



Florida Department of Transportation

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MEMORANDUM

DATE: June 4, 2015

TO: Specification Review Distribution List

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

SUBJECT: Proposed Specification: **3530000 Concrete Pavement Slab Replacement**

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

The changes are proposed by Michael Bergin of the State Materials Office based on project issues, new technology in materials and new construction methods. Changes include allowance of fibers for concrete, change of compressive strength from 2,200 psi to 1,600 psi for opening to traffic, change from 24 hour to 28 day acceptance strength, etc.

Please share this proposal with others within your responsibility. Review comments are due within four weeks and should be sent to Mail Station 75 or online at <http://www2.dot.state.fl.us/ProgramManagement/Development/IndustryReview.aspx> . Comments received after **July 2, 2015**, may not be considered. Your input is encouraged.

DS/ft
Attachment

CONCRETE PAVEMENT SLAB REPLACEMENT.

(REV ~~5-8-155-12-155-27-15~~)

SECTION 353 is deleted and the following substituted:

SECTION 353 CONCRETE PAVEMENT SLAB REPLACEMENT

353-1 Description.

Replace the existing defective area of concrete pavement with Portland cement concrete free of any uncontrolled cracks. Repair the damaged area of adjacent slabs, caused by slab removal at no cost to the Department.

353-2 Materials.

Meet the following requirements:

Portland Cement Concrete *	.....	Section 346
Coarse Aggregate.....	.....	Section 901
Fine Aggregate.....	.....	Section 902
Portland Cement.....	.....	Section 921
Water.....	.....	Section 923
Admixtures **.....	.....	Section 924
Curing Materials **.....	.....	Section 925
<i>Epoxy Compounds **</i>	<i>Section 926</i>
Post-Installed Anchor Systems For Structural Applications In Concrete Elements <i>Adhesive Bonding Materials Systems for Structural Applications **</i>	Section 937
Pozzolans and or Slags*.....	.....	Section 929
Embedded Items <i>Dowel Bar Assembly**</i>	Section 931
Calcium Chloride.....	AASHTO M-144, Type 1	

*For concrete pavement slab replacement, the use of pozzolans and slag is optional. *Fibers may be used in accordance with Developmental Specification Dev346FRP.*

*** Use products listed on the Departments Approved Products List (APL). Use Type B or J epoxy compounds. Dispense the epoxy from a cartridge or from metered equipment that indicates the amount of each component material being dispensed. Fibers may be used in accordance with Developmental Specification Dev346FRP.*

Concrete pavement containing only dowel bars will be considered non-reinforced concrete.

353-3 Composition of Concrete.

353-3.1 Mixture Proportions: Designate the actual proportions to be used to produce a concrete with a minimum ~~6-hour~~ compressive strength of ~~2,200~~*1,600* psi and a minimum ~~24-hour~~*28 day* compressive strength of 3,000 psi.

Prior to producing concrete, submit the design mix for approval on a form acceptable to the Department. ~~Ensure the 24-hour acceptance strength has a minimum over design of 400 psi.~~ Indicate slump before and after addition of accelerator. Use mixes approved by the Department and obtain concrete from a plant that is currently on the Department's

Production Facility listing. Producers seeking inclusion on the list shall meet the requirements of Section 105.

When an accelerating admixture is used ~~in solution~~, the amount of ~~water in the solution is considered to be part of the mixing water~~ *accelerating admixture will be noted on the delivery ticket for each load of concrete placed.* Make necessary adjustments to the concrete mix-water to account for the amount of water in the accelerating admixture solution. Test the concrete for consistency subject to the following ~~values~~ *deviations* from the approved mix design values:

<i>Table 1</i>		
<i>Property</i>	<i>Tolerance</i>	<i>Test Method</i>
<i>Water to Cementitious Materials ratio</i>	<i>+/- 0.02</i>	<i>FM 5-501</i>
<i>Air Content*</i>	<i>+/- 1.0%</i>	<i>ASTM C173 or C231</i>
<i>Slump*</i>	<i>+/- 1.0 inch</i>	<i>ASTM C143</i>
<i>Unit Weight*</i>	<i>+/- 2.0 lbs</i>	<i>ASTM C138</i>
<i>Temperature</i>	<i>≤ 100°F</i>	<i>ASTM C1064</i>

**When these values are outside the Tolerance in Table 1, a new maturity curve will be required.*

~~Slump Tolerance**plus or minus 1.5 inches~~
~~Entrained Air**1% to 6%~~
~~Temperature not to exceed 100°F~~

~~**For values as specified in the approved Design Mix prior to the addition of accelerating admixture.~~

353-3.2 Delivery Certification: Provide ~~certification~~ *a delivery ticket* in accordance with 346-6.3.

353-3.3 Demonstration Slab: Prior to batching production concrete, demonstrate the ability to furnish replacement slabs by constructing a demonstration slab on site. Demonstrate production techniques for slab removal, dowel installation, concrete placement, finishing, slab curing, sample preparation and curing, and proper timing of joint sawing. Demonstrate the ability to achieve the required compressive strengths. ~~Demonstrate the ability of the slabs to achieve the maturity needed for opening to traffic within the required time.~~ *Use and demonstrate proficiency to the Engineer the Maturity Method to determine when the concrete has achieved a compressive strength of 1,600 psi in order to open the pavement to traffic. Use cylinders to verify the concrete compressive strength at 28 days.* Schedule construction of the demonstration slab during the same time period specified in the Contract Documents. If the Engineer determines that elements of the demonstration slab fail to meet requirements of the Contract Documents, propose adjustments to the construction processes and/or materials for the Engineer's approval. The Engineer may require additional demonstration slabs until a demonstration slab conforms to the Contract Documents.

353-4 Batching and Mixing Concrete.

Obtain concrete that meets the requirements of 346-7 with the following additional requirements:

Add all the concrete ingredients, excluding the accelerator to the truck mixer at the plant. Mix each batch at the plant at the mixing speed for 70-100 revolutions of the drum.

~~Agitate the concrete en route to the job site at a speed of no more than three revolutions per minute.~~ Add the accelerator to the ~~concrete load~~ at the job site *and record the amount on the delivery ticket*. Mix the concrete for ~~40-30~~ additional revolutions at mixing speed after the accelerator is added to the mixer. Do not add accelerator to any concrete which has attained the age of 60 minutes, measured from the beginning of the initial mixing at the plant.

Incorporate the accelerator into the concrete ~~design mix~~ in accordance with the recommendations of the admixture ~~supplier~~ *manufacturer*. *Do not exceed the recommendations of the manufacturer's technical data sheet for the dosage rate of the accelerating admixture.*

353-5 Test Requirements.

Perform concrete sampling and testing in accordance with Section 346-5. Perform the plastic property tests in accordance with 346-8, except when the mix design contains an accelerator; perform the plastic property tests prior to the addition of the accelerator. The requirements of 346-9 apply to this Section with the following modification: ~~28-day requirements will be replaced with 24 hours and if the design mix includes an accelerator, then the compressive strength cylinders will be fabricated after all ingredients, including the accelerator, are added.~~

Make a minimum of four test cylinders from the last slab for each day of placement to assess *the compressive strength at 28 days for acceptance of the concrete.* ~~for protection and opening to traffic (protection set). Cure the protection set of cylinders by methods identical to those used in curing the concrete replacement slabs.~~ Cure the acceptance set of cylinders *as close to the replacement slab as possible* ~~identical to the protection set of cylinders~~ for the first 6-hours. *Transport the acceptance cylinders to the laboratory and cure the cylinders using, then by laboratory* ~~cured-curing conditions thereafter until the 24-hour~~ *28 days* strength test. ~~Provide a location and curing facility for initial curing of verification cylinders.~~ *Provide a curing box at the project when the temperature is expected to fall below 40°F.*

~~Test two cylinders from the protection set within 6 hours of sampling and consider the average compressive strength of these two tests to be the 6 hour compressive strength. If the compressive strength is below 2,200 psi, test the remaining 2 cylinders from the protection set no longer than 6 hours from sampling.~~ The Maturity Method specified in 353-10.2 ~~may~~ *must* be used *determine if the concrete has achieved 1,600 psi and can be opened to traffic.* ~~as an alternate to the protection set of concrete cylinders.~~ *Use the Maturity Meter to verify the strength of the last slab of each day's placement.*

Test the *QC and V cylinders* ~~acceptance and verification cylinders~~ at ~~24 hours~~ *28 days* from the time of sampling.

353-6 Concrete Slab Acceptance.

Reject any Concrete not meeting the ~~plastic property~~ requirements of 353-5. Acceptance will be based on ~~plastic properties~~, achieving the ~~2,200~~ *1,600* psi compressive strength prior to opening the slabs to traffic *based on the Maturity Method* and the ~~24-hour~~ *28 days* compressive strength *of 3,000 psi.*

If the compressive strength of any set of test cylinders fails to meet the strength requirements, take immediate corrective measures to ensure that concrete placed in the future meets the specified strength requirements. The Engineer will evaluate the particular circumstances in each instance where a strength deficiency occurs. If the Engineer determines that there will be a significant effect on the service life of the replacement slab, replace the concrete at no expense to the Department.

If any uncontrolled cracks appear *in a replaced slab* during the life of the contract, remove and replace the cracked slab at no expense to the Department. *Controlled cracks are cracks that are designed to occur at specific locations based on the pavement design. All other cracks in the pavement are uncontrolled cracks.* Repair *uncontrolled cracked slabs* by removing and replacing the pavement across the full width *and depth* of all affected lanes or shoulders and to the nearest transverse joint in each direction. Investigate and implement immediate effective solutions to eliminate further cracks, in consultation with, and subject to the approval of, the Engineer.

353-7 Placing, Striking Off, Consolidating and Finishing Concrete.

Place concrete as specified in 350-8.

The requirements of 350-9 and 350-10 are applicable to this Section.

Perform straight edging while the concrete is still in plastic state after floating is completed and the excess water removed. Furnish and operate a 10 foot straightedge meeting the requirements of 350-3.6. Hold the straightedge in successive positions parallel to the road centerline, in contact with the surface, testing until the replacement slab is straight edged from one side to the other. Advance along the road in successive stages of not more than one-half the length of the straightedge. Fill any depressions immediately with freshly mixed concrete, *consolidate*, strike-off, ~~consolidate~~ and refinish. Cut down and refinish any high areas. Continue straightedge testing and surface correction until the entire surface conforms to the required grade and cross section. Ensure that transverse slope deviations of the finished pavement do not exceed 1/8 inch with the straightedge laid in a direction perpendicular to the centerline. When ~~portland~~ *Portland* cement concrete pavement abuts bridge approaches or pavement not under this Contract, ensure that the longitudinal slope deviations of the finished pavement do not exceed 1/8 inch in 10 foot length. Produce a uniform, gritty textured final finish longitudinally along the pavement by dragging a broom or seamless strip of damp burlap, having at least 3 feet in contact with the pavement.

~~If the Engineer identifies a surface irregularity determined to be objectionable in an area to be opened to traffic and the design speed is 55 mph or greater, straightedge with a 10 foot long straightedge and address all deficiencies in excess of 1/4 inch within 72 hours of placement by grinding in accordance with the requirements of Section 352.~~ *When the Engineer identifies surface irregularities that are determined to be objectionable, use a 10 foot long straightedge and address the deficiencies in excess of 1/8 inch by grinding in accordance with Section 352.*

When required in the Contract Documents, produce a pavement surface that is true to grade and uniform in appearance with a longitudinal line type texture by grinding in accordance with Section 352.

353-8 Curing.

Cure the slab as specified in 350-11, except for time and temperature restrictions. Use *a Type I curing compounds with a fugitive dye* as specified in 350-11.2 *and apply within one-half hour* after completing the finishing operations. After the curing compound has been applied, cover the surface and exposed edges with two layers of white burlap-polyethylene curing blanket conforming to Section 925 or insulating blankets approved by the Engineer. ~~Cover the slab with the curing materials as soon as the slab hardens enough to resist marring the concrete surface.~~ Continue curing the slab until the concrete achieves the required ~~6-hour~~ *1,600 psi compressive strength as indicated by the Maturity Meter reading.*

353-9 Joints.

353-9.1 General: Construct transverse joints as specified in 350-12 and as shown on the Design Standards, except that dowels bars are installed per 353-9.2. Tie bars will not be placed along the longitudinal joints unless shown in the Contract Documents. Apply a ~~liquid~~ bond breaker ~~recommended by the manufacturer for the intended application~~ to all vertical faces of the adjacent slabs. *Submit the proposed bond breaker to the Engineer for approval.*

Clean and seal joints in accordance with Section 350.

353-9.2 Dowel Bars: Provide dowel bars in accordance with the details shown in the Contract Documents.

353-9.2.1 Dowel Bars at Transverse Joint Between two Replacement Slabs:

Follow the requirements of 350-12 when providing dowel bars at a transverse joint between two freshly placed replacement slabs.

353-9.2.2 Dowel Bars at Transverse Joints Between Existing and

Replacement Slabs: Follow the requirements of 350-12, except drill holes and install dowel bars into the sawed face or end of the existing slab. Develop load transfer between existing and freshly placed replacement slab. The dowels shall be free to move inside the replacement slab and epoxy-bonded into the existing slab.

353-9.2.3 Dowel Bar Installation: Install dowel bars in accordance with Section 416 except as modified herein. *Position each dowel such that its final deviation from parallel to the surface of the pavement and parallel to the longitudinal centerline of the pavement does not exceed 1/2 inch. Position each dowel such that its final deviation from centered on the joint does not exceed 2 inches. Position each dowel such that at no point in its length does it deviate from the surface of the pavement as shown in the Plans in excess of 1 inch. Confirm the position of dowel bars by suitable means acceptable to the Engineer, which may include non-destructive testing methods.* ~~Use a gang drill (several drills mounted parallel in a rigid frame), when enough operating space is available. Drill parallel to the centerline of the concrete pavement.~~

Use Type B or J epoxy compounds. Dispense the epoxy from a cartridge or from metered equipment that indicates the amount of each component material being dispensed.

Inject epoxy into the hole after cleaning and prior to dowel insertion. Start injection at the back of the hole to force the epoxy to move forward during dowel insertion. Twist the dowel a minimum of one full turn during the insertion to ensure that the epoxy completely surrounds the dowel. The injection process and viscosity of the epoxy shall be adequate to insure that the space between the surface of the dowel and the inside of the hole is completely filled with epoxy.

Do not allow the epoxy to escape from the front of the hole after inserting the dowel in the hole. Use a grout retention disk 1/8 inch thick, fabricated from nylon or plastic, to hold epoxy in the hole during dowel insertion.

353-10 Protection and Opening to Traffic.

353-10.1 General: The requirements of 350-6 apply to this Section. ~~Keep the~~ *The placed* slabs *will remain* closed to traffic until the *Maturity Meter data indicates that the* compressive strength requirement ~~of 2,200 psi~~ is achieved. ~~Verify the achievement of the required strength by cylinder testing as specified in 353-5 or the use of the maturity method test as described in 353-10.2.~~ Provide *a printed Maturity Meter record* ~~documentation to the Engineer indicating that the~~

~~required that 6-hour~~ strength was achieved prior to opening to traffic. ~~by either a cylinder test report or a printed maturity meter monitoring record.~~

Protect the pavement from all traffic, including construction vehicles, until the *maturity data indicates that the required* ~~specified 2,200-psi~~ strength has been obtained. The protective measures shall be arranged so as not to interfere with traffic lanes being utilized for required maintenance of traffic.

353-10.2 Maturity Method Testing: ~~Provide and perform, with the assistance of the Engineer, Maturity Method Testing as specified in ASTM C1074 using Maturity Meter apparatus specified therein.~~

~~Use a~~ Maturity ~~Method Testing may be used~~ *Curve* to estimate the ~~in-place~~ strength of *the concrete for opening to traffic for each day of that days* production. ~~of concrete slabs. Temperature sensors will be e~~Embedded *temperature sensors at mid-depth in the slab, at 6 inches from the leading edge of the transverse joint and at 6 inches from the longitudinal joint or* at locations designated by the Engineer.

~~When this method is used, Provide~~ a strength-maturity relationship ~~chart~~*curve* using the Arrhenius maturity function with an activation energy of 33,500 J/mol, ~~as outlined in ASTM C1074 in a laboratory qualified to perform the method, will be prepared and tested at the concrete producer's design mix trial batch laboratory, or at other approved laboratory facilities designated by the Engineer.~~ Compressive strength tests, as specified in ASTM C1074, will be ~~generated~~*performed* to produce a five point curve with points before and after the *anticipated time for opening to traffic. Provide the mix design supporting data and the maturity curve to the Engineer for his approval.* ~~target and with prior approval by the Engineer.~~

The Engineer may require compressive strength testing as outlined in 353-5. Fabricate six test cylinders for ~~protection-acceptance~~ strength and Maturity ~~Meter~~ *Curve* correlation testing. The compressive strength cylinders and ~~maturity meter~~*Maturity Curve* correlation testing will be performed for the first production day, *when the mix design is changed to another mix design,* ~~and~~ at the discretion of the Engineer for each remaining placement week, or until terminated by the Engineer.

Any changes of a material source or proportion in the concrete mixture require a new Maturity Curve.

353-11 Method of Measurement.

The pay quantity for concrete pavement slab replacement, calculated using field-measured horizontal dimensions and thickness of the removed slab, will be the volume, in cubic yards, of calculated concrete volume placed and accepted.

The pay quantity for cleaning and sealing joints will be in accordance with Section 350.

353-12 Basis of Payment.

Price and payment for concrete pavement slab replacement, will be full compensation for all work specified in this Section and shall include demonstration slab construction, all joint construction, including tie bars and dowels, furnishing of test specimens, and all necessary incidentals.

Price and payment for cleaning and sealing joints will be made in accordance with Section 350.

Payment will be made under:

Item No. 353- 70- Concrete Pavement Slab Replacement - per cubic yard.

3530000
All Jobs