

**SECTION 1019**  
**SHOULDER AND SLOPE MATERIAL**

**1019-1 GENERAL**

Use shoulder and slope material to construct shoulders and plate slopes with materials capable of supporting vegetation. Material that contains roots, root mats, stumps or other unsatisfactory material will not be acceptable.

**1019-2 SHOULDER AND SLOPE BORROW**

Use borrow sources in accordance with Article 1018-2.

Use soil consisting of loose, friable, sandy material with a PI greater than 6 and less than 25 and a pH ranging from 5.5 to 7.0. Remove stones and other foreign material 2 inches or larger in diameter.

Soil consisting of a pH ranging from 4.0 to 5.5 may be accepted if the following limestone application used. Substitute listed limestone application rates when performing seeding and mulching operations. Standard lime application rate is 4000 lbs. per acre. Soil type should be identified during the soil analysis. Soils with a pH below 4.0 should not be used. Soils with a pH above 7.0 require acidic amendments to be added. Contract the Roadside Environmental Unit for recommendations to lower pH below 7.0.

pH Test Result	TABLE 1019-1 LIMESTONE APPLICATION RATE (lbs / acre) TO RAISE pH		
	Sandy Soils	Silt Loam Soils	Clay Loam Soils
4.0 to 4.4	4000 + 1000	4000 + 4000	4000 + 6000
4.5 to 4.9	4000 + 500	4000 + 3000	4000 + 5000
5.0 to 5.4	4000	4000 + 2000	4000 + 4000

**1019-3 AGGREGATE SHOULDER BORROW**

Use aggregate shoulder borrow (ASB) that meets the following gradation in Table 1019-2.

TABLE 1019-2 GRADATION OF AGGREGATE SHOULDER BORROW	
Sieve	Percentage Passing
1 1/2"	100
1/2"	55-95
#4	35-74

**SECTION 1020**  
**ASPHALT MATERIALS AND ADDITIVES**

**1020-1 DELIVERY AND ACCEPTANCE OF ASPHALT MATERIALS**

Asphalt materials are accepted at the source of shipment subject to the conditions herein.

All asphalt transport tankers, including rail and truck tankers, shall have a sampling valve in accordance with Asphalt Institute Publication MS-18, AASHTO R66, ASTM D140 or a comparable device acceptable to the Engineer.

Each transport tanker delivering asphalt materials to the project or rail siding shall keep a running log showing the date, destination and type and grade of material hauled on each trip. Print, stamp, or write in ink information appearing in the log and have available for examination upon request.

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1 Furnish with each shipment 2 copies of a delivery ticket. Ensure both copies accompany the  
2 shipment and are delivered to the Engineer or his representative at the destination. The  
3 delivery ticket shall contain the following information:

- 4 (A) Name of Producer/Supplier and location
- 5 (B) A statement that the material has been tested and meets AASHTO specifications or is  
6 being provided by an approved supplier under Approved Supplier Certification (ASC)
- 7 (C) The grade of the material
- 8 (D) If applicable, the rotational viscosity in Pascal-Seconds (Pa-S) at 135°C and 165°C
- 9 (E) If applicable, the recommended laboratory mixing and compaction temperature (°C for  
10 the PGAB)
- 11 (F) Delivery ticket number
- 12 (G) Date and time loaded (mm/dd/yyyy AM:PM)
- 13 (H) Date and time shipped (mm/dd/yyyy AM:PM)
- 14 (I) State project or purchase order number
- 15 (J) NCDOT assigned batch number
- 16 (K) Destination
- 17 (L) Name of consignee
- 18 (M) Trailer or car number
- 19 (N) Producer's or Supplier's storage tank and batch number
- 20 (O) Quantity loaded in tons or gallons (kg/L) at 60°F
- 21 (P) Specific Gravity or lbs/gal (kg/L) at 60°F
- 22 (Q) Loading temperature
- 23 (R) Net gallon at 60°F
- 24 (S) If applicable, the brand, grade and percentage or quantity of anti-strip additive
- 25 (T) See below for the required certification format

26 When anti-strip additive is introduced into the asphalt binder, ensure the delivery ticket notes  
27 the brand, grade and percentage or quantity at which the additive was introduced.

28 The Contractor's asphalt materials supplier shall furnish to the Materials and Tests Unit  
29 a typical viscosity-temperature chart at the beginning of each calendar year and a new chart  
30 whenever a change in production results in a shift of 5°F or more.

31 Furnish a statement of certification from the supplier and a separate statement of certification  
32 from the transporter. Sign each certification by an authorized representative of the supplier or  
33 transporter. Stamp, write or print these certifications on the delivery ticket, or attach to the  
34 delivery ticket.

35 Unless otherwise approved by the Engineer, the following form shall be used in the supplier's  
36 certification:

37 This is to certify that this shipment of \_\_\_\_\_ gallons/liters or  
38 tons/metric tons of \_\_\_\_\_ grade asphalt including \_\_\_\_\_  
39 gallons/liters of \_\_\_\_\_ anti-strip meet all requirements of  
40 NC Department of Transportation Specifications.

41 Signed \_\_\_\_\_  
42 Authorized Representative of Supplier

43 When no anti-strip additive is included with the load, the supplier shall indicate zero (0) in the  
44 gallons field and "NA" in the anti-strip field on the above certification.

1 Unless otherwise approved by the Engineer, the following form shall be used in the  
2 transporter's certification:

3 This is to certify that this transport tank was clean and free from  
4 contaminating materials when loaded. The material transported on the  
5 previous load in this tanker was \_\_\_\_\_.

6 Signed \_\_\_\_\_  
7 Authorized Representative of Transporter

8 Failure to sign the certifications by either the supplier or transporter will be cause to withhold  
9 use of the material until a sample can be taken and tested, except where an alternative testing  
10 and invoicing procedure has been pre-approved by the Engineer.

11 The Engineer reserves the right to sample and test any shipment regardless of whether or not  
12 the above conditions have been met and to reject any material not meeting the Specifications.

### 13 **1020-2 ASPHALT BINDER**

14 Use performance graded asphalt binder meeting AASHTO M 320 Table 1. See Article 610-3  
15 for the specified grades.

16 Submit a Quality Control Plan for asphalt binder production in conformance with  
17 AASHTO R 26 to the Materials and Tests Unit. The Department's Performance Graded  
18 Asphalt Binder QC/QA Program shall be implemented in accordance with Article 1020-6.

19 Where modification of the asphalt binder is required to meet the specified grade, accomplish  
20 the modification using a styrene butadiene styrene (SBS), styrene butadiene rubber (SBR),  
21 styrene butadiene (SB) polymer or other modifiers approved by the Engineer to modify  
22 asphalt to meet the grade specified before delivery to the asphalt plant. Other polymers shall  
23 be pre-approved and listed by the Materials and Tests Unit. Air blown asphalt will not be  
24 permitted.

### 25 **1020-3 ASPHALT EMULSION**

26 Submit a QC Plan for asphalt emulsion. The Department's Asphalt Emulsion  
27 QC/QA Program shall be implemented in accordance with Article 1020-6.

#### 28 **(A) Anionic**

29 Use asphalt emulsion that meets AASHTO M 140.

30 Perform the testing of the asphalt in accordance with AASHTO T 59 except as follows:

- 31 (1) The determination of coating test, oil distillate, pH, solubility of residue, ash and  
32 particle charge will be made when deemed necessary.
- 33 (2) Use Materials and Tests Method A-24 to determine the coating ability and water  
34 resistance using either crushed or uncrushed aggregate from a source selected by the  
35 Department.

#### 36 **(B) Cationic**

37 Asphalt emulsion shall meet AASHTO M 208 or M 316 except as follows:

- 38 (1) All polymer or latex modified cationic asphalt emulsion materials, CRS-2P and  
39 CRS-2L, are subject to the following requirements:
- 40 (a) The sieve shall be no more than 0.15%.
- 41 (b) The elastic recovery (AASHTO T 301) at 77°F shall be 60% minimum.
- 42 (c) The ring and ball softening point (AASHTO T 53) shall be 110°F minimum.
- 43 (d) Penetration on residue at 77°F is not performed on CRS-2L.

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- 1 (e) Polymer content may be analyzed, if deemed necessary.
- 2 (2) Perform the testing of the asphalt in accordance with AASHTO T 59 except as
- 3 follows:
- 4 (a) Referee testing will be performed in accordance with AASHTO T 59.
- 5 (b) The determination of coating test, oil distillate, pH, solubility of residue, ash and
- 6 particle charge will be made when deemed necessary by the Engineer.
- 7 (c) Materials and Tests Method A-24 is used to determine the coating ability and
- 8 water resistance using either crushed or uncrushed aggregate from a source
- 9 selected by the Department.

**1020-4 POLYMER MODIFIED EMULSION MEMBRANE**

11 Use polymer modified emulsion membrane consisting of styrene butadiene block copolymer  
 12 modified asphalt emulsion to form a water impermeable seal and bond the new hot mix to the  
 13 existing surface. Complete polymer modification of base asphalt before emulsification.  
 14 Conform to Table 1020-1.

<b>TABLE 1020-1</b>			
<b>EMULSION AND RESIDUE TESTING</b>			
<b>Property</b>	<b>Requirement</b>		<b>Test Method</b>
<b>EMULSION:</b>	<b>Min.</b>	<b>Max.</b>	
Viscosity @ 77°F, SFS	20	100	AASHTO T-59
Sieve Test, %		0.1	AASHTO T-59
24-Hour Storage Stability, % <sup>A</sup>		1	AASHTO T-59
Residue from Distillation @ 400°F, % <sup>B</sup>	63		AASHTO T-59
Oil portion from distillation ml of oil per 100 g emulsion		2.0	
Demulsibility	60		AASHTO T-59
<b>RESIDUE:</b>			
Solubility in TCE, % <sup>C</sup>	97.5		AASHTO T-44
Elastic Recovery, 50°F			
20 cm elongation % <sup>D</sup>	60		AASHTO T-301
Penetration @ 77°F, 100 g, 5 sec, d <sub>mm</sub>	60	150	AASHTO T-49

- 15 **A.** After standing undisturbed for 24 hours, the surface shall show no white, milky colored
- 16 substance, but shall be a smooth homogeneous color throughout.
- 17 **B.** AASHTO T-59 with modifications to include a 400°F ± 10°F maximum temperature to
- 18 be held for 15 minutes.
- 19 **C.** ASTM D5546 may be substituted where polymers block the filter in Method D-2042.
- 20 **D.** ASTM D6084 except that the elongation is 20 cm and the test temperature is 50°F.

**1020-5 PRIME COAT MATERIALS**

22 Supply prime coat materials from pre-approved sources in accordance with Materials and  
 23 Tests Unit Method A and listed by the Materials and Tests Unit. Verification samples taken  
 24 at the point of application (destination) are subject to the following conditions:

- 25 **(A)** All prime coat materials shall be delivered to the project ready for use.
- 26 **(B)** Sampling will be made at the point of application. The Department reserves the right to
- 27 sample all materials used for prime coat applications, either at the destination or at the
- 28 point of origin, and to withhold acceptance of material until analysis of such samples
- 29 have been made. When a material meets specification requirements, but has a history of
- 30 unsatisfactory service performance, its use for construction or maintenance purposes may
- 31 be restricted by the Department and such restriction will be noted on the list of approved
- 32 products.

- 1 (C) Proposed materials for prime coat applications that are not listed as approved will be  
 2 investigated upon the request of the supplier or Contractor. The maximum volatile  
 3 organic compounds for the products (materials) on the approved list for prime coat  
 4 applications shall not exceed 6.8 ounces per gallon of material or the current applicable  
 5 regulatory limit. Submit a MSDS and a 2 quart sample from three different batches of  
 6 the same material to the Materials and Tests Unit for evaluation.
- 7 (D) The sand penetration results for a material used as a prime coat are penetration depth of at  
 8 least 12 mm and penetration time of not more than 90 seconds. Copies of the *Sand*  
 9 *Penetration Test Procedure* are available upon request from the Materials and Tests Unit.
- 10 (E) Materials used as a prime coat shall have a minimum rating of fair on the No-Tracking  
 11 Time Test. Copies of the *No-Tracking Time Test Procedures* are available upon request  
 12 from the Materials and Tests Unit.
- 13 (F) Materials used as a prime coat shall have a minimum rating of fair on the coating ability  
 14 and water resistance test in accordance with AASHTO T-59.
- 15 (G) For materials stored longer than one day at the destination point (Contractors'/Divisions'  
 16 tanks), submit to the Engineer a certified laboratory report on the performance of the  
 17 material for storage stability test in accordance with AASHTO T-59.
- 18 (H) The diluted materials shall be tested for asphalt residue percent in accordance with  
 19 AASHTO T-59, Section 55, and shall have a minimum asphalt residue percent of 15%.

20 **1020-6 PERFORMANCE GRADED ASPHALT BINDER AND ASPHALT**  
 21 **EMULSION QUALITY CONTROL/QUALITY ASSURANCE**

22 The Performance Graded Asphalt Binder and Asphalt emulsion QC/QA Programs are  
 23 designed to give asphalt binder and asphalt emulsion producers/suppliers (henceforth  
 24 Producer designates Producer/Supplier) more responsibility for controlling the quality of  
 25 material they produce and to use the quality control information they provide in the  
 26 acceptance process by the Department. It requires asphalt binder and asphalt emulsion  
 27 producers to perform quality control sampling, testing and record keeping on materials they  
 28 ship for use by the Department. It documents that the Department will perform quality  
 29 assurance sampling, testing and record keeping confirming the performance of the producers'  
 30 control plan. In addition, the Producer is required to participate in independent assurance  
 31 comparative sample activities. The program is described in the *Performance Graded Asphalt*  
 32 *Binder and Asphalt Emulsion QC/QA Program Manuals*. An electronic copy of the program  
 33 manuals may be obtained by accessing the Materials and Tests website.

34 The types of samples and the lot sizes required by the Producers and the Department are  
 35 described in detail in the *Performance Graded Asphalt Binder and Asphalt Emulsion*  
 36 *QC/QA Program Manuals*.

37 Acceptance or rejection of material will be based on the total program. Therefore,  
 38 a comparison of the quality control, quality assurance and other sample data may be used by  
 39 the Department for acceptance or rejection of a lot of material.

40 Participation in this program does not relieve the producer of the responsibility of complying  
 41 with all requirements of the *Standard Specifications*.

42 **1020-7 WATERPROOFING AND DAMPPROOFING MATERIALS**

43 **(A) Asphalt Primer**

44 Asphalt primer shall meet ASTM D41.

45 **(B) Asphalt Binder**

46 Asphalt Binder shall meet Article 1020-2, Grade PG 64-22.

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**(C) Tar**

Tar shall meet ASTM D490.

**(D) Woven Cotton Fabric**

Bitumen-saturated woven cotton fabric for waterproofing shall meet ASTM D173.

**1020-8 ANTI-STRIP ADDITIVES**

Anti-strip additives may either be hydrated lime or a chemical additive or a combination of both. Use an anti-strip additive capable of preventing the separation of the asphalt binder from the aggregate and achieving the required tensile strength ratio (TSR) on the asphalt mix when tested in accordance with AASHTO T 283 as modified by the Department.

Use hydrated lime conforming to AASHTO M 303. Add hydrated lime used of anti-strip purposes at a rate of not less than 1.0% by weight of the total dry aggregate.

Add chemical anti-strip additives to the asphalt binder before introduction into the mix. Do not use any chemical additive or particular concentration of chemical additive found to be harmful to the asphalt material or which causes the performance grading of the original asphalt binder to be out of specifications for the grade required.

**1020-9 SILICONE**

Silicone additives shall be pre-approved by the Materials and Tests Unit.

**1020-10 FIBER STABILIZING ADDITIVES**

Use fiber stabilizing additives that are capable of stabilizing the asphalt film surrounding the aggregate particles to reduce drain-down of the asphalt binder. A fiber stabilizer such as mineral fiber or cellulose may be used. The selected fiber shall meet the properties described below. Dosage rates given are typical ranges but the actual dosage rate used will be approved by the Engineer.

**(A) Mineral Fibers**

Mineral fibers shall be made from virgin basalt, diabase or slag treated with a cationic sizing agent to enhance disbursement of the fiber as well as increase adhesion of the fiber surface to the asphalt binder. Mineral fibers shall be in accordance with Table 1012-5. Add the fiber at a dosage rate between 0.2% and 0.4% by weight of total mix, as approved.

**TABLE 1020-2  
MINERAL FIBER PROPERTIES**

<b>Property</b>	<b>Requirement</b>	<b>Test Method</b>
Average Fiber length	0.25" maximum	-
Average Fiber thickness	0.0002" maximum	-
Shot Content Passing No. 60 sieve	90 - 100%	ASTM C612
Shot Content Passing No. 230 sieve	65 - 100%	ASTM C612
Degradation	30% maximum	GDT-124/McNett Fractionation

**(B) Cellulose Fibers**

Add cellulose fibers at a dosage rate between 0.2% and 0.4% by weight of total mix as approved. Fiber properties shall be in accordance with the following table.

<b>Property</b>	<b>Requirement</b>
Average Fiber Length	0.25" maximum
Alpine Sieve Method Passing No. 100 Sieve	60 - 80%
Ro-Tap Sieve Method Passing No. 20 Sieve	80 - 95%
Ro-Tap Sieve Method Passing No. 40 Sieve	45 - 85%
Ro-Tap Sieve Method Passing No. 100 Sieve	5 - 40%
Ash Content	18% ± 5% non-volatiles
pH	7.5 ± 1
Oil Absorption	5.0 ± 1 (times fiber weight)
Moisture Content	5.0 maximum

**(C) Cellulose Pellets**

Cellulose pellets consist of a 50/50 blend of cellulose fiber and asphalt binder. Use cellulose that complies with Subarticle 1020-10 (B) and the following table. Add the cellulose pellets at a dosage rate between 0.4% and 0.8% by weight of total mix, as approved.

<b>Property</b>	<b>Requirement</b>
Pellet Size	1/4 cu.in. maximum
Asphalt	25 - 80 pen.

**SECTION 1024****MATERIALS FOR PORTLAND CEMENT CONCRETE****1024-1 PORTLAND CEMENT**

Supply Portland cement that meets AASHTO M 85 for Type I, II or III except that the maximum fineness requirements of AASHTO M 85 do not apply to cement used in precast concrete products. Throughout these Specifications Types I and II cement are referred to as regular Portland cement and Type III as high early strength Portland cement.

Certain combinations of cement and aggregate exhibit an adverse alkali-silica reaction. The alkalinity of any cement, expressed as sodium-oxide equivalent, shall not exceed 1.0%. For mix designs that contain non-reactive aggregates and cement with an alkali content less than 0.6%, straight cement or a combination of cement and fly ash, cement and ground granulated blast furnace slag or cement and microsilica may be used. The supplementary cementitious material (SCM) quantity shall not exceed the amount shown in Table 1024-1. For mixes that contain cement with an alkali content between 0.6% and 1.0% and for mixes that contain a reactive aggregate documented by the Department, use a supplementary cementitious material in the amount shown in Table 1024-1.