Florida Department of Transportation

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GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

KEVIN J. THIBAULT, P.E.
SECRETARY

July 2, 2020

Khoa Nguyen
Director, Office of Technical Services
Federal Highway Administration
3500 Financial Plaza, Suite 400
Tallahassee, Florida 32312

Re: State Specifications Office
Section: **930**
Proposed Specification: **9300100 MATERIALS FOR CONCRETE REPAIR.**

Dear Mr. Nguyen:

We are submitting, for your approval, two copies of the above referenced Supplemental Specification.

These changes are proposed by Harvey (Dale) DeFord from the State Materials Office to modify Tables 930-1 and 930-2, and incorporate language to meet contract requirements for sampling into the Standard Specification.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via email to daniel.strickland@dot.state.fl.us.

If you have any questions relating to this specification change, please call me at 414-4130.

Sincerely,

Signature on file

Daniel Strickland, P.E.
State Specifications Engineer

DS/dh
Attachment
cc: Florida Transportation Builders' Assoc.
State Construction Engineer

MATERIALS FOR CONCRETE REPAIR
(REV 4-30-20)

ARTICLE 930-1 is deleted and the following substituted:

930-1 Description.

This Section covers cementitious materials used to repair concrete including defects or purposely placed openings in concrete elements. Materials containing organic compounds, such as bitumens and epoxy resin as the principal binder are not included. The requirements for epoxy resin materials are covered in Section 926. Any depth larger than the manufacturer's recommendation for the specific material shall be repaired with portland cement concrete meeting the requirements of Section 346.

SUBARTICLE 930-2.2 is deleted and the following substituted:

930-2.2 Material Supply, Storage, and Marking: The material shall be pre-proportioned including aggregate. Deliver products in original, unopened containers with manufacturer's name, date of manufacture, and clearly marked with all information described below. Store the material in an elevated dry and weather protected enclosure in full compliance with the manufacturer's recommendations. Material must be used within manufacturer's recommended shelf life.

The material from which the containers are made shall have water vapor transmission not greater than 100 g/m^2 in 24 hours as determined in accordance with Procedure B of ASTM E96.

All containers shall be marked with the following information:

1. LOT identification number and material expiration date
2. Directions for use shall include but are not limited to the following:
    a. The type and kind of adhesive recommended (if any) to bond fresh repair material to the concrete or mortar being repaired.
    b. The recommended amount of resin, other liquid component, or both, to be mixed with the package contents.
    c. The recommended length of mixing time or sequence of mixing and resting times in minutes.
3. Date the material was packaged.
4. The yield in cubic feet or yield in $ft^2/in.$ thickness when mixed with the recommended amount of liquid.
5. The net weight in each container. The contents of any container shall not vary by more than 2% from the weight stated in the declarations. The average weight of filled containers in a LOT shall be not less than the individual weight stated in the declarations.
6. Instructions for the maximum and minimum water (or solutions) to cementitious material ratio.
7. State the approximate working time.

SUBARTICLE 930-4.3 is deleted and the following substituted:

930-4.3 Physical Properties: The repair material shall meet or exceed the physical properties stated in Table 930-1 as determined by the specified test methods.

Table- 930-1 - Physical Properties of Repair Materials for Horizontal Surfaces			
Requirement	Test Method	Rapid Hardening	Very Rapid Hardening
Minimum Compressive Strength, psi			
3 hours	ASTM C39* or ASTM C109*	N/A	2,000
24 hours		2,000	4,000
7 days		4,000	6,000
28 days		Greater than or equal to strength at 7 days.	
Maximum Length Change, %			
Allowable expansion at 28 days when water cured compared to length at one day	ASTM C157**	0.12	0.12
Allowable shrinkage at 28 days when air cured compared to length at one day		-0.12	-0.12
Allowable difference between increase in water and decrease in air		0.20	0.20
Minimum Slump (Concrete), inches	ASTM C143***	3	3
Minimum Flow (Mortar), %	ASTM C1437***	100	80
Time of Setting (Initial), minutes	ASTM C191* or ASTM C403*	Minimum 30	10 to 29
Coefficient of Thermal Expansion, in/in/°F	ASTM C531* or AASHTO T336	3.0~~5.0~~ x 10^{-6} to 9.0 x 10^{-6}	3.0~~5.0~~ x 10^{-6} to 9.0 x 10^{-6}
Minimum Bond Strength by Slant Shear, psi			
24 hours	FM 5-587	400	450
7 days		Greater than or equal to strength at 24 hours.	
Maximum Allowable Total Chlorides lb~~s~~/yd^3	FM 5-516	0.40	

* as applicable
** Make and cure the test specimens in accordance with ASTM C-157, except omit the curing period in Section 10.3; however both 11.1.1 and 11.1.2 shall apply for 28 day curing period.
*** Testing for flow/slump will be completed in 15 plus or minus 1/2 minute after the start of mixing liquid with the rapid hardening materials or 5 plus or minus 1/2 minute after mixing the liquid with the very rapid hardening materials.

SUBARTICLE 930-5.3 is deleted and the following substituted:

930-5.3 Physical Properties: The repair material shall meet or exceed the physical properties stated in Table 930-2 as determined by the specified test methods.

Table 930--2 - Physical Properties of Repair Materials for Vertical Surfaces*			
Requirement	Test Method	High Performance	Ultra-high Performance
Minimum Compressive Strength, psi			
24 hours	ASTM C39** or ASTM C109**	1,000	2,000
7 days		N/A	5,000
28 days		5,000	Greater than or equal to strength at 7 days
Maximum Length Change, %			
Allowable expansion at 28 days when water cured compared to length at one day	ASTM C157**	0.12	0.12
Allowable shrinkage at 28 days when air cured compared to length at one day		-0.08	-0.08
Maximum Slump (Concrete), inches	ASTM C143	3****	3****
Maximum Flow (Mortar), %	ASTM C1437	100****	100****
Time of Setting (Initial), minutes	ASTM C191** or ASTM C403**	10 to 180****	10 to 180****
Coefficient of Thermal Expansion, in/in/°F	ASTM C531*** or AASHTO T336***	3.05.0 x 10^{-6} to 9.0 x 10^{-6}	
Minimum Bond Strength by Slant Shear, psi,			
24 hours	FM 5-587	450	750
7 days		750.	750
Minimum Flexural Strength (at 7 days), psi	ASTM C580	500	700
Maximum Absorption (Mortar at 7 days), %	ASTM C413	4	4
Minimum Surface Resistivity (Concrete at 28 days), kohmKOhm-cm	AASHTO T358	N/A	22
Maximum Allowable Total Chlorides lbs/yd^3	FM 5-516	0.40	

* Use cement--based materials -modified with polymers and silica fume for extremely aggressive environments
** Make and cure the test specimens in accordance with ASTM C157, except omit the curing period in Section 10.3; however both 11.1.1 and 11.1.2 shall apply for 28 day curing period.
*** As applicable
**** For pump and pour applications, the maximum flow, slump and time of setting can be adjusted according to the manufacturer's recommendation.

SUBARTICLE 930-6.2 is deleted and the following substituted:

930-6.2 Physical Properties: The MAPC and MPPC materials shall meet or exceed physical properties stated in Table 930-3 as determined by the specified standard test methods.

Table 930--3 - Physical Properties of Repair Material in High Stress Areas		
Requirement	Test Method	Test Value
Minimum Compressive Strength (at 28 days), psi	ASTM C109*	8,500
Minimum Flexural Strength (at 28 days), psi	ASTM C348*	600
Minimum Slant Shear Bond (at 14 days), psi	FM 5-587*	2,500
Time of Setting (Initial), minutes	ASTM C191**	15 to 60
Maximum Scaling Resistance	ASTM C672	No scaling
Maximum Length Change, %		
Allowable expansion at 28 days when water cured compared to length at one day	ASTM C157***	0.03
Allowable shrinkage at 28 days when air cured compared to length at one day		-0.03
Maximum Allowable Total Chlorides lb~~s~~/yd^3	FM 5-516	0.40

* The test methods for compressive strength (ASTM C109), flexural strength (ASTM C348), and Slant Shear Bond (FM 5-587) shall be modified so that the specimens are air cured instead of moist cured. All of these samples shall be air cured until the time of testing.
** Initial time of set for MAPC or MPPC will be tested in accordance with ASTM C191 with the following modification. The initial time of set shall be tested at 95° plus or minus 5°F.
*** Make and cure the test specimens in accordance with ASTM C-157, except omit the curing period in Section 10.3; however both 11.1.1 and 11.1.2 shall apply for 28 day curing period.

SUBARTICLE 930-7.1 is deleted and the following substituted:

930-7 Special Fillers.

930-7.1 General: This material is intended to be used as filler material and for rapid repairs to pile jacket structures and other locations specified in the Plans ~~when no design mix concrete is available or a special filler is specified in the Contract Documents~~. Meet the requirements of ~~Section 457~~the contract documents for preparing the surfaces, placing, sampling, testing, and curing the concrete. Mix the material in accordance with the manufacturer's recommendations.

SUBARTICLE 930-7.3 is deleted and the following substituted:

930-7.3 Physical Properties: The repair material shall meet or exceed the physical properties stated in Table 930-4 as determined by the specified standard test methods. If extended, materials shall meet the minimum requirements of Table 930-4.

Table -930-4 - Physical Properties of Special Fillers			
Requirement	Test Method	Cathodic Protection	Non-Cathodic Protection
Minimum Compressive Strength, psi			
24 hours	ASTM C39* or ASTM C109*	1,500	2,000
28 days		5,000	5,000
Maximum Length Change, %			

Table -930-4 - Physical Properties of Special Fillers			
Requirement	Test Method	Cathodic Protection	Non-Cathodic Protection
Allowable expansion at 28 days when water cured compared to length at one day	ASTM C157**	0.12	0.12
Allowable shrinkage at 28 days when air cured compared to length at one day		-0.12	-0.12
Allowable difference between increase in water and decrease in air		0.20	0.20
Slump (Concrete), inches	ASTM C143	7-9	7-9
Minimum Flow (Mortar), %	ASTM C1437	100	100
Time of Setting (Initial), minutes	ASTM C191* or ASTM C403*	200 to 400	200 to 400
Minimum Bond Strength by Slant Shear (at 7 days), psi	FM 5-587	450	450
Minimum Flexural Strength (at 7 days), psi	ASTM C580	700	700
Minimum Tensile Strength (at 7 days), psi	ASTM C307	200	200
Surface Resistivity (at 28 days), kohm~~KOhm~~-cm	AASHTO T358	15 or less	22 or greater
Maximum Allowable Total Chlorides lb~~s~~/yd^3	FM 5-516	0.40	

* as applicable
** Make and cure the test specimens in accordance with ASTM C157, except omit the curing period in Section 10.3; however both 11.1.1 and 11.1.2 shall apply for 28 day curing period.

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930-1 Description.

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The material from which the containers are made shall have water vapor transmission not greater than 100 g/m^2 in 24 hours as determined in accordance with Procedure B of ASTM E96.

All containers shall be marked with the following information:

1. LOT identification number and material expiration date
2. Directions for use shall include but are not limited to the following:
    a. The type and kind of adhesive recommended (if any) to bond fresh repair material to the concrete or mortar being repaired.
    b. The recommended amount of resin, other liquid component, or both, to be mixed with the package contents.
    c. The recommended length of mixing time or sequence of mixing and resting times in minutes.
3. Date the material was packaged.
4. The yield in cubic feet or yield in ft^2/in. thickness when mixed with the recommended amount of liquid.
5. The net weight in each container. The contents of any container shall not vary by more than 2% from the weight stated in the declarations. The average weight of filled containers in a LOT shall be not less than the individual weight stated in the declarations.
6. Instructions for the maximum and minimum water (or solutions) to cementitious material ratio.
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SUBARTICLE 930-4.3 is deleted and the following substituted:

930-4.3 Physical Properties: The repair material shall meet or exceed the physical properties stated in Table 930-1 as determined by the specified test methods.

Table 930-1 - Physical Properties of Repair Materials for Horizontal Surfaces			
Requirement	Test Method	Rapid Hardening	Very Rapid Hardening
Minimum Compressive Strength, psi			
3 hours	ASTM C39* or ASTM C109*	N/A	2,000
24 hours		2,000	4,000
7 days		4,000	6,000
28 days		Greater than or equal to strength at 7 days.	
Maximum Length Change, %			
Allowable expansion at 28 days when water cured compared to length at one day	ASTM C157**	0.12	0.12
Allowable shrinkage at 28 days when air cured compared to length at one day		-0.12	-0.12
Allowable difference between increase in water and decrease in air		0.20	0.20
Minimum Slump (Concrete), inches	ASTM C143***	3	3
Minimum Flow (Mortar), %	ASTM C1437***	100	80
Time of Setting (Initial), minutes	ASTM C191* or ASTM C403*	Minimum 30	10 to 29
Coefficient of Thermal Expansion, in/in/°F	ASTM C531* or AASHTO T336	3.0×10^{-6} to 9.0×10^{-6}	3.0×10^{-6} to 9.0×10^{-6}
Minimum Bond Strength by Slant Shear, psi			
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7 days		Greater than or equal to strength at 24 hours.	
Maximum Allowable Total Chlorides lb/yd^3	FM 5-516	0.40	

* as applicable
** Make and cure the test specimens in accordance with ASTM C-157, except omit the curing period in Section 10.3; however both 11.1.1 and 11.1.2 shall apply for 28 day curing period.
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SUBARTICLE 930-5.3 is deleted and the following substituted:

930-5.3 Physical Properties: The repair material shall meet or exceed the physical properties stated in Table 930-2 as determined by the specified test methods.

Table 930-2 - Physical Properties of Repair Materials for Vertical Surfaces*			
Requirement	Test Method	High Performance	Ultra-high Performance
Minimum Compressive Strength, psi			
24 hours	ASTM C39** or ASTM C109**	1,000	2,000
7 days		N/A	5,000
28 days		5,000	Greater than or equal to strength at 7 days
Maximum Length Change, %			
Allowable expansion at 28 days when water cured compared to length at one day	ASTM C157**	0.12	0.12
Allowable shrinkage at 28 days when air cured compared to length at one day		-0.08	-0.08
Maximum Slump (Concrete), inches	ASTM C143	3****	3****
Maximum Flow (Mortar), %	ASTM C1437	100****	100****
Time of Setting (Initial), minutes	ASTM C191** or ASTM C403**	10 to 180****	10 to 180****
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Minimum Bond Strength by Slant Shear, psi,			
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Minimum Surface Resistivity (Concrete at 28 days), kohm-cm	AASHTO T358	N/A	22
Maximum Allowable Total Chlorides lb/yd^3	FM 5-516	0.40	

* Use cement-based materials modified with polymers and silica fume for extremely aggressive environments
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Minimum Slant Shear Bond (at 14 days), psi	FM 5-587*	2,500
Time of Setting (Initial), minutes	ASTM C191**	15 to 60
Maximum Scaling Resistance	ASTM C672	No scaling
Maximum Length Change, %		
Allowable expansion at 28 days when water cured compared to length at one day	ASTM C157***	0.03
Allowable shrinkage at 28 days when air cured compared to length at one day		-0.03
Maximum Allowable Total Chlorides lb/yd^3	FM 5-516	0.40

* The test methods for compressive strength (ASTM C109), flexural strength (ASTM C348), and Slant Shear Bond (FM 5-587) shall be modified so that the specimens are air cured instead of moist cured. All of these samples shall be air cured until the time of testing.
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Table 930-4 - Physical Properties of Special Fillers			
Requirement	Test Method	Cathodic Protection	Non-Cathodic Protection
Minimum Compressive Strength, psi			
24 hours	ASTM C39* or ASTM C109*	1,500	2,000
28 days		5,000	5,000
Maximum Length Change, %			

Table 930-4 - Physical Properties of Special Fillers			
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Slump (Concrete), inches	ASTM C143	7-9	7-9
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Time of Setting (Initial), minutes	ASTM C191* or ASTM C403*	200 to 400	200 to 400
Minimum Bond Strength by Slant Shear (at 7 days), psi	FM 5-587	450	450
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