit penalties.
2. Greater than 20% CHCC Blends will follow testing guidelines as set forth in Section 208.06 (b) for Atterburg limits.

**Section 208.03** is amended to add the following:

- (h) **Deleterious Material:** The quantity of deleterious materials present in stockpiles of Crushed Hydraulic Cement Concrete, to be used in blending with virgin aggregates or as 100 percent CHCC, shall not exceed the following values:

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<b>MATERIAL</b>	<b>PERCENT BY WEIGHT (MASS)</b>
Asphalt Concrete	5.0
Glass and Metals	5.0
Wood, Plastic, Brick and other foreign matter	0.5

**Section 208.04—Job-Mix Formula** is replaced by the following:

- (a) The Contractor shall submit, or shall have the source of supply submit, for the Engineer's approval, a job-mix formula for each mixture to be supplied for the project prior to starting work. The formula shall be within the design range specified in Table II-9 of the Specifications. If unsatisfactory results or other conditions make it necessary, the Contractor shall prepare and submit a new job-mix formula for approval.
- (b) A job mix formula shall be submitted for the engineer's approval for each category of CHCC mixture used. Designated categories shall indicate the mixture percentage of CHCC used according to the following criteria:
1. **Category 1:** 100% CHCC
    - Category 2:** 20% or less CHCC (□ 20%)
    - Category 3:** greater than 20% CHCC but less than 100% CHCC (>20%<100%)
  2. The quantity of CHCC in the mix shall be expressed as a percentage of the total mix.

**Section 208.06—Acceptance** is replaced with the following:

- (a) The Contractor shall provide the quality assurance necessary for the Engineer to determine conformance to the required grading and Atterberg limits of subbase and aggregate base material.

Sampling and testing for determination of grading and Atterberg limits shall be performed by the Contractor. The Contractor shall provide copies of test results to the Department on forms furnished by the Department and shall maintain appropriate current quality control charts. The Department will perform independent monitor tests at a laboratory of its choice. If there is a statistically significant difference between the two sets of results, an investigation will be made to determine the reason for the difference. If it is determined that the material does not conform to the requirements of the Contract, the material will be rejected or a payment adjustment will be made in accordance with the requirements of Section 208.08 of the Specifications.

Determination of grading and Atterberg limits will be based on a mean of the results of tests performed on four samples taken in a stratified random manner from each 2,000-ton lot. Lots of 4,000 tons may be used when the normal daily production of the source from which the material being obtained is more than 2,000 tons. Unless otherwise approved, samples shall be obtained from the approximate center of truckloads of material. Any statistically acceptable method of randomization may be used to determine the time and location of the stratified random sample to be taken. The Department shall be advised of the method to be used prior to the beginning of production.

A lot will be considered acceptable for grading if the mean of the test results is within the deviation from the job-mix formula specified in Table II-10 of the Specifications.

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A lot will be considered acceptable for Atterberg limits if the mean of the test results is less than the maximum for the liquid limit and plasticity index specified in Table II-11 of the Specifications.

If the liquid limit exceeds 30 or the plasticity index exceeds 6 for Type I base material or No. 19 subbase material; or the plasticity index exceeds 9 for Type II base material or subbase materials No. 20, 21, 21A, 21B, or 22 on any individual sample; that portion of the lot from which the sample was taken will be considered a separate part of the lot and shall be removed from the road.

If either the amount of material in the lot is less than 2,000 tons (4,000 tons if applicable), the job-mix formula is modified within a lot, or a portion of the lot is rejected on the basis of individual test results, the mean test results of the samples taken will be compared to the job-mix formula with the tolerances given in Tables II-10 and II-11 of the Specifications for the number of tests performed.

If a visual examination reveals that material in any load is obviously contaminated or segregated, the load will be rejected without additional sampling or testing of the lot. If it is necessary to determine grading or Atterberg limits of material in an individual load, one sample (taken from the load) will be tested and the results compared to the job-mix formula with the tolerances given in Tables II-10 and II-11 of the Specifications for one test. Results obtained in the testing of a specific individual load will apply only to the load in question.

- (b) The following applies specifically to the use of Crushed Hydraulic Cement Concrete (CHCC) mixtures. All provisions for acceptance of these products shall conform to the same criteria as in (a) herein with the following additions:
1. **100% CHCC** shall conform to the requirements of this special provision.
  2. **20% or Less CHCC Blends** shall conform to the requirements of this special provision.
  3. **Greater than 20% CHCC Blends** shall conform to the following:
    - a. The virgin aggregate portion of the blend will be tested for Atterberg limits, prior to CHCC blending.
    - b. Price adjustments for Liquid Limit and the Plasticity Index of the virgin aggregates used in the blend with CHCC shall be in accordance with Table II-11 of the Specifications.
    - c. No additional testing for Liquid Limit or Plasticity Index will be required on the final blended product.
  4. All shipments of products containing CHCC must be designated on the shipping ticket (scale ticket) by the use of the letter "R". Examples: [22R, 21AR and 21BR] for: Aggregate Base material, Type I or Subbase materials.

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**GUIDELINES — FOR SPECIFICALLY CHOSEN PILOT PROJECTS IN THE 2016 PLANT MIX PAVING SEASON. INCLUDE S315HP0 SuperPave -Asphalt Conc Place.**

**S211HP0-0116**

VIRGINIA DEPARTMENT OF TRANSPORTATION  
SPECIAL PROVISION FOR  
**SECTION 211—ASPHALT CONCRETE**

January 29, 2016

**SECTION 211—ASPHALT CONCRETE** of the Specifications is replaced with the following:

**211.01—Description**

Asphalt concrete shall consist of a combination of mineral aggregate and asphalt material mixed mechanically in a plant specifically designed for such purpose.

An equivalent single-axle load (ESAL) will be established by the Engineer, and SUPERPAVE mix types may be specified as one of the types listed as follows:

<b>Mix Type</b>	<b>Equivalent Single-Axle Load (ESAL) Range (millions)</b>	<b>Minimum Asphalt Performance Grade (PG)<sup>2</sup></b>	<b>Aggregate Nominal Maximum Size<sup>1</sup></b>
SM-9.0A	0 to 3	64S-16	3/8 in
SM-9.0D	3 to 10	64H-16	3/8 in
SM-9.0E	Above 10	64E-22	3/8 in
SM-9.5A	0 to 3	64S-16	3/8 in
SM-9.5D	3 to 10	64H-16	3/8 in
SM-9.5E	Above 10	64E-22	3/8 in
SM-12.5A	0 to 3	64S-16	1/2 in
SM-12.5D	3 to 10	64H-16	1/2 in
SM-12.5E	Above 10	64E-22	1/2 in
IM-19.0A	Less than 10	64S-16	3/4 in
IM-19.0D	10 to 20	64H-16	3/4 in
IM-19.0E	20 and above	64E-22	3/4 in
BM-25.0A	All ranges	64S-16	1 in
BM-25.0D	Above 10	64H-16	1 in

<sup>1</sup>**Nominal Maximum Size** is defined as one sieve size larger than the first sieve to retain more than 10 percent aggregate.

<sup>2</sup>**Minimum Asphalt Performance Grade (PG)** is defined as the minimum binder performance grade for the job mixes as determined by AASHTO T170 or AASHTOM332.

**Note:** SM = Surface Mixture; IM = Intermediate Mixture; BM = Base Mixture

Asphalt concrete shall conform to the requirements for the mix type designated on the plans or elsewhere in the contract for use

At the Contractor's option, an approved Warm Mix Asphalt (WMA) additive or process may be used to produce the asphalt concrete (AC) mix type designated.

**211.02—Materials**

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- (a) **Asphalt materials** shall conform to the requirements of Section 210 except asphalt cement materials shall be performance graded (PG) in accordance with the requirements of AASHTO M332. In addition, asphalt mixtures with the E designation shall meet the asphalt cement requirements in Section 211.04(e)1.
- (b) **Coarse aggregate** shall be Grade A or B conforming to the requirements, except for grading, of Section 203 for quality. In addition, the coarse aggregate sizes retained on and above the No. 4 sieve shall comply with the coarse aggregate requirements in Table II-12A. Flat and elongated (F&E) particles shall be tested in accordance with the requirements of ASTM D 4791, and coarse aggregate angularity (CAA) shall only be tested on crushed gravel in accordance with the requirements of ASTM D 5821.
- (c) **Fine aggregate** shall conform to the requirements, except for grading, of Section 202 for quality and the fine aggregate requirements in Table II-12A. Fine aggregate angularity (FAA) shall be tested in accordance with the requirements of AASHTO T 304 (Method A) and the sand equivalent (SE) shall be tested in accordance with the requirements of AASHTO T 176.
- (d) After a gradation test is performed:
1. If 10 percent or more of the material is retained on the No. 4 sieve, that portion shall be tested in accordance with the requirements for coarse aggregate.
  2. If 10 percent or more of the material passes the No. 4 sieve, that portion shall be tested for SE.
  3. If 10 percent or more of the material passes the No. 8 sieve, that portion shall be tested for FAA.
- (e) Fine or coarse aggregates that tend to polish under traffic will not be permitted in any final surface exposed to traffic except in areas where the two-way average daily traffic is less than 750 vehicles per day and as permitted elsewhere in these Specifications.

**TABLE II-12A**  
**Aggregate Properties**

Mix Type	Coarse Aggregate Properties			Fine Aggregate Properties	
	CAA		ASTM D4791 F & E "(5:1) % by weight	SE	FAA
	1 fractured face	2 fractured faces			
SM-9.0 A	85% min.	80% min.	10% max. <sup>1</sup>	40% min.	40% min.
SM-9.0 D	85% min.	80% min.	10% max. <sup>1</sup>	45% min.	45% min.
SM-9.0 E	95% min.	90% min.	10% max. <sup>1</sup>	45% min.	45% min.
SM-9.5 A	85% min.	80% min.	10% max. <sup>1</sup>	45% min.	45% min.
SM-9.5 D	85% min.	80% min.	10% max. <sup>1</sup>	45% min.	45% min.
SM-9.5 E	95% min.	90% min.	10% max. <sup>1</sup>	45% min.	45% min.
SM-12.5 A	85% min.	80% min.	10% max. <sup>1</sup>	45% min.	45% min.
SM-12.5 D	85% min.	80% min.	10% max. <sup>1</sup>	45% min.	45% min.
SM-12.5 E	95% min.	90% min.	10% max. <sup>1</sup>	45% min.	45% min.
IM-19.0 A	85% min.	80% min.	10% max. <sup>1</sup>	45% min.	45% min.
IM-19.0 D	95% min.	90% min.	10% max. <sup>1</sup>	45% min.	45% min.
IM-19.0 E	95% min.	90% min.	10% max. <sup>1</sup>	45% min.	45% min.

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BM-25.0 A	80% min.	75% min.	10% max. <sup>1</sup>	45% min.	45% min.
BM-25.0 D	80% min.	75% min.	10% max. <sup>1</sup>	45% min.	45% min.

<sup>1</sup>10 percent measured at 5:1 on maximum to minimum dimensions

- (f) **Mineral filler** shall conform to the requirements of Section 201.
- (g) **Aggregate for asphalt concrete** shall be provided in sufficient sizes and amounts to produce a uniform mixture. The Contractor shall indicate on the proposed job-mix formula the separate approximate sizes of aggregate to be used.

Where segregation or nonuniformity is evident in the finished pavement, the Engineer reserves the right to require the Contractor to discontinue the use of crusher run or aggregate blends and to furnish separate sizes of open-graded aggregate material.

- (h) An antistripping additive shall be used in all asphalt mixes. It may be hydrated lime or a chemical additive from the VDOT Materials Division Approved Products List No. 7 or a combination of both. The approved chemical additive shall be added at a rate of not less than 0.30 percent by weight of the total asphalt content of the mixture.

The mixture shall produce a tensile strength ratio (TSR) of not less than 0.80 for the design and production tests. The TSR shall be determined in accordance with AASHTO T283, including a freeze-thaw cycle (4-inch specimens compacted with a Marshall Hammer or 3.5 by 6-inch specimens when compacted with a gyratory compactor); except that the 16-hour curing time requirement and the 72 to 96-hour storage period will not be enforced by the Department. Design tests shall use the same materials that are to be used in the production mix and shall be conducted in a laboratory approved by the Department.

When a chemical additive is used, it shall be added to the asphalt cement prior to the introduction of the cement into the mix. Any chemical additive or particular concentration of chemical additive found to be harmful to the asphalt material or that changes the original asphalt binder performance grade (PG) shall not be used.

- (i) **Hydrated lime** shall conform to the requirements of ASTM C977. Hydrated lime shall be added at a rate of not less than 1 percent by weight of the total dry aggregate.

A separate bin or tank and feeder system shall be provided to store and accurately proportion the dry or slurried lime into the aggregate. The lime and aggregate shall be mixed by pugmill or other Department approved means to achieve a uniform lime coating of the aggregate prior to entering the drier. If lime is added in dry form, the aggregate shall contain at least 3 percent free moisture. The Department will not permit the stockpiling of lime treated aggregate.

The feeder system shall be controlled by a proportioning device, which shall be accurate to within  $\pm 10$  percent of the specified amount. The proportioning device shall have a convenient and accurate means of calibration. A flow indicator or sensor shall be provided with the proportioning device and interlocked with the plant controls, aggregate feed or weigh system, such that production of the mixture shall be consistently maintained and, if there is a stoppage of the lime feed, interrupted.

The method of introducing and mixing the lime and aggregate shall be subject to approval by the Engineer prior to beginning production.

- (j) **Reclaimed Asphalt Pavement (RAP)** material may be used as a component material of asphalt mixtures in conformance with the following:

1. Asphalt surface, intermediate and base mixtures containing RAP (but without RAS) should use the performance grade (PG) of asphalt cement as indicated in Table II-14A, however,

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the choice of PG to use in the mix shall be the responsibility of the Contractor in order to meet the requirements of Section 211.01.

2. The final asphalt mixture shall conform to the requirements for the type specified.
3. During the production process, RAP material shall not be allowed to contact open flame.
4. RAP material shall be handled, hauled, and stored in a manner that will minimize contamination. Further, the material shall be stockpiled and used in such manner that variable asphalt contents and asphalt penetration values will not adversely affect the consistency of the mixture.
5. RAP shall be processed in such a manner as to ensure that the maximum top size particle of material introduced into the mix shall be 2 inches. The Engineer may require smaller sized particles to be introduced into the mix if the reclaimed particles are not broken down or uniformly distributed throughout the mixture during heating and mixing.

**(k) Reclaimed Asphalt Shingles (RAS) – Tear-off RAS Materials** in Asphalt Concrete

1. Asphalt surface, intermediate, and base mixtures containing **Tear-off RAS Materials** shall meet the requirements of Section 211.01 and 211.03 of the Specifications.
2. Tear-off RAS Materials shall be discarded shingle scrap from the re-roofing of domestic buildings. These tear-offs shall have been produced by the manufacturing process for roofing shingles.

Tear-off RAS materials shall contain less than 3.0 percent foreign materials such as paper, roofing nails, wood, or metal flashing. Materials shall be shredded prior to being incorporated in the AC mixture so that at least 99 percent of the shredded pieces passes the ½ inch (12.5 mm) sieve and at least 80 percent passed the #4 (4.75 mm) sieve.

Tear-off RAS materials shall not have asbestos containing material (ACM) as defined by the National Emission Standards for Hazardous Air Pollutants (NESHAP), which is less than 1 percent asbestos. The Contractor shall furnish a certification obtained from the recycler that Polarized Light Microscopy (PLM) tests were performed on random samples of RAS at the rate of 1 test per 100 tons or if operating under a Virginia DEQ permit the rate will be the 1 test per 750 tons. The test results shall reveal no detectable level of ACM. Copies of the test results from the recycler shall be available upon request.

3. Asphalt Binder of the asphalt concrete mixture shall be Performance Grade (PG) of asphalt conforming to the requirements specified in Section 211 of the Specifications.
4. RAS tear-offs in asphalt concrete shall be mixed mechanically in a plant specifically designed for asphalt concrete production.
5. Contractors shall store tear-off RAS materials by stockpiling either whole or as partial shingles which have not been shredded or shredded shingles that meet the maximum size requirements. Stockpiled RAS shall not be contaminated by dirt or other objectionable foreign materials. Blending of the shingles with fine aggregate may be necessary to prevent conglomeration of shingle particles. When fine aggregate is used for this purpose, this material shall be accounted for in the mix design.

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**(l) Reclaimed Asphalt Shingles (RAS) – Tabs RAS Materials** in Asphalt Concrete

1. Asphalt surface, intermediate, and base mixtures containing **Tabs RAS Materials** shall meet the requirements of Section 211.01 and 211.03 of the Specifications.
2. Tabs RAS Materials shall be produced by the manufacturing process for domestic roofing shingles. Blending or mixing of Tabs and Tear-offs shall not be permitted.

Tabs RAS Materials shall be shredded prior to being incorporated into the asphalt concrete mixture so that one hundred percent of the shredded pieces are less than ½ inches (12.5mm) in any dimension.

Tabs RAS Materials shall not contain asbestos fibers. The Contractor shall furnish the Department a certification from the manufacturer of the shingles stating that the shingles are free of asbestos. If a certification cannot be obtained then the contractor shall furnish test results of RAS sample analysis for Polarized Light Microscopy (PLM) on the shingles which certify the material to be used is free of asbestos. Testing is required at the specified rate of 1 per manufacturer per type of RAS prior to processing and results shall be submitted prior to or during the stockpile approval process.

3. Asphalt Binder of the asphalt concrete mixture shall be Performance Grade (PG) of asphalt conforming to the requirements specified in Section 211 of the Specifications.
  4. Tabs RAS Materials in asphalt concrete shall be mixed mechanically in a plant specifically designed for asphalt concrete production.
  5. Contractors shall store Tabs RAS materials by stockpiling either whole or as partial shingles which have not been shredded or shredded shingles that meet the maximum size requirements. Stockpiled RAS shall not be contaminated by dirt or other objectionable foreign materials. Blending of the shingles with fine aggregate may be necessary to prevent conglomeration of shingle particles. When fine aggregate is used for this purpose, this material shall be accounted for in the mix design.
- (k) **Warm Mix Asphalt (WMA)** additives or processes shall be approved by the Department prior to use and shall be obtained from the Department's approved list which is included in the Materials Division's Manual of Instructions.

**211.03—Job-Mix Formula**

The Contractor shall submit a job-mix formula for each mixture planned for use on the project for the Department's evaluation and approval through the "Producer Lab Analysis and Information Details" (PLAID) website. Paper copies of the job mix formula along with supporting documentation shall also be submitted to the Department. The job-mix formula shall be within the design range specified. The job-mix formula shall establish a single percentage of aggregate passing each required sieve, a single percentage of asphalt material to be added to the aggregate, a temperature at which the mixture is to be produced, and a temperature at which the mixture is to be compacted for SUPERPAVE testing in accordance with the requirements of AASHTO R35. Each approved job-mix formula shall remain in effect provided the results of tests performed on material currently being produced consistently comply with the requirements of the job-mix formula for grading, asphalt content, temperature, and SUPERPAVE compaction results and the requirements of Section 315.

- (a) SUPERPAVE mixes shall be designed and controlled in accordance with the requirements of AASHTO R35 and as specified herein. The Contractor shall have available all of the equipment outlined in AASHTO T312 (Section 4-6) and a Department-certified Asphalt Mix

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Design Technician. The SUPERPAVE mixture shall be compacted in a gyratory compactor with an internal angle of  $1.16 \pm 0.02$  degrees. **The internal angle shall be measured and calibrated using a cold (non-mix) device.** The SUPERPAVE Gyratory Compactor (SGC) shall be one from the Department's approved list of devices found in the VDOT Materials Division's Manual of Instructions. The SUPERPAVE mixes shall conform to the requirements of Table II-13 and Table II-14. Section 7.1.2 of AASHTO R30 shall be modified such that the compaction temperature is as specified in (d) 6 herein.

- (b) In conjunction with the submittal of a job-mix formula, the Contractor shall submit complete SUPERPAVE design test data, ignition furnace calibration data in accordance with VTM-102 prepared by an approved testing laboratory, and viscosity data or supplier temperature recommendations for the asphalt cement if different from (d) 6 herein.
- (c) Three trial blends for gradation shall be run at one asphalt content

**TABLE II-13**  
**Asphalt Concrete Mixtures: Design Range**

Mix Type	Percentage by Weight Passing Square Mesh Sieves										
	2 in	1 1/2 in	1 in	3/4 in	1/2 in	3/8 in	No. 4	No. 8	No. 30	No. 50	No. 200
SM-9.0 A,D,E					100 <sup>1</sup>	90-100	90 max.	47-67			2-10
SM-9.5 A,D,E					100 <sup>1</sup>	90-100	58-80	38-67	23 max		2-10
SM-12.5 A,D,E				100	95-100	90 max.	58-80	34-50	23 max		2-10
IM-19.0 A,D,E			100	90-100	90 max.	--	--	28-49			2-8
BM-25.0 A,D		100	90-100	90 max.	--	--	--	19-38			1-7
C (Curb Mix)					100	92-100	70-75	50-60	28-36	15-20	7-9

<sup>1</sup>A production tolerance of 1% will be applied to this sieve regardless of the number of tests in the lot.

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**TABLE II-14**  
**Mix Design Criteria**

Mix Type	VTM (%)	VFA (%)	VFA (%)	Min. VMA (%)	Fines/Asphalt Ratio	No. of Gyration
	Production	Design	Production			N Design
SM-9.0A <sup>1,2</sup>	2.0-5.0	75-80	70-85	16	0.6-1.3	65
SM-9.0D <sup>1,2</sup>	2.0-5.0	75-80	70-85	16	0.6-1.3	65
SM-9.0E <sup>1,2</sup>	2.0-5.0	75-80	70-85	16	0.6-1.3	65
SM-9.5A <sup>1,2</sup>	2.0-5.0	75-80	70-85	16	0.7-1.3	50
SM-9.5D <sup>1,2</sup>	2.0-5.0	75-80	70-85	16	0.7-1.3	50
SM-9.5E <sup>1,2</sup>	2.0-5.0	75-80	70-85	16	0.7-1.3	50
SM-12.5A <sup>1,2</sup>	2.0-5.0	73-89	68-84	15	0.7-1.3	50
SM-12.5D <sup>1,2</sup>	2.0-5.0	73-89	68-84	15	0.7-1.3	50
SM-12.5E <sup>1,2</sup>	2.0-5.0	73-89	68-84	15	0.7-1.3	50
IM-19.0A <sup>1,2</sup>	2.0-5.0	69-76	64-81	13	0.6-1.2	65
IM-19.0D <sup>1,2</sup>	2.0-5.0	69-76	64-81	13	0.6-1.2	65
IM-19.0E <sup>1,2</sup>	2.0-5.0	69-76	64-81	13	0.6-1.2	65
BM-25.0A <sup>2,3</sup>	1.0-4.0	67-87	67-92	12	0.6-1.3	65
BM-25.0D <sup>2,3</sup>	1.0-4.0	67-87	67-92	12	0.6-1.3	65

<sup>1</sup>Asphalt content should be selected at 4.0% air voids for A & D mixes, 3.5% air voids for E mix.

<sup>2</sup>Fines-asphalt ratio is based on effective asphalt content.

<sup>3</sup>Base mix shall be designed at 2.5% air voids. BM-25A shall have a minimum asphalt content of 4.4% unless otherwise approved by the Engineer. BM-25D shall have a minimum asphalt content of 4.6% unless otherwise approved by the Engineer.

For SM-9.5 and SM-12.5 mixes, the minimum asphalt contents shall be based on the following unless otherwise approved by the Engineer:

Bulk Specific Gravity of the Total Aggregate	Minimum Design AC Content Mix Type (%)	
	SM-9.5	SM-12.5
Less Than 2.65	5.5	5.3
2.65 - 2.74	5.4	5.2
2.74 - 2.85	5.3	5.1
Greater Than 2.85	5.2	5.0

(d) The SUPERPAVE design test data shall include, but not be limited to, the following information:

1. Grading data for each aggregate component of three trial blends shall be submitted to the Department. The data for the mixture shall show percent passing for the following sieves: 2 inch, 1 1/2 inch, 1 inch, 3/4 inch, 1/2 inch, 3/8 inch, No. 4, No. 8, No. 16, No. 30, No. 50, No. 100, and No. 200. The grading shall be reported to the nearest 1.0 percent except the No. 200 sieve shall be reported to the nearest 0.1 percent.

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2. The test data shall include, but not be limited to, the percentage of each aggregate component as compared to the total aggregate in the asphalt mixture. The specific gravity and aggregate properties for coarse and fine aggregates defined in Section 211.02 (b) and (c), including flat and elongated properties, for each aggregate component or for the total aggregates used in the mixture shall be reported. Aggregate properties, except sand equivalent, shall be reported for RAP portions of a mixture. The aggregate specific gravity of RAP shall be the effective aggregate specific gravity calculated from the results of tests conducted in accordance with AASHTO T 209 and VTM-102.
3. The aggregate grading in the asphalt mixture shall be determined by igniting or extracting the asphalt from a laboratory-prepared sample. The laboratory sample shall be batched on the basis of component percentages as indicated in (d) 2. herein and at the proposed job-mix asphalt content. The aggregate shall be obtained in accordance with the requirements of VTM-102 or VTM-36, when approved. Sieves specified in (d) 1. herein shall be reported, beginning with the top size for the mix.
4. The following volumetric properties of the compacted mixture, calculated on the basis of the mixture's maximum specific gravity determined in accordance with AASHTO T-209, shall be reported to the Engineer. The mixture shall be aged in accordance with AASHTO R30 and the bulk specific gravity of the specimens determined in accordance with AASHTO T-166, Method A, for each asphalt content tested. Properties shall be determined and reported in accordance with the requirements of AASHTO R35.
  - a. Voids in total mix (VTM)
  - b. Voids in mineral aggregate (VMA)
  - c. Voids filled with Asphalt (VFA)
  - d. Fines/Asphalt ratio (F/A)
5. The value of the maximum specific gravity of the asphalt mixture used in (c) 4. herein shall be reported to three decimal places.
6. The mixing and compaction temperature for testing shall be as follows:
  - a. For mixes designation A, the mix temperature shall be 300 degrees F to 310 degrees F and the compaction temperature shall be 285 degrees F to 290 degrees F.
  - b. For mixes designation D, the mix temperature shall be 310 degrees F to 320 degrees F and the compaction temperature shall be 295 degrees F to 300 degrees F.
  - c. In cases involving PG 64E-22 or modified binders, the temperatures shall be based on documented supplier's recommendations.
7. The field correction factor as determined by subtracting the bulk specific gravity of the aggregate from the effective specific gravity of the aggregate at the design asphalt content.
8. For surface mixes, permeability test data shall be submitted in accordance with VTM 120 using either single point verification or the regression method for each surface mix having a different gradation. If the average of the permeability results from the single point

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verification method exceeds  $150 \times 10^{-5}$  cm/sec, or if the regression method predicts a permeability exceeding  $150 \times 10^{-5}$  cm/sec at 7.5% voids, the Contractor shall redesign the mixture to produce a permeability number less than  $150 \times 10^{-5}$  cm/sec.

- (e) The SUPERPAVE design binder content test data shall be plotted on graphs as described in AASHTO R 35 and shall show that the proposed job-mix formula conforms to the requirements of the designated mix type.
- (f) A determination will be made to verify if any asphalt concrete mixture being produced conforms to the job-mix formula approved by the Department. The Department and Contractor will test the mixture using samples removed from production. The following tests will be conducted to determine the properties listed:

Property	Test
Asphalt content	VTM-102, (VTM-36 when approved)
Gradation	AASHTO T-30
SUPERPAVE properties	AASHTO R35
Asphalt cement material	AASHTO T316 or T-201

For Warm Mix Asphalt (WMA), SUPERPAVE properties for mixing and compaction temperatures will be determined by the Department and Contractor based on the mix designations in Section 211.03(d)6.

The Department will perform rut testing in accordance with the procedures detailed in VTM-110. If the results of the rut testing do not conform to the following requirements, the Engineer reserves the right to require adjustments to the job-mix formula:

Mix Designation	Maximum Rut Depth, mm
A	7.0
D	5.5
E, (S)	3.5

After calibration of the gyratory compactor is completed, the Engineer may require the Contractor to make adjustments to the job-mix formula.

If the Department determines that the mixture being produced does not conform to the approved job-mix formula and volumetric properties specified in Table II-14 based on the Department's or Contractor's test results, the Contractor shall immediately make corrections to bring the mixture into conformance with the approved job-mix formula or cease paving with that mixture.

Subsequent paving operations using either a revised or another job-mix formula that has not been verified as described herein shall be limited to a test run of 100 to 300 tons of mixture if such material is to be placed in Department project work. No further paving for the Department using that specific mixture shall occur until the acceptability of the mixture being produced has been verified using the 100 to 300 ton constraint.

**TABLE II-14A  
Recommended Performance Grade of Asphalt Cement**

Mix Type	Percentage of Reclaimed Asphalt Pavement (RAP) in Mix		
	%RAP ≤ 25.0%	25.0% < %RAP ≤ 30%	25.0% < %RAP ≤ 35%
SM-4.75A, SM-9.0A, SM-9.5A, SM-12.5A	PG 64S-22	PG 64S-22	

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**TABLE II-14A**  
**Recommended Performance Grade of Asphalt Cement**

Mix Type	Percentage of Reclaimed Asphalt Pavement (RAP) in Mix		
	%RAP ≤ 25.0%	25.0% < %RAP ≤ 30%	25.0% < %RAP ≤ 35%
SM-4.75D, SM-9.0D, SM-9.5D, SM-12.5D	PG 64H-22	PG 64S-22	
IM-19.0A	PG 64S-22	PG 64S-22	
IM-19.0D	PG 64H-22	PG 64S-22	
BM-25.0A	PG 64S-22		PG 64S-22
BM-25.0D	PG 64H-22		PG 64S-22

Based on rut testing performed by the Department and/or field performance of the job mix, the Engineer reserves the right to require the Contractor to make adjustments to the job-mix formula.

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- (g) When utilizing **RAS Materials (Tear-off or Tabs)**, the Contractor shall submit material samples to include the RAS stockpiled tear-off shingles, reclaimed asphalt pavement (RAP) and PG Binder.

The amount of RAS material used in the recycled mixture shall be no more than five percent of the total mixture weight. However, the combined percentages of RAS and RAP shall not contribute more than 30 percent (by weight) of the total asphalt content of the mixture, according to the following equation:

$$\frac{\left( \%RAS_{mix} \times \%AC_{RAS} / 100 \right) + \left( \%RAP_{mix} \times \%AC_{RAP} / 100 \right)}{\%AC_{JMF}} \leq 30.0\%$$

Where:

% RAS <sub>mix</sub> =	Percent RAS in the Job Mix Formula
% AC <sub>RAS</sub> =	Average Percent AC in the RAS
% RAP <sub>mix</sub> =	Percent RAP in the Job Mix Formula
% AC <sub>RAP</sub> =	Average Percent AC in the RAP
% AC <sub>JMF</sub> =	Design AC content of the JMF

The Contractor shall determine the asphalt content of the RAS using AASHTO T-164, Method B, or VTM-102 and report the average results to the nearest 0.1 percent. When the ignition furnace is used, a correction factor shall be applied for the non-asphalt combustible materials in the RAS. Unless the actual correction factor is determined by comparing the test results on paired samples from AASHTO T-164 Method B and VTM-102, the estimated correction factor for the RAS shall be 5 percent.

Used separately or with RAP, RAS can be used to stiffen the asphalt concrete mixture binder to meet the requirements in Section 211.01 of Specifications. Asphalt surface, intermediate, and base mixtures containing RAS in order to meet the asphalt concrete mixture stiffness of PG 64H-16 should use PG 64S-22 asphalt cement. Further, mixes using RAS shall not exceed the 30% (by weight) and are required to use the maximum binder replacement criteria noted here:

- 5% RAS and 0% RAP
- 4% RAS and 5% RAP minimum
- 3% RAS and 10% RAP minimum
- 2% RAS and 20% RAP minimum

Interpolation shall be used to determine combinations between the whole number RAS/RAP usage figures shown herein, subject to review and approval by the Engineer.

#### **211.04—Asphalt Concrete Mixtures**

Asphalt concrete mixtures shall conform to the requirements of Table II-14 and the following:

- (a) **Types SM-9.0A, SM-9.0D, SM-9.0E, SM-9.5A, SM-9.5D, SM-9.5E, SM-12.5A, SM-12.5D, and SM-12.5E asphalt concrete** shall consist of crushed stone, crushed slag, or crushed gravel and fine aggregate, slag or stone screenings, or a combination thereof combined with asphalt cement.

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**NOTE:** For all surface mixes, except where otherwise noted, no more than 5 percent of the aggregate retained on the No. 4 sieve and no more than 20 percent of the total aggregate may be polish susceptible. At the discretion of the Engineer, SM-9.5AL or SM-12.5AL may be specified and polish susceptible aggregates may be used (without percentage limits).

**NOTE:** Unless Type C (curb mix) is specified by the Engineer in the contract plans and specifications, SM9.0, SM-9.5, and SM-12.5 mix types are acceptable for use in the construction of asphalt curbing.

- (b) **Types IM-19.0A, IM-19.0D, and IM-19.0E asphalt concrete** shall consist of crushed stone, crushed slag, or crushed gravel and fine aggregate, slag or stone screenings, or a combination thereof combined with asphalt cement.

**NOTE:** At the discretion of the Engineer, an intermediate mix may be designated as either SM-19.0A, SM-19.0D or SM-19.0E. When designated as such, no more than 5 percent of the aggregate retained on the No. 4 sieve may be polish susceptible. All material passing the No. 4 sieve may be polish susceptible.

- (c) **Types BM-25.0A and BM-25.0D asphalt concrete** shall consist of crushed stone, crushed slag, or crushed gravel and fine aggregate, slag or stone screenings, or a combination thereof combined with asphalt cement.

- (d) **Type C (curb mix) asphalt concrete** shall consist of a blend of No. 78 or No. 8 crushed aggregate, No. 10 crushed aggregate, fine aggregate, mineral filler, and a stabilizing additive from the Department's approved list found in the Materials Division's Manual of Instructions combined with 6.0 to 9.0 percent of PG 64S-22. This mix does not require a volumetric mix design or volumetric testing under the SUPERPAVE system.

- (e) **Type SM-9.5, SM-12.5, IM-19.0 and BM-25.0 asphalt concrete** may be designated E (polymer modified), or stabilized (S). Asphalt concrete mixtures with the E designation may not be stabilized.

1. **Type E designated mixtures** shall consist of mixes incorporating a neat asphalt material with polymer modification complying with the requirements of PG 64E-22 and have a rolling thin film oven test residue elastic recovery at 77 degrees F of a minimum of 70 percent when tested in accordance with ASTM D 6084 procedure A.. E designated mixtures shall not contain more than 15 percent reclaimed asphalt pavement (RAP) material (by weight) or 3% recycled asphalt shingles (RAS) (by weight).
2. **Type (S) asphalt mixtures** shall consist of mixes incorporating a stabilizing additive from the Department's approved list found in the Materials Division's Manual of Instructions. These mixes shall be designated with an (S) following the standard mix designation. The minimum required additive shall be as specified on the Department's approved list found in the Materials Division's Manual of Instructions.
3. **Type L asphalt mixtures** will be allowed to contain a 100 percent polishing coarse and fine aggregate. These mixes shall be designated with a L following the standard mix designation.

### 211.05—Testing

The Contractor shall provide the quality control and quality assurance necessary for the Department to determine conformance with the required grading, asphalt content, and temperature properties for asphalt concrete.

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The Contractor shall have a Department-certified Asphalt Mix Design Technician for designing and adjusting mixes as necessary. The Asphalt Mix Design Technician or Asphalt Plant Level II Technician may perform testing of asphalt mixes. The Asphalt Mix Design Technician shall be responsible for reviewing and approving the results of all testing. The Asphalt Mix Design Technician shall be available and have direct communication with the plant for making necessary adjustments in the asphalt concrete mixes at the mixing plant. The Asphalt Mix Design Technician and Asphalt Plant Level II Technician shall each be capable of conducting any tests necessary to put the plant into operation; however, the Asphalt Mix Design Technician shall be responsible for producing a mixture that complies with the requirements of these Specifications. The Department will award certification.

The Contractor shall maintain all records and test results associated with the material production and shall maintain appropriate current quality control charts. Test results and control charts shall be available for review by the Engineer.

The Contractor shall execute a quality control plan of process inspections and tests, including the determination of SUPERPAVE properties. The results of the SUPERPAVE tests shall be used, along with the results of other quality control efforts, to achieve and maintain the quality of the mixture being produced.

The Contractor shall perform at least one field SUPERPAVE test per day per mix or per 1,000 tons per mix if more than 1,000 tons of a mix is produced per day. Aging as described in AASHTO R30 shall not be performed. If less than 300 tons of asphalt mixture is produced under a single job-mix formula in a day, field SUPERPAVE testing will not be required on that day. That day's tonnage shall be added to subsequent production. When the accumulated tonnage exceeds 300 tons, minimum testing frequency shall apply. Field SUPERPAVE test results shall be plotted and displayed in control chart form in the plant immediately following the completion of each individual test. The tests shall determine asphalt content in percentages to the nearest 0.01. The tests shall determine VTM, VMA, VFA, and F/A in percentages to the nearest 0.1 percent. The Department will conduct on-site inspections so the Contractor's Asphalt Mix Design Technician can demonstrate knowledge of the SUPERPAVE mix design and production requirements on Department-supplied mixtures.

Aggregate specific gravity and aggregate property tests shall be conducted by a Department-certified Aggregate Properties Technician or Asphalt Mix Design Technician on each aggregate component (including RAP) or total aggregate mixture once at mix design stage and once prior to beginning production in each calendar year. Sand equivalent shall not be determined on RAP. In addition, for each 50,000 tons of each aggregate size used at each plant, aggregate specific gravity and the results of aggregate property tests shall be reported for each aggregate component or the total aggregate mixture. Otherwise, if the total blend (cold feed) is used to determine aggregate specific gravity and aggregate properties, these tests shall be run for each 50,000 tons of the total blend.

Field SUPERPAVE tests shall be performed to  $N_{\text{design}}$  gyrations as specified in Table II-14.

For surface mixes, permeability test data shall be submitted in accordance with VTM 120 using either single point verification or the regression method for each surface mix having a different gradation.

A minimum of one permeability samples will be taken and test run in the first lot, and every other lot thereafter, and results submitted to the District Materials Engineer.

### **211.06—Tests**

The Department may sample materials entering into the composition of the asphalt concrete, the mixture, or the completed pavement. The Contractor shall cooperate with the Engineer in obtaining these samples. When samples are obtained from the pavement by coring, the resulting voids shall be filled and refinished by the Contractor without additional compensation.

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Abson recovery samples shall be PG graded according to the requirements of AASHTO M 322-14. Samples meeting the required grades specified in Section 211.01 shall be acceptable.

When the Department performs PG grading on the asphalt in a Contractor's liquid asphalt storage tank, the Engineer will notify the asphalt concrete producer and binder supplier if tests indicate that the binder properties of the asphalt material differ from those of the approved job-mix. The asphalt concrete producer and binder supplier shall determine what corrective action must be taken with the approval of the Engineer.

### **211.07—Plant Inspection**

The Department will accept the preparation of asphalt concrete mixtures under a quality assurance plan. The Contractor shall provide a laboratory as specified in Section 106.07.

In addition, the Contractor shall have all laboratory scales and gyratory compactors calibrated once a year by an independent source. The Contractor shall maintain the calibration records for 3 years from the date of the last calibration.

### **211.08—Acceptance**

Acceptance will be made under the Department's quality assurance program, which includes the testing of production samples by the Contractor and of monitor samples by the Department. Sampling and testing for the determination of grading, asphalt cement content, and temperature shall be performed by the Contractor, and the Department will perform independent monitor checks at a laboratory of its choosing. The Contractor shall input such test results within 24 hours of sampling to the Department through the "Producer Lab Analysis and Information Details" (PLAID) website <https://plaid.vdot.virginia.gov>, unless otherwise approved by the appropriate District Materials Engineer.

Where the Contractor's test results indicate that the mixture conforms to the gradation, asphalt cement content, and mix temperature requirements of the Specifications, the mixture will be acceptable for these properties; however, nothing herein shall be construed as waiving the requirements of Section 106.06, Section 200.02, Section 200.03, and Section 315 of the Specifications or relieving the Contractor of the contractual obligation to furnish and install a finished functional product that conforms to the requirements of the Contract.

If a statistical comparative analysis of the Contractor's test results and the Department's monitor tests indicate a statistically significant difference in the results and either of the results indicates that the material does not conform to the grading and asphalt cement content requirements of the Specifications, the Department and the Contractor will make an investigation to determine the reason for the difference. If it is determined from the investigation that the material does not conform to the requirements of the Contract, price adjustments will be made in accordance with the requirements of Section 211.09.

Acceptance for gradation and asphalt cement content will be based on the mean of results of eight tests performed on samples taken in a stratified random manner from each 4,000-ton lot (8,000-ton lots may be used when the normal daily production of the source from which the material is being obtained is in excess of 4,000 tons). The Contractor shall take samples from the approximate center of the truckload of material unless otherwise approved by the Engineer. Any statistically acceptable method of randomization may be used to determine when to take the stratified random sample; however, the Department shall be advised of the method to be used prior to the beginning of production.

A lot will be considered to be acceptable for gradation and asphalt content if the mean of the test results obtained is within the tolerance allowed for the job-mix formula as specified in Table II-15.

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The temperature of the mixture at the plant shall be controlled to provide load-to-load uniformity during changing weather conditions and surface temperatures. The maximum temperature of mix designations A and D and base mixes shall not exceed 350 degrees F unless otherwise directed by the Engineer. The maximum temperature as recommended by the supplier shall not be exceeded for a mix designated E or (S).

If the job-mix formula is modified within a lot, the mean test results of the samples taken will be compared to the applicable process tolerance shown in Table II-15.

Asphalt content will be measured as extractable asphalt or weight after ignition.

Field SUPERPAVE tests will be performed by the Department in accordance with the requirements of AASHTO R35 during the production of the approved job mixes designed by the SUPERPAVE method. Aging, as described in AASHTO R30, will not be performed. Should any field SUPERPAVE test fail with regard to the limits specified in Table II-14, the Department may require that production be stopped until necessary corrective action is taken by the Contractor. The Engineer will investigate and determine the acceptability of material placed and represented by failing field SUPERPAVE test results.

Should visual examination by the Engineer reveal that the material in any load or portion of the paved roadway is obviously contaminated or segregated, that load or portion of the paved roadway will be rejected without additional sampling or testing of the lot. If it is necessary to determine the gradation or asphalt content of the material in any load or portion of the paved roadway, samples will be taken and tested and the results will be compared to the requirements of the approved job-mix formula. The results obtained in the testing will apply only to the material in question.

**TABLE II-15**  
**Process Tolerance**

Tolerance on Each Laboratory Sieve and Asphalt Content: Percent Plus and Minus												
No. Tests	Top Size <sup>1</sup>	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 30	No. 50	No. 200	A.C.
1	0.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	6.0	5.0	2.0	.60
2	0.0	5.7	5.7	5.7	5.7	5.7	5.7	5.7	4.3	3.6	1.4	0.43
3	0.0	4.4	4.4	4.4	4.4	4.4	4.4	4.4	3.3	2.8	1.1	0.33
4	0.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2.5	1.0	0.30
5	0.0	3.6	3.6	3.6	3.6	3.6	3.6	3.6	2.7	2.2	0.9	0.27
6	0.0	3.3	3.3	3.3	3.3	3.3	3.3	3.3	2.4	2.0	0.8	0.24
7	0.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.3	1.9	0.8	0.23
8	0.0	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.1	1.8	0.7	0.21
12	0.0	2.3	2.3	2.3	2.3	2.3	2.3	2.3	1.7	1.4	0.6	0.17

<sup>1</sup>Defined as the sieve that has 100% passing as defined in Table II-13.

### 211.09—Adjustment System

If a lot of material does not conform to the acceptance requirements of Section 211.08, the Department will determine adjustment points as follows:

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**Adjustment Points for Each 1% the Gradation Is Outside the Process Tolerance Permitted In  
Table II-15**

<b>Sieve Size</b>	<b>(Applied in 0.1% increments)</b>
1 1/2 in	1
1 in	1
3/4 in	1
1/2 in	1
3/8 in	1
No. 4	1
No. 8	1
No. 30	2
No. 50	2
No. 200	3

One adjustment point will be applied for each 0.1 percent that the material is out of the process tolerance for asphalt content.

If the total adjustment for a lot is greater than 25 points, the Contractor shall remove the failing material from the road. If the total adjustment is 25 points or less and the Contractor does not elect to remove and replace the material, the unit price for the material will be reduced 3 percent of the unit price bid for each adjustment point the material is outside of the process tolerance. The Engineer will apply this adjustment to the tonnage represented by the sample(s). If the Engineer applies adjustment points against two successive lots, the Contractor shall ensure plant adjustment is made prior to continuing production.

The Contractor shall control the variability of the Contractor's product in order to furnish a consistently uniform mix. When the quantity of any one type of material furnished to a project (i.e., SMA, SM, IM, BM, etc) exceeds 4,000 tons, the variability of the total quantity furnished will be determined on the basis of the standard deviation for each sieve size and the asphalt content. If the standard deviation is within the ranges specified in Table II-16, the Engineer will adjust the unit bid price for the material as indicated herein. The Engineer will not make adjustments for standard deviation computations on more than two job mixes for the same type of material.

**TABLE II-16  
Standard Deviation**

<b>Sieve Size and A.C.</b>	<b>Standard Deviation 1 Adjustment Point for Each Sieve Size and A.C.</b>	<b>2 Adjustment Points for Each Sieve Size and A. C.</b>	<b>3 Adjustment Points for Each Sieve Size and A.C.</b>
1/2 in.	3.8-4.7	4.8-5.7	5.8-6.7
3/8 in	3.8-4.7	4.8-5.7	5.8-6.7
No. 4	3.8-4.7	4.8-5.7	5.8-6.7
No. 8	3.0-3.9	4.0-4.9	5.0-5.9
No. 30	2.2-3.1	3.2-4.1	4.2-5.1
No. 50	1.5-2.4	2.5-3.4	3.5-4.4
No. 200	1.1-2.0	2.1-3.0	3.1-4.0
A.C.	0.27-0.36	0.37-0.46	0.47-0.56

The Engineer will reduce the unit bid price by 1.0percent for each adjustment point applied for standard deviation.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.



If the standard deviation for A.C is within the ranges of 0.0 – 0.15, and there are no adjustment points assigned for any sieve sizes as noted in Table II-16, the Engineer will increase the unit bid price for AC mixture by five (5) percent.

### **211.10—Referee System**

- (a) If the test results obtained from one of the eight samples taken to evaluate a particular lot appear to be questionable, the Contractor may request in writing that the results of the questionable sample be disregarded, whereupon the Contractor shall have either an AASHTO-accredited lab or a Department lab perform tests on five additional samples taken from randomly selected locations in the roadway where the lot was placed.

If the Engineer determines that one of the 8 test results appears to be questionable, the Department will perform tests on five additional samples taken from the randomly selected locations in the roadway where the lot was placed. The test results of the seven original, i.e. unquestioned, samples will be averaged with the test results of the five road samples, and the mean of the test values obtained for the twelve samples will be compared to the requirements for the mean of twelve tests as specified in Table II-15.

- (b) If the Contractor questions the mean of the eight original test results obtained for a particular lot, the Contractor may request in writing approval to have either an AASHTO-accredited lab or a Department lab perform additional testing of that lot.

If the Engineer determines that the mean of the eight original test results are questionable, the Department will perform additional testing of that lot. The test results of the eight samples will be averaged with the test results of four additional samples taken from randomly selected locations in the roadway where the lot was placed, and the mean of the test values obtained from the twelve samples will be compare to the requirements for the mean of twelve tests as specified in Table II-15.

If the Contractor requests additional tests, as described in (a) or (b) herein, the Contractor shall sample the material and have either an AASHTO-accredited lab or Department lab test the material in accordance with Department-approved procedures. The Engineer may observe the sampling and testing.

If the mean of the test values obtained for the twelve samples conforms to the requirements for the mean of twelve tests, the material will be considered acceptable. If the mean of the test values obtained for the twelve samples does not conform to the requirements for the mean result of twelve tests, the lot will be adjusted in accordance with the adjustment rate specified in Section 211.09.

Samples of the size shown herein shall be saw cut by the Contractor for testing without the use of liquids:

<b>Application Rate</b>	<b>Minimum Sample Size</b>
125 lb/yd <sup>2</sup>	8 by 8 in
150 lb/yd <sup>2</sup>	7 by 7 in
200 lb/yd <sup>2</sup>	6 by 6 in
300 lb/yd <sup>2</sup>	5 by 5 in

### **211.11—Handling and Storing Aggregates**

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

Aggregates shall be handled, hauled, and stored in a manner that will minimize segregation and avoid contamination. Aggregates shall be stockpiled in the vicinity of the plant and on ground that is denuded of vegetation, hard, well drained, or otherwise prepared to protect the aggregate from contamination. Placing aggregate directly from the crusher bins into the cold feed may be permitted provided the material is consistent in gradation. When different size aggregates are stockpiled, the stockpiles shall be separated to prevent commingling of the aggregates.

### **211.12—Asphalt Concrete Mixing Plant**

Plants used for the preparation of asphalt concrete mixtures shall conform to the following requirements:

- (a) **Certification for Plant Operation and Sampling:** A Certified Asphalt Plant Level I Technician or a Certified Asphalt Plant Level II Technician shall sample material at the plant.
- (b) **Plant Scales:** Scales shall be approved in accordance with the requirements of Section 109.01.
- (c) **Drier:** The plant shall include a drier(s) that continuously agitates the aggregate during the heating and drying process. The aggregate shall be dried to a point at which the moisture content of the completed mixture does not exceed 1 percent as determined from samples taken at the point of discharge from the mixing operation.
- (d) **Feeder for Drier:** The plant shall be equipped with accurate mechanical means for uniformly feeding the aggregate into the drier so that a consistent production and temperature are reached and maintained. Where different size aggregates are required to comply with grading specifications, they shall be proportioned by feeding into the cold elevator through a multiple compartment feeder bin, one bin for each size used, equipped with positive action gates that can be securely locked to maintain desired proportioning.
- (e) **Bins:** When bins are used, adequate and convenient facilities shall be provided to make possible the sampling of representative aggregate material from each bin. Each compartment shall be provided with an overflow pipe of such size and location to prevent contamination of the aggregate in adjacent compartments. Bins shall be provided with individual outlet gates that, when closed, will allow no leakage.
- (f) **Thermometric Equipment:** The plant shall be equipped with a thermometric instrument so placed at the discharge chute of the drier as to register automatically or indicate the temperature of the heated aggregate or the completed mix if a drier drum mixing plant is used.

A thermometric device shall be fixed in the asphalt feed line at a suitable location near the charging valve at the mixer unit.

Thermometric devices shall be maintained in good working condition and shall be subject to checking against the laboratory thermometer. Any thermometric devices that do not operate or accurately register temperatures shall be removed and repaired or replaced.

- (g) **Pollution Control:** Pollution control shall conform to the requirements of Section 107.16.
- (h) **Equipment for Preparation of Asphalt Material:** Tanks for the storage of asphalt material shall be equipped with a heating system capable of heating and holding the material at the required temperatures. A separate storage tank or a storage tank having separate compartments shall be available for each grade of asphalt cement being used on the project. The heating system shall be designed to heat the contents of the tank by means of steam, electricity, or other approved means so that no flame is in direct contact with the heating surface of the tank. The circulating system for the asphalt material shall be designed to assure proper and continuous circulation

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during the operating period and to minimize oxidation. Pipelines shall be steam jacketed or insulated to prevent undue loss of heat. Storage facilities for asphalt material shall be sufficient capacity for at least one day's operation or an equivalent means of supply shall be provided that will ensure continuous operation. Provisions shall be made for measuring and sampling asphalt within storage tanks. When asphalt material is proportioned by volume, the temperature of the asphalt material in storage shall be uniformly maintained at  $\pm 20$  degrees F during operation of the plant by means of an automatic temperature control device. A sampling valve shall be provided for sampling of each asphalt storage tank used in production of the mix. If there are multiple storage tanks, a dedicated valve for each tank shall be provided.

- (i) **Asphalt Control:** Asphalt material shall be accurately proportioned by volume or weight. When volumetric methods are used, measurements shall be made by means of meters or pumps, calibrated for accuracy. The section of the asphalt line between the charging valve and the spray bar shall be provided with an outlet valve for checking the meter.

When proportioned by weight, the asphalt material shall be weighed on approved scales. Dial scales shall have a capacity of not more than 15 percent of the capacity of the mixer. The value of the minimum graduation shall not be greater than 2 pounds.

Except when a drier-drum mixing plant is used, the asphalt material bucket and its valves and spray bar shall be steam jacketed or heated by other Department approved means. The bucket shall have a capacity of at least 115 percent of the weight of the asphalt material required in any mixture and shall be supported by fulcrums.

The asphalt shall be delivered to the mixer in multiple uniform streams for the full width of the mixer.

- (j) **Proportioning Aggregates:** Mineral filler and any bag house fines the Contractor uses shall be metered or introduced by means of an approved device for uniform proportioning by weight or by volume.

The weigh hopper shall be of sufficient size to hold the maximum required weight of aggregate for one batch without hand raking or running over. Sufficient clearance between the weigh hopper and supporting devices shall be provided to prevent accumulation of foreign materials.

The discharge gate of the weigh hopper shall be situated in such a manner that the aggregates will not segregate when dumped into the mixer. Gates on the bins and weigh hopper shall be constructed to prevent leakage when closed.

- (k) **Drum Mixer:** The aggregate shall be proportioned by a positive weight control at the cold aggregate feed by use of a belt scale that will automatically regulate the supply of material being fed and permit instant correction of variations in load. The cold feed flow shall be automatically coupled with the asphalt flow to maintain the required proportions.
- (l) **Batch Mixer:** The batch mixer shall be of a twin pugmill or other approved type, steam jacketed or heated by other approved means, and capable of producing uniform mixtures within the specified tolerances. It shall be equipped with a sufficient number of paddles or blades operating at such speeds as to produce a properly and uniformly mixed batch. The number and arrangement of the mixer paddles shall be subject to the Engineer's approval. Worn or defective blades shall not be used in mixing operations.

The mixer shall be provided with an approved time lock that will lock the discharge gate after the aggregates and asphalt have been placed in the mixer and will not release the gate until the specified time for mixing has elapsed.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

Batch-type mixing plants used to produce asphalt concrete shall be equipped with approved automatic proportioning devices. Such devices shall include equipment for accurately proportioning batches of the various components of the mixture by weight or volume in the proper sequence and for controlling the sequence and timing of mixing operations. The automated system shall be designed to interrupt and stop the batching operation at any time batch quantities are not satisfied for each of the materials going into the mix. A means shall be provided for observing the weight of each material during the batching operation.

The aggregate may be proportioned by cold feed controls in lieu of plant screens provided the cold aggregate feed conforms to the requirements specified in (j) herein.

Should the automatic proportioning devices become inoperative, the plant may be allowed to batch and mix asphalt materials for a period of not more than 48 hours from the time the breakdown occurs provided alternate proportioning facilities are verbally approved by the Engineer. Written permission of the Engineer will be required for operation without automatic proportioning facilities for periods longer than 48 hours.

- (m) **Continuous Mixing Plant:** A continuous mixing plant shall include a means for accurately proportioning each size of aggregate either by weighing or volumetric measurement. When gradation control is by volume, the unit shall include a feeder mounted under the compartment bins. Each bin shall have an accurately controlled individual gate to form an orifice for volumetrically measuring the material drawn from each respective bin compartment. The orifice shall be rectangular, with one dimension adjustable by positive mechanical means, and shall be provided with a lock. Indicators shall be provided to show the individual gate opening in inches. The plant shall be equipped with a satisfactory revolution counter.

The plant shall include a means for calibrating gate openings by weight. The materials fed out of the bins through individual orifices shall be bypassed to a suitable test box, with each component material confined in a separate section. The plant shall be equipped to conveniently handle test samples weighing up to 200 pounds per bin with accurate platform scales provided for this purpose.

Positive interlocking control shall be provided between the flow of aggregate from the bins and the flow of asphalt material from the meter or other proportioning device. This shall be accomplished by approved interlocking devices or other approved positive means.

Accurate control of the asphalt material shall be obtained by weighing, metering, or volumetric measurement.

The aggregate may be proportioned by cold feed controls in lieu of plant screens provided the cold aggregate feed conforms to the requirements specified in (j) herein.

The plant shall include a continuous mixer of an approved type that is steam jacketed or heated by other approved means. The paddles shall be of any adjustable type for angular position on the shafts and reversible to retard the flow of the mixture.

Interlock cutoff circuits shall be included to interrupt and to stop the proportioning and mixing operations when the aggregate level in the plant or the asphalt material in storage falls below that necessary to produce the specified mixture.

- (n) **Trucks, Truck Scales, and Automatic Printer System:** These shall conform to the requirements of Section 109.01.

### **211.13—Preparation of Mixture**

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

The asphalt and aggregate shall be introduced into the mixer at a temperature that will produce a mixture that conforms to the requirements of the job-mix formula.

After the required amounts of aggregate and asphalt material have been introduced into the mixer, the materials shall be mixed until a uniform coating of asphalt and a thorough distribution of the aggregate throughout the mixture are secured that comply with the requirements of the Ross count procedure in AASHTO T195.

The wet mixing time, based on the procedures in AASHTO T195, shall be determined by the Contractor at the beginning of production and will be approved by the Engineer for each individual plant or mixer and for each type of aggregate used; however, in no case shall the wet mixing time be less than 20 seconds. The *wet mixing time* is the interval of time between the start of introduction of the asphalt material into the mixer and the opening of the discharge gate. A wet mixing time that results in fully coating a minimum of 95 percent of the coarse particles, based on the average of the three samples is acceptable, provided that none of the three sample results has a coating less than 92 percent of the coarse particles shall be the minimum wet mixing time requirement.

A dry mixing time of up to 15 seconds may be required by the Engineer to accomplish the degree of aggregate distribution necessary to obtain complete and uniform coating of the aggregate with asphalt.

#### **211.14—Storage System**

If the Contractor elects to use a storage system, the system shall be capable of conveying the mix from the plant to the storage bins and storing the mix without a loss in temperature or segregation or oxidation of the mix. Storage time shall be limited by the ability of the bins to maintain the mix within the quality requirements specified herein with a maximum time limit not to exceed 10 days. Material may be stored in bins for no more than 24 hours without a Department approved heating system.

The conveyor system may be a continuous or skip bucket type. Continuous type conveyors shall be enclosed so that the mix temperature is maintained.

The storage bins shall be designed in a manner to prevent segregation of the mix during discharge from the conveyor into the bins and shall be equipped with discharge gates that will not cause segregation of the mix while the mix is being loaded into the trucks.

Approval for the use of storage bins may be withdrawn by the Engineer if the amount of heat loss, segregation, or oxidation of the mix is excessive.

#### **211.15—Initial Production**

- (a) **Warm Mix Asphalt (WMA):** At the start of production, the Contractor shall place no more than 500 tons or up to one day's production as directed by the Engineer at an approved site, which may be the project site, so the Engineer can examine the process control of the mixing plant, the Contractor's placement procedures, surface appearance of the mix, compaction patterns of the Contractor's roller(s), and correlation of the nuclear density device.
- (b) **Hot Mix Asphalt (HMA):** At the start of production of a mix not previously used on a state roadway, the Contractor shall place 100 to 300 tons or up to one day's production as directed by the Engineer at an approved site, which may be the project site, so the Engineer can examine the process control of the mixing plant, the Contractor's placement procedures, surface appearance of the mix, compaction patterns of the Contractor's roller(s), and correlation of the nuclear density device.

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The material shall be placed at the specified application rate. The Engineer will determine the disposition of material that was not successfully produced and/or placed due to negligence in planning, production, or placement by the Contractor.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**GUIDELINES — INCLUDE WHEN CORROSION RESISTANT REINFORCING STEEL IS DESIGNATED ON THE PLANS. INCLUDE SS40604 Reinforcing Steel.**

**S223AG2-0313**

VIRGINIA DEPARTMENT OF TRANSPORTATION  
SPECIAL PROVISION FOR  
**CORROSION RESISTANT REINFORCING STEEL**

January 24, 2012

**SECTION 223—STEEL REINFORCEMENT** of the Specifications is revised as follows:

**223.02—Detail Requirements** is amended to add the following

- (e) **Corrosion Resistant Reinforcing Steel, Class I:** Steel shall conform to the requirements of ASTM A1035/A1035M – Standard Specification for Deformed and Plain, Low-carbon, Chromium, Steel Bars for Concrete Reinforcement; or shall conform to the requirements of ASTM A955/A955M – Standard Specification for Deformed and Plain, Solid Stainless Steel Bars for Concrete Reinforcement, UNS\* Designation(s): S32101.
- (f) **Corrosion Resistant Reinforcing Steel, Class II:** Steel shall conform to the requirements of AASHTO Designation: MP 13M/MP 13-04, Standard Specification for Stainless Steel Clad Deformed and Plain Round Steel Bars for Concrete Reinforcement; or shall conform to the requirements of ASTM A955/A955M - Standard and Specification for Deformed and Plain Solid Stainless Steel Bars for Concrete Reinforcement. UNS\* Designations: S24100. Stainless steel clad bars may only be provided if they are domestically produced except for projects designated as experimental in the plans.
- (g) **Corrosion Resistant Reinforcing Steel, Class III:** Steel shall conform to the requirements of ASTM A955/A955M - Standard Specification for Deformed and Plain Solid Stainless Steel Bars for Concrete Reinforcement. UNS\* Designations: S24000, S30400, S31603, S31653, S31803, S32304.

\* Unified Numbering System for Metals and Alloys

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**GUIDELINES — FOR PROJECTS REQUIRING ASPHALT OR CEMENT CONCRETE.**

SS20001-1212

September 28, 2012

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS**SUPPLEMENTAL SECTION 200—GENERAL****SECTION 200—GENERAL** of the Specifications is amended as follows:**200.06-Technician and Batchers Certification** is replaced with the following:

Certification for technicians and batchers will be awarded by the Department upon a candidate's satisfactory completion of an examination.

- (a) **Central Mix Aggregate Technician:** A Central Mix Aggregate Technician designs and makes necessary adjustments in job mixtures at the plant based on an analysis of the specified material. The technician also samples materials and conducts any tests necessary to put the plant into operation and produce a mixture in accordance with the applicable Specifications.
- (b) **Asphalt Plant Level I Technician:** An Asphalt Plant Level I Technician samples materials.
- (c) **Asphalt Plant Level II Technician:** An Asphalt Plant Level II Technician samples material and is capable of conducting any tests necessary to put the plant into operation.
- (d) **Concrete Plant Technician:** A Concrete Plant Technician performs necessary adjustments in the proportioning of material used to produce the specified concrete mixtures
- (e) **Concrete Batchers:** A Concrete Batchers performs the batching operation. The batchers implements adjustments only at the direction of a certified Concrete Plant Technician unless the batchers's certification authorizes otherwise.
- (f) **Asphalt Field Level I Technician:** An Asphalt Field Level I Technician provides quality control of the placement operations of Asphalt Concrete.
- (g) **Asphalt Field Level II Technician:** An Asphalt Field Level II Technician inspects asphalt concrete placement in accordance with applicable requirements.
- (h) **Concrete Field Technician:** A Concrete Field Technician provides quality control of placement operations for hydraulic cement concrete in accordance with applicable requirements.
- (i) **Asphalt Mix Design Technician:** An Asphalt Mix Design Technician is responsible for designing and adjusting mixes as needed, reviewing and approving all test results, having direct communication with the plant for making recommended adjustments and is capable of conducting any tests necessary to put the plant into operation.
- (j) **Aggregate Properties Technician:** An Aggregate Properties Technician conducts all aggregate tests on aggregate used in asphalt concrete in accordance with applicable requirements

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.



- (k) **Slurry Surfacing Technician:** A Slurry Surfacing Technician inspects the placement of emulsified asphalt slurry seal and latex modified emulsion treatment (Micro-surfacing) in accordance with applicable requirements.
- (l) **Surface Treatment Technician:** A Surface Treatment Technician inspects the placement of single seal and modified (blotted) seal coats in accordance with applicable requirements.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**GUIDELINES — FOR PROJECTS REQUIRING SELECT MATERIAL**

SS20702-0714

February 19, 2014

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS**SUPPLEMENTAL SECTION 207—SELECT MATERIAL****SECTION 207—SELECT MATERIAL** of the Specifications is amended as follows:

**Section 207.03—Job Mix Formula for Select Material, Type I** is amended to replace the first paragraph with the following:

The Contractor shall submit or shall have the source of supply submit a job-mix formula for each mixture for the Engineer's approval through the "Producer Lab Analysis and Information Details" (PLAID) website <https://plaid.vdot.virginia.gov> prior to starting work. The formula shall establish a single percentage of aggregate passing each required sieve size denoted in Table II-6 and shall be in effect until a modification is approved by the Engineer. If unsatisfactory results or other changed conditions make it necessary, the Contractor shall prepare and submit a new formula for the Engineer's approval.

**Section 207.05—Acceptance of Select Material, Type I** is amended to replace the first and second paragraphs with the following:

Sampling and testing for determination of grading, moisture, and Atterberg limits shall be performed by the Contractor. The Contractor shall provide such test results within 48 hours of sampling to the Department through the "Producer Lab Analysis and Information Details" (PLAID) website <https://plaid.vdot.virginia.gov>. The Contractor shall maintain appropriate, current quality control charts. The Department will perform independent monitor tests. If there is a statistically significant difference between the two sets of results, an investigation will be made to determine the reason for the difference. If it is determined that the material does not conform to the requirements of the Contract, the material will be rejected or a payment adjustment will be made in accordance with the requirements of Section 207.07.

Determination of gradation and Atterberg limits will be based on a mean of the results of tests performed on four samples taken in a stratified random manner from each lot. Lots of 2000 tons or 4000 tons may be used at the discretion of the Engineer when warranted by annual plant shipping quantity and past performance. If visual examination reveals that the material is obviously contaminated or segregated, the material will be rejected without additional sampling or testing. If it is necessary to determine the gradation and Atterberg limits of the material in an individual location, one sample taken from the material in question will be tested and the results will be compared to the job-mix formula with the tolerances specified in Table II-7 and Table II-8 for one test. The results obtained will apply only to the material in question.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**GUIDELINES — FOR PROJECTS REQUIRING SUBBASE AND AGGREGATE BASE MATERIAL**

SS20802-0714

February 19, 2014

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS**SUPPLEMENTAL SECTION 208—SUBBASE AND AGGREGATE BASE MATERIAL**

**SECTION 208—SUBBASE AND AGGREGATE BASE MATERIAL** of the Specifications is amended as follows:

**Section 208.04—Job Mix Formula** is amended to replace the first paragraph with the following:

The Contractor shall submit, or shall have the source of supply submit a job-mix formula for each mixture for the Engineer's approval through the "Producer Lab Analysis and Information Detail" (PLAID) website <https://plaid.vdot.virginia.gov> prior to starting work. The formula shall be within the design range specified in Table II-9. If unsatisfactory results or other conditions make it necessary, the Contractor shall prepare and submit a new job-mix formula for approval.

**Section 208.06—Acceptance** is amended to replace the second and third paragraphs with the following:

Sampling and testing for determination of grading, moisture, and Atterberg limits shall be performed by the Contractor. The Contractor shall provide such test results within 48 hours of sampling to the Department through "the Producer Lab Analysis and Information Details" (PLAID) website <https://plaid.vdot.virginia.gov>. The Contractor shall maintain appropriate current quality control charts. The Department will perform independent monitor tests at a laboratory of its choice. If there is a statistically significant difference between the two sets of results, an investigation will be made to determine the reason for the difference. If it is determined that the material does not conform to the requirements of the Contract, the material will be rejected or a payment adjustment will be made in accordance with the requirements of Section 208.08 of the Specifications.

Determination of gradation and Atterberg limits will be based on a mean of the results of tests performed on four samples taken in a stratified random manner from each lot. Lots of 2000 tons or 4000 tons may be used at the discretion of the Engineer when warranted by annual plant shipping quantity and past performance. Samples shall be obtained by methods approved by the Engineer. Any statistically acceptable method of randomization may be used to determine the time and location of the stratified random sample to be taken. The Department shall be advised of the method to be used prior to the beginning of production.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**GUIDELINES — FOR PROJECTS REQUIRING ASPHALT MATERIALS**

SS21001-1014

September 3, 2014

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS**SUPPLEMENTAL SECTION 210—ASPHALT MATERIALS****SECTION 210—ASPHALT MATERIALS** of the Specifications is replaced with the following:**210.01—Description**

These specifications cover the manufacturing and material requirements for asphalt material consisting of asphalt, asphalt cement, asphalt cutback, or asphalt emulsion as defined in ASTM D8.

**210.02—Materials**

Asphalt material shall be homogeneous and shall conform to the following:

- (a) **Rapid curing and medium curing liquid asphalts used as surface treatments** shall contain a heat-stable additive conforming to the requirements of Section 211 of the Specifications.
- (b) **Liquid asphalt material** will be tested for coating ability in accordance with the requirements of AASHTO T182, with the following modifications:
  - 1. Material that can coat 95 percent of a shady dolomite will be classified Type I.
  - 2. Material that can coat 95 percent of a siliceous gravel wetted with 2 percent water by weight will be classified Type II.
- (c) **Rapid curing cutback asphalts** shall conform to the requirements of AASHTO M81.
- (d) **Medium curing cutback asphalts** shall conform to the requirements of AASHTO M82.
- (e) **Cements** shall be viscosity graded and shall conform to the requirements of AASHTO M226, Table 2, except that the loss on heating shall be not greater than 1.0 for AC-5, 0.8 for AC-20, and 0.5 for all other grades.
- (f) **Emulsions** shall conform to the requirements of AASHTO M208 and shall be Type I as specified herein except that CRS-2 shall be Type II as specified herein. CRS-1h shall conform to the requirements of AASHTO M208 for CRS-1 except that the penetration shall be 40 to 110. Emulsions will be sampled and tested in accordance with the requirements of AASHTO T59 except that viscosity will be tested in accordance with the requirements of VTM-64.
- (g) **Polymer Modified Cationic Emulsified Asphalt** shall conform to the requirements of AASHTO M316.
- (h) **Non-tracking tack** will be tested in accordance with the requirements set forth in Section 210.07 of the Specifications.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**210.03—VDOT Asphalt Acceptance Program (VAAP)**

Acceptance into the VAAP

- (a) Asphalt materials will be accepted under the VDOT Asphalt Acceptance Program (VAAP). This involves sampling, testing, documentation and certification of the product by the manufacturer in combination with a Department monitoring effort. Performance Graded Binder suppliers shall conform to AASHTO R-26 and Emulsion supplies shall conform to AASHTO PP-71 to be added to the VAAP, with provisions listed below.
- (b) To have a new facility added to the VAAP, producers shall:
  - 1. Submit a split sample of each material to be approved to VDOT Central Office Materials Division for testing.
- (c) Approved shipping facilities from the VAAP that need to add a material to the approved list shall:
  - 1. Submit a split sample of the material to be approved to VDOT Central Office Materials Division for testing.

**210.04—VDOT Asphalt Acceptance Program Requirements and Compliance**

The manufacturer shall ensure the following are performed:

- (a) Asphaltic materials shall be sampled at a minimum frequency of once a month and when additional materials are added to existing material and tested in accordance with the specified methods in Section 210.07 of the Specifications.
- (b) A file or certified test reports representing the asphaltic material shall be maintained by the manufacturer.
- (c) A copy of the certified test report shall be provided to the VDOT Central Office Materials Division at Elko within 30 days of sampling. Failure to comply with this requirement can result in removal from the VAAP and the approved materials list.
- (d) Manufacturers shall supply to the Central Office Materials Division at Elko a summary sheet of quantities shipped to state work annually in January of the following year. This summary sheet will show the number of gallons of each type/grade of material shipped to Virginia addresses.
- (e) The manufacturer shall submit to the Department a detailed plan of action describing the procedures to be taken to ensure tracking of sample test results and the material represented by these results.

**210.05—Sampling**

- (a) Samples shall be taken in the presence of VDOT personnel or a VDOT representative.
- (b) Samples taken for testing of asphaltic materials are to be not less than one quart (one liter) of material (0.5 gallons (2 liters) for asphalt emulsions).

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

- (c) Care is to be taken to ensure that the samples are not contaminated and the sample containers are perfectly clean and dry before filling.
- (d) Immediately after filling, sample containers are to be tightly closed, and properly marked for identification on the container itself.

#### **210.06—Testing**

- (a) The Manufacturer shall conduct the standard control tests on asphaltic materials as detailed in Section 210.07 of the Specifications.
- (b) Testing for certified test reports shall be performed by the Manufacturer's personnel in the Manufacturer's VDOT approved laboratory or by a VDOT approved commercial testing facility.
- (c) The Department shall conduct acceptance testing at a frequency of a minimum of 1 test per month per type/grade of asphaltic material that has been supplied to VDOT projects during the previous month at the VDOT Central Office Materials at Elko. This frequency is to be maintained during the construction season, with a lesser frequency during the remainder of the year.
- (d) Laboratories conducting quality control must be certified by VDOT as meeting the requirements of certification:
  - 1. All Binder Laboratories shall hold AASHTO Accreditation and provide VDOT with a copy of accreditation.
  - 2. All Emulsion Laboratories shall be one of the following two levels:
    - a. Level I: AASHTO Accreditation
      - (1) Provide VDOT with a copy of accreditation.
    - b. Level II: AMRL Proficiency Sample Program
      - (1) Provide VDOT with copies of last "Round Robin" results, with ratings for each type of asphaltic material tested and copies of the lab's response for each sample.
      - (2) Development of a calibration program and personnel record keeping procedure, with results being kept on file at site.
  - 3. All laboratories under the VAAP shall be AASHTO accredited by January 1, 2016.
  - 4. Test Reports
    - a. The Manufacturer shall maintain a file of certified test reports for all asphaltic materials ultimately shipped to Contractors that perform work for VDOT.
    - b. Test Reports shall indicate that the material shipped meets the requirements for that type/grade of asphaltic material and will show the

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test results that were obtained to determine compliance with the applicable specifications.

- c. Records shall be kept by the Manufacturer for at least 12 months and shall be available for verification by VDOT personnel.
- d. Copies of certified test results shall also be sent to the VDOT Central Office Materials Division at ELKO.
- e. Certified Test Reports shall be a company's standard form containing the following information:
  - (1) Manufacturer's name and address
  - (2) Type and grade of asphaltic material
  - (3) Testing performed (AASHTO or Virginia Test Method designation)
  - (4) Test results and date obtained
  - (5) Quantity represented
  - (6) Tank Number
  - (7) Unique Report Identifier
  - (8) Statement indicating that the Manufacturer "certified that these are the test results obtained on the material tested under the VAAP program".

## 210.07—Tests

### (a) **PG Asphalt Binders:**

1. Certified Test Reports for **PG Asphalt Binders** shall be based upon the results of tests performed in accordance with AASHTO M332, Table 1. The Manufacturer is not required to perform the Direct Tension Test, AASHTO T314.
2. Certified test results for Superpave PG Asphalt Binders are to be based upon the results of tests performed in accordance with AASHTO R 29, as specified below:

#### a. Original Material

Flash Point °C	AASHTO T 48
Viscosity @ 135°C/100°C	AASHTO T316
Dynamic Shear, 10 Rad/sec	AASHTO T 315

#### b. RTFO (AASHTO T 240) Material

Mass Loss %	AASHTO T 240
Dynamic Shear, 10 Rad/sec	AASHTO T 315
Multiple Stress Creep Recovery (MSCR) Test	AASHTO T 350

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## c. Pressure Aging Vessel, Residue at 100°C (AASHTO R 28)

Dynamic Shear, 10 Rad/sec	AASHTO T 315
Creep Stiffness, 60 sec	AASHTO T 313
M-Slope	AASHTO T 313

3. For asphalt binders tested in accordance with AASHTO T 350, indication of elastic response shall be determined using Figure X1.1 Nonrecoverable Creep Compliance Versus Percent Recovery in AASHTO M 332.

(b) **Cutback Asphalts:**

1. Certified Test Reports for **Cutback Asphalts** shall be based upon the results of tests performed in accordance with AASHTO M81 and M82. The Manufacturer is not required to perform the Flash Point, Ductility, and Solubility tests unless otherwise directed by the Engineer. VDOT shall perform Ductility and Solubility tests on all acceptance samples. Flash Point tests will be performed by VDOT periodically. When performed by VDOT, failure of either sample on Flash Point, Ductility, and Solubility will be considered sufficient reason to require the Manufacturer to perform this testing. If the Manufacturer elects to conduct these tests to better control production, the results shall be included on the certified test report.
2. When used in surface treatments, the Coating Ability test shall be conducted subject to the specifications listed in Section 210.02 of the Specifications.

(c) **Emulsified Asphalts:**

1. Certified Test Reports for **Emulsified Asphalts** shall be based upon the results of tests performed in accordance with AASHTO M208 or AASHTO M316, as specified below:
  - a. Cationic Emulsions- Table 1, specifically
    - (1) Tests on Emulsions:
      - Saybolt Furol Viscosity
      - Sieve Test (if necessary)
      - Demulsibility or Classification test
      - Particle Charge Test
      - Residue by Distillation
    - (2) Tests on residue from distillation:
      - Penetration
  - b. CSS-1h (Quick Set):
    - Same tests as Cationic Emulsions, as well as:
      - Quick set Emulsified Asphalt Setting Time (VTM-89)
  - c. Latex Modified Cationic Emulsions (Quick Set)
    - (1) CQS-1h Latex Modified (CQS-1hLM)
      - a) Tests on Emulsions
        - Saybolt Furol Viscosity

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- Sieve Test (if necessary)
- Particle Charge Test
- Residue by Evaporation (VTM-78)

- b) Tests on residue
- Penetration
  - Ring and Ball Softening Point

(2) CRS-2 Latex

- a) Tests on Emulsions
- Saybolt Furol Viscosity
  - Sieve Test (if necessary)
  - Particle Charge Test
  - Residue by Distillation
- b) Tests on residue by Distillation
- Penetration
  - Ring and Ball Softening Point
  - Elastic Recovery

2. The Manufacturer is not required to perform the Flash Point, Ductility, and Solubility tests unless otherwise directed by the Engineer. VDOT shall perform Ductility and Solubility tests on all independent assurance (monitor) and Q.A. samples. Flash Point tests will be performed by VDOT periodically. When performed by VDOT, failure of either sample on Flash Point, Ductility, and Solubility will be considered sufficient reason to require the Manufacturer to perform this testing. If the Manufacturer elects to conduct these tests to better control production, the results shall be included on the certified test report.

(d) **Non-Tracking Tack:**

1. Certified Test Reports for Non-Tracking Tack shall be based upon the results of tests performed, as specified below:
- a. Tests on Non-Tracking Tack:
- Saybolt Furol Viscosity
  - Residue by Distillation
- b. Tests on residue by distillation:
- Ring and Ball Softening Point

**210.08—Storing and Shipping**

(a) **Shipping:**

1. Shipments of asphalt material shall be made in transporting media that are free from contamination. Tank trucks or trailers shall be equipped with an Engineer approved sampling device. The device shall have an inside diameter of 1/2 to 1 inch and a gate valve or petcock. The device shall be built into the tank or the recirculating or discharge line so that a sample can be drawn during circulation or discharge.

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2. All Shipping documents shall contain sufficient information such that at any point, the material may be traceable back to the original test results. If the material is mixed with other approved material for storage, the record system will be such as to assure the traceability of all the material which is being mixed.
  3. All shipping documents shall be accompanied by a statement similar to "We certify that all material being shipped on this invoice/bill of lading has been tested and approved under the Virginia Asphalt Acceptance Program and that the material has been loaded under the supervision of our representative into carriers that are suitable for shipment of this material."
  4. All shipping documents shall be kept by the recipient of the material for at least 12 months and are to be available for verification by VDOT personnel I.
  5. Only material tested and certified in accordance with the VAAP shall be mixed and shipped to VDOT projects.
- (b) **Storing:** Asphalt material shall be placed in storage tanks that are free from contamination.

#### **210.09—Payment Adjustment System**

If the asphalt material represented by any one sample does not conform to the requirements herein and the material is a pay item, the Engineer will reduce the contract unit price for the item by 4 percent for each property that does not conform to the Specifications for the quantity represented by the sample that was used on the project. The Engineer will reject any unused material represented by the failing sample.

The Engineer will consider any failed sampled asphalt material that is not a pay item unacceptable and subject to the requirements of Section 105.18 and Section 106.10 of the Specifications.

**GUIDELINES — FOR PROJECTS REQUIRING SUPERPAVE ASPHALT CONCRETE. WHEN THIS PROVISION APPLIES INCLUDE THE FOLLOWING IN THE PROPOSAL: SS31510 SuperPave -Asphalt Conc Place.**

SS21113-1215

December 4, 2015

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

**SUPPLEMENTAL SECTION 211—ASPHALT CONCRETE**

**SECTION 211—ASPHALT CONCRETE** of the Specifications is replaced with the following:

**211.01—Description**

Asphalt concrete shall consist of a combination of mineral aggregate and asphalt material mixed mechanically in a plant specifically designed for such purpose.

An equivalent single-axle load (ESAL) will be established by the Engineer, and SUPERPAVE mix types may be specified as one of the types listed as follows:

<b>Mix Type</b>	<b>Equivalent Single-Axle Load (ESAL) Range (millions)</b>	<b>Minimum Asphalt Performance Grade (PG)<sup>2</sup></b>	<b>Aggregate Nominal Maximum Size<sup>1</sup></b>
SM-9.0A	0 to 3	64S-16	3/8 in
SM-9.0D	3 to 10	64H-16	3/8 in
SM-9.0E	Above 10	64E-22	3/8 in
SM-9.5A	0 to 3	64S-16	3/8 in
SM-9.5D	3 to 10	64H-16	3/8 in
SM-9.5E	Above 10	64E-22	3/8 in
SM-12.5A	0 to 3	64S-16	1/2 in
SM-12.5D	3 to 10	64H-16	1/2 in
SM-12.5E	Above 10	64E-22	1/2 in
IM-19.0A	Less than 10	64S-16	3/4 in
IM-19.0D	10 to 20	64H-16	3/4 in
IM-19.0E	20 and above	64E-22	3/4 in
BM-25.0A	All ranges	64S-16	1 in
BM-25.0D	Above 10	64H-16	1 in

<sup>1</sup>**Nominal Maximum Size** is defined as one sieve size larger than the first sieve to retain more than 10 percent aggregate.

<sup>2</sup>**Minimum Asphalt Performance Grade (PG)** is defined as the minimum binder performance grade for the job mixes as determined by AASHTO T170 or AASHTOM332.

**Note:** SM = Surface Mixture; IM = Intermediate Mixture; BM = Base Mixture

Asphalt concrete shall conform to the requirements for the mix type designated on the plans or elsewhere in the contract for use

At the Contractor's option, an approved Warm Mix Asphalt (WMA) additive or process may be used to produce the asphalt concrete (AC) mix type designated.

**211.02—Materials**

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- (a) **Asphalt materials** shall conform to the requirements of Section 210 of the Specifications except asphalt cement materials shall be performance graded (PG) in accordance with the requirements of AASHTO M332. In addition, asphalt mixtures with the E designation shall meet the asphalt cement requirements in Section 211.04(e)1 of the Specifications.
- (b) **Coarse aggregate** shall be Grade A or B conforming to the requirements, except for grading, of Section 203 of the Specifications for quality. In addition, the coarse aggregate sizes retained on and above the No. 4 sieve shall comply with the coarse aggregate requirements in Table II-12A. Flat and elongated (F&E) particles shall be tested in accordance with the requirements of ASTM D 4791, and coarse aggregate angularity (CAA) shall only be tested on crushed gravel in accordance with the requirements of ASTM D 5821.
- (c) **Fine aggregate** shall conform to the requirements, except for grading, of Section 202 of the Specifications for quality and the fine aggregate requirements in Table II-12A. Fine aggregate angularity (FAA) shall be tested in accordance with the requirements of AASHTO T 304 (Method A) and the sand equivalent (SE) shall be tested in accordance with the requirements of AASHTO T 176.
- (d) After a gradation test is performed:
1. If 10 percent or more of the material is retained on the No. 4 sieve, that portion shall be tested in accordance with the requirements for coarse aggregate.
  2. If 10 percent or more of the material passes the No. 4 sieve, that portion shall be tested for SE.
  3. If 10 percent or more of the material passes the No. 8 sieve, that portion shall be tested for FAA.
- (e) Fine or coarse aggregates that tend to polish under traffic will not be permitted in any final surface exposed to traffic except in areas where the two-way average daily traffic is less than 750 vehicles per day and as permitted elsewhere in these Specifications.

**TABLE II-12A  
Aggregate Properties**

Mix Type	Coarse Aggregate Properties			Fine Aggregate Properties	
	CAA		ASTM D4791 F & E "(5:1) % by weight	SE	FAA
	1 fractured face	2 fractured faces			
SM-9.0 A	85% min.	80% min.	10% max. <sup>1</sup>	40% min.	40% min.
SM-9.0 D	85% min.	80% min.	10% max. <sup>1</sup>	45% min.	45% min.
SM-9.0 E	95% min.	90% min.	10% max. <sup>1</sup>	45% min.	45% min.
SM-9.5 A	85% min.	80% min.	10% max. <sup>1</sup>	45% min.	45% min.
SM-9.5 D	85% min.	80% min.	10% max. <sup>1</sup>	45% min.	45% min.
SM-9.5 E	95% min.	90% min.	10% max. <sup>1</sup>	45% min.	45% min.
SM-12.5 A	85% min.	80% min.	10% max. <sup>1</sup>	45% min.	45% min.
SM-12.5 D	85% min.	80% min.	10% max. <sup>1</sup>	45% min.	45% min.
SM-12.5 E	95% min.	90% min.	10% max. <sup>1</sup>	45% min.	45% min.
IM-19.0 A	85% min.	80% min.	10% max. <sup>1</sup>	45% min.	45% min.
IM-19.0 D	95% min.	90% min.	10% max. <sup>1</sup>	45% min.	45% min.
IM-19.0 E	95% min.	90% min.	10% max. <sup>1</sup>	45% min.	45% min.

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BM-25.0 A	80% min.	75% min.	10% max. <sup>1</sup>	45% min.	45% min.
BM-25.0 D	80% min.	75% min.	10% max. <sup>1</sup>	45% min.	45% min.

<sup>1</sup>10 percent measured at 5:1 on maximum to minimum dimensions

- (f) **Mineral filler** shall conform to the requirements of Section 201 of the Specifications.
- (g) **Aggregate for asphalt concrete** shall be provided in sufficient sizes and amounts to produce a uniform mixture. The Contractor shall indicate on the proposed job-mix formula the separate approximate sizes of aggregate to be used.

Where segregation or nonuniformity is evident in the finished pavement, the Engineer reserves the right to require the Contractor to discontinue the use of crusher run or aggregate blends and to furnish separate sizes of open-graded aggregate material.

- (h) An antistripping additive shall be used in all asphalt mixes. It may be hydrated lime or a chemical additive from the VDOT Materials Division Approved Products List No. 7 or a combination of both. The approved chemical additive shall be added at a rate of not less than 0.30 percent by weight of the total asphalt content of the mixture.

The mixture shall produce a tensile strength ratio (TSR) of not less than 0.80 for the design and production tests. The TSR shall be determined in accordance with AASHTO T283, including a freeze-thaw cycle (4-inch specimens compacted with a Marshall Hammer or 3.5 by 6-inch specimens when compacted with a gyratory compactor); except that the 16-hour curing time requirement and the 72 to 96-hour storage period will not be enforced by the Department. Design tests shall use the same materials that are to be used in the production mix and shall be conducted in a laboratory approved by the Department.

When a chemical additive is used, it shall be added to the asphalt cement prior to the introduction of the cement into the mix. Any chemical additive or particular concentration of chemical additive found to be harmful to the asphalt material or that changes the original asphalt binder performance grade (PG) shall not be used.

- (i) **Hydrated lime** shall conform to the requirements of ASTM C977. Hydrated lime shall be added at a rate of not less than 1 percent by weight of the total dry aggregate.

A separate bin or tank and feeder system shall be provided to store and accurately proportion the dry or slurried lime into the aggregate.. The lime and aggregate shall be mixed by pugmill or other Department approved means to achieve a uniform lime coating of the aggregate prior to entering the drier. If lime is added in dry form, the aggregate shall contain at least 3 percent free moisture. The Department will not permit the stockpiling of lime treated aggregate.

The feeder system shall be controlled by a proportioning device, which shall be accurate to within  $\pm 10$  percent of the specified amount. The proportioning device shall have a convenient and accurate means of calibration. A flow indicator or sensor shall be provided with the proportioning device and interlocked with the plant controls, aggregate feed or weigh system, such that production of the mixture shall be consistently maintained and, if there is a stoppage of the lime feed, interrupted.

The method of introducing and mixing the lime and aggregate shall be subject to approval by the Engineer prior to beginning production.

- (j) **Reclaimed Asphalt Pavement (RAP)** material may be used as a component material of asphalt mixtures in conformance with the following:

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1. Asphalt surface, intermediate and base mixtures containing RAP (but without RAS) should use the performance grade (PG) of asphalt cement as indicated in Table II-I4A, however, the choice of PG to use in the mix shall be the responsibility of the Contractor in order to meet the requirements of Section 211.01 of the Specifications.
2. The final asphalt mixture shall conform to the requirements for the type specified.
3. During the production process, RAP material shall not be allowed to contact open flame.
4. RAP material shall be handled, hauled, and stored in a manner that will minimize contamination. Further, the material shall be stockpiled and used in such manner that variable asphalt contents and asphalt penetration values will not adversely affect the consistency of the mixture.
5. RAP shall be processed in such a manner as to ensure that the maximum top size particle of material introduced into the mix shall be 2 inches. The Engineer may require smaller sized particles to be introduced into the mix if the reclaimed particles are not broken down or uniformly distributed throughout the mixture during heating and mixing.

**(m) Reclaimed Asphalt Shingles (RAS) – Tear-off RAS Materials in Asphalt Concrete**

6. Asphalt surface, intermediate, and base mixtures containing **Tear-off RAS Materials** shall meet the requirements of Section 211.01 and 211.03 of the Specifications.
7. Tear-off RAS Materials shall be discarded shingle scrap from the re-roofing of domestic buildings. These tear-offs shall have been produced by the manufacturing process for roofing shingles.

Tear-off RAS materials shall contain less than 3.0 percent foreign materials such as paper, roofing nails, wood, or metal flashing. Materials shall be shredded prior to being incorporated in the AC mixture so that at least 99 percent of the shredded pieces passes the ½ inch (12.5 mm) sieve and at least 80 percent passed the #4 (4.75 mm) sieve.

Tear-off RAS materials shall not have asbestos containing material (ACM) as defined by the National Emission Standards for Hazardous Air Pollutants (NESHAP), which is less than 1 percent asbestos. The Contractor shall furnish a certification obtained from the recycler that Polarized Light Microscopy (PLM) tests were performed on random samples of RAS at the rate of 1 test per 100 tons or if operating under a Virginia DEQ permit the rate will be the 1 test per 750 tons. The test results shall reveal no detectable level of ACM. Copies of the test results from the recycler shall be available upon request.

8. Asphalt Binder of the asphalt concrete mixture shall be Performance Grade (PG) of asphalt conforming to the requirements specified in Section 211 of the Specifications.
9. RAS tear-offs in asphalt concrete shall be mixed mechanically in a plant specifically designed for asphalt concrete production.
10. Contractors shall store tear-off RAS materials by stockpiling either whole or as partial shingles which have not been shredded or shredded shingles that meet the maximum size requirements. Stockpiled RAS shall not be contaminated by dirt or other objectionable foreign materials. Blending of the shingles with fine aggregate may be necessary to prevent conglomeration of shingle particles. When fine aggregate is used for this purpose, this material shall be accounted for in the mix design.

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(n) **Reclaimed Asphalt Shingles (RAS) – Tabs RAS Materials** in Asphalt Concrete

6. Asphalt surface, intermediate, and base mixtures containing **Tabs RAS Materials** shall meet the requirements of Section 211.01 and 211.03 of the Specifications.
7. Tabs RAS Materials shall be produced by the manufacturing process for domestic roofing shingles. Blending or mixing of Tabs and Tear-offs shall not be permitted.

Tabs RAS Materials shall be shredded prior to being incorporated into the asphalt concrete mixture so that one hundred percent of the shredded pieces are less than ½ inches (12.5mm) in any dimension.

Tabs RAS Materials shall not contain asbestos fibers. The Contractor shall furnish the Department a certification from the manufacturer of the shingles stating that the shingles are free of asbestos. If a certification cannot be obtained then the contractor shall furnish test results of RAS sample analysis for Polarized Light Microscopy (PLM) on the shingles which certify the material to be used is free of asbestos. Testing is required at the specified rate of 1 per manufacturer per type of RAS prior to processing and results shall be submitted prior to or during the stockpile approval process.

8. Asphalt Binder of the asphalt concrete mixture shall be Performance Grade (PG) of asphalt conforming to the requirements specified in Section 211 of the Specifications.
  9. Tabs RAS Materials in asphalt concrete shall be mixed mechanically in a plant specifically designed for asphalt concrete production.
  10. Contractors shall store Tabs RAS materials by stockpiling either whole or as partial shingles which have not been shredded or shredded shingles that meet the maximum size requirements. Stockpiled RAS shall not be contaminated by dirt or other objectionable foreign materials. Blending of the shingles with fine aggregate may be necessary to prevent conglomeration of shingle particles. When fine aggregate is used for this purpose, this material shall be accounted for in the mix design.
- (k) **Warm Mix Asphalt (WMA)** additives or processes shall be approved by the Department prior to use and shall be obtained from the Department's approved list which is included in the Materials Division's Manual of Instructions.

### **211.03—Job-Mix Formula**

The Contractor shall submit a job-mix formula for each mixture planned for use on the project for the Department's evaluation and approval through the "Producer Lab Analysis and Information Details" (PLAID) website. Paper copies of the job mix formula along with supporting documentation shall also be submitted to the Department. The job-mix formula shall be within the design range specified. The job-mix formula shall establish a single percentage of aggregate passing each required sieve, a single percentage of asphalt material to be added to the aggregate, a temperature at which the mixture is to be produced, and a temperature at which the mixture is to be compacted for SUPERPAVE testing in accordance with the requirements of AASHTO R35. Each approved job-mix formula shall remain in effect provided the results of tests performed on material currently being produced consistently comply with the requirements of the job-mix formula for grading, asphalt content, temperature, and SUPERPAVE compaction results and the requirements of Section 315 of the Specifications.

- (a) SUPERPAVE mixes shall be designed and controlled in accordance with the requirements of AASHTO R35 and as specified herein. The Contractor shall have available all of the equipment outlined in AASHTO T312 (Section 4-6) and a Department-certified Asphalt Mix

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Design Technician. The SUPERPAVE mixture shall be compacted in a gyratory compactor with an internal angle of  $1.16 \pm 0.02$  degrees. **The internal angle shall be measured and calibrated using a cold (non-mix) device.** The SUPERPAVE Gyratory Compactor (SGC) shall be one from the Department's approved list of devices found in the VDOT Materials Division's Manual of Instructions. The SUPERPAVE mixes shall conform to the requirements of Table II-13 and Table II-14. Section 7.1.2 of AASHTO R30 shall be modified such that the compaction temperature is as specified in (d) 6 herein.

- (b) In conjunction with the submittal of a job-mix formula, the Contractor shall submit complete SUPERPAVE design test data, ignition furnace calibration data in accordance with VTM-102 prepared by an approved testing laboratory, and viscosity data or supplier temperature recommendations for the asphalt cement if different from (d) 6 herein.
- (c) Three trial blends for gradation shall be run at one asphalt content

**TABLE II-13**  
**Asphalt Concrete Mixtures: Design Range**

Mix Type	Percentage by Weight Passing Square Mesh Sieves											
	2 in	1 1/2 in	1 in	3/4 in	1/2 in	3/8 in	No. 4	No. 8	No. 30	No. 50	No. 200	
SM-9.0 A,D,E					100 <sup>1</sup>	90-100	90 max.	47-67				2-10
SM-9.5 A,D,E					100 <sup>1</sup>	90-100	58-80	38-67	23 max			2-10
SM-12.5 A,D,E				100	95-100	90 max.	58-80	34-50	23 max			2-10
IM-19.0 A,D,E			100	90-100	90 max.	--	--	28-49				2-8
BM-25.0 A,D		100	90-100	90 max.	--	--	--	19-38				1-7
C (Curb Mix)					100	92-100	70-75	50-60	28-36	15-20		7-9

<sup>1</sup>A production tolerance of 1% will be applied to this sieve regardless of the number of tests in the lot.

**TABLE II-14**  
**Mix Design Criteria**

Mix Type	VTM (%)	VFA (%)	VFA (%)	Min. VMA (%)	Fines/Asphalt Ratio	No. of Gyration N Design
	Production	Design	Production			
SM-9.0A <sup>1,2</sup>	2.0-5.0	75-80	70-85	16	0.6-1.3	65
SM-9.0D <sup>1,2</sup>	2.0-5.0	75-80	70-85	16	0.6-1.3	65
SM-9.0E <sup>1,2</sup>	2.0-5.0	75-80	70-85	16	0.6-1.3	65
SM-9.5A <sup>1,2</sup>	2.0-5.0	75-80	70-85	16	0.7-1.3	50
SM-9.5D <sup>1,2</sup>	2.0-5.0	75-80	70-85	16	0.7-1.3	50
SM-9.5E <sup>1,2</sup>	2.0-5.0	75-80	70-85	16	0.7-1.3	50
SM-12.5A <sup>1,2</sup>	2.0-5.0	73-79	68-84	15	0.7-1.3	50
SM-12.5D <sup>1,2</sup>	2.0-5.0	73-79	68-84	15	0.7-1.3	50
SM-12.5E <sup>1,2</sup>	2.0-5.0	73-79	68-84	15	0.7-1.3	50
IM-19.0A <sup>1,2</sup>	2.0-5.0	69-76	64-81	13	0.6-1.2	65
IM-19.0D <sup>1,2</sup>	2.0-5.0	69-76	64-81	13	0.6-1.2	65
IM-19.0E <sup>1,2</sup>	2.0-5.0	69-76	64-81	13	0.6-1.2	65
BM-25.0A <sup>2,3</sup>	1.0-4.0	67-87	67-92	12	0.6-1.3	65

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BM-25.0D <sup>2,3</sup>	1.0-4.0	67-87	67-92	12	0.6-1.3	65
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<sup>1</sup>Asphalt content should be selected at 4.0% air voids for A & D mixes, 3.5% air voids for E mix.

<sup>2</sup>Fines-asphalt ratio is based on effective asphalt content.

<sup>3</sup>Base mix shall be designed at 2.5% air voids. BM-25A shall have a minimum asphalt content of 4.4% unless otherwise approved by the Engineer. BM-25D shall have a minimum asphalt content of 4.6% unless otherwise approved by the Engineer.

(d) The SUPERPAVE design test data shall include, but not be limited to, the following information:

2. Grading data for each aggregate component of three trial blends shall be submitted to the Department. The data for the mixture shall show percent passing for the following sieves: 2 inch, 1 1/2 inch, 1 inch, 3/4 inch, 1/2 inch, 3/8 inch, No. 4, No. 8, No. 16, No. 30, No. 50, No. 100, and No. 200. The grading shall be reported to the nearest 1.0 percent except the No. 200 sieve shall be reported to the nearest 0.1 percent.
2. The test data shall include, but not be limited to, the percentage of each aggregate component as compared to the total aggregate in the asphalt mixture. The specific gravity and aggregate properties for coarse and fine aggregates defined in Section 211.02 (b) and (c) of the Specifications, including flat and elongated properties, for each aggregate component or for the total aggregates used in the mixture shall be reported. Aggregate properties, except sand equivalent, shall be reported for RAP portions of a mixture. The aggregate specific gravity of RAP shall be the effective aggregate specific gravity calculated from the results of tests conducted in accordance with AASHTO T 209 and VTM-102.
3. The aggregate grading in the asphalt mixture shall be determined by igniting or extracting the asphalt from a laboratory-prepared sample. The laboratory sample shall be batched on the basis of component percentages as indicated in (d) 2. herein and at the proposed job-mix asphalt content. The aggregate shall be obtained in accordance with the requirements of VTM-102 or VTM-36, when approved. Sieves specified in (d) 1. herein shall be reported, beginning with the top size for the mix.
4. The following volumetric properties of the compacted mixture, calculated on the basis of the mixture's maximum specific gravity determined in accordance with AASHTO T-209, shall be reported to the Engineer. The mixture shall be aged in accordance with AASHTO R30 and the bulk specific gravity of the specimens determined in accordance with AASHTO T-166, Method A, for each asphalt content tested. Properties shall be determined and reported in accordance with the requirements of AASHTO R35.
  - a. Voids in total mix (VTM)
  - b. Voids in mineral aggregate (VMA)
  - c. Voids filled with Asphalt (VFA)
  - d. Fines/Asphalt ratio (F/A)
5. The value of the maximum specific gravity of the asphalt mixture used in (c) 4. herein shall be reported to three decimal places.
6. The mixing and compaction temperature for testing shall be as follows:

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- d. For mixes designation A, the mix temperature shall be 300 degrees F to 310 degrees F and the compaction temperature shall be 285 degrees F to 290 degrees F.
  - e. For mixes designation D, the mix temperature shall be 310 degrees F to 320 degrees F and the compaction temperature shall be 295 degrees F to 300 degrees F.
  - f. In cases involving PG 64E-22 or modified binders, the temperatures shall be based on documented supplier's recommendations.
7. The field correction factor as determined by subtracting the bulk specific gravity of the aggregate from the effective specific gravity of the aggregate at the design asphalt content.
  8. For surface mixes, permeability test data shall be submitted in accordance with VTM 120 using either single point verification or the regression method for each surface mix having a different gradation. If the average of the permeability results from the single point verification method exceeds  $150 \times 10^{-5}$  cm/sec, or if the regression method predicts a permeability exceeding  $150 \times 10^{-5}$  cm/sec at 7.5% voids, the Contractor shall redesign the mixture to produce a permeability number less than  $150 \times 10^{-5}$  cm/sec.
- (e) The SUPERPAVE design binder content test data shall be plotted on graphs as described in AASHTO R 35 and shall show that the proposed job-mix formula conforms to the requirements of the designated mix type.
  - (f) A determination will be made to verify if any asphalt concrete mixture being produced conforms to the job-mix formula approved by the Department. The Department and Contractor will test the mixture using samples removed from production. The following tests will be conducted to determine the properties listed:

Property	Test
Asphalt content	VTM-102, (VTM-36 when approved)
Gradation	AASHTO T-30
SUPERPAVE properties	AASHTO R35
Asphalt cement material	AASHTO T316 or T-201

For Warm Mix Asphalt (WMA), SUPERPAVE properties for mixing and compaction temperatures will be determined by the Department and Contractor based on the mix designations in Section 211.03(d)6 of the Specifications.

The Department will perform rut testing in accordance with the procedures detailed in VTM-110. If the results of the rut testing do not conform to the following requirements, the Engineer reserves the right to require adjustments to the job-mix formula:

Mix Designation	Maximum Rut Depth, mm
A	7.0
D	5.5
E, (S)	3.5

After calibration of the gyratory compactor is completed, the Engineer may require the Contractor to make adjustments to the job-mix formula.

If the Department determines that the mixture being produced does not conform to the approved job-mix formula and volumetric properties specified in Table II-14 based on the Department's or

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Contractor's test results, the Contractor shall immediately make corrections to bring the mixture into conformance with the approved job-mix formula or cease paving with that mixture.

Subsequent paving operations using either a revised or another job-mix formula that has not been verified as described herein shall be limited to a test run of 100 to 300 tons of mixture if such material is to be placed in Department project work. No further paving for the Department using that specific mixture shall occur until the acceptability of the mixture being produced has been verified using the 100 to 300 ton constraint.

**TABLE II-14A  
Recommended Performance Grade of Asphalt Cement**

Mix Type	Percentage of Reclaimed Asphalt Pavement (RAP) in Mix		
	%RAP ≤ 25.0%	25.0% < %RAP ≤ 30%	25.0% < %RAP ≤ 35%
SM-4.75A, SM-9.0A, SM-9.5A, SM-12.5A	PG 64S-22	PG 64S-22	
SM-4.75D, SM-9.0D, SM-9.5D, SM-12.5D	PG 64H-22	PG 64S-22	
IM-19.0A	PG 64S-22	PG 64S-22	
IM-19.0D	PG 64H-22	PG 64S-22	
BM-25.0A	PG 64S-22		PG 64S-22
BM-25.0D	PG 64H-22		PG 64S-22

Based on rut testing performed by the Department and/or field performance of the job mix, the Engineer reserves the right to require the Contractor to make adjustments to the job-mix formula.

- (h) When utilizing **RAS Materials (Tear-off or Tabs)**, the Contractor shall submit material samples to include the RAS stockpiled tear-off shingles, reclaimed asphalt pavement (RAP) and PG Binder.

The amount of RAS material used in the recycled mixture shall be no more than five percent of the total mixture weight. However, the combined percentages of RAS and RAP shall not contribute more than 30 percent (by weight) of the total asphalt content of the mixture, according to the following equation:

$$\frac{\left( \%RAS_{mix} \times \%AC_{RAS} / 100 \right) + \left( \%RAP_{mix} \times \%AC_{RAP} / 100 \right)}{\%AC_{JMF}} \leq 30.0\%$$

Where:

- % RAS<sub>mix</sub> = Percent RAS in the Job Mix Formula
- % AC<sub>RAS</sub> = Average Percent AC in the RAS
- % RAP<sub>mix</sub> = Percent RAP in the Job Mix Formula
- % AC<sub>RAP</sub> = Average Percent AC in the RAP
- % AC<sub>JMF</sub> = Design AC content of the JMF

The Contractor shall determine the asphalt content of the RAS using AASHTO T-164, Method B, or VTM-102 and report the average results to the nearest 0.1 percent. When the ignition furnace

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is used, a correction factor shall be applied for the non-asphalt combustible materials in the RAS. Unless the actual correction factor is determined by comparing the test results on paired samples from AASHTO T-164 Method B and VTM-102, the estimated correction factor for the RAS shall be 5 percent.

Used separately or with RAP, RAS can be used to stiffen the asphalt concrete mixture binder to meet the requirements in Section 211.01 of Specifications. Asphalt surface, intermediate, and base mixtures containing RAS in order to meet the asphalt concrete mixture stiffness of PG 64H-16 should use PG 64S-22 asphalt cement. Further, mixes using RAS shall not exceed the 30% (by weight) and are required to use the maximum binder replacement criteria noted here:

- 5% RAS and 0% RAP
- 4% RAS and 5% RAP minimum
- 3% RAS and 10% RAP minimum
- 2% RAS and 20% RAP minimum

Interpolation shall be used to determine combinations between the whole number RAS/RAP usage figures shown herein, subject to review and approval by the Engineer.

#### **211.04—Asphalt Concrete Mixtures**

Asphalt concrete mixtures shall conform to the requirements of Table II-14 and the following:

- (a) **Types SM-9.0A, SM-9.0D, SM-9.0E, SM-9.5A, SM-9.5D, SM-9.5E, SM-12.5A, SM-12.5D, and SM-12.5E asphalt concrete** shall consist of crushed stone, crushed slag, or crushed gravel and fine aggregate, slag or stone screenings, or a combination thereof combined with asphalt cement.

**NOTE:** For all surface mixes, except where otherwise noted, no more than 5 percent of the aggregate retained on the No. 4 sieve and no more than 20 percent of the total aggregate may be polish susceptible. At the discretion of the Engineer, SM-9.5AL or SM-12.5AL may be specified and polish susceptible aggregates may be used (without percentage limits).

**NOTE:** Unless Type C (curb mix) is specified by the Engineer in the contract plans and specifications, SM-9.0, SM-9.5, and SM-12.5 mix types are acceptable for use in the construction of asphalt curbing.

- (b) **Types IM-19.0A, IM-19.0D, and IM-19.0E asphalt concrete** shall consist of crushed stone, crushed slag, or crushed gravel and fine aggregate, slag or stone screenings, or a combination thereof combined with asphalt cement.

**NOTE:** At the discretion of the Engineer, an intermediate mix may be designated as either SM-19.0A, SM-19.0D or SM-19.0E. When designated as such, no more than 5 percent of the aggregate retained on the No. 4 sieve may be polish susceptible. All material passing the No. 4 sieve may be polish susceptible.

- (c) **Types BM-25.0A and BM-25.0D asphalt concrete** shall consist of crushed stone, crushed slag, or crushed gravel and fine aggregate, slag or stone screenings, or a combination thereof combined with asphalt cement.

- (d) **Type C (curb mix) asphalt concrete** shall consist of a blend of No. 78 or No. 8 crushed aggregate, No. 10 crushed aggregate, fine aggregate, mineral filler, and a stabilizing additive from the Department's approved list found in the Materials Division's Manual of Instructions combined with 6.0 to 9.0 percent of PG 64S-22. This mix does not require a volumetric mix design or volumetric testing under the SUPERPAVE system.

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- (e) **Type SM-9.5, SM-12.5, IM-19.0 and BM-25.0 asphalt concrete** may be designated E (polymer modified), or stabilized (S). Asphalt concrete mixtures with the E designation may not be stabilized.
1. **Type E designated mixtures** shall consist of mixes incorporating a neat asphalt material with polymer modification complying with the requirements of PG 64E-22 and have a rolling thin film oven test residue elastic recovery at 77 degrees F of a minimum of 70 percent when tested in accordance with ASTM D 6084 procedure A.. E designated mixtures shall not contain more than 15 percent reclaimed asphalt pavement (RAP) material (by weight) or 3% recycled asphalt shingles (RAS) (by weight).
  2. **Type (S) asphalt mixtures** shall consist of mixes incorporating a stabilizing additive from the Department's approved list found in the Materials Division's Manual of Instructions. These mixes shall be designated with an (S) following the standard mix designation. The minimum required additive shall be as specified on the Department's approved list found in the Materials Division's Manual of Instructions.
  3. **Type L asphalt mixtures** will be allowed to contain a 100 percent polishing coarse and fine aggregate. These mixes shall be designated with a L following the standard mix designation.

### **211.05—Testing**

The Contractor shall provide the quality control and quality assurance necessary for the Department to determine conformance with the required grading, asphalt content, and temperature properties for asphalt concrete.

The Contractor shall have a Department-certified Asphalt Mix Design Technician for designing and adjusting mixes as necessary. The Asphalt Mix Design Technician or Asphalt Plant Level II Technician may perform testing of asphalt mixes. The Asphalt Mix Design Technician shall be responsible for reviewing and approving the results of all testing. The Asphalt Mix Design Technician shall be available and have direct communication with the plant for making necessary adjustments in the asphalt concrete mixes at the mixing plant. The Asphalt Mix Design Technician and Asphalt Plant Level II Technician shall each be capable of conducting any tests necessary to put the plant into operation; however, the Asphalt Mix Design Technician shall be responsible for producing a mixture that complies with the requirements of these Specifications. The Department will award certification.

The Contractor shall maintain all records and test results associated with the material production and shall maintain appropriate current quality control charts. Test results and control charts shall be available for review by the Engineer.

The Contractor shall execute a quality control plan of process inspections and tests, including the determination of SUPERPAVE properties. The results of the SUPERPAVE tests shall be used, along with the results of other quality control efforts, to achieve and maintain the quality of the mixture being produced.

The Contractor shall perform at least one field SUPERPAVE test per day per mix or per 1,000 tons per mix if more than 1,000 tons of a mix is produced per day. Aging as described in AASHTO R30 shall not be performed. If less than 300 tons of asphalt mixture is produced under a single job-mix formula in a day, field SUPERPAVE testing will not be required on that day. That day's tonnage shall be added to subsequent production. When the accumulated tonnage exceeds 300 tons, minimum testing frequency shall apply. Field SUPERPAVE test results shall be plotted and displayed in control chart form in the plant immediately following the completion of each individual test. The tests shall determine asphalt content in percentages to the nearest 0.01 . The tests shall determine VTM, VMA, VFA, and F/A in

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percentages to the nearest 0.1 percent. The Department will conduct on-site inspections so the Contractor's Asphalt Mix Design Technician can demonstrate knowledge of the SUPERPAVE mix design and production requirements on Department-supplied mixtures.

Aggregate specific gravity and aggregate property tests shall be conducted by a Department-certified Aggregate Properties Technician or Asphalt Mix Design Technician on each aggregate component (including RAP) or total aggregate mixture once at mix design stage and once prior to beginning production in each calendar year. Sand equivalent shall not be determined on RAP. In addition, for each 50,000 tons of each aggregate size used at each plant, aggregate specific gravity and the results of aggregate property tests shall be reported for each aggregate component or the total aggregate mixture. Otherwise, if the total blend (cold feed) is used to determine aggregate specific gravity and aggregate properties, these tests shall be run for each 50,000 tons of the total blend.

Field SUPERPAVE tests shall be performed to  $N_{\text{design}}$  gyrations as specified in Table II-14.

For surface mixes, permeability test data shall be submitted in accordance with VTM 120 using either single point verification or the regression method for each surface mix having a different gradation.

A minimum of one permeability samples will be taken and test run in the first lot, and every other lot thereafter, and results submitted to the District Materials Engineer.

#### **211.06—Tests**

The Department may sample materials entering into the composition of the asphalt concrete, the mixture, or the completed pavement. The Contractor shall cooperate with the Engineer in obtaining these samples. When samples are obtained from the pavement by coring, the resulting voids shall be filled and refinished by the Contractor without additional compensation.

Abson recovery samples shall be PG graded according to the requirements of AASHTO M 322-14. Samples meeting the required grades specified in Section 211.01 of the Specifications shall be acceptable.

When the Department performs PG grading on the asphalt in a Contractor's liquid asphalt storage tank, the Engineer will notify the asphalt concrete producer and binder supplier if tests indicate that the binder properties of the asphalt material differ from those of the approved job-mix. The asphalt concrete producer and binder supplier shall determine what corrective action must be taken with the approval of the Engineer.

#### **211.07—Plant Inspection**

The Department will accept the preparation of asphalt concrete mixtures under a quality assurance plan. The Contractor shall provide a laboratory as specified in Section 106.07 of the Specifications.

In addition, the Contractor shall have all laboratory scales and gyratory compactors calibrated once a year by an independent source. The Contractor shall maintain the calibration records for 3 years from the date of the last calibration.

#### **211.08—Acceptance**

Acceptance will be made under the Department's quality assurance program, which includes the testing of production samples by the Contractor and of monitor samples by the Department. Sampling and testing for the determination of grading, asphalt cement content, and temperature shall be performed by

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the Contractor, and the Department will perform independent monitor checks at a laboratory of its choosing. The Contractor shall input such test results within 24 hours of sampling to the Department through the "Producer Lab Analysis and Information Details" (PLAID) website <https://plaid.vdot.virginia.gov>, unless otherwise approved by the appropriate District Materials Engineer.

Where the Contractor's test results indicate that the mixture conforms to the gradation, asphalt cement content, and mix temperature requirements of the Specifications, the mixture will be acceptable for these properties; however, nothing herein shall be construed as waiving the requirements of Section 106.06, Section 200.02, Section 200.03, and Section 315 of the Specifications or relieving the Contractor of the contractual obligation to furnish and install a finished functional product that conforms to the requirements of the Contract.

If a statistical comparative analysis of the Contractor's test results and the Department's monitor tests indicate a statistically significant difference in the results and either of the results indicates that the material does not conform to the grading and asphalt cement content requirements of the Specifications, the Department and the Contractor will make an investigation to determine the reason for the difference. If it is determined from the investigation that the material does not conform to the requirements of the Contract, price adjustments will be made in accordance with the requirements of Section 211.09 of the Specifications.

Acceptance for gradation and asphalt cement content will be based on the mean of results of eight tests performed on samples taken in a stratified random manner from each 4,000-ton lot (8,000-ton lots may be used when the normal daily production of the source from which the material is being obtained is in excess of 4,000 tons). The Contractor shall take samples from the approximate center of the truckload of material unless otherwise approved by the Engineer. Any statistically acceptable method of randomization may be used to determine when to take the stratified random sample; however, the Department shall be advised of the method to be used prior to the beginning of production.

A lot will be considered to be acceptable for gradation and asphalt content if the mean of the test results obtained is within the tolerance allowed for the job-mix formula as specified in Table II-15.

The temperature of the mixture at the plant shall be controlled to provide load-to-load uniformity during changing weather conditions and surface temperatures. The maximum temperature of mix designations A and D and base mixes shall not exceed 350 degrees F unless otherwise directed by the Engineer. The maximum temperature as recommended by the supplier shall not be exceeded for a mix designated E or (S).

If the job-mix formula is modified within a lot, the mean test results of the samples taken will be compared to the applicable process tolerance shown in Table II-15.

Asphalt content will be measured as extractable asphalt or weight after ignition.

Field SUPERPAVE tests will be performed by the Department in accordance with the requirements of AASHTO R35 during the production of the approved job mixes designed by the SUPERPAVE method. Aging, as described in AASHTO R30, will not be performed. Should any field SUPERPAVE test fail with regard to the limits specified in Table II-14, the Department may require that production be stopped until necessary corrective action is taken by the Contractor. The Engineer will investigate and determine the acceptability of material placed and represented by failing field SUPERPAVE test results.

Should visual examination by the Engineer reveal that the material in any load or portion of the paved roadway is obviously contaminated or segregated, that load or portion of the paved roadway will be rejected without additional sampling or testing of the lot. If it is necessary to determine the gradation or asphalt content of the material in any load or portion of the paved roadway, samples will be taken and tested and the results will be compared to the requirements of the approved job-mix formula. The results obtained in the testing will apply only to the material in question.

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**TABLE II-15  
Process Tolerance**

Tolerance on Each Laboratory Sieve and Asphalt Content: Percent Plus and Minus												
No. Tests	Top Size <sup>1</sup>	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 30	No. 50	No. 200	A.C.
1	0.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	6.0	5.0	2.0	.60
2	0.0	5.7	5.7	5.7	5.7	5.7	5.7	5.7	4.3	3.6	1.4	0.43
3	0.0	4.4	4.4	4.4	4.4	4.4	4.4	4.4	3.3	2.8	1.1	0.33
4	0.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	2.5	1.0	0.30
5	0.0	3.6	3.6	3.6	3.6	3.6	3.6	3.6	2.7	2.2	0.9	0.27
6	0.0	3.3	3.3	3.3	3.3	3.3	3.3	3.3	2.4	2.0	0.8	0.24
7	0.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.3	1.9	0.8	0.23
8	0.0	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.1	1.8	0.7	0.21
12	0.0	2.3	2.3	2.3	2.3	2.3	2.3	2.3	1.7	1.4	0.6	0.17

<sup>1</sup>Defined as the sieve that has 100% passing as defined in Table II-13.

### 211.09—Adjustment System

If a lot of material does not conform to the acceptance requirements of Section 211.08 of the Specifications, the Department will determine adjustment points as follows:

#### Adjustment Points for Each 1% the Gradation Is Outside the Process Tolerance Permitted In Table II-15

Sieve Size	(Applied in 0.1% increments)
1 1/2 in	1
1 in	1
3/4 in	1
1/2 in	1
3/8 in	1
No. 4	1
No. 8	1
No. 30	2
No. 50	2
No. 200	3

One adjustment point will be applied for each 0.1 percent that the material is out of the process tolerance for asphalt content.

If the total adjustment for a lot is greater than 25 points, the Contractor shall remove the failing material from the road. If the total adjustment is 25 points or less and the Contractor does not elect to remove and replace the material, the unit price for the material will be reduced 1 percent of the unit price bid for each adjustment point the material is outside of the process tolerance. The Engineer will apply this adjustment to the tonnage represented by the sample(s). If the Engineer applies adjustment points against two successive lots, the Contractor shall ensure plant adjustment is made prior to continuing production.

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The Contractor shall control the variability of the Contractor's product in order to furnish a consistently uniform mix. When the quantity of any one type of material furnished to a project (i.e., SMA, SM, IM, BM, etc) exceeds 4,000 tons, the variability of the total quantity furnished will be determined on the basis of the standard deviation for each sieve size and the asphalt content. If the standard deviation is within the ranges specified in Table II-16, the Engineer will adjust the unit bid price for the material as indicated herein. The Engineer will not make adjustments for standard deviation computations on more than two job mixes for the same type of material.

**TABLE II-16  
Standard Deviation**

<b>Sieve Size and A.C.</b>	<b>Standard Deviation 1 Adjustment Point for Each Sieve Size and A.C.</b>	<b>2 Adjustment Points for Each Sieve Size and A. C.</b>	<b>3 Adjustment Points for Each Sieve Size and A.C.</b>
1/2 in.	3.8-4.7	4.8-5.7	5.8-6.7
3/8 in	3.8-4.7	4.8-5.7	5.8-6.7
No. 4	3.8-4.7	4.8-5.7	5.8-6.7
No. 8	3.0-3.9	4.0-4.9	5.0-5.9
No. 30	2.2-3.1	3.2-4.1	4.2-5.1
No. 50	1.5-2.4	2.5-3.4	3.5-4.4
No. 200	1.1-2.0	2.1-3.0	3.1-4.0
A.C.	0.27-0.36	0.37-0.46	0.47-0.56

The Engineer will reduce the unit bid price by 0.5 percent for each adjustment point applied for standard deviation.

### **211.10—Referee System**

- (a) If the test results obtained from one of the eight samples taken to evaluate a particular lot appear to be questionable, the Contractor may request in writing that the results of the questionable sample be disregarded, whereupon the Contractor shall have either an AASHTO-accredited lab or a Department lab perform tests on five additional samples taken from randomly selected locations in the roadway where the lot was placed.

If the Engineer determines that one of the 8 test results appears to be questionable, the Department will perform tests on five additional samples taken from the randomly selected locations in the roadway where the lot was placed. The test results of the seven original, i.e. unquestioned, samples will be averaged with the test results of the five road samples, and the mean of the test values obtained for the twelve samples will be compared to the requirements for the mean of twelve tests as specified in Table II-15.

- (b) If the Contractor questions the mean of the eight original test results obtained for a particular lot, the Contractor may request in writing approval to have either an AASHTO-accredited lab or a Department lab perform additional testing of that lot.

If the Engineer determines that the mean of the eight original test results are questionable, the Department will perform additional testing of that lot. The test results of the eight samples will be averaged with the test results of four additional samples taken from randomly selected locations in the roadway where the lot was placed, and the mean of the test values obtained from the twelve samples will be compare to the requirements for the mean of twelve tests as specified in Table II-15.

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If the Contractor requests additional tests, as described in (a) or (b) herein, the Contractor shall sample the material and have either an AASHTO-accredited lab or Department lab test the material in accordance with Department-approved procedures. The Engineer may observe the sampling and testing.

If the mean of the test values obtained for the twelve samples conforms to the requirements for the mean of twelve tests, the material will be considered acceptable. If the mean of the test values obtained for the twelve samples does not conform to the requirements for the mean result of twelve tests, the lot will be adjusted in accordance with the adjustment rate specified in Section 211.09 of the Specifications.

Samples of the size shown herein shall be saw cut by the Contractor for testing without the use of liquids:

Application Rate	Minimum Sample Size
125 lb/yd <sup>2</sup>	8 by 8 in
150 lb/yd <sup>2</sup>	7 by 7 in
200 lb/yd <sup>2</sup>	6 by 6 in
300 lb/yd <sup>2</sup>	5 by 5 in

### 211.11—Handling and Storing Aggregates

Aggregates shall be handled, hauled, and stored in a manner that will minimize segregation and avoid contamination. Aggregates shall be stockpiled in the vicinity of the plant and on ground that is denuded of vegetation, hard, well drained, or otherwise prepared to protect the aggregate from contamination. Placing aggregate directly from the crusher bins into the cold feed may be permitted provided the material is consistent in gradation. When different size aggregates are stockpiled, the stockpiles shall be separated to prevent commingling of the aggregates.

### 211.12—Asphalt Concrete Mixing Plant

Plants used for the preparation of asphalt concrete mixtures shall conform to the following requirements:

- (a) **Certification for Plant Operation and Sampling:** A Certified Asphalt Plant Level I Technician or a Certified Asphalt Plant Level II Technician shall sample material at the plant.
- (b) **Plant Scales:** Scales shall be approved in accordance with the requirements of Section 109.01 of the Specifications.
- (c) **Drier:** The plant shall include a drier(s) that continuously agitates the aggregate during the heating and drying process. The aggregate shall be dried to a point at which the moisture content of the completed mixture does not exceed 1 percent as determined from samples taken at the point of discharge from the mixing operation.
- (d) **Feeder for Drier:** The plant shall be equipped with accurate mechanical means for uniformly feeding the aggregate into the drier so that a consistent production and temperature are reached and maintained. Where different size aggregates are required to comply with grading specifications, they shall be proportioned by feeding into the cold elevator through a multiple compartment feeder bin, one bin for each size used, equipped with positive action gates that can be securely locked to maintain desired proportioning.

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- (e) **Bins:** When bins are used, adequate and convenient facilities shall be provided to make possible the sampling of representative aggregate material from each bin. Each compartment shall be provided with an overflow pipe of such size and location to prevent contamination of the aggregate in adjacent compartments. Bins shall be provided with individual outlet gates that, when closed, will allow no leakage.
- (f) **Thermometric Equipment:** The plant shall be equipped with a thermometric instrument so placed at the discharge chute of the drier as to register automatically or indicate the temperature of the heated aggregate or the completed mix if a drier drum mixing plant is used.

A thermometric device shall be fixed in the asphalt feed line at a suitable location near the charging valve at the mixer unit.

Thermometric devices shall be maintained in good working condition and shall be subject to checking against the laboratory thermometer. Any thermometric devices that do not operate or accurately register temperatures shall be removed and repaired or replaced.

- (g) **Pollution Control:** Pollution control shall conform to the requirements of Section 107.16 of the Specifications.
- (h) **Equipment for Preparation of Asphalt Material:** Tanks for the storage of asphalt material shall be equipped with a heating system capable of heating and holding the material at the required temperatures. A separate storage tank or a storage tank having separate compartments shall be available for each grade of asphalt cement being used on the project. The heating system shall be designed to heat the contents of the tank by means of steam, electricity, or other approved means so that no flame is in direct contact with the heating surface of the tank. The circulating system for the asphalt material shall be designed to assure proper and continuous circulation during the operating period and to minimize oxidation. Pipelines shall be steam jacketed or insulated to prevent undue loss of heat. Storage facilities for asphalt material shall be sufficient capacity for at least one day's operation or an equivalent means of supply shall be provided that will ensure continuous operation. Provisions shall be made for measuring and sampling asphalt within storage tanks. When asphalt material is proportioned by volume, the temperature of the asphalt material in storage shall be uniformly maintained at  $\pm 20$  degrees F during operation of the plant by means of an automatic temperature control device. A sampling valve shall be provided for sampling of each asphalt storage tank used in production of the mix. If there are multiple storage tanks, a dedicated valve for each tank shall be provided.
- (i) **Asphalt Control:** Asphalt material shall be accurately proportioned by volume or weight. When volumetric methods are used, measurements shall be made by means of meters or pumps, calibrated for accuracy. The section of the asphalt line between the charging valve and the spray bar shall be provided with an outlet valve for checking the meter.

When proportioned by weight, the asphalt material shall be weighed on approved scales. Dial scales shall have a capacity of not more than 15 percent of the capacity of the mixer. The value of the minimum graduation shall not be greater than 2 pounds.

Except when a drier-drum mixing plant is used, the asphalt material bucket and its valves and spray bar shall be steam jacketed or heated by other Department approved means. The bucket shall have a capacity of at least 115 percent of the weight of the asphalt material required in any mixture and shall be supported by fulcrums.

The asphalt shall be delivered to the mixer in multiple uniform streams for the full width of the mixer.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

- (j) **Proportioning Aggregates:** Mineral filler and any bag house fines the Contractor uses shall be metered or introduced by means of an approved device for uniform proportioning by weight or by volume.

The weigh hopper shall be of sufficient size to hold the maximum required weight of aggregate for one batch without hand raking or running over. Sufficient clearance between the weigh hopper and supporting devices shall be provided to prevent accumulation of foreign materials.

The discharge gate of the weigh hopper shall be situated in such a manner that the aggregates will not segregate when dumped into the mixer. Gates on the bins and weigh hopper shall be constructed to prevent leakage when closed.

- (k) **Drum Mixer:** The aggregate shall be proportioned by a positive weight control at the cold aggregate feed by use of a belt scale that will automatically regulate the supply of material being fed and permit instant correction of variations in load. The cold feed flow shall be automatically coupled with the asphalt flow to maintain the required proportions.
- (l) **Batch Mixer:** The batch mixer shall be of a twin pugmill or other approved type, steam jacketed or heated by other approved means, and capable of producing uniform mixtures within the specified tolerances. It shall be equipped with a sufficient number of paddles or blades operating at such speeds as to produce a properly and uniformly mixed batch. The number and arrangement of the mixer paddles shall be subject to the Engineer's approval. Worn or defective blades shall not be used in mixing operations.

The mixer shall be provided with an approved time lock that will lock the discharge gate after the aggregates and asphalt have been placed in the mixer and will not release the gate until the specified time for mixing has elapsed.

Batch-type mixing plants used to produce asphalt concrete shall be equipped with approved automatic proportioning devices. Such devices shall include equipment for accurately proportioning batches of the various components of the mixture by weight or volume in the proper sequence and for controlling the sequence and timing of mixing operations. The automated system shall be designed to interrupt and stop the batching operation at any time batch quantities are not satisfied for each of the materials going into the mix. A means shall be provided for observing the weight of each material during the batching operation.

The aggregate may be proportioned by cold feed controls in lieu of plant screens provided the cold aggregate feed conforms to the requirements specified in (j) herein.

Should the automatic proportioning devices become inoperative, the plant may be allowed to batch and mix asphalt materials for a period of not more than 48 hours from the time the breakdown occurs provided alternate proportioning facilities are verbally approved by the Engineer. Written permission of the Engineer will be required for operation without automatic proportioning facilities for periods longer than 48 hours.

- (m) **Continuous Mixing Plant:** A continuous mixing plant shall include a means for accurately proportioning each size of aggregate either by weighing or volumetric measurement. When gradation control is by volume, the unit shall include a feeder mounted under the compartment bins. Each bin shall have an accurately controlled individual gate to form an orifice for volumetrically measuring the material drawn from each respective bin compartment. The orifice shall be rectangular, with one dimension adjustable by positive mechanical means, and shall be provided with a lock. Indicators shall be provided to show the individual gate opening in inches. The plant shall be equipped with a satisfactory revolution counter.

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The plant shall include a means for calibrating gate openings by weight. The materials fed out of the bins through individual orifices shall be bypassed to a suitable test box, with each component material confined in a separate section. The plant shall be equipped to conveniently handle test samples weighing up to 200 pounds per bin with accurate platform scales provided for this purpose.

Positive interlocking control shall be provided between the flow of aggregate from the bins and the flow of asphalt material from the meter or other proportioning device. This shall be accomplished by approved interlocking devices or other approved positive means.

Accurate control of the asphalt material shall be obtained by weighing, metering, or volumetric measurement.

The aggregate may be proportioned by cold feed controls in lieu of plant screens provided the cold aggregate feed conforms to the requirements specified in (j) herein.

The plant shall include a continuous mixer of an approved type that is steam jacketed or heated by other approved means. The paddles shall be of any adjustable type for angular position on the shafts and reversible to retard the flow of the mixture.

Interlock cutoff circuits shall be included to interrupt and to stop the proportioning and mixing operations when the aggregate level in the plant or the asphalt material in storage falls below that necessary to produce the specified mixture.

- (n) **Trucks, Truck Scales, and Automatic Printer System:** These shall conform to the requirements of Section 109.01 of the Specifications.

### **211.13—Preparation of Mixture**

The asphalt and aggregate shall be introduced into the mixer at a temperature that will produce a mixture that conforms to the requirements of the job-mix formula.

After the required amounts of aggregate and asphalt material have been introduced into the mixer, the materials shall be mixed until a uniform coating of asphalt and a thorough distribution of the aggregate throughout the mixture are secured that comply with the requirements of the Ross count procedure in AASHTO T195.

The wet mixing time, based on the procedures in AASHTO T195, shall be determined by the Contractor at the beginning of production and will be approved by the Engineer for each individual plant or mixer and for each type of aggregate used; however, in no case shall the wet mixing time be less than 20 seconds. The *wet mixing time* is the interval of time between the start of introduction of the asphalt material into the mixer and the opening of the discharge gate. A wet mixing time that results in fully coating a minimum of 95 percent of the coarse particles, based on the average of the three samples is acceptable, provided that none of the three sample results has a coating less than 92 percent of the coarse particles shall be the minimum wet mixing time requirement.

A dry mixing time of up to 15 seconds may be required by the Engineer to accomplish the degree of aggregate distribution necessary to obtain complete and uniform coating of the aggregate with asphalt.

### **211.14—Storage System**

If the Contractor elects to use a storage system, the system shall be capable of conveying the mix from the plant to the storage bins and storing the mix without a loss in temperature or segregation or oxidation

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of the mix. Storage time shall be limited by the ability of the bins to maintain the mix within the quality requirements specified herein with a maximum time limit not to exceed 10 days. Material may be stored in bins for no more than 24 hours without a Department approved heating system.

The conveyor system may be a continuous or skip bucket type. Continuous type conveyors shall be enclosed so that the mix temperature is maintained.

The storage bins shall be designed in a manner to prevent segregation of the mix during discharge from the conveyor into the bins and shall be equipped with discharge gates that will not cause segregation of the mix while the mix is being loaded into the trucks.

Approval for the use of storage bins may be withdrawn by the Engineer if the amount of heat loss, segregation, or oxidation of the mix is excessive.

### **211.15—Initial Production**

- (a) **Warm Mix Asphalt (WMA):** At the start of production, the Contractor shall place no more than 500 tons or up to one day's production as directed by the Engineer at an approved site, which may be the project site, so the Engineer can examine the process control of the mixing plant, the Contractor's placement procedures, surface appearance of the mix, compaction patterns of the Contractor's roller(s), and correlation of the nuclear density device.
- (b) **Hot Mix Asphalt (HMA):** At the start of production of a mix not previously used on a state roadway, the Contractor shall place 100 to 300 tons or up to one day's production as directed by the Engineer at an approved site, which may be the project site, so the Engineer can examine the process control of the mixing plant, the Contractor's placement procedures, surface appearance of the mix, compaction patterns of the Contractor's roller(s), and correlation of the nuclear density device.

The material shall be placed at the specified application rate. The Engineer will determine the disposition of material that was not successfully produced and/or placed due to negligence in planning, production, or placement by the Contractor.

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**GUIDELINES — FOR PROJECTS REQUIRING JOINT MATERIALS.**

**SS21202-0911**

June 28, 2011

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

**SUPPLEMENTAL SECTION 212—JOINT MATERIALS**

**SECTION 212—JOINT MATERIALS** of the Specifications is amended as follows:

**Section 212.02(h)—Gaskets for pipe** is replaced with the following:

- (h) **Gaskets for pipe** shall conform to the following: Rubber gaskets for ductile iron pipe and fittings shall conform to the requirements of AWWA C111; rubber gaskets for all other pipe shall conform to the requirements of ASTM C443 and the ozone cracking resistance described in Section 237.02.

Preformed plastic gaskets shall conform to the requirements of ASTM C990.

**GUIDELINES — FOR PROJECTS REQUIRING HYDRAULIC CEMENT (CEMENT THAT HARDENS WHEN MIXED WITH WATER). WHEN THIS PROVISION APPLIES INCLUDE THE FOLLOWING IN THE PROPOSAL: SS21501 Hydraul Cement Conc Admixtures.**

**SS21402-0908**

January 28, 2008

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

**SUPPLEMENTAL SECTION 214—HYDRAULIC CEMENT**

**SECTION 214—HYDRAULIC CEMENT** of the Specifications is amended as follows:

**Section 214.02(b) Portland cements** is amended by replacing 1. with the following:

1. The SO<sub>3</sub> content as specified in AASHTO M85 will be permitted, provided supporting data specified in AASHTO M85 are submitted to the Department for review and acceptance prior to use of the material.

**Section 214.02(b) Portland cements** is amended by deleting 3., 4., and 5.

**Section 214.02—Detail Requirements** is amended by adding the following:

- (c) **Expansive hydraulic cement** shall conform to the requirements of ASTM C 845 Type K.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.



**GUIDELINES — FOR PROJECTS REQUIRING HYDRAULIC CEMENT CONCRETE ADMIXTURES.**

**SS21501-0908**

January 28, 2008

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

**SUPPLEMENTAL SECTION 215—HYDRAULIC CEMENT CONCRETE ADMIXTURES**

**SECTION 215—HYDRAULIC CEMENT CONCRETE ADMIXTURES** of the Specifications is amended as follows:

**Section 215.02(g) Fly ash** is replaced with the following:

- (g) **Pozzolan** shall conform to Section 241 of the Specifications.

**Section 215.02—Materials** is amended by adding the following:

- (k) **Metakaolin** shall conform to the requirements of AASHTO M321

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**GUIDELINES — FOR PROJECTS REQUIRING HYDRAULIC CEMENT CONCRETE. LOW PERMEABILITY CONCRETE IS NOW INCLUDED IN THIS SS. WHEN THIS PROVISION APPLIES INCLUDE THE FOLLOWING IN THE PROPOSAL: SS21402 HYDRAULIC CEMENT AND SS21501 HYDRAUL CEMENT CONC ADMIXTURES.**

SS21706-0214

July 29, 2013

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

**SUPPLEMENTAL SECTION 217—HYDRAULIC CEMENT CONCRETE**

**SECTION 217—HYDRAULIC CEMENT CONCRETE** of the Specifications is amended as follows:

**Section 217.02(a) Cementitious Materials** is replaced with the following:

**Cementitious materials** shall be a blend of mineral admixtures and Portland cement or a blended cement. In overlay concretes, expansive hydraulic cement is permitted in lieu of Portland cement. Portland cement (Types I, II, III) blended cements (Type IP, Type IS) or expansive cement (Type K) shall comply with Section 214 of the Specifications. Flyash, ground granulated iron blast-furnace slag (GGBFS), silica fume or metakaolin shall conform to Section 215 of the Specifications. As a portion of the cementitious material, Table 1 lists the minimum percents of specific pozzolans required by mass of the cementitious material depending on the alkali content of the cement. Any other mineral admixture or any other amount or combination of mineral admixtures may be used if approved by the Engineer. As a portion of the cementitious material, the fly ash content shall not exceed 30 percent for Class F, the ground granulated blast-furnace slag content shall not exceed 50 percent and the silica fume content shall not exceed 10 percent unless approved by the Engineer. Class C Flyash or other pozzolans may be used provided the contractor demonstrates that the percent usage of Class C Flyash or other pozzolans have a maximum expansion of 0.15% according to ASTM C227 at 56 days using borosilicate glass as aggregate. Blended cements require no further pozzolan additions to meet minimum pozzolan content to compensate for the alkali-silica reaction.

Up to 7 percent silica fume may be added to all combinations of cementitious materials to reduce early permeability without approval by the Engineer. Other silica fume additions must be approved by the Engineer.

Table 1 – Minimum percent pozzolan required by mass of cementitious material as a portion of the total cementitious materials and are based upon the alkali content of the cement.

	Total Alkalies of Cement is less than or equal to 0.75%	Total Alkalies of Cement is greater than 0.75% and less than or equal to 1.0%
Class F Flyash	20%	25%
GGBF Slag	40%	50%
Silica Fume	7%	10%
Metakaolin	7%	10%

**TABLE II–17 Requirements for Hydraulic Cement Concrete** is replaced with the following:

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**TABLE II-17  
Requirements for Hydraulic Cement Concrete**

Class of Concrete	Design Min. Laboratory Compressive Strength at 28 Days (f'c) (psi)	Aggregate Size No. <sup>6</sup>	Design Max. Laboratory Permeability at 28 Days (Coulombs) <sup>5</sup>	Design Max. Laboratory Permeability at 28 days - Over tidal water (Coulombs) <sup>5</sup>	Nominal Max. Aggregate Size (in)	Min. Grade Aggregate	Min. Cementitious Content (lb./cu yd)	Max. Water /Cementitious Mat. (lb. Water/lb. Cement)	Consistency (in of slump)	Air Content (percent) <sup>1</sup>
A5 Prestressed and other special designs <sup>2</sup>	5,000 or as specified on the plans	57 or 68	1,500	1,500	1	A	635	0.40	0-4	4 1/2 ± 1 1/2
A4 General	4,000	56 or 57	2,500	2,000	1	A	635	0.45	2-4	6 1/2 ± 1 1/2
A4 Post & rails	4,000	7,8 or 78	2,500	2,000	0.5	A	635	0.45	2-5	7 ± 2
A3 General	3,000	56 or 57	3,500	2,000	1	A	588	0.49	1-5	6 ± 2
A3a Paving	3,000	56 or 57	3,500	3,500	1	A	564	0.49	0-3	6 ± 2
A3b Paving	3,000	357	3,500	3,500	2	A	N.A	0.49	0-3	6 ± 2
B2 Massive or lightly Reinforced	2,200	57	N.A.	N.A.	1	B	494	0.58	0-4	4 ± 2
C1 Massive Unreinforced	1,500	57	N.A.	N.A.	1	B	423	0.71	0-3	4 ± 2
T3 Tremie seal	3,000	56 or 57	N.A.	N.A.	1	A	635	0.49	3-6	4 ± 2
Latex hydraulic cement concrete overlay <sup>3</sup>	3,500	7,8 or 78	1,500	1,500	0.5	A	658	0.40	4-6	5 ± 2
Silica fume, silica fume /Class F Fly Ash or silica fume/slag concrete overlay <sup>4</sup>	5000	7,8 or 78	1,500	1,500	0.5	A	658	0.40	4-7	6 ± 2
Class F Fly Ash or slag overlay	4000	7,8 or 78	1,500	1,500	0.5	A	658	0.40	4-7	6 ± 2

(See next page for notes on TABLE II-17).

(See next page for notes on TABLE II-17).

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## ----- (TABLE II-17 Notes) -----

- <sup>1</sup> When a high-range water reducer is used, the upper limit for entrained air may be increased by 1% and the slump shall not exceed 7 inches.
- <sup>2</sup> When Class A5 concrete is used as the finishing bridge deck riding surface, or when it is to be covered with asphalt concrete with or without waterproofing, the air content shall be  $5 \frac{1}{2} \pm 1 \frac{1}{2}$  percent.
- <sup>3</sup> The latex modifier content shall be 3.5 gallons per bag of cement. Slump shall be measured approximately 4.5 minutes after discharge from the mixer.
- <sup>4</sup> Silica fume with a minimum of 7% by weight of cementitious material; silica fume with a range of 2.5-5 % shall be combined with Class F Fly Ash in range of 15-20% and minimum cement of 77.5% by weight of cementitious material; silica fume with a range of 2.5-5% shall be combined with Ground Granulated Blast Furnace Slag in the range of 30-35% and a minimum cement of 67.5% by weight of cementitious material.
- <sup>5</sup> The permeability testing does not apply to small bridges identified on the bridge plans and to concrete structures and incidental concrete as described in Sections 219, 232, 302, 415, 502, 504, 506 and 519. Curing and testing of test cylinders for permeability will be in accordance with VTM 112.
- <sup>6</sup> The contractor may use different aggregate sizes or a combination of sizes to increase the coarse aggregate content of the concrete as approved by the Engineer. The maximum size of the coarse aggregate shall not exceed 2.5 inches.

**Note:** With the approval of the Engineer, the Contractor may substitute a higher class of concrete for that specified at the Contractor's expense.

**Section 217.02(b) Formulated latex modifier** is amended by adding the following:

For latex-modified concrete, Type I, Type II, Type III or Type K, cement shall be used without mineral admixtures.

**Section 217.04(a)4. Admixtures** is replaced with the following:

4. **Admixtures** shall be dispensed and used according to the manufacturer's recommendations. They shall be added within a limit of accuracy of 3 percent, by means of an approved, graduated, transparent, measuring device before they are introduced into the mixer. If more than one admixture is to be used, they shall be released in sequence rather than in the same instant. Once established, the sequence of dispensing admixtures shall not be altered. However, when the amount of admixture required to give the specified results deviates appreciably from the manufacturer's recommended dosage, use of the material shall be discontinued.

**Section 217.05—Equipment** is amended to replace the first paragraph with the following:

Equipment and tools necessary for handling materials and performing all parts of the work will be approved by the Engineer and must be in accordance with one of the following procedures:

1. having a current National Ready Mix Concrete Association Plant and Truck Certification, or
2. having a Department approved self-certification program in-place prior to the production of concrete for the Department.

Failure to comply with one or the other of these procedures will result in the concrete production being unapproved and work will not be allowed to proceed.

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**Section 217.05(a) Batching Equipment** is amended to replace the second paragraph with the following:

Scales used for weighing aggregates and cement shall be approved and sealed in accordance with the requirements of Section 109 of the Specifications.

**Section 217.05—Equipment** is amended to add the following:

(d) **High Performance Volumetric Mixers (HPVMs):** The Contractor may produce the specified class of hydraulic cement concrete in Table II-17 in accordance with Section 217.02(a) of the Specifications provided that the manufacturer's equipment meets the tolerance requirements of Section 217.04(a) of the Specifications and has a stamped plate from the Volumetric Mixers Manufacturers Bureau stating that the equipment conforms to the requirements in ASTM C685.

The hydraulic cement concrete shall be mixed at the point of delivery by a combination of materials transport and mixer unit conforming to the following:

1. The unit shall be equipped with calibrated proportioning devices for each ingredient added to the concrete mix. The unit shall be equipped with a working recording meter that is visible at all times and furnishes a ticket printout with the calibrated measurement of the mix being produced. If at anytime the mixer fails to discharge a uniform mix, production of concrete shall halt until any problems are corrected.
2. Each unit shall have a metal plate(s) attached in a prominent place by the manufacturer on which the following are plainly marked: the gross volume of the transportation unit in terms of mixed concrete, the discharge speed and the mass calibrated constant of the machine in terms of volume.
3. HPVMs shall be calibrated by a Department approved testing agency in accordance with the manufacturer's recommendations at an interval of every 6 months or a maximum production of 2500 cubic yards, whichever occurs first prior to use on the project. The yield shall be maintained within a tolerance of  $\pm 1$  percent and verified using a minimum 2 cubic feet container every 500 cubic yards or a minimum once per week.
4. The three cubic feet initially discharged from the truck shall be discarded and not used for concrete placement. Acceptance of the specified class of concrete shall comply with Section 217.08 of the Specifications except that the sample secured for acceptance testing will be taken after four cubic feet is discharged from the delivery vehicle. During discharge, the consistency as determined by ASTM C143 on representative samples taken from the mixer discharge at random intervals shall not vary more than 1 inch. Acceptance tests shall be performed on each load. If test data demonstrates that consistency of concrete properties are being achieved, the Engineer may reduce testing requirements.
5. The HPVM shall be operated by a person who is a certified operator by the HPVM manufacturer. Any equipment adjustments made during the on-site production of concrete shall be done under the direct on-site supervision of the producer's VDOT Concrete Plant and Field Certified Technician.

Each load of HPVM produced concrete shall be accompanied by a Form TL-28 signed by the producer's VDOT Certified Concrete Plant Technician or a designated company representative working under the direct on-site supervision of the producer's VDOT Concrete

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Plant and Field Certified Technician. The form shall be delivered to the Inspector at the site of the work. Loads that do not carry such information or do not arrive in satisfactory condition shall not be used.

**Section 217.07—Proportioning Concrete Mixtures** is amended to replace the first paragraph with the following:

The Contractor is responsible for having a Certified Concrete Plant Technician available during batching operations, and a Certified Concrete Field Technician shall be present during placing operations.

**Section 217.07—Proportioning Concrete Mixtures** is amended to delete the third paragraph beginning with “**A Certified Concrete Batchers**”.

**Section 217.07—Proportioning Concrete Mixtures** of the Specifications is amended to replace the eleventh paragraph with the following:

Except for latex hydraulic cement concrete, concrete mixtures shall be developed and/or verified by any one of the following three options listed below.

The mix design(s) as determined by the respective option shall be valid provided there is no change in sources of aggregate, chemical admixtures, mineral admixtures or hydraulic cement. All concrete mixtures shall contain the minimum amount of mineral admixtures or combination thereof expressed as a percent of the total cementitious materials in accordance with Section 217.02(a). All quantities of materials shall be weighed in accordance with tolerances specified in Section 217.04. Neither the quantities of coarse or fine aggregates used in concrete production shall deviate by more than  $\pm 5\%$  by weight from the batch weights of the approved mix design.

When low permeability concrete is specified, two 4 X 8 inch specimens shall be molded from concrete representing the proposed mix design and tested in accordance with VTM 112 to validate conformance. For trial batches, the tested permeability value shall be considered satisfactory provided it is 500 coulombs less than the specified maximum value for the class of concrete specified.

**Option 1 - Prescriptive Method:**

Mix proportions for normal, heavy weight, and lightweight concrete shall be established by the methods described in ACI 211, on an absolute volume basis, for the respective aggregate size and meeting all the requirements of Table II-17 for the class of concrete indicated. Aggregate properties obtained from the aggregate producer shall be used for design purposes.

Once the proposed mix design has been established, the contractor or their concrete supplier shall produce one 3-cubic yard production verification batch using the same type of equipment intended for use in supplying concrete to the Department. The proposed mix design will be considered acceptable provided that the plastic properties of the concrete are within the Department's specification limits for the given class of concrete. Strength tests of the verification batch must equal or exceed  $f'c$  for the intended class of concrete.

**Option 2 - Trial Batch Mix Design Method:**

The minimum cementitious content requirement in Table II-17 shall be waived provided that the maximum water-cementitious ratio requirement of Table II-17 is met for the respective class of concrete. The required grading for fine and coarse aggregate shall be waived

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provided the coarse aggregate meets the nominal maximum size as required in Table II-17 for the respective class of concrete.

The Contractor or their concrete supplier shall prepare a minimum of 3 trial concrete batches with differing cementitious materials contents over a range anticipated to encompass the design strength,  $f'_c$ , plus overdesign, and water-cementitious ratios encompassing the range permitted for the classes of concrete being evaluated. Trial batches may be produced in either;

Option 2A: Small scale laboratory batches, or

Option 2B: Truck batches with a minimum batch volume of 3 cubic yards each.

The plastic properties of the trial concrete batches shall meet the requirements for consistency and air content in Table II-17 and meet the additional requirements listed below:

- The concrete temperature of the trial batches, as batched and sampled, shall be a minimum of 68 degrees F.
- Air content of the trial batches shall within a range of -1.0 to + 1.5 percentage points of the median design air content for the classes of concrete being evaluated.
- Slump of the trial batches shall be within  $\pm 1$  inch of the maximum slump permitted for the class of concrete.

Three 4 X 8 inch test specimens shall be molded from each batch, cured in accordance with ASTM C 31 for acceptance specimens, and then compression tested at an age of 28 days. The strength results of these tests shall be plotted on a graph to establish the relationship between the water-cementitious ratio and the compressive strength. Alternately, the relationship can be established between the cementitious content and the compressive strength. The design water-cementitious ratio, or design cementitious content, can then be derived from the graph to satisfy the required design strength plus an appropriate overdesign to be designated as  $f'_{cr}$ . The required cementitious materials content determined from these tests can be interpolated from the established graph. If desired, the design water-cementitious ratio or cementitious content can be determined from a polynomial regression analysis of the plotted strength data.

Test results from prior trial concrete batches are acceptable for use provided that they represent the same material sources proposed for the Department work, meet the requirements for trial concrete batches as stated above and are less than 18 months old.

The required cementitious content to satisfy the strength requirement for the respective class of concrete shall be determined in accordance with either of the two following procedures:

1. When the concrete production facility has sufficient data to establish a production standard deviation ( $s$ ), as described in **Documentation of Previous Field Experience or Production Standard Deviation (s)**. The cementitious content required to meet the design strength requirement,  $f'_{cr}$ , then the  $f'_{cr}$  shall be based upon the following equation:

$$f'_{cr} = f'_c + 3s$$

2. When the concrete production facility does not have a production standard deviation established the cementitious content required to meet the design strength requirement,  $f'_{cr}$ , then the  $f'_{cr}$  shall be based upon the following equation :

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$$f'_{cr} = f'_c + 1700 \text{ psi.}$$

Once the proposed mix design has been established, the contractor or their concrete supplier shall produce one 3-cubic yard production verification batch using the same type of equipment intended for use in supplying concrete to the Department. The proposed mix design will be considered acceptable provided that the plastic properties of the concrete are within the Department's specification limits for the given class of concrete. Strength tests of the verification batch must equal or exceed  $f'_c$  for the intended class of concrete. The requirement for a production verification batch shall be waived when the trial batching is performed by Option 2B -Truck batches.

### **Option 3 - Documented Field Experience Method:**

The minimum cementitious content requirement in Table II-17 shall be waived provided that the maximum water-cementitious ratio requirement of Table II-17 is met for the respective class of concrete. The required grading for fine and coarse aggregate shall be waived provided the coarse aggregate meets the nominal maximum size as required in Table II-17 for the respective class of concrete.

An existing concrete mixture shall be considered acceptable for use provided that the contractor or their concrete supplier has a satisfactory test record of previous field experience as described in:

**Documentation of Previous Field Experience or Production Standard Deviation (s),** and that the proposed concrete mixture meets the following requirements:

1. The water cementitious ratio of the proposed concrete mixture is less than or equal to the maximum water cementitious ratio specified for the respective class of concrete.
2. The documented average strength,  $f'_{cr}$ , equals or exceeds the design compressive strength  $f'_c$  for the respective class of concrete in accordance with the following equation:  $f'_{cr} = f'_c + 3s$
3. The proposed concrete mixture contains the same aggregate sources, supplementary cementitious materials type, and admixture type as those used to establish the previous field experience test record.
4. The consistency (slump) and air content are within the specification limits for the respective class of concrete.

### **Documentation of Previous Field Experience or Production Standard Deviation (s)**

An acceptable test record to document previous field experience and/or to establish a production facility standard deviation shall represent a minimum of 30 consecutive compressive strength tests results, encompass a production period of at least 45 days and test data not more than 18 months old. A test record of less than 30 tests, but not less than 15 tests, shall be permitted provided a modification factor is applied to the production facility sample standard deviation as shown below:

Multiply Standard Deviation by Modification Factor	
Number of Test	Modification Factor
15	1.16
20	1.08
25	1.03
30	1.00

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.



The test record does not necessarily have to be based on Department projects provided that documentation of the source(s) of concrete strength test results accompanies the submittal.

**Section 217.08—Acceptance** is replaced with the following:

- (a) **Air Consistency Tests:** Air and consistency tests will be performed by the Department prior to discharge of concrete into the forms to ensure that specification requirements are consistently being complied with for each class of concrete. The sample secured for the tests shall be taken after at least two cubic feet of concrete has been discharged from the delivery vehicle. The two cubic feet discharged is not to be used as part of the test sample. Any deviation from sampling and testing procedures must be approved by the Engineer. The Contractor shall provide a receptacle conforming to the requirements of ASTM C31, Section 5.9, for the Department's use in obtaining the sample. If either determination yields a result that is outside of the allowable range for air content or consistence, the following procedure will be used:
1. The Engineer will immediately perform a recheck determination. If the results confirm the original test results, the load will be rejected.
  2. The Contractor's representative will be immediately informed of the test results.
  3. The Contractor's representative shall notify the producer of the test results through a pre-established means of communication.

The Engineer may perform any additional tests deemed necessary and reject all remaining material that fails the tests.

Entrained air content will be determined in accordance with the requirements of ASTM C231 or ASTM C173. Acceptance or rejection will be based on the results obtained from these tests.

In general, a mixture that contains the minimum amount of water consistent with the required workability shall be used. Consistency will be determined in accordance with the requirements of ASTM C143. Adding cement to loads previously rejected for excessive water content or consistency will not be permitted.

- (b) **Strength Tests:** The 28-day compressive strengths ( $f'_c$ ) specified in Table II-17 are the strengths used in the design calculations. The Engineer will verify design strengths by tests made during the progress of the work in accordance with the requirements of ASTM C31 (Standard Practice for Making and Curing Concrete Test Specimens in the Field) and ASTM C39 (Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens) with the exception that the fresh concrete sample used for testing is to be secured after at least two cubic feet has been discharged from the delivery vehicle. The two cubic feet discharged is not to be used as part of the test sample. Any deviation from sampling and testing procedures must be pre-approved by the Engineer. The use of ASTM C42 (Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete) will be at the Engineer's discretion. If the 28-day design compressive strength ( $f'_c$ ) test results do not conform to the strength requirements specified in Table II-17, immediate steps shall be taken to adjust the mixture design. In addition, the Engineer may require removal of or corrective measures be applied to any concrete that does not meet the requirements of Table II-17. If the concrete cylinder strength,  $f'_{cyl}$ , is less than the specified compressive strength found in Table II-17, the criteria in Table II-17A shall apply:

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**Table II – 17A Price Reduction or Action Taken due to  $f'_{cyl}$  not meeting the specification value  $f'_c$  listed in Table II-17**

Condition	Concrete is a Pay Item	Concrete is <u>Not</u> a Pay Item
$f'_{cyl}$ is greater than or equal to 98% $f'_c$	A	A
$f'_{cyl}$ is greater than or equal to 90% $f'_c$ and less than 98% $f'_c$	B	C
$f'_{cyl}$ is less than 90% $f'_c$	D	D
$f'_{cyl}$ is not available due to the Contractor's inappropriate handling and storage of specimens in accordance with ASTM C31	D	D

$f'_c$  is the 28-day design compressive strength found in Table II-17.

$f'_{cyl}$  is the actual average tested strength of the standard-cured concrete cylinder made and tested in accordance with ASTM C31 and ASTM C39.

A = full payment

B = pay reduction =  $[(f'_c - f'_{cyl})/f'_c] \times \text{contract unit price for concrete per yd}^3 \times \text{number of yds}^3 \text{ the concrete represents}]$  or \$500, whichever is greater.

C = pay reduction =  $[(f'_c - f'_{cyl})/f'_c] \times 5 \times \text{Contractor's invoice price for concrete per yd}^3 \times \text{number of yds}^3 \text{ the concrete represents}]$  or \$500, whichever is greater.

D = The Contractor shall submit an investigative plan stamped by a Virginia-licensed Professional Engineer outlining how the Contractor shall demonstrate that the in-place concrete meets the structural strength requirements of the design. For barriers, parapets, railings, etc., no reduction in concrete strength below  $0.9f'_c$  shall be allowed. For all other applications, the investigative plan must be approved by the Department's Engineer prior to the execution of the investigation. All costs associated with this investigation shall be borne by the Contractor. After the investigation is completed, a report shall be submitted to the Engineer showing the results of the analysis, testing and conclusions of the Virginia-licensed Professional Engineer and recommendations for action proposed by the Contractor to be taken with the concrete that did not meet the strength requirements. The Department retains all rights to determine if the action proposed with regard to the concrete in question is acceptable. If the Department concurs with the proposed action and the concrete meets the structural strength requirements of the design and remains in place, any price reduction will be taken by Method B if the concrete is a pay item or Method C if the concrete is not a pay item. If the concrete does not meet the structural requirements of the design, the concrete shall be removed and replaced at no cost to the Department. The maximum penalty assessed for low strength concrete left

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in place will be 10% as specified in Table II-17A not including the cost of the investigation and any corrective measures taken by the Contractor.

No calculated penalty less than \$500 will be assessed. The Contractor shall have the right to remove and replace concrete failing to meet specifications at the Contractor's cost.

Before concrete is placed, the Contractor shall provide a storage chamber at his expense for temporary storage of the Department's concrete cylinders. The contractor shall be responsible for maintaining the chamber such that the concrete test cylinders are kept in a continuously moist condition and within a temperature range of 60 degrees F to 80 degrees F. The chamber shall be equipped with a continuously recording thermometer accurate to  $\pm 2$  degrees F for the duration of concrete cylinder curing. The chamber shall be located in an area where the test cylinders will not be subject to vibration and shall be of sufficient size or number to store, without crowding or wedging, the required number of test cylinders as determined by the Contractor based on his plan of operations. Location of the chamber is subject to approval by the Engineer.

When use of high-early-strength hydraulic cement concrete is required, it shall conform to the requirements specified in Table II-17 except that the 28-day strength shall be obtained in 7 days. Up to 800 pounds per cubic yard of Type I, Type II or Type III cement may be used to produce high-early-strength concrete.

- (c) **Concrete Temperature** shall be measured in accordance with the requirements of ASTM C1064.
- (d) **Quality Assurance** for Low Permeability Concrete:

**General:**

At least two trial batches, using job materials, with permissible combination of cementitious materials shall be prepared, and test specimens shall be cast by the Contractor and tested by the Department for permeability and strength at least a month before the field application. The permeability samples shall be cylindrical specimens with a 4-inch diameter and at least 4-inches in length. Cylinders will be tested at 28 days in accordance with VTM 112. The test value shall be the result of the average values of tests on two specimens from each batch. Permeability values obtained from trial batches shall be 500 coulombs below the maximum values specified in Table II-17 of the Specifications to be acceptable.

**Acceptance Tests:**

For each set of cylinders made for compressive strength tests, two additional cylinders shall be made for the permeability test. The Department will be responsible for making and testing all permeability test specimens.

If the average permeability test result is equal to or less than the value for the specified class of concrete in Table II-17, then full payment will be made for the lot the average permeability test result represents. However, if the average permeability test result exceeds the coulomb value in Table II-17, payment for that lot of concrete shall be reduced by 0.005 percent for each coulomb above the coulomb value in Table II-17 multiplied by the bid item cost of the concrete times the number of cubic yards or cubic meters of concrete in the lot. The reduction in price will not exceed 5 percent of the bid price of the concrete. Any concrete with a coulomb value that exceeds the maximum required in Table II-17 by 1000 coulomb will be rejected. However, bridge deck concrete

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

with any coulomb value exceeding the maximum required by over 1000 coulomb may be accepted by the Engineer at 95 percent of the bid price if the concrete in question has the required strength and meets other specification requirements, and the Contractor applies, at his own expense, an approved epoxy concrete overlay to the top of the entire deck. In such case deck grooving will not be required. Epoxy overlays over latex overlays will not be permitted. The adjustment to the roadway grade shall be made as required by the Engineer at the Contractor's expense.

Similarly, concrete in abutments and pier caps with coulomb value exceeding the maximum required in Table II-17, by more than 1000 coulomb may be accepted at 95 percent of the bid price if it has the required strength and meets other specification requirements, and the Contractor applies at his own expense, one coat of Type EP-3B and one coat of EP-3T in conformance with the requirements of Section 243.02 of the Specifications, on top of the pier cap or abutment seat.

**Section 217.09(b) Ready Mixed Concrete** is amended to replace the second paragraph with the following:

Each load of transit or shrink-mixed concrete shall be accompanied by Form TL-28 signed by the VDOT Certified Concrete Field Technician or a designated company representative working under the direction of the VDOT Certified Concrete Field Technician. The form shall be delivered to the Inspector at the site of the work. Loads that do not carry such information or that do not arrive in satisfactory condition shall not be used.

**Section 217.09(b) Ready-Mixed Concrete** is amended to replace the fourth paragraph and the table with the following:

Each batch of concrete shall be delivered to the site of work and discharged within 90 minutes of the time the cement is introduced into the mixture unless approved otherwise by the Engineer.

**Section 217.09(b)1. Transit mixing** is amended to replace the first paragraph with the following:

1. **Transit mixing:** Concrete shall be mixed in a truck mixer. Mixing shall begin immediately after all ingredients are in the mixer and shall continue for at least 70 revolutions of the drum or blades at the rate of at least 14 but no more than 20 revolutions per minute.

**GUIDELINES — PROJECTS REQUIRING GUARDRAIL.**

**SS22101-0412**

January 6, 2012

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

**SUPPLEMENTAL SECTION 221—GUARDRAIL**

**SECTION 221—GUARDRAIL** of the Specifications is amended as follows:

**Section 221.02(e)2** is replaced with the following:

2. **Sheet steel for fabricated shapes** shall conform to the requirements of ASTM A1011, Grade 36.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**GUIDELINES — PROJECTS REQUIRING MASONRY UNITS:**

SS22201-0911

June 28, 2011

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS**SUPPLEMENTAL SECTION 222—MASONRY UNITS****SECTION 222—MASONRY UNITS** of the Specifications is completely replaced with the following:**222.01—Description**

These specifications cover masonry units manufactured of regular or lightweight concrete or brick made from clay or shale in a plant specifically designed for such a purpose.

**222.02—Detail Requirements****(a) Wall Units:**

1. **Hollow load-bearing units** shall conform to the requirements of ASTM C90, Grade N-I.
2. **Hollow non-load bearing units** shall conform to the requirements of ASTM C129, Type I.
3. **Solid load-bearing units** shall conform to the requirements of ASTM C145, Grade N-I.
4. **Building bricks** shall conform to the requirements of either
  - a. ASTM C62 Grade SW, or
  - b. ASTM C55 except that the average compressive strength of 5 bricks shall be a minimum 3000 psi and no individual brick less than 2500 psi.

**(b) Catch Basins and Manholes:**

1. **Masonry blocks** shall conform to the requirements of ASTM C139.
2. **Bricks** shall conform to the requirements of either
  - a. ASTM C32, Grade MS, or
  - b. ASTM C55 except that the average compressive strength of 5 bricks shall be a minimum 3000 psi and no individual brick less than 2500 psi.

**(c) Sewer Brick:** Sewer brick shall conform to the requirements of ASTM C32, Grade SM.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**GUIDELINES — PROJECTS REQUIRING STEEL REINFORCEMENT.**

SS22301-1214

November 4, 2014

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS**SUPPLEMENTAL SECTION 223—STEEL REINFORCEMENT**

**SECTION 223—STEEL REINFORCEMENT** of the Specifications is completely replaced with the following:

**223.01—Description**

These specifications cover steel items designed to give added flexural strength to hydraulic cement concrete or to control and reduce cracking.

**223.02—Detail Requirements****(a) Reinforcement:**

1. **Deformed bars** shall conform to the requirements of ASTM A615, Grade 40 or 60.
2. **Plain bars** shall conform to the requirements of ASTM A615, Grade 40 or 60, deformation waived. When used as a dowel, material may be a plain bar conforming to the requirements of ASTM A615, Grade 40 or 60, or a plain dowel conforming to the requirements of ASTM A709, Grade 36.
3. **Welded wire fabric** shall conform to the requirements of ASTM A185. When used in continuously reinforced pavement, wire fabric shall be deformed and furnished in flat sheets and shall conform to the requirements of ASTM A497, high yield of 70,000 pounds per square inch.
4. **Longitudinal bars** for continuous reinforced concrete pavement shall conform to the requirements of ASTM A615, Grade 60.
5. **Structural steel** shall conform to the requirements of Section 226.
6. **Bar mats** shall conform to the requirements of ASTM A184.
7. **Spiral wire** shall conform to the requirements of AASHTO M32 or ASTM A82.
8. **Wire mesh** for use in gabions shall be made of galvanized steel wire at least 0.105 inch, 12 gage, in diameter. The tensile strength of the wire shall be at least 60,000 pounds per square inch. Wire mesh shall be galvanized in accordance with the requirements of ASTM A641, Class 3. When PVC coating is specified, it shall be at least 0.015 inch in thickness and shall be black.

Wire shall be welded to form rectangular openings or twisted to form hexagonal openings of uniform size. The linear dimension of the openings shall be not more than 4 1/2 inches. The area of the opening shall be not more than 9 square inches. The unit shall be nonraveling. *Nonraveling* is defined as the ability to resist pulling apart at any of the twists or connections forming the mesh when a single wire strand in a section is cut.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

- (b) **Prestressing Tendons:** Seven-wire stress-relieved strands, stress-relieved wire, and low-relaxation strands shall conform to the requirements of ASTM A416, Grade 270; ASTM A421; and ASTM A416, Supplement I, respectively, with the following modifications:
1. Strands or wires used in units of any one-bed layout shall be manufactured by the same plant.
  2. A manufacturer's certification and load-elongation curve in accordance with the requirements of ASTM A416 or ASTM A421 shall be obtained by the prestressed concrete fabricator for each lot of strand. The data shall be submitted to the Engineer for approval in permanent record form.
- (c) **Reinforcing Steel to Be Epoxy Coated:** Steel shall conform to the requirements herein and shall be coated in accordance with the requirements of ASTM A775.
1. Plants that epoxy coat reinforcing steel shall be CRSI certified for epoxy coating. CRSI inspection reports shall be on file at the plant and shall be available to the Engineer.
  2. Handling and storage of the coated bars shall conform to the requirements of ASTM A775.
  3. Visible damage to the epoxy coating shall be patched or repaired with materials compatible with the existing coating in accordance with ASTM A775.
- (d) **Reinforcing Steel to Be Galvanized:** Steel shall conform to the requirements herein and shall be galvanized in accordance with the requirements of ASTM A767.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.



**GUIDELINES — FOR PROJECTS REQUIRING ITEMS CAST FROM METAL TO A SPECIFIC DESIGN IN A MANUFACTURING PLANT.**

SS22401-0908

November 15, 2007

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS**SUPPLEMENTAL SECTION 224—CASTINGS****SECTION 224—CASTINGS** of the Specifications is amended as follows:**Section 224.02—Materials** is amended as follows:

The following is added as the first paragraph:

All casting suppliers/manufacturers shall have an approved QA/QC plan on file with the Department. Junction boxes that are to be installed within that portion of the roadway not protected by a guardrail or barrier shall be designed in accordance with the requirements of AASHTO M306 and M105, Class 35B.

**Section 224.02(b)** is replaced with the following:

- (b) **Gray iron castings** used in that portion of the roadway not protected by a guardrail or barrier shall conform to the requirements of AASHTO M306 and M105, Class 35B. All other castings shall conform to AASHTO M105, Class 35B.

**Section 224.02(c)** is replaced with the following:

- (c) **Ductile iron castings** used in that portion of the roadway not protected by a guardrail or barrier shall conform to AASHTO M306. All other ductile iron castings shall conform to ASTM A536, Grade 60-40-18.

**Section 224.03—Detail Requirements** is replaced with the following:

If castings are supplied from materials conforming to Sections 224.02 (a), (d) and (e) of the Specifications, all tolerances and workmanship requirements for castings shall conform to AASHTO M306. If used in that portion of the roadway not protected by a guardrail or barrier, the load testing shall conform to the requirements of AASHTO M306. When the alternate load test is used, test bars shall be present and fully identifiable with regard to the casting lot. Each casting in a lot must have the same markings as all of the other castings in the lot; if not, each group of castings with the same markings within the original lot, becomes a new lot.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**GUIDELINES — FOR PROJECTS REQUIRING STRUCTURAL STEEL.**

**SS22601-0609**

December 16, 2008

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

**SUPPLEMENTAL SECTION 226—STRUCTURAL STEEL**

**SECTION 226—STRUCTURAL STEEL** of the Specifications is amended as follows:

**Section 226.02(b) Other Structural Steel** is replaced with the following:

- (b) **Other Structural Steel:** Unless otherwise specified, steel for other structural members except H-piles shall conform to the requirements of ASTM A36. H-piles shall conform to the requirements of ASTM A572 or ASTM A992. One copy of the mill analysis shall accompany steel piles shipped to the project site. Three copies of the mill analysis for structural steel members shall be submitted to the Engineer.

**GUIDELINES — FOR PROJECTS REQUIRING PIPE AND PIPE ARCHES.**

SS23203-0912

May 17, 2012

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS**SUPPLEMENTAL SECTION 232—PIPE AND PIPE ARCHES****SECTION 232—PIPE AND PIPE ARCHES** of the Specifications is amended as follows:**Section 232.02 Detail Requirements** of the specifications is amended to replace the first paragraph with the following:

Concrete, corrugated steel and polyethylene pipe shall only be supplied from manufacturers currently having an approved Quality Control Plan on file with the Department.

**Section 232.02(a)1.b.(6)** is replaced with the following:

- (6) **Strength tests** shall be performed by the three-edge bearing method in accordance with the requirements of AASHTO T280 or by control cylinders tested in accordance with ASTM C31 and C39 or by the testing of cores in accordance with ASTM C42. Control cylinders for acceptance testing shall be cured under the same conditions as the concrete the cylinders represent. Hand cast pipe and end sections may be tested in accordance with the requirements of ASTM C31 and C39. Concrete pipe may be shipped after reaching 85 percent of design strength as determined by control cylinders or cores.

**Section 232.02(a)1.b.(7)** is replaced with the following:

- (7) **Absorption tests** shall be performed in accordance with the requirements of AASHTO T280 on specimens of broken pipe or cores.

**Section 232.02(c)2. Asphalt-coated corrugated steel culvert pipe and pipe arches** is deleted entirely.**Section 232.02-Detail Requirements** is amended to add the following:**(m) Polypropylene (PP) Pipe:**

1. **PP corrugated culvert and storm drain pipe** shall conform to the requirements of AASHTO MP 21-11, and shall be double wall pipe (Type S) for nominal diameters of 12 inches through 30 inches, inclusive, and shall be triple wall pipe (Type D) for nominal diameters of 36 inches through 48 inches, inclusive. Polypropylene Pipe less than 12 inches and greater than 48 inches in diameter will not be allowed. Fittings and joining systems shall also meet the requirements of the AASHTO MP 21-11.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**GUIDELINES — FOR PROJECTS REQUIRING REFLECTORIZED TRAFFIC MARKINGS.**

**SS23401-1214**

October 16, 2014

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

**SUPPLEMENTAL SECTION 234—GLASS BEADS FOR REFLECTORIZING TRAFFIC MARKINGS**

**SECTION 234—GLASS BEADS FOR REFLECTORIZING TRAFFIC MARKINGS** of the Specifications is completely replaced with the following:

**234.01—Description**

This specification covers glass beads applied on the surface or incorporated into traffic-marking materials so as to produce a retroreflective surface.

**234.02—Detail Requirements**

Beads shall be manufactured from glass of a composition designed to be highly resistant to traffic wear and weather. Glass beads shall conform to the requirements of AASHTO M247, Type 1-5, except that at least 80 percent of the beads shall be round when tested in accordance with the requirements of ASTM D 1155, Procedure B.

The contractor shall provide a written certification that each batch of glass beads used in or on VDOT pavement markings conform to AASHTO M247 including the total concentration limit of lead and arsenic.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**GUIDELINES — FOR PROJECTS REQUIRING ELECTRICAL AND SIGNAL COMPONENTS**

SS23802-0609

March 4, 2008

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS**SUPPLEMENTAL SECTION 238—ELECTRICAL AND SIGNAL COMPONENTS****SECTION 238 ELECTRICAL AND SIGNAL COMPONENTS** of the Specifications is amended as follows:**Section 238.02(f) Electrical and Signal Junction Boxes** is replaced with following:**(f) Electrical and Signal Junction Boxes:**

Boxes, frames and covers shall be water resistant. Covers shall be secured with stainless steel bolts and fasteners. Covers shall be flush with surface of the junction box and not protrude above the top of the junction box flange.

Junction box bolt attachment holes shall be drilled through to prevent debris from collecting in the threaded bolt holes.

Junction boxes shall be tested and certified by an independent testing laboratory as meeting the requirements indicated herein for approval for use. Independent testing laboratory shall be approved by VDOT Materials Division prior to testing. The Contractor shall furnish the Engineer documentation of such test results.

Testing reports shall provide complete test results for the type of design testing indicated for the respective type of junction box.

**Junction Boxes for deliberate traffic in the roadway applications:**

- Concrete shall conform to the requirements of Section 217 of the Specifications and shall be designed to meet the provisions of AASHTO's *Standard Specifications for Highway Bridges* for HS20 loading. Concrete shall have a design minimum compressive strength of 4000 psi.
- Gray Iron frame and covers shall conform to the requirements of Section 224 of the Specifications.

**Junction Boxes for off roadway applications:**

- Shall conform to the requirements of ANSI/SCTE 77 2007 and tier 15 loading. Boxes shall be open bottom.
- Shall be Polymer concrete with straight sides or Polymer concrete with flared or straight fiberglass sides.
- Other materials may be submitted for the sidewalls provided they conform to the requirements of ANSI/SCTE 77 2007 and tier 15 loading.

**Junction Boxes frames and covers for bridge structures encasements shall be one of the following types:**

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1. Steel castings conforming to the requirements of Section 224 of the Specifications, galvanized inside and out.
2. Welded sheet steel having a thickness of at least 3/16 inch or 7 gage, galvanized inside and out.
3. Polymer concrete with fiberglass sides or all polymer concrete.

**Section 238.02(h)6.f. Light Emitting Diode (LED) traffic signal head sections** is amended to replace the third paragraph with the following:

LED arrow traffic signal modules shall conform to the requirements of the *ITE Vehicle Traffic Control Signal Heads – Light Emitting Diode Vehicle Arrow Traffic* issued April 3, 2006 (inclusive of any ITE documents that amend, revise and/or supersede it).

And to replace the seventh paragraph with the following:

The LED's shall be mounted and soldered to a printed circuit board. Modules shall be provided with an external in-line fuse or internal fusing of the 120 VAC (+) input. The fuse shall be rated in accordance with the LED module manufacturer. The LED signal module shall utilize the same mounting hardware used to secure the incandescent lens and gasket assembly and shall only require a screwdriver or standard installation tool to complete the mounting.

**GUIDELINES — PROJECTS REQUIRING SILT FENCES, SILT BARRIERS OR FILTER BARRIERS.**

SS24504-1215

September 25, 2015

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS**SUPPLEMENTAL SECTION 245—GEOSYNTHETICS AND LOW PERMEABILITY LINERS****SECTION 245—GEOSYNTHETICS** of the Specifications is completely replaced with the following:**SECTION 245—GEOSYNTHETICS AND LOW PERMEABILITY LINERS****245.01—Description**

These specifications cover artificial fiber textile products to be used in transportation construction work, and low permeability liners for stormwater management facilities.

**245.02—Shipping, Handling, and Storage Requirements**

Geosynthetic shall be permanently marked with a clearly legible print showing manufacturing plant or plant Identification Code number, located on the roll edge at least every 16 feet. Rolls shall be labeled at both ends of the outside of the roll outer wrapping and both ends of the inside of the geotextile roll core, and labels shall list the roll number, production date, AASHTO M288 class(es) the product meets, and the product name; if the permanent marking contains this information, the labels may be omitted.

Each geosynthetic roll shall be wrapped or otherwise packaged in a manner that will protect the geosynthetic, including the ends of the roll, from damage due to shipment, water, sunlight, and contaminants. The protective wrapping shall be maintained during periods of shipment and storage.

During storage, geosynthetics rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage; precipitation; extended ultraviolet radiation including sunlight; strong acids or strong bases; flames including welding sparks; temperatures in excess of 160 degrees F; and other environmental conditions that may damage the physical property values of the geosynthetic. Geosynthetics that are not properly protected may be subject to rejection.

**245.03—Testing and Documentation**

Each geosynthetic material provided to the project shall have a manufacture date within its current NTPEP product 3-year evaluation cycle. The manufacturer and any subsequent private labeler facility shall be listed as compliant by NTPEP within the current calendar year, or immediate past calendar year with an application for audit for the current calendar year.

VDOT may sample product from a facility or project at any time for verification sampling and testing. Failure may result in the product being rejected or removed from the Approved List.

Property values in these specifications represent minimum average roll values (MARV) in the weakest principal direction unless direction is otherwise specified; permittivity values specified are minimum; AOS and panel vertical strain values are maximum; or mass per unit area, UV degradation, and asphalt retention values are typical.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

Product acceptance is determined by comparing the manufacturer test data against these specifications and using independent assurance testing, verification sampling and testing, and facility audits.

- (a) **Geotextile Fabric for Use in Silt Fences:** Geotextile shall be a woven fabric and function as a vertical, permeable interceptor designed to remove suspended soil from overland water flow. Fabric shall filter and retain soil particles from sediment-laden water to prevent eroding soil from being transported off the construction site by water runoff.

Physical Property	Test Method	Requirements
Filtering efficiency	ASTM D5141-11 and NTPEP Erosion Control Products Committee Work Plan	Min. 75%
Flow rate	ASTM D5141-11 and NTPEP Erosion Control Products Committee Work Plan	Min. 0.2 gal/ft <sup>2</sup> /min

In addition to these requirements, the geotextile shall comply with the requirements of AASHTO M288 for temporary silt fence property requirements, Table 7, Temporary Silt Fence Property Requirements, for grab strength and ultraviolet stability.

- (b) **Geotextile for Use as Riprap Bedding Material:** Geotextile shall comply with the requirements of AASHTO M288 for separation geotextile properties, Table 3, for apparent opening size and ultraviolet stability and geotextile strength property requirements, Table 1, Class 2, for grab strength and puncture strength.
- (c) **Geotextile Fabric for Use in Drainage Systems (Drainage Fabric):** Drainage fabric shall be nonwoven and clog resistant, suitable for subsurface application, and thermally and biologically stable.

Polypropylene material is acceptable in environments with pH values between 3 and 12 inclusive; polyester material between 3 and 9 inclusive.

Physical Property	Test Method	Requirements
Permittivity	ASTM D4491	Min. 0.5 sec <sup>-1</sup>
Apparent opening size	ASTM D4751	Max. No. 50 sieve

In addition to these requirements, the geotextile shall comply with the requirements of AASHTO M288 for strength requirements, Table 1, Class 3, for grab strength.

- (d) **Geotextile for Use in Stabilization:** These are geotextiles used in saturated and/or unstable conditions to provide the functions of separation and reinforcement.

1. **Subgrade Stabilization Fabric:**

Physical Property	Test Method	Requirements
Apparent opening size	ASTM D 4751	Max. No. 20 sieve

In addition to this requirement, the geotextile shall comply with the requirements of AASHTO M 288 for strength property requirements, Table 1, Class 3, for grab strength, tear strength, and puncture strength.

2. **Embankment Stabilization Fabric Up to 6 Feet High:**

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.



Physical Property	Test Method	Requirements
Apparent opening size	ASTM D 4751	Max. No. 20 sieve
Seam strength	ASTM D 4632	90% specified grab strength

In addition to this requirement, the geotextile shall comply with the requirements of AASHTO M288 for strength property requirements, Table 1, Class 1 for grab strength, tear strength, and puncture strength.

- (e) **Prefabricated Geocomposite Pavement Underdrain:** Prefabricated geocomposite pavement underdrain shall consist of a polymeric drainage core encased in a nonwoven filter fabric envelope having sufficient flexibility to withstand bending and handling without damage. Prefabricated geocomposite pavement underdrain shall conform to the following:

1. **Core:** The drainage core shall be made from an inert, polymeric material resistant to commonly encountered chemicals and substances in the pavement environment and shall have a thickness of not less than 3/4 inch. Outer surfaces shall be smooth to prevent excessive wear of bonded filter fabric.

Physical Properties	Test Method	Requirements
Compressive strength panel vertical strain and core area change	ASTM D1621/D2412	Min. 40 psi at 20% deflection after 24 hrs at 0 deg F and at 125 deg F
Panel vertical strain and core area change at 22.7 psi	ASTM D6244	Max. 10% for core area and panel height
Water flow rate (after 100 hr at 10 psi normal confining pressure gradient of no more than 1.0)	ASTM D4716	Min. 15 gal/min/ft width for 12-in specimen length

2. **Filter Fabric:** Geotextile shall be bonded to and tightly stretched over the core. Geotextile shall not sag or block the flow channels, shall have a life equivalent to that of the core material, and shall conform to the requirements of (c) herein.

- (f) **Geocomposite Wall Drains:** Prefabricated geocomposite wall drain shall consist of a polymeric drainage core encased in a nonwoven filter fabric envelope having sufficient flexibility to withstand bending and handling without damage. Geocomposite wall drains shall conform to the following:

1. **Core:** The drainage core shall be made from an inert, polymeric material resistant to commonly encountered chemicals and substances in the roadway. Outer surfaces shall be smooth to prevent excessive wear of bonded filter fabric.

Physical Property	Test Method	Requirements
Compressive strength at 20% deflection	ASTM D1621/D2412	Min. 40 psi after 24 hrs at 0 degree F and at 125 degree F
Water flow rate (after 100 hr at 10 psi normal confining pressure and gradient of no more than 0.1)	ASTM D4716	Min. 15 gal/min/ft width (for 12-in specimen length)

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

2. **Filter Fabric:** Geotextile shall be bonded to and tightly stretched over both sides of the core. Geotextile shall not sag or block the flow channels, shall have a life equivalent to that of the core material, and shall conform to the requirements of (c) herein, except that grab strength requirement shall meet AASHTO M288 Table 1, Class 2.

- (g) **Geomembrane Moisture Barrier:** Geomembrane moisture barrier shall be resistant to biological attack. geomembrane shall be constructed of PVC and shall conform to the requirements of the PVC geomembrane Institute 1104 material specification for PVC geomembrane (Revision #1 effective April 15, 2008) and shall meet the following additional or more stringent requirements:

Physical Property	Test Method	Requirements
Thickness	ASTM D5199	Min. 30 mils
Tensile (1-in strip)	ASTM D882	Min. 0.80 kip/ft (ultimate)
Tear Strength (Die C)	ASTM D1004	Min. 8 lbf
Seam Seal Strength	ASTM D1004	Min. 0.18kip/ft

- (h) **Dewatering Bag:** A nonwoven geotextile sewn together to form a bag that can be used in lieu of a de-watering basin for the purpose of filtering out suspended soil particles. The bag shall be capable of accommodating the water flow from the pump without leaking at the spout and seams.

Physical Property	Test Method	Requirements
Grab strength @ Elongation >50%(CRE/Dry)	ASTM D4632	Min. 250 lb (min)
Seam strength	ASTM D4632	90% Specified grab strength
Puncture	ASTM D4833	Min. 150 lb
Flow rate	ASTM D4491	Min. 0.189 ft <sup>3</sup> /sec/ft <sup>2</sup> (min)
Permittivity	ASTM D4491	Min. 1.2 sec <sup>-1</sup>
UV resistance	ASTM D4355	Min. 70% at 500 hr
AOS	ASTM D4751	Max. 100 sieve

- (i) **Pavement Interlayer:** Paving geosynthetics shall be used as an interlayer between pavement layers. Specific application of these paving interlayers shall be determined by the Engineer.

1. **Paving Fabric:** The geotextile shall conform to the requirements of AASHTO M288 Paving Fabric Property Requirements, Section 10.

2. **Paving Mat:** The paving mat shall meet the requirements of ASTM D7239 Geosynthetic Paving Mat, Type 1.

- (j) **Low Permeability Liners for Stormwater Management Facilities:** SWM liner soil shall be classified as CL, CH or MH in accordance with ASTM D2487 and shall have a maximum coefficient of permeability of  $1 \times 10^{-6}$  cm/sec in accordance with ASTM D5084, after compaction. The maximum particle size shall be three inches in its largest dimension. Natural soils, which do not meet these specifications, may be blended with bentonite to provide the specified permeability characteristics.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

Geosynthetic Clay Liner shall have a maximum coefficient of permeability of  $1 \times 10^{-8}$  cm/sec in accordance with ASTM D5887.

This specification is not intended for dam embankment material or clay core cut-off trench material.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**GUIDELINES — PROJECTS REQUIRING REFLECTIVE SHEETING USED ON TRAFFIC CONTROL DEVICES TO PROVIDE A RETROREFLECTIVE SURFACE OR MESSAGE.**

SS24701-0611

February 10, 2011

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS**SUPPLEMENTAL SECTION 247—REFLECTIVE SHEETING****SECTION 247—REFLECTIVE SHEETING** of the Specifications is completely replaced with the following:**247.01—Description**

This specification covers reflective sheeting used on traffic control devices to provide a retroreflective surface or message. The color of the reflective sheeting shall be as specified in the Contract Documents. Reflective sheeting shall be certified in accordance with the requirements of Section 106.06 of the Specifications.

**247.02—Detail Requirements**

Reflective sheeting shall be selected from the Department's Approved Products list. Reflective sheeting products are included on the Approved Products List only after the Department determines conformance to the Specifications and the manufacturer has supplied written information indicating conformance to the warranty requirements of Section 247.03 of the Specifications where required. Determination of conformance will include, but not be limited to, the evaluation of test data from AASHTO's National Transportation Product Evaluation Program (NTPEP) or other Department-approved facilities except as noted. When color test data (Chromaticity and Luminance Factor - Y%) provided by NTPEP or other Department-approved facilities are evaluated, color must have been maintained within the color specification limits for the full duration of the outdoor weathering test. The sheeting and any applied coatings such as inks, overlay films, other coatings, shall be weather resistant in accordance with ASTM D4956 after being tested by AASHTO, NTPEP or other Department approved facilities except as noted.

- (a) **Reflective sheeting used on permanent signs (except those addressed in Section b), on object markers, nose of guardrails, permanent impact attenuators (except sand barrels), standard road edge delineators, special road edge delineators, barrier delineators, guardrail delineators, interstate road edge delineators, chevron panels, bridge end panel signs (VW-13), and railroad advance warning signs (including any supplemental plaques) vertical panels (Group 2 channelizing devices), traffic gates, Automatic Flagger Assistance Device (AFAD) gate arms, and the "STOP" side of sign paddles (hand signaling device)** shall conform to the requirements of ASTM D4956 for a Type IX material and, except for the "STOP" side of sign paddles, shall be warranted in accordance with Section 247.03 Sheeting Warranty Class I of the Specifications.

Color shall conform to the requirements of 23 CFR, Part 655, Subpart F, Appendix Tables 1 and 1A (non-fluorescent colors) and Tables 3 and 3A (fluorescent colors). In Table 1A, the values for daytime luminance factor (Y%) shall be based on the colors for a Type IV, VII, and VIII sheeting.

The minimum maintained coefficient of retroreflection of the sheeting after 3 years on the test deck shall conform to the requirements of ASTM D4956.

1. **Reflective sheeting used on the following signs** shall be Fluorescent Yellow-Green conforming to the requirements of ASTM D4956 for a Type IX material

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and shall be warranted in accordance with Section 247.03, Sheeting Warranty Class I of the Specifications.

- **Bicycle Crossing sign (W11-1) including supplemental plaques**
- **Pedestrian Crossing sign (W11-2) including supplemental plaques**
- **Playground sign (W15-1) including supplemental plaques**
- **DEAF CHILD AREA sign including supplemental plaques**
- **WATCH FOR CHILDREN sign including supplemental plaques**
- **School Signing consisting of the following:**
  - School Crossing sign (S1-1)**
  - School Bus Stop Ahead sign (S3-1)**
  - SCHOOL plaque (S4-3)**
  - School Portion of the School Speed Limit sign (S5-1)**
  - Supplemental plaques used with these signs**

Color shall conform to the requirements of 23 CFR, Part 655, Subpart F, Appendix Tables 3 and 3A.

The minimum maintained coefficient of retroreflection of the sheeting after 3 years on the test deck shall conform to the requirements of ASTM D4956.

- (b) **Reflective sheeting used on permanent recreational and cultural interest area guidance signs, and for the hand symbol/DON'T WALK and numerals on permanent educational pedestrian signal signs (R10-3b thru R10-3e)** shall conform to the requirements of ASTM D4956 for a Type III material and shall be warranted in accordance with Section 247.03, Sheeting Warranty Class I of the Specifications.

Color shall conform to the requirements of 23 CFR, Part 655, Subpart F, Appendix Tables 1 and 1A.

The minimum maintained coefficient of retroreflection of the sheeting after 3 years on the test deck shall conform to the requirements of ASTM D4956.

- (c) **Reflective sheeting used to delineate the trailer's back frame of Portable Changeable Message Signs (PCMS), Automatic Flagger Assistance Device (AFAD) gate arm, arrow boards and portable lights** shall conform to the requirements of 49 CFR 571.108 for a Grade DOT-C2 truck conspicuity marking. References to ASTM specifications therein shall be interpreted to mean the latest version of the specification at the time of advertisement regardless of the date indicated in the reference.

Color shall conform to the requirements of 23 CFR, Part 655, Subpart F, Appendix Tables 1 and 1A.

This reflective sheeting is not required to be tested by NTPEP.

- (d) **Reflective sheeting used on Type III barricades** shall conform to the following:

<b>Minimum Coefficient of Retroreflection <math>R_A</math></b> <b>(<math>R_A</math> =Candelas per foot-candle per square foot)</b>			
<b>Observation Angle (°)</b>	<b>Entrance Angle (°)</b>	<b>White</b>	<b>Orange</b>
0.2	-4	400	200
0.2	+30	200	80
0.5	-4	300	100
0.5	+30	100	40

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

1.0	-4	50	25
1.0	+30	15	10

Color and Luminance Factor (Y%) shall conform to the requirements of 23 CFR, Part 655, Subpart F, Appendix Tables 1 and 1A, for a Type IV Sheeting.

Impact Resistance shall conform to the requirements of ASTM D4956.

The minimum maintained coefficient of retroreflection of the sheeting after one year on the test deck shall be at least 50 percent of the minimum coefficient of retroreflection values specified.

- (e) **Reflective sheeting used on orange construction and maintenance activity signs, barrier vertical panels installed on concrete traffic barrier service, rear panel of truck-mounted attenuators, temporary impact attenuators (except temporary sand barrels), and the "SLOW" side of sign paddles** shall conform to the requirements of ASTM D4956 for a Type IX, Fluorescent Orange material (with the following retroreflection exception):

**Minimum Coefficient of Retroreflection  $R_A$   
( $R_A$  =Candelas per foot-candle per square foot)**

Observation Angle (°)	Entrance Angle (°)	Fluorescent Orange
0.2	-4	140
0.2	+30	90
0.2	+40	24
0.5	-4	90
0.5	+30	50
0.5	+40	15
1.0	-4	10
1.0	+30	5
1.0	+40	3

Color shall conform to the requirements of 23 CFR, Part 655, Subpart F, Appendix Tables 3 and 3A.

The minimum maintained coefficient of retroreflection of the sheeting after one year on the test deck shall be at least 50 percent of the minimum coefficient of retroreflection values specified.

- (f) **Reflective sheeting used on tubular delineators, drums and temporary sand barrels** shall conform to the following:

1. **Reflective sheeting used on tubular delineators and drums** shall conform requirements of ASTM D4956 including supplementary requirement S2 for a Type III reboundable material. Color shall conform to the requirements of Tables 1 and 1A of the USDOT specification as contained in the Appendix to 23 CFR, Part 655, Subpart F except the minimum daytime luminance factor (Y%) for white shall be 25 when used on tubular delineators and drums. The following supplementary table shall apply for tubular delineators and drums:

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**Minimum Coefficient of Retroreflection  $R_A$   
(Candelas per foot-candle per square foot)  
(High Intensity)**

Observation Angle (°)	Entrance Angle (°)	White	Orange
0.2	+50	75	25
0.5	+50	35	10

Reflective sheeting used on tubular delineators is not required to be tested by NTPEP.

2. **Reflective sheeting used on temporary sand barrels** shall be a fluorescent orange prismatic lens reboundable sheeting conforming to the following:

Color shall conform to the requirements of Tables 3 and 3A of the USDOT specification as contained in the Appendix to 23 CFR, Part 655, Subpart F.

**Minimum Coefficient of Retroreflection  $R_A$   
(Candelas per foot-candle per square foot)  
(High Intensity)**

Observation Angle (°)	Entrance Angle (°)	Fluorescent Orange
0.2	-4	200
0.2	+30	120
0.2	+50	40
0.5	-4	80
0.5	+30	50
0.5	+50	30

Minimum maintained coefficient of retroreflection of the sheeting after one year on the test deck shall be at least 50 percent of the minimum coefficient of retroreflection values indicated above.

Reflective sheeting shall conform to the supplementary requirement S2 of ASTM D4956.

**Please note:** Beginning July 1, 2012 reflective sheeting used on Drums, Temporary Sand Barrels and Tubular delineators for all projects shall conform to the requirements of ASTM D4956 including supplementary requirement S2 for a Type III reboundable material with the following retroreflection exception as shown in the chart below:

**Minimum Coefficient of Retroreflection  $R_A$   
( $R_A$  =Candelas per foot-candle per square foot)  
(Prismatic Lens)**

Observation Angle (°)	Entrance Angle (°)	White	Fluorescent Orange
0.2	-4	400	175
0.2	+30	200	100
0.2	+40	135	60
0.2	+45	120	40
0.5	-4	150	70
0.5	+30	50	30
0.5	+40	45	25

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

0.5	+45	40	20
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Color shall conform to the requirements of 23 CFR, Part 655, Subpart F, Appendix Tables 1 and 1A (non-fluorescent colors) and Table 3 and 3A (fluorescent colors).

The minimum maintained coefficient of retroreflection of the sheeting after one year on the test deck shall be at least 50 percent of the minimum coefficient of retroreflection specified.

- (g) **Reflective sheeting used on Permanent Sand Barrels and on Cones** shall conform to the requirements of ASTM D4956 including supplementary requirement S2 for a Type III reboundable material. The following supplementary table shall also apply for cones:

**Minimum Coefficient of Retroreflection  $R_A$**   
**( $R_A$  =Candelas per foot-candle per square foot)**  
**(High Intensity)**

Observation Angle (°)	Entrance Angle (°)	White
0.2	+50	60
0.5	+50	35

Color shall conform to the requirements of 23 CFR, Part 655, Subpart F, Appendix Tables 1 and 1A.

The maintained coefficient of retroreflection of the sheeting after one year on the test deck shall be at least 50 percent of the minimum coefficient of retroreflection specified for permanent sand barrel sheeting.

Reflective sheeting for cones is not required to be tested by NTPEP.

- (h) **Reflective sheeting used on Retroreflective Rollup Signs** shall conform to the following:

**Minimum Coefficient of Retroreflection  $R_A$**   
**( $R_A$  =Candelas per foot-candle per square foot)**  
**(Prismatic Lens)**

Observation Angle (°)	Entrance Angle (°)	White	Fluorescent Orange	Fluorescent Pink
0.2	-4	500	200	200
0.2	+30	200	80	100
0.5	-4	225	90	100
0.5	+30	85	35	35
1.0	-4	20	10	10
1.0	+30	15	8	10
1.5	-4	5	3	2
1.5	+30	4	1.5	2

Color shall conform to the requirements of 23 CFR, Part 655, Subpart F, Appendix Tables 1 and 1A for white, and Appendix Tables 3 and 3A for fluorescent colors.

Reflective sheeting for retroreflective rollup signs is not required to be tested by NTPEP.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.



**247.03—Warranty Requirements**

The reflective or retroreflective sheeting manufacturer shall provide the following warranty to the Department for the respective types of sheeting furnished as specified herein:

**Class I Warranty:** 10-year warranty with 7 years being 100 percent full replacement covering all material and labor costs associated with fabrication and installation of the sign or device and the final 3 years being 100 percent sheeting replacement cost.

The minimum values of retroreflectivity maintained during the warranty period shall be the same as those required for the maintained coefficient of retroreflection values as indicated herein, or where not indicated, shall be in accordance with those specified in ASTM D4956.

Loss of colorfastness is considered to have occurred if the color of the sheeting is not within the color specification limits in 23 CFR, Part 655, Subpart F, Appendix during the full duration of the warranty period.

Warranty period shall begin on the date of fabrication and shall be documented as follows:

For warranty requirements, each permanent sign shall be labeled on the reverse in a location not to be obscured by sign supports or backing hardware, showing 1.) Month and year the sign was fabricated, marked via punch-out numerals, 2.) Sheeting Manufacturer's name or logo and product designation or number, and 3.) Sign fabricator's name or logo. Labels shall be made of a self adhesive, permanent weather resistant material and shall be a minimum 4" by 4" in size. Label may be made from permanent sign material provided the finished label meets all other aspects required for warranty documentation.

Where the information required for the label is not furnished by punched-out numerals, it shall be supplied by permanent means, such as sign ink, capable of resisting weathering so as to be legible for the full duration of the warranty period.

Prior to applying the label, the area shall be thoroughly cleaned to ensure proper adhesion.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**GUIDELINES — PROJECTS REQUIRING STONE MATRIX ASPHALT CONCRETE MIXES. WHEN THIS SECTION APPLIES INCLUDE THE FOLLOWING IN THE PROPOSAL: SS21001 Asphalt Materials SS21113 SuperPave - Asphalt Concrete, SS31510 SuperPave -Asphalt Conc Place, and SS31706 SMA -Asphalt Concrete Place.**

SS24807-1214

December 2, 2014

VIRGINIA DEPARTMENT OF TRANSPORTATION  
2007 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

**SUPPLEMENTAL SECTION 248—STONE MATRIX ASPHALT CONCRETE**

**SECTION 248—STONE MATRIX ASPHALT CONCRETE** of the Specifications is replaced with the following:

**248.01—Description**

These specifications cover the materials used to produce stone matrix asphalt (SMA) concrete pavement. SMA shall be in accordance to this specification and Section 211. SMA consists of a combination of coarse aggregate, fine aggregate, mineral filler, fiber additives, and liquid asphalt binder mechanically mixed in a plant to produce a stable gap-graded asphalt concrete paving mixture.

**248.02—Materials**

(a) **Coarse Aggregate:** Coarse aggregate shall conform to the following requirements when tested in accordance with the specified tests:

1. Los Angeles Abrasion	AASHTO T96	40% max.
2. Flat and Elongated Particles: Measured on No. 4 VTM-121 retained,		
3 to 1		20% max.
5 to 1		5% max.
3. Magnesium Sulfate Soundness Loss, 5 cycles	AASHTO T104	15% max.
4. Particles retained on No. 4 sieve shall have at least	ASTM D5821	
1 fractured face		100% min.
2 fractured faces		90% min.
5. Absorption	AASHTO T 85	2% max.

Except for the determination of flat and elongated particles in (a)2 herein, the aggregate properties specified are for each stockpile of coarse aggregate material designated on the job mix form (Form No. TL-127). The material contained in each stockpile shall meet the minimum or maximum criteria specified.

For flat and elongated particles, these values are based on the mathematical blend of the coarse aggregate material designated on the job mix form (TL-127). During production, these values are based on the SMA material sampled during the acceptance process (QC testing).

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

SMA must contain two or more coarse aggregate sizes. At least two of the aggregate sizes must comprise a minimum of 10 percent of the total mix composition each. At least one cold feed bin shall be used for each aggregate size.

The Engineer will not permit the use of slag in the job mix formula.

At the Engineer's discretion, mixes containing Reclaimed Asphalt Pavement (RAP) may be tested by VDOT for aggregate breakdown during lab compaction in accordance with VTM-99. If the percent of the total mix passing the No. 4 sieve increases by more than 10 percent after being compacted to  $N_{design}$  then the RAP component shall be changed or the Engineer will discontinue its use in the mix.

- (b) **Fine Aggregate:** Virgin fine aggregates shall consist of a blend of 100 percent crushed aggregate. If RAP is being used as a component in SMA then the portion of the final SMA blend passing the No. 8 sieve shall have a minimum Fine Aggregate Angularity value of 45 percent as determined in accordance with AASHTO T 304 (Method A). The magnesium sulfate soundness loss in 5 cycles shall not exceed 20 percent. In addition, the liquid limit shall not exceed 25 as determined in accordance with AASHTO T89.
- (c) **Asphalt Binder:** Asphalt binders shall be performance graded binder PG 64H-22 or polymer modified binder PG 64E-22 conforming to the requirements of the mix designation (E) designated by the Department. The supplier shall certify to the Department that the binder complies with the requirements for all properties of the grade as specified in AASHTO M332 Table 1 for performance-graded asphalt binder. This certification shall be based on testing performed on samples of binder provided to the Contractor for incorporation into the mixture. The Engineer will not allow certification based on testing performed on laboratory-produced binders.

The Contractor shall submit to the Engineer for Department review the source, formulation, and PG grading of the binder at least 15 days prior to the production of the SMA mixture.

The Department will perform testing during mixture production to determine the binder PG grade on samples taken from storage at the hot-mix asphalt plant at the Engineer's direction. The Contractor shall be responsible for obtaining the sample of binder when requested by the Engineer. If the Department determines the binder does not comply with the requirements of the specified PG grade, production shall be stopped until further testing indicates that the problem has been corrected.

- (d) **Mineral Filler:** Mineral filler shall consist of finely divided mineral matter such as rock or limestone dust or other suitable material. The Engineer will not permit the use of hydrated lime and fly ash. The supplier may blend up to two mineral fillers to comply with the mineral filler requirements. Mineral filler shall conform to the requirements of Section 201 with the following modifications. The mineral filler or mineral filler blend used in surface and intermediate SMA shall have a minimum of 55 percent passing the No. 200 sieve. At the time of use, it shall be sufficiently dry to flow freely and be essentially free from agglomerations.
- (e) **Fiber Additive:** The supplier shall use cellulose fiber in either loose or pelletized form. The minimum dosage rate for cellulose is 0.3 percent by weight of the total mixture. The Department may require the percentage of fiber additive to be increased during production if visual inspection or draindown testing on plant-produced material indicates that draindown in excess of 0.3 percent by weight of the mixture is occurring as determined in accordance with VTM-100. Allowable tolerances of fiber dosage shall be  $\pm 10$  percent of the required fiber weight.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**NOTE:** When using pelletized fiber, the dosage rate shall be adjusted to comply with the specified minimum dosage rates for cellulose fiber. Pelletized fiber consists of cellulose fiber and a binder. The specified minimum dosage rates are based on fiber content only. Therefore, the amount of pelletized fiber added shall typically be higher than for loose fiber.

The Engineer will accept fibers based on the manufacturer's certification.

**TABLE II-23**

<b>Cellulose Fiber Properties</b>		
<b>Sieve Analysis</b>		
<b>Method A: Alpine Sieve<sup>1</sup> Analysis</b>		
Fiber Length:		0.25 inch max.
Passing	No. 100 Sieve	70% (±10%)
<b>Method B: Mesh Screen<sup>2</sup> Analysis</b>		
Fiber Length:		0.25 inch max.
Passing	No. 20 Sieve	85% (±10%)
	No. 40 Sieve	65% (±10%)
	No. 140 Sieve	30% (±10%)
<b>Ash Content<sup>3</sup></b>		18% (±5%) non-volatile
<b>pH<sup>4</sup></b>		7.5 (±1.0)
<b>Oil Absorption<sup>5</sup></b>		5.0 (±1.0) (times fiber weight)
<b>Moisture Content<sup>6</sup></b>		<5%

<sup>1</sup>*Method A: Alpine Sieve Analysis.* Performed using an Alpine Air Jet Sieve (Type 200 LS). A representative 5-gram sample of fiber is sieved for 14 minutes at a controlled vacuum of 22 inches (±3 inches) of water. The portion remaining on the screen is weighed.

<sup>2</sup>*Method B: Mesh Screen Analysis.* This test is performed using standard Nos. 20, 40, 60, 80, 100, and 140 sieves, nylon brushes, and a shaker. A representative 10-gram sample of fiber is sieved, using a shaker and two nylon brushes on each screen. The amount retained on each sieve is weighed and the percentage passing calculated.

<sup>3</sup>*Ash Content:* A representative 2- to 3-gram sample of fiber is placed in a tared crucible and heated between 1100 and 1200 degrees F for not less than 2 hours. The crucible and ash are cooled in a desiccator and reweighed.

<sup>4</sup>*pH Test:* Five grams of fiber is added to 3.5 ounces of distilled water, stirred, and allowed to set for 30 minutes. The pH is determined with a probe calibrated with a pH 7.0 buffer.

<sup>5</sup>*Oil Absorption Test:* Five grams of fiber is accurately weighed and suspended in an excess of mineral spirits for not less than 5 minutes to ensure total saturation. It is then placed in a screen mesh strainer (with a hole size of approximately 0.5 square millimeter), and shaken on a wrist action shaker for 10 minutes (approximately 1¼-inch motion at 20 shakes/minute). The shaken mass is then transferred without touching to a

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tared container and weighed. Results are reported as the amount (number or times its own weight) the fibers are able to absorb.

<sup>6</sup>*Moisture Content:* Ten grams of fiber is weighed and placed in a 250 degree F forced air oven for 2 hours. The sample is then reweighed immediately upon removal from the oven.

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- (f) **Antistripping Additive:** An antistripping additive shall be used in all stone matrix asphalt mixes. It may be hydrated lime or a chemical additive from the VDOT Materials Division Approved Products List No. 7 or a combination of both. The approved chemical additive shall be added at a rate of not less than 0.30 percent by weight of the total asphalt content of the mixture.

The mixture shall produce a tensile strength ratio (TSR) of not less than 0.80 for the design and production tests. The TSR shall be determined in accordance with AASHTO T283, including a freeze-thaw cycle (4-inch specimens compacted with a Marshall Hammer or 3.5 by 6-inch specimens when compacted with a gyratory compactor); except that the 16-hour curing time requirement and the 72 to 96-hour storage period will not be enforced by the Department. Design tests shall use the same materials that are to be used in the production mix and shall be conducted in a laboratory approved by the Department.

When a chemical additive is used, it shall be added to the asphalt cement prior to the introduction of the asphalt cement into the mix. Any chemical additive or particular concentration of chemical additive found to be harmful to the asphalt material or that changes the original asphalt binder performance grade (PG) shall not be used.

- (g) **Hydrated lime** shall conform to the requirements of ASTM C977. Hydrated lime shall be added at a rate of not less than 1 percent by weight of the total dry aggregate.

A separate bin or tank and feeder system shall be provided to store and accurately proportion the dry or slurried lime into the aggregate. The lime and aggregate shall be mixed by pugmill or other Department approved means to achieve a uniform lime coating of the aggregate prior to entering the drier. If lime is added in dry form, the aggregate shall contain at least 3 percent free moisture. The Department will not permit the stockpiling of lime treated aggregate.

The feeder system shall be controlled by a proportioning device, which shall be accurate to within  $\pm 10$  percent of the specified amount. The proportioning device shall have a convenient and accurate means of calibration. A flow indicator or sensor shall be provided with the proportioning device and interlocked with the plant controls, aggregate feed or weigh system, such that production of the mixture shall be consistently maintained and, if there is a stoppage of the lime feed, interrupted.

The method of introducing and mixing the lime and aggregate shall be subject to approval by the Engineer prior to beginning production.

- (h) **RAP:** The Contractor or his supplier may use Reclaimed Asphalt Pavement (RAP) material as a component material of SMA mixtures provided it conforms to the following:
1. SMA surface and intermediate mixtures containing RAP shall use the PG grade of asphalt cement designated by the mix specified on the plans or in the proposal e.g. an SMA-12.5 (64E-22).

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

2. The final asphalt mixture shall conform to the requirements for the type specified.
3. During the production process, RAP material shall not be allowed to contact open flame.
4. The Contractor or his supplier shall handle, haul and store the RAP material in a manner that will minimize contamination. Further, the material shall be stockpiled and used in such manner that variable asphalt contents and asphalt penetration values will not adversely affect the consistency of the mixture.

### 248.03—Composition of SMA Mixture

The Contractor or his supplier shall design and test the SMA mixture using a gyratory compactor. The mixture shall conform to the requirements listed in Table II-24 and Table II-25. One percent hydrated lime will be required as an antistripping additive. An alternative antistripping additive can be used only with the Engineer's permission.

**TABLE II-24  
SMA Design Range**

Percentage by Weight Passing Square Mesh Sieves (in)								
Type No. (See Note)	1	¾	1/2	3/8	No. 4	No. 8	No. 30	No. 200
Surface Mixes								
SMA 12.5		100	83-93	80 max	22-28	16-24	15-20	9-11
SMA 9.5		100	90-100	65-75	25-32	15-25		9-11
Intermediate Mixes								
SMA 19.0	100	85-95	50-60	30-45		16-24	12-16	8-10

Note: The required PG binder will be shown in parentheses as part of the mix type on the plans or proposal, e.g., SMA 12.5 (64E-22).

**TABLE II-25  
SMA Mixture Requirements**

Mix Type	VTM <sup>1</sup> (%)	VMA Design (Min. %)	VMA Production (Min. %)	VCA Design and Production <sup>2</sup> (%)	AC (Min. %)	Draindown (%)	Design Gyrations	Specimen Height <sup>3</sup>
SMA 9.5	2.0-4.0	18.0	17.0	<VCA <sub>DRC</sub>	6.3	0.3 max	75	115
SMA 12.5	2.0-4.0	18.0	17.0	<VCA <sub>DRC</sub>	6.3	0.3 max	75	115
SMA 19.0	2.0-4.0	17.0	16.0	<VCA <sub>DRC</sub>	5.5	0.3 max	75	115

- 1) Asphalt content shall be selected at the midpoint of the VTM range but shall not be less than the minimum specified.
- 2) The voids in coarse aggregates (VCA) of the dry rodded condition (DRC) and mix shall be determined in accordance with VTM-99.
- 3) Specimen height after compaction shall be between 4.33 inches (110mm) and 4.75 inches (120mm). The fines-effective asphalt ratio shall be 1.2-2.0

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NOTE: The SUPERPAVE gyratory compactor (SGC) shall be from the Department's approved list maintained by the Department's Materials Division. Gyratory procedures shall be performed in accordance with VTM-99. Calculations for volumetrics shall be performed in accordance with VTM-57 and VTM-58, 6-inch specimens.

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

Draindown testing shall be conducted in accordance with VTM-100.

RAP Percentages are allowed as follows:

**TABLE II-26  
Specified Performance Grade of Asphalt and Use of RAP**

Mix Type & PG	Allowable RAP Percentage in Mix
SMA-9.5 (64H-22), SMA-12.5 (64H-22) & SMA-19.0(64H-22)	0.0 to 20.0
SMA-9.5 (64E-22), SMA-12.5 (64E-22) & SMA-19.0 (64E-22)	0.0 to 15.0

#### 248.04—Acceptance

The Engineer will consider a lot to be acceptable for gradation and asphalt content if the mean of the test results obtained is within the tolerance allowed from the job-mix formula. The production tolerances for the control sieves and asphalt content shall be as follows:

#### Process Tolerance

Tolerance on Each Laboratory Sieve and Asphalt Content: Percent Plus and Minus									
No. Tests	Top Size	¾"	½"	3/8"	No. 4	No. 8	No. 30	No. 200	A.C.
1	0.0	8.0	8.0	8.0	6.0	6.0	6.0	4.0	0.60
2	0.0	5.7	5.7	5.7	4.3	4.3	4.3	2.8	0.43
3	0.0	4.4	4.4	4.4	3.3	3.3	3.3	2.2	0.33
4	0.0	4.0	4.0	4.0	3.0	3.0	3.0	2.0	0.30
5	0.0	3.6	3.6	3.6	2.7	2.7	2.7	1.8	0.27
6	0.0	3.3	3.3	3.3	2.4	2.4	2.4	1.6	0.24
7	0.0	3.0	3.0	3.0	2.3	2.3	2.3	1.5	0.23
8	0.0	2.8	2.8	2.8	2.1	2.1	2.1	1.4	0.21
12	0.0	2.3	2.3	2.3	1.7	1.7	1.7	1.2	0.17

The production tolerance for the specimen height after compaction is 4.33 inches (110mm) and 4.75 inches (120mm).

The Contractor shall check and report the VCA of the mix during production for each gyratory sample. If the VCA of the mix exceeds the VCA of the DRC, the Contractor shall stop production and notify the Engineer. Production shall not resume until the Contractor has taken corrective action and the Engineer has accepted the Contractor's means of correction.

The Contractor shall check and report the percentage of flat and elongated particles (F&E) in the coarse aggregates of the mix design during production. When the Contractor samples the SMA material for acceptance (gradation and AC content), two of eight sub-lots must be selected for F&E verification in the first lot. The F&E testing shall be performed on the coarse aggregate material retained on the #4 sieve, in accordance with the requirements of VTM-121, after the gradation is performed. If passing results are obtained on each sample in the first lot, then F&E testing shall be

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performed on a frequency of every second lot of material produced (i.e., Lots 3, 5, 7, etc.) by randomly selecting two sub-lots. If the F&E of the mix exceeds the specified limits, the Contractor shall stop production and notify the Engineer. Production shall not resume until the Contractor has taken corrective action and the Engineer has accepted the Contractor's means of correction.

Once production has resumed, the Contractor shall determine the F&E of the mix for two consecutive lots by randomly selecting two sub-lots per lot. If passing results are obtained for these two lots, then the F&E testing frequency shall return to every second lot of material produced.

If the Department determines that the mixture being produced does not conform to the approved job-mix formula and volumetric properties in Table II-25 based on Department or Contractor's test results, the Contractor shall immediately make corrections to bring the mixture into conformance with the approved job-mix formula or cease paving with that mixture.

The Engineer will limit subsequent paving operations, using either a revised or other job-mix formula which has not been verified as described herein, to a test run of 300 tons maximum if such material is to be placed in Department project work. The Engineer will not allow any further paving for the Department using that specific mixture until the acceptability of the mixture being produced has received the Engineer's approval based on the 300-ton constraint.

For SMA surface mixes, permeability test data shall be submitted in accordance with VTM 120 using either single point verification or the regression method for each surface mix having a different gradation.

Samples will be taken in the first lot, and every other lot thereafter, and results submitted to the District Materials Engineer.

#### **248.05—SMA Mixing Plant**

Plants used for the preparation of the SMA mixture shall conform to the following:

- (a) **Handling of Mineral Filler:** Adequate dry storage shall be provided for the mineral filler that will, at a minimum, consist of a waterproof cover that shall completely cover the stockpile at all times. Provisions shall be made for metering of the filler into the mixture uniformly and in the desired quantities. In a batch plant, mineral filler shall be added directly into the weigh hopper. In a drum plant, mineral filler shall be added directly onto the cold feed belt. Equipment shall be capable of accurately and uniformly metering the large amounts of mineral filler up to 25 percent of the total mix.
- (b) **Fiber Addition:** Adequate dry storage shall be provided for the fiber additive, and provisions shall be made for accurately and uniformly metering fiber into the mixture at plus or minus 10 percent of the desired quantities.

Introduction of loose or pelletized fiber shall require a separate system that can accurately proportion, by weight, the required quantity of fiber in such a manner as to ensure consistent, uniform blending into the mixture at all rates of production and batch sizes. This supply system shall be interlocked with the other feeding devices of the plant system, and sensing devices shall provide for interruption of mixture production if the introduction of fiber fails.

**Batch Plant:** Loose fiber or pelletized fiber shall be added through a separate inlet directly into the weigh hopper above the pugmill. The addition of fiber shall be timed to occur during the hot aggregate charging of the hopper. Adequate dry mixing time is required to ensure proper blending of the aggregate and fiber stabilizer. Therefore, dry

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mixing time shall typically be increased 5 to 15 seconds. Wet mixing time shall typically be increased at least 5 seconds for cellulose fibers to ensure adequate blending with the asphalt cement.

When fiber is used, the fiber supply system shall include low level and no flow indicators and a printout of the date, time, and net batch weight of fiber.

**Drum Mix Plant:** When fiber is used, the fibers shall be added in such a manner as not to be entrained into the exhaust gases of the drum plant. The fiber supply system shall include low level and no flow indicators and a printout of status of feed rate in pounds per minute.

When pelletized fibers are used, they shall be added directly into the drum mixer through the RAP inlet or a specialized fiber inlet. Operation of the drum mixer shall be such as to ensure complete blending of the pelletized fiber into the mix.

- (c) **Hot Mixture Storage:** When the Contractor does not immediately haul and place the hot mixture on the project, it, he shall provide suitable bins for storage of the hot mixture. Such bins shall be either surge bins to balance production capacity with hauling and placing capacity or storage bins that are heated and insulated and that have a controlled atmosphere around the mixture. The Engineer will impose limitations on the holding times based on laboratory tests of the stored mixture. In no case shall the SMA mixture be kept in storage more than 8 hours.
- (d) **Mixing Temperature:** The recommended plant mixing temperatures for PG 64H-22 should be 315 to 340 degrees F and at no time shall the temperature exceed 350 degrees F. For PG 64E-22, the plant mixing temperatures shall be within the limits of the asphalt supplier's recommendations.

**———— CNSP SELECT USE 200 SERIES SPCNs and SPs ————**

The following are Select Use Special Provisions. None have been through the Department's complete Specifications Committee review/comment/acceptance process and are not part of the Standard Specifications. They are to be considered as project-specific and may be subject to modifications required to meet specific project conditions or requirements for Federal funding. Anyone making modifications is responsible for obtaining the appropriate expertise in the discipline applicable to the modification. If modifications are made the date must also be changed to reflect the current date. Please send a copy of the modified special provision with the new date and specific project number to [David.Gayle@VDOT.Virginia.gov](mailto:David.Gayle@VDOT.Virginia.gov) so it may be added to the Specifications Stockpile.

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cu211000a SM-22.5 Asph Conc (Bris Coal Co)

**GUIDELINES – FOR ASPHALT MAINTENANCE PROJECTS IN BRISTOL DISTRICT COAL COUNTIES ONLY WHEN CALLED FOR BY THE DISTRICT MAINTENANCE ENGINEER.**

**SM-22.5 ASPHALT CONCRETE MIXTURES (Bristol District Coal Counties Only)** — When asphalt concrete mix types SM-22.5 A, D, or E are specified in the Schedules, **TABLE II-13—Asphalt Concrete Mixtures: Design Range** of the Specifications shall be amended to add the following to the table:

**TABLE II-13  
Asphalt Concrete Mixtures: Design Range<sup>1</sup>**

Mix Type	Percentage by Weight Passing Square Mesh Sieves											
	2 in	1 ½ in	1 in	¾ in	½ in	3/8 in	No. 4	No. 8	No. 30	No. 50	No. 200	
SM-22.5 A,D,E			95-100	Max. 90	60-84				19-38			2-8

10-21-08a (SPCN)

\*These SPECIFICATIONS REVISIONS are subject to change on short notice.

**SU210000B Thin Hot Mix Asph Conc Overlay****GUIDELINES – FOR PROJECTS WHERE “THIN HOT MIX ASPHALT CONCRETE OVERLAY” IS REQUIRED.**

VIRGINIA DEPARTMENT OF TRANSPORTATION  
SPECIAL PROVISION FOR  
**THIN HOT MIX ASPHALT CONCRETE OVERLAY**

July 8, 2014b

**I. DESCRIPTION**

This work shall consist of the production and placement of a thin hot mix asphalt concrete overlay in accordance with the contract requirements, this provision, and as directed by the Engineer.

**II. MATERIALS**

A. **Asphalt:** The asphalt cement shall be a performance graded asphalt (PG) 64H-28 conforming to the requirements of AASHTO Provisional Specification MP-1 and the requirements of Section 210 of the Specifications or as designated by the Engineer

B. **RAP:** Recycled asphalt pavement material will not be permitted.

C. **Coarse aggregate** shall conform to the requirements of Section 203 of the Specifications or as directed by the Engineer. In addition the following requirements shall be met:

Flat and Elongated Particles when tested according to ASTM D 4791 the amount retained on and above the No. 4 sieve shall conform to the following:

3 to 1	Not greater than 25 percent.
5 to 1	Not greater than 10 percent.

Water Absorption when tested according to AASHTO T85 shall be no greater than 2 percent.

D. **Fine aggregate** shall conform to the requirements of Section 202 of the Specifications, except for grading, which shall be tested according to AASHTO TP 33 (Method A) with a value of not less than 45 percent and a sand equivalent value of not less than 50 (AASHTO T 176).

E. **Mineral Filler** shall conform to the requirements of Section 201 of the Specifications.

F. **Fiber Additive** when required shall be cellulose or mineral fiber approved by the Engineer based on supplier's certification of properties and documentation of success in similar applications in hot mix asphalt.

G. Antistripping additive shall be used. It may be hydrated lime or a chemical additive from the VDOT Materials Division Approved Products List No. 7 or a combination of both. The approved chemical additive shall be added at a rate of not less than 0.30 percent by weight of the total asphalt content of the mixture.

The mixture shall produce a tensile strength ratio (TSR) of not less than 0.80 for the design and production tests. The TSR shall be determined in accordance with AASHTO T283, including a freeze-thaw cycle (4-inch specimens compacted with a Marshall Hammer or 3.5 by 6-inch specimens when compacted with a gyratory compactor); except that the 16-hour curing time requirement and the 72 to 96-hour storage period will not be

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enforced by the Department. Design tests shall use the same materials that are to be used in the production mix and shall be conducted in a laboratory approved by the Department.

When a chemical additive is used, it shall be added to the asphalt cement prior to the introduction of the asphalt cement into the mix. Any chemical additive or particular concentration of chemical additive found to be harmful to the asphalt material or that changes the original asphalt binder performance grade (PG) shall not be used.

- (i) **Hydrated lime** shall conform to the requirements of ASTM C977. Hydrated lime shall be added at a rate of not less than 1 percent by weight of the total dry aggregate.

A separate bin or tank and feeder system shall be provided to store and accurately proportion the dry or slurried lime into the aggregate. The lime and aggregate shall be mixed by pugmill or other Department approved means to achieve a uniform lime coating of the aggregate prior to entering the drier. If lime is added in dry form, the aggregate shall contain at least 3 percent free moisture. The Department will not permit the stockpiling of lime treated aggregate.

The feeder system shall be controlled by a proportioning device, which shall be accurate to within ±10 percent of the specified amount. The proportioning device shall have a convenient and accurate means of calibration. A flow indicator or sensor shall be provided with the proportioning device and interlocked with the plant controls, aggregate feed or weigh system, such that production of the mixture shall be consistently maintained and, if there is a stoppage of the lime feed, interrupted.

The method of introducing and mixing the lime and aggregate shall be subject to approval by the Engineer prior to beginning production.

**III. MIX FORMULA**

The Contractor shall submit for the Engineer's approval, a job mix formula within the following design ranges of percent passing each sieve size as noted:

Sieve Size	Percent By Weight Passing Square Mesh Sieves (in)	Production Tolerance (Single Test)
1/2"	100	-2
3/8"	85-100	+/- 5
#4	25-40	+/- 4
#8	19-32	+/- 4
#16	15-23	+/- 3
#30	10-18	+/- 3
#50	8-13	+/- 3
#100	6-10	+/- 2
#200	4-7	+/- 1
<b>Asphalt Content, %</b>	<b>Production Tolerance (Single Test)</b>	
5.0 – 5.5*	+/-0.2	

\*Target asphalt content shall result in a minimum film thickness of 9 microns.

In addition to the job mix submittal, the Contractor shall submit ignition furnace calibration data in accordance with VTM-102 and aggregate property test results prepared by an approved testing laboratory for the aggregate components or aggregate blend.

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Job mixes outside the above design range will be considered by the Engineer based on mix performance documented by the supplier to eliminate or minimize flushing or visual deficiencies and may include changes to gradation, asphalt content and/or the use of fibers. The Engineer may require limited production of less than 300 tons for verification of an acceptable mix, prior to the Engineer's approval of the job mix.

**IV. SURFACE PREPARATION**

Prior to the commencement of paving operations, the existing pavement surface shall be cleaned of all accumulated dust, mud, vegetation or other debris, which may affect the bond of the thin lift hot mix asphalt overlay by the Contractor.

Pavement cracks or joints ¼ inch or more in width shall be cleaned and filled with a sealant material conforming to the Special Provision For Sealing Cracks in Asphalt Concrete Pavements or Hydraulic Cement Concrete Pavement. Quantities and payment will be according to the Special Provision For Sealing Cracks in Asphalt Concrete Pavements or Hydraulic Cement Concrete Pavement.

Pavement markers, thermoplastic pavement marking and tape pavement markings shall be removed prior to the commencement of paving operations. Pavement irregularities greater than 1 inch in depth shall be filled with a material designated in the contract or approved by the Engineer. Payment for the material will be in accordance of Section 315 of the Specifications.

Utility structures shall be protected and referenced prior to paving for location and adjustment (when necessary) after paving at no cost to the Department.

**V. TACK COAT**

Unless otherwise directed in the contract, two options for placing the tack coat are available.

**Option 1:** A tack coat of asphalt emulsion meeting the requirements specified herein or other emulsion approved by the Engineer shall be applied prior to placement of the asphalt concrete. The tack coat shall be placed within 10 seconds of placement of preventive maintenance asphalt concrete overlay unless otherwise directed by the Engineer. At no time should any part of the paving machine come into contact with the tack coat before the overlay applied. The emulsion shall be uniformly applied with a paver spray bar, except hand spray equipment may be used in areas inaccessible to the paver spray bar as directed by the Engineer inaccessible areas are exempt from the 10-second criterion. The emulsion asphalt shall be applied at a temperature recommended by the supplier at a starting rate of 0.25 gallons per square yard +/-0.02 unless otherwise approved by the Engineer.

<b>Test on Emulsion</b>	<b>Method</b>	<b>Min</b>	<b>Max</b>
Viscosity at 77° F, SSF	AASHTO T59	20	100
Sieve Test, % (Note 1)	AASHTO T59	—	0.05
24 hour storage stability, % (Note 2)	AASHTO T59	—	1
Residue from distillation at 400° F, % (Note 3)	AASHTO T59	63	
Oil portion from distillation ml of oil per 100g emulsion			2
Demulsibility, % 35 ml 0.02 N CaCl <sub>2</sub> or 35 ml 0.8% dioctyl sodium sulfosuccinate	AASHTO T59	60	
<b>Test on Residue From Distillation</b>		<b>Min</b>	<b>Max</b>
Elastic Recovery, % (Note 4)	AASHTO T301	60	—

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Penetration @ 77° F, 100 g, 5 sec. dmm.      AASHTO T49      60      150

Note 1: The sieve test is waived if successful application of the material has been achieved in the field.

Note 2: After standing undisturbed for 24 hours, the surface shall show no white, milky colored substance, but shall be a smooth homogeneous color throughout.

Note 3: AASHTO T59 with modifications to include a 400° F +/- 10° F maximum temperature to be held for a period of 15 minutes.

Note 4: With exception that the elongation is 20 cm and the test temperature is 50° F.

**Option 2:** An asphalt binder tack coat meeting the requirements specified in Special Provision for Non-tracking Tack Coat and listed on Approved List 50.1A shall be applied prior to placement of the preventive maintenance asphalt concrete overlay. The tack coat shall be uniformly applied with a spray bar paver or a mechanical distributor, except hand spray equipment may be used in areas inaccessible. The tack coat shall be applied at a temperature recommended by the supplier at a residual rate of 0.14 gallons per square yard +/-0.02 unless otherwise approved by the Engineer.

## **VI. PLACEMENT OF HOT MIX ASPHALT**

The application rates of the overlay shall range from 80 lbs/sy to 85 lbs/sy in order to result in a 3/4" compacted lift thickness.

The thin lift of hot mix asphalt shall be placed by a paver designed for the placement of thin lifts as designated in the contract. The asphalt mix shall be delivered to the paver hopper at a temperature of 315°F +/- 15°F measured in the paver hopper. The paver shall be capable of placing the asphalt mix at a speed of 30 feet per minute. When the base temperature is 50°F or above, placement of the asphalt concrete wearing course shall be permitted.

## **VII. COMPACTION**

Two steel double drum rollers weighing no less than 10 tons shall perform compaction of the asphalt mix. No less than two passes shall be completed before the surface temperature of the asphalt has reached 185°F.

## **VIII. ACCEPTANCE**

The Contractor shall perform a gradation, and asphalt cement content on one sample taken in a random manner approved by the Engineer from each 500 tons of production. The material will be considered acceptable for gradation and asphalt content, if the results obtained are within the tolerance allowed from the job mix formula in the above table. Material represented by test results outside the tolerance may be removed and replaced with acceptable material by the Contractor at no additional cost to the Department at the discretion of the Engineer.

Should visual examination by the Engineer reveal that the material in any load, or portion of the paved roadway is contaminated, segregated, or flushed with asphalt cement, that load, or portion of the paved roadway may be rejected without additional sampling of the material.

## **IX. WARRANTY**

The Contractor shall provide a one-year warranty from the date of final acceptance on all thin hot mix asphalt concrete overlay surfaces. The Department will periodically monitor the overlay surface installed throughout the warranty period for compliance and acceptability. The Contractor shall repair any area that fails before the end of the warranty period and shall do so within 14

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days after Department notification unless otherwise directed by the Department. Failure of the thin hot mix asphalt concrete overlay surface is defined as the loss of adhesion of the material to the underlying layer resulting in a pothole greater than 1 square foot of area (delamination). The Engineer shall notify the Contractor of the date for the warranty inspection at the end of the warranty period and the Contractor shall be present at the inspection.

**X. MEASUREMENT AND PAYMENT**

**Thin hot mix asphalt concrete** will be measured in tons and paid for at the contract unit price per ton, which shall include tack coat, surface preparation (except crack and joint sealing), all materials, additives, labor and equipment as described herein to install and complete the work. Crack and joint sealing will be paid in accordance with Special Provision for Sealing Cracks in Asphalt Concrete Pavements or Hydraulic Cement Concrete Pavement (Prior to Overlay).

Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
Thin Hot Mix Asphalt Concrete	Ton

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UPDATED **Apr 1, 2016**

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