



Tr n-30-1-87728- <b>SUPERSEDED</b> BY EB 99-066 <del>MC 0750</del> , EFFECTIVE 11/4/99		New York State Department of Transportation <b>ENGINEERING          INSTRUCTION</b>	<b>EI</b> <b>98-030</b>
<b>Title: SPECIFICATIONS- (701-03) BLENDED PORTLAND CEMENTS AND (711-11&amp; 711-12) CEMENTITIOUS ADMIXTURES</b>			
<b>Distribution:</b> <input checked="" type="checkbox"/> Manufacturers (18) <input type="checkbox"/> Surveyors (33) <input checked="" type="checkbox"/> Main Office (30) <input checked="" type="checkbox"/> Consultants (34) <input checked="" type="checkbox"/> Local Govt. (31) <input checked="" type="checkbox"/> Contractors (39) <input checked="" type="checkbox"/> Regions/Agencies (32) <input type="checkbox"/> _____ ( )	<b>Approved:</b>  <hr/> Paul J. Mack, Deputy Chief Engineer, Technical Services Division <span style="float: right;">           8/25/99            Date         </span>		

**EFFECTIVE DATE.** This instruction shall be effective on all contracts let after January 14, 1999.

**PURPOSE.** This instruction transmits subsections 701-03 BLENDED PORTLAND CEMENT, 711-11 MICROSILICA and 711-12 GROUND GRANULATED BLAST FURNACE SLAG into the Standard Specifications.

**BACKGROUND.** The continuing effort to improve the quality of concrete being placed on NYSDOT projects has resulted in the implementation of Class HP concrete for bridge decks (EI 96-024), Class HP for substructures (EI 97-23), and Class DP concrete for specialized overlays (EI 98-13). These concrete mixtures specify the substitution for Portland cement with Class F flyash and microsilica at a given rate. The object is to produce a more durable, less permeable end product than conventional structural concrete. Flyash and microsilica have traditionally been added to the concrete mixture at the concrete batch plant. The introduction of items 701-03 BLENDED PORTLAND CEMENT, 711-11 MICROSILICA and 711-12 GROUND GRANULATED BLAST FURNACE SLAG (GGBFS) will allow the production and storage of preblended mixtures of Portland cement and flyash, Portland cement and microsilica, Portland cement and ground granulated blast furnace slag, or a ternary blend of Portland cement, flyash and microsilica.

**IMPLEMENTATION.** This EI transmits new Specification subsections to be inserted into contract proposals by the Main Office Design Quality Assurance Bureau.

**COST IMPACT.** The decreased cost of shipping and storage of the cement after blending may be reflected in the cost of concrete at the project.

**SPECIFICATIONS CHANGES.** Section 700- MATERIALS DETAILS of the Standard Specifications of January 2, 1995 will be revised as per the attached.

**CONTACT PERSON.** Any questions regarding the specification changes should be directed to the Materials Bureau at (518) 457-4582.

Insert the following subsection into Section 700- MATERIALS DETAILS of the Standard Specifications of January 2, 1995:

### 711-11 MICROSILICA

**SCOPE.** This specification covers the material requirements for microsilica admixture for use in portland cement concrete and other mixes.

**GENERAL.** Supply microsilica admixture as a dry powder or slurry. When necessary for testing purposes, microsilica slurries will be dried to obtain a representative sample of dry powder.

**MATERIAL REQUIREMENTS.** The microsilica powder shall conform to the requirements of AASHTO M 307\* (including optional chemical and optional physical requirements) and the following:

1. **Uniformity of Silicon Dioxide Content.** Maximum  $\pm 7.0\%$  from the acceptance value.
2. **Chloride Content.** Maximum 0.20% as determined by AASHTO T 260, Procedure B.
3. **Fineness.** Maximum 5.0% retained on a 45- $\mu\text{m}$  sieve (wet method).
4. **Uniformity of Percent Solids (Slurry).** Maximum  $\pm 5.0\%$  from the acceptance value.

\* For Materials other than Silica fume as defined by AASHTO M307, the requirement for  $\text{SiO}_2$  may be reduced if the combined quantity of reactive  $\text{SiO}_2 + \text{AlO}_2 + \text{FeO}_2$  is at least 85%, and all other chemical and physical requirements are met as determined by the Materials Bureau.

**Sampling and Testing.** Submit two - 1 liter samples of microsilica to the Materials Bureau for approval, with the following:

1. **Supplier and Manufacturer's Names and Addresses.** If the material will be manufactured at several locations, identify each location and submit a separate sample representing each location.
2. **Product Label, Product Information Sheets and Material Safety Data Sheets.** Include the date of manufacture and shelf life of the supplied sample.
3. **Test Results.** Submit laboratory test results indicating the product meets all specification requirements. The testing laboratory must be acceptable to the Director, Materials Bureau. The Department will test the submitted microsilica sample in accordance with the specification and Department instructions. Test procedures are available from the Materials Bureau upon request. Upon approval by the Materials Bureau, the name of the product will be placed on the Approved List. The Department reserves the right to monitor the performance of any approved microsilica. Samples of microsilica may be taken from actual concrete operations and tested by the Materials Bureau. If these test results indicate that the sampled microsilica does not meet this specification, concrete incorporating the microsilica represented by the sample may be rejected.

**BASIS OF ACCEPTANCE.** Each shipment of microsilica will be considered for acceptance where it will be incorporated into the concrete. Acceptance will be based on the product name appearing on the Approved List and Manufacturer's certification of conformance to this specification.

Insert the following subsection into Section 700- MATERIALS DETAILS of the Standard Specifications of January 2, 1995:

## 711-12 GROUND GRANULATED BLAST- FURNACE SLAG

**SCOPE.** This specification covers the material requirements for ground granulated blast-furnace slag when used as a partial replacement for portland cement in portland cement concrete.

**MATERIAL REQUIREMENTS.** Ground granulated blast-furnace slag (GGBFS) shall conform to the chemical and physical requirements for Grade 100 slag as described in ASTM C 989.

**Storage.** The ground granulated blast-furnace slag shall be stored at its source of supply in approved weather-tight silos. Facilities shall be provided for maintaining such silos under Department seal control when and as directed by the Materials Bureau.

All silos shall be completely empty and clean before GGBFS is deposited therein unless the silo contains Department specification GGBFS of the same type.

GGBFS remaining in bulk storage at the mill and/or distribution terminal for a period greater than one year after completion of tests shall be resampled and retested before shipment. However, GGBFS which has been in bulk storage at mills and/or distribution terminals more than two years from the time of original manufacture shall not be used. No GGBFS stored by the Contractor over the winter shall be used until retested by the Materials Bureau.

**Shipment.** All shipments of ground granulated blast-furnace slag shall be made in accordance with procedural directives issued by the Materials Bureau. Conveyances for bulk shipment shall be of a type approved by the Department. The compartments of all such conveyances shall be completely empty and clean before any GGBFS is loaded therein.

**Inspection and testing.** All inspection and testing shall be in accordance with procedural directives issued by the Materials Bureau. When required by the Materials Bureau, GGBFS shall be sampled by means of an automatic sampling device constructed so as to obtain continuous samples across the full stream of GGBFS and deliver such samples into a sealed container approved by the Materials Bureau. Tests for chemical and physical properties shall be in accordance with test methods stipulated by ASTM C 989.

**BASIS OF ACCEPTANCE.** Ground granulated blast-furnace slag will be considered for acceptance at mill or terminal locations in accordance with procedural directives issued by the Materials Bureau.

Insert the following subsection into Section 700- MATERIALS DETAILS of the Standard Specifications of January 2, 1995:

### 701-03 BLENDED PORTLAND CEMENT

**SCOPE.** This specification covers blended portland cement, for use in portland cement concrete, using Class F fly ash, microsilica, ground granulated blast furnace slag or a combination of fly ash and microsilica. The cement, and percent of each material in the blended cement, will be at an appropriate quantity to achieve the desired percentage in the concrete mix as shown in the plans or specifications without further addition of any cementitious component.

**GENERAL.** Blended portland cements, as described in ASTM C 595M will conform to the chemical and physical requirements described herein, or as modified in the concrete mix as shown in the plans or specifications of each contract. Acceptable blended portland cements are defined as follows:

***Portland/ fly ash cement (IP)***- A product consisting of portland cement and fly ash in which the fly ash content does not exceed 22 percent by mass.

***Portland/ microsilica cement (SF)*** - A product consisting of portland cement and microsilica in which the microsilica content does not exceed 10 percent by mass.

***Portland/ ground granulated slag cement (SM)***- A product consisting of portland cement and finely ground, granulated blast furnace slag in which the slag content does not exceed 22 percent by mass.

***Ternary blend cement*** - A product consisting of portland cement, fly ash, and microsilica in which the total supplementary cementitious content does not exceed 30 percent by mass. The fly ash portion will range from 15 -20 percent of the total mass. The microsilica portion will range from 6-10 percent of the total mass.

Blending may be completed by means of intergrinding or by mechanical means. The blended cement must remain homogeneous from the point of blending to the point of use at a portland cement concrete batching facility. The ability and means of maintaining homogeneity will be demonstrated to the satisfaction of the Department.

## 701-03 BLENDED PORTLAND CEMENT

**MATERIAL REQUIREMENTS.** The individual components, before blending, must meet the following requirements:

Portland Cement	701-01 Type I, II or I/II only
Fly ash	711-10
Microsilica	711-11
Ground, Granulated Blast Furnace Slag	711-12

Blended portland cements shall meet the chemical requirements specified in Table 701-1 and the physical requirements specified in Table 701-2.

<b>TABLE 701-1</b>				
<b>CHEMICAL REQUIREMENTS - BLENDED PORTLAND CEMENTS (ASTM C114)</b>				
	Portland/flyash (IP)	Portland /microsilica (SF)	Ternary Blend	Portland /slag (SM)
Loss on Ignition	5.0 % max. <sup>1</sup>	3.4 % max.	3.6 % max.	3.0 % max. <sup>2</sup>
SiO <sub>2</sub>	--- <sup>1</sup>	22.0 % min.	31.5 % min.	---
MgO	6.0 % max. <sup>1</sup>	6.0 % max.	6.0 % max.	---
SO <sub>3</sub>	4.0 % max. <sup>1,3</sup>	3.1 % max. <sup>3</sup>	3.5 % max. <sup>3</sup>	3.0 % max. <sup>2,3</sup>
Total Alkalinity	0.85 % max. <sup>4</sup>	0.80 % max. <sup>4</sup>	0.95 % max. <sup>4</sup>	0.75 % max. <sup>4</sup>

Note 1- As per chemical requirements of ASTM C 595M for Type IP blended cement.

Note 2- As per chemical requirements of ASTM C 595M for Type I(SM) blended cement.

Note 3- There are cases where the optimum SO<sub>3</sub> (using ASTM test method C563) for a particular cement is close to or in excess of the limit in this specification. In such cases where the properties of a cement can be improved by exceeding the SO<sub>3</sub> limits stated in this table, it is permissible to exceed the values in the table, provided it has been demonstrated by ASTM test method C1038 that the cement with the increased SO<sub>3</sub> will not develop expansion under water exceeding 0.020 % at 14 days. When the manufacturer supplies cement under this provision, the supporting data will be supplied, on request, to the Materials Bureau.

Note 4- Any blended cement where the portland cement portion contains an alkali content in excess of 0.70% may be either rejected, accepted, or have use limitations imposed as directed by the Materials Bureau.

## 701-03 BLENDED PORTLAND CEMENT

Passing 45 $\mu$ m (ASTM C430)	70% minimum
Time of setting, Vicat test (ASTM C191) (minutes)	45 minimum 420 maximum
Autoclave contraction (ASTM C151) Autoclave expansion	0.2% maximum 0.8% maximum
Compressive strength (ASTM C109) (MPa) 3 days 7 days 28 days	10.0 minimum 20.0 minimum 25.0 minimum

**Storage.** The blended cement will be stored at its source of supply in approved weather-tight silos. Facilities must be provided for maintaining such silos under Department seal control when and as directed by the Materials Bureau.

All silos will be completely empty and clean before blended cement is deposited therein unless the silo contains Department specification blended cement of the same type.

Blended cement remaining in bulk storage at the mill and/or distribution terminal for a period greater than one year after completion of tests must be resampled and retested before shipment. However, blended cement which has been in bulk storage at mills and/or distribution terminals more than two years from the time of original manufacture will not be used. No blended cement stored by the Supplier over the winter may be used until retested by the Materials Bureau.

Bagged blended cement will not be stored at mill or terminal locations for a period longer than that time considered reasonable by the Department for preparing an order for shipment.

**Shipment.** All shipments of blended cement will be in accordance with procedural directives issued by the Materials Bureau. Conveyances for bulk shipment must be of a type approved by the Department. The compartments of all such conveyances must be completely empty and clean before any blended cement is loaded therein. Blended cement may be shipped in paper bags which conform to industry standards and which have the brand name, type of blended cement, and the name of the manufacturer plainly marked thereon.

**Inspection and testing.** All inspection and testing will be in accordance with procedural directives issued by the Materials Bureau. When required by the Materials Bureau, blended cement will be sampled by means of an automatic sampling device constructed so as to obtain continuous samples across the full stream of blended cement and deliver such samples into a sealed container approved by the Materials Bureau. Tests for chemical and physical properties will be in accordance with test methods stipulated herein.

**BASIS OF ACCEPTANCE.** Blended portland cement will be considered for acceptance at mill or terminal locations in accordance with procedural directives issued by the Materials Bureau.