Origination Form

Specifications

Name:	Andrew Pinkham	**Standard Specification Section:**	929
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Date:	2025-06-05T11:31:16Z	**Associated Specs:**	None

Summary:

This change aligns supplementary cementitous materials requirements with AASHTO equivalents (as available) and updates strength activity index and LOI requirements for metakaolin.

Justification:

Alignment with AASHTO permits utilization of our AASHTO COMP resources. SMO is seeing an increase in metakaolin sources with SAI values of <100, which is not a highly reactive pozzolan.

Do the changes affect other types of specifications?

Neither

List Specifications Affected:

Other Affected Documents/Offices	Contacted	Yes/No
Other Standard Plans		No
Florida Design Manual		No
Structures Manual		No
Basis of Estimates Manual		No
Approved Product List		No
Construction Office		No
Maintenance Office		No
Materials Manual		No
Traffic Engineering Manual		No

Are changes in line with promoting and making progress on improving safety, enhancing mobility, inspiring innovation, and fostering talent; explain how?

This change aligns FDOT with AASHTO requirements for SCMs.

What financial impact does the change have; project costs, pay item structure, or consultant fees?

None

What impact does the change have on production or construction schedules?

None

How does this change improve efficiency or quality?

FDOT is not able to directly impact ASTM requirements, but has a direct voice in AASHTO requirements. This change ensures that FDOT is maintaining the best quality materials available.

Which FDOT offices does the change impact?

Office of Materials

What is the impact to districts with this change?

None

Does the change shift risk and to who?

No

Provide summary and resolution of any outstanding comments from the districts or industry.

Comments and Responses are available on the Track the Status of Revisions hyperlink located on the Specifications landing page: https://www.fdot.gov/programmanagement/Specs.shtm

What is the communication plan?

Through the established specification revision process (e.g., Internal and Industry Review)

What is the schedule for implementation?

The Standard Specifications eBook and Workbook are effective July 1st every year.

SUPPLEMENTARY CEMENTITIOUS MATERIALS
(REV 6-5-25)

SUBARTICLE 929-1.1 is deleted and the following substituted:

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 reported as an average of the last twelve monthly tests, updated every six months.
f. The approved laboratory that performed all tests.

4. Purchaser: The term "purchaser" in the ~~ASTM~~ AASHTO requirements shall be taken as the Department.

ARTICLE 929-3 is deleted and the following substituted:

929-3 Coal Ash.

929-3.1 General: Sampling and testing of coal ash shall follow the requirements of ~~ASTM C311~~AASHTO M 295. Coal 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. The Engineer may accept sources of coal ash containing bottom ash on a case-by-case basis. The SCM Producer shall report:

1. If the material is fly ash or harvested coal ash.
2. If harvested coal ash is combined with any other material.

929-3.1.1 Fly Ash (Class F or Class C): Coal ash derived from the combustion of ground or powdered coal meeting the requirements of ~~ASTM C618~~AASHTO M 295 Class F or Class C coal ash, and this Section.

929-3.1.2 Harvested Coal Ash (Class F or Class C): Coal ash derived from the combustion of ground or powdered coal that has been stored in a landfill or surface

impoundment and subsequently excavated and processed to meet the requirements of ~~ASTM C618~~AASHTO M 295 Class F or Class C coal ash, and this Section.

929-3.2 Acceptance Testing of Coal Ash: Coal Ash derived from the combustion of ground or powdered coal shall meet the requirements of ~~ASTM C618~~AASHTO M 295 Class F or Class C coal ash.

Acceptance of coal 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~~AASHTO M 295 Class F or Class C, and this Section. When the loss on ignition exceeds 6.0%, the Supplementary Optional Physical Requirements shall be mandatory.

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

929-3.2.1 Concrete/Mortar Testing: Six concrete mixes shall be prepared by an accredited laboratory, three control batches using Class F coal ash and three comparison batches with Class C coal ash, while all other constituents remain the same except for small adjustments to get the mix to yield. Concrete constituents used in the mixes must be obtained from FDOT approved sources. Use a Class IV (5,500 psi) Conventional binary concrete mix design meeting the requirements of Section 346, with the following attributes:

1. Type II or Type IL cement.
2. Size No. 57 coarse aggregate.
3. Control batches: Replace 18 to 22% of the cement with Class F coal ash.
4. Comparison batches: Replace a portion of cement with a quantity of Class C coal ash sufficient to produce properties comparable to those of the control batches.
5. Water/cementitious materials ratio of 0.41.

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

Table 929-1
Concrete/Mortar Testing Requirements

Test Description	Standard Test Method	Test Age
Surface Resistivity	AASHTO T 358	28, 56, 91, and 180 days
Compressive Strength	ASTM C39	28, 56, 91, and 180 days
Chloride Diffusion	ASTM C1556 or NT Build 443	6 and 12 months
Length Change	ASTM C157	Per ASTM C157 (1)
Sulfate Resistance (2)	ASTM C1012	6, 12, and 18 months

(1) Follow both the Water and Air Storage procedures.
(2) Prepare a mortar mix using a fixed water/cementitious materials ratio of 0.485.

Upon completion of the 6-month concrete and mortar testing, the SCM Producer may present the data to the SMO for acceptance. The 12 and 18-month data shall be provided to the SMO upon completion.

ARTICLE 929-4 is deleted and the following substituted:

929-4 Slag Cement.

Slag cement (ground granulated blast furnace slag, GGBFS) is the quenched, ground by-product of the iron ore refinement process conducted in blast furnaces. It is primarily an amorphous material of calcium aluminosilicate constituents.

929-4.1 General: Slag cement and reference cement used for determination of slag activity tests shall meet the requirements of AASHTO M 302~~ASTM C989~~. Sampling and testing procedures shall follow the requirements of AASHTO M 302~~ASTM C989~~.

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 AASHTO M 302 ~~ASTM C989~~ and this Section. The test report shall include:

1**.** For slag granules, provide X-ray Fluorescence (XRF) elemental analysis of the granules, presented in oxide form. Include CaO, SiO_2, Al_2O_3, MgO, Mn_2O_3, TiO_2, Fe_2O_3, and sulfur (as sulfide).

2. For slag cement, provide XRF elemental analysis, presented in oxide form. Include CaO, SiO_2, Al_2O_3, MgO, Mn_2O_3, TiO_2, Fe_2O_3, sulfur as sulfide (S), sulfate sulfur (SO_3), and total sulfur as sulfate (SO_3).

3. The results of all testing listed under Test Methods section of AASHTO M 302~~ASTM C989~~..

4. Indicate the amount of any additions introduced during grinding of the slag granules and report compliance with Section 6 of AASHTO M 302~~ASTM C989~~.

a. Amount of limestone added and its $CaCO_3$ content.

b. Amount of other inorganic processing addition.

5. For calcium sulfate additions, indicate:

a. Amount of calcium sulfate added.

b. Form of calcium sulfate.

c. SO_3 content.

d. Method used to determine the amount of calcium sulfate that was added.

929-4.2.1 Assessment of Sulfate Resistance: Following guidance in ACI 233R-17 Guide to the Use of Slag Cement in Concrete and Mortar, slag cements with Al_2O_3 contents greater than 11% should be interground with calcium sulfate to avoid an undersulfated cementitious system. Provide ASTM C1012 data with a 50:50 cement-slag cement blend, using a Type II or Type IL cement on the Department's Cementitious Materials Production Facility Listing, with an alkali content of no more than 0.6%, when any of the following conditions occur:

1.The Al_2O_3 content of the slag cement is equal to or greater than 12%.

2. The slag cement is a blend of slag granules from more than one source that are interground during production of the slag cement and for which one or more of the following are true:

a. The Al_2O_3 contents of both slag sources are equal to or greater than 12%.

b. The average Al_2O_3 content of the blend is equal to or greater than 12%.

c. One of the slag sources has an Al_2O_3 content that is equal to or greater than 14%.

The Department will consider the ASTM C1012 data acceptable when the results indicate no more than 0.10% expansion at 12 months.

The Department may grant provisional acceptance if the expansion does not exceed 0.05% at 6 months.

For any slag cements with Al_2O_3 content equal to or greater than 12%, perform a retest of ASTM C1012 if the monthly test report indicates that any of the following conditions have occurred:

1. The Al_2O_3 content increases by greater than or equal to 1.0% of the content measured during qualification of the sulfate resistance.

2. The sulfate sulfur (SO_3) content decreases by 0.25% less than that measured during qualification of the sulfate resistance.

3. The Blaine fineness increases by 50 m^2/kg greater than that measured during qualification of the sulfate resistance.

The Department may grant provisional acceptance of the slag cement source if ASTM C1012 data is required for any of the above retesting conditions.

ARTICLE 929-5 is deleted and the following substituted:

929-5 Calcined Clay.

929-5.1 General: Sampling and testing of calcined clay shall follow the requirements of ~~ASTM C311~~AASHTO M 295. Calcined clay shall meet the requirements of AASHTO M 295 ~~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 AASHTO M 295 ~~ASTM C618~~ Class N and this Section.

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

929-5.2.1 Concrete/Mortar Testing: Six concrete mixes shall be prepared by an accredited laboratory, three control batches using Class F coal 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. Concrete constituents used in the mixes must be obtained from FDOT approved sources. Use a Class IV (5,500 psi) Conventional binary concrete mix design meeting the requirements of Section 346, with the following attributes:

1. Type II or Type IL cement.

2. Size No. 57 coarse aggregate.

3. Control batches: Replace 18 to 22% of the cement with Class F coal ash.

4. Comparison batches: Replace a portion of cement with a quantity of calcined clay sufficient to produce properties comparable to those of the control batches.

5. Water/cementitious materials ratio of 0.41.

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

ARTICLE 929-7 is deleted and the following substituted:

929-7 Natural Pozzolan.

929-7.1 General: Sampling and testing of natural pozzolans shall follow the requirements of AASHTO M 295~~ASTM C311~~. Natural pozzolans shall meet the requirements of ~~ASTM C618~~AASHTO M 295 Class N.

929-7.2 Acceptance Testing of Natural Pozzolans: Acceptance of natural pozzolans 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~~AASHTO M 295 Class N and this Section.

Natural pozzolans may be used in concrete if the test results provide improved or comparable compressive strength, sulfate resistance, corrosion protective properties, and other durability requirements of concrete, when compared to concrete containing Class F coal ash.

929-7.2.1 Concrete/Mortar Testing: Six concrete mixes shall be prepared by an accredited laboratory, three control batches using Class F coal ash and three comparison batches with the natural pozzolan, while all other constituents remain the same except for small adjustments to get the mix to yield. Concrete constituents used must be obtained from FDOT approved sources. Use a Class IV Conventional (5,500 psi) binary concrete mix design meeting the requirements of Section 346, with the following attributes:

1. Type II or Type IL cement.
2. Size No. 57 coarse aggregate.
3. Control batches: Replace 18 to 22% of the cement with Class F coal ash.
4. Comparison batches: Replace a portion of cement with a quantity of natural pozzolan sufficient to produce properties comparable to those of the control batches.
5. Water/cementitious materials ratio of 0.41.

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

ARTICLE 929-8 is deleted and the following substituted:

929-8 Highly Reactive Pozzolans.

929-8.1 Silica Fume:

929-8.1.1 General: Silica Fume shall meet the requirements of AASHTO M 307~~ASTM C1240 using the referenced test methods and frequencies~~.

929-8.1.2 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~~ AASHTO M 307 and this Section.

929-8.2 Metakaolin:

929-8.2.1 General: Metakaolin shall meet the requirements of ~~ASTM C618 Class N~~AASHTO M 321 and the following:

1. The sum of $SiO_2 + Al_2O_3 + Fe_2O_3$ shall be at least 85%.
2. The loss on ignition shall be less than 3.0%.
3. The available alkalis, as equivalent Na_2O, shall not exceed 1.0%.
4. The strength activity index~~,~~ shall be at least 85% at 7 days, and at least 100% at 28-days.~~shall be at least 85%.~~

929-8.2.2 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~~AASHTO M 321 and this Section.~~, as modified herein, and this Section.~~

929-8.3 Ultra-Fine Fly Ash:

929-8.3.1 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~~AASHTO M 295 as a Class F fly ash with the following modifications:

1. The strength activity index, at 7 days, shall be at least 85% of the control and the strength 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-µm 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%.

929-8.3.2 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 ~~ASTM C618~~ AASHTO M 295 2.0%, the Uniformity Requirements in the Supplementary Optional Physical Requirements shall be mandatory.