

ORINATION FORM

Proposed Revisions to the Specifications

(Please provide all information - incomplete forms will be returned)

Date:

Office:

Originator:

Specification Section:

Telephone:

Article/Subarticle:

email:

****Will the proposed revision require changes to:**

Publication	Yes	No	Office Staff Contacted and date contacted
Standard Plans Index			
Traffic Engineering Manual			
FDOT Design Manual			
Construction Project Administration Manual			
Basis of Estimate/Pay Items			
Structures Design Guidelines			
Approved Product List			
Materials Manual			

**This section must be completed prior to processing proposed revisions.

Will this revision necessitate any of the following:

Design Bulletin

Construction Bulletin

Estimates Bulletin

Materials Bulletin

Are all references to external publications current?

Yes

No

If not, what references need to be updated? (Please include changes in the redline document.)

Why does the existing language need to be changed?

Summary of the changes:

Are these changes applicable to all Department jobs?

Yes

No

If not, what are the restrictions?

Contact the State Specifications Office for assistance in completing this form.

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M E M O R A N D U M

DATE: June 11, 2020
TO: Specification Review Distribution List
FROM: Daniel Strickland, P.E., State Specifications Engineer
SUBJECT: Proposed Specification: **9290000 SUPPLEMENTARY CEMENTITIOUS MATERIALS**

In accordance with Specification Development Procedures, we are sending you a copy of a proposed specification change.

This change was proposed by Tim Counts to clarify the concrete and mortar testing requirements, update Quality Control requirements, and add the approval process for foreign cementitious materials to the Standard Specification.

Please share this proposal with others within your responsibility. Review comments are due within four weeks and should be sent to Mail Station 75 or online at <http://fdotewp1.dot.state.fl.us/programmanagement/development/industryreview.aspx>. Comments received after **July 9, 2020**, may not be considered. Your input is encouraged.

DS/dh

Attachment

**SUPPLEMENTARY CEMENTITIOUS MATERIALS
(REV 5-7-20)**

SECTION 929 is deleted and the following substituted:

**SECTION 929
SUPPLEMENTARY CEMENTITIOUS MATERIALS**

929-1 ~~General~~ Basis for Source Approval.

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.

~~929-1.1 General: The cementitious materials supplier shall submit the proposed Quality Control (QC) Plan, certified test reports from an approved independent laboratory acceptable to the State Materials Office (SMO), and a sample of the material for Department verification. The Quality Control Program of a cementitious materials supplier shall conform to Section 105. Continuance of Department qualifications is subject to satisfactory results from periodic verification evaluations. A verification sample may be taken at the manufacturer's plant, distribution facility or at the concrete producer's plant.~~

~~Upon review of the QC Plan and satisfactory verification of the test results, the plant will be placed on the Department's Production Facility Listing. The cementitious materials supplier shall utilize a QC Plan accepted by the SMO. The Department reserves the right to withdraw QC Plan acceptance and to require cementitious material shipments to be individually tested prior to incorporation into Department work. QC Plans may be suspended when the performance of cementitious material is in question, including problems with concrete quality, inconsistent QC data, or failure of QC or verification test results.~~

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.

929-1.12 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.

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. 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-~~32~~ Fly Ash.

929-~~32.1~~ 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-~~32.2~~ 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.

~~**929-2.2.1 Petroleum Coke Class F:** Fly ash resulting from the combustion of coal and petroleum coke shall meet the physical and chemical requirements of ASTM C618 Class F fly ash. When petroleum coke Class F fly ash is used in concrete, the test results shall verify improved or comparable strength, sulfate resistance, corrosion protective properties and other durability requirements of concrete, as compared to ASTM C618 Class F fly ash concrete. The strength and durability tests of concrete shall be performed in accordance with ASTM C39, ASTM C157, FM 3-C1012, FM 5-516 and AASHTO T358.~~

~~**929-2.2.2 Bark Ash Class F:** Fly ash resulting from the combustion of timber bark ash and coal shall meet the physical and chemical requirements of ASTM C618 Class F fly ash. When bark ash is used in concrete, test results shall verify improved or comparable strength,~~

~~sulfate resistance, corrosion protective properties, and other durability requirements of concrete, as compared to ASTM C618 Class F fly ash concrete. The strength and durability tests of concrete shall be performed in accordance with ASTM C39, ASTM C157, AASHTO T358, FM 3 C1012, and FM 5-516.~~

929-~~32.3~~ 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. ~~When Class C fly ash is used in concrete, the test results shall verify improved or comparable strength, sulfate resistance, corrosion protective properties, and other durability requirements of concrete, as compared to ASTM C618 Class F fly ash concrete. The strength and durability tests of concrete shall be performed in accordance with ASTM C39, ASTM C157, AASHTO T358, FM 3 C1012, and FM 5-516.~~

~~929-2.4 Exceptions:~~ Fly ash shall not be used in conjunction with Type IP or Type IS cements.

929-~~32.45~~ Acceptance Testing of Fly Ash: Acceptance of fly ash from sources operating under an ~~accepted~~approved QC Plan shall be based on the monthly ~~certified~~ test report 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 ~~except that the Effectiveness in Controlling Alkali-Silica Reaction will not be required. An approved laboratory shall perform the monthly QC tests and a copy of their certified test reports shall be sent to the SMO when the material is in use on Department projects. The certification shall indicate that the fly ash meets the requirements of this Specification. Also, the corresponding samples along with certified test reports shall be submitted to the Department, upon request.~~ 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 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.
4. Water/cementitious materials ration of 0.41.

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

<u>Test Description</u>	<u>Standard Test Method</u>	<u>Test Age</u>
<u>Surface Resistivity</u>	<u>AASHTO T 358</u>	<u>28 days</u>
<u>Compressive Strength</u>	<u>ASTM C39</u>	<u>28 days</u>

<u>Table 929-1</u> <u>Concrete / Mortar Testing Requirements</u>		
<u>Test Description</u>	<u>Standard Test Method</u>	<u>Test Age</u>
<u>Chloride Diffusion</u>	<u>ASTM C1556 or NT Build 443</u>	<u>6 months, 12 months ⁽¹⁾</u>
<u>Sulfate Resistance</u>	<u>ASTM C1012</u>	<u>6 months, 12 months, 18 months ⁽¹⁾</u>
<u>Length Change</u>	<u>ASTM C157</u>	<u>28 days</u>
<u>(1) Upon completion of all 28 day and 6-month testing, the cement producer should present the data to the SMO for acceptance. 12-month and 18-month data should be provided to the SMO upon completion.</u>		

929-43 Slag Cement.

929-43.1 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.**

~~929-3.2 Special Requirements: Only ground granulated blast furnace slag Grade 100 and 120 will be permitted.~~

~~929-3.3 Exceptions: Slag shall not be used in conjunction with Type IP or Type IS cements.~~

929-43.24 Acceptance Testing of Slag Cement: Acceptance of slag **cement** from sources operating under an approved QC Plan shall be based on the monthly **certified QC tests reports** meeting the chemical and physical requirements of ASTM C989 **and this Section.** ~~An approved laboratory shall perform the monthly QC tests and a copy of their mill certificates shall be sent to the SMO when the material is in use on Department projects. The certification shall indicate that the slag meets the requirements of this Specification. Also, the corresponding samples along with mill certificates shall be submitted to the Department, upon request.~~

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 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:

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.

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.

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.

929-6.2.1 Concrete/Mortar Testing: Six 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:

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.

929-74 Highly Reactive Pozzolans.**929-74.1 Silica Fume:**

929-74.1.1 General: Silica Fume shall meet the requirements of ASTM C1240 using the referenced test methods and frequencies.

929-74.1.2 Acceptance Testing of Silica Fume: Acceptance of silica fume from sources operating under an ~~accepted~~approved QC Plan shall be based on ~~monthly test reports~~certification that the material meets the requirements of ASTM C1240 and this ~~Section~~Specification.

929-74.2 Metakaolin:

929-74.2.1 General: Metakaolin shall meet the requirements of ASTM C618 Class N with the following modifications:

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%.
3. The available alkali's, as equivalent Na_2O , shall not exceed 1.0%.
4. The strength activity Index, at 7 days, shall be at least 85%.

~~5. When metakaolin is used in concrete, the test results shall verify improved or comparable strength, sulfate resistance, corrosion protective properties and other durability performance properties of concrete, as compared to the performance of silica fume concrete. The comparison strength and durability tests shall be performed in accordance with ASTM C39, ASTM C157, FM 3 C1012, FM 5 516, and AASHTO T358, by an independently approved testing laboratory. Sampling and testing of metakaolin shall follow the requirements of ASTM C311.~~

929-74.2.2 Acceptance Testing of Metakaolin: Acceptance of metakaolin from sources operating under an ~~accepted~~approved QC Plan shall be based on the monthly ~~test reports~~certified 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. An approved laboratory shall perform the monthly QC tests and a copy of their certified test reports shall be sent to the SMO, when the material is in use on Department projects. Also, the corresponding samples along with certified test reports shall be submitted to the Department, upon request. The certification shall indicate that the metakaolin meets the requirements of this Specification.

929-7.2.3 Concrete/Mortar Testing: Six 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.

929-7.4.3 Ultra Fine Fly Ash:

929-7.4.3.1 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. Particles less than 3.25 microns shall be at least 50% of the particle size distribution, as measured by laser particle size analyzer. Particles less than 8.50 microns shall be at least 90% of the particle size distribution, as measured by laser particle size analyzer.~~
- ~~3.~~ 23. The amount of material retained when wet-sieved on a 45- μ m sieve shall be less than 6.0%.
- ~~4.~~ 34. The moisture content shall be less than 1.0%.
- ~~5.~~ 45. The loss on ignition shall be less than 2.0%.

~~**929-4.3.2 Exceptions:** Ultra fine fly ash shall not be used in conjunction with Type IP or Type IS cements.~~

929-7.4.3.2 Acceptance Testing of Ultra Fine Fly Ash: Acceptance of fly ash from sources operating under an ~~accepted~~ approved QC Plan shall be based on the monthly ~~certified~~ test report 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. ~~An approved laboratory shall perform the monthly QC tests and a copy of their certified test reports shall be sent to the SMO when the material is in use on Department projects. The certification shall indicate that the fly ash meets the requirements of this Specification. Also, the corresponding samples along with certified test reports shall be submitted to the Department, upon request.~~

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 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 sample of the imported SCM shall be sent to the SMO for chemical and physical testing.

3. Upon receiving the SCM at the arrival terminal, a Department representative will obtain a verification sample. Verification testing of the chemical and physical properties will be performed at the SMO.

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.

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