

- 1 (4) When material is to be used for placing embankments or backfilling of undercut
2 areas that are excessively wet, the material shall consist of Class II, III or IV select
3 material.

4 **SECTION 1019**
5 **SHOULDER AND SLOPE MATERIAL**

6 **1019-1 GENERAL**

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

10 **1019-2 SHOULDER AND SLOPE BORROW**

11 Use borrow sources in accordance with Article 1018-2.

12 Use soil consisting of loose, friable, sandy material with a PI greater than 6 and less than 25
13 and a pH ranging from 5.5 to 6.8. Remove stones and other foreign material 2" or larger in
14 diameter.

15 Use approved material obtained from unclassified excavation, fine grading operations or
16 borrow sources as provided in Section 230.

17 **1019-3 AGGREGATE SHOULDER BORROW**

18 Use aggregate shoulder borrow (ASB) that meets the following gradation in Table 1019-1.

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

19 **SECTION 1020**
20 **ASPHALT MATERIALS**

21 **1020-1 DELIVERY AND ACCEPTANCE OF ASPHALT MATERIALS**

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

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

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

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

- 33 (A) Name of Producer/Supplier and location
34 (B) A statement that the material has been tested and meets AASHTO specifications or is
35 being provided by an approved supplier under Approved Supplier Certification (ASC)
36 (C) The grade of the material
37 (D) If applicable, the rotational viscosity in Pascal-Seconds (Pa-S) at 135°C and 165°C
38 (E) If applicable, the recommended laboratory mixing and compaction temperature (°C for
39 the PGAB)

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- 1 (F) Delivery ticket number
- 2 (G) Date and time loaded (mm/dd/yyyy AM:PM)
- 3 (H) Date and time shipped (mm/dd/yyyy AM:PM)
- 4 (I) State project or purchase order number
- 5 (J) NCDOT assigned batch number
- 6 (K) Destination
- 7 (L) Name of consignee
- 8 (M) Trailer or car number
- 9 (N) Producer's or Supplier's storage tank and batch number
- 10 (O) Quantity loaded in tons or gallons (kg/L) at 60°F
- 11 (P) Loading temperature
- 12 (Q) Net gallon at 60°F

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

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

18 Furnish a statement of certification from the supplier and a separate statement of certification
19 from the transporter. Sign each certification by an authorized representative of the supplier or
20 transporter. Stamp, write or print these certifications on the delivery ticket, or attach to the
21 delivery ticket.

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

24 This is to certify that this shipment of _____ gallons/liters or
25 tons/metric tons of _____ grade asphalt including _____
26 gallons/liters of _____ anti-strip meet all requirements of
27 NC Department of Transportation Specifications.

28 Signed _____
29 Authorized Representative of Supplier

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

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

34 This is to certify that this transport tank was clean and free from
35 contaminating materials when loaded. The material transported on the
36 previous load in this tanker was _____.

37 Signed _____
38 Authorized Representative of Transporter

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

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

44 **1020-2 ASPHALT BINDER**

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

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

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

10 **1020-3 ASPHALT EMULSION**

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

13 **(A) Anionic**

14 Use asphalt emulsion, except for Grade RS-1H, that meets AASHTO M 140. Use asphalt
 15 emulsion Grade RS-1H that meets AASHTO M 140 for Grade RS-1, except the
 16 penetration of residue shall be at least 50 and no more than 100.

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

- 18 (1) Use a hot plate instead of an oven to perform the residue by evaporation.
- 19 (2) The determination of coating test, oil distillate, pH, solubility of residue, ash and
 20 particle charge will be made when deemed necessary.
- 21 (3) Use Materials and Tests Method A-24 to determine the coating ability and water
 22 resistance using either crushed or uncrushed aggregate from a source selected by the
 23 Department.

24 **(B) Cationic**

25 Asphalt emulsion shall meet AASHTO M 208 except as follows:

- 26 (1) Asphalt emulsion Grade CRS-1H shall meet AASHTO M 208 for Grade CRS-1
 27 except as follows:
 - 28 (a) The residue after distillation shall be at least 55%.
 - 29 (b) The penetration of residue shall be at least 50 and no more than 100.
 - 30 (c) Viscosity, Saybolt Furol at 77°F shall be at least 20 and no more than 100.
- 31 (2) All polymer or latex modified cationic asphalt emulsion materials, CRS-2P and
 32 CRS-2L, are subject to the following requirements:
 - 33 (a) The viscosity at 122°F shall be at least 100 seconds and no more than
 34 400 seconds.
 - 35 (b) The sieve shall be no more than 0.15%.
 - 36 (c) The 24 hour storage stability shall not exceed 1%.
 - 37 (d) The residue by evaporation (oven evaporation) shall be at least 65%.
 - 38 (e) The elastic recovery (AASHTO T 301) at 50°F shall be at least 50%.
 - 39 (f) The ring and ball softening point (AASHTO T 53) shall be at least 110°F.
 - 40 (g) Polymer content may be analyzed, if deemed necessary.

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(3) Perform the testing of the asphalt in accordance with AASHTO T 59 except as follows:

(a) Residue by evaporation will be performed using a hot plate instead of an oven with a maximum temperature of 400°F. Referee testing will be performed in accordance with AASHTO T 59.

(b) The determination of coating test, oil distillate, pH, solubility of residue, ash and particle charge will be made when deemed necessary by the Engineer.

(c) Materials and Tests Method A-24 is used to determine the coating ability and water resistance using either crushed or uncrushed aggregate from a source selected by the Department.

1020-4 POLYMER MODIFIED EMULSION MEMBRANE

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

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

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

B. AASHTO T 59 with modifications to include a 400°F ± 10°F maximum temperature to be held for 15 minutes.

C. ASTM D5546 may be substituted where polymers block the filter in Method D 2042.

D. ASTM D6084 except that the elongation is 20 cm and the test temperature is 50°F.

1020-5 PRIME COAT MATERIALS

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

(A) All prime coat materials shall be delivered to the project ready for use.

(B) Sampling will be made at the point of application. The Department reserves the right to sample all materials used for prime coat applications, either at the destination or at the point of origin, and to withhold acceptance of material until analysis of such samples have been made. When a material meets specification requirements, but has a history of unsatisfactory service performance, its use for construction or maintenance purposes may be restricted by the Department and such restriction will be noted on the list of approved 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 oz/gal of material or the current applicable regulatory
 5 limit. Submit a MSDS and a 2 quart sample from 3 different batches of the same material
 6 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) Fabric

Woven cotton fabric for waterproofing shall meet ASTM D173.

**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 pozzolan 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 pozzolan in the amount shown in Table 1024-1.

Obtain the list of reactive aggregates documented by the Department at the Materials and Tests Unit website.

TABLE 1024-1 POZZOLANS FOR USE IN PORTLAND CEMENT CONCRETE	
Pozzolan	Rate
Class F Fly Ash	20% by weight of required cement content with 1.2 lb Class F fly ash per lb of cement replaced
Ground Granulated Blast Furnace Slag	35%-50% by weight of required cement content with 1.0 lb slag per lb of cement replaced
Microsilica	4%-8% by weight of required cement content with 1.0 lb microsilica per lb of cement replaced

Type IP or IS blended cement is allowed for the cement-and-fly-ash or cement-and-slag portion of the mix. Type IT may be allowed for the cement-and-pozzolan portion of the mix with the permission of the Engineer. Do not substitute fly ash or slag for a portion of Type IP, IS or IT cement or for Portland cement in high early strength concrete.

Use white cement that meets ASTM C150, except that the ferric oxide content is limited to 0.5%.

Use Type IP blended cement that meets AASHTO M 240, except that the pozzolanic content is limited to between 17 and 23% by weight and the constituents shall be interground.

Use Type IS blended cement that meets AASHTO M 240 except that the slag content is limited to between 35% and 50% by weight and the constituents are interground.

Use Type IT blended cement that meets AASHTO M 240. The Engineer will evaluate the blend of constituents for acceptance in Department work.

Do not use air-entraining Portland cement. Do not mix different types of cement, different brands of cement, or the same brand from different mills nor use them alternately except when authorized in writing by the Engineer.