ORIGINATION FORM
Proposed Revisions to the Specifications

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

Date: 2/20/2020

Office: State Materials Office

Originator: Tim Counts

Specification Section: 921

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Article/Subarticle: Entire Document

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

Publication	Yes	No	Office Staff Contacted and date contacted
Standard Plans Index	○	◉	Cheryl Hudson 2/24/2020
Traffic Engineering Manual	○	◉	Javier Ponce 2/24/2020
FDOT Design Manual	○	◉	Bobby Bull 2/24/2020
Construction Project Administration Manual	○	◉	Scott Arnold 2/24/2020
Basis of Estimate/Pay Items	○	◉	Melissa Hollis 2/24/2020
Structures Design Guidelines	○	◉	Ben Goldsberry 2/24/2020
Approved Product List	○	◉	Karen Byrum 2/24/2020
Materials Manual	○	◉	Susan Musselman 2/24/202

**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?

Clarification of the concrete and mortar testing requirements was needed for high alkali cements. Additionally, definitions and terms needed clarification, the Quality Control Program requirements were updated to current practices, and additional requirements for delivery tickets were included. The process for the approval of Type IL Portland Limestone Cement was formalized and included, as well as the process for the approval of foreign cement sources.

Summary of the changes:

Editorial changes throughout. Section 921-1.2.1 Concrete/Mortar Testing was added. Section 921-2 Definitions was formatted for consistency with other Specification Sections. Section 921-3 Quality Control Program was reorganized for clarity. Section 921-5 Type IL Portland Limestone Cement Approval was added. Section 921-6 Foreign Cement Acceptance was added.

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: May 21, 2020

TO: Specification Review Distribution List

FROM: Daniel Strickland, P.E., State Specifications Engineer

SUBJECT: Proposed Specification: **9210000 Portland Cement and Blended Cement.**

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

This change was proposed by Tim Counts at the State Materials Office to clarify the concrete and mortar testing requirements for high alkali cements. Definitions and terms were clarified, the Quality Control Program requirements were updated, and delivery tickets were included.

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 **June 18, 2020,** may not be considered. Your input is encouraged.

DS/rf

Attachment

PORTLAND CEMENT AND BLENDED CEMENT
(REV 5-15-20)

SECTION 921 is deleted and the following substituted:

921-1 General.

Cement shall conform to the requirements of AASHTO M85 or AASHTO M240, as applicable, except as ~~defined below or as specifically restricted in Section 346~~provided in this Section.

921-1.1 Type of Cement: Cement may be Types I, II, II (MH), III, IV, V (as defined by AASHTO M85), or IL, IP, IS (as defined by AASHTO M240). Cement type shall be selected based on component and environmental conditions in accordance with Section 346. Different brands of cement, cement of the same brand from different facilities, or different types of cement shall be stored separately, identified, and shall not be mixed.

921-1.2 Alkali Content: Portland cement containing a maximum of 0.60% alkali, or less, calculated as Na_2O (% Na_2O plus 0.658% K_2O), may be used with no further testing.

Cement with an alkali content greater than 0.60% but less than or equal to 1.00%, calculated as Na_2O (% Na_2O plus 0.658% K_2O), may be used ~~with the following requirement.~~if the c~~C~~oncrete test results ~~shall verify~~ provides an improvement~~d~~ or comparable compressive strength, sulfate resistance, corrosion protective properties and other durability requirements, when~~as~~ compared to concrete containing cement with an ~~maximum~~ alkali content less than~~of~~ 0.60%. ~~The strength and durability tests of concrete shall be performed in accordance with AASHTO T358, ASTM C39, ASTM C157, FM 3-C1012, and FM 5-516.~~

921-1.2.1 Concrete/Mortar Testing: Six mixes shall be prepared by an independent accredited laboratory, three control batches using an approved cement with a maximum alkali content of 0.60% and three trial batches with cement with an alkali content above 0.60%, while all other constituents remain the same except for small adjustments to get the mix to yield. The alkali content of the cement used in the trial batches shall be at least the anticipated maximum alkali content of the cement that will be observed during production. 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% Class F fly ash replacement from an approved FDOT source
4. Water/Cementitious ratio of 0.41

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

Table 921-1
Concrete /Mortar 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	35 days, 6 months, 12 months
Sulfate Resistance	ASTM C1012	6 months, 12 months, 18 months

Length Change	ASTM C157	28d

Upon completion of all 28 days and 6-month testing, the cement producer shall present the date to the State Materials Office (SMO) for acceptance, 12 month and 18-month data shall be provided to the SMO upon completion.

921-1.3 Heat of Hydration: The cement heat of hydration for Type II (MH) and~~or~~ Type IL shall be tested in accordance with ASTM C1702 and reported at three days.

921-2 Definitions~~Terminology~~.

The following definitions are applicable to the production and Qquality Cc~~o~~ntrol (QC) of cement:

1. Approved Laboratory:~~ – indicates~~ A~~a~~ laboratory ~~acceptable to the State Materials Office (SMO)~~ that is currently inspected by the Cement and Concrete Reference Laboratory (CCRL), is actively participating in the CCRL~~their~~ proficiency program and which has all deficiencies noted at the time of inspection corrected. The laboratory must also authorize CCRL to submit their~~final~~ inspection reports to the SMO.

2. Cement Producer~~Approved Source~~:~~ –~~ ~~indicates~~ A~~a~~ cement supplier, including but not limited to a plant, a terminal, or a transfer facility, that has been qualified by the SMO. ~~A list of approved cement sources~~ The Cementitious Materials Production Facility Listing will be maintained by the SMO.

3. Mill Test Report:~~ –~~ ~~indicates~~ A~~a~~ certification from the cement supplier showing~~identifying~~ that the cement meets the requirements of Section 921.~~, the type, the production period the sample represents and the chemical and physical analyses of the cement, and the silo numbers where the cement is stored. The mill test report must identify any limestone and/or inorganic processing additions, if either is incorporated into the finished product. The mill test report must also include the amount of limestone and/or inorganic processing additions used, expressed as a percentage of cement mass, the base cement phase composition, and the oxide composition of any limestone and/or inorganic processing additions, where applicable.~~

The mill test report must include, at a minimum, the following information:

1. The type of cement.
2. The production period.
3. Chemical and physical analysis of the cement.
4. The silo identification where the cement is stored.
5. The base cement phase composition.
6. Amount of limestone and/or inorganic processing additions used, expressed as a percentage of the cement mass, as applicable.
7. The oxide composition of the limestone and/or inorganic processing additions, as applicable.
8. The specific gravity of cement reported as an average of the last twelve-monthly tests, updated every six months.
9. The heat of hydration at three days, as applicable.
10. The approved laboratory that performed all tests.

An acceptable mill test report is available~~found~~ in the appendix of AASHTO M85.

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

~~Quality Control (QC) Plan Status - indicates quality control approval status, for each cement supplier and will be maintained by the SMO in conjunction with the approved source list.~~

~~Source of Supply - indicates a cement supplier responsible for supplying the final product. Where the supplier has more than one manufacturing facility, the source of supply may be designated as the manufacturer/facility.~~

~~**921-3 Packing, Handling and Storing.**~~

~~Cement may be delivered in bags or in bulk. The storage building, bin or silo shall be weatherproof and shall be located convenient to the work. On small jobs, storage in the open may be permitted by the Engineer in which case raised platforms and adequate waterproof coverings shall be provided.~~

~~**921-4 Rejection.**~~

~~The entire contents of the sack or bulk container which contains cement that does not meet the requirements of this Section or has been damaged, is partially set, lumpy or caked shall be rejected.~~

~~Bagged cement which varies more than 5% from the designated weight, or if the average weight of 50 sacks, taken at random, is less than the designated weight, the cement shall be rejected.~~

921-3~~5~~ Quality Control P~~rogram~~lan~~~~.

921-3~~5~~.1 General: ~~The~~Develop a Producer Q~~uality~~ C~~ontrol~~ Program ~~of a cement supplier shall conform to~~ as specified in Section 105.

Cement producers~~suppliers~~ shall submit a proposed QC Plan to the SMO for~~ plan~~ acceptance~~pproval~~. In addition to the QC Plan, the producer~~supplier~~ must submit monthly mill test reports from an approved laboratory which certifies that the cement in current production or supply conforms to the~~se~~ requirements of this Section.~~ Upon initial QC Plan approval and receipt of the cement mill test report, the suppliers will be placed in an approved source status with an approved QC Plan.~~

Cement producer 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 a reason for rejection of the material if the cement producer's QC Plan indicated that material will be diverted and not used for Department work.

921-3.2 Sampling and Testing: An approved laboratory shall perform one Q~~quality~~ C~~control~~ test per day. Mill test reports representing no more than one month's production shall be submitted to the SMO on a monthly basis, for foreign cement, refer to 921-6.~~Submit the monthly mill test report to the SMO. The mill test report shall indicate that the cement meets the requirements of this Section. Also, the corresponding samples along with mill test reports shall be submitted to the Department, upon request.~~

Representatives from the Department may take verification samples at ~~from~~ the cement producer's plant, terminal, distribution facility or the concrete production facility~~ at a minimum of once per year to verify compliance with the producer's QC Plan~~. Samples shall be obtained by one of the methods described in FM 5-503. Sample size shall be a minimum of one gallon. At the concrete production facility, cement samples shall be jointly obtained by the Department inspector and the concrete producer's representative.

~~The supplier's QC Plan shall be sufficient to ensure that more than 97% of all cement delivered for Department work shall meet all Specification requirements.~~ Upon request of the Department, the producer~~supplier~~ shall provide split samples of the cement collected for QC~~quality control~~ testing. Split samples shall be delivered to the SMO and shall be identified as representing a designated LOT of cement.

Notification of failing verification sample test results will be distributed to the cement producer and concrete producer, if applicable. Split samples of the initial sample may be provided to the cement supplier and concrete producer upon request.

921-3~~5~~.3~~2~~ Limestone and Inorganic Processing Additions: Producers intending to use limestone and/or inorganic processing additions as component materials in the production of cement shall describe the type, source, and the target amount, expressed as a percentage of cement mass. In addition, the producer shall display the information required in 921-2 on the mill test report. Samples of any pulverized~~both the~~ limestone and/or ~~any~~ inorganic processing additions shall be provided to the SMO for evaluation upon request.

~~**921-5.3 Acceptance of Portland Cement:** Portland cement from an approved source with a current QC Plan approval may be accepted on the basis of mill test reports meeting the applicable AASHTO requirements and Department Specifications and a delivery ticket on the producer's letterhead and traceable to the mill test report. Mill test reports shall be submitted upon request to the SMO and corresponding samples for verification testing. Quality control testing shall be performed by an approved laboratory.~~

~~**921-5.4 Cement Ownership and Responsibility:** For purposes of QC Plan approval status, the cement supplier shall be responsible for cement quality until the cement is accepted by the concrete producer. Where the cement has been accepted by a concrete producer and is subsequently found deficient, the concrete plant QC Plan approval may be withdrawn with respect to further use of that cement and reinstated only when the deficiency is adequately resolved. Reinstatement is made by the SMO.~~

~~**921-5.5 Quality Control Plan Approval Control:** The SMO may withdraw QC Plan approval and may require cement shipments to be individually tested prior to incorporation into Department work. QC Plan approvals may be rescinded when the performance of cement is in question, including problems with concrete quality, inconsistent quality control data, or failure of quality control or verification test results. Discontinuance of approval may be based on testing at the point of use, testing by the manufacturer or proven poor performance of the cement in concrete.~~

~~In the specific instance of a failing cement sample taken by the Department at the cement source, the failure shall initiate the Department to retest the sample. Failure of the retest will be considered adequate evidence to withdraw the QC Plan of the cement supplier.~~

~~Notification of failing test results will be distributed to the cement supplier (and concrete producers, if applicable) as designated in the approved QC Plan. Split samples of the initial sample may be provided to the cement supplier and concrete producer upon request.~~

~~Reinstatement of the QC Plan will occur when the cement producer identifies and corrects the specific cause of the failures or that a statistical analysis indicates that the current cement production meets or exceeds the requirements of this Section.~~

~~**921-5.6 Sampling of Cement:** The verification samples may be taken at the manufacturer's plant, distribution facility or at the concrete production facility. Samples shall be obtained by one of the methods in FM 5-503. Samples sizes shall be a minimum of one quart. At~~

~~the concrete production facility, cement samples shall be jointly obtained by the Department inspector and the concrete producer's representative.~~

921-4 Shipping and Storage.

Cement shall be delivered in bags or in bulk. Portland cement from a producer on the Cementitious Materials Production Facility Listing shall be shipped on the basis of mill test reports meeting the requirements of this Section. Ensure that each shipment is accompanied by a delivery ticket that is traceable to the mill test report and includes, at a minimum, the following information:

1. FDOT Facility Identifier
2. Type of cement
3. Date shipped
4. Silo Identification

The storage building, bin or silo shall be weatherproofed.

921-5 Type IL Portland-Limestone Cement Approval.

Type IL Portland-Limestone cement approval for the Department will be based on the ability of the cement to perform in extremely aggressive environments. Perform the required testing listed in this Section and submit the test data to the SMO once the 6-month testing has been completed. The SMO will review the provided data to verify trends and will provide provisional approval based on that performance. Additional data that is required at 12 and 18 months shall be submitted to the SMO to determine continued approval of the material. Present all data in comparison tables or charts. Send a two-gallon sample of the Type IL cement as well as a minimum 10-gram sample of the pulverized limestone shall be sent to the SMO for analysis.

921-5.1 Cement Testing: Perform AASHTO M240 Type IL chemical and physical testing as well as the heat of hydration in accordance with ASTM C1702.

921-5.2 Concrete/Mortar Testing: Six mixes shall be prepared by an independent accredited laboratory, three control batches using an approved Type II(MH) cement and three comparison batches where the Type IL (at the proposed limestone replacement percentage) replaces the Type II(MH) cement, 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% Class F fly ash replacement from an approved FDOT source
4. Water/Cementitious ratio of 0.41

Testing shall be performed in accordance with Section 921-1.2.1 Table 921-1.

921-6 Foreign Cement Acceptance.

Cement 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 cement 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 cement shall be sent to the SMO for chemical and physical verification testing.

3. Upon receiving the cement 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.

Mill test reports representing each shipment shall be sent to the SMO.

921-7 Rejection of Material:

The entire container which holds cement that does not meet the requirements of this Section or has been damaged, is partially set, lumpy or caked shall be rejected.

Bagged cement which varies more than 5% from the designated weight, or if the average weight of 50 sacks, taken at random, is less than the designated weight, the cement shall be rejected.