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M E M O R A N D U M

DATE: June 2, 2015

TO: Specification Review Distribution List

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

SUBJECT: Proposed Specification: **9380000 Post-Tensioning Grout.**

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

This change was proposed by Charles Boyd of the State Structures Design Office to modify the language to allow for use of flexible filler in post-tensioning applications. Revisions to include flexible filler are also proposed for Sections 105, 452, 462, and 960.

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://www2.dot.state.fl.us/ProgramManagement/Development/IndustryReview.aspx . Comments received after **June 30, 2015,** may not be considered. Your input is encouraged.

DS/dt
Attachment

POST-TENSIONING GROUT.
(REV ~~4-30~~5-~~13182~~729-15)

SECTION 938 is deleted and the following substituted:

SECTION 938
DUCT FILLER FOR POST-TENSION~~ING~~ED ~~GROUT~~STRUCTURES

938-1 ~~General Requirements~~Description.

This Section covers ~~grouts~~ filler materials ~~to be~~ used to fill voided areas within ducts to protect post-tensioning steel. Grout applications are differentiated into three applications: horizontal, vertical and repair.

~~Grouts shall be prepackaged in moisture proof containers. Grout bags shall indicate application, date of manufacture, LOT number and mixing instructions. Any change of materials or material sources requires new testing and certification of the conformance of the grout with this Specification. A copy of the Quality Control Data Sheet for each lot number and shipment sent to the job site shall be provided to the Contractor by the grout supplier and furnished to the Engineer. Materials with a total time from manufacture to usage in excess of six months shall be tested and certified by the supplier that the product meets the quality control specifications before use or the material shall be removed and replaced.~~

938-2 Approved Product List.

Only post-tensioning grouts and flexible filler material listed on the Department's Approved Product List (APL) shall be used. Manufacturers ~~of post-tensioning grout~~ seeking evaluation of their product shall submit an application in accordance with Section 6 and include certified test reports from an independent laboratory, ~~audited by the Cement Concrete Reference Laboratory (CCRL)~~~~certified by and~~ meeting the requirements of ISO 9001, ~~which~~ show~~s~~ing the material meets all the requirements specified herein. A written certification from the manufacturer that the product meets the requirements of this Section must be provided.

Any change of materials or material sources requires new testing and certification of the conformance of the grout with this Specification.

Grout products will be qualified by application (horizontal, vertical or repair).

938-~~2~~3 General Requirements.

938-~~2~~3.1 Grout: Grouts shall be prepackaged in clearly labeled moisture proof containers. Grout bags shall indicate application type, date of manufacture, LOT number and mixing instructions. ~~Any change of materials or material sources requires new testing and certification of the conformance of the grout with this Specification.~~ A copy of the Quality Control Data Sheet for each lot number and shipment sent to the job site shall be provided to the Contractor by the grout supplier and furnished to the Engineer. Materials with a total time from manufacture to usage in excess of six months shall be tested and certified by the supplier that the product meets the quality control specifications before use or the material shall be removed and replaced.

938-~~2~~3.2 Flexible Filler Microcystalline Wax: Flexible filler shall be delivered to the project site in clearly labeled prepackaged and stored in accordance with the manufacturer's recommendations and as applicable for the particular project. A copy of the manufacturer's

~~product data sheet~~Quality Control Data Sheet indicating compliance with Table 938-2 for each shipment sent to the job site shall be provided to the Contractor ~~by the wax supplier~~ and furnished to the Engineer.

938-~~3~~ 4 Grout.

938-~~3~~4.1 Mixing:~~.~~

The material shall be mixed in accordance with the manufacturer's recommendations.

938-4~~.~~.2 Grout Physical Properties~~.~~:

938-4.2.1 Gas Generation: The grout shall not contain aluminum or other components which produce hydrogen, carbon dioxide or oxygen gas.

938-4.2.2 Laboratory Testing: The grout shall meet or exceed the specified physical properties stated herein as determined by the following standard and modified ASTM and FM test methods conducted at normal laboratory temperature (65°F-~~78~~90°F) and conditions. ~~Conduct all grout tests with grout mixed to produce the minimum time of efflux. Establish~~ Use the midrange of the water content indicated in the manufacturer's technical data sheet to produce the ~~minimum and maximum~~ time of efflux shown in Table 938-1.

Table 938-1		
Property	Test Value	Test Method
Total Chloride Ions	Max. 1.0 lbs/yd^3	FM 5-516
~~Fine Aggregate (if utilized)~~Gradation	99% passing the No. 50 95% passing the No. 100 90% passing the No. 170 ~~Sieve (300 micron)~~	ASTM C136*
Hardened Height Change @ 24 hours and 28 days	0.0% to + 0.2%	ASTM C1090**
Expansion	≤ 2.0% for up to 3 hours	ASTM C940
Wet Density - Laboratory	Report maximum and minimum obtained test value lb/ft^3	ASTM C~~185~~138
Wet Density - Field	Report maximum and minimum obtained test value lb/ft^3	ASTM C138 or ASTM D4380
Compressive Strength 28 day (Average of 3 cubes)	≥7,000psi	ASTM C942
Initial Set of Grout	Min. 3 hours Max. 12 hours	ASTM C953
Time of Efflux immediately after mixing	~~***~~Max. 12 seconds	~~***~~ASTM C939
~~(a) Immediately after mixing~~	~~Min. 20 Sec.~~ ~~Max. 30 Sec.~~ ~~or~~ ~~Min. 9 Sec.~~ ~~Max. 20 Sec.~~	~~ASTM C939~~ ~~ASTM C939****~~

Table 938-1		
Property	Test Value	Test Method
~~(b) 30 minutes after mixing with remixing for 30 sec~~	~~Max. 30 Sec.~~ ~~or~~ ~~Max. 30 Sec.~~	~~ASTM C939~~ ~~ASTM C939****~~
Bleeding @ 3 hours	~~Max.~~ 0.0 percent	ASTM C940*****
Pressure Induces Bleeding	0.0 percent	ASTM C1741
~~Permeability~~ Surface Resistivity@ 28 days	~~Max. 2,500 coulombs at 30 V for 6 hours~~16 KOhms-cm	~~ASTM C1202~~FM 5-578
Relative Viscosity, RV_f, determined from Dynamic Sheer Rheometry	< 1.15	FM 5-605

*Use ASTM C117 procedure ~~modified to use a #50 sieve.~~ to ~~D~~determine the percent passing ~~the #50 sieve~~ after washing the sieve.
~~**Modify ASTM C1090 to include verification at both 24 hours and 28 days.~~
****~~*Adjustments to flow rates will be achieved by strict compliance with the manufacturer's recommendations.~~ The time of efflux is the time to fill a one liter container placed directly under the flow cone. Modify the ASTM C939 test by filling the cone to the top instead of to the standard level.
~~****Modify the ASTM C939 test by filling the cone to the top instead of to the standard level.~~
*****~~**~~Modify ASTM C940 to conform with the wick induced bleed test as follows:
(a) Use a wick made of a 20 inch length of ASTM A416 seven wire 0.5 inch diameter strand. Wrap the strand with 2 inch wide duct or electrical tape at each end prior to cutting to avoid splaying of the wires when it is cut. Degrease (with acetone or hexane solvent) and wire brush to remove any surface rust on the strand before temperature conditioning.
~~(b) Condition the dry ingredients, mixing water, prestressing strand and test apparatus overnight at 65 Fto 75°F.~~
(~~e~~b) Mix the conditioned dry ingredients with the conditioned mixing water and place 800 ml of the resulting grout into the 1,000 ml graduate cylinder. Measure and record the ~~level~~ volume of the ~~top of the~~ grout.
(~~d~~c) Completely insert the strand into the graduated cylinder. Center and fasten the strand so it remains essentially parallel to the vertical axis of the cylinder. Measure and record the level of the top of the grout.
~~(e) Store the mixed grout at the temperature range listed above in (b).~~
~~(f) Measure the level of the bleed water every 15 minutes for the first hour and hourly for two successive readings thereafter.~~
(~~g~~d) Calculate the bleed water, if any, at the end of the 3 hour test period and the resulting expansion per the procedures outlined in ASTM C940, with the quantity of bleed water expressed as a percent of the initial grout volume. Note if the bleed water remains above or below the top of the original grout height. Note if any bleed water is absorbed into the specimen during the test.

938-~~5~~4.3 Accelerated Corrosion Test Method (ACTM)~~.~~:
Perform the ACTM as outlined in Appendix B of the Specification for Grouting of Post-Tensioning Structures published by the Post-Tensioning Institute. Report the time to corrosion for both the grout being tested and the control sample using a 0.45 water-cement ratio neat grout.

A grout that shows a longer average time to corrosion in the ACTM than the control sample and the time to corrosion exceed 1,000 hours is considered satisfactory.

938-~~6~~4.4 Variation in Testing for Specific Applications.

938-~~6~~4.4.1 Horizontal Applications: Horizontal grout applications are defined as grouting of all superstructure tendons and transverse substructure tendons in caps, struts, etc. All physical requirements defined in 938-4.2 and 938-~~5~~4.3 are applicable for grouts used in horizontal applications.

938-~~6~~4.4.2 Vertical Applications: Vertical grout applications are defined as grouting of substructure column tendons. All physical requirements defined in 938-4.2 and

938-~~5~~4.3 are applicable for grouts used in vertical applications. ~~In addition, perform the Schupack Pressure Bleed Test Procedure for Cement Grouts for Post-Tensioned Structures as outlined in Section 4 of the Specification for Grouting of Post-Tensioned Structures published by the Post-Tensioning Institute. Report the percent bleed for the grout tested. Test grout at the specified pressure of 100 psi. An acceptable test will result in no bleed water (0.0 percent).~~

938-~~6~~4.~~3~~5 Repair Applications: Repair applications are used to augment grouting operations which did not completely fill the duct or anchorage. For new construction, repairs may be made with the same ~~grout~~filler approved for use in the tendon as long as the volume of the void is less 0.5 gal. In all other cases, use a non-sanded grout meeting the requirements of 938-4.2 and 938-~~5~~4.3 ~~with a modified maximum permeability of 2,800 coulombs (ASTM C1202 at 30 volts). Non-sanded grouts shall have 95% passing on the #100 sieve and 90% passing the #170 sieve as determined by ASTM C33~~ that meets or exceeds 16 KOhm-cm at 28 days when tested in accordance with FM 5-578. Each sieve may be washed and dried before weighing in accordance with the procedure in ASTM C117 modified for sieve size.

938-~~4~~5 Flexible Filler - Microcrystalline Wax.

938-~~4~~5.1~~:~~ Storage and Preparation: Store and prepare wax according to the manufacturer's product data sheet. Reject wax that shows any sign of se~~pa~~gre~~r~~gation prior to application even though it conforms to these Specifications. Use equipment designed for pumping the wax in a fluid state to fill the tendon ducts.

938-~~4~~5.2 Laboratory Testing: The wax shall meet or exceed the specified physical properties stated herein as determined by the following standard and modified ASTM and FM test methods conducted at normal laboratory temperature (65°F-78°F) and conditions.

Table 938-2

Property	Test Value	Test Method
Salt Fog – 168 hours@35°C	No corrosion	ASTM B117*
Corrosive Constituent Concentration Chlorides, Sulfides, and Nitrates Sulfate	 ≤ 50 ppm (total) ≤ 100 ppm	 ASTM D512 &ASTM D3867** ASTM D516**
Congealing Point	≥ 65°C	ASTM D938
Cone Penetration at 25°C	≤ 260 d-mm	ASTM D937
Bleeding	≤ 0.5%	ASTM D6184
Resistance to Oxidation 100 hours at 100°C	≤ 0.03 MPa	ASTM D942
Kinematic Viscosity at 100°C	10 – 30mm^2/s	ASTM D445

*Test sample consists of a 4 inch x 6 inch steel panel blast cleaned to a NACE surface preparation SP5 or equivalent, with a 2 to 2.5 mil surface profile. The plate is covered with a layer of wax equivalent to 0.5 grams wax per square inch of panel.

**Prepare sample in accordance with NF M07-023, sections 6a through 6c or equivalent.