(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.

Protect cement from contamination or damage during handling and storage. Do not use cement that is damaged, partially set, lumpy or caked.

All cement is sampled and tested by the Department as it arrives on the project or at the precasting plant at such frequency as established by the Department.

1024-2 AGGREGATE

Provide aggregate that meets Section 1014.

1024-3 ADMIXTURES

(A) Basis of Acceptance

Admixtures from an approved source are accepted without prior testing. Do not use admixtures that are not from an approved source until the admixture is approved by the 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 Materials and Tests Unit certified reports of tests that show that the admixture meets the applicable Specifications. Perform tests in a laboratory certified by the Cement and Concrete Reference Laboratory of the National Bureau of Standards.

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 Materials and Tests Unit 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 make any or all 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 wells or public water systems which are suitable for drinking and must meet the criteria listed in Table 1024-2.

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

TABLE 1024-2
PHYSICAL PROPERTIES OF WATER

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

1024-5 FLY ASH

Provide fly ash that meets ASTM C618 for Class F or Class C, except ensure that the loss on ignition does not exceed 4%. Table 1A of ASTM C618 applies to Class F fly ash. Use fly ash that meets the optional physical requirements for uniformity shown in Table 2A of ASTM C618.

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

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

1024-6 GROUND GRANULATED BLAST FURNACE SLAG

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

1024-7 SILICA FUME

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

SECTION 1026
CURING AGENTS FOR CONCRETE

1026-1 GENERAL

All curing agents shall be free from impurities that may be detrimental to the concrete. Do not use curing agent until the applicable tests have been performed and the Engineer has approved the curing agent.

1026-2 LIQUID MEMBRANE CURING COMPOUNDS

(A) General

Liquid membrane curing compounds shall meet AASHTO M 148, except that when tested in the water retention test described in AASHTO T 155 the curing compound shall restrict the loss of water in the test specimen at the time of application of the compound to not more than 0.007 oz/sq.in.

The curing compound shall be Type 2, white pigmented, except where clear type is required for a particular application, the curing compound shall be Type 1D, clear or translucent with fugitive dye.

Deliver curing compound in the manufacturer's original clean, sealed containers. Legibly mark each container with the name of the manufacturer, the name of the compound, the type of compound, the manufacturer's batch number, the date of manufacture and the manufacturer's recommended shelf life.

Do not use curing compound that has been in storage for more than one year from the date of manufacture or more than the manufacturer's recommended shelf life, whichever is less.

(B) Test Procedures

Curing compound will be tested in accordance with AASHTO M 148, except the size of molds for making test specimens will be approximately 5.5" in diameter by approximately 1" deep, or any other size selected by the Engineer.

1026-3 POLYETHYLENE FILM

Polyethylene film shall meet AASHTO M 171 for white opaque polyethylene film, except that when tested for moisture retention efficiency the loss shall not be more than 0.007 oz./sq.in of surface area.

1026-4 WATER

All water used for curing concrete shall meet Article 1024-4 and Table 1024-2. Water from wells, streams, ponds or public water systems may be used.