WORKBOOK CHANGE(S)

Add D 9380000~~2~~0.D03
Rev Date 11-10-03
F.A. Date 11-23-03
Letting Date 7-04

Move D 93800000
To Deleted File 12/3/03 ah
Rev Date 1-9-03
F.A Date 1-28-03
Letting Date 7-03

Remarks

New SS.
Renamed Spec from D9380002.D03 to D9380000.D03.
To establish applications for which grout will be qualified for inclusion on the QPL, and to specify fluidity values under which grout tests are to be conducted.

Dates

*Copy of Spec to ~~Paul~~ Prod Eval Section that Impacts QPL (ONLY)
Added to Nextwb file 12-3-03
Deleted from Nextwb file 12-3-03
History File Updated
Rolodexed 4/21/04 ah
Additional back-up see

Route Slip

U.S. Department of Transportation
Federal Highway Administration
Florida Division
227 N. Bronough Street, Room 2015
Tallahassee, FL 32301

Distribution:
FDOT MS-75

NOV 2 6
SPECIFICATIONS

To:	Organization:	Date:	Routing Symbol:
MR. DUANE BRAUTIGAM	FDOT, SPECIFICATIONS ENGINEER	Nov. 24, 2003	MS-75

- ☐ Per Your Request
- **x For Your Information**
- ☐ Per Our Conversation
- ☐ Comment
- ☐ Take Appropriate Action
- ☐ Note and Return
- ☐ Discuss With Me
- ☐ For Your Approval
- ☐ For Your Signature
- ☐ Please Answer
- ☐ Prepare Reply
  For Signature of

Remarks:

FLORIDA SPECIFICATIONS:

D1050005 - Supplemental Specification for Contractor Quality Control, Section 105 (Resubmittal)

D9380002.D03, for Post Tensioning Grout, Section 938 (Resubmittal)

ATTACHMENTS

From:	Telephone Number:	FDOT MS:	Org/Rtg Symbol
FOR: JAMES E. ST. JOHN, DIVISION ADMINISTRATOR	(850) 942-9650, EXT. 3035	# 29	

DON Davis: ANN to file in binders cc: 1 (w/specification)

Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSÉ ABREU
SECRETARY

November 17, 2003

Mr. Donald Davis
Program Operations Engineer
Federal Highway Administration
227 N. Bronough Street, Suite 2015
Tallahassee, Florida 32301

Re: Office of Design, Specifications
Section 938
Proposed Specification: D9380002.D03 – Post-Tensioning Grout

Dear Mr. Davis:

We are submitting, for your approval, two copies of a proposed Supplemental Specification for Post-Tensioning Grout.

These changes were made as requested by Doug Edwards of your office.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via Email to SP965DB or duane.brautigam@dot.state.fl.us.

If you have any questions relating to this specification change, please call Duane F. Brautigam, State Specifications Engineer at 414-4110.

Sincerely,

Duane F. Brautigam, P.E.
State Specifications Engineer

DFB/jo/sh
Attachment
cc: General Counsel
Florida Transportation Builders' Assoc.
State Construction Engineer

Property	Test Value	Test Method
hours and 28 days		
Expansion	≤ 2.0% for up to 3 hours	ASTM C 940
Wet Density - Laboratory	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 185
Wet Density - Field	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 138
Compressive Strength 28 day (Average of 3 cubes)	≥7,000 psi [48.3 MPa]	ASTM C 942
Initial Set of Grout	Min. 3 hours Max. 12 hours	ASTM C 953
Time of Efflux***		
(a) Immediately after mixing	Min. 20 Sec. Max. 30 Sec.	ASTM C 939
	or Min. 9 Sec. Max. 20 Sec.	ASTM C 939****
(b) 30 minutes after mixing with remixing for 30 sec	Max. 30 Sec.	ASTM C 939
	or Max. 30 Sec.	ASTM C 939****
Bleeding @ 3 hours	Max. 0.0 percent	ASTM C 940*****
Permeability @ 28 days	Max. 2500 coulombs at 30 V for 6 hours	ASTM C 1202

Deleted: Fluidity Test***¶
Deleted: Time from Flow Cone

*Use ASTM C117 procedure modified to use a #50 sieve. 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 ASTM C940 to conform with the wick induced bleed test as follows:

Deleted: Grout fluidity shall meet either the standard ASTM C939 flow cone test or the modified test described herein.
Deleted: The efflux time is the time to fill a one liter container placed directly under the flow cone.

(a) Use a wick made of a 20 inch [0.5 m] length of ASTM A416 seven wire 0.5 inch [12.7 mm] diameter strand. Wrap the strand with 2 inch [50 mm] 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 to 75°F [18 to 24°C].

(c) 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 of the top of the grout.

(d) 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).

on the #100 sieve and 90% passing the #170 sieve as determined by ASTM C33. Each sieve may be washed and dried before weighing in accordance with the procedure in ASTM C117 modified for sieve size.

Property	Test Value	Test Method
Hardened Height Change @ 24 hours and 28 days	0.0% to + 0.2%	ASTM C 1090**
Expansion	≤ 2.0% for up to 3 hours	ASTM C 940
Wet Density - Laboratory	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 185
Wet Density - Field	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 138
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****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 [0.5 m] length of ASTM A416 seven wire 0.5 inch [12.7 mm] diameter strand. Wrap the strand with 2 inch [50 mm] 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 to 75°F [18 to 24°C].

(c) 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 of the top of the grout.

(d) 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.

permeability of 2,800 coulombs (ASTM C 1202 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. Each sieve may be washed and dried before weighing in accordance with the procedure in ASTM C117 modified for sieve size.

APPROVED: _____ DATE: 11/25/03
For the Division Administrator

Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSÉ ABREU
SECRETARY

November 17, 2003

Mr. Donald Davis
Program Operations Engineer
Federal Highway Administration
227 N. Bronough Street, Suite 2015
Tallahassee, Florida 32301

Re: Office of Design, Specifications
Section 938
Proposed Specification: D9380002.D03 – Post-Tensioning Grout

Dear Mr. Davis:

We are submitting, for your approval, two copies of a proposed Supplemental Specification for Post-Tensioning Grout.

These changes were made as requested by Doug Edwards of your office.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via Email to SP965DB or duane.brautigam@dot.state.fl.us.

If you have any questions relating to this specification change, please call Duane F. Brautigam, State Specifications Engineer at 414-4110.

Sincerely,

Duane F. Brautigam, P.E.
State Specifications Engineer

DFB/jo/sh
Attachment
cc: General Counsel
Florida Transportation Builders' Assoc.
State Construction Engineer

Shirley Harvey
11/04/2003 08:18 AM

To: douglas.edwards@FHWA.dot.gov
cc:
Subject: Resubmittal for D9380002.D02 - Post-Tensioning Grout

See attached memo. For some reason your email address didn't go through.

If you have any questions please call.

Thanks,
shirley harvey
SC 994-4120
(850)414-4120
shirley.harvey@dot.state.fl.us
----- Forwarded by Shirley Harvey/CO/FDOT on 11/04/2003 08:14 AM -----

Shirley Harvey
11/04/2003 08:13 AM

To: donald.davis@fhwa.dot.gov
cc: douglas.l.edwards@FHWA.dot.gov, Robert Robertson/CO/FDOT@FDOT, ann.allshouse@fhwa.dot.gov
Subject: Resubmittal for D9380002.D02 - Post-Tensioning Grout

D9380002.D02.doc

This is a resubmittal from Doug Edwards comments.

Please review the attached document and return comments/approval as soon as possible.

Thanks for your help in this matter,
shirley harvey
SC 994-4120
(850)414-4120
shirley.harvey@dot.state.fl.us

Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSÉ ABREU
SECRETARY

November 4, 2003

Mr. Donald Davis
Program Operations Engineer
Federal Highway Administration
227 N. Bronough Street, Suite 2015
Tallahassee, Florida 32301

Re: Office of Design, Specifications
Section 938
Proposed Specification: D9380002.D02 – Post-Tensioning Grout

Dear Mr. Davis:

We are resubmitting, for your approval, two copies of a proposed Supplemental Specification for Post – Tensioning Grout.

These changes were made as requested by Doug Edwards of your office.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via Email to SP965DB or duane.brautigam@dot.state.fl.us.

If you have any questions relating to this specification change, please call Duane F. Brautigam, State Specifications Engineer at 414-4110.

Sincerely,

Duane F. Brautigam, P.E.
State Specifications Engineer

DFB/jo/sh
Attachment
cc: General Counsel
Florida Transportation Builders' Assoc.
State Construction Engineer

~~938~~ **POST-TENSIONING GROUT.**
~~(REV 1-9-036-20-037-1-039-10-0311-3-03) (FA 1-28-03) (7-03)~~

SECTION 938 (of the Supplemental Specifications) is deleted and the following substituted:

SECTION 938
POST-TENSIONING GROUT

938-1 General Requirements.

This Section covers grouts to be used 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 QC Control Specifications before use or the material shall be removed and replaced.

938-2 Qualified Products List.

Only post-tensioning grouts listed on the Department's Qualified Products List (QPL) 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) which shows 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. *Grout products will be qualified by application (horizontal, vertical or repair).*

938-3 Mixing.

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

938-4 Grout Physical Properties.

938-4.1 Gas Generation.

The grout shall not contain aluminum ~~powder~~ or *other* components~~,~~ which produce hydrogen, carbon dioxide or oxygen gas.

938-4.2 Laboratory Test.

The grout shall meet or exceed the specified physical properties stated herein as determined by the following standard and modified ASTM test methods conducted at normal laboratory temperature (65-78°F [18-25°C]) and conditions. ~~*Conduct grout tests at the minimum fluidity value (maximum water content). Establish the minimum water content and maximum density corresponding to the maximum fluidity value or, test for maximum fluidity using the minimum water content.*~~ *Conduct all grout tests with grout mixed to produce the minimum time of efflux.. Establish the water content to produce the minimum and maximum time of efflux..*

Property	Test Value	Test Method
Total Chloride Ions	Max. 0.08% by weight of cementitious material	ASTM C 1152
Fine Aggregate (if utilized)	99% passing the No. 50	ASTM C 136*

Property	Test Value	Test Method
	Sieve (300 micron)	
Hardened Height Change @ 24 hours and 28 days	0.0% to + 0.2%	ASTM C 1090**
Expansion	≤ 2.0% for up to 3 hours	ASTM C 940
Wet Density - Laboratory	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 185
Wet Density - Field	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 138
Compressive Strength 28 day (Average of 3 cubes)	≥7,000 psi [48.3 MPa]	ASTM C 942
Initial Set of Grout	Min. 3 hours Max. 12 hours	ASTM C 953
~~Fluidity Test***~~ *Time of* Efflux*** ~~Time from Flow Cone~~		
(a) Immediately after mixing	Min. 20 Sec. Max. 30 Sec.	ASTM C 939
	or Min. 9 Sec. Max. 20 Sec.	ASTM C 939****
(b) 30 minutes after mixing with remixing for 30 sec	Max. 30 Sec.	ASTM C 939****
	~~or~~ ~~Max. 30 Sec.~~	~~ASTM C 939****~~
Bleeding @ 3 hours	Max. 0.0 percent	ASTM C 940*****
Permeability @ 28 days	Max. 2500 coulombs at 30 V for 6 hours	ASTM C 1202

*Use ASTM C117 procedure modified to use a #50 sieve. 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.
****Grout fluidity shall meet either the standard ASTM C939 flow cone test or the modified test described herein. Modify the ASTM C939 test by filling the cone to the top instead of to the standard level. The efflux time is the time to fill a one liter container placed directly under the flow cone.
*****Modify ASTM C940 to conform with the wick induced bleed test as follows:

(a) Use a wick made of a 20 inch [0.5 m] length of ASTM A416 seven wire 0.5 inch [12.7 mm] diameter strand. Wrap the strand with 2 inch [50 mm] 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 to 75°F [18 to 24°C].

(c) 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 of the top of the grout.

(d) 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) Calculate the bleed water, if any, at the end of the three 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 Simulated Field High Temperature Fluidity Test.

Perform a conditioned laboratory high temperature grout fluidity test as described below using production grouting equipment utilizing both mixing and storage tanks. Grouts must conform to the requirements of 938-4 including initial fluidity test. For the test to be successful, the grout must have an efflux time of not greater than 30 seconds at the end of the one hour test period. Efflux time may be determined by either ASTM C939 or the modified ASTM C939 described herein.

(a) Perform the test in a temperature conditioned laboratory. Condition the room, grout, water, duct, pump, mixer and all other equipment to be used to a temperature of 90°F [32.5°C] for a minimum of 12 hours prior to the test.

(b) Use 400 feet [122 m] (± 10 feet [3.0 m]) of duct (tube) for the test. Use a duct with a nominal inside diameter of 1 inch [25 mm].

(c) Mix the grout to the specified water content. Pump the grout through the duct until the grout discharges from the outlet end of the duct and is returned to the pump.

(d) Start the one hour test period after the duct is completely filled with grout. Record the time to circulate the grout through the duct. Constantly pump and recirculate the grout into the commercial grout mixer storage tank.

(e) Pump and recirculate the grout for a minimum of one hour.

(f) Record at 15 minute intervals throughout the test period, the pumping pressure at the inlet, grout temperature, and fluidity at the discharge outlet.

938-6 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.

938-7 Variation in Testing for Specific Applications.

938-7.1 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, 938-5 and 938-6 are applicable for grouts used in horizontal applications.

938-7.2 Vertical Applications: Vertical grout applications are defined as grouting of substructure column tendons. All physical requirements defined in 938-4, 938-5 and 938-6 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 Appendix C 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 (689 kPa). An acceptable test will result in no bleed water (0.0 percent).

938-7.3 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 approved for use in the tendon as long as the volume of the void is less 0.5 gal. (2.0 l). In all other cases, use a non-sanded grout meeting the requirements of 938-4 and 938-6 with a modified maximum

permeability of 2,800 coulombs (ASTM C 1202 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. Each sieve may be washed and dried before weighing in accordance with the procedure in ASTM C117 modified for sieve size.

POST-TENSIONING GROUT.
(REV 11-3-03)

SECTION 938 (of the Supplemental Specifications) is deleted and the following substituted:

SECTION 938
POST-TENSIONING GROUT

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938-3 Mixing.

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

938-4 Grout Physical Properties.

938-4.1 Gas Generation.

The grout shall not contain aluminum or other components which produce hydrogen, carbon dioxide or oxygen gas.

938-4.2 Laboratory Test.

The grout shall meet or exceed the specified physical properties stated herein as determined by the following standard and modified ASTM test methods conducted at normal laboratory temperature (65-78°F [18-25°C]) and conditions. Conduct all grout tests with grout mixed to produce the minimum time of efflux. Establish the water content to produce the minimum and maximum time of efflux.

Property	Test Value	Test Method
Total Chloride Ions	Max. 0.08% by weight of cementitious material	ASTM C 1152
Fine Aggregate (if utilized)	99% passing the No. 50 Sieve (300 micron)	ASTM C 136*
Hardened Height Change @ 24 hours and 28 days	0.0% to + 0.2%	ASTM C 1090**

Property	Test Value	Test Method
Expansion	≤ 2.0% for up to 3 hours	ASTM C 940
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Wet Density - Field	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 138
Compressive Strength 28 day (Average of 3 cubes)	≥7,000 psi [48.3 MPa]	ASTM C 942
Initial Set of Grout	Min. 3 hours Max. 12 hours	ASTM C 953
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	or Min. 9 Sec. Max. 20 Sec.	ASTM C 939****
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*Use ASTM C117 procedure modified to use a #50 sieve. Determine the percent passing the #50 sieve after washing the sieve.
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(b) Condition the dry ingredients, mixing water, prestressing strand and test apparatus overnight at 65 to 75°F [18 to 24°C].

(c) 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 of the top of the grout.

(d) 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) Calculate the bleed water, if any, at the end of the three 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 Simulated Field High Temperature Fluidity Test.

Perform a conditioned laboratory high temperature grout fluidity test as described below using production grouting equipment utilizing both mixing and storage tanks. Grouts must conform to the requirements of 938-4 including initial fluidity test. For the test to be successful, the grout must have an efflux time of not greater than 30 seconds at the end of the one hour test period. Efflux time may be determined by either ASTM C939 or the modified ASTM C939 described herein.

(a) Perform the test in a temperature conditioned laboratory. Condition the room, grout, water, duct, pump, mixer and all other equipment to be used to a temperature of 90°F [32.5°C] for a minimum of 12 hours prior to the test.

(b) Use 400 feet [122 m] (± 10 feet [3.0 m]) of duct (tube) for the test. Use a duct with a nominal inside diameter of 1 inch [25 mm].

(c) Mix the grout to the specified water content. Pump the grout through the duct until the grout discharges from the outlet end of the duct and is returned to the pump.

(d) Start the one hour test period after the duct is completely filled with grout. Record the time to circulate the grout through the duct. Constantly pump and recirculate the grout into the commercial grout mixer storage tank.

(e) Pump and recirculate the grout for a minimum of one hour.

(f) Record at 15 minute intervals throughout the test period, the pumping pressure at the inlet, grout temperature, and fluidity at the discharge outlet.

938-6 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.

938-7 Variation in Testing for Specific Applications.

938-7.1 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, 938-5 and 938-6 are applicable for grouts used in horizontal applications.

938-7.2 Vertical Applications: Vertical grout applications are defined as grouting of substructure column tendons. All physical requirements defined in 938-4, 938-5 and 938-6 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 Appendix C 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 (689 kPa). An acceptable test will result in no bleed water (0.0 percent).

938-7.3 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 approved for use in the tendon as long as the volume of the void is less 0.5 gal. (2.0 l). In all other cases, use a non-sanded grout meeting the requirements of 938-4 and 938-6 with a modified maximum permeability of 2,800 coulombs (ASTM C 1202 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. Each sieve may be washed and dried before weighing in accordance with the procedure in ASTM C117 modified for sieve size.

Is This OK? to

Conduct *all* grout tests *with grout mixed to produce the minimum time of efflux.* ~~at the minimum fluidity value (maximum water content). Establish the minimum water content and maximum density corresponding to the maximum fluidity value or, test for maximum fluidity using the minimum water content.~~ *Establish the water content to produce the minimum and maximum time of efflux.*

Property	Test Value	Test Method
Total Chloride Ions	Max. 0.08% by weight of cementitious material	ASTM C 1152
Fine Aggregate (if utilized)	99% passing the No. 50 Sieve (300 micron)	ASTM C 136*
Hardened Height Change @ 24 hours and 28 days	0.0% to + 0.2%	ASTM C 1090**
Expansion	≤ 2.0% for up to 3 hours	ASTM C 940
Wet Density - Laboratory	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 185
Wet Density - Field	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 138
Compressive Strength 28 day (Average of 3 cubes)	≥7,000 psi [48.3 MPa]	ASTM C 942
Initial Set of Grout	Min. 3 hours Max. 12 hours	ASTM C 953
~~Fluidity Test***~~ *Time of* Efflux*** ~~Time from Flow Cone~~		
(a) Immediately after mixing	Min. 20 Sec. Max. 30 Sec. or Min. 9 Sec. Max. 20 Sec.	ASTM C 939 ASTM C 939****
(b) 30 minutes after mixing with remixing for 30 sec	Max. 30 Sec.	ASTM C 939****
	~~or~~ ~~Max. 30 Sec.~~	~~ASTM C 939****~~
Bleeding @ 3 hours	Max. 0.0 percent	ASTM C 940*****
Permeability @ 28 days	Max. 2500 coulombs at 30 V for 6 hours	ASTM C 1202

PLS. CALL ME - 4113

*Use ASTM C117 procedure modified to use a #50 sieve. 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.

****Grout fluidity shall meet either the standard ASTM C939 flow cone test or the modified test described herein. Modify the ASTM C939 test by filling the cone to the top instead of to the standard level. The efflux time is the time to fill a one liter container placed directly under the flow cone.

*****Modify ASTM C940 to conform with the wick induced bleed test as follows:

(a) Use a wick made of a 20 inch [0.5 m] length of ASTM A416 seven wire 0.5 inch [12.7 mm] diameter strand. Wrap the strand with 2 inch [50 mm] 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 to 75°F [18 to 24°C].

(c) 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 of the top of the grout.

(d) 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) Calculate the bleed water, if any, at the end of the three 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 Simulated Field High Temperature Fluidity Test.

Perform a conditioned laboratory high temperature grout fluidity test as described below using production grouting equipment utilizing both mixing and storage tanks. Grouts must conform to the requirements of 938-4 including initial fluidity test. For the test to be successful, the grout must have an efflux time of not greater than 30 seconds at the end of the one hour test period. Efflux time may be determined by either ASTM C939 or the modified ASTM C939 described herein.

(a) Perform the test in a temperature conditioned laboratory. Condition the room, grout, water, duct, pump, mixer and all other equipment to be used to a temperature of 90°F [32.5°C] for a minimum of 12 hours prior to the test.

(b) Use 400 feet [122 m] (± 10 feet [3.0 m]) of duct (tube) for the test. Use a duct with a nominal inside diameter of 1 inch [25 mm].

(c) Mix the grout to the specified water content. Pump the grout through the duct until the grout discharges from the outlet end of the duct and is returned to the pump.

(d) Start the one hour test period after the duct is completely filled with grout. Record the time to circulate the grout through the duct. Constantly pump and recirculate the grout into the commercial grout mixer storage tank.

(e) Pump and recirculate the grout for a minimum of one hour.

(f) Record at 15 minute intervals throughout the test period, the pumping pressure at the inlet, grout temperature, and fluidity at the discharge outlet.

938-6 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.

938-7 Variation in Testing for Specific Applications.

938-7.1 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, 938-5 and 938-6 are applicable for grouts used in horizontal applications.

938-7.2 Vertical Applications: Vertical grout applications are defined as grouting of substructure column tendons. All physical requirements defined in 938-4, 938-5 and 938-6 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 Appendix C 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 (689 kPa). An acceptable test will result in no bleed water (0.0 percent).

938-7.3 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 approved for use in the tendon as long as the volume of the void is less 0.5 gal. (2.0 l). In all other cases, use a non-sanded grout meeting the requirements of 938-4 and 938-6 with a modified maximum permeability of 2,800 coulombs (ASTM C 1202 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. Each sieve may be washed and dried before weighing in accordance with the procedure in ASTM C117 modified for sieve size.

POST-TENSIONING GROUT.
(REV ~~9-10-03~~*11-3-03*)

SECTION 938 (of the Supplemental Specifications) is deleted and the following substituted:

SECTION 938
POST-TENSIONING GROUT

938-1 General Requirements.

This Section covers grouts to be used 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 QC Control Specifications before use or the material shall be removed and replaced.

938-2 Qualified Products List.

Only post-tensioning grouts listed on the Department's Qualified Products List (QPL) 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) which shows 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. Grout products will be qualified by application (horizontal, vertical or repair).

938-3 Mixing.

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

938-4 Grout Physical Properties.

938-4.1 Gas Generation.

The grout shall not contain aluminum or other components which produce hydrogen, carbon dioxide or oxygen gas.

938-4.2 Laboratory Test.

The grout shall meet or exceed the specified physical properties stated herein as determined by the following standard and modified ASTM test methods conducted at normal laboratory temperature (65-78°F [18-25°C]) and conditions.

Property	Test Value	Test Method
Hardened Height Change @ 24 hours and 28 days	0.0% to + 0.2%	ASTM C 1090**
Expansion	≤ 2.0% for up to 3 hours	ASTM C 940
Wet Density - Laboratory	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 185
Wet Density - Field	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 138
Compressive Strength 28 day (Average of 3 cubes)	≥7,000 psi [48.3 MPa]	ASTM C 942
Initial Set of Grout	Min. 3 hours Max. 12 hours	ASTM C 953
Fluidity Test*** Efflux Time from Flow Cone		
(a) Immediately after mixing	Min. 20 Sec. Max. 30 Sec.	ASTM C 939
	or Min. 9 Sec. Max. 20 Sec.	ASTM C 939****
(b) 30 minutes after mixing with remixing for 30 sec	Max. 30 Sec.	ASTM C 939
	or Max. 30 Sec.	ASTM C 939****
Bleeding @ 3 hours	Max. 0.0 percent	ASTM C 940*****
Permeability @ 28 days	Max. 2500 coulombs at 30 V for 6 hours	ASTM C 1202

*Use ASTM C117 procedure modified to use a #50 sieve. 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.
****Grout fluidity shall meet either the standard ASTM C939 flow cone test or the modified test described herein. Modify the ASTM C939 test by filling the cone to the top instead of to the standard level. The efflux time is the time to fill a one liter container placed directly under the flow cone.
*****Modify ASTM C940 to conform with the wick induced bleed test as follows:

(a) Use a wick made of a 20 inch [0.5 m] length of ASTM A416 seven wire 0.5 inch [12.7 mm] diameter strand. Wrap the strand with 2 inch [50 mm] 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 to 75°F [18 to 24°C].

(c) 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 of the top of the grout.

(d) 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.

U. S. DEPARTMENT OF TRANSPORTATION
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October 24, 2003

IN REPLY REFER TO: HPO-FL

Mr. José Abreu
Secretary of Transportation
Florida Department of Transportation
605 Suwannee Street
Tallahassee, Florida 32399-0250

Attn: Mr. Duane Brautigam

Dear Mr. Abreu:

Subject: Proposed Specification D9380002.D01, Post–Tensioning Grout

Mr. Duane Brautigam's letter dated September 10, 2003 submitted the subject Supplemental Specification for our approval. We have completed our review of the enclosed proposed specification and offer comments that have also been provided to Robert Robertson at FDOT:

1. It is suggested that a term different than grout **fluidity** be utilized in the specification, or utilized in a manner different than proposed. Used as currently proposed in the specification, it is counter intuitive; that is, as the fluidity value increases, the ability to flow actually lessons. Although this is similar to viscosity, viscosity is a term more widely used and understood. The term "flowability" might also serve the purpose. Suggested alternative language to the new verbiage currently proposed in 938-4.2 is; "Conduct grout test at the maximum **flowability** (maximum water content). **"Establish the minimum and maximum water content corresponding respectively to the greatest and least efflux time shown in the Table below for Fluidity Test".**

2. Within the table placed under Section 938-4.2 of the proposed specification, there is an (a) and (b) listing under the Property "Fluidity Test". In (b) the maximum value shown for "ASTM C939" is 30 seconds, and the alternative under "ASTM C939****" is also 30 seconds. However, in (a), the maximum value shown for "ASTM C939" is 30 seconds, but for "ASTM C939****" it is only 20 seconds. There appears to be a discrepancy. See also the third sentence in the first paragraph of 938-5. Please verify the proper values and make appropriate changes.

If you have any questions, please contact Mr. Doug Edwards at (850) 942-9650 extension 3037.

Sincerely,

For: James E. St. John
Division Administrator

Enclosure

Designation: C 939 – 97

Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)[1]

This standard is issued under the fixed designation C 939; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This specification has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method covers a procedure, used both in the laboratory and in the field, for determining the time of efflux of a specified volume of fluid hydraulic cement grout through a standardized flow cone and used for preplaced-aggregate (PA) concrete; however, the test method may also be used for other fluid grouts.

1.2 It is for use with neat grout and with grouts containing fine aggregate all passing a 2.36-mm (No. 8) sieve.

1.3 This test method is intended for use with grout having an efflux time of 35 s or less.

1.4 When efflux time exceeds 35 s, flowability is better determined by flow table, found in Test Method C 109, using 5 drops in 3 s.

1.5 The values stated in SI units are to be regarded as the standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 109/C109MTest Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)[2]

C 938 Practice for Proportioning Grout Mixtures for Preplaced-Aggregate Concrete[3]

3. Summary of Test Method

3.1 The time of efflux of a specified volume of grout from a standardized flow cone is measured.

4. Significance and Use

4.1 This test method is applicable to the determination of the fluidity of various fluid grout mixtures.

5. Interferences

5.1 The presence of solid particles retained on the 2.36-mm (No. 8) sieve or lumps of unmixed material in the grout may cause the grout to flow unevenly through the discharge tube of the flow cone or stop the flow completely. Uneven flow will result in slower transit of the grout, thereby indicating a false consistency.

6. Apparatus

6.1 *Flow Cone*, with dimensions as shown in Fig. 1. The discharge tube shall be stainless steel. The body can be stainless steel, cast aluminum, or other essentially noncorroding metal.

NOTE 1—Cones with high-density polyethylene bodies are acceptable for field use in situations where precision as described in this test method is not required.

6.2 *Receiving Container*, capacity 2000 mL, minimum.

6.3 *Ring Stand* or other device, capable of supporting the flow cone in a vertical, steady position over the receiving container.

6.4 *Level*, carpenter's or similar.

6.5 *Stop Watch*, least reading of not more than 0.2 s.

6.6 *Grout Mixer*, conforming to Practice C 938.

7. Test Sample

7.1 The grout test sample shall be in excess of 1725 mL and shall be representative of the grout in the mixer.

7.2 When sampling and testing is being done for the purpose of proportioning or comparing mixes or for qualifying materials, the temperature of the dry materials and mixing water shall be such that the temperature of the freshly mixed grout is 73.4 ± 3°F (23 ± 1.7°C), unless otherwise specified.

8. Calibration of Apparatus

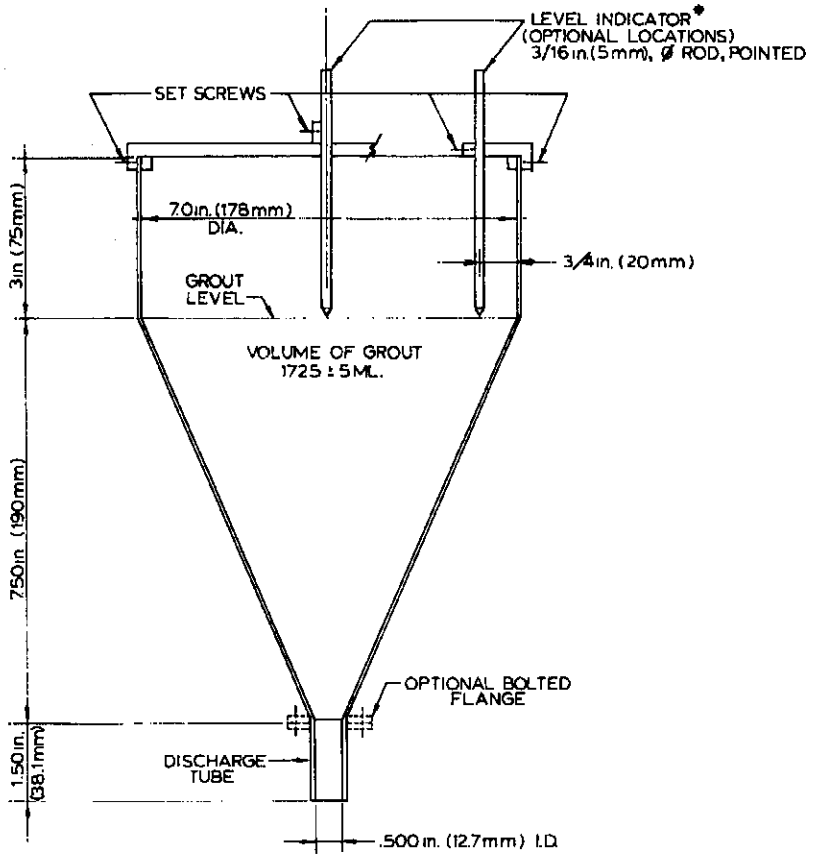
8.1 Mount the flow cone firmly in such a manner that it is free of vibration. Level the top to assure verticality. Close the

[1] This test method is under the jurisdiction of ASTM Committe C-9 on Concrete and Concrete Aggregatesand is the direct responsibility of Subcommittee C 09.41 on Concrete for Radiation Shielding.

Current edition approved July 10, 1997. Published June 1998. Originally published as C 939 – 81. Last previous edition C 939 – 94a.

[2] *Annual Book of ASTM Standards*, Vol 04.01.

[3] *Annual Book of ASTM Standards*, Vol 04.02.



NOTE 1—Other means of indicating grout level may be used as long as accurate indication of grout level on volume is obtained.

FIG. 1 Cross Section of Flow Cone

outlet of the discharge tube with a finger or a stopper. Introduce 1725 ± 5 mL of water into the cone. Adjust the point gage to indicate the level of the water surface. Then allow the water to drain.

8.2 Before first use of the flow cone with grout and periodically thereafter, check the accuracy of the cone by filling it with water as described in 8.1. After checking or adjusting the point gage, start the stop watch and simultaneously remove the finger. Stop the watch at the first break in the continuous flow of water. The time indicated by the stop watch is the time of efflux of water. If this time is 8.0 ± 0.2 s, the cone may be used for determining the time of efflux of grout.

9. Procedure

9.1 Moisten the inside of the flow cone by filling the cone with water and, 1 min before introducing the grout sample, allow the water to drain from the cone. Close the outlet of the discharge tube with a finger or a stopper. Introduce the grout into the cone until the grout surface rises to contact the point gage, start the stop watch, and simultaneously remove the finger or stopper. Stop the watch at the first break in the continuous flow of grout from the discharge tube, then look into the top of the cone; if the grout has passed sufficiently, such that light is visible through the discharge tube, the time indicated by the stop watch is the time of efflux of the grout. If light is not visible through the discharge tube, then the use of the flow cone is not applicable for grout of this consistency. At least two tests having times of efflux within 1.8 s of their average shall be made for each grout mixture.

9.2 The test for time of efflux shall be made within 1 min of drawing of the grout from the mixer or transmission line. When grout is being placed over a significant period of time, the time of efflux may be determined at selected intervals to demonstrate that the consistency is suitable for the work.

10. Report

10.1 Report the following information:

10.1.1 Identification of sample,

10.1.2 Identification of materials in the sample, the proportions, and whether laboratory-prepared or taken from the field production mix,

10.1.3 Average time of efflux to nearest 0.2 s and time interval from completion of mixing at which the test was made, and

10.1.4 Temperature, ambient and of the sample at the time of test.

11. Precision and Bias

11.1 *Precision*—The following within-laboratory, multiple-operator precision applies. The single laboratory standard deviation has been found to be 0.88 s. Therefore, results from two properly conducted tests on the same material should not differ by more than 2.49 s.

11.2 *Bias*—No statement on bias can be prepared because there are no standard reference materials.

12. Keywords

12.1 flow cone; grout; preplaced—aggregate concrete; time of efflux

Only post-tensioning grouts listed on the Department's Qualified Products List (QPL) 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) which shows 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. Grout products will be qualified by application (horizontal, vertical or repair).

938-3 Mixing.

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

938-4 Grout Physical Properties.

938-4.1 Gas Generation.

The grout shall not contain aluminum powder or components, which produce hydrogen, carbon dioxide or oxygen gas.

938-4.2 Laboratory Test.

The grout shall meet or exceed the specified physical properties stated herein as determined by the following standard and modified ASTM test methods conducted at normal laboratory temperature (65-78°F [18-25°C]) and conditions. ~~Conduct grout tests at the minimum fluidity value (maximum water content). Establish the minimum water content and maximum density corresponding to the maximum fluidity value or, test for maximum fluidity using the~~ minimum water content.

Replace with

John, I do not recommend any changes except consideration of the following.

Conduct all grout test with grout mixed to produce the minimum efflux time. ~~When appropriate,~~ Establish the ~~range of variables using grout mixed,~~ to produce the maximum efflux time.

water Content

Min. 2'

(not to be included, thought matrix

20 efflux	max. water	min. density
30 efflux	min. water	max. density)

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October 24, 2003

IN REPLY REFER TO: HPO-FL

Mr. José Abreu
Secretary of Transportation
Florida Department of Transportation
605 Suwannee Street
Tallahassee, Florida 32399-0250

Attn: Mr. Duane Brautigam

Dear Mr. Abreu:

Subject: Proposed Specification D9380002.D01, Post–Tensioning Grout

Mr. Duane Brautigam's letter dated September 10, 2003 submitted the subject Supplemental Specification for our approval. We have completed our review of the enclosed proposed specification and offer comments that have also been provided to Robert Robertson at FDOT:

1. It is suggested that a term different than grout **fluidity** be utilized in the specification, or utilized in a manner different than proposed. Used as currently proposed in the specification, it is counter intuitive; that is, as the fluidity value increases, the ability to flow actually lessons. Although this is similar to viscosity, viscosity is a term more widely used and understood. The term "flowability" might also serve the purpose. Suggested alternative language to the new verbiage currently proposed in 938-4.2 is; "Conduct grout test at the maximum **flowability** (maximum water content). **"Establish the minimum and maximum water content corresponding respectively to the greatest and least efflux time shown in the Table below for Fluidity Test".**

2. Within the table placed under Section 938-4.2 of the proposed specification, there is an (a) and (b) listing under the Property "Fluidity Test". In (b) the maximum value shown for "ASTM C939" is 30 seconds, and the alternative under "ASTM C939****" is also 30 seconds. However, in (a), the maximum value shown for "ASTM C939" is 30 seconds, but for "ASTM C939****" it is only 20 seconds. There appears to be a discrepancy. See also the third sentence in the first paragraph of 938-5. Please verify the proper values and make appropriate changes.

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Sincerely,

For: James E. St. John
Division Administrator

Enclosure

Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSÉ ABREU
SECRETARY

September 10, 2003

Mr. Donald Davis
Program Operations Engineer
Federal Highway Administration
227 N. Bronough Street, Suite 2015
Tallahassee, Florida 32301

Re: Office of Design, Specifications
Section 938
Proposed Specification: D9380002.D01 – Post-Tensioning Gout

Dear Mr. Davis:

We are submitting, for your approval, two copies of a proposed Supplemental Specification for Post-Tensioning Grout.

This change was proposed by Robert Robertson of the State Structures Office to establish applications for which grout will be qualified for inclusion on the QPL, and to specify fluidity values under which grout tests are to be conducted.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via Email to SP965DB or duane.brautigam@dot.state.fl.us.

If you have any questions relating to this specification change, please call Duane F. Brautigam, State Specifications Engineer at 414-4110.

Sincerely,

Signature on file

Duane F. Brautigam, P.E.
State Specifications Engineer

DFB/sh
Attachment
cc: General Counsel
Florida Transportation Builders' Assoc.
State Construction Engineer

POST-TENSIONING GROUT.
(REV 9-10-03)

Deleted: 938 .
Deleted:
Deleted: 1-9-03
Deleted: 6-20-03
Deleted: (FA 1-28-03) (7-03
Deleted:)
Inserted: 6-20-03
Deleted: 7-1-03
Inserted: 7-1-03

SECTION 938 (of the Supplemental Specifications) is deleted and the following substituted:

SECTION 938
POST-TENSIONING GROUT

938-1 General Requirements.

This Section covers grouts to be used 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 QC Control Specifications before use or the material shall be removed and replaced.

938-2 Qualified Products List.

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Deleted: ¶

938-3 Mixing.

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

938-4 Grout Physical Properties.

938-4.1 Gas Generation.

The grout shall not contain aluminum or other components which produce hydrogen, carbon dioxide or oxygen gas.

Deleted: powder
Deleted: ,

938-4.2 Laboratory Test.

The grout shall meet or exceed the specified physical properties stated herein as determined by the following standard and modified ASTM test methods conducted at normal laboratory temperature (65-78°F [18-25°C]) and conditions. Conduct grout tests at the minimum fluidity value (maximum water content). Establish the minimum water content and maximum density corresponding to the maximum fluidity value or, test for maximum fluidity using the minimum water content.

Property	Test Value	Test Method
Total Chloride Ions	Max. 0.08% by weight of cementitious material	ASTM C 1152
Fine Aggregate (if utilized)	99% passing the No. 50 Sieve (300 micron)	ASTM C 136*
Hardened Height Change @ 24	0.0% to + 0.2%	ASTM C 1090**

Property	Test Value	Test Method
hours and 28 days		
Expansion	≤ 2.0% for up to 3 hours	ASTM C 940
Wet Density - Laboratory	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 185
Wet Density - Field	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 138
Compressive Strength 28 day (Average of 3 cubes)	≥7,000 psi [48.3 MPa]	ASTM C 942
Initial Set of Grout	Min. 3 hours Max. 12 hours	ASTM C 953
Fluidity Test*** Efflux Time from Flow Cone		
(a) Immediately after mixing	Min. 20 Sec. Max. 30 Sec.	ASTM C 939
	or Min. 9 Sec. Max. 20 Sec.	ASTM C 939****
(b) 30 minutes after mixing with remixing for 30 sec	Max. 30 Sec.	ASTM C 939
	or Max. 30 Sec.	ASTM C 939****
Bleeding @ 3 hours	Max. 0.0 percent	ASTM C 940*****
Permeability @ 28 days	Max. 2500 coulombs at 30 V for 6 hours	ASTM C 1202

*Use ASTM C117 procedure modified to use a #50 sieve. 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.
****Grout fluidity shall meet either the standard ASTM C939 flow cone test or the modified test described herein. Modify the ASTM C939 test by filling the cone to the top instead of to the standard level. The efflux time is the time to fill a one liter container placed directly under the flow cone.
*****Modify ASTM C940 to conform with the wick induced bleed test as follows:

(a) Use a wick made of a 20 inch [0.5 m] length of ASTM A416 seven wire 0.5 inch [12.7 mm] diameter strand. Wrap the strand with 2 inch [50 mm] 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 to 75°F [18 to 24°C].

(c) 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 of the top of the grout.

(d) 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) Calculate the bleed water, if any, at the end of the three 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 Simulated Field High Temperature Fluidity Test.

Perform a conditioned laboratory high temperature grout fluidity test as described below using production grouting equipment utilizing both mixing and storage tanks. Grouts must conform to the requirements of 938-4 including initial fluidity test. For the test to be successful, the grout must have an efflux time of not greater than 30 seconds at the end of the one hour test period. Efflux time may be determined by either ASTM C939 or the modified ASTM C939 described herein.

(a) Perform the test in a temperature conditioned laboratory. Condition the room, grout, water, duct, pump, mixer and all other equipment to be used to a temperature of 90°F [32.5°C] for a minimum of 12 hours prior to the test.

(b) Use 400 feet [122 m] (± 10 feet [3.0 m]) of duct (tube) for the test. Use a duct with a nominal inside diameter of 1 inch [25 mm].

(c) Mix the grout to the specified water content. Pump the grout through the duct until the grout discharges from the outlet end of the duct and is returned to the pump.

(d) Start the one hour test period after the duct is completely filled with grout. Record the time to circulate the grout through the duct. Constantly pump and recirculate the grout into the commercial grout mixer storage tank.

(e) Pump and recirculate the grout for a minimum of one hour.

(f) Record at 15 minute intervals throughout the test period, the pumping pressure at the inlet, grout temperature, and fluidity at the discharge outlet.

938-6 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.

938-7 Variation in Testing for Specific Applications.

938-7.1 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, 938-5 and 938-6 are applicable for grouts used in horizontal applications.

938-7.2 Vertical Applications: Vertical grout applications are defined as grouting of substructure column tendons. All physical requirements defined in 938-4, 938-5 and 938-6 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 Appendix C 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 (689 kPa). An acceptable test will result in no bleed water (0.0 percent).

938-7.3 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 approved for use in the tendon as long as the volume of the void is less 0.5 gal. (2.0 l). In all other cases, use a non-sanded grout meeting the requirements of 938-4 and 938-6 with a modified maximum

permeability of 2,800 coulombs (ASTM C 1202 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. Each sieve may be washed and dried before weighing in accordance with the procedure in ASTM C117 modified for sieve size.

POST-TENSIONING GROUT.
(REV 9-10-03)

SECTION 938 (of the Supplemental Specifications) is deleted and the following substituted:

SECTION 938
POST-TENSIONING GROUT

938-1 General Requirements.

This Section covers grouts to be used 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 QC Control Specifications before use or the material shall be removed and replaced.

938-2 Qualified Products List.

Only post-tensioning grouts listed on the Department's Qualified Products List (QPL) 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) which shows 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. Grout products will be qualified by application (horizontal, vertical or repair).

938-3 Mixing.

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

938-4 Grout Physical Properties.

938-4.1 Gas Generation.

The grout shall not contain aluminum or other components which produce hydrogen, carbon dioxide or oxygen gas.

938-4.2 Laboratory Test.

The grout shall meet or exceed the specified physical properties stated herein as determined by the following standard and modified ASTM test methods conducted at normal laboratory temperature (65-78°F [18-25°C]) and conditions. Conduct grout tests at the minimum fluidity value (maximum water content). Establish the minimum water content and maximum density corresponding to the maximum fluidity value or, test for maximum fluidity using the minimum water content.

Property	Test Value	Test Method
Total Chloride Ions	Max. 0.08% by weight of cementitious material	ASTM C 1152
Fine Aggregate (if utilized)	99% passing the No. 50 Sieve (300 micron)	ASTM C 136*
Hardened Height Change @ 24	0.0% to + 0.2%	ASTM C 1090**

Property	Test Value	Test Method
hours and 28 days		
Expansion	≤ 2.0% for up to 3 hours	ASTM C 940
Wet Density - Laboratory	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 185
Wet Density - Field	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 138
Compressive Strength 28 day (Average of 3 cubes)	≥7,000 psi [48.3 MPa]	ASTM C 942
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	or Min. 9 Sec. Max. 20 Sec.	ASTM C 939****
(b) 30 minutes after mixing with remixing for 30 sec	Max. 30 Sec.	ASTM C 939
	or Max. 30 Sec.	ASTM C 939****
Bleeding @ 3 hours	Max. 0.0 percent	ASTM C 940*****
Permeability @ 28 days	Max. 2500 coulombs at 30 V for 6 hours	ASTM C 1202

*Use ASTM C117 procedure modified to use a #50 sieve. 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.
****Grout fluidity shall meet either the standard ASTM C939 flow cone test or the modified test described herein. Modify the ASTM C939 test by filling the cone to the top instead of to the standard level. The efflux time is the time to fill a one liter container placed directly under the flow cone.
*****Modify ASTM C940 to conform with the wick induced bleed test as follows:

(a) Use a wick made of a 20 inch [0.5 m] length of ASTM A416 seven wire 0.5 inch [12.7 mm] diameter strand. Wrap the strand with 2 inch [50 mm] 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 to 75°F [18 to 24°C].

(c) 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 of the top of the grout.

(d) 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) Calculate the bleed water, if any, at the end of the three 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 Simulated Field High Temperature Fluidity Test.

Perform a conditioned laboratory high temperature grout fluidity test as described below using production grouting equipment utilizing both mixing and storage tanks. Grouts must conform to the requirements of 938-4 including initial fluidity test. For the test to be successful, the grout must have an efflux time of not greater than 30 seconds at the end of the one hour test period. Efflux time may be determined by either ASTM C939 or the modified ASTM C939 described herein.

(a) Perform the test in a temperature conditioned laboratory. Condition the room, grout, water, duct, pump, mixer and all other equipment to be used to a temperature of 90°F [32.5°C] for a minimum of 12 hours prior to the test.

(b) Use 400 feet [122 m] (± 10 feet [3.0 m]) of duct (tube) for the test. Use a duct with a nominal inside diameter of 1 inch [25 mm].

(c) Mix the grout to the specified water content. Pump the grout through the duct until the grout discharges from the outlet end of the duct and is returned to the pump.

(d) Start the one hour test period after the duct is completely filled with grout. Record the time to circulate the grout through the duct. Constantly pump and recirculate the grout into the commercial grout mixer storage tank.

(e) Pump and recirculate the grout for a minimum of one hour.

(f) Record at 15 minute intervals throughout the test period, the pumping pressure at the inlet, grout temperature, and fluidity at the discharge outlet.

938-6 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.

938-7 Variation in Testing for Specific Applications.

938-7.1 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, 938-5 and 938-6 are applicable for grouts used in horizontal applications.

938-7.2 Vertical Applications: Vertical grout applications are defined as grouting of substructure column tendons. All physical requirements defined in 938-4, 938-5 and 938-6 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 Appendix C 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 (689 kPa). An acceptable test will result in no bleed water (0.0 percent).

938-7.3 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 approved for use in the tendon as long as the volume of the void is less 0.5 gal. (2.0 l). In all other cases, use a non-sanded grout meeting the requirements of 938-4 and 938-6 with a modified maximum

permeability of 2,800 coulombs (ASTM C 1202 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. Each sieve may be washed and dried before weighing in accordance with the procedure in ASTM C117 modified for sieve size.

Duane F Brautigam
10/28/2003 11:29 AM

To: CO-SPECDEV
cc: Robert Robertson/CO/FDOT@FDOT
Subject: D9380002.D01

FHWA did NOT approve the subject specification; it has been returned with comments by their letter of October 24, 2003. According to the letter, the comments have already been provided to Robert Robertson. Please handle with Robert accordingly.

Thanks - DFB

Duane F. Brautigam, P.E.
State Specifications Engineer
Florida Department of Transportation
(850) 414-4130; SC 994-4130
duane.brautigam@dot.state.fl.us

Shirley Harvey

09/11/2003 09:53 AM

To: donald.davis@fhwa.dot.gov
cc: Clay McGonagill/CO/FDOT@FDOT, bburleson@ftba.com, Ananth Prasad/CO/FDOT@FDOT, acarlisle@ftba.com, ann.allshouse@fhwa.dot.gov, Robert Robertson/CO/FDOT@FDOT
Subject: Approval for Proposed Spec D9380002.D01 - Post-Tensioning Grout

D9380002.d01.doc

Please review the attached document and return comments/approval as soon as possible.

If you have any questions please call.

Thanks,
shirley harvey
SC 994-4120
(850)414-4120
shirley.harvey@dot.state.fl.us

Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSÉ ABREU
SECRETARY

September 10, 2003

Mr. Donald Davis
Program Operations Engineer
Federal Highway Administration
227 N. Bronough Street, Suite 2015
Tallahassee, Florida 32301

Re: Office of Design, Specifications
Section 938
Proposed Specification: D9380002.D01 – Post-Tensioning Gout

Dear Mr. Davis:

We are submitting, for your approval, two copies of a proposed Supplemental Specification for Post-Tensioning Grout.

This change was proposed by Robert Robertson of the State Structures Office to establish applications for which grout will be qualified for inclusion on the QPL, and to specify fluidity values under which grout tests are to be conducted.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via Email to SP965DB or duane.brautigam@dot.state.fl.us.

If you have any questions relating to this specification change, please call Duane F. Brautigam, State Specifications Engineer at 414-4110.

Sincerely,

Duane F. Brautigam, P.E.
State Specifications Engineer

DFB/sh
Attachment
cc: General Counsel
Florida Transportation Builders' Assoc.
State Construction Engineer

~~938~~—POST-TENSIONING GROUT.
~~———(REV 1-9-03~~*~~6-20-03~~*~~7-1-03~~*~~9-10-03~~*~~) (FA 1-28-03) (7-03)~~

SECTION 938 (of the Supplemental Specifications) is deleted and the following substituted:

SECTION 938
POST-TENSIONING GROUT

938-1 General Requirements.

This Section covers grouts to be used 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 QC Control Specifications before use or the material shall be removed and replaced.

938-2 Qualified Products List.

Only post-tensioning grouts listed on the Department's Qualified Products List (QPL) 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) which shows 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. *Grout products will be qualified by application (horizontal, vertical or repair).*

938-3 Mixing.

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

938-4 Grout Physical Properties.

938-4.1 Gas Generation.

The grout shall not contain aluminum ~~powder~~ or *other* components~~,~~ which produce hydrogen, carbon dioxide or oxygen gas.

938-4.2 Laboratory Test.

The grout shall meet or exceed the specified physical properties stated herein as determined by the following standard and modified ASTM test methods conducted at normal laboratory temperature (65-78°F [18-25°C]) and conditions. *Conduct grout tests at the minimum fluidity value (maximum water content). Establish the minimum water content and maximum density corresponding to the maximum fluidity value or, test for maximum fluidity using the minimum water content.*

Property	Test Value	Test Method
Total Chloride Ions	Max. 0.08% by weight of cementitious material	ASTM C 1152
Fine Aggregate (if utilized)	99% passing the No. 50 Sieve (300 micron)	ASTM C 136*

Property	Test Value	Test Method
Hardened Height Change @ 24 hours and 28 days	0.0% to + 0.2%	ASTM C 1090**
Expansion	≤ 2.0% for up to 3 hours	ASTM C 940
Wet Density - Laboratory	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 185
Wet Density - Field	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 138
Compressive Strength 28 day (Average of 3 cubes)	≥7,000 psi [48.3 MPa]	ASTM C 942
Initial Set of Grout	Min. 3 hours Max. 12 hours	ASTM C 953
Fluidity Test*** Efflux Time from Flow Cone		
(a) Immediately after mixing	Min. 20 Sec. Max. 30 Sec.	ASTM C 939
	or Min. 9 Sec. Max. 20 Sec.	ASTM C 939****
(b) 30 minutes after mixing with remixing for 30 sec	Max. 30 Sec.	ASTM C 939
	or Max. 30 Sec.	ASTM C 939****
Bleeding @ 3 hours	Max. 0.0 percent	ASTM C 940*****
Permeability @ 28 days	Max. 2500 coulombs at 30 V for 6 hours	ASTM C 1202

*Use ASTM C117 procedure modified to use a #50 sieve. 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.
****Grout fluidity shall meet either the standard ASTM C939 flow cone test or the modified test described herein. Modify the ASTM C939 test by filling the cone to the top instead of to the standard level. The efflux time is the time to fill a one liter container placed directly under the flow cone.
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(b) Condition the dry ingredients, mixing water, prestressing strand and test apparatus overnight at 65 to 75°F [18 to 24°C].

(c) 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 of the top of the grout.

(d) 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) Calculate the bleed water, if any, at the end of the three 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.

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(b) Use 400 feet [122 m] (± 10 feet [3.0 m]) of duct (tube) for the test. Use a duct with a nominal inside diameter of 1 inch [25 mm].

(c) Mix the grout to the specified water content. Pump the grout through the duct until the grout discharges from the outlet end of the duct and is returned to the pump.

(d) Start the one hour test period after the duct is completely filled with grout. Record the time to circulate the grout through the duct. Constantly pump and recirculate the grout into the commercial grout mixer storage tank.

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cases, use a non-sanded grout meeting the requirements of 938-4 and 938-6 with a modified maximum permeability of 2,800 coulombs (ASTM C 1202 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. Each sieve may be washed and dried before weighing in accordance with the procedure in ASTM C117 modified for sieve size.

POST-TENSIONING GROUT.
(REV 9-10-03)

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938-4.1 Gas Generation.

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Compressive Strength 28 day (Average of 3 cubes)	≥7,000 psi [48.3 MPa]	ASTM C 942
Initial Set of Grout	Min. 3 hours Max. 12 hours	ASTM C 953
Fluidity Test*** Efflux Time from Flow Cone		
(a) Immediately after mixing	Min. 20 Sec. Max. 30 Sec.	ASTM C 939
	or Min. 9 Sec. Max. 20 Sec.	ASTM C 939****
(b) 30 minutes after mixing with remixing for 30 sec	Max. 30 Sec.	ASTM C 939
	or Max. 30 Sec.	ASTM C 939****
Bleeding @ 3 hours	Max. 0.0 percent	ASTM C 940*****
Permeability @ 28 days	Max. 2500 coulombs at 30 V for 6 hours	ASTM C 1202

*Use ASTM C117 procedure modified to use a #50 sieve. 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.
****Grout fluidity shall meet either the standard ASTM C939 flow cone test or the modified test described herein. Modify the ASTM C939 test by filling the cone to the top instead of to the standard level. The efflux time is the time to fill a one liter container placed directly under the flow cone.
*****Modify ASTM C940 to conform with the wick induced bleed test as follows:

(a) Use a wick made of a 20 inch [0.5 m] length of ASTM A416 seven wire 0.5 inch [12.7 mm] diameter strand. Wrap the strand with 2 inch [50 mm] 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 to 75°F [18 to 24°C].

(c) 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 of the top of the grout.

(d) 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) Calculate the bleed water, if any, at the end of the three 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 Simulated Field High Temperature Fluidity Test.

Perform a conditioned laboratory high temperature grout fluidity test as described below using production grouting equipment utilizing both mixing and storage tanks. Grouts must conform to the requirements of 938-4 including initial fluidity test. For the test to be successful, the grout must have an efflux time of not greater than 30 seconds at the end of the one hour test period. Efflux time may be determined by either ASTM C939 or the modified ASTM C939 described herein.

(a) Perform the test in a temperature conditioned laboratory. Condition the room, grout, water, duct, pump, mixer and all other equipment to be used to a temperature of 90°F [32.5°C] for a minimum of 12 hours prior to the test.

(b) Use 400 feet [122 m] (± 10 feet [3.0 m]) of duct (tube) for the test. Use a duct with a nominal inside diameter of 1 inch [25 mm].

(c) Mix the grout to the specified water content. Pump the grout through the duct until the grout discharges from the outlet end of the duct and is returned to the pump.

(d) Start the one hour test period after the duct is completely filled with grout. Record the time to circulate the grout through the duct. Constantly pump and recirculate the grout into the commercial grout mixer storage tank.

(e) Pump and recirculate the grout for a minimum of one hour.

(f) Record at 15 minute intervals throughout the test period, the pumping pressure at the inlet, grout temperature, and fluidity at the discharge outlet.

938-6 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.

938-7 Variation in Testing for Specific Applications.

938-7.1 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, 938-5 and 938-6 are applicable for grouts used in horizontal applications.

938-7.2 Vertical Applications: Vertical grout applications are defined as grouting of substructure column tendons. All physical requirements defined in 938-4, 938-5 and 938-6 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 Appendix C 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 (689 kPa). An acceptable test will result in no bleed water (0.0 percent).

938-7.3 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 approved for use in the tendon as long as the volume of the void is less 0.5 gal. (2.0 l). In all other cases, use a non-sanded grout meeting the requirements of 938-4 and 938-6 with a modified maximum

permeability of 2,800 coulombs (ASTM C 1202 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. Each sieve may be washed and dried before weighing in accordance with the procedure in ASTM C117 modified for sieve size.

Robert Robertson
09/10/2003 07:33 AM

To: Shirley Harvey/CO/FDOT@FDOT
cc:
Subject: Re: Comments on Proposed Spec D9380002 - Post-Tensioning Grout

As recommended in the comment from Mr. Leonard revise 4.1 to read: The grout shall not contain aluminum or other components which produce hydrogen, carbon dioxide or oxygen gas.

The spec was not meant to delete 938-5 thru 938-7 as noted by Donnie Bagwell.

Robert Robertson
FDOT Tallahassee Structures
SC 994-4267
(850) 414-4267
Shirley Harvey

Shirley Harvey
09/09/2003 01:34 PM

To: Robert Robertson/CO/FDOT@FDOT
cc:
Subject: Comments on Proposed Spec D9380002 - Post-Tensioning Grout

D9380002.doc

Please review the comments from Industry Review and submit changes as needed.
If you have any questions please call.

Thanks,
shirley harvey
SC 994-4120
(850)414-4120
shirley.harvey@dot.state.fl.us

Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSÉ ABREU
SECRETARY

MEMORANDUM

DATE: September 9, 2003

TO: Robert Robertson, State Structures Office

FROM: Clinton J. Shaw, State Specifications Office

SUBJECT: **Proposed Modifications To Specification: D9380002 – Post-Tensioning Grout**

Comments received, regarding the subject modification to the Standard Specifications, are attached. Please review these comments and advise of any further modifications by September 23, 2003. Also, please submit an electronic summary, of your decisions concerning these comment(s) in memorandum format. This summary will be posted on the State Specifications Office Web Page and included in the Specifications folder for future reference, should someone question your response. Your assistance will be appreciated.

Please Email submittals to SP965CS or clinton.shaw@dot.state.fl.us.

CS/sh

Attachment

~~938~~—POST-TENSIONING GROUT.
(REV ~~1-9-03~~*6-20-03*/*7-1-03*) ~~(FA-1-28-03) (7-03)~~

SECTION 938 (of the Supplemental Specifications) is deleted and the following substituted:

SECTION 938
POST-TENSIONING GROUT

938-1 General Requirements.

This Section covers grouts to be used 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 QC Control Specifications before use or the material shall be removed and replaced.

938-2 Qualified Products List.

Only post-tensioning grouts listed on the Department's Qualified Products List (QPL) 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) which shows 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. *Grout products will be qualified by application (horizontal, vertical or repair).*

938-3 Mixing.

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

938-4 Grout Physical Properties.

938-4.1 Gas Generation.

The grout shall not contain aluminum powder or components, which produce hydrogen, carbon dioxide or oxygen gas.

938-4.2 Laboratory Test.

The grout shall meet or exceed the specified physical properties stated herein as determined by the following standard and modified ASTM test methods conducted at normal laboratory temperature (65-78°F [18-25°C]) and conditions. *Conduct grout tests at the minimum fluidity value (maximum water content). Establish the minimum water content and maximum density corresponding to the maximum fluidity value or, test for maximum fluidity using the minimum water content.*

Property	Test Value	Test Method
Total Chloride Ions	Max. 0.08% by weight of cementitious material	ASTM C 1152
Fine Aggregate (if utilized)	99% passing the No. 50 Sieve (300 micron)	ASTM C 136*

Property	Test Value	Test Method
Hardened Height Change @ 24 hours and 28 days	0.0% to + 0.2%	ASTM C 1090**
Expansion	≤ 2.0% for up to 3 hours	ASTM C 940
Wet Density - Laboratory	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 185
Wet Density - Field	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 138
Compressive Strength 28 day (Average of 3 cubes)	≥7,000 psi [48.3 MPa]	ASTM C 942
Initial Set of Grout	Min. 3 hours Max. 12 hours	ASTM C 953
Fluidity Test*** Efflux Time from Flow Cone		
(a) Immediately after mixing	Min. 20 Sec. Max. 30 Sec.	ASTM C 939
	or Min. 9 Sec. Max. 20 Sec.	ASTM C 939****
(b) 30 minutes after mixing with remixing for 30 sec	Max. 30 Sec.	ASTM C 939
	or Max. 30 Sec.	ASTM C 939****
Bleeding @ 3 hours	Max. 0.0 percent	ASTM C 940*****
Permeability @ 28 days	Max. 2500 coulombs at 30 V for 6 hours	ASTM C 1202

*Use ASTM C117 procedure modified to use a #50 sieve. 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.
****Grout fluidity shall meet either the standard ASTM C939 flow cone test or the modified test described herein. Modify the ASTM C939 test by filling the cone to the top instead of to the standard level. The efflux time is the time to fill a one liter container placed directly under the flow cone.
*****Modify ASTM C940 to conform with the wick induced bleed test as follows:

(a) Use a wick made of a 20 inch [0.5 m] length of ASTM A416 seven wire 0.5 inch [12.7 mm] diameter strand. Wrap the strand with 2 inch [50 mm] 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 to 75°F [18 to 24°C].

(c) 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 of the top of the grout.

(d) 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) Calculate the bleed water, if any, at the end of the three 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 Simulated Field High Temperature Fluidity Test.

Perform a conditioned laboratory high temperature grout fluidity test as described below using production grouting equipment utilizing both mixing and storage tanks. Grouts must conform to the requirements of 938-4 including initial fluidity test. For the test to be successful, the grout must have an efflux time of not greater than 30 seconds at the end of the one hour test period. Efflux time may be determined by either ASTM C939 or the modified ASTM C939 described herein.

(a) Perform the test in a temperature conditioned laboratory. Condition the room, grout, water, duct, pump, mixer and all other equipment to be used to a temperature of 90°F [32.5°C] for a minimum of 12 hours prior to the test.

(b) Use 400 feet [122 m] (± 10 feet [3.0 m]) of duct (tube) for the test. Use a duct with a nominal inside diameter of 1 inch [25 mm].

(c) Mix the grout to the specified water content. Pump the grout through the duct until the grout discharges from the outlet end of the duct and is returned to the pump.

(d) Start the one hour test period after the duct is completely filled with grout. Record the time to circulate the grout through the duct. Constantly pump and recirculate the grout into the commercial grout mixer storage tank.

(e) Pump and recirculate the grout for a minimum of one hour.

(f) Record at 15 minute intervals throughout the test period, the pumping pressure at the inlet, grout temperature, and fluidity at the discharge outlet.

938-6 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.

938-7 Variation in Testing for Specific Applications.

938-7.1 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, 938-5 and 938-6 are applicable for grouts used in horizontal applications.

938-7.2 Vertical Applications: Vertical grout applications are defined as grouting of substructure column tendons. All physical requirements defined in 938-4, 938-5 and 938-6 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 Appendix C 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 (689 kPa). An acceptable test will result in no bleed water (0.0 percent).

938-7.3 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 approved for use in the tendon as long as the volume of the void is less 0.5 gal. (2.0 l). In all other

cases, use a non-sanded grout meeting the requirements of 938-4 and 938-6 with a modified maximum permeability of 2,800 coulombs (ASTM C 1202 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. Each sieve may be washed and dried before weighing in accordance with the procedure in ASTM C117 modified for sieve size.

D9380002
Post-Tensioning Jobs and
Jobs with cylinder piles

Duane F Brautigam

09/05/2003 07:14 AM

To: Clinton Shaw/CO/FDOT@FDOT
cc:
Subject: Data posted to form 1 of http: //www11.myflorida.com/specificationsoffice/IndustryReview.htm

Duane F. Brautigam, P.E.
State Specifications Engineer
Florida Department of Transportation
(850) 414-4130; SC 994-4130
duane.brautigam@dot.state.fl.us
----- Forwarded by Duane F Brautigam/CO/FDOT on 09/05/2003 07:13 AM -----

<webmaster@dot.state.fl.us>

09/04/2003 11:59 AM

To: <duane.brautigam@dot.state.fl.us>
cc:
Subject: Data posted to form 1 of http: //www11.myflorida.com/specificationsoffice/IndustryReview.htm

```
**************************************************************
**************
File:              D9380002 - Post-Tensioning Grout
Username:          donald bagwell
UserEmail:         donald.bagwell@dot.state.fl.us
UserTel:           352-995-6667
UserFAX:           352-955-6680
ContactRequested:
Remote Name:       156.75.248.157
Remote User:

Comments:

As discussed with John Owens and Larry Sessions, Sections 938-5
through
938-7 have been omitted from this review.  If this was the intent
the
specificaion is not complete.  If this was an oversight I can't
respond
until the oversight is corrected
```

D9380002
Post-Tensioning Jobs and
Jobs with cylinder piles

Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSÉ ABREU
SECRETARY

MEMORANDUM

DATE: August 7, 2003

TO: Specification Review Distribution List

FROM: Duane F. Brautigam, P.E., State Specifications Engineer

SUBJECT: **Proposed Specifications Change: D9380002 – Post-Tensioning Grout**

In accordance with Specification Development Procedures, we are sending you a copy of a proposed specification change to Post-Tensioning - Grout.

This change was proposed by Robert Robertson, of the State Structures Office, to establish applications for which grout will be qualified for inclusion on the QPL, and to specify fluidity values under which grout tests are to be conducted.

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 to my attention via e-mail at SP965DB or duane.brautigam@dot.state.fl.us. Comments received after September 4, 2003 may not be considered. Your input is encouraged.

DFB/sh

Attachment

COMMENTS: I suggest that 938-4.1 Gas Generation be reworded to recite:

"The grout shall not contain aluminum or components that produce hydrogen, carbon dioxide or oxygen gas."

Submitted by: JACK R. LEONARD Phone #: SC 335-3679

TO: SPECIFICATION DEVELOPMENT

☐ NO COMMENTS
☒ COMMENTS–PLEASE PROCESS

DATE 08/26/03

~~938~~—**POST-TENSIONING GROUT.**

(REV ~~1-9-03~~*6-20-03*~~7-1-03)~~ ~~(FA 1-28-03) (7-03)~~

SECTION 938 (of the Supplemental Specifications) is deleted and the following substituted:

SECTION 938
POST-TENSIONING GROUT

938-1 General Requirements.

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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 QC Control Specifications before use or the material shall be removed and replaced.

938-2 Qualified Products List.

Only post-tensioning grouts listed on the Department's Qualified Products List (QPL) 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) which shows 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. *Grout products will be qualified by application (horizontal, vertical or repair).*

938-3 Mixing.

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

938-4 Grout Physical Properties.

938-4.1 Gas Generation.

The grout shall not contain aluminum powder or components, which produce hydrogen, carbon dioxide or oxygen gas.

938-4.2 Laboratory Test.

The grout shall meet or exceed the specified physical properties stated herein as determined by the following standard and modified ASTM test methods conducted at normal laboratory temperature (65-78°F [18-25°C]) and conditions. *Conduct grout tests at the minimum fluidity value (maximum water content). Establish*

the minimum water content and maximum density corresponding to the maximum fluidity value or, test for maximum fluidity using the minimum water content.

Property	Test Value	Test Method
Total Chloride Ions	Max. 0.08% by weight of cementitious material	ASTM C 1152
Fine Aggregate (if utilized)	99% passing the No. 50 Sieve (300 micron)	ASTM C 136*
Hardened Height Change @ 24 hours and 28 days	0.0% to + 0.2%	ASTM C 1090**
Expansion	≤ 2.0% for up to 3 hours	ASTM C 940
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(a) Immediately after mixing	Min. 20 Sec. Max. 30 Sec.	ASTM C 939
	or Min. 9 Sec. Max. 20 Sec.	ASTM C 939****
(b) 30 minutes after mixing with remixing for 30 sec	Max. 30 Sec.	ASTM C 939
	or Max. 30 Sec.	ASTM C 939****
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*Use ASTM C117 procedure modified to use a #50 sieve. 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.
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*****Modify ASTM C940 to conform with the wick induced bleed test as follows:

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(c) 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 of the top of the grout.

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(a) Perform the test in a temperature conditioned laboratory. Condition the room, grout, water, duct, pump, mixer and all other equipment to be used to a temperature of 90°F [32.5°C] for a minimum of 12 hours prior to the test.

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(c) Mix the grout to the specified water content. Pump the grout through the duct until the grout discharges from the outlet end of the duct and is returned to the pump.

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938-7.3 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 approved for use in the tendon as long as the volume of the void is less 0.5 gal. (2.0 l). In all other cases, use a non-sanded grout meeting the requirements of 938-4 and 938-6 with a modified maximum permeability of 2,800 coulombs (ASTM C 1202 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. Each sieve may be washed and dried before weighing in accordance with the procedure in ASTM C117 modified for sieve size.

POSTED 8/7/03

Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSÉ ABREU
SECRETARY

MEMORANDUM

DATE: August 7, 2003

TO: Specification Review Distribution List

FROM: Duane F. Brautigam, P.E., State Specifications Engineer

SUBJECT: **Proposed Specifications Change: D9380002 – Post-Tensioning Grout**

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DFB/sh

Attachment

COMMENTS: _____

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Submitted by: _____ Phone #: _____

938 POST-TENSIONING GROUT.
(REV ~~1-9-03~~ ~~*6-20-03*~~ *7-1-03*) ~~(FA 1-28-03) (7-03)~~

PAGE 846. The following new Section is added after Section 937.

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938-3 Mixing.

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

938-4 Grout Physical Properties.

938-4.1 Gas Generation.

The grout shall not contain aluminum powder or components, which produce hydrogen, carbon dioxide or oxygen gas.

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The grout shall meet or exceed the specified physical properties stated herein as determined by the following standard and modified ASTM test methods conducted at normal laboratory temperature (65-78°F [18-25°C]) and conditions. *Conduct grout tests at the minimum fluidity value (maximum water content). Establish the minimum water content and maximum density corresponding to the maximum fluidity value or, test for maximum fluidity using the minimum water content.*

Property	Test Value	Test Method
Total Chloride Ions	Max. 0.08% by weight of cementitious material	ASTM C 1152
Fine Aggregate (if utilized)	99% passing the No. 50 Sieve (300 micron)	ASTM C 136*
Hardened Height Change @ 24	0.0% to + 0.2%	ASTM C 1090**

Property	Test Value	Test Method
hours and 28 days		
Expansion	≤ 2.0% for up to 3 hours	ASTM C 940
Wet Density - Laboratory	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 185
Wet Density - Field	Report maximum and minimum obtained test value lb/ft^3(kg/l)	ASTM C 138
Compressive Strength 28 day (Average of 3 cubes)	≥7,000 psi [48.3 MPa]	ASTM C 942
Initial Set of Grout	Min. 3 hours Max. 12 hours	ASTM C 953
Fluidity Test*** Efflux Time from Flow Cone		
(a) Immediately after mixing	Min. 20 Sec. Max. 30 Sec.	ASTM C 939
	or Min. 9 Sec. Max. 20 Sec.	ASTM C 939****
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Permeability @ 28 days	Max. 2500 coulombs at 30 V for 6 hours	ASTM C 1202

*Use ASTM C117 procedure modified to use a #50 sieve. 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.
****Grout fluidity shall meet either the standard ASTM C939 flow cone test or the modified test described herein. Modify the ASTM C939 test by filling the cone to the top instead of to the standard level. The efflux time is the time to fill a one liter container placed directly under the flow cone.
*****Modify ASTM C940 to conform with the wick induced bleed test as follows:

(a) Use a wick made of a 20 inch [0.5 m] length of ASTM A416 seven wire 0.5 inch [12.7 mm] diameter strand. Wrap the strand with 2 inch [50 mm] 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 to 75°F [18 to 24°C].

(c) 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 of the top of the grout.

(d) 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) Calculate the bleed water, if any, at the end of the three 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.

Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSÉ ABREU
SECRETARY

MEMORANDUM

DATE: August 7, 2003

TO: Specification Review Distribution List

FROM: Duane F. Brautigam, P.E., State Specifications Engineer

SUBJECT: **Proposed Specifications Change: D9380002 – Post-Tensioning Grout**

In accordance with Specification Development Procedures, we are sending you a copy of a proposed specification change to Post-Tensioning - Grout.

This change was proposed by Robert Robertson, of the State Structures Office, to establish applications for which grout will be qualified for inclusion on the QPL, and to specify fluidity values under which grout tests are to be conducted.

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 to my attention via e-mail at SP965DB or duane.brautigam@dot.state.fl.us. Comments received after September 4, 2003 may not be considered. Your input is encouraged.

DFB/sh

Attachment

COMMENTS: I suggest that 938-4.1 Gas Generation be reworded to recite:

"The grout shall not contain aluminum or components that produce hydrogen, carbon dioxide or oxygen gas."

Submitted by: JACK R. LEONARD Phone #: SC 335-3679

TO: SPECIFICATION DEVELOPMENT

☐ NO COMMENTS
☒ COMMENTS–PLEASE PROCESS

DATE 08/26/03

Shirley Harvey

07/03/2003 02:54 PM

To: bburleson@ftba.com, David Sadler/CO/FDOT, Brian A Blanchard/CO/FDOT, Bruce Dietrich/CO/FDOT, Phillip G Davis/CO/FDOT, Clay McGonagill/CO/FDOT, acarlisle@ftba.com
cc: Robert Robertson/CO/FDOT@FDOT
Subject: Proposed Spec D9380002 - Post-Tensioning Grout

D9380002.doc

Please review the attached draft specification and return your comments/approval. Thank you.

shirley harvey
SC 994-4120
(850)414-4120
shirley.harvey@dot.state.fl.us

Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSE ABREU
SECRETARY

MEMORANDUM

DATE: July 3, 2003

TO: Bob Burleson, FTBA, David Sadler, State Construction Office, Brian Blanchard, State Roadway Design Office, Bruce Dietrich, State Pavement Management Office, Greg Davis, State Estimates Office, Clay McGonagill, General Counsel's Office

FROM: Clinton J. Shaw, State Specifications Office

SUBJECT: **Proposed Specification: D9380002 – Post-Tensioning Grout**

Attached for your review and comments is a copy of the subject Special Provision for Post-Tensioning Grout.

This change was proposed by Robert Robertson to benefit/cost analysis where appropriate, and to include impacts to those affected by the implementation such as cost, impact to project schedules, supplemental agreements, etc.

Please review and offer your comments.

CS/sh
Attachment

938 POST-TENSIONING GROUT.
(REV ~~1-9-03~~ *6-20-03* *7-1-03*) ~~(FA 1-28-03) (7-03)~~

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Robert Robertson
07/14/2003 07:52 AM

To: Shirley Harvey/CO/FDOT@FDOT
cc:
Subject: Re: Proposed Spec D9380002 - Post-Tensioning Grout

okay

Robert Robertson
FDOT Tallahassee Structures
SC 994-4267
(850) 414-4267
Shirley Harvey

Shirley Harvey
07/01/2003 01:11 PM

To: Robert Robertson/CO/FDOT@FDOT
cc:
Subject: Proposed Spec D9380002 - Post-Tensioning Grout

D9380002.doc

Please review the proposed spec attached.

Thanks,
shirley harvey
SC 994-4120
(850)414-4120
shirley.harvey@dot.state.fl.us

Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSÉ ABREU
SECRETARY

MEMORANDUM

DATE: July 1, 2003

TO: Robert Robertson, State Structures Office

FROM: Clinton J. Shaw, State Specifications Office

SUBJECT: **Proposed Specification: D9380002 – Post-Tensioning Grout**

Your proposed specification has been formatted and entered for processing. As the originator for this specification, please review the formatted draft and make any necessary changes.

Additionally, please verify the condition under which this specification is to be used (see usage note under specification number).

If you have any questions, please contact Clinton Shaw at (850) 414-4129 or Suncom 994-4129. Your response within two weeks will be appreciated, as further processing is dependent upon your response. We will continue to update you as we process this request for implementation.

CS/sh
Attachment

938 POST-TENSIONING GROUT.
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ORIGINATION FORM

THE INFORMATION BELOW IS TO BE PROVIDED BY THE ORIGINATOR
(The person who receives or originates the issue and needs to forward the issue for action.)

☐ Modify Specification _____D9380000_____.
Section/File number

☐ New Section _____.
Section number

Subject: Post-Tensioning Gout

Origination date: June 23, 2003

Originator: Robert Robertson
Office/Phone: State Structures Office/(850) 414-4267 SC 994-4267
Email address/ Userid: robert.robertson2@dot.state.fl.us

Problem statement: The current specification only deals with one grout type. Different grout properties are required for grouts used in horizontal, vertical or repair operations.

Information source: Larry Sessions worked with various industry grout companies to coordinate the changes and perform testing to assure the desired results were obtainable.

Background data:

Desired implementation date: Beginning with the July 2004 letting.

ORIGINATION FORM

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☐ Modify Specification _____D9380000_____.
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Originator: Robert Robertson
Office/Phone: State Structures Office/(850) 414-4267 SC 994-4267
Email address/ Userid: robert.robertson2@dot.state.fl.us

Problem statement: A brief statement of the perceived problem that we are trying to solve (including data that quantifies the magnitude of the problem when possible)

Information source: Any contacts through industry, or Department staff who may have information, or who provided information on the issue.

Background data: Any factual information on the problem, or potential solutions that could assist those working on the issue.

Desired implementation date: Beginning with the July 2004 letting.

VOID

SPECIFICATION PROCESSING AND STATUS FORM

Begin date:

File Number: D9380002

Scheduled completion date: Projected process completion date.

Implementation team member: Engineer assigned to shepherd issue through the process.

Schedule of activities: List each activity along with the person who is responsible. May also need to include progress-reporting activities, depending on duration of project or as agreed upon with the originator.

Resource needs: FTBA, C-Team, or SDRC recommendations. Product Evaluation, Estimates, Structures, Construction. SMO. or other identified financial, personnel, resource needs or impacts required to research, identify, and finalize the issue. Should include schedule changes, procedure changes, or other administrative impacts to each office involved in implementation.

Implementation schedule: Target letting date for implementation

Proposed solution: Include identification of documents that would provide direction on implementing the change. Benefit/cost analysis where appropriate. Also include impacts to those affected by the implementation such as cost, impact to project schedules, supplemental agreements, etc.

Recommended Usage Note:

Progress report: What is the current status of the issue? Detail problems encountered, that hinders the process.

938 POST-TENSIONING GROUT.

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