

(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.

Property	Requirement
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.

Property	Requirement
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.

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

TABLE 1024-1 SUPPLEMENTARY CEMENTITIOUS MATERIAL FOR USE IN PORTLAND CEMENT CONCRETE	
SCM	Rate
Class F Fly Ash	20% - 30% by weight of required cement content with 1.0 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

- 3 Type IP or IS blended cement is allowed for the cement-and-fly-ash or cement-and-slag
4 portion of the mix. Type IT may be allowed for the cement-and- supplementary cementitious
5 portion of the mix with the permission of the Engineer. Do not substitute fly ash or slag for a
6 portion of Type IP, IS or IT cement or for Portland cement in high early strength concrete.
- 7 Use white cement that meets ASTM C150, except that the ferric oxide content is limited
8 to 0.5%.
- 9 Use Type IP blended cement that meets AASHTO M 240, except that the pozzolanic content
10 is limited to between 17 and 23% by weight and the constituents shall be interground.
- 11 Use Type IS blended cement that meets AASHTO M 240 except that the slag content is
12 limited to between 35% and 50% by weight and the constituents are interground.
- 13 Use Type IT blended cement that meets AASHTO M 240. The Engineer will evaluate the
14 blend of constituents for acceptance in Department work.
- 15 Use Type IL blended cement that meets AASHTO M 240, except the constituents shall be
16 interground. Class F fly ash can replace a portion of Type IL blended cement and shall be
17 replaced as outlined in Subarticle 1000-4(I) for Portland cement. For mixes that contain
18 cement with alkali content between 0.6% and 1.0% and for mixes that contain a reactive
19 aggregate documented by the Department, use a pozzolan in the amount shown in Table
20 1024-1.
- 21 Do not use air-entraining Portland cement. Do not mix different types of cement, different
22 brands of cement, or the same brand from different mills nor use them alternately except
23 when authorized in writing by the Engineer.
- 24 Protect cement from contamination or damage during handling and storage. Do not use
25 cement that is damaged, partially set, lumpy or caked.
- 26 All cement is sampled and tested by the Department as it arrives on the project or at the
27 precasting plant at such frequency as established by the Department.

28 **1024-2 AGGREGATE**

- 29 Provide aggregate that meets Section 1014.

30 **1024-3 ADMIXTURES**

31 **(A) Basis of Acceptance**

- 32 Admixtures from an approved source are accepted without prior testing. Do not use
33 admixtures that are not from an approved source until the admixture is approved by the
34 Department.

(B) Approved Sources

An approved source is considered to be any manufacturer of admixtures who complies with this subarticle.

The manufacturer shall submit to the Product Evaluation Program an application and certified reports of tests that show that the admixture meets the applicable Specifications. Tests shall be performed by AASHTO's designated National Transportation Product Evaluation Program (NTPEP) laboratory for concrete admixture testing. Admixtures that contain chloride other than calcium chloride as provided herein are not permitted. The manufacturer is required to state in writing that no chloride was added during the manufacture of the admixture.

After an admixture is accepted, the manufacturer is required to submit to the Product Evaluation Program on or before February 1 of each year a notarized certification that shows that the material is of the same composition as originally accepted and has not been changed or altered. If an admixture is changed or altered, approval of the source in accordance with the above requirements is necessary before using the admixture.

The Engineer has the option to perform tests deemed desirable to verify the manufacturer's certification. Failure of the admixture in such tests is cause for discontinuation of its use. Failure of an admixture to perform satisfactorily under job conditions is cause for rejection of the source.

The Engineer maintains a list of approved sources on file.

(C) Air Entraining Agent

Provide air entraining agents that meet AASHTO M 154.

(D) Chemical Admixtures**(1) Set Retarding Admixtures**

Use set retarding admixtures that meet AASHTO M 194 for Type D, water reducing and retarding admixtures.

(2) Water Reducing Admixtures

Use water reducing admixtures that meet AASHTO M 194 for Type A admixtures.

(3) Calcium Chloride

Provide calcium chloride that meets AASHTO M 144 for Type 2, concentrated flake, pellet or other granular calcium chloride. The Engineer may waive the gradation requirement.

(4) High-Range Water Reducing Admixtures

Use high-range water reducing admixtures that meet AASHTO M 194 for Type F or Type G.

(5) Calcium Nitrite Corrosion Inhibitor

Use an approved calcium nitrite corrosion inhibitor that contains 30% solids.

(E) Other Admixtures

Admixtures not otherwise classified will be reviewed on a case-by-case basis by the Materials and Tests Unit.

1024-4 WATER

Ensure that water used to condition, wash, or as an integral part of materials is clear and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substance. It shall not be salty or brackish. Water used in the production of concrete or grout shall be from

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1 wells or public water systems which are suitable for drinking and must meet the criteria listed
2 in Table 1024-2.

3 Test all water from wells and public water supplies from all out of state locations and in the
4 following counties: Beaufort, Bertie, Brunswick, Camden, Carteret, Chowan, Craven,
5 Currituck, Dare, Gates, Hyde, New Hanover, Onslow, Pamlico, Pasquotank, Pender,
6 Perquimans, Tyrell and Washington unless the Engineer waives the testing requirements.
7 Water from a municipal water supply in all other NC counties may be accepted by the
8 Engineer without testing.

Property	Requirement	Test Method
Compressive Strength, minimum percent of control at 3 and 7 days	90%	NCDOT Modified / AASHTO T 106
Time of set, deviation from control	From 1:00 hr. earlier to 1:30 hr. later	NCDOT Modified / AASHTO T 131
pH	4.5 to 8.5	NCDOT Modified / AASHTO T 26
Chloride Ion Content, Max.	250 ppm	ASTM D512
Total Solids Content (Residue), Max.	1,000 ppm	NCDOT Modified / Standard Methods for Examination of Water and Wastewater
Resistivity, Min.	0.500 kohm-cm	NCDOT Modified / ASTM D1125
Sulfate as SO ₄ , Max.	1,500 ppm	NCDOT Modified / ASTM D516
Presence of Sugar	None	NCDOT Procedure
Dissolved Organic Matter	None	NCDOT Modified / AASHTO T 26

9 **1024-5 FLY ASH**

10 Provide fly ash that meets ASTM C618 for Class F or Class C, except ensure that the loss on
11 ignition does not exceed 4%. Use fly ash that meets the optional physical requirements for
12 uniformity shown in Table 2 of ASTM C618.

13 Do not use Class C fly ash in Portland cement concrete if the alkali content of the cement
14 exceeds 0.4%.

15 All fly ash is sampled and tested by the Department as it arrives on the project at such
16 frequency as established by the Department.

17 **1024-6 GROUND GRANULATED BLAST FURNACE SLAG**

18 Use blast furnace slag that meets AASHTO M 302, Grade 100. All slag is sampled and tested
19 by the Department as it arrives on the project at such frequency as established by the
20 Department.

21 **1024-7 SILICA FUME**

22 Provide silica fume (microsilica) that meets Tables 1, 2 and 3 of ASTM C1240. All silica
23 fume is sampled and tested by the Department as it arrives on the project at such frequency as
24 established by the Department.