2016 ROAD AND BRIDGE SPECIFICATIONS

DIVISION II—MATERIALS

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GUIDELINES – Use with asphalt plant mix in Bristol, Salem, and Staunton districts. {2007-c211hg0}

cn211-000100-00 **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 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).

(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; Reissued 7-12-16 (SPCN)

cq211-000310-00 [formerly cq211-030100-00]

GUIDELINES – For asphalt maintenance projects in Bristol district coal counties only when called for by the District Maintenance Engineer. {2007-cu211000a}

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[1]

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

10-21-08; Reissued 7-12-16_(SPCN)

cq217-000100-00

GUIDELINES – For use on all projects where concrete is used.{2007-c211hg0}

DENSITY OF LIGHTWEIGHT CONCRETE

Section 217.12(b) is amended by replacing the third paragraph with the following:

Maximum density of freshly mixed lightweight concrete, when tested according to ASTM C138, shall be 120 lbs/ft^3, or as specified on the Plans.

3-5-19 (SPCN)

GUIDELINES — Use when requested by the Designer.{2007-S208B00}

SP208-000100-00

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
SECTION 208—SUBBASE AND AGGREGATE BASE
Crushed Hydraulic Cement Concrete (CHCC)

July 12, 2016

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)**, and 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 screenings; 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 include the following:

Plasticity: Subbase and aggregate base materials shall be either non-plastic (PI=0) or shall conform to Table II-11 of the Specifications when tested according to VTM-7. If the material is classified as non-plastic (PI=0), according to 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:

MATERIAL	PERCENT BY WEIGHT *(MASS)*
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 amended to include the following:

The following applies specifically to the use of Crushed Hydraulic Cement Concrete (CHCC) mixtures in addition to the acceptance criteria specificed in this section:

1. **100% CHCC** shall conform to this special provision.

2. **20% or Less CHCC Blends** shall conform to 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 according to 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.

GUIDELINES — For use on Asphalt Schedule Work - Plant Mix projects. Include SP315-000100-02. {2007-S211HP0}

SP211-000100-02

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

September 13, 2018

SECTION 211—ASPHALT CONCRETE of the Specifications is amended as follows:

Section 211.03(a) SUPERPAVE mixes is amended by inserting the following:

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

Section 211.03—Job-Mix Formula is amended to replace **TABLE II-14** with the following:

TABLE II-14
Mix Design Criteria

Mix Type	VTM (%) Production	VFA (%) Design	VFA (%) Production	Min. VMA (%)	Fines/Asphalt Ratio	No. of Gyrations N Design
SM-9.0A [1,2]	2.0-5.0	75-80	70-85	17.0	0.6-1.3	50
SM-9.0D [1,2]	2.0-5.0	75-80	70-85	17.0	0.6-1.3	50
SM-9.0E [1,2]	2.0-5.0	75-80	70-85	17.0	0.6-1.3	50
SM-9.5A [1,2]	2.0-5.0	75-80	70-85	16.0	0.7-1.3	50
SM-9.5D [1,2]	2.0-5.0	75-80	70-85	16.0	0.7-1.3	50
SM-9.5E [1,2]	2.0-5.0	75-80	70-85	16.0	0.7-1.3	50
SM-12.5A [1,2]	2.0-5.0	73-79	68-84	15.0	0.7-1.3	50
SM-12.5D [1,2]	2.0-5.0	73-79	68-84	15.0	0.7-1.3	50
SM-12.5E [1,2]	2.0-5.0	73-79	68-84	15.0	0.7-1.3	50
IM-19.0A [1,2]	2.0-5.0	69-76	64-83	14.0	0.6-1.3	50
IM-19.0D [1,2]	2.0-5.0	69-76	64-83	14.0	0.6-1.3	50
IM-19.0E [1,2]	2.0-5.0	69-76	64-83	14.0	0.6-1.3	50
BM-25.0A [2,3]	1.0-4.0	67-87	67-92	13.0	0.6-1.3	50
BM-25.0D [2,3]	1.0-4.0	67-87	67-92	13.0	0.6-1.3	50

[1]Asphalt content should be selected at 4.0% air voids for A & D mixes, 3.5% air voids for E mix.
[2]Fines-asphalt ratio is based on effective asphalt content.
[3]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.

Section 211.08 – Acceptance is amended to replace the sixth paragraph with the following:

Asphalt content will be measured as extractable asphalt or weight after ignition. The Contractor shall submit a copy of burn tickets from an ignition oven to the Engineer and all the original tickets shall be available upon Engineer's request. Original tickets shall be maintained on file by the contractor for a period of 5 years or until final acceptance of the applicable contract, whichever is greater.

Section 211.09—Adjustment System is amended to replace the third paragraph with the following:

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% 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 samples. If the Engineer applies adjustment points against two successive lots, the Contractor shall ensure plant adjustment is made prior to continuing production.

Section 211.09—Adjustment System is amended to replace the last paragraph with the following:

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

The Engineer will increase the unit bid price for SM, IM, and BM mixes by 5% if the following criteria are met: 1) the standard deviation of the AC content is within the ranges of 0.0 – 0.15; 2) there are no adjustment points assigned for any sieve sizes as noted in Table II-16; and 3) the average AC content is no less than 0.10% below and no more than 0.20% above the approved mix design AC content.

GUIDELINES — Use when requested by the Designer for asphalt projects. {2007-S315AA0}

SP211-000400-00

VIRGINIA DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION FOR
COLD CENTRAL PLANT RECYCLING MATERIAL

August 7, 2015; Reissued July 12, 2016

I. DESCRIPTION

These specifications cover the requirements for Cold Central Plant Recycling Material (CCPRM). Cold Central Plant Recycling (CCPR) is a process in which recycled asphalt concrete pavement is processed and stabilized using foamed asphalt or emulsified asphalt at a plant and then placed using conventional asphalt paving equipment. **CCPRM shall not be used as a final riding surface.**

II. MATERIALS

1. **Stabilizing Agent (Emulsified or Foamed Asphalt)** – All liquid asphalts used for stabilizing agents shall be emulsions or PG binders (List Nos. 50 and 50.1) on the VDOT Materials Division's Approved List. Emulsified asphalts shall conform to Section 210 of the Specifications; liquid asphalts shall be a neat (i.e., not modified) asphalt that meets Section 211.02 of the Specifications.

2. **Water** – Any water used for mixing shall meet Section 216 of the Specifications.

3. **Crushed Reclaimed Asphalt Pavement (RAP) Material** – RAP material shall meet Section 211.02(j) 4. of the Specifications and **TABLE 1** herein.

TABLE 1
CRUSHED RAP PROPERTIES

Tests	Method	Limit
Deleterious Materials: Clay Lumps and Friable Particles in Aggregate	AASHTO T 112	0.2% maximum
Maximum Sieve Size, 1.5 inches (37mm)	AASHTO T 27	100% Passing,

4. **Aggregate** – Based on the results of the job mixture design(s) or other requirements of this provision, the Contractor shall determine if additional aggregate is required. If the Contractor determines additional aggregate is needed any additional aggregate shall meet Section 203 of the Specifications and **TABLE 2** herein, and it shall be graded to produce a product which meets the specification requirements given in **TABLE 3.** The percentage of additional aggregate used in the mixture shall not exceed 50 percent.

5. **Other Additives** – If necessary, additional additives may be used to meet the requirements in **TABLE 4**. In the case where an additional additive is used, the type and dosage must be described in the Job Mix Formula(s) submitted to the Department.

TABLE 2 AGGREGATE PROPERTIES		
Tests	**Method**	**Limit**
Los Angeles Abrasion Value	AASHTO T 96	45% maximum loss
Sand Equivalent	AASHTO T 176	45% minimum
Maximum size, 100% Passing, Sieve Size	AASHTO T 27	1.5 inches (37mm)
Water absorption	AASHTO T 85	3% maximum

III. Job-Mix Formula

A job-mix formula (JMF) for CCPRM shall be submitted to the Engineer for approval no less than 30 calendar days prior to the start of CCPRM operations. More than one JMF may be required. The gradation of each JMF shall fall within the bands shown in **TABLE 3. If gradation fails to meet the requirements, the Department at its discretion reserves the right to require appropriate measures that may include stopping the work.**

TABLE 3 CCPRM DESIGN RANGE		
	Percentage by Weight Passing Square Mesh Sieves (in)	
Sieve Size	**Lower**	**Upper**
1.5”	100	100
3/4"	--	--
3/8”	--	--
No. 4	--	--
No. 200	2	9

Values based on AASHTO T 27 using washed, pulverized materials, prior to stabilization.

For CCPRM using Foamed Asphalt, cement can be used as a portion of the material passing the No. 200 sieve.

The Contractor shall establish, as part of the JMF, a target percent passing for the 1.5”, 3/4", 3/8”, No. 4 and No. 200 sieves. The JMF(s) shall be created using either existing materials obtained directly from the project site (prior to the start of construction) or from an existing stockpile of Reclaimed Asphalt Pavement (RAP). Sampling shall be conducted at a maximum of once per 2500 lane-feet when sampled from the road. When sampling from a stockpile, material shall be taken from various locations around the stockpile and combined to produce a representative sample. Each JMF shall provide as a minimum the following mix design parameters:

1) Target field density,

2) Percent by weight of all stabilizing agent(s) to be added to the recycled mix,

3) Percent by weight of water (at room temperature) required,

4) Expansion ratio and half-life characteristics and temperature of asphalt binder at the time of dosage into foaming chamber (for mixtures using foamed asphalt), minimum curing

time/set time for the emulsified asphalt and temperature of emulsified asphalt at the time of dosage into the mixture (for mixtures using emulsified asphalt), and

5) Target gradation for sieve sizes 1.5", ¾", 3/8", No. 4 and No. 200 (including any aggregate to be added).

If a change in source materials is made during construction, the Contractor shall create a new JMF(s) and submit it to the Engineer for approval prior to use. The JMF(s) shall meet the criteria of Table 4 at the approved stabilizing agent(s) content.

TABLE 4
CCPRM MIX DESIGN CRITERIA

Item	Test Method	Criteria	Fabrication / Conditioning Procedure
Emulsified Asphalt Stabilized Materials			
1	Moisture Density Relations AASHTO T 180, Method D	Determined by Design	
2	Marshall Stability Test ASTM 5581 (6 inch specimens), AASHTO T 245 (4 inch specimens)	2500 lbs minimum (6 inch (150mm) diameter specimen), or 1250 lbs (4 inch (100mm) diameter specimen)	Three (3) specimens shall be produced at 75 blows per side (or 30 gyrations per AASHTO T 312) and cured at 140ºF (60°C) to constant mass, hold specimens at 104ºF (40°C) for 2 hours in a forced draft oven immediately prior to testing.
3	Retained Stability ASTM 5581 (6 inch specimens), AASHTO T 245 (4 inch specimens)	70% of results of #2	An additional three (3) specimens shall be produced at cured at 140ºF (60°C) to constant mass. Specimens shall then be vacuum saturated to 55-65%, 77ºF (25°C) water bath for 23 hours and 104ºF (40°C) water bath for an additional hour immediately prior to testing
4	Raveling Stability (ASTM D 7196)	Maximum 2%	Specimens shall be produced using a gyratory at 20 gyrations and cured at 50ºF (10°C) for 4 hours at 50% humidity.
5	Thermal Cracking (Indirect Tensile Test, AASHTO T 322)	The critical cracking temperature must be less than or equal to the pavement temperature given for the project climate area and pavement	See Notes 1 through 7 below.

TABLE 4 CCPRM MIX DESIGN CRITERIA			
Item	**Test Method**	**Criteria**	**Fabrication / Conditioning Procedure**
		depth by LTPPBind.	
Foamed Asphalt Stabilized Materials			
1	Moisture Density Relations AASHTO T 180, Method D	Determined by Design	
2	Dry Indirect Tensile Strength (ITS), AASHTO T 283 Section 11	45 psi minimum	Three (3) specimens shall be produced using 75 blows per side (or 30 gyrations per AASHTO T 312) compacted at or below OMC and cured as follows: 4 inch (100 mm) diameter specimens, oven dry at 104ºF (40°C) for 72 hrs and cool to ambient temperature for 24 hrs; 6 inch (150 mm) diameter specimens, air dried for 24 hours, then an additional 48 hours at 104ºF (40ºC) in sealed plastic bag, cool to ambient temperature for 24 hrs.
3	Retained Indirect Tensile Strength, AASHTO T 283 Section 11	Minimum, 70% of the Dry ITS	An additional three (3) specimens shall be produced and cured according to Item 9, and then submerged in 77ºF (25ºC) water bath for 24 hours prior to testing.
4	Expansion Ratio. Wirtgen 2012 Cold Recycling Manual	10 times when Aggregate Temperature is 50ºF to 77ºF (10 ºC to 25 ºC) 8 times when Aggregate Temperature is greater than 77ºF (25 ºC)	
5	Half-Life – Wirtgen 2012 Cold Recycling Manual	6 second minimum	
All materials (emulsified asphalt and foamed asphalt) shall be controlled following Item 1.			
1	Materials Gradation Test (AASHTO T 27), prior to stabilization	Gradation to control field production.	

TABLE 4 CCPRM MIX DESIGN CRITERIA			
Item	**Test Method**	**Criteria**	**Fabrication / Conditioning Procedure**

Notes:

1. Specification temperature shall be chosen using current FHWA LTPPBind software, using the weather station closest to the project. The required temperature shall be the coldest temperature at the top of the recycled layer, using 98% reliability.

2. Samples shall be compacted to 150 mm diameter and at least 115 mm height, compacted to within 1% of design air voids at the design stabilizing agent content. Compacted samples shall be cured at 140ºF (60 ºC) no less than 48 hours. Before testing, sample mass shall be checked every two (2) hours until change in mass between successive checks does not exceed 0.05%. After curing, two specimens shall be sawcut from each compacted sample to 50 mm in height. Perform bulk density testing after sawcutting.

3. Three specimens are required at each of the three (3) testing temperatures.

4. Select two testing temperatures that bracket the specification temperature above. For example, if the specification temperature is -13ºF (-25 ºC), then two of the selected testing temperatures shall be -4ºF and -22ºF (-20 ºC and -30 ºC). A temperature of 14ºF or -40ºF (-10 ºC or -40 ºC) shall be used as the third testing temperature.

5. The tensile strength test shall be performed on each specimen directly after the tensile creep test (at the same temperature as the creep test).

6. The critical cracking temperature is defined as the temperature at the intersection of the thermal stress curve (derived from the creep data) and the tensile strength line (the line connecting the average tensile strengths at the three testing temperatures).

7. To meet this specification, the critical cracking temperature predicted by the Indirect Tensile Test must be less than or equal to the pavement temperature given for the project climate area and pavement depth by LTPPBind.

IV. QUALITY CONTROL PLAN

The Contractor shall be responsible for developing and implementing a Quality Control Plan to ensure that operational techniques and activities are controlled to provide a homogeneous and finished material of acceptable quality meeting this provision. Contractor sampling and testing shall be performed to control the processes and ensure material compliance with this special provision. The Contractor shall provide the Quality Control Plan (according to this special provision) and Job Mix Formula(s) to the Department for approval no less than thirty (30) calendar days prior to the start of CCPRM operations.

For each CCPRM project, a project specific Quality Control Plan is required, and shall include the following (minimum) information:

1. A description of the Contractor's Quality Control organization, including the number of full-time equivalent employees or Sub-Contractors with specific Quality Control

responsibilities, including an organizational chart showing lines of authority and reporting responsibilities.

2. A listing by discipline with the name, qualifications, duties, responsibilities and authorities for all persons proposed to be responsible for Construction Quality Control.

3. A Quality Control Sampling, Testing and Analysis Plan with methods that include a description of how random locations for testing and sampling are determined;

4. Identification and description (including any accreditation) of the laboratory(s) to be used for each type of testing. Lab shall meet Section 106.07 of the Specifications.

5. Specify documentation for Quality Control activities;

6. Procedures to meet contract requirements for corrective action when Quality Control criteria are not met.

7. Procedures to protect stabilized material from receiving excessive moisture from weather events (i.e. rain, fog, etc.) and corrective actions when criteria are not met.

8. Contingency Plan including:

   (1) Inclement weather

   (2) Equipment breakdowns

   (3) Materials shortages

   (4) Deficient density of installed CCPRM

   (5) Material doesn't break or cure in timely manner

   (6) Gradation is outside tolerance(s)

   (7) Production modifications based on changes in ambient and/or material temperature.

V. ACCEPTANCE

1. **Gradation –** CCPRM acceptance for gradation will be based on a mean of the results of eight tests performed on pre-stabilized 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).

   A lot will be considered to be acceptable for gradation if the mean of the test results obtained is within the tolerance allowed for the job-mix formula as specified in TABLE 5. If a lot does not conform to the acceptance requirements for gradation, the Department will determine adjustment points in conformance with Section 211.09 of the Specifications. In addition, variability will be determined according to Section 211.09 of the Specifications.

2. **Stabilizing Agent Content** – The Contractor will provide with each gradation sample, a computer printout of the stabilizing agent content percentage/rate of the plant at the time of sampling. If the dosage rate is outside 0.20 percentage points, then paving/production shall stop and the Contractor shall take corrective measures to bring the dosage rate

within tolerance of the approved JMF. In addition, a daily summary of the stabilizing agent content percentage/rate will be provided to the Department.

3. **Moisture Content** – Moisture content will be reported for each Asphalt Content test. After drying as noted if (a) above, the following equation shall be used:

$$\% \text{ Moisture} = \frac{\text{Original Mass} - \text{Final Mass}}{\text{Final Mass}} \times 100$$

4. **Marshall Stability –** When emulsified asphalt is used as the stabilizing agent, acceptance for Marshall Stability will be based on results of samples taken in a stratified random manner at a frequency of at least one per day or one per 1,000 tons per mix per day if more than 1,000 tons are produced daily. If the results are less than the established job-mix target, the following pay adjustment will be applied for the tonnage represented by the results:

% of Job-Mix Target Marshall Stability	% of Payment
99.0 to 100.0	100
95.0 to 98.9	95
90.0 to 94.9	90
Less than 90.0*	90% pay and Cease Production

* The Contractor shall immediately cease production and notify the Department when results fall below 90.0% of the approved job-mix target. The Contractor shall make any necessary corrective actions to the mix and provide verification to the Engineer that it conforms to the approved job-mix formula. Should the results fall below the minimum specified in Table 4, the material represented by the failing results shall be removed and replaced at no cost to the Department. With approval of the Engineer, subsequent paving operations can resume.

5. **Dry Indirect Tensile Strength -** When foamed asphalt is used as the stabilizing agent, acceptance for Dry Indirect Tensile Strength will be based on results of samples taken in a stratified random manner at a frequency of at least one per day or one per 1,000 tons per mix per day if more than 1,000 tons are produced daily. If the results are less than the established job-mix target, the following pay adjustment will be applied for the tonnage represented by the results:

% of Job-Mix Target Dry Indirect Tensile Strength	% of Payment
99.0 to 100.0	100
95.0 to 98.9	95
90.0 to 94.9	90
Less than 90.0*	90% and Cease Production

* The Contractor shall immediately cease production and notify the Department when results fall below 90.0% of the approved job-mix target. The Contractor shall make any necessary corrective actions to the mix and provide verification to the Engineer that it conforms to the approved job-mix formula.

Should the results fall below the minimum specified in Table 4, the material represented by the failing results shall be removed and replaced at no cost to the Department. With approval of the Engineer, subsequent paving operations can resume.

6. **Half-Life and Expansion Ratio –** The Contractor shall verify and provide reports to the Department confirming that each load of asphalt binder used for foaming meets TABLE 4.

7. **Testing Records** – The Contractor shall prepare separate test reports meeting the requirements of AASHTO R 18. Records documenting the test results from **TABLE 4** shall be provided to the Engineer, unless specified otherwise.

TABLE 5 Process Tolerance						
Tolerance on Each Laboratory Sieve and Asphalt Content: Percent Plus and Minus						
No. Tests	**1 ½"**	**3/4"**	**3/8"**	**No. 4**	**No. 200**	
1	0.0	8.0	8.0	8.0	2.0	
2	0.0	5.7	5.7	5.7	1.4	
3	0.0	4.4	4.4	4.4	1.1	
4	0.0	4.0	4.0	4.0	1.0	
5	0.0	3.6	3.6	3.6	0.9	
6	0.0	3.3	3.3	3.3	0.8	
7	0.0	3.0	3.0	3.0	0.8	
8	0.0	2.8	2.8	2.8	0.7	
12	0.0	2.3	2.3	2.3	0.6	

VI. TESTING

The Contractor shall perform Asphalt Content testing and report the results as extractable asphalt or weight after ignition (VTM-102). In addition, a RAP correction factor shall be determined according to VTM-102. For production samples, testing shall be conducted at a rate of 1 sample per 1,000 tons and the material shall be cured to constant weight in an oven at 225° F (107° C) until the weight loss in a two hour period does not exceed 0.02% by weight (i.e., for a 5000 gram sample, the sample does not lose more than 1 gram in a two hour period). There will be no price adjustment for asphalt content.

VII. EQUIPMENT

1. **CCPRM Plant:** The plant shall be capable of homogeneously incorporating all stabilizing agent(s) and materials up to the sizes shown in **TABLE 3**. The plant shall be capable of delivering the amount of additives to within +/- 0.2% of the required amount by weight of the pulverized bituminous material, except that a capability of adding up to 5% water by weight of the pulverized bituminous material is mandatory. Automated systems shall be used to regulate the application of stabilizing agent(s) and water and shall adjust automatically to the mass of the material being processed. When using foamed asphalt, the plant shall also be outfitted with a test or inspection nozzle at one end of the spray bar that can produce a representative sample. The plant shall be capable of maintaining the temperature of the liquid asphalt at a minimum of 300°F. The plant shall be equipped with the means for the operator to verify the stabilizing agent(s) and water are being evenly distributed and that the correct dosage rates of each are being applied. The plant shall have the ability to print out stabilizing agent(s) and water quantities used during production. The equipment shall be operated according to the manufacturers' recommendations.

2. **Plant Scales:** Scales shall be approved according to Section 109.01 of the Specifications.

3. **Trucks, Truck Scales and Automatic Printer System:** Shall conform to Section 109.01 of the Specifications.

GUIDELINES — For use on all projects.

SS200-002016-01 September 11, 2019

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS
SECTION 200 – GENERAL

SECTION 200 – GENERAL of the Specifications is amended as follows:

Section 200.04 – Acceptance Procedures for Aggregates is amended to replace the fourth paragraph with the following:

The No. 10 sieve shall be the dividing sieve for soils, select material, aggregate subbase material, and aggregate base material. The No. 8 sieve shall be the dividing sieve for asphalt concrete aggregates. That portion of the total aggregate retained on the sieves is defined as *coarse aggregate,* and that portion passing the sieves is defined as *fine aggregate.* Soundness tests will be performed according to the requirements of AASHTO T 104 without regard to these definitions of fine and coarse aggregate. Fine and coarse aggregates for hydraulic cement concrete are distinguishable by their conformity to the series of grading requirements specified in Sections 202 and 203, respectively, except that lightweight aggregate is specified in Section 206.

Section 200.06 – Technician and Batcher Certification is amended to replace the first paragraph with the following:

When the Contract requires a type of technician or batcher defined by this Section, the Contractor shall use a person certified by the Department. The Department will certify technicians and batchers upon a candidate's satisfactory completion of an examination.

Section 200.06(m) – Soils and Aggregate Compaction Technician is inserted as follows:

Soils and Aggregate Compaction Technician: A Soils and Aggregate Compaction Technician conducts density, moisture content, and depth checks of soil placement and aggregate lifts during construction, including stabilized lifts. The Technician also monitors application rates of stabilizing chemicals used in soil and aggregate lifts in the field.

GUIDELINES — For projects requiring fine aggregate.

SS202-002016-02 September 23, 2019

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS
SECTION 202—FINE AGGREGATE

SECTION 202—FINE AGGREGATE of the Specifications is revised as follows:

Section 202.02 – Materials is amended by replacing the first paragraph with the following:

Fine aggregate is classified herein in according to its natural occurrence or method of manufacture as natural sand or stone sand. Natural sand shall consist of grains of hard, sound material, predominantly quartz, occurring in natural deposits or in loosely bound deposits, such as sandstone conglomerate. Stone sand shall consist of sound crushed particles of approved Grade A stone, essentially free from flat or elongated pieces, with sharp edges and corners removed.

Section 202.02 – Materials is amended by inserting the following:

Lightweight aggregate can also be used as a fine aggregate and shall conform to Section 206.

Section 202.03(e) – Deleterious Material is replaced with the following:

Deleterious Material: The amount of deleterious material in sands shall be not more than the following:

Material	% by Weight	AASHTO Test Method
Clay lumps	0.25	T 112
Shale, mica, coated grains, soft or flaky particles	1.0	T 113
Organic material	0	T 21
Total material passing No. 200 sieve by washing[1,2]		T 11 and T 27
For use in concrete subject to abrasion	3	
For other concrete	5	

[1]In the case of stone sand, if the material passing the No. 200 sieve is dust of fracture, essentially free from clay and shale, the percentages shown for use in concrete subject to abrasion and in other concrete may be increased to 5% and 7%, respectively.

[2]In the case of blends of stone sand and natural sand, provided the natural sand contains no greater than 3% passing the No. 200 sieve for use in concrete subject to abrasion and no greater than 5% for other concrete, then the stone sand limits of 5% and 7% shall apply to the blend.

GUIDELINES — For projects requiring coarse aggregate.

SS203-002016-01 September 19, 2019

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS
SECTION 203 – COARSE AGGREGATE

SECTION 203 – COARSE AGGREGATE is amended as follows:

Section 203.02 – Materials is amended by replacing the first paragraph with the following:

Coarse aggregate shall consist of crushed stone, crushed slag, crushed or uncrushed gravel, or lightweight aggregate. Coarse aggregate shall be clean, hard, tough, and durable pieces free from: adherent coatings and deleterious amounts of friable, thin, elongated, or laminated pieces; soluble salts; or organic materials.

Section 203.02(e) – Lightweight coarse aggregate is inserted as follows:

Lightweight coarse aggregate shall conform to Section 206.

GUIDELINES — For projects requiring coarse aggregate.

SS204-002016-01 February 22, 2019

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS
SECTION 204 – STONE FOR MASONRY, RIPRAP, POROUS BACKFILL, AND GABIONS

SECTION 204 – STONE FOR MASONRY, RIPRAP, POROUS BACKFILL, AND GABIONS of the Specifications is amended as follows:

Section 204.02(c) – Porous backfill is replaced with the following:

Porous backfill shall be No. 78 or 8 aggregate, at least Grade B. Crushed glass meeting the gradation requirements specified in Section 203.02(d) may be directly substituted for No. 78 and 8 aggregates. Lightweight aggregate conforming to Section 206 for coarse aggregate and meeting the 3/4-inch or 1/2-inch grading in AASHTO M 195 may be directly substituted for No. 78 and 8 aggregates.

GUIDELINES — For projects requiring coarse aggregate.

SS206-002016-01 September 23, 2019

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFIATIONS
SECTION 206 – LIGHTWEIGHT AGGREGATE

SECTION 206 – LIGHTWEIGHT AGGREGATE is replaced by the following:

206.01 – Description

These specifications cover lightweight aggregate used in the production of hydraulic cement concrete, internally cured concrete using pre-wetted lightweight aggregate, and asphalt surface treatment.

206.02 – Detail Requirements

Lightweight aggregate shall consist of clay, shale, or slate expanded through a sintering or rotary kiln.

The requirements for normal weight aggregate and concrete shall apply to lightweight concrete when a reduced density is specified or when internally-cured concrete (where a portion of the fine aggregate is replaced with pre-wetted lightweight fine aggregate) is specified, except for the following:

(a) **Lightweight aggregate used in hydraulic cement concrete** shall conform to AASHTO M 195 and the following requirements.

1. **Grading**: Gradation for fine and coarse aggregates shall conform to AASHTO M 195. Tests to verify conformance shall be performed in accordance with AASHTO T 27.

2. **Soundness:** Soundness for fine aggregate shall conform to the freeze and thaw requirements of Table II-2. Soundness for coarse aggregate shall conform to the freeze and thaw requirements of Table II-4. Soundness shall be tested in accordance with AASHTO T 103.

3. **Void Content:** Void content requirements for fine aggregate shall not apply to lightweight aggregate.

4. **Deleterious Material:** The amount of deleterious material in fine aggregate shall conform to Section 202 for stone sand. The amount of deleterious material in coarse aggregate shall conform to Section 203.

5. **Abrasion Loss:** Abrasion loss for coarse aggregate shall conform to the Grade A requirements in Table II-5.

6. **Flat and Elongated Particles:** Coarse aggregate shall conform to Section 203.

(b) **Lightweight aggregate used for asphalt surface treatment** shall conform to AASHTO M 195 except that Sections 3, 6, and 8 will not apply. Grading shall conform to Table II-3 except that the maximum percentage by weight of material passing the No. 8 sieve shall be 16% and passing the No. 16 sieve shall be 9%.

Included in the 2019_Supplement_to_the_2016_Specifications page 12

SS208-002016-01 July 7, 2016; Issued October 5, 2016

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

SECTION 208—SUBBASE AND AGGREGATE BASE MATERIALS

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

Section 208.06—Acceptance is amended by replacing the sixth paragraph with the following:

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 the Contractor shall remove that portion from the roadway.

GUIDELINES — For projects requiring asphalt.

SS210-002016-04 **September 16, 2019**

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS
SECTION 210 – ASPHALT MATERIALS

SECTION 210 – ASPHALT MATERIALS 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 Section 211.

(b) **Liquid asphalt material** will be tested for coating ability in accordance with 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 AASHTO M81.

(d) **Medium curing cutback asphalts** shall conform to AASHTO M82.

(e) **Asphalt Binders** shall conform to AASHTO M332, Table 1**.** High polymer Binder shall consist of mixes incorporating a neat asphalt material with a high polymer modification (approximately 7.5%) complying with AASHTO M332 for PG 76E-28(HP) with the exception that the Multiple Stress Creep Recovery (MSCR) shall have a $J_{nr3.2}$ maximum value of 0.1 kPa^{-1} when tested according to AASHTO T350. The minimum MSCR percent recovery at 3.2 kPa shall be 90%. The MSCR test for J_{nr} and percent recovery shall be run at 76°C. The viscosity shall be less than or equal to 3.0 Pa-s, however the Engineer may increase the viscosity limit to 5.0 Pa-s if the binder supplier and Contractor agree that the binder is suitably workable. The Contractor shall use an approved asphalt binder shown on the Department's Approved list 50.

(f) **Cationic Emulsified Asphalt** shall conform to AASHTO M208, except that the penetration for CRS-1h shall be 40 to 110. The Contractor shall use an approved emulsion shown on the Department's Approved List 50.1.

(g) **Polymer Modified Cationic Emulsified Asphalt** shall conform to AASHTO M316. CRS-2L shall have the same requirements as CRS-2P. Penetration requirement at 77 ºF shall be a minimum 70 and maximum 140. The Contractor shall use an approved polymer-modified cationic emulsions shown on the Department's Approved List 50.1.

(h) **Non-tracking tack** will be tested in accordance with Section 210.04. The Contractor shall use an approved non-tracking tack shown on the Department's Approved List 50.1A.

210.03 – Sampling & Testing

Samples shall be taken in the presence of VDOT personnel or a VDOT representative in accordance with AASHTO R-66, with the exception that asphalt emulsion samples shall be a minimum of 0.5 gallons (2 liters).

The Contractor shall ensure the quality control tests on asphaltic materials, as detailed in Section 210.04, are conducted by the Manufacturer.

210.04 – 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. For asphalt binders tested in accordance with AASHTO T350, indication of elastic response shall be determined using the Figure 1 from AASHTO R 92. When the plotted point falls on or above the line shown in Figure 1 in AASHTO R 92, this indicates that the asphalt binder is modified with an acceptable elastomeric polymer. When the plotted point falls below the line on Figure 1 in AASHTO R 92, this indicates that the asphalt binder is not modified with an elastomeric polymer and the sample fails. The percent recovery requirement will not apply to non-polymer binders (PG 64S and PG 64H).

(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.

2. When used in surface treatments, the Coating Ability test shall be conducted subject to the specifications listed in Section 210.02.

(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. Emulsions will be sampled and tested in accordance with AASHTO T59 except that viscosity will be tested in accordance with VTM-64.

   a. Cationic Emulsions- Table 1 (from AASHTO M208 or M316, as applicable), specifically

      (1) Tests on Emulsions:

      - Saybolt Furol Viscosity
      - Sieve Test (if necessary)
      - Demulsibility (if applicable)
      - Particle Charge Test

- Residue by Distillation

(2) Tests on residue from distillation:

- Penetration
- Ductility

b. **CQS-1h** (Quick Set) shall be tested the same as Cationic Emulsions, with the addition of "Quick set Emulsified Asphalt Setting Time (VTM-89)."

c. Latex Modified Cationic Emulsions

(1) CQS-1h Latex Modified (CQS-1hLM)

(a) Tests on Emulsions

- Saybolt Furol Viscosity
- 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 Polymer Modified (CRS-2L and CRS-2P)

(a) Tests on Emulsions

- Saybolt Furol Viscosity
- Sieve Test (if necessary)
- Particle Charge Test
- Residue by Evaporation

(b) Tests on residue by Evaporation

- Penetration
- Ring and Ball Softening Point
- Elastic Recovery at 10°C

2. The manufacturer is not required to perform the Flash Point, Ductility, or Ash Content tests unless the Engineer directs the Contractor to require it. 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:**

Non-Tracking Tack shall meet the requirements based upon the results of tests performed, as specified below:

1. Requirements for Non-Tracking Emulsified Tack

Property	Test Method	Min	Max
Residue by Evaporation, %	AASHTO T59	50	
Viscosity, 77° F	AASHTO T59		150
Sieve (plant)	AASHTO T59		0.1%
Sieve (field)	AASHTO T59		0.3%
Penetration	AASHTO T49		50
Softening Point	AASHTO T 53	57°C	

2. Requirements for Non-Tracking Hot-Applied Tack

Test	Test Method	Min	Max
Penetration, 25°C, 100g, 5s (dmm)	AASTHO T49		35
Softening Point (°C)	ASTM D36	70	
Rotational Viscosity, 149°C, (Pa-s)	AASHTO T316		3.0
Ductility, 25°C, (cm)	ASTM D113-17	20	

210.05 – 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.

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 and are available for verification by VDOT personnel.

5. Only material tested and certified in accordance with the VAAP and on VDOT approved product lists shall be mixed and shipped to VDOT projects.

(b) **Storing:** Asphalt material shall be placed in storage tanks that are free from contamination. Emulsified asphalts stored longer than 30 days from the shipping date on the Bill of Lading shall be retested in accordance with Section 210.04 to verify the material still meets product specifications.

210.06 – 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 provisions of Section 105.18 and Section 106.10.

GUIDELINES — For projects requiring SUPERPAVE asphalt concrete.

SS211-002016-03 January 8, 2019

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS
SECTION 211 – ASPHALT CONCRETE

SECTION 211 – ASPHALT CONCRETE of the Specifications is amended as follows:

Section 211.01 – Description is replaced with the following:

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:

Mix Type	Equivalent Single-Axle Load (ESAL) Range (millions)	Minimum Asphalt Performance Grade (PG)[1]	Aggregate Nominal Maximum Size[2]
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

[1]**Minimum Asphalt Performance Grade (PG)** is defined as the minimum binder performance grade for the job mixes as determined by AASHTO T170 or AASHTO M332.
[2]**Aggregate Nominal Maximum Size** is defined as one sieve size larger than the first sieve to retain more than 10 percent aggregate.
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.

Table II-13 – Asphalt Concrete Mixtures: Design Range is replaced with the following:

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	¾ in	½ in	3/8 in	No. 4	No. 8	No. 30	No. 50	No. 200
SM-9.0 A,D,E					100[1]	90-100	90 max.	47-67			2-10
SM-9.5 A,D,E					100[1]	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

[1]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 is replaced with the following:

TABLE II-14
Mix Design Criteria

Mix Type	VTM (%) Production	VFA (%) Design	VFA (%) Production	Min. VMA (%)	Fines/Asphalt Ratio	No. of Gyrations N Design
SM-9.0A [1,2]	2.0-5.0	75-80	70-85	17.0	0.6-1.3	50
SM-9.0D [1,2]	2.0-5.0	75-80	70-85	17.0	0.6-1.3	50
SM-9.0E [1,2]	2.0-5.0	75-80	70-85	17.0	0.6-1.3	50
SM-9.5A [1,2]	2.0-5.0	75-80	70-85	16.0	0.7-1.3	50
SM-9.5D [1,2]	2.0-5.0	75-80	70-85	16.0	0.7-1.3	50
SM-9.5E [1,2]	2.0-5.0	75-80	70-85	16.0	0.7-1.3	50
SM-12.5A [1,2]	2.0-5.0	73-79	68-84	15.0	0.7-1.3	50
SM-12.5D [1,2]	2.0-5.0	73-79	68-84	15.0	0.7-1.3	50
SM-12.5E [1,2]	2.0-5.0	73-79	68-84	15.0	0.7-1.3	50
IM-19.0A [1,2]	2.0-5.0	69-76	64-83	14.0	0.6-1.3	50
IM-19.0D [1,2]	2.0-5.0	69-76	64-83	14.0	0.6-1.3	50
IM-19.0E [1,2]	2.0-5.0	69-76	64-83	14.0	0.6-1.3	50
BM-25.0A [2,3]	1.0-4.0	67-87	67-92	13.0	0.6-1.3	50
BM-25.0D [2,3]	1.0-4.0	67-87	67-92	13.0	0.6-1.3	50

[1]Asphalt content should be selected at 4.0% air voids for A & D mixes, 3.5% air voids for E mix.
[2]Fines-asphalt ratio is based on effective asphalt content.
[3]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.

Section 211.04(e)4 – Type E(HP) asphalt mixtures is inserted as follows:

Type E(HP) asphalt mixtures shall consist of mixes incorporating a neat asphalt material with a high polymer modification (approximately 7.5%) complying with AASHTO M332 for PG 76E-28(HP) with the exception that Multiple Stress Creep and Recovery (MSCR) shall have a $J_{nr3.2}$ maximum value of 0.1 kPa^{-1} when tested according to AASHTO T350. The minimum MSCR %

recovery at 3.2 kPa shall be 90%. The MSCR test for J_{nr} and % recovery shall be run at 76°C. The viscosity shall be less than or equal to 3.0 Pa-s, however the Engineer may increase this limit to 5.0 Pa-s if the binder supplier and contractor agree that the binder is suitably workable. HP designated mixtures shall not contain more than 15% RAP material.

Section 211.05 – Testing is amended by deleting the eighth and ninth paragraphs.

Section 211.08 – Acceptance is amended by replacing the sixth paragraph with the following:

Asphalt content will be measured as extractable asphalt or weight after ignition. The Contractor shall submit a copy of burn tickets from an ignition oven to the Engineer and all the original tickets shall be available upon Engineer's request. Original tickets shall be maintained on file by the Contractor for a period of 5 years or until final acceptance of the applicable contract, whichever is greater.

Included in the 2019_Supplement_to_the_2016_Specifications page 21

SS212-002016-01 May 13, 2016; Issued July 12, 2016

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

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:

Gaskets for pipe and box culvert sections shall conform to the following: Rubber gaskets for ductile iron pipe and fittings shall conform to AWWA C111. Rubber gaskets for concrete and metal pipe shall conform to ASTM C443. Rubber gaskets for plastic pipe shall conform to ASTM F 477. Flexible cellular sponge or expanded rubber gaskets for metal pipe shall conform to ASTM D1056. Gaskets for box culvert sections shall conform to ASTM C1677. All gaskets shall conform to the ozone cracking resistance described in Section 237.02 of the Specifications.

GUIDELINES — For projects requiring SUPERPAVE asphalt concrete.

SS217-002016-02 September 27, 2019

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS
SECTION 217—HYDRAULIC CEMENT CONCRETE

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

Section 217.02(c) – Fine aggregate is replaced with the following
:

Fine aggregate shall conform to Section 202 for Grading A or Section 206.

Section 217.02(d) – Coarse aggregate is replaced with the following:

Coarse aggregate shall conform to Sections 203 or 206 for the class of concrete being produced.

Section 217.02(m) – Lightweight aggregate is inserted as follows:

Lightweight aggregate shall conform to Section 206.

Section 217.07 – Proportioning Concrete Mixes is replaced with the following:

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

The Contractor shall have at least one certified Concrete Field Technician on the project for single or multiple incidental concrete placements. The Contractor shall have at least one certified Concrete Field Technician present at each site during the placement of pavements, bridge decks, bridge piers and abutments, box culverts, and any placement of 50 or more cubic yards.

The certified Concrete Field Technician shall provide control over methods used for discharging, conveying, spreading, consolidating, screeding, finishing, texturing, curing, and protecting the concrete. Deficiencies in conformance to specification requirements and good concreting practices shall be corrected by or under the direction of the certified Concrete Field Technician as soon as they begin to occur.

The concrete producer shall plan batching operations so that delays do not occur because of the absence of certified personnel.

Concrete shall be proportioned to secure the strength and durability required for the pavement or the part of the structure in which it will be used.

The Contractor shall submit concrete mixture designs conforming to the Specifications for the class of concrete specified for the Engineer's approval prior to the start of concrete mixing operations.

The Contractor shall furnish and incorporate a water-reducing and retarding admixture in bridge deck concrete and in other concrete when conditions are such that the initial set may occur prior to completion of approved finishing operations. The two admixtures shall not be used together in the same concrete batch unless tests indicate the admixtures are compatible in accordance with

Section 215.02(b). If the Engineer elects to waive the requirement to have both admixtures, the Contractor may supply and incorporate only a water-reducing admixture, in lieu of having both the water-reducing and retarding admixtures normally required in the bridge deck concrete, to provide the required slump without exceeding the maximum water/cement ratio. The Contractor shall demonstrate to the Engineer that use of the admixture will not cause segregation.

Concrete shall be air entrained. The air content shall conform to Table II-17.

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

The mix designs as determined by the respective option below 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. The quantities of coarse and fine aggregates used in concrete production shall not deviate by more than ±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.

(a) **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. The mix design shall conform to Table II-17 or other parts of the Contract for the class and type 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.

(b) **Option 2 – Trial Batch Mix Design Method:**

The minimum cementitious content requirement in Table II-17 will 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 will be waived provided the coarse aggregate meets the nominal maximum size as required in Table II-17 for the respective class of concrete.

The Contractor 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 small scale laboratory batches or 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°F.
- Air content of the trial batches shall be 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 ±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 C31 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 if 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 Section 217.07(d). 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:

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

Once the proposed mix design has been established, the Contractor 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 if and only if 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 will be waived when the trial batching is performed –with truck batches.

(c) **Option 3 - Documented Field Experience Method:**

The minimum cementitious content requirement in Table II-17 will 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 will 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 if the Contractor has a satisfactory test record of pervious field experience as described in Section 217.07(d), 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.

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

An acceptable test record to document previous field experience 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

The test record may be based on non-Department projects if documentation of the sources of concrete strength test results accompanies the submittal.

For latex hydraulic cement content, the dry weight ratio of cement/fine aggregate/coarse aggregate shall be 1:2.5:2. With the Engineer’s approval a maximum adjustment of 10 percent may be made in aggregate weights to compensate for grading changes and variable specific gravity.

The Contractor shall adjust batch quantities during the course of the work to compensate for changes in workability caused by differences in the characteristics of aggregates and cements permitted within the specification requirements. Such adjustments shall be made only by the Contractor and shall not change the yield.

If concrete cannot be obtained with the required workability or consistency or within the maximum design water content with the materials furnished, the Contractor shall make changes to secure the desired properties subject to the limiting requirements specified in Table II-17 and the Engineer’s approval. The Contractor shall use a fine aggregate having a void content of less than 50.5 percent, except when lightweight fine aggregate is used. When the void content of the fine

aggregate is more than 50.5 percent and the concrete does not have the desired properties, in lieu of changing the fine aggregate, the Contractor may take one or more of the following actions:

- Use a water-reducing admixture.
- Increase the cement content.
- Change the source of coarse aggregate.
- In hot weather, add ice or otherwise reduce the temperature to increase the workability.
- Submit other recommendations to the Engineer for approval.

The Contractor shall make trial batches under the observation of the Engineer to verify that concrete of the required workability and consistency is obtained within the specified water content when any of the actions is exercised. At least one trial batch shall be made with the concrete temperature at approximately 90°F to verify that the concrete mixture has sufficient workability and consistency without exceeding the specified water content. The concrete mixture shall be redesigned when the fineness modulus of the fine aggregate changes more than 0.2 from the original design and the concrete does not have the desired properties. Costs incurred because of adjustments of concrete mixture designs and for trial batches shall be borne by the Contractor with no additional compensation being made.

Section 217.08 – Acceptance is replaced with the following:

(a) **Hydraulic cement concrete sampling:** For the purpose of acceptance testing for consistency, air content, density (unit weight), and preparation of specimens for strength testing or permeability testing, hydraulic cement concrete shall be sampled from the mixing/delivery unit in accordance with ASTM C172, except the sample shall be permitted to be taken after discharge of a minimum of two cubic feet of concrete from the delivery vehicle. The two cubic feet discharged shall not be used as part of the test sample or in the Work. The Contractor shall provide a receptacle conforming to ASTM C31 for the Department's use in obtaining the sample. Additional (but not alternate) points of sampling may be required by the Engineer when deemed necessary.

(b) **Air and 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 supplied. If either determination yields a result that is outside of the allowable range for air content or consistency, the Engineer will use the following procedure:

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 shall notify the concrete 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 ASTM C231 or ASTM C173. Acceptance or rejection will be based on the results obtained from these tests.

A mixture that contains the minimum amount of water consistent with the required workability shall be used. Consistency will be determined in accordance with ASTM C143. The Engineer will not allow adding cement to loads previously rejected for excessive water content or unsatisfactory consistency.

(c) **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 ASTM C31 and ASTM C39. The use of ASTM C42 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, the Contractor shall take immediate steps 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. The Department will not assess a calculated penalty less than $500. However, 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 so that the concrete test cylinders are kept in a continuously moist condition and within a temperature range of 60°F to 80°F. The chamber shall be equipped with a continuously recording thermometer accurate to ±2°F for the duration of concrete cylinder curing. The Contractor shall provide the data from the continuously recording thermometer within time frames as approved by the Engineer. 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. The Engineer will approve the location of the chamber prior to its placement.

When use of high-early-strength hydraulic cement concrete is required, it shall conform to Table II–17 except that the 28-day compressive strength requirement shall be obtained in 7 days. The Contractor may use up to 800 lbs/yd^3 of Type I, Type II or Type III cement to produce high-early-strength concrete.

(d) **Concrete Temperature** shall be measured in accordance with ASTM C1064.

(e) **Density (Unit Weight)** of freshly mixed concrete will be measured, when required by the Engineer, in accordance with ASTM C138.

(f) **Quality Assurance for Low Permeability Concrete:**

1. **General**

The Contractor shall prepare and cast test specimens on at least two trial batches using job materials, with permissible combination of cementitious materials, for testing by the Department for permeability and strength at least 5 weeks 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 to be acceptable.

2. **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 at most 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, the percent reduction in payment for that lot of concrete shall be calculated by multiplying 0.005 by each coulomb above the coulomb value in Table II-17 by the concrete item Contract unit price 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 concrete item Contract unit price. The Engineer will reject any concrete with a coulomb value that exceeds the maximum required in Table II-17 by 1000 coulombs. However, bridge deck concrete with any coulomb value exceeding the maximum required value by over 1000 coulomb may be accepted by the Engineer at 95 percent of the Contract unit price if the concrete in question has the required strength, meets the 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 cases deck grooving will not be required. The Engineer will not allow the placement of epoxy overlays over latex overlays. The Contractor shall make the adjustment to the roadway grade 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 Contract unit price if it has the required strength, meets the other specification requirements and the Contractor applies, at his own expense, one coat of epoxy Type EP 3B and one coat of epoxy EP 3T in conformance with Section 243.02, on top of the pier caps or abutment seats.

(g) **Bond Strength for Silica fume concrete, latex-modified concrete and very-early-strength latex-modified concrete overlays:**

The Contractor shall perform the bond strength testing in accordance with VTM 92 at a minimum age of 7 days; when scheduling the lane closure for testing, the inconvenience to the public shall be minimized. The bond strength shall be at least 150 psi; otherwise the substrate concrete shall fail at a depth of at least 0.5 inch over at least 50%of the test area. A minimum of one test result (based upon the average of three test specimen results) shall be conducted on each placement.

Table II-17A - Price Reduction or Action Taken due to f'_{cyl} not meeting the specification value f'_c listed in Table II-17 is replaced with the following:

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[1,2]	Concrete is a Pay Item	Concrete is Not a Pay Item
f'_{cyl} is greater than or equal to 98% f'_c	A[3]	A[3]
f'_{cyl} is greater than or equal to 90% f'_c and less than 98% f'_c	B[4]	C[5]
f'_{cyl} is less than 90% f'_c	D[6]	D[6]
f'_{cyl} is not available due to the Contractor's inappropriate handling and storage of specimens in accordance with ASTM C31	D[6]	D[6]

[1] f'_c is the 28-day design compressive strength requirement found in Table II-17.
[2] 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.
[3] A = full payment
[4] B = pay reduction = [((f'_c - f'_{cyl})/f'_c) x Contract unit price for concrete per yd^3 x number of yds^3 the concrete represents] or $500, whichever is greater.
[5] C = pay reduction = [((f'_c - f'_{cyl})/f'_c) x 5 x Contractor's invoice price for concrete per yd^3 x number of yds^3 the concrete represents] or $500, whichever is greater.
[6] D = The Contractor shall submit an investigative plan stamped by a Professional Engineer holding a valid license to practice engineering in the Commonwealth of Virginia outlining how the Contractor shall demonstrate that the in-place concrete meets the structural strength requirements for the design. The Engineer will not permit any reduction in concrete strength below $0.9f'_c$ for barriers, parapets, railings, etc. The Engineer will approve the investigative plan for all other applications prior to the execution of the investigation. All costs associated with this investigation shall be borne by the Contractor. After the investigation is completed, the Contractor shall submit a report to the Engineer showing the results of the Professional Engineer's analysis, testing and conclusions as well as any recommended actions 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.

Section 217.11 – Self-Consolidating Concrete (SCC) is replaced with the following:

When specified or designated on the Plans, SCC shall be designed as the Class of Concrete specified in Table II-17 and conform to all the requirements herein except as outlined below. Combined aggregate grading and Viscosity Modifying Admixture (VMA) may be used. The VMA shall conform to ASTM C494, Type S. Synthetic fibers from the Department's Approved List 35 may be added to control cracking. Shrinkage-reducing admixture may be added to control shrinkage if approved by the Engineer. The maximum size of aggregate shall not be larger than: 3/4-inch; 1/5 the narrowest dimension between the sides of the forms; 1/3 the slab depth; and 3/4 of the minimum clear spacing between individual reinforcing bars or wires, bundles of bars, individual tendons, bundled tendons or ducts.

The Contractor shall furnish the Engineer a mix design for the SCC which is proportioned according to the project specific criteria for compressive strength, air content, slump flow, VSI, J-Ring value, and segregation factor. The maximum water-cementitious materials ratio shall be 0.45 unless otherwise approved by the Engineer. The Contractor shall use the same components in the trial batches as are to be used in the project including: coarse and fine aggregates; water; source and type of cement; supplementary cementitious materials; and admixtures, including any site-added admixtures intended to be used.

(a) **Slump flow** shall be measured in accordance with ASTM C1611, Procedure B. The slump flow shall be 26 ±3 inches, and there shall be no visible segregation of the mix in the spread. The slump flow shall be compared to the slump flow with the J-ring in accordance with ASTM C1621.

(b) **Visual Stability Index (VSI)** Rating in accordance with ASTM C1611 shall not exceed 1.

(c) **J-Ring Flow** as measured by ASTM C1621 shall not be more than 2 inches different from slump flow.

(d) **Stability (performed on trial batches)** of the concrete shall be determined in the laboratory prior to approval of the SCC mixture using test method ASTM C1610. Concrete mixtures shall have a maximum static segregation (segregation factor) of 15%.

(e) **Permeability (if specified) and Strength Test Specimens**shall be sampled in accordance with Section 217.08(c) and fabricated in accordance with ASTM C1758.

Section 217.12 – Low Shrinkage Class A4 Modified Concrete is replaced by the following:

Low shrinkage Class A4 modified concrete shall be either Normal or Lightweight, as specified on the Plans.

(a) **Normal weight:** The cementitious materials content shall be less than 600 pounds per cubic yard. High-early-strength hydraulic cement concrete as described in Section 217.08(b) shall not be used.

The 28 day drying shrinkage shall be less than 0.035% based on average of three specimens when tested in accordance with ASTM C157. Specimens shall be moist-cured for 7 days prior to testing for drying shrinkage. A Shrinkage Reducing Admixture (SRA) shall be used unless the 28 day drying shrinkage is < 0.035% without the admixture. A fixed amount of SRA dosage can be used without additional drying shrinkage testing if approved by the Engineer.
The Contractor, at his expense, shall prepare a minimum 3-cubic-yard trial batch of the mix at least 5 weeks before the proposed start date of production. The trial batch will be used to verify compliance with the shrinkage requirements listed herein and the minimum compressive strength, permeability, air void content, and slump listed in Table II-17. The Contractor shall prepare the trial batch with the same equipment to be used on the project. The Contractor shall obtain the services of a Departmentapproved independent laboratory to perform the trial batch testing. Test results shall be furnished to the Engineer for review and approval. The Engineer will not authorize the Contractor to proceed with production of low shrinkage Class A4 modified concrete for the work required by the Contract until the test results verify conformance with the requirements stated herein.

(b) **Lightweight:** Use lightweight concrete with lightweight aggregates in conformance with AASHTO M 195.

The maximum cementitious materials content shall be 650 lbs/yd^3. All other requirements shall conform to those listed in Table II-17 for Low Shrinkage Class A4 Modified concrete.
Maximum density of freshly mixed lightweight concrete, when tested in accordance with ASTM C138, shall be 120 lbs/ft^3, or as specified on the plans.

Section 217.13 – Latex-modified Concrete, Very-Early Strength (LMCVE), for Bridge Deck Overlays is replaced with the following:

LMCVE shall conform to the requirements of Section 217 and Table II-17 except as modified herein.

Cement shall be approximately 1/3 calcium sulfoaluminate (C4A3S) and 2/3 dicalcium silicate (C2S) or other hydraulic cement that will provide a Latex-Modified Concrete that meets the physical requirements indicated in this section.
The LMCVE shall contain a minimum 658 lbs/yd$_3$ of rapid hardening cement, 15% styrene butadiene latex by weight of cement, water not to exceed a water-cement ratio of 0.40, and aggregates as proposed by the Contractor for the mixture. The compressive strength minimum shall be 2500 psi at 3 hours and 3500 psi at 24 hours. Compressive strength specimens shall be cured in the molds in the same environment as the in-place LMCVE they represent. Specimens

shall remain undisturbed at the site for 2 hours and shall be transported to the testing lab for testing.

Prior to placing overlay the Contractor shall calibrate the mobile concrete mixers. Once the mixers are calibrated, the mixtures shall be sampled and tested for slump and air content. The Contractor shall prepare and test specimens to demonstrate that the concrete mixture shall obtain a compressive strength of at least 2500 psi within 3 hours at the curing temperatures in which the overlay will be placed, and a compressive strength of at least 3500 psi at an age of 24 hours. All trial batching and preparatory work prior to placing LMCVE shall be at the Contractor's expense. During the placement of the overlay the Contractor shall take samples for testing for compressive strength. Permeability, slump and air content measurements will not be required, but may be performed by the Engineer.

Section 217.15 – Lightweight Concrete is inserted as follows:

Lightweight aggregate shall be proportioned for incorporation into the mix in accordance with AASHTO M 195. Prior to producing concrete for a project, the lightweight aggregate shall be in a moisture condition such that the total moisture exceeds the absorbed moisture by a minimum of one percentage point.
The air content for lightweight concrete will be measured by the Department in accordance with ASTM C173.

The fresh lightweight concrete density shall be a maximum 120 lbs/ft^3 unless noted otherwise on the Plans and determined in accordance with ASTM C138. If specified in the Contract, the equilibrium density of the hardened concrete shall be determined in accordance with ASTM C567.

When the lightweight aggregate is used to provide internal curing, when concrete will be delivered by pumping, or when otherwise required by the Engineer, the aggregate shall be pre-wetted to obtain an absorbed moisture content equal to at least the 24-hour absorption as determined by AASHTO T 84 or T 85. In lieu of testing, the Engineer may allow use of a minimum absorbed moisture content equal to the recommendation of the lightweight aggregate manufacturer or as known by the concrete supplier through previous experience to provide the desired performance.
If no previous experience is available for the field performance of the lightweight aggregate, the Contractor shall perform freeze/thaw resistance testing of the hardened concrete mixture on a trial batch in accordance with ASTM C666. The minimum durability factor shall be 90%. This information shall be provided to the Engineer for approval prior to the placement of lightweight concrete.

At least two weeks prior to the initial placement of lightweight concrete, a pre-pour meeting be held with the Contractor, Subcontractors, the concrete producer, and the lightweight aggregate supplier to discuss the production of the lightweight concrete and the placement operations. On the first day of production, the lightweight aggregate manufacturer's representative shall be at the batch plant and/or at the project site to provide technical assistance.

GUIDELINES — For projects requiring SUPERPAVE asphalt concrete.

SS221-002016-01 January 3, 2018

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS
SECTION 221—GUARDRAIL

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

Section 221.02—Detail Requirements is amended to replace the first paragraph with the following:

Guardrail shall consist of rail or cable elements and fastenings fabricated to develop continuous beam or cable strength when installed. Guardrail materials conforming to AASHTO M180 and M30 specification requirements shall be supplied by manufacturers included on the Department's Approved List 12. Manufacturers of guardrail materials shall participate and be in compliance with the AASHTO National Transportation Product Evaluation Program Evaluation of Highway Guardrail Manufacturers.

GUIDELINES — For use on all projects with steel reinforcement.

SS223-002016-03 July 3, 2019

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

SECTION 223—STEEL REINFORCEMENT

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

Section 223.02(a)3 – Welded wire fabric is raplaced with the following:

Welded wire fabric shall conform ASTM A1064. When used in continuously reinforced hydraulic cement concrete pavement wire fabric shall be deformed, furnished in flat sheets, and shall conform to ASTM A497, high yield of 70,000 psi.

Section 223.02(e) – Corrosion Resistant Reinforcing Steel, Class I is replaced with the following:

Corrosion Resistant Reinforcing Steel, Class I shall conform to AASHTO M 334M/M 334-17 Type 1035 CS with a minimum chromium content of 9.2% or UNS (Unified Numbering System for Metals and Alloys) Designation: S24100.

Section 223.02(f) – Corrosion Resistant Reinforcing Steel, Class II is replaced with the following:

Corrosion Resistant Reinforcing Steel, Class II shall conform to AASHTO M 334M/M 334-17. UNS Designation: S32101.

Section 223.02(g) – Corrosion Resistant Reinforcing Steel, Class III is replaced with the following:

Corrosion Resistant Reinforcing Steel, Class III shall conform to AASHTOM 334M/M 334-17 . UNS Designations: S24000, S30400, S31603, S31653, S31803, and S32304.

GUIDELINES — For use on all projects with structural steel**.**

SS226-002016-01 **September 27, 2019**

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS
SECTION 226 – STRUCTURAL STEEL

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

Section 226.02(c) – Anchor Bolts is replaced with the following:

Anchor bolts shall conform to AASHTO M 314 or ASTM F1554.

1. **Anchor bolts for general use** shall be Grade 36. Nuts and washers shall conform to ASTM A563 and ASTM F844 respectively. Threads shall be coarse series.
2. **High-strength anchor bolts** shall conform to ASTM F1554, Grade 55 or AASHTO M314, Grade 55, with supplemental requirements of S1. Nuts and washers shall conform to ASTM A563, Grade DH and ASTM F436 respectively.
3. **Galvanization** of steel anchor bolts, nuts, and washers shall conform to ASTM A153.
4. **Anchor bolts for railings** shall conform to (c)1 herein, and shall be hot-dipped galvanized.

Section 226.02(h) – High-Strength Bolts, Nuts, Washers, and Direct Tension Indicators is renamed **High-Strength Bolts** and replaced with the following:

High-Strength Bolts shall conform to ASTM F3125 Grade A325 Type 1, unless specified otherwise. Nuts, Washers, and Direct Tension Indicators (DTIs) shall conform to specifications appropriate for the grade and type of bolt according to the table below. All nuts shall be Heavy Hex, and all washers shall be Hardened.

High-Strength Bolts	Nuts	Washers	DTIs
ASTM F3125, Grade A325, Type 1[1]	ASTM A563, Grade DH	ASTM F436	ASTM F959
ASTM F3125, Grade A325, Type 3	ASTM A563, Grade DH3	ASTM F436	ASTM F959
ASTM F3125, Grade A490, Type 1	ASTM A563, Grade DH ASTM A194, Grade 2H	ASTM F436	ASTM F959
ASTM F3125, Grade A490, Type 3	ASTM A563, Grade DH3	ASTM F436	ASTM F959
ASTM A449, Type 1[1]	ASTM A563, Grade DH	ASTM F436	ASTM F959
ASTM A449 Type 3	ASTM A563, Grade DH3	ASTM F436	ASTM F959

[1]All bolts conforming to ASTM F3125, Grade A325, Type 1 or ASTM A449, Type 1 and their nuts, washers, and DTIs shall be galvanized.

1. Bolts, nuts, and washers conforming to ASTM F3125 Grade A490 shall not be galvanized. High-strength bolts used with unpainted weathering steel shall conform to ASTM F3125 Grade A325, Type 3; ASTM A449, Type 3; or, when specified, ASTM F3125 Grade A490, Type 3. All use of high-strength bolts conforming to ASTM A449 shall be approved, in writing, by the Engineer. ASTM A449 bolts shall conform to the rotational capacity testing requirement in ASTM F3125 Grade A325 and these Specifications.

2. The maximum hardness for bolts conforming to ASTM F3125 Grade A325 shall be 33Rc. The maximum tensile strength for such bolts shall be 150 kips per square inch for bolts 1 inch or less in diameter and 120 kips per square inch for larger bolts.

3. High-strength fasteners (plain and coated) shall pass a rotational-capacity test as detailed in VTM 135.

   a. Bolts shall be proof-load tested in accordance with ASTM F606, Method I. Full-size bolts shall be wedge tested in accordance with ASTM F606. Nuts shall be proof-load tested in accordance with ASTM F606. Galvanized bolts shall be wedge tested after galvanizing. Galvanized nuts shall be proof-load tested in accordance with ASTM F606 only after overtapping, galvanizing, and lubricating operations are completed.

   b. Galvanized bolts, nuts and washers shall be hot-dipped galvanized in accordance with ASTM A153. The Contractor may use mechanically galvanized bolts, nuts, and washers that conform to ASTM B695, Class 50 if the bolts are to be topcoated with paint.

      When galvanized nuts conforming to ASTM A563 are specified, the amount of over-tapping may be less than specified; however, all nuts in each lot shall be over-tapped by the same amount. Galvanized nuts shall be lubricated in accordance with ASTM A563 using a lubricant sufficiently tinted so as to be readily visible.

      Galvanized bolts, nuts, and washers shall have the galvanization measured for thickness. Measurements for bolts shall be taken on the wrench flats or top of the bolt head. Measurements for nuts shall be taken on the wrench flats.

      When galvanized washers are specified, hardness testing shall be performed after galvanizing. The coating shall be removed prior to testing.

   c. All bolts, nuts, and washers shall be furnished with a marking that readily identifies their manufacturer. The Contractor shall provide the Engineer with an example of such marking and the manufacturer's certification for each bolt, nut, and washer supplied to the project. The Contractor shall ensure that two samples from each rotational capacity lot, each sample consisting of one bolt, nut, washer, and DTI (if used on the project), are submitted to the Department for testing, and are accompanied by all documentation.

      Documentation shall indicate the results of all tests and processes performed on the hardware, the name of the testing facility, address where the tests were performed and the date of testing. Test results of bolts and nuts shall also indicate the lot number of the product. Bolts, nuts, and washers from different rotational-capacity lots shall not be shipped in the same container. In addition, shipping containers shall be marked with the rotational-capacity test lot number of the product supplied.

Section 226.02(i) – Steel Plate is inserted as follows:

Steel plate shipped to the project site as plate shall have the direction of roll indicated on the plate to provide direction to the field for cutting along the appropriate axis when making components in the field. The plate shall be blast cleaned to either SSPC SP-6 or SP-10 finish and have an arrow painted along the direction of roll with the letters "DOR" above it using an inorganic zinc rich primer from the Department's Approved List 13.

GUIDELINES — For projects requiring pipe and pipe arches.

SS232-002016-03 May 21, 2019

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

SECTION 232—PIPE AND PIPE ARCHES

SECTION 232—PIPE AND PIPE ARCHES of the Specifications is amended as follows:

Section 232.02(c)1 – **Corrugated steel culvert pipe and pipe arches** is replaced with the following:

Corrugated steel culvert pipe and pipe arches shall conform to AASHTO M36 except that helically formed pipe shall be tested in accordance with AASHTO T249 at the rate of one test per week per corrugation machine per work shift. The Contractor shall maintain records of such test for a period of 24 months. Pipe shall be fabricated from materials conforming to AASHTO M218 for galvanized pipe, AASHTO M274 for aluminum coated pipe, AASHTO M246 for polymer coated pipe and AASHTO M289 for aluminum zinc alloy coated pipe. Steel spiral rib pipe shall be of smooth wall spiral rib construction. When connecting bands or flared end sections are required, helically formed pipe shall have rerolled ends with a minimum of two annular corrugations. End sections shall be produced in accordance with AASHTO M36 from materials conforming to the applicable requirements of AASHTO M218 for use with galvanized pipe, AASHTO M274 for use with aluminum-coated or polymer coated pipe, or AASHTO M289 for use with aluminum zinc alloy-coated pipe.

Joints shall be installed as specified on the plans, in the event the joint is not specified, it shall be a Silt-Tight joint.

Section 232.02(c)4a – Steel encasement pipe is replaced with the following:

Steel encasement pipe shall conform to ASTM A139 or ASTM A53 with a minimum wall thickness of 0.500 inch and shall have beveled edges suitable for welding or be threaded. The hydrostatic test for such pipe will not be required.

Section 232.02(c)7 – Concrete-lined corrugated steel pipe is deleted, and paragraphs 8 and 9 are renumbered to 7 and 8, respectively.

Section 232.02(l) – Polypropylene (PP) Pipe is replaced with the following:

Polypropylene (PP) Pipe: PP corrugated culvert and storm drain pipe and its fittings and joining systems shall conform to AASHTO M330. Pipes with nominal diameters of 12 inches through 30 inches, inclusive, shall be Type S (double-wall). Pipes with nominal diameters of 36 inches through 60 inches, inclusive, shall be Type S or Type D (triple-wall). The Department will not permit the use of PP less than 12 inches or greater than 60 inches in nominal diameter.

Section 232.02(m) – Pipe Joints is inserted as follows:

Pipe joints shall meet the requirements of AASHTO R 82 for Soil-Tight, Silt-Tight, Leak-Resistant or other special design, except that leak-resistant joints shall not require infiltration or exfiltration testing in the field, and joints shall be on VDOT Materials Division Approved List for pipe joints. Pipe Joint systems shall be submitted to the Materials Division certifying the system meets the requirements for Soil-Tight, Silt-Tight, Leak-Resistant or Special Design in order to be on the approved list.

Section 232.02(n) – Pipe to Structure Connections and Waterstops is inserted as follows:

Manufactured pipe connection systems for connecting pipe to drainage structures shall be submitted to the Materials Division certifying the system meets the requirements for Soil-Tight, Silt-Tight, or Leak-Resistant in order to be on the approved list. When resilient connectors for silt tight connections are specified for concrete pipe to concrete structures, the connectors shall meet the requirements of ASTM C1478. When resilient connectors for leak resistant connections are specified for flexible pipe to concrete structures, the connectors shall meet the requirements of ASTM F2510.

When waterstops are specified, they shall meet the requirements of ASTM F2510, Section 4.1 Materials and Manufacture and Section 4.2 Mechanical Devices. The waterstop shall have a 1 inch minimum keylok anchor embedded into the concrete or mortar connection on pipe sizes below 18 inch diameter and 1.5 inch for pipe 18 inches and greater in diameter. There shall be a minimum 2 inches of concrete or mortar connection around the rubber gasket to permit proper consolidation around the gasket. All waterstops shall be secured to the pipe with a take-up clamp before applying mortar.

GUIDELINES — For projects requiring electrical and signal components.

SS238-002016-02 August 20, 2019

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS
SECTION 238 – ELECTRICAL AND SIGNAL COMPONENTS

SECTION 238 – ELECTRICAL AND SIGNAL COMPONENTS of the Specifications is amended as follows:

Section 238.02(d) – PE Conduit is replaced with the following:

PE Conduit shall conform to NEMA TC-7 for high-density PE duct except that the wall thickness of conduit with a diameter of 1-1/4 inches and less shall conform to UL-651 for heavy-wall PVC conduit. Conduit shall have a carbon black loading of 2.5 ±0.5 percent by weight in accordance with ASTM D1603.

Section 238.02(g)2a – Signal cables from the controller cabinet to signal heads is replaced with the following:

Signal cables from the controller cabinet to signal heads shall be minimum No. 14 AWG copper.

Section 238.02(g)2e – Pedestrian detection cables is inserted as follows:

Pedestrian detection cables shall be two conductor No. 14 AWG copper**.** IMSA 19-1 or 20-1 cables shall be used for aerial or duct installations. IMSA 19-5 or 20-5 cables shall be used for direct buried installations.

Section 238.02(h)7 – Backplates for signal heads is replaced with the following:

Backplates for signal heads may be either aluminum or aluminum composite, unless otherwise specified in the Plans. ABS plastic shall not be used.
Aluminum shall be 0.06-0.08 inch thick, smooth, flat, and free of metal burrs and splinters. Aluminum alloy shall conform to Section 229.

Aluminum Composite shall be a 0.07-0.09 inch thick aluminum plastic composite. The composite shall be manufactured by bonding two panels of aluminum to an extruded polyethylene core using a thermoset adhesive under tension and pressure in a continuous process. The interior coating of the aluminum panels shall be coated with an epoxy chromate primer for added bonding strength with the polyethylene.

a. **Black (non-reflective) Signal Backplates**:

   Aluminum black signal backplates shall be entirely powder coated black in accordance with manufacturer's instructions.
   For aluminum Composite black backplates, both sides of the aluminum composite exterior shall be entirely coated with black fluoropolymer paint.

b. **High-Visibility Signal Backplates (HVSBs)** shall be preassembled by the manufacturer with a 3-inch retroreflective fluorescent yellow border on the outside of the front of the backplate.

All retroreflective sheeting on the front surface of the backplate shall be ASTM D4956, Type XI fluorescent yellow from the Materials Division's Approved Products List 46, which shall be warrantied in accordance with Section 247.03.

Retroreflective sheeting shall be applied to the backplate with a zero-degree orientation (downweb direction perpendicular to the road) and adhered to the backplate in accordance with the retroreflective sheeting manufacturer's instructions. Retroreflective sheeting shall be butt spliced when more than one piece of sheeting is adhered to the backplate. For each surface of the backplate, a maximum of five butt splices shall be used for three-section and four-section signal heads, and a maximum of nine butt splices shall be used for five-section signal heads.

Aluminum HVSBs shall be manufactured by covering the entire front surface with the retroreflective sheeting specified above, then subsequently applying black color to the front surface, except for the outer 3 inches of the front of the backplate which shall remain fluorescent yellow. The black color on the front surface of the backplate shall be obtained by screen printing or applying acrylic film. Black color on the back surface of Aluminum HVSB backplates shall be obtained by applying acrylic film to the aluminum or by screen printing on sheeting applied to the aluminum. Aluminum preparation and application of sheeting and film shall be in accordance with the sheeting manufacturer's instructions.

Aluminum Composite HVSBs surfaces shall be coated with black fluoropolymer paint suitable for proper retroreflective sheeting adhesion. Retroreflective sheeting shall be applied to the outer 3 inches of the front surface of the backplate as specified above.

Section 238.02(h)20 – Photoelectric controls is replaced with the following:

Photoelectric controls shall be used at the electrical service control center for roadway lighting system or electrical service for overhead sign lighting structures to turn fixtures ON or OFF, typically in sync with dusk to dawn. Photoelectric controls shall conform to ANSI C136.10, and the following:

- Locking-type/twist-lock photoelectric control with locking-type receptacles
- Use a cadmium sulfide or filtered silicon type sensor
- Fail-on type so that the lights stay 'ON' if the photoelectric control fails to operate
- Factory preset and calibrated to turn on at 1.5 ± 0.5 footcandles (fc), not exceeding 3 fc
- Ratio of the turn-off to turn-on light level shall not exceed 1.65:1
- Output control relay shall have a time delay of 2 to 15 seconds to prevent false turn-off due to headlights and other transient light source.
- Normal operating voltage shall be in the range of 120V - 277V or 347V- 480V
- Capable of controlling load of up to1000 Watts for tungsten and 1800 volt-amps for ballast
- Have a built-in metal oxide varistor of minimum 160-Joules for surge/transient protection
- Operating temperature shall be in the range of -40ºF to 158ºF (-40ºC to 70ºC)
- Cover shall be an impact and ultraviolet-resistant material that complies with the flammability and impact requirements of UL-773
- Warranted against defects in materials and manufacture for at least 4 years.

All the receptacles at the electrical service control cabinets and LED fixtures (with the exception of individual sign lighting fixtures), shall be prewired 7-pin twist lock ANSI C136.41 complaint and shall come with rain-tight shorting cap.

Included in the 2019_Supplement_to_the_2016_Specifications page 23

SS242-002016-01 February 1, 2017

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

SECTION 242—FENCES

SECTION 242—FENCES of the Specifications is amended as follows:

Section 242.02(c)**2 – Posts for temporary silt fences** is replaced with the following:

Posts for temporary silt fences shall be a nominal 2 by 2 inch oak, or steel having a weight of at least 1.25 pounds per linear foot.

GUIDELINES — For use on all projects with roadside development materials.

SS244-002016-02 April 15, 2019

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS
SECTION 244 – ROADSIDE DEVELOPMENT MATERIALS

SECTION 244 – ROADSIDE DEVELOPMENT MATERIALS of the Specifications is amended as follows:

Section 244.02(b) – Topsoil is amended by replacing the first paragraph with the following:

Topsoil may be naturally occurring or may be manufactured and shall be free of foreign objects such as refuse, woody vegetation, stumps, roots, brush, stone larger than 3/4 inches, viable noxious weeds or weed seed, plant propagules, and any other material toxic or deleterious to plant growth. Maximum size of other foreign objects shall be 2 inches. Topsoil shall conform to the following:

Section 244.02(b)1 – Class A topsoil is replaced by the following:

Class A topsoil shall be stockpiled topsoil that has been salvaged from within the project limits in accordance with Section 303.04(a). It shall be the original layer of the soil profile formed under natural conditions, and its physical, chemical, and biological characteristics shall be consistent with the "A" horizon soil profile as defined by the United States Department of Agriculture–Natural Resources Conservation Service (USDA–NRCS) Soil Survey Division.

Section 244.02(b)2 – Class B topsoil is amended by replacing the first paragraph with the following:

Class B topsoil shall be topsoil furnished from sources outside the project limits and shall be either the original top layer of a soil profile formed under natural conditions, or manufactured top soil. Regardless of the source, all topsoil shall have the physical, chemical, and biological characteristics consistent with the "A" horizon soil profile as defined by USDA–NRCS Soil Survey Division, If the topsoil is not manufactured topsoil, then it shall consist of natural, friable, loamy soil without admixtures of subsoil or foreign materials. The Contractor shall provide to the Engineer a source of materials for topsoil planned for use on the project prior to use.

Section 244.02(l) – Rolled Erosion Control Products is replaced by the following:

Rolled Erosion Control Products:

1. **Rolled Erosion Control Products (Standard EC-2)** shall conform to Table II-22C and the following requirements. EC-2 products shall be designed for use on geotechnically stable slopes and channels as detailed herein.

   a. **EC-2, Type 1** shall be a relative short-term single-net erosion control blanket or open weave textile. EC-2, Type 1 shall be one of the following materials: (1) an erosion control blanket composed of processed degradable natural or polymer fibers mechanically-bound together by a single degradable synthetic or natural fiber netting to form a continuous matrix; or (2) an open weave textile composed of processed degradable natural or polymer yarns or twines woven into a continuous matrix. EC-2, Type 1 shall typically have a 12-month functional longevity from the date of installation and be designed for shear stresses up to 1.50 pounds per square foot, for use on up to 1V:3H slopes and channels.

   b. **EC-2, Type 2** shall be a relative short-term double-net erosion control blanket. The blanket shall be composed of processed natural or polymer fibers mechanically bound between two natural fiber or

synthetic nettings to form a continuous matrix. EC-2, Type 2 materials shall typically have a 12-month functional longevity from the date of installation and be designed for shear stresses up to 1.75 pounds per square foot, for use on up to 1V:2H slopes and channels.

c. **EC-2, Type 3** shall be an extended term erosion control blanket or open weave textile. EC-2, Type 3 blankets shall be one of the following materials: 1) an erosion control blanket composed of processed slow degrading natural or polymer fibers mechanically-bound together between two slow degrading synthetic or natural fiber nettings to form a continuous matrix; or 2) an open weave textile composed of processed slow degrading natural or polymer yarns or twines woven into a continuous matrix. EC-2, Type 3 material shall typically have a 24-month functional longevity from the date of installation and be designed for shear stresses up to 2.00 pounds per square foot, for use on slopes up to 1V:1.5H and channels.

d. **EC-2 Type 4** shall be a long-term erosion control blanket or open weave textile. EC-2, Type 4 blankets shall be one of the following materials: (1) an erosion control blanket composed of processed slow degrading natural or polymer fibers mechanically-bound together between two slow degrading synthetic or natural fiber nettings to form a continuous matrix; or (2) an open weave textile composed of processed slow degrading natural or polymer yarns or twines woven into a continuous matrix. EC-2, Type 4 material shall typically have a 36-month functional longevity from the date of installation and be designed for shear stresses up to 2.25 pounds per square foot, for use on up to 1V:1H slopes and channels with.

2. **Permanent Rolled Erosion Control Products (Standard EC-3)** shall be permanent turf reinforcement mats conforming to Table II-22D and the following:

a. **EC-3, Type 1** shall be a non-degradable mat of sufficient thickness, strength and void space for permanent erosion protection and vegetation reinforcement on geotechnically stable slopes with gradients up to 1V:1.5H, channels with design shear stresses up to 6.0 pounds per square foot, and on other areas where design flow conditions exceed the limits of sustainability for mature natural vegetation.

b. **EC-3, Type 2** shall be a non-degradable mat with sufficient thickness, strength and void space for permanent erosion protection and vegetation reinforcement on geotechnically stable slopes with gradients up to 1V:1H, channels with design shear stresses up to 8.0 pounds per square foot, and other areas where design flow conditions exceed the limits of sustainability for mature natural vegetation.

c. **EC-3, Type 3** shall be a non-degradable mat with sufficient thickness, strength and void space for permanent erosion protection and vegetation reinforcement for use on geotechnically stable slopes up to 1V:0.5H, channels with design shear stresses up to 10.0 pounds per square foot, and other areas where design flow conditions exceed the limits of sustainability for mature natural vegetation.

Section 244.02(o) – Sediment Tubes is replaced with the following:

Sediment Tubes shall be composed of compacted material such as certified 100% weed free curled excelsior wood with 80% of the fiber being at least 4 inches in length, natural coconut fibers (bristle and mattress form obtained from freshwater cured coconut husk.), certified 100% weed free agricultural straw, certified 100% weed free hardwood mulch, or a mix of these materials or other VDOT-accepted materials enclosed by a tubular flexible outer netting material consisting of one of the following:

- Seamless, photo-degradable, high-density, polyethylene, polyester, or ethyl vinyl acetate, treated with ultraviolet stabilizers.
- Seamless, non-degradable, high-density polyethylene.
- Seamless, non-degradable, high-density polypropylene.

- Coir netting or coir fastening twine.

Sediment tubes of washed shredded recycled rubber particles with a minimum of 98% of metal removed contained in seamless, non-degradable, high-density polypropylene may be used for Inlet Protection and Temporary Check Dams in accordance with the Standard Drawings.

Straw, curled excelsior wood, or natural coconut products that are rolled up to create a sediment tube without an outer netting will not be allowed. Natural pine needles, leaf mulch, and grass clipping-filled sediment tubes will not be permitted.

Included in the 2019_Supplement_to_the_2016_Specifications page 25

SS245-002016-05 February 26, 2018

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS

SECTION 245—GEOSYNTHETICS AND LOW PERMEABILITY LINERS

SECTION 245—GEOSYNTHETICS AND LOW PERMEABILITY LINERS of the Specifications is amended as follows:

Section 245.03—Testing and Documentation is amended by replacing the third paragraph with the following:

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; mass per unit area, UV degradation, and asphalt retention values are typical.

Section 245.03(e) – Prefabricated Geocomposite Pavement Underdrain is replaced with the following:

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/D6364	Min. 40 psi at 20% deflection after 24 hrs at 0 deg F and at 125 deg F
Water flow rate (after 100 hr at 10 psi normal confining pressure gradient of no more than 0.1)	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.

Section 245.03(f) – Geocomposite Wall Drains is replaced with the following:

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/D6364	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 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 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.

Section 245.03(h) – Dewatering Bag is replaced with the following:

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 D6241	Min. 150 lb
Flow rate	ASTM D4491	Min. 0.189 ft3/sec/ft2(min)
Permittivity	ASTM D4491	Min. 1.2 sec-1
UV resistance	ASTM D4355	Min. 70% at 500 hr
AOS	ASTM D4751	Max. 100 sieve

Section 245.03(i) – Pavement Interlayer is replaced with the following:

Pavement Interlayer products shall be listed on the Materials Division Approved List No. 63. All interlayer material shall be from National Transportation Product Evaluation Program (NTPEP)-compliant manufacturers, and shall be evaluated through NTPEP; tests not covered by the NTPEP Geosynthetics Work Plan shall be performed by independent, certified laboratories and submitted to the State Materials Engineer. Testing for products not covered by NTPEP shall be on a minimum 3-year cycle also. Terms defined by ASTM D4439 shall apply herein, except when they conflict with terms defined by Section 101.

For Paving Fabric, Paving Mat, Paving Grid, and Composite Paving Grid, the Contractor shall provide asphalt retention rates (ASTM D6140), material properties specified herein, and manufacturer's recommendations for tack application to the Engineer at the preconstruction meeting. The total minimum tack coat application rate sprayed in the field shall meet the manufacturer's recommendations, but shall be clearly totaled at the pre-construction meeting as the components of the asphalt retention rate and the additional rate based on the anticipated surface condition of pavement.

1. **Paving Fabric, Type I & II:** All paving fabrics shall meet the requirements of the table below, and have 50% retained strength after 500 hours of UV exposure when tested in accordance with ASTM D4355.

Property	Test Method	Type I	Type II
Mass per unit area, min (oz/yd^2)	ASTM D5261	4.5	4.1
Grab Tensile Strength, min (lbs.)	ASTM D4632	120	101
Grab Tensile Elongation, min (%)	ASTM D4632	50	50
Melting point, min (°F)	ASTM D276	320[1]	320[1]

[1]320 is the softening/melt point of polypropylene. See Section 318.03 for more on placement temperature.

2. **Paving Mat; Type I, II, and III:** Materials used for paving mat shall be a hybrid of two or more of the following material types: fiberglass, polyester, or polypropylene. Paving mat shall meet the requirements of the table below.

Property	Test Method	Type I	Type II	Type III
Tensile Strength, min (lb/in)	ASTM D5035	280	140	45
Ultimate Elongation, max (%)	ASTM D5035	5	5	5
Melting Point, min (°F)	ASTM D276	320[1]	320[1]	320[1]
Mass/Unit Area, min (oz/yd^2)	ASTM D5261	7.0	4.0	4.0

[1]320 is the softening/melt point of polypropylene, which is lower than either polyester or fiberglass. See Section 318.03 for more on placement temperature.

3. **Paving Grid: Type I, II, & III:** Materials used for paving grids shall be comprised of fiberglass and shall meet the requirements of the table below. Some paving grids are self-adhesive and some require nails for installation. Tack coat required for the installation of the overlay shall be specified with the paving grid. Refer to manufacturer's recommendations for tack coat type and application rate.

Property	Test	Type I	Type II	Type III
Tensile Strength, min (lbs/in)[1]	ASTM D6637, Method A, modified	560 x 1,120	560	280
Aperture size, min (in)	Calipered	0.5	0.5	0.5
Elongation, max (%)	ASTM D6637	3	3	3
Mass per area, min (oz/yd^2)	ASTM D5261	16	10	5.5
Melting Point, min (°F) (fabric component – if applicable)	ASTM D276	420[2]	420[2]	420[2]

[1]For Type I, machine and cross direction respectively. Strengths for Type II and III are in both directions

4. **Composite Paving Grids: Type I, II, & III:** Composite paving grids shall consist of a fiberglass, polyester, or polyvinylacetate (PVA) paving grid integrated with a nonwoven geotextile and meet the requirements of the table below.

Property	Test	Type I	Type II	Type III
Tensile Strength, Min (lbs/in)[1]	ASTM D6637, Method A, modified	560 x 1,120	560	280
Aperture size, Min (in)	Calipered	0.5	0.5	0.5
Elongation, Max (%)	ASTM D6637	5	5	10
Mass per area, Min (oz/yd^2)	ASTM D5261	16	10	5.5
Melting Point, Min (°F) (fabric component)	ASTM D276	320[2]	320[2]	320[2]

[1]For Type I, machine and cross direction respectively. Strengths for Type II and III are in both directions.
[2]320 is the assumed softening/melt point of PVA. See Section 318.03 for more on placement temperature.

5. **Pavement Repair and Bridge Deck Waterproofing Strip Membrane: Materials used for strip membranes shall be comprised of** composite self-adhering rubberized asphalt attached to a pavingfabric, a paving mat, or a paving grid and meet the requirements of the table below.

Property	Test Method	Type I
Strip Tensile Strength, min (lb/in)	ASTM D882	50
Puncture Resistance, min (lbs)	ASTM E154	200
Permeance-Perms, max	ASTM E-96 Method B	0.05
Pliability - 1/4" Mandrel 180º Bend at -25 ºF	ASTM D146	No cracks in fabric or rubberized asphalt

Section 245.03(k) – Fabric for Use in Turbidity Curtains is inserted as follows:

Fabric for Use in Turbidity Curtains: This fabric shall consist of synthetic fabric coated with suitable elastomeric or polymeric compound. The coating shall have a high resistance to weathering, hydrocarbons, fresh and salt water, and temperature extremes. The curtain shall form a continuous vertical and horizontal barrier for the entire width and length of each section. Seams, if required, shall be either vulcanized welded or sewn and shall develop the full strength of the fabric.

The curtain fabric shall meet the minimum requirements noted below:

Physical Properties of Turbidity Curtain Fabric

Physical Property	Requirement
Weight (oz/yd^2)	
Type I	18
Type II	22
Type III	22
Grab Tensile Strength (ASTM D 4632)	300 lbs
UV Inhibitor	Required

GUIDELINES — For use on all projects with reflective sheeting.

SS247-002016-01 **March 6, 2019**

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS
SECTION 247 – REFLECTIVE SHEETING

SECTION 247 – REFLECTIVE SHEETING of the Specifications is 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. Reflective sheeting shall be certified in accordance with Section 106.06.

247.02 – Detail Requirements

Reflective sheeting shall be selected from the Department's Approved List 46. Except where outdoor testing is not required (as noted herein), the sheeting and any applied coatings including inks, overlay films, and all other coatings shall be tested by either NTPEP, the Department, or other Department-approved facilities, to ensure all the materials and the completed sign meet the outdoor weathering requirements in ASTM D4956 for both Retroreflectivity and Daytime Color (Chromaticity and Luminance Factor %).

Reflective inks and overlay films shall be approved by the sheeting manufacturer.

All orange and pink sheeting shall be fluorescent (except where noted).

(a) **ASTM D4956, Type IX and XI Reflective Sheeting** shall be used for **Overhead Permanent Signs** as specified in Section 701.

Retroreflectivity and Color requirements shall be maintained for the values listed in ASTM D4956 after 3 years on the outdoor weathering test rack.

(b) **ASTM D4956, Type IV, IX and XI Reflective Sheeting** shall be used for **Non-Overhead Permanent Signs** as specified in Section 701.

Retroreflectivity and Color requirements shall be maintained for the values listed in ASTM D4956 after 3 years on the outdoor weathering test rack.

(c) **ASTM D4956 Type IX or XI Reflective sheeting** shall be used on **rigid devices that are not permanent signs or object markers,** including but not limited to the following:

- Temporary rigid (non-rollup) signs
- Delineators (Standard ED-2, Standard ED-3, barrier, and guardrail)
- Permanent impact attenuators (except permanent sand barrels)
- Guardrail end terminals
- Type 3 barricades (Orange sheeting does not have to be Fluorescent)
- Group 2 channelizing device vertical panels
- Directional indicator barricades
- STOP/SLOW hand paddles
- Rear panels of truck- and trailer-mounted attenuators
- Barrier panels temporarily installed on traffic barrier service

The yellow portions of such devices shall be fluorescent.

Retroreflectivity and Color requirements for all colors (except fluorescent orange and fluorescent pink) shall be maintained for the values listed in ASTM D4956 after 3 years on the outdoor weathering test rack.

The retroreflectivity of fluorescent orange and fluorescent pink sheeting after 1 year on the outdoor weathering test rack shall be at least 50% of the retroreflectivity values specified for new (non-weathered) sheeting.

Color requirements for fluorescent orange and fluorescent pink sheeting shall be maintained after 1 year on the outdoor weathering test rack.

(d) **ASTM D4956 Type IV reflective sheeting** meeting the ASTM D4956 Supplementary Requirements (S2) shall be used on the following traffic control devices:

- Tubular markers
- Flexible post delineators
- Drums (See Note 1 below)
- Temporary sand barrels (See Note 1 below)
- Permanent sand barrels
- Cones

Note 1 - Reflective sheeting on temporary sand barrels and drums shall also conform to the following table:

Table 1 - Minimum Coefficient of Retroreflection R_A
(R_A =Candelas per foot-candle per square foot)

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
0.5	+45	40	20

The retroreflectivity of the sheeting after 1 year on the outdoor weathering test deck shall be at least 50 percent of the retroreflectivity values specified for new (non-weathered) sheeting, except that outdoor weathering testing is not required for reflective sheeting on cones.

(e) Color requirements shall be maintained after 1 year on the outdoor weathering test rack, except that outdoor weathering testing is not required for reflective sheeting on cones.**Grade DOT-C2 Conspicuity Tape** shall conform to the retroreflectivity requirements of 49 CFR 571.108 and shall be used to delineate the back frame of trailer mounted traffic control devices (including, but not limited to, Portable Changeable Message Signs, Automatic Flagger Assistance Devices, electronic arrow boards, speed trailers, camera trailers, and portable lights) and traffic control devices equipped with gate arms. **Daytime Color shall conform to the requirements of ASTM D4956.**

Outdoor weathering testing is not required for Grade DOT-C2 conspicuity tape.

(f) **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)

Observation Angle (°)	Entrance Angle (°)	White	Green	Fluorescent Orange	FluorescentPink
0.2	–4	500	60	200	200
0.2	+30	200	24	80	100
0.5	-4	225	-	90	100
0.5	+30	85	27	35	35
1.0	-4	20	10	10	10
1.0	+30	15	-	8	10
1.5	-4	5	-	3	2
1.5	+30	4	-	1.5	2

Outdoor weathering testing is not required for reflective sheeting used on rollup signs.

(g) **Reflective sheeting on hand signaling flags and gate-arm flags** shall conform to the following:

Minimum Coefficient of Retroreflection R_A

Observation Angle (°)	Entrance Angle (°)	Orange/Red Sheeting (R_A)
0.2	-4	50

247.03 – Reflective Sheeting Warranty Requirements

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 in ASTM D4956 for Outdoor Weathering Photometric Requirements for All Climates.

Loss of colorfastness is considered to have occurred if the color of the sheeting is not within the color specification limits in ASTM D4956 during the full duration of the warranty period.

Warranty periods shall begin on the date of installation. Contractor shall label permanent signs with date of installation as per Section 701.

(a) **Permanent Devices with ASTM D4956 Types IX or XI sheeting:** 12-year warranty with 7 years being 100% full replacement covering all material and labor costs associated with fabrication and installation of the sign or device and the final 5 years being 100% sheeting material replacement cost.

(b) **Permanent Devices with ASTM D4957 Types IV sheeting:** 10-year warranty with 7 years being 100% 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% sheeting material replacement cost.

(c) **Temporary rigid signs, rollup signs, and other temporary devices:** 3-year full replacement covering all material and labor costs associated with fabrication of the sign or device.

Included in the 2019_Supplement_to_the_2016_Specifications page 30

SS248-002016-01 August 1, 2018

VIRGINIA DEPARTMENT OF TRANSPORTATION
2016 ROAD AND BRIDGE SUPPLEMENTAL SPECIFICATIONS
SECTION 248—STONE MATRIX ASPHALT CONCRETE

SECTION 248—STONE MATRIX ASPHALT CONCRETE of the Specifications is amended as follows:

Table II-24 – SMA Design Range is replaced with the following:

TABLE II-24
SMA Design Range

Type No. (See Note)	**Percentage by Weight Passing Square Mesh Sieves (in)**							
	1	3/4	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 in the Proposal, e.g., SMA 12.5 (64E-22).

Section 248.04—Acceptance is amended by deleting the seventh and eighth paragraphs: