

# EXPECTED IMPLEMENTATION JANUARY 2021

## 929 SUPPLEMENTARY CEMENTITIOUS MATERIALS (REV 7-22-20) (FA 8-3-20) (1-21)

SECTION 929 is deleted and the following substituted:

### SECTION 929 SUPPLEMENTARY CEMENTITIOUS MATERIALS

#### 929-1 General.

Supplementary cementitious materials (SCMs) shall conform to the requirements of this Section. SCMs shall be used in concrete mix designs in accordance with Section 346.

Fly ash, slag cement, and ultra-fine fly ash shall not be used in conjunction with Type IP or Type IS cements.

Repulable bags may be accepted by the Engineer, provided a successful demonstration by the producer has indicated complete degradation of the repulable bags during the mixing operation and before the mix is discharged.

#### 929-1.1 Definitions.

The following definitions are applicable to the production and quality control (QC) of SCMs:

1. Approved Laboratory: A laboratory that is currently inspected by the Cement and Concrete Reference Laboratory (CCRL), is actively participating in the CCRL proficiency program and has corrected all deficiencies noted at the time of inspection. The laboratory must authorize the CCRL to send a copy of the final inspection report and proficiency sample results to the State Materials Office (SMO).

2. SCM Producer: Indicates an SCM supplier, including but not limited to a plant, a terminal, or a transfer facility, that has been qualified by the SMO. The Cementitious Materials Production Facility Listing will be maintained by the SMO.

3. Test Report: A certification from the SCM producer showing that the SCM meets the requirements of this Section. The test report must include, at a minimum, the following information:

- a. The Type of SCM.
- b. The production period.
- c. Chemical and physical analysis of the SCM.
- d. The silo numbers where the SCM is stored.
- e. The specific gravity of the SCM.
- f. The approved laboratory that performed all tests.

4. Purchaser: The term “purchaser” in the ASTM requirements shall be taken as the Department.

#### 929-2 Quality Control Program.

**929-2.1 General:** Develop a Producer QC Program as specified in Section 105.

SCM producers shall submit a proposed QC Plan to the SMO for acceptance. In addition to the QC Plan, the SCM producer must submit monthly test reports from an approved laboratory which certifies that the SCM in current production or supply conforms to the requirements of this Section.

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SCM producers with an accepted QC Plan will appear on the Cementitious Materials Production Facility Listing.

QC test data that does not comply with the Specification will not be reason for rejection of the material if the SCM producer's QC Plan indicates that material will be diverted and not used for Department projects.

**929-2.2 Sampling and Testing:** Representatives from the Department may take verification samples at the SCM producer's plant, terminal, distribution facility or the concrete production facility. Samples shall be obtained by one of the methods described in FM 5-503. Sample sizes shall be a minimum of one gallon by volume. At the concrete production facility, cementitious samples shall be jointly obtained by the Department inspector and the concrete producer's representative.

Upon request of the Department, the SCM producer shall provide split samples of the cementitious material collected for QC testing. Split samples shall be delivered to the SMO and shall be identified as representing a designated LOT of the SCM.

Notification of failing verification sample test results will be distributed to the SCM producer and concrete producers (if applicable). Split samples of the initial sample may be provided to the SCM producer and concrete producer upon request.

## 929-3 Fly Ash.

**929-3.1 General:** Sampling and testing of fly ash shall follow the requirements of ASTM C311. Fly ash shall not include the residue resulting from the burning of municipal waste or any other refuse with coal, or the burning of industrial or municipal waste in incinerators.

**929-3.2 Fly Ash (Class F):** Fly ash derived from the combustion of ground or powdered coal shall meet the requirements of ASTM C618 Class F fly ash.

**929-3.3 Fly Ash (Class C):** Fly ash derived from the combustion of ground or powdered coal shall meet the requirements of ASTM C618 Class C fly ash.

**929-3.4 Acceptance Testing of Fly Ash:** Acceptance of fly ash from sources operating under an accepted QC Plan shall be based on the monthly test reports meeting the chemical and physical requirements of ASTM C618 Class F or Class C and this Section. When the loss on ignition exceeds 5.0%, the Supplementary Optional Physical Requirements shall be mandatory. Fly ash meeting the requirements of ASTM C618 Class F may be used with no further testing.

Petroleum coke, bark ash, or Class C fly ash may be used if the concrete test results provide an improvement or comparable compressive strength, sulfate resistance, corrosion protective properties and other durability requirements, when compared to concrete containing Class F fly ash.

**929-3.4.1 Concrete/Mortar Testing:** Six concrete mixes shall be prepared by an accredited laboratory, three control batches using an approved Class F fly ash and three trial batches with petroleum coke, bark ash, or Class C fly ash, while all other constituents remain the same except for small adjustments to get the mix to yield. Follow the below criteria for each mix:

1. Use a previously approved FDOT Class IV (5,500 psi) mix design.
2. Size No. 57 Coarse Aggregate from an approved FDOT source.
3. 18 to 22% fly ash replacement.

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4. Water/cementitious materials ratio of 0.41.

The following testing shall be performed on each concrete mix, as appropriate.

Table 929-1 Concrete Testing Requirements		
Test Description	Standard Test Method	Test Age
Surface Resistivity	AASHTO T 358	28 days
Compressive Strength	ASTM C39	28 days
Chloride Diffusion	ASTM C1556 or NT Build 443	6 months, 12 months <sup>(1)</sup>
Length Change	ASTM C157	28 days

(1) Upon completion of all 28 day and 6 month testing, the SCM producer may present the data to the SMO for acceptance. The 12 month data shall be provided to the SMO upon completion.

Sulfate Resistance testing shall be performed on a mortar mix in accordance with ASTM C1012 and results reported after 6 and 12 months of testing.

## 929-4 Slag Cement.

**929-4.1 General:** Slag cement and reference cement used for determination of slag activity tests shall meet the requirements of ASTM C989. Sampling and testing procedures shall follow the requirements of ASTM C989. Only slag cement Grade 100 and 120 will be permitted.

**929-4.2 Acceptance Testing of Slag Cement:** Acceptance of slag cement from sources operating under an accepted QC Plan shall be based on the monthly test reports meeting the chemical and physical requirements of ASTM C989 and this Section.

## 929-5 Calcined Clay.

**929-5.1 General:** Sampling and testing of calcined clay shall follow the requirements of ASTM C311. Calcined clay shall meet the requirements of ASTM C618 Class N.

**929-5.2 Acceptance Testing of Calcined Clay:** Acceptance of calcined clay from sources operating under an accepted QC Plan shall be based on the monthly test reports meeting the chemical and physical requirements of ASTM C618 Class N and this Section.

Calcined clay may be used in concrete if the test results provide an improvement or comparable compressive strength, sulfate resistance, corrosion protective properties, and other durability requirements of concrete, when compared to ASTM C618 Class F fly ash concrete.

**929-5.2.1 Concrete/Mortar Testing:** Six concrete mixes shall be prepared by an accredited laboratory, three control batches using an approved Class F fly ash and three comparison batches with the calcined clay, while all other constituents remain the same except for small adjustments to get the mix to yield. Follow the below criteria for each mix:

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- design.
1. Use a previously approved FDOT Class IV (5,500 psi) mix
  2. Size No. 57 Coarse Aggregate from an approved FDOT source.
  3. 18 to 22% fly ash replacement.
  4. Water/cementitious materials ratio of 0.41.
- Testing shall be performed in accordance with Table 929-1.  
Sulfate Resistance testing shall be performed on a mortar mix in accordance with ASTM C1012 and results reported after 6, 12, and 18 months of testing.

## 929-6 Ground Glass.

**929-6.1 General:** Sampling and testing of ground glass shall follow the requirements of ASTM C311. Ground glass shall meet the requirements of ASTM C1866. Sampling and testing procedures shall follow the requirements of ASTM C1866.

**929-6.2 Acceptance Testing of Ground Glass:** Acceptance of ground glass from sources operating under an accepted QC Plan shall be based on the monthly test reports meeting the chemical and physical requirements of ASTM C1866 and this Section.

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Ground glass may be used in concrete if the test results provide an improvement or comparable compressive strength, sulfate resistance, corrosion protective properties, and other durability requirements of concrete, when compared to ASTM C618 Class F fly ash concrete.

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**929-6.2.1 Concrete/Mortar Testing:** Six concrete mixes shall be prepared by an accredited laboratory, three control batches using an approved Class F fly ash and three comparison batches with the ground glass, while all other constituents remain the same except for small adjustments to get the mix to yield. Follow the below criteria for each mix:

- design.
1. Use a previously approved FDOT Class IV (5,500 psi) mix
  2. Size No. 57 Coarse Aggregate from an approved FDOT source.
  3. 18 to 22% fly ash replacement.
  4. Water/cementitious materials ratio of 0.41.
- Testing shall be performed in accordance with Table 929-1.  
Sulfate Resistance testing shall be performed on a mortar mix in accordance with ASTM C1012 and results reported after 6, 12, and 18 months of testing.

## 929-7 Highly Reactive Pozzolans.

### 929-7.1 Silica Fume:

**929-7.1.1 General:** Silica Fume shall meet the requirements of ASTM C1240 using the referenced test methods and frequencies.

**929-7.1.2 Acceptance Testing of Silica Fume:** Acceptance of silica fume from sources operating under an accepted QC Plan shall be based on monthly test reports that the material meets the requirements of ASTM C1240 and this Section.

### 929-7.2 Metakaolin:

**929-7.2.1 General:** Metakaolin shall meet the requirements of ASTM C618 Class N with the following modifications:

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1. The sum of  $\text{SiO}_2 + \text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3$  shall be at least 85%.
  2. The loss on ignition shall be less than 3.0%.

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3. The available alkali's, as equivalent  $\text{Na}_2\text{O}$ , shall not exceed 1.0%.

4. The strength activity Index, at 7 days, shall be at least 85%.

**929-7.2.2 Acceptance Testing of Metakaolin:** Acceptance of metakaolin from sources operating under an accepted QC Plan shall be based on the monthly test reports meeting the chemical and physical requirements of ASTM C618 Class N, as modified herein, and this Section.

Metakaolin may be used in concrete if the test results provide an improvement or comparable compressive strength, sulfate resistance, corrosion protective properties, and other durability requirements of concrete, when compared to ASTM C618 Class F fly ash concrete.

**929-7.2.3 Concrete/Mortar Testing:** Six concrete mixes shall be prepared by an accredited laboratory, three control batches using an approved Class F fly ash and three comparison batches with the metakaolin, while all other constituents remain the same except for small adjustments to get the mix to yield. Follow the below criteria for each mix:

1. Use a previously approved FDOT Class IV (5,500 psi) mix design.
2. Size No. 57 Coarse Aggregate from an approved FDOT source.
3. 18 to 22% fly ash replacement.
4. Water/cementitious materials ratio of 0.41.

Testing shall be performed in accordance with Table 929-1.

Sulfate Resistance testing shall be performed on a mortar mix in accordance with ASTM C1012 and results reported after 6, 12, and 18 months of testing.

## **929-7.3 Ultra Fine Fly Ash:**

**929-7.3.1 General:** Sampling and testing of the ultra fine fly ash shall follow the requirements of ASTM C311. Ultra fine fly ash derived from the combustion of ground or powdered coal shall meet the requirements of ASTM C618 as a Class F fly ash with the following modifications:

1. The pozzolanic activity index, at 7 days, shall be at least 85% of the control and the pozzolanic activity index, at 28 days, shall be at least 95% of the control.
2. The amount of material retained when wet-sieved on a 45- $\mu\text{m}$  sieve shall be less than 6.0%.
3. The moisture content shall be less than 1.0%.
4. The loss on ignition shall be less than 2.0%.

**929-7.3.2 Acceptance Testing of Ultra Fine Fly Ash:** Acceptance of fly ash from sources operating under an accepted QC Plan shall be based on the monthly test reports meeting the chemical and physical requirements of ASTM C618 Class F fly ash and this Section. When the loss on ignition exceeds 2.0%, the Uniformity Requirements in the Supplementary Optional Physical Requirements shall be mandatory.

## **929-8 Shipping and Storage.**

SCMs may be delivered in bags or in bulk. SCMs from an SCM producer on the Cementitious Materials Production Facility Listing shall be shipped on the basis of test reports meeting the requirements of this Section. Ensure that each shipment is

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accompanied by a delivery ticket that is traceable to the test report and includes, at a minimum, the following information:

1. FDOT Facility Identifier
2. Type of material (e.g. Class F fly ash or Grade 120 slag)
3. Date shipped
4. Silo Identification

The storage building, bin or silo shall be weatherproofed.

## **929-9 Foreign Supplementary Cementitious Material Acceptance.**

SCMs being imported from a foreign source shall conform to all requirements of this Section and will be subject the following process:

1. The proposed QC Plan shall be sent to the SMO and will include information regarding the QC, sampling, storage, and handling of the material at the arrival terminal as well as the shipping control to and from the arrival terminal. In addition, the QC Plan from the foreign source shall be translated to English and will be included with the proposed QC Plan for the arrival terminal.

2. An initial one gallon by volume sample of the imported SCM shall be sent to the SMO for chemical and physical testing.

3. When the first ship is being loaded from the foreign source, a one gallon by volume verification sample will be obtained and shipped to the SMO for chemical and physical property testing.

The material will be accepted for use on Department projects provided that the QC Plan has been accepted, and the results of the initial and verification samples have been confirmed to meet the requirements of this Section.

Upon receiving the shipment of cement at the arrival terminal, the Department will be notified, and a Department representative may obtain another verification sample.

Test reports representing each shipment shall be sent to the SMO.