

WORKBOOK CHANGE(S)

Add D 3530000.D03
Rev Date 2-3-04
F.A. Date 2-4-04
Letting Date 7-04

Move D _____
To Deleted File _____
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Remarks New SS.

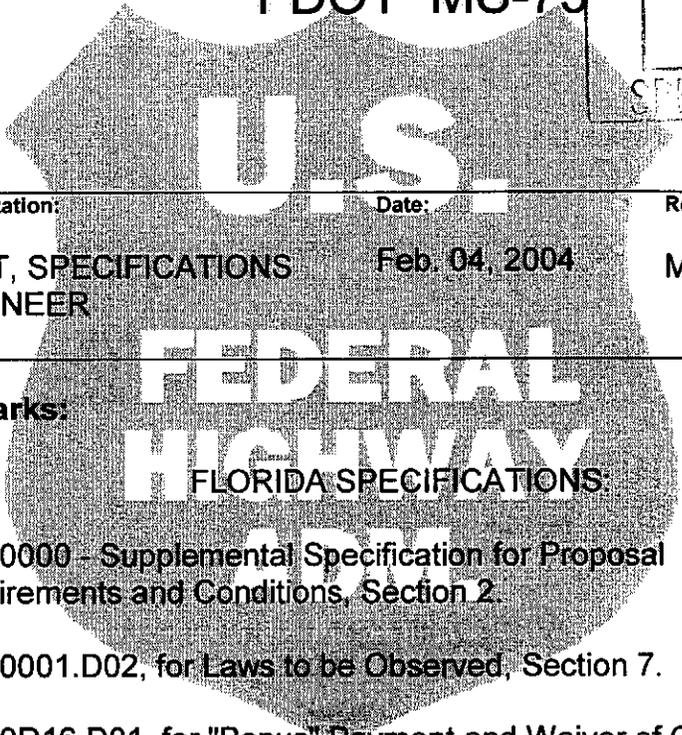
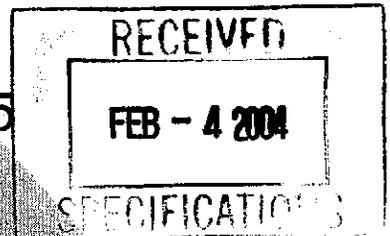
Dates

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QPL (ONLY) _____
Added to Nextwb file 2-5-04
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History File Updated _____
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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



To:	Organization:	Date:	Routing Symbol:
MR. DUANE BRAUTIGAM	FDOT, SPECIFICATIONS ENGINEER	Feb. 04, 2004	MS-75

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- For Signature of

Remarks:

D0020000 - Supplemental Specification for Proposal Requirements and Conditions, Section 2.

D0070001.D02, for Laws to be Observed, Section 7.

D0080D16.D01, for "Bonus" Payment and Waiver of Contractor Claims, Section 8.

D3500000.D04, for Cement Concrete Pavement, Section 350.

D3520000.D03, for Grinding Concrete Pavement, Section 352.

D3530000.D03, for Concrete Pavement Slab Replacement, Section 353.

D9480044, for Pipe Liner-Machine Spiral Wound Pipe Liner, Section 948.

ATTACHMENTS

From:	Telephone Number:	FDOT MS:	Org/Rtg Symbol
By Ann Allshouse FOR: JAMES E. ST. JOHN, DIVISION ADMINISTRATOR	(850) 942-9650, EXT. 3034	# 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

February 3, 2004

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

Re: Office of Design, Specifications
Section 353
Proposed Specification: D3530000.D03 - Concrete Pavement Slab Replacement

Dear Mr. Davis:

We are resubmitting, for your approval, two copies of a proposed Supplemental Specification for Concrete Pavement Slab Replacement.

This change was proposed by Charles Ishee of the State Materials Office to update language and terminology in order to bring it in line with other recently published specifications.

Please review and transmit your comments, if any, as soon as possible so that we may include this in the July 2004 Workbook. 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/jf
Attachment

cc: General Counsel
Florida Transportation Builders' Assoc.
State Construction Engineer

353 CONCRETE PAVEMENT SLAB REPLACEMENT.
(REV2-3-04)

SECTION 353 (Pages 326-331) 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. Repair the damaged area of adjacent slabs, caused by slab removal at no cost to the Department.

353-2 Materials.

353-2.1 General: Meet the following requirements:

Portland Cement Concrete (Class I Paving)*.....	Section 346
Coarse Aggregate	Section 901
Fine Aggregate	Section 902
Portland Cement.....	Section 921
Water	Section 923
Admixtures.....	Section 924
Curing Materials.....	Section 925
Epoxy Compounds.....	Section 926
Embedded Items.....	Section 931
Calcium Chloride.....	AASHTO M 144, Type 1

* Concrete will meet the requirements of Section 346 (Class I Paving) with the changes described in this Section.

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 psi [15 MPa] and a minimum 24-hour compressive strength of 3,000 psi [21 MPa].

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 [3MPa]. Indicate slump before and after addition of accelerator. Use mixes approved by the Department and from an approved concrete production facility meeting the requirements of Chapter 9.2 of the Materials Manual – Concrete Production Facilities Guidelines.

When an accelerating admixture is used in solution, the amount of water in the solution is considered to be part of the mixing water. Make necessary adjustment 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 from the approved mix design values:

Slump Tolerance**.....	± 1.5 inches [40 mm]
Entrained Air**.....	1% to 6%
Temperature not to exceed 100 °F [38°C]	

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

353-3.2 Certification: Provide certification 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

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traffic within the required time. 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 with 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 at the job site. Mix the concrete for 40 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.

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 strength 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 identical to the protection set of cylinders for the first 6-hours, then by laboratory cured conditions thereafter until the 24-hour strength test. Provide a location and curing facility for initial curing of verification cylinders.

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 [15 MPa], 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 be used as an alternate to the protection set of concrete cylinders.

Test the acceptance and verification cylinders at 24-hours 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 psi [15 MPa] compressive strength prior to opening the slabs to traffic and the 24-hour compressive strength.

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 during the life of the contract, remove and replace the cracked slab at no expense to the Department. Repair by removing and replacing the pavement across the full width 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.

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Deleted: Thoroughly dissolve the calcium chloride in the withheld mixing water before adding it to the mixer at the jobsite.

Deleted: If approved by the Engineer, a Type C or Type E admixture that is on the Qualified Products List (QPL) may be used in lieu of calcium chloride.¶

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Deleted: the tests will be performed prior to the addition of any Calcium Chloride. The requirements of 346-9 apply to this Section with the following modification:

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Deleted: Perform concrete sampling and testing according to standard test methods listed in 346-5.¶

Cure the protection set cylinders by methods identical to those used in curing the concrete replacement slabs. Cure the acceptance set cylinders identical to the protection set cylinders for the first 6-hours, then by laboratory cured conditions thereafter until the 24-hour strength test.¶

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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 [3 meter] 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, 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 [3 mm] with the straightedge laid in a direction perpendicular to the centerline. When 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 [3 mm] in 10 foot [3 m] 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 [1 m] in contact with the pavement.

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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.

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353-8 Curing.

Cure the slab as specified in 350-11, except for time and temperature restrictions. Use curing compounds as specified in 350-11.2 after completing the finishing operations. After the curing compound has been applied, cover the surface and exposed edges with 2 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 strength.

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353-9 Joints.

353-9.1 General: Construct transverse joints as specified in 350-12 and as shown on the Design Standards, except that dowel 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.

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

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Deleted: along the longitudinal joint

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.

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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.

Deleted: 15.4

353-9.2.3 Dowel Bar Installation: Install dowel bars in accordance with Section 416 except as modified herein. 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.

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 [3.2 mm] 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 slab closed to traffic until the compressive strength requirement of 2,200 psi [15 MPa] 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 documentation 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 specified 2,200 psi [15 MPa] strength has been obtained. Include in the Quality Control Plan (QCP) what actions will be used to protect the pavement. The protective measures shall be arranged so as not to interfere with traffic lanes being utilized for required maintenance of traffic.

Deleted: Such protection shall include the erection and maintenance of signs, lights, barricades, construction and removal of temporary pavement, bridges, crossovers, and the use of flagmen or similar methods approved by the Engineer

353-10.2 Maturity Method Testing: Provide and perform, with the assistance of the Engineer, Maturity Method Testing as specified in ASTM C 1074 using Maturity Meter apparatus specified therein.

Maturity Method Testing may be used to estimate the in-place strength of that days production of concrete slabs. Temperature sensors will be embedded at locations designated by the Engineer.

When this method is used, a strength-maturity relationship chart, as outlined in ASTM C 1074, 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 C 1074, will be generated to produce a five point curve with points before and after the target and with prior approval by the Engineer.

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The Engineer may require compressive strength testing as outlined in 353-5. Fabricate six test cylinders for protection strength and Maturity Meter correlation testing. The compressive strength cylinder and maturity meter correlation testing will be performed for the first production day and at the discretion of the Engineer for each remaining placement week, or until terminated by the Engineer.

353-11 Method of Measurement.

The quantity to be paid for will be the volume, in cubic yards [cubic meters], of concrete placed and accepted. The quantity will be calculated on the basis of field-measured dimensions. The depth used in this calculation will be determined by averaging an appropriate number of measurements from the plane of the existing pavement surface to the surface of the subgrade, as it exists immediately prior to placing the concrete.

353-12 Basis of Payment.

Price and payment 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.

Payment will be made under:

- Item No. 353- 70- Concrete Pavement Slab Replacement - per cubic yard.
- Item No. 2353- 70- Concrete Pavement Slab Replacement - per cubic meter.

**353 CONCRETE PAVEMENT SLAB REPLACEMENT.
(REV2-3-04)**

SECTION 353 (Pages 326-331) 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. Repair the damaged area of adjacent slabs, caused by slab removal at no cost to the Department.

353-2 Materials.

353-2.1 General: Meet the following requirements:

Portland Cement Concrete (Class I Paving)*	Section 346
Coarse Aggregate	Section 901
Fine Aggregate	Section 902
Portland Cement	Section 921
Water	Section 923
Admixtures	Section 924
Curing Materials	Section 925
Epoxy Compounds	Section 926
Embedded Items	Section 931
Calcium Chloride	AASHTO M 144, Type 1

* Concrete will meet the requirements of Section 346 (Class I Paving) with the changes

described in this Section.

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 psi [15 MPa] and a minimum 24-hour compressive strength of 3,000 psi [21 MPa].

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 [3MPa]. Indicate slump before and after addition of accelerator. Use mixes approved by the Department and from an approved concrete production facility meeting the requirements of Chapter 9.2 of the Materials Manual – Concrete Production Facilities Guidelines.

When an accelerating admixture is used in solution, the amount of water in the solution is considered to be part of the mixing water. Make necessary adjustment 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 from the approved mix design values:

Slump Tolerance**	± 1.5 inches [40 mm]
Entrained Air**	1% to 6%
Temperature not to exceed	100 °F [38°C]

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

353-3.2 Certification: Provide certification 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. 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 with 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 at the job site. Mix the concrete for 40 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.

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 strength 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 identical to the protection set of cylinders for the first 6-hours, then by laboratory cured conditions thereafter until the 24-hour strength test. Provide a location and curing facility for initial curing of verification cylinders.

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 [15 MPa], 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 be used as an alternate to the protection set of concrete cylinders.

Test the acceptance and verification cylinders at 24-hours 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 psi [15 MPa] compressive strength prior to opening the slabs to traffic and the 24-hour compressive strength.

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 during the life of the contract, remove and replace the cracked slab at no expense to the Department. Repair by removing and replacing the pavement across the full width 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 [3 meter] 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, 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 [3 mm] with the straightedge laid in a direction perpendicular to the centerline. When 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 [3 mm] in 10 foot [3 m] 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 [1 m] in contact with the pavement.

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 curing compounds as specified in 350-11.2 after completing the finishing operations. After the curing compound has been applied, cover the surface and exposed edges with 2 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 strength.

353-9 Joints.

353-9.1 General: Construct transverse joints as specified in 350-12 and as shown on the Design Standards, except that dowel 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.

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. 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.

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 [3.2 mm] 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 slab closed to traffic until the compressive strength requirement of 2,200 psi [15 MPa] 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 documentation 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 specified 2,200 psi [15 MPa] strength has been obtained. Include in the Quality Control Plan (QCP) what actions will be used to protect the pavement. 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 C 1074 using Maturity Meter apparatus specified therein.

Maturity Method Testing may be used to estimate the in-place strength of that days production of concrete slabs. Temperature sensors will be embedded at locations designated by the Engineer.

When this method is used, a strength-maturity relationship chart, as outlined in ASTM C 1074, 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 C 1074, will be generated to produce a five point curve with points before and after the 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 strength and Maturity Meter correlation testing. The compressive strength cylinder and maturity meter correlation testing will be performed for the first production day and at the discretion of the Engineer for each remaining placement week, or until terminated by the Engineer.

353-11 Method of Measurement.

The quantity to be paid for will be the volume, in cubic yards [cubic meters], of concrete placed and accepted. The quantity will be calculated on the basis of field-measured dimensions. The depth used in this calculation will be determined by averaging an appropriate number of measurements from the plane of the existing pavement surface to the surface of the subgrade, as it exists immediately prior to placing the concrete.

353-12 Basis of Payment.

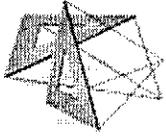
Price and payment will be full compensation for all work specified in this Section and shall include demonstration slab construction, all joint construction, including tie bars and dowels, furnishing of test specimens, and all necessary incidentals.

Payment will be made under:

- | | |
|--------------------|---|
| Item No. 353- 70- | Concrete Pavement Slab Replacement - per cubic yard. |
| Item No. 2353- 70- | Concrete Pavement Slab Replacement - per cubic meter. |

***The amount of calcium chloride in the mix may be increased to 1.5% by weight of the cement if the purity of calcium chloride is 80% or less.

APPROVED  DATE: 2-04-04
For the Division Administrator



Judy F Frazier

01/16/2004 09:56 AM

To: donald.davis@fhwa.dot.gov,
cc: ann.allshouse@fhwa.dot.gov, bburleson@ftba.com, Clay
McGonagill/CO/FDOT, Ananth Prasad/CO/FDOT, Charles A
Ishee/SM/FDOT,
cc:
Subject: D3530000.D02

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



D3530000.D02.doc

Judy Frazier
(850) 414-4127, SC 994-4127
judy.frazier@dot.state.fl.us



Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSÉ ABREU
SECRETARY

January 16, 2004

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

Re: Office of Design, Specifications
Section 353
Proposed Specification: D3530000.D02

Dear Mr. Davis:

We are submitting, for your approval, two copies of a proposed Supplemental Specification for Concrete Pavement Slab Replacement.

This change was proposed by Charles Ishee of the State Materials Office to update language and terminology in order to bring it in line with other recently published specifications.

Please review and transmit your comments, if any, as soon as possible so that we may include this in the July 2004 Workbook. 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,

A handwritten signature in black ink, appearing to read "Duane F. Brautigam".

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

DFB/jf

Attachment

cc: General Counsel
Florida Transportation Builders' Assoc.
State Construction Engineer

353 CONCRETE PAVEMENT SLAB REPLACEMENT.
~~(REV 12-20-015-19-0310-24-0312-2-031-16-04) (FA 1-3-02) (7-02) (FA 00-00-00) (7-04)~~

SECTION 353 (Pages 326-331) is deleted and the following substituted:

**SECTION 353
CONCRETE PAVEMENT SLAB REPLACEMENT**

353-1 Description.

Replace the existing defective area of concrete pavement with ~~P~~portland cement concrete slabs. Repair the damaged area of adjacent slabs, caused by slab removal, ~~to the satisfaction of the Engineer and~~ at no cost to the Department.

353-2 Materials.

353-2.1 General: Meet the following requirements:

- (a) Coarse Aggregate.....Section 901
- (b) Fine Aggregate.....Section 902
- (c) Portland Cement.....Section 921
- (d) WaterSection 923
- (e) Admixtures.....Section 924*
- (f) Curing Materials.....Section 925
- (g) Epoxy Compounds.....Section 926
- (h) Embedded ItemsSection 931
- (i) Calcium Chloride.....AASHTO M 144, Type 1*

~~*The requirements of 346-2.5 are applicable to the admixtures.~~ Concrete pavement containing only tie and dowel bars will be considered ~~unreinforced~~ *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 psi [15 MPa] and a minimum 24-hour compressive strength of 3,000 psi [21 MPa].

Prior to producing concrete, submit the design mix for approval on a form acceptable to the Department. ~~The minimum over design shall be 400 psi [3 MPa] at~~ *Ensure* the 24-hour acceptance strength *has a minimum over design of 400 psi [3MPa]*. Indicate slump before and after addition of accelerator. Use mixes approved by the Department and from an approved concrete production facility meeting the requirements of Chapter 9.2 of the Materials Manual – Concrete Production Facilities Guidelines.

When an accelerating admixture is used in solution, the amount of water in the solution is considered to be part of the mixing water. Make necessary adjustment to the concrete mix-water to account for the amount of water in the accelerating admixture solution. ~~Inspect and~~ *Test* the concrete for consistency and strength, subject to the following ~~tolerance values~~ *from the approved mix design values:*

- ~~**Target Slump Tolerance**~~ ± 1.5 inches [40 mm]
- Entrained Air** 1% to 6%
- ~~***Calcium Chloride up to 1%, by weight of Cement***~~ *Temperature not to exceed 100*

°F [38°C]

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

~~***The amount of calcium chloride in the mix may be increased to 1.5% by weight of the cement if the purity of calcium chloride is 80% or less.~~

353-3.2 Certification: Provide certification in accordance with 346-6.3.

353-3.3 Demonstration Slab: Prior to producing 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. 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 with 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 calcium chloride and 3 gal/yd³ [15 L/m³] of withheld mixing water 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 calcium chloride and withheld mixing water accelerator to the concrete at the job site. Mix the concrete for 40 additional revolutions at mixing speed after the calcium chloride and withheld mixing water are accelerator is added to the mixer. Do not add calcium chloride accelerator to any concrete which has attained the age of 4560 minutes, measured from the beginning of the initial mixing at the plant.

~~Thoroughly dissolve the calcium chloride in the withheld mixing water before adding it to the mixer at the jobsite. If approved by the Engineer, a Type C or Type E admixture that is on the Qualified Products List (QPL) may be used in lieu of calcium chloride.~~

Incorporate the admixture accelerator is into the concrete design mix in accordance with the recommendations of the admixture supplier when a Type C or Type E admixture is used.

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 Calcium Chloride an accelerator; perform the plastic property tests prior to the addition of Calcium Chloride the accelerator. Perform concrete sampling and testing in accordance with 346-5. 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 has Calcium Chloride includes an accelerator, then the tests will be performed prior to the addition of any Calcium Chloride. The requirements of 346-9 apply to this Section with the following modification: the compressive strength cylinders will be fabricated after all ingredients, including the accelerators, are added.~~

Make one set a minimum of four test cylinders from the last slab for each day of placement to assess strength 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 identical to the protection set of cylinders for the first 6-hours, then by laboratory cured conditions thereafter until the 24-hour strength test. Provide a location and curing facility for initial curing of verification cylinders.

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 [15 MPa], 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 be used as an alternate to the protection set of concrete cylinders.

~~Perform concrete sampling and testing according to standard test methods listed in 346-5.
Cure the protection set cylinders by methods identical to those used in curing the concrete replacement slabs. Cure the acceptance set cylinders identical to the protection set cylinders for the first 6 hours, then by laboratory cured conditions thereafter until the 24-hour strength test.~~

Test the acceptance *and verification* cylinders at 24-hours 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 psi [15 MPa] compressive strength prior to opening the slabs to traffic and the 24-hour compressive strength.

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 during the life of the contract unacceptable to the Engineer, remove and replace any slab at no expense to the Department. Repair by removing and replacing the pavement across the full width 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 ~~350-109, and 350-110 and 350-12.2~~ 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 a straightedge meeting the requirements of 350-3.126. 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, 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. 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 [1 m] in contact with the pavement, ~~longitudinally along the pavement.~~

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 350-131, except for time and temperature restrictions. Use curing compounds as specified in 350-131.2 after completing the finishing operations. *After the curing compound has been applied,* cover the surface and exposed edges with 2 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 ~~sustain the load~~ *resist marring the concrete surface.* Continue curing the slab until the concrete achieves the required 6-hour strength.

353-9 Joints.

353-9.1 General: Construct transverse joints as specified in 350-152 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 ~~the~~ all vertical faces of the adjacent slabs ~~along the longitudinal joint~~.

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 350-15-412 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 350-15-412, 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. 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.*

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 [3.2 mm] 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 slab closed to traffic until the compressive strength requirement of 2,200 psi [15 MPa] 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 documentation 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 specified 2,200 psi [15 MPa] strength has been obtained. ~~Such protection shall include the erection and maintenance of signs, lights, barricades, construction and removal of temporary pavement, bridges, crossovers, and the use of flagmen or similar methods approved by the Engineer.~~ *Include in the Quality Control Plan (QCP) what actions will be used to protect the pavement.* 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 C 1074 using Maturity Meter apparatus specified therein.

Maturity Method Testing may be used to estimate the in-place strength of that days production of concrete slabs. Temperature sensors will be embedded at locations designated by the Engineer.

When this method is used, a strength-maturity relationship chart, as outlined in ASTM C 1074, 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 C 1074, will be ~~at ages 4, 6, 8, 12, 24 and 48 hours in accordance with ASTM C 39~~ *generated to produce a five point curve with two points before and two points after the 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 strength and Maturity Meter correlation testing. The compressive strength cylinder and maturity meter correlation testing will be performed for the first production day and at the discretion of the Engineer for each remaining placement week, or until terminated by the Engineer.

353-11 Method of Measurement.

The quantity to be paid for will be the volume, in cubic yards [cubic meters], of concrete placed and accepted. The quantity will be calculated on the basis of field-measured dimensions. The depth used in this calculation will be determined by averaging an appropriate number of measurements from the plane of the existing pavement surface to the surface of the subgrade, as it exists immediately prior to placing the concrete.

353-12 Basis of Payment.

Price and payment 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.

Payment will be made under:

- | | |
|--------------------|---|
| Item No. 353- 70- | Concrete Pavement Slab Replacement - per cubic yard. |
| Item No. 2353- 70- | Concrete Pavement Slab Replacement - per cubic meter. |

**353 CONCRETE PAVEMENT SLAB REPLACEMENT.
(REV1-16-04) (FA 00-00-00) (7-04)**

SECTION 353 (Pages 326-331) 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. Repair the damaged area of adjacent slabs, caused by slab removal at no cost to the Department.

353-2 Materials.

353-2.1 General: Meet the following requirements:

- (a) Coarse Aggregate.....Section 901
- (b) Fine Aggregate.....Section 902
- (c) Portland Cement.....Section 921
- (d) WaterSection 923
- (e) Admixtures.....Section 924
- (f) Curing Materials.....Section 925
- (g) Epoxy Compounds.....Section 926
- (h) Embedded ItemsSection 931
- (i) Calcium Chloride.....AASHTO M 144, Type 1

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 psi [15 MPa] and a minimum 24-hour compressive strength of 3,000 psi [21 MPa].

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 [3MPa]. Indicate slump before and after addition of accelerator. Use mixes approved by the Department and from an approved concrete production facility meeting the requirements of Chapter 9.2 of the Materials Manual – Concrete Production Facilities Guidelines.

When an accelerating admixture is used in solution, the amount of water in the solution is considered to be part of the mixing water. Make necessary adjustment 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 from the approved mix design values:

- Slump Tolerance** ± 1.5 inches [40 mm]
- Entrained Air** 1% to 6%
- Temperature not to exceed 100 °F [38°C]

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

353-3.2 Certification: Provide certification 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. 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 with 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 at the job site. Mix the concrete for 40 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.

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 strength 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 identical to the protection set of cylinders for the first 6-hours, then by laboratory cured conditions thereafter until the 24-hour strength test. Provide a location and curing facility for initial curing of verification cylinders.

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 [15 MPa], 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 be used as an alternate to the protection set of concrete cylinders.

Test the acceptance and verification cylinders at 24-hours 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 psi [15 MPa] compressive strength prior to opening the slabs to traffic and the 24-hour compressive strength.

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 during the life of the contract unacceptable to the Engineer, remove and replace any slab at no expense to the Department. Repair by removing and replacing the

pavement across the full width 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 a 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, 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. 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 [1 m] in contact with the pavement.

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 curing compounds as specified in 350-11.2 after completing the finishing operations. After the curing compound has been applied, cover the surface and exposed edges with 2 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 strength.

353-9 Joints.

353-9.1 General: Construct transverse joints as specified in 350-12 and as shown on the Design Standards, except that dowel 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.

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. 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.

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 [3.2 mm] 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 slab closed to traffic until the compressive strength requirement of 2,200 psi [15 MPa] 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 documentation 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 specified 2,200 psi [15 MPa] strength has been obtained. Include in the Quality Control Plan (QCP) what actions will be used to protect the pavement. 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 C 1074 using Maturity Meter apparatus specified therein.

Maturity Method Testing may be used to estimate the in-place strength of that days production of concrete slabs. Temperature sensors will be embedded at locations designated by the Engineer.

When this method is used, a strength-maturity relationship chart, as outlined in ASTM C 1074, 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 C 1074, will be generated to produce a five point curve with points before and after the 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 strength and Maturity Meter correlation testing. The compressive strength cylinder and maturity meter correlation testing will be performed for the first production day and at the discretion of the Engineer for each remaining placement week, or until terminated by the Engineer.

353-11 Method of Measurement.

The quantity to be paid for will be the volume, in cubic yards [cubic meters], of concrete placed and accepted. The quantity will be calculated on the basis of field-measured dimensions. The depth used in this calculation will be determined by averaging an appropriate number of measurements from the plane of the existing pavement surface to the surface of the subgrade, as it exists immediately prior to placing the concrete.

353-12 Basis of Payment.

Price and payment 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.

Payment will be made under:

Item No. 353- 70-	Concrete Pavement Slab Replacement - per cubic yard.
Item No. 2353- 70-	Concrete Pavement Slab Replacement - per cubic meter.



Florida Department of Transportation

JEB BUSH
GOVERNOR

State Materials Office – Materials Research Park
5007 NE 39th Avenue, Gainesville, FL 32609
Phone (352) 955-6600, Fax (352) 955-6613

JOSÉ ABREU
SECRETARY

MEMORANDUM

DATE: January 12, 2003
TO: Clinton J. Shaw, State Specifications Office
FROM: Charles A. Ishee, Structural Materials Research Engineer
COPIES: Michael J. Bergin, John Owens
SUBJECT: **Proposed Modifications to Specification: D3530000**

All received comments have been reviewed regarding the subject modification to the Standard Specification and are attached with reply. If you have any questions, please e-mail me at RT822CI or charles.ishee@dot.state.fl.us.

CAI/cai

Attachment

Responses to Comments Received on Draft Specifications

1. **Specification 353 (General)**
Submitted by: Jim Armaghani – Florida Concrete Products Association
Comment: Check out the spelling of Portland... should be a capital “P”
Response: Agree, all instances of Portland cement pavement and such should be with a capital P.
2. **Specification 353-2 (Materials)**
Submitted by: Daniel Haldi – District 5 Materials Office
Comment: Indexes show Tie bar also at multiple slab pavements. So non-reinforced pavement also has tie bar, should not be discounted here.
Response: Disagree, the standard index is for many slabs and this specification for replace one slab at a time or multiple slabs in one location.
3. **Specification 353-2 (Materials)**
Submitted by: Pam Murray – District 5 Materials
Comment: Does (i) still apply?
Response: In certain districts, the majority of the slab replacement concrete used has calcium chloride in it. Therefore, it is still being used (especially in District 3) and should remain in the specification.
4. **Specification 353-2 (Materials)**
Submitted by: Pam Murray – District 5 Materials
Comment: Fourth paragraph - Incorporate the accelerator (is?) into the concrete design...
Response: Agree, the sentence should read... “Incorporate the accelerator into the concrete design mix in accordance with the recommendations of the admixture supplier.”
5. **Specification 353-2 (Materials)**
Submitted by: Jim Martin – District 2 Specifications Office
Comment: In 353, they have some grammar problems. See the fourth paragraph of 353-4. Delete the work “is”.
Response: Agree, the sentence should read... “Incorporate the accelerator into the concrete design mix in accordance with the recommendations of the admixture supplier.”
6. **Specification 353-2.1 (Materials)**
Submitted by: Daniel Haldi – District 5 Materials Office
Comment: list liquid bond breaker referenced later in spec.
Response: Disagree, there is not specification on the liquid bond breaker except that it be recommended by the manufacture. There is also no standard specification, nor national specification, for a liquid bond breaker that I am aware of.
7. **Specification 353-3.1 (Mixture Proportions)**
Submitted by: Keith West – District 1&7 Materials
Comment: Target Slump- should be Slump Tolerance
Response: Agree, changed sentence should read... “Slump Tolerance...”
8. **Specification 353-3.1 (Composition of Concrete)**
Submitted by: Daniel Haldi – District 5 Materials Office
Comment: when is entrained air tested ... no double asterisk to say before adding accelerator
Response: Agree, changed to read... “Entrained Air**.....”
9. **Specification 353-3.1 (Mixture Proportions)**
Submitted by: Jim Armaghani – Florida Concrete Products Association
Comment: Check consistence of how hours is use (example 6-hours) and temperature conversion is consistent with other specifications such as 346.

Response: Agree, all instances where an hour is specified it should be with a dash as in 6-hours. The temperature at the end of third paragraph should read... "Temperature not to exceed 100°F [40°C]"

10. **Specification 353-3.1 (Mixture Proportions)**
Submitted by: Jim Armaghani – Florida Concrete Products Association
Comment: Batch process in the lab should be spelled out such as "leave in the mixer for 30 minutes at 95 °F"
Response: Disagree, this should be placed in the Materials Manual 9.2 like reference in 346.
11. **Specification 353-3.3 (Composition of Concrete)**
Submitted by: Daniel Haldi – District 5 Materials Office
Comment: discusses dowel install, but not tie bar install when multiple slab replacement runs.
Response: Disagree, tie bars are not allowed until specified in the contract documents. Tie bars should be the exception and not the rule.
12. **Specification 353-4 (Batching and Mixing Concrete)**
Submitted by: Keith West – District 1&7 Materials
Comment: Do not add accelerator to any concrete which has attained the age of 45 (60) minutes, measured from the beginning of the initial mixing at the plant.
Response: Agree, changed sentence should read... "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."
13. **Specification 353-5 (Test Requirements)**
Submitted by: Daniel Haldi – District 5 Materials Office
Comment: duplicated 1st and 4th sentences.
Response: Agree
14. **Specification 353-5 (Test Requirements)**
Submitted by: Daniel Haldi – District 5 Materials Office
Comment: 2nd para., out of place discussing curing of acceptance cylinders. Should refer to 346-8 or 9, where Contractor provides, and same for QC as V, etc.
Response: Agree, second paragraph needs to have last sentence added to read... "Provide a location and curing facility for initial curing of verification cylinders."
15. **Specification 353-5 (Test Requirements)**
Submitted by: Daniel Haldi – District 5 Materials Office
Comment: 353-5, 346-9 applies, except 28-day strength is at 24-hours, here.
Response: Agree, first paragraph (last sentence) needs to be changed to read... "The requirements of 346-9 apply to this Section with the following modification: 28-day requirement 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."
16. **Specification 353-5 (Test Requirements)**
Submitted by: Daniel Haldi – District 5 Materials Office
Comment: last sentence ... test acceptance QC and V @ 24 hours...
Response: Agree, changed to read... "Test the acceptance and verification cylinders at 24-hours from the time of sampling"
17. **Specification 353-5 (Test Requirements)**
Submitted by: Keith West – District 1&7 Materials
Comment: Perform concrete sampling and testing in accordance with Section 346-5
This sentence shows up twice in the first paragraph of this section.
Response: Agree, the second instance of this of sentence should be taken out.
18. **Specification 353-5 (Test Requirements)**
Submitted by: Jim Armaghani – Florida Concrete Products Association

Comment: Second Paragraph, first sentence, change "one set of four test cylinders" to a minimum of four
Response: Agree, changed sentence should read... "Make a minimum of four test cylinders from the last slab for each day of placement to assess strength for protection and opening to traffic (protection set)."

19. **Specification 353-7 (Placing, Striking Off, Consolidating and Finishing Concrete)**
Submitted by: Daniel Haldi – District 5 Materials Office
Comment: 3rd para, last sentence, produce final finish by burlap or broom.
Response: Agree, changed to read... "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 [1 m] in contact with the pavement."
20. **Specification 353-7 (Placing, Strike Off, Consolidating and Finishing Concrete)**
Submitted by: Bill Richards – District 5
Comment: Article 353-7, In the newly added last paragraph, delete the words "When required in the contract Documents," and start the sentence with "Produce".
I am not aware of any operations where we would not desire the surface to meet the standard stated in the paragraph.
Response: Disagree, if the concrete pavement that is being replaced is an older project, then it will not have ever been grinded as specified in 352. To require the new concrete pavement to meet 352 would be extremely expensive and not needed. Eventually, this sentence will go away, but not at this time.
21. **Specification 353-8 (Curing)**
Submitted by: Daniel Haldi – District 5 Materials Office
Comment: in order to ensure both compound and burlap is used, add ... blankets after application of compound ...
Response: Agree, section needs to read... "Cure the slab as specified in 350-11, except for time and temperature restrictions. Use curing compounds as specified in 350-11.2 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 strength."
22. **Specification 353-9 (Joints)**
Submitted by: Daniel Haldi – District 5 Materials Office
Comment: no tie bars for individual slabs, but use on long runs two or three or more. Pick a number ... see index 405 ?
Response: Agree, changed to read... "Tie bars will not be placed along the longitudinal joints unless shown in the contract documents."
23. **Specification 353-9 (Joints)**
Submitted by: Daniel Haldi – District 5 Materials Office
Comment: bond breaker on all vertical surfaces.
Response: Agree, changed to read... "Apply a liquid bond breaker recommended by the manufacturer for the intended application to all vertical faces of the adjacent slabs."
24. **Specification 353-9.1 (Joints)**
Submitted by: Jim Armaghani – Florida Concrete Products Association
Comment: Last sentence, add in the wording that the liquid bond breaker should be for the intended application.
Response: Agree, changed to read... "Apply a liquid bond breaker recommended by the manufacturer for the intended application to all vertical faces of the adjacent slabs."
25. **Specification 353-9.2.3 (Dowel Bar Installation)**
Submitted by: Jim Armaghani – Florida Concrete Products Association

Comment: First paragraph, add a sentence to read “Drill parallel to the centerline of the pavement.” This is in the situations where the transverse joint is not perpendicular to the centerline of the pavement.

Response: Agree, add a sentence to the first paragraph to read... “Drill parallel to the centerline of the concrete pavement.”

26. **Specification 353-10 (Protection and Opening to Traffic)**

Submitted by: Daniel Haldi – District 5 Materials Office

Comment: test cylinders @ Engineer discretion for 1st and any remaining placements until terminated by engineer [may need a bunch upfront to train and get started, might not wish to waste a week to get up to speed].

Response: Disagree, this specification is intended to be more of a performance specification and this is getting to be too much of a prescription specification that is not adding any value to the pavement.

27. **Specification 353-10 (Protection and Opening to Traffic)**

Submitted by: Daniel Haldi – District 5 Materials Office

Comment: provide permanent report documentation that 6 hour strength was achieved prior to opening to traffic, by either a cylinder test report or a printed maturity meter monitoring record ...

Response: Agree, add a sentence at the end of first paragraph in 353-10.1 to read... “Provide documentation that 6-hour strength was achieved prior to opening to traffic, by either a cylinder test report or a printed maturity meter monitoring record.”

28. **Specification 353-10.2 (Maturity Method Testing)**

Submitted by: Jim Armaghani – Florida Concrete Products Association

Comment: Delete the requirement of two points before and two points after, because it would be a waste of time to redo an entire mix just because the producers only have one point, but still enough data.

Response: Agree to a degree, changed sentence should read... “Compressive strength tests, as specified in ASTM C 1074, will be generated to produce a five point curve with points before and after the target and with prior approval by the Engineer.”



Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSÉ ABREU
SECRETARY

MEMORANDUM

DATE: January 8, 2004

TO: Charles Ishee

FROM: Clinton J. Shaw, State Specifications Office 

SUBJECT: Proposed Modifications To Specification: D3530000.D01

Comments received, regarding the subject modification to the Standard Specifications, are attached. Please review these comments and advise of any further modifications as soon as possible. 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/jo

Attachment

**COMMENTS RECEIVED FROM INDUSTRY REVIEW FOR
D3530000.D01 - CONCRETE PAVEMENT SLAB REPLACEMENT**

File: D3530000.D01 - Concrete Pavement Slab Replacement
 Username: Daniel F. Haldi
 UserEmail: daniel.haldi@dot.state.fl.us
 UserTel: 386-740-3516
 UserFAX: 386-736-5178

Comments:

353-2 Indexes show Tie bar also at multiple slab pavements. So non-reinforced pavement also has tie bar, should not be discounted here.

353-2.1 list liquid bond breaker referenced later in spec.

353-3.1 when is entrained air tested ... no double asterisk to say before adding accelerator

353-3.3 discusses dowel install, but not tie bar install when multiple slab replacement runs.

~~353-5 duplicated 1st and 4th sentences. This has been done JHO.~~

353-5 2nd para., out of place discussing curing of acceptance cylinders. Should refer to 346-8 or 9, where Contractor provides, and same for QC as V, etc.

353-5, 346-9 applies, except 28-day strength is at 24-hours, here.

353-5, last sentence ... test acceptance QC and V @ 24 hours...

353-7, 3rd para, last sentence, produce final finish by burlap or broom.

353-8, in order to ensure both compound and burlap is used, add ... blankets after application of compound ...

353-9 no tie bars for individual slabs, but use on long runs two or three or more. Pick a number ... see index 405 ?

353-9 bond breaker on all vertical surfaces.

353-10 test cylinders @ Engineer discretion for 1st and any remaining placements until terminated by engineer [may need a bunch upfront to train and get started, might not wish to waste a week to get up to speed].

353-10 provide permanent report documentation that 6 hour strength was achieved prior to opening to traffic, by either a cylinder test report or a printed maturity meter monitoring record ...

END.

File: D3530000.D01 - Concrete Pavement Slab Replacement
Username: **Bill Richards**
UserEmail: william.richards@dot.state.fl.us
UserTel: 386/943-5161
UserFAX: 386/736-5302

Comments:

Article 353-7, In the newly added last paragraph, delete the words "When required in the contract Docuements," and start the sentence with "Produce".

I am not aware of any operations where we would not desire the surface to meet the standard stated in the paragraph.

File: D3530000.D01 - Concrete Pavement Slab Replacement
Username: **Pam Murray**
UserEmail: pamela.murray@dot.state.fl.us
UserTel: 386-740-3525 S/C 373-3525
UserFAX: 386-736-5178

Comments:

353-2.1 Does (i) still apply?

353-4 Fourth paragraph - Incorporate the accelerator (is?) into the concrete design...

File: D3530000.D01 - Concrete Pavement Slab Replacement
Username: **Keith West**
UserEmail: keith.west@dot.state.fl.us
UserTel: SC 557-4264
UserFAX:
ContactRequested:
Remote Name: 156.75.10.115
Remote User:

Comments:

353-3.1 Mixture Proportions

Target Slump- should be Slump Tolerance

353-4 Batching and Mixing Concrete

Do not add accelerator to any concrete which has attained the age of 45 (60) minutes, measured from the beginning of the initial mixing at the plant.

353-5 Test Requirements.

Perform concrete sampling and testing in accordance with Section 346-5 This sentence shows up twice in the first paragraph of this section.

These are the comments from D2 personnel.

1. These specs are going into CQC, so whenever there is concrete pavement to be done, it will also have to be listed in the CQC plan. However, I do not see where spec 6-8 is being changed to accommodate this additional set of specifications. Is 6-8 going to be changed?

2. In 352, they are not following the same protocol as they did in 350. In 350, they cross off the ".048" when going metric for 10 feet. However, in 352, they describe 10 feet as being 3.048 meters, The specs should agree in the interpretation of what 10 feet is.

3. ~~In 353, they have some grammar problems. See the fourth paragraph of 353-4. Delete the word "is".~~ **This has been done JHO.**

Best Regards, Jim

Jim Martin, P.E.
District II Specifications Engineer
386.961.7577, SC 8



Florida Department of Transportation

605 Suwannee Street
Tallahassee, FL 32399-0450

JEB BUSH
GOVERNOR

JOSÉ ABREU
SECRETARY

POSTED 11/3/03
JAD

MEMORANDUM

DATE: November 3, 2003
TO: Specification Review Distribution List
FROM: Duane F. Brautigam, P.E., State Specifications Engineer *Duane F. Brautigam*
SUBJECT: **Proposed Specifications Change – D3530000.D01 – Concrete Pavement Slab Replacement.**

In accordance with Specification Development Procedures, we are sending you a copy of a proposed specification change to Concrete Pavement Slab Replacement.

This change was proposed by Charles Ishee, State Materials Office.

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 December 1, 2003 may not be considered. Your input is encouraged.

DFB/jho

Attachment

COMMENTS:

Submitted by: _____ Phone #: _____



Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSÉ ABREU
SECRETARY

MEMORANDUM

DATE: November 3, 2003

TO: Specification Review Distribution List

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

SUBJECT: **Proposed Specifications Change: D3530000.D01 – Concrete Pavement Slab Replacement.**

In accordance with Specification Development Procedures, we are sending you a copy of a proposed specification change to Concrete Pavement Slab Replacement.

This change was proposed by Charles Ishee, State Materials Office.

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 December 1, 2003 may not be considered. Your input is encouraged.

DFB/jho

Attachment

COMMENTS:

Submitted by:

Phone #:

353 CONCRETE PAVEMENT SLAB REPLACEMENT.
(REV 12-20-015-19-0310-24-03) (FA 1-3-02) (7-02)

SECTION 353 (Pages 326-331) is deleted and the following substituted:

SECTION 353
CONCRETE PAVEMENT SLAB REPLACEMENT

353-1 Description.

Replace the existing defective area of concrete pavement with ~~P~~portland cement concrete slabs. Repair the damaged area of adjacent slabs, caused by slab removal, ~~to the satisfaction of the Engineer and~~ at no cost to the Department.

353-2 Materials.

353-2.1 General: Meet the following requirements:

- (a) Coarse Aggregate.....Section 901
- (b) Fine Aggregate.....Section 902
- (c) Portland Cement.....Section 921
- (d) WaterSection 923
- (e) Admixtures.....Section 924*
- (f) Curing Materials.....Section 925
- (g) Epoxy Compounds.....Section 926
- (h) Embedded ItemsSection 931
- (i) Calcium Chloride.....AASHTO M 144, Type 1*

*The requirements of 346-2.5 are applicable to the admixtures. Concrete pavement containing only tie and dowel bars will be considered ~~unreinforced~~ 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 6hour compressive strength of 2,200 psi [15 MPa] and a minimum 24-hour compressive strength of 3,000 psi [21 MPa].

Prior to producing concrete, submit the design mix for approval on a form acceptable to the Department. ~~The minimum over design shall be 400 psi [3 MPa] at~~ Ensure the 24 hour acceptance strength *has a minimum over design of 400 psi [3MPa]*. Indicate slump before and after addition of accelerator. Use mixes approved by the Department and from an approved concrete production facility meeting the requirements of Chapter 9.2 of the Materials Manual – Concrete Production Facilities Guidelines.

When an accelerating admixture is used in solution, the amount of water in the solution is considered to be part of the mixing water. Make necessary adjustment to the concrete mix-water to account for the amount of water in the accelerating admixture solution. ~~Inspect and test~~ the concrete for consistency and strength, subject to the following ~~tolerances~~ values from the approved mix design values:

- **Target Slump** ± 1.5 inches [40 mm]
- Entrained Air 1% to 6%
- ***Calcium Chloride up to 1%, by weight of Cement*** Temperature not to exceed 100

°F [38°C]

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

~~***The amount of calcium chloride in the mix may be increased to 1.5% by weight of the cement if the purity of calcium chloride is 80% or less.~~

353-3.2 Certification: Provide certification in accordance with 346-6.3.

353-3.3 Demonstration Slab: Prior to ~~producing~~*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. 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 with 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 calcium chloride and 3 gal/yd³ [15 L/m³] of withheld mixing water-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 ~~calcium chloride and withheld mixing water~~ *accelerator* to the concrete at the job site. Mix the concrete for 40 additional revolutions at mixing speed after the ~~calcium chloride and withheld mixing water~~ *are accelerator* is added to the mixer. Do not add ~~calcium chloride-accelerator~~ to any concrete which has attained the age of 45 minutes, measured from the beginning of the initial mixing at the plant.

~~Thoroughly dissolve the calcium chloride in the withheld mixing water before adding it to the mixer at the jobsite. If approved by the Engineer, a Type C or Type E admixture that is on the Qualified Products List (QPL) may be used in lieu of calcium chloride.~~

Incorporate the ~~admixture-accelerator~~ *is* into the concrete design mix in accordance with the recommendations of the admixture supplier ~~when a Type C or Type E admixture is used.~~

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 Calcium Chloride an accelerator; perform the plastic property tests prior to the addition of Calcium Chloride the accelerator. Perform concrete sampling and testing in accordance with 346-5. The requirements of 346-9 apply to this Section with the following modification: if the design mix has Calcium Chloride includes an accelerator, then the tests will be performed prior to the addition of any Calcium Chloride. The requirements of 346-9 apply to this Section with the following modification: the compressive strength cylinders will be fabricated after all ingredients, including the accelerators, are added.~~

Make one set of four test cylinders from the last slab for each day of placement to assess strength 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 identical to the protection set of cylinders for the first 6-hours, then by laboratory cured conditions thereafter until the 24-hour strength test.*

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 [15 MPa], 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 be used as an alternate to the protection set of concrete cylinders.

~~Perform concrete sampling and testing according to standard test methods listed in 346-5.~~

~~Cure the protection set cylinders by methods identical to those used in curing the concrete replacement slabs. Cure the acceptance set cylinders identical to the protection set cylinders for the first 6 hours, then by laboratory cured conditions thereafter until the 24-hour strength test.~~

Test the acceptance cylinders at 24-hours 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 psi [15 MPa] compressive strength prior to opening the slabs to traffic and the 24-hour compressive strength.

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 during the life of the contract unacceptable to the Engineer, remove and replace any slab at no expense to the Department. Repair by removing and replacing the pavement across the full width 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 ~~350-109, and 350-110 and 350-12.2~~ 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 a straightedge meeting the requirements of 350-3.126. 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, 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. Produce a uniform, gritty textured final finish by dragging a seamless strip of damp burlap, having at least 3 feet [1 m] in contact with the pavement, longitudinally along the pavement.

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 350-131, except for time and temperature restrictions. Use curing compounds as specified in 350-131.2 after completing the finishing operations. Cover the surface and exposed edges with 2 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 ~~sustain the load~~ *resist marring the concrete surface*. Continue curing the slab until the concrete achieves the required 6-hour strength.

353-9 Joints.

353-9.1 General: Construct transverse joints as specified in 350-152 and as shown on the Design Standards, except that dowel bars are installed per 353-9.2. Tie bars will not be placed along the longitudinal joints. Apply a *liquid bond breaker recommended by the manufacturer* to the vertical faces of the adjacent slabs along the longitudinal joint.

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 350-4.4/2 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 350-4.4/2, 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. Use a gang drill (several drills mounted parallel in a rigid frame), when enough operating space is available.

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 [3.2 mm] 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 slab closed to traffic until the compressive strength requirement of 2,200 psi [15 MPa] 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.

Protect the pavement from all traffic, including construction vehicles, until the specified 2,200 psi [15 MPa] strength has been obtained. ~~Such protection shall include the erection and maintenance of signs, lights, barricades, construction and removal of temporary pavement, bridges, crossovers, and the use of flagmen or similar methods approved by the Engineer.~~ *Include in the Quality Control Plan (QCP) what actions will be used to protect the pavement.* 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 C 1074 using Maturity Meter apparatus specified therein.

Maturity Method Testing may be used to estimate the in-place strength of that days production of concrete slabs. Temperature sensors will be embedded at locations designated by the Engineer.

When this method is used, a strength-maturity relationship chart, as outlined in ASTM C 1074, 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 C 1074, will be ~~at ages 4, 6, 8, 12, 24 and 48 hours in accordance with ASTM C 39~~ *generated to produce a five point curve with two points before and two points after the 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 strength and Maturity Meter correlation testing. The compressive strength cylinder and maturity meter correlation testing will be performed for the first production day and at the discretion of the Engineer for each remaining placement week, or until terminated by the Engineer.

353-11 Method of Measurement.

The quantity to be paid for will be the volume, in cubic yards [cubic meters], of concrete placed and accepted. The quantity will be calculated on the basis of field-measured dimensions. The depth used in this calculation will be determined by averaging an appropriate number of measurements from the

plane of the existing pavement surface to the surface of the subgrade, as it exists immediately prior to placing the concrete.

353-12 Basis of Payment.

Price and payment 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.

Payment will be made under:

- | | |
|--------------------|---|
| Item No. 353- 70- | Concrete Pavement Slab Replacement - per cubic yard. |
| Item No. 2353- 70- | Concrete Pavement Slab Replacement - per cubic meter. |

**Responses to Comments Received on Specification
D3530000 - Concrete Pavement Slab Replacement
by Charles A. Ishee, P.E., Structural Materials Research Engineer**

File: D3530000 - Concrete Pavement Slab Replacement
Username: **Tracy Witt**
UserEmail: tracy.witt@dot.state.fl.us
UserTel: SC 881-7842
UserFAX: SC 881-7849
ContactRequested:
Remote Name: 156.75.19.144
Remote User:

Comments:

Don Rauch - There is no requirement up front to indicate that this material is part of a contractor's QCP. There is one statement that indicates that the protection methods have to be in the QCP. There should be a statement up front indicating that this material falls under CQC specifications. The mix design should be part of the QCP as well.

Reply: All concrete specifications fall into the CQC specifications and the information should fall under 105.

File: D3530000 - Concrete Pavement Slab Replacement
Username: **Daniel F. Haldi**
UserEmail: daniel.haldi
UserTel:
UserFAX:
ContactRequested:
Remote Name: 156.75.75.113
Remote User:

Comments:

As originator of 353, seeing all the twists, changes, and new applications of "repair concrete" for pavement, approaches, and structural, a really new turn is needed as revised below:

**TITLE - Section 353 - CONCRETE REPAIR and PAVEMENT REPLACEMENT
Reply: No change. The repair specification already exists as 354.**

353-1 Description: Replace existing defective areas of concrete and pavement with "early strength" or "accelerated" PCC [capitalized - sir name]. Repair the damaged adjacent areas caused by the repair or replacement at no cost to the Department.

Reply: No change. The concrete should meet the strength requirements no matter what name is used.

353-2 (i) Change CaCL- to "Accelerator", Section QPL. then [1] Chlorinated for non-reinforced areas. [2] Non-Chlorinated for re-enforced areas. KEEP in FOOTNOTE ... Concrete pavement containing dowel is not reinforced

....
Reply: No change to CaCL, because other accelerators are in Specification 924. Change unreinforced to non-reinforced.

353-3.1 ONLY place / paragraph that actually specifies 6 - hour and 24 - hour strength [so that when ever a different strength might be needed, and the repair concrete spec is needed, then TSP or whatever only needs to reference change in this section to new strength desired.

Reply: No change because this is not a repair specification

2nd para ... Prior to producing, submit on form "Attachment G" from MM 9.1, Form # __ - to be Statewide uniform. Also make over design at "plus 15 % of the minimum required" so that other strengths can be inserted and Department still gets appropriate over design for that strength concrete. Also indicate the "plastic properties" (not just slump) before and after addition of accelerator. Also Test the concrete for the "properties" (not just consistency = slump) Add "Temperature less than 100 F", remove the double ** because all tests are done before accelerator addition. Also remove *** CaCl %/wt ... not needed because going to add quantity per manufacturer recommendation, later in spec section.

Reply: There is no longer an Attachment G. The overdesign strength is being evaluated with a current research project and no change is needed until the conclusion of the research. Admixtures have been previously addressed. The temperature requirements are already addressed in the specification. The ** and * is for the design mix approval and not field testing.**

353-3.3 Demonstration ... remove word slab. Remove word slab everywhere and replace with "repair, or replacement concrete" etc., so section can be used inclusively. Remove joint "saweing", and say "preparation", so that other means can be inclusive. Change demop slab to just demo, for other inclusion demeo s.

Reply: This is not a repair specification, see Spec 354.

353-4. TITLE .. remove "concrete", for uniformity to other sections. Also Add all ingredients at plant excluding "accelerator". No dissolving business, because we want a "proprietary" solution meeting ASTM 494 for "accelerator". Everywhere it says CaCL insert "accelerator". Remove verbiage regarding Type C or E (place in section 2 materials.

Reply: No change, see previous replies.

353-5. everywhere word CaCL remove and insert "accelerator". 1st para is redundant for testing per 353-5. Remove "slab" and say "placement". Remove psi strength and insert "6-hour minimum strength requirement".

Reply: No change, see previous replies.

353-6 TITLE remove word slab. Also everywhere it says slab, replace with "the repair".

Reply: No change, see previous replies.

353-7 Place "repair" concrete as specified

Reply: No change, see previous replies.

353-8 remove word slab and replace with "repair"

Reply: No change, see previous replies.

353-9. Rewrite 9.1, such asConstruct pavement joints by 350-15. Dowel bars install by 353-9.2.No tie bars at pavement longitudinal joints. Apply bond breaker to vertical faces of pavement longitudinal joints. Construct other structural joints as specified in 400-9. Do not apply bond break unless Engineer approved. "Doing so allows 353 to be used on approach slabs, bridge decks and other areas besides just pavement slab areas.

Reply: No change, this specification is for slab replacement and not bridge deck repair.

353-9.2.2 Change word slab to concrete IS replacement concrete, and existing concrete.

Reply: No change, see previous replies.

353-10 remove psi strength, change to "6-hour minimum", change slab to "concrete", capitalize "Maturity", in all places as sir name. Rewrite protection in MOT to reference "traffic areas" not lanes ... for multiple use area spec.

Reply: No change. The strength requirement is needed to opening traffic. Maturity is not a sir name. Not a multiple use area spec.

353-10.2 Only Maturity should be capitalized. Change Temperature sensor to "Thermal Couple" for correct terminology. Capitalize "Strength Maturity Relationship" as sir name. ASTM C 1074 strength tests "should" be not will be, Engineer might have other needs.

Reply: No change. See previous replies. Maturity is not a sir name. Thermal couples might not be the only temperature sensor. ASTM C 1074 is the Department approved specification for maturity meters and there is no other nationally recognized specification for maturity of concrete.

353-11 measure from the plane of the existing "concrete" surface not pavement so can be used elsewhere besides just pavement, with no exceptions in many sections....

Reply: No change. See previous reply.

353-10.3 Pay Item no. Concrete "Repair and" Pavement Replacement – per CY.....

Reply: No change. See previous reply.

Same for metric.

Reply: No change. See previous reply.



Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSÉ ABREU
SECRETARY

MEMORANDUM

DATE: June 23, 2003

TO: Charles Ishee, State Materials Office

FROM: Clinton J. Shaw, State Specifications Office 

SUBJECT: **Proposed Modifications To Specification: D3530000 – Concrete Pavement Slab Replacement.**

Comments received, regarding the subject modification to the Standard Specifications, are attached. Please review these comments and advise of any further modifications by June 27, 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/jho

Attachment

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Username: **Tracy Witt**
UserEmail: tracy.witt@dot.state.fl.us
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Username: **Daniel F. Haldi**
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As originator of 353, seeing all the twists, changes, and new applications of "repair concrete" for pavement, approaches, and structural, a really new turn is needed as revised below:

TITLE - Section 353 - CONCRETE REPAIR and PAVEMENT REPLACEMENT

353-1 Description: Replace existing defective areas of concrete and pavement with "early strength" or "accelerated" PCC [capitalized - sir name]. Repair the damaged adjacent areas caused by the repair or replacement at no cost to the Department.

353-2 (i) Change CaCL- to "Accelerator", Section QPL. then [1] Chlorinated for non-reinforced areas. [2] Non-Chlorinated for reinforced areas. KEEP in FOOTNOTE ... Concrete pavement containing dowel is not reinforced

353-3.1 ONLY place / paragraph that actually specifies 6 - hour and 24 - hour strength [so that when ever a different strength might be needed, and the repair concrete spec is needed, then TSP or whatever only needs to reference change in this section to new strength desired.

2nd para ... Prior to producing, submit on form "Attachment G" from MM 9.1, Form # __ - to be Statewide uniform. Also make overdesign at "plus 15 % of the minimum required" so that other strengths can be inserted and Department still gets appropriate overdesign for that

strength concrete. Also indicate the "plastic properties" (not just slump) before and after addition of accelerator. Also Test the concrete for the "properties" (not just consistency = slump) Add "Temperature less than 100 F", remove the double ** because all tests are done before accelerator addition. Also remove *** CaCl %/wt ... not needed because going to add quantity per manufacturer recommendation, later in spec section.

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353-4. TITLE .. remove "concrete", for uniformity to other sections. ALSO Add all ingredients at plant excluding "accelerator". No dissolving business, because we want a "proprietary" solution meeting ASTM 494 for "accelerator". Everywhere it says CaCL insert "accelerator". Remove verbage regarding Type C or E (place in section 2 materials.

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353-9. Rewrite 9.1, such asConstruct pavement joints by 350-15. Dowel bars install by 353-9.2.No tie bars at pavement longitudinal joints.

Apply bond breaker to vertical faces of pavement longitudinal joints. Construct other structural joints as specified in 400-9. Do not apply bond break unless Engineer approved. "Doing so allows 353 to be used on approach slabs, bridge decks and other areas besides just pavement slab areas.

353-9.2.2 Change word slab to concrete IS replacement concrete, and existing concrete.

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353-11 measure from the plane of the existing "concrete" surface not pavement so can be used elsewhere besides just pavement, with no

exseptions in many sections....

353-10.3 Pat Item no. Concrete "Repair and" Pavement Replacement -
per CY.....

Same for metric.

WOW. Done.



POSTED 5/23/2003
JAO

Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSÉ ABREU
SECRETARY

MEMORANDUM

DATE: May 23, 2003

TO: Specification Review Distribution List

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

SUBJECT: **PROPOSED SPECIFICATIONS CHANGE – D3530000 – Concrete Pavement Slab Replacement.**

In accordance with Specification Development Procedures, we are sending you a copy of a proposed revision to Section 353 – Concrete Pavement Slab Replacement.

This change was proposed by Charles Ishee to update the language and terminology in Section 353, to bring it in line with other recently published Specifications.

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 June 20, 2003 may not be considered. Your input is encouraged.

DFB/jho

Attachment

COMMENTS:

Submitted by:

Phone #:

GRINDING 353 CONCRETE PAVEMENT SLAB REPLACEMENT.
(REV ~~12-20-015-19-03~~)-(FA 1-3-02)-(7-02)

SECTION 353 (Pages 326-331) is deleted and the following substituted:

SECTION 353
CONCRETE PAVEMENT SLAB REPLACEMENT

353-1 Description.

Replace the existing defective area of concrete pavement with ~~P~~portland cement concrete slabs. Repair the damaged area of adjacent slabs, caused by slab removal, ~~to the satisfaction of the Engineer and~~ at no cost to the Department.

353-2 Materials.

353-2.1 General: Meet the following requirements:

- (a) Coarse Aggregate.....Section 901
- (b) Fine Aggregate.....Section 902
- (c) Portland Cement.....Section 921
- (d) WaterSection 923
- (e) Admixtures.....Section 924*
- (f) Curing Materials.....Section 925
- (g) Epoxy Compounds.....Section 926
- (h) Embedded ItemsSection 931
- (i) Calcium Chloride.....AASHTO M 144, Type 1*

*The requirements of 346-2.5 are applicable to the admixtures. Concrete pavement containing only tie and dowel bars will be considered unreinforced 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 6hour compressive strength of 2,200 psi [15 MPa] and a minimum 24-hour compressive strength of 3,000 psi [21 MPa].

Prior to producing concrete, submit the design mix for approval on a form acceptable to the Department. ~~The minimum over design shall be 400 psi [3 MPa] at~~ Ensure the 24 hour acceptance strength *has a minimum over design of 400 psi [3MPa]*. Indicate slump before and after addition of accelerator. Use mixes approved by the Department and from an approved concrete production facility meeting the requirements of Chapter 9.2 of the Materials Manual – Concrete Production Facilities Guidelines.

When an accelerating admixture is used in solution, the amount of water in the solution is considered to be part of the mixing water. Make necessary adjustment to the concrete mix-water to account for the amount of water in the accelerating admixture solution. ~~Inspect and~~ Test the concrete for consistency ~~and strength~~, subject to the following ~~tolerances-values~~ from the approved mix design values:

- **Slump ± 1.5 inches [40 mm]
- Entrained Air 1% to 6%
- ***Calcium Chlorideup to 1%, by weight of Cement

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

***The amount of calcium chloride in the mix may be increased to 1.5% by weight of the cement if the purity of calcium chloride is 80% or less.

353-3.2 Certification: Provide certification in accordance with 346-6.3.

353-3.3 Demonstration Slab: Prior to producing 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. 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 with 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 calcium chloride and 3 gal/yd³ [15 L/m³] of withheld mixing water 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 calcium chloride and withheld mixing water to the concrete at the job site. Thoroughly dissolve the calcium chloride in the withheld mixing water before adding it to the mixer at the jobsite.~~ Mix the concrete for 40 additional revolutions at mixing speed after the calcium chloride and withheld mixing water are added to the mixer. Do not add calcium chloride to any concrete which has attained the age of 45 minutes, measured from the beginning of the initial mixing at the plant.

~~Thoroughly dissolve the calcium chloride in the withheld mixing water before adding it to the mixer at the jobsite.~~ If approved by the Engineer, a Type C or Type E admixture that is on the Qualified Products List (QPL) may be used in lieu of calcium chloride.

Incorporate the *Type C or Type E* admixture into the concrete design mix in accordance with the recommendations of the admixture supplier ~~when a Type C or Type E admixture is used.~~

353-5 Test Requirements.

Perform the plastic property tests in accordance with 346-8, except when the mix design contains Calcium Chloride; perform the plastic property tests prior to the addition of Calcium Chloride. Perform concrete sampling and testing in accordance with 346-5. The requirements of 346-9 apply to this Section with the following modification: if the design mix has Calcium Chloride the tests will be performed prior to the addition of any Calcium Chloride. The requirements of 346-9 apply to this Section with the following modification: the compressive strength cylinders will be fabricated after all ingredients, including accelerators, are added.

Make one set of four test cylinders from the last slab for each day of placement to assess strength for protection and opening to traffic (protection set). 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 [15 MPa], 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 be used as an alternate to the protection set of concrete cylinders.

Perform concrete sampling and testing according to standard test methods listed in 346-5.

Cure the protection set cylinders by methods identical to those used in curing the concrete replacement slabs. Cure the acceptance set cylinders identical to the protection set cylinders for the first 6-hours, then by laboratory cured conditions thereafter until the 24-hour strength test.

Test the acceptance cylinders at 24-hours 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 psi [15 MPa] 6 hour compressive strength prior to opening the slabs to traffic and the 24-hour compressive strength.

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 during the life of the contract unacceptable to the Engineer, remove and replace any slab at no expense to the Department. Repair by removing and replacing the pavement across the full width 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 350-10, 350-11 and 350-12.2 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 a straightedge meeting the requirements of 350-3.12. 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, 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. Produce a uniform, gritty textured final finish by dragging a seamless strip of damp burlap, having at least 3 feet [1 m] in contact with the pavement, longitudinally along the pavement.

353-8 Curing.

Cure the slab as specified in 350-13, except for time and temperature restrictions. Use curing compounds as specified in 350-13.2 after completing the finishing operations. Cover the surface and exposed edges with 2 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 sustain the load. Continue curing the slab until the concrete achieves the required 6-hour strength.

353-9 Joints.

353-9.1 General: Construct transverse joints as specified in 350-15 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. Apply a bond breaker to the vertical faces of the adjacent slabs along the longitudinal joint.

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 350-15.4 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 350-15.4, 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. Use a gang drill (several drills mounted parallel in a rigid frame), when enough operating space is available.

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 [3.2 mm] 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 slab closed to traffic until the compressive strength requirement of 2,200 psi [15 MPa] 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.

Protect the pavement from all traffic, including construction vehicles, until the specified 2,200 psi [15 MPa] strength has been obtained. ~~Such protection shall include the erection and maintenance of signs, lights, barricades, construction and removal of temporary pavement, bridges, crossovers, and the use of flagmen or similar methods approved by the Engineer.~~ *Include in the Quality Control Plan (QCP) what actions will be used to protect the pavement.* 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 C 1074 using Maturity Meter apparatus specified therein.

Maturity Method Testing may be used to estimate the in-place strength of that days production of concrete slabs. Temperature sensors will be embedded at locations designated by the Engineer.

When this method is used, a strength-maturity relationship chart, as outlined in ASTM C 1074, 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 C 1074, will be at ages 4, 6, 8, 12, 24 and 48 hours in accordance with ASTM C 39.

The Engineer may require compressive strength testing as outlined in 353-5. Fabricate six test cylinders for protection strength and Maturity Meter correlation testing. The compressive strength cylinder and maturity meter correlation testing will be performed for the first production day and at the discretion of the Engineer for each remaining placement week, or until terminated by the Engineer.

353-11 Method of Measurement.

The quantity to be paid for will be the volume, in cubic yards [cubic meters], of concrete placed and accepted. The quantity will be calculated on the basis of field-measured dimensions. The depth used in this calculation will be determined by averaging an appropriate number of measurements from the plane of the existing pavement surface to the surface of the subgrade, as it exists immediately prior to placing the concrete.

353-12 Basis of Payment.

Price and payment 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.

Payment will be made under:

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

D3530000
353-70; 2353-70

Item No. 2353- 70- Concrete Pavement Slab Replacement - per cubic meter.



Florida Department of Transportation

JEB BUSH
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSE ABREU
SECRETARY

MEMORANDUM

DATE: May 19, 2003

TO: Bob Burleson, FTBA, David Sadler, State Construction Office, Brian Blanchard, State Roadway Design Office, William N. Nickas, State Structures 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: D3530000 – Concrete Pavement Slab Replacement.**

Attached for your review and comments is a copy of the subject Special Provision for Concrete Pavement Slab Replacement.

This change was proposed by Charles Ishee to update the language and terminology in Section 353, to bring it in line with other recently published Specifications.

Please review and offer your comments.

CS/jho
Attachment

353 CONCRETE PAVEMENT SLAB REPLACEMENT.
(REV 12-20-015-19-03)-(FA 1-3-02)-(7-02)

SECTION 353 (Pages 326-331) is deleted and the following substituted:

SECTION 353
CONCRETE PAVEMENT SLAB REPLACEMENT

353-1 Description.

Replace the existing defective area of concrete pavement with ~~P~~portland cement concrete slabs. Repair the damaged area of adjacent slabs, caused by slab removal, ~~to the satisfaction of the Engineer and~~ at no cost to the Department.

353-2 Materials.

353-2.1 General: Meet the following requirements:

- (a) Coarse Aggregate.....Section 901
- (b) Fine Aggregate.....Section 902
- (c) Portland Cement.....Section 921
- (d) WaterSection 923
- (e) Admixtures.....Section 924*
- (f) Curing Materials.....Section 925
- (g) Epoxy Compounds.....Section 926
- (h) Embedded ItemsSection 931
- (i) Calcium Chloride.....AASHTO M 144, Type 1*

~~*The requirements of 346 2.5 are applicable to the admixtures.~~ Concrete pavement containing only tie and dowel bars will be considered unreinforced 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 6hour compressive strength of 2,200 psi [15 MPa] and a minimum 24-hour compressive strength of 3,000 psi [21 MPa].

Prior to producing concrete, submit the design mix for approval on a form acceptable to the Department. ~~The minimum over design shall be 400 psi [3 MPa] at~~ Ensure the 24 hour acceptance strength *has a minimum over design of 400 psi [3MPa]*. Indicate slump before and after addition of accelerator. Use mixes approved by the Department and from an approved concrete production facility meeting the requirements of Chapter 9.2 of the Materials Manual – Concrete Production Facilities Guidelines.

When an accelerating admixture is used in solution, the amount of water in the solution is considered to be part of the mixing water. Make necessary adjustment to the concrete mix-water to account for the amount of water in the accelerating admixture solution. ~~Inspect and~~ Test the concrete for consistency ~~and strength,~~ subject to the following ~~tolerances-values~~ from the approved mix design values:

- **Slump ± 1.5 inches [40 mm]
- Entrained Air 1% to 6%
- ***Calcium Chloride up to 1%, by weight of Cement

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

***The amount of calcium chloride in the mix may be increased to 1.5% by weight of the cement if the purity of calcium chloride is 80% or less.

353-3.2 Certification: Provide certification in accordance with 346-6.3.

353-3.3 Demonstration Slab: Prior to producing 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. 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 with 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 calcium chloride and 3 gal/yd³ [15 L/m³] of withheld mixing water 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 calcium chloride and withheld mixing water to the concrete at the job site. Thoroughly dissolve the calcium chloride in the withheld mixing water before adding it to the mixer at the jobsite.~~ Mix the concrete for 40 additional revolutions at mixing speed after the calcium chloride and withheld mixing water are added to the mixer. Do not add calcium chloride to any concrete which has attained the age of 45 minutes, measured from the beginning of the initial mixing at the plant.

~~Thoroughly dissolve the calcium chloride in the withheld mixing water before adding it to the mixer at the jobsite.~~ If approved by the Engineer, a Type C or Type E admixture that is on the Qualified Products List (QPL) may be used in lieu of calcium chloride.

Incorporate the *Type C or Type E* admixture into the concrete design mix in accordance with the recommendations of the admixture supplier ~~when a Type C or Type E admixture is used.~~

353-5 Test Requirements.

Perform the plastic property tests in accordance with 346-8, except when the mix design contains Calcium Chloride; perform the plastic property tests prior to the addition of Calcium Chloride. Perform concrete sampling and testing in accordance with 346-5. The requirements of 346-9 apply to this Section with the following modification: if the design mix has Calcium Chloride the tests will be performed prior to the addition of any Calcium Chloride. The requirements of 346-9 apply to this Section with the following modification: the compressive strength cylinders will be fabricated after all ingredients, including accelerators, are added.

Make one set of four test cylinders from the last slab for each day of placement to assess strength for protection and opening to traffic (protection set). 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 [15 MPa], 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 be used as an alternate to the protection set of concrete cylinders.

Perform concrete sampling and testing according to standard test methods listed in 346-5.

Cure the protection set cylinders by methods identical to those used in curing the concrete replacement slabs. Cure the acceptance set cylinders identical to the protection set cylinders for the first 6-hours, then by laboratory cured conditions thereafter until the 24-hour strength test.

Test the acceptance cylinders at 24-hours 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 psi [15 MPa]~~ 6 hour compressive strength prior to opening the slabs to traffic and the 24-hour compressive strength.

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 during the life of the contract unacceptable to the Engineer, remove and replace any slab at no expense to the Department. Repair by removing and replacing the pavement across the full width 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 350-10, 350-11 and 350-12.2 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 a straightedge meeting the requirements of 350-3.12. 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, 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. Produce a uniform, gritty textured final finish by dragging a seamless strip of damp burlap, having at least 3 feet [1 m] in contact with the pavement, longitudinally along the pavement.

353-8 Curing.

Cure the slab as specified in 350-13, except for time and temperature restrictions. Use curing compounds as specified in 350-13.2 after completing the finishing operations. Cover the surface and exposed edges with 2 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 sustain the load. Continue curing the slab until the concrete achieves the required 6-hour strength.

353-9 Joints.

353-9.1 General: Construct transverse joints as specified in 350-15 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. Apply a bond breaker to the vertical faces of the adjacent slabs along the longitudinal joint.

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 350-15.4 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 350-15.4, 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. Use a gang drill (several drills mounted parallel in a rigid frame), when enough operating space is available.

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 [3.2 mm] 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 slab closed to traffic until the compressive strength requirement of 2,200 psi [15 MPa] 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.

Protect the pavement from all traffic, including construction vehicles, until the specified 2,200 psi [15 MPa] strength has been obtained. ~~Such protection shall include the erection and maintenance of signs, lights, barricades, construction and removal of temporary pavement, bridges, crossovers, and the use of flagmen or similar methods approved by the Engineer.~~ *Include in the Quality Control Plan (QCP) what actions will be used to protect the pavement.* 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 C 1074 using Maturity Meter apparatus specified therein.

Maturity Method Testing may be used to estimate the in-place strength of that days production of concrete slabs. Temperature sensors will be embedded at locations designated by the Engineer.

When this method is used, a strength-maturity relationship chart, as outlined in ASTM C 1074, 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 C 1074, will be at ages 4, 6, 8, 12, 24 and 48 hours in accordance with ASTM C 39.

The Engineer may require compressive strength testing as outlined in 353-5. Fabricate six test cylinders for protection strength and Maturity Meter correlation testing. The compressive strength cylinder and maturity meter correlation testing will be performed for the first production day and at the discretion of the Engineer for each remaining placement week, or until terminated by the Engineer.

353-11 Method of Measurement.

The quantity to be paid for will be the volume, in cubic yards [cubic meters], of concrete placed and accepted. The quantity will be calculated on the basis of field-measured dimensions. The depth used in this calculation will be determined by averaging an appropriate number of measurements from the plane of the existing pavement surface to the surface of the subgrade, as it exists immediately prior to placing the concrete.

353-12 Basis of Payment.

Price and payment 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.

Payment will be made under:

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

Item No. 2353- 70- Concrete Pavement Slab Replacement - per cubic meter.

SPECIFICATION PROCESSING AND STATUS FORM

Begin date: May 13, 2003

File Number: D3530000

Projected completion date: August 12, 2003.

Implementation team member: John Owens.

Schedule of activities: Internal, Industry and FHWA reviews.

Resource needs: None identified at this time.

Implementation schedule: Beginning with the January 2004 letting.

Proposed solution: Update language and terminology in Section 353, in order to bring it in line with other recently published specifications

Recommended Usage Note: 353-70 2353-70

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

353 CONCRETE PAVEMENT SLAB REPLACEMENT.
(REV 12-20-01) (FA 1-3-02) (7-02)

PAGE 373. The following new Section is added after Section 352.

SECTION 353
CONCRETE PAVEMENT SLAB REPLACEMENT

353-1 Description.

Replace the existing defective area of concrete pavement with ~~P~~portland cement concrete slabs. Repair the damaged area of adjacent slabs, caused by slab removal, ~~to the satisfaction of the Engineer and~~ at no cost to the Department.

353-2 Materials.

353-2.1 General: Meet the following requirements:

- (a) Coarse Aggregate Section 901
- (b) Fine Aggregate Section 902
- (c) Portland Cement Section 921
- (d) Water Section 923
- (e) Admixtures Section 924*
- (f) Curing Materials Section 925
- (g) Epoxy Compounds Section 926
- (h) Embedded Items Section 931
- (i) Calcium Chloride AASHTO M 144, Type 1*

~~*The requirements of 346-2.5 are applicable to the admixtures. Concrete pavement containing only tie and dowel bars will be considered unreinforced 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 psi [15 MPa] and a minimum 24-hour compressive strength of 3,000 psi [21 MPa].

Prior to producing concrete, submit the design mix for approval on a form acceptable to the Department. ~~The minimum over design shall be 400 psi [3 MPa] at t~~The 24-hour acceptance strength *will have a minimum over design of 400 psi [3MPa]*. Indicate slump before and after addition of accelerator. Use mixes approved by the Department and from an approved concrete production facility meeting the requirements of Chapter 9.2 of the Materials Manual – Concrete Production Facilities Guidelines.

When an accelerating admixture is used in solution, the amount of water in the solution is considered to be part of the mixing water. Make necessary adjustment to the concrete mix-water to account for the amount of water in the accelerating admixture solution. ~~Inspect and t~~Test the concrete for consistency and strength, subject to the following ~~tolerances values~~ from the approved mix design values:

- **Slump ± 1.5 inches [40 mm]
- Entrained Air 1% to 6%
- *** Calcium Chloride up to 1%, by weight of Cement

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

±**The amount of calcium chloride in the mix may be increased to 1.5% by weight of the cement if the purity of calcium chloride is 80% or less.

353-3.2 Certification: Provide certification in accordance with 346-6.3.

353-3.3 Demonstration Slab: Prior to ~~producing~~ 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. 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 with 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 calcium chloride and 3 gal/yd³ [15 L/m³] of withheld mixing water 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. *Thoroughly dissolve the calcium chloride in the withheld mixing water before adding it to the mixer at the jobsite.* ~~Add the calcium chloride and withheld mixing water to the concrete at the job site.~~ Mix the concrete for 40 additional revolutions at mixing speed after the calcium chloride and withheld mixing water are added to the mixer. Do not add calcium chloride to any concrete which has attained the age of 45 minutes, measured from the beginning of the initial mixing at the plant.

~~Thoroughly dissolve the calcium chloride in the withheld mixing water before adding it to the mixer at the jobsite.~~

If approved by the Engineer, a Type C or Type E admixture that is on the Qualified Products List (QPL) may be used in lieu of calcium chloride.

~~—Incorporate the Type C or Type E admixture into the concrete design mix in accordance with the recommendations of the admixture supplier when a Type C or Type E admixture is used.~~

353-5 Test Requirements.

Perform the plastic property tests in accordance with 346-8, except when the mix design contains Calcium Chloride; perform the plastic property tests prior to the addition of Calcium Chloride. Perform concrete sampling and testing in accordance with 346-5. The requirements of 346-9 apply to this Section with the following modification: if the design mix has Calcium Chloride the tests will be performed prior to the addition of any Calcium Chloride. The requirements of 346-9 apply to this Section with the following modification: the compressive strength cylinders will be fabricated after all ingredients, including accelerators, are added.

Make one set of four test cylinders from the last slab for each day of placement to assess strength for protection and opening to traffic (protection set). 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 [15 MPa], 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 be used as an alternate to the protection set of concrete cylinders.

Perform concrete sampling and testing according to standard test methods listed in 346-5.

Cure the protection set cylinders by methods identical to those used in curing the concrete replacement slabs. Cure the acceptance set cylinders identical to the protection set cylinders for the first 6-hours, then by laboratory cured conditions thereafter until the 24-hour strength test.

Test the acceptance cylinders at 24-hours 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 psi [15 MPa]~~ 6-hour compressive strength prior to opening the slabs to traffic and the 24-hour compressive strength.

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 during the life of the contract unacceptable to the Engineer, remove and replace any slab at no expense to the Department. Repair by removing and replacing the pavement across the full width 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 350-10, 350-11 and 350-12.2 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 a straightedge meeting the requirements of 350-3.12. 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, 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.

Produce a uniform, gritty textured final finish by dragging a seamless strip of damp burlap, having at least 3 feet [1 m] in contact with the pavement, longitudinally along the pavement.

353-8 Curing.

Cure the slab as specified in 350-13, except for time and temperature restrictions. Use curing compounds as specified in 350-13.2 after completing the finishing operations. Cover the surface and exposed edges with 2 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 sustain the load. Continue curing the slab until the concrete achieves the required 6-hour strength.

353-9 Joints.

353-9.1 General: Construct transverse joints as specified in 350-15 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. Apply a bond breaker to the vertical faces of the adjacent slabs along the longitudinal joint.

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 350-15.4 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 350-15.4, 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. Use a gang drill (several drills mounted parallel in a rigid frame), when enough operating space is available.

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 [3.2 mm] 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 slab closed to traffic until the compressive strength requirement of 2,200 psi [15 MPa] 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.

Protect the pavement from all traffic, including construction vehicles, until the specified 2,200 psi [15 MPa] strength has been obtained. ~~Such protection shall include the erection and maintenance of signs, lights, barricades, construction and removal of temporary pavement, bridges, crossovers, and the use of flagmen or similar methods approved by the Engineer.~~ *Include in the QCP what actions will be used to protect the pavement.* 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 C 1074 using Maturity Meter apparatus specified therein.

Maturity Method Testing may be used to estimate the in-place strength of that days production of concrete slabs. Temperature sensors will be embedded at locations designated by the Engineer.

When this method is used, a strength-maturity relationship chart, as outlined in ASTM C 1074, 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 C 1074, will be at ages 4, 6, 8, 12, 24 and 48 hours in accordance with ASTM C 39.

The Engineer may require compressive strength testing as outlined in 353-5. Fabricate six test cylinders for protection strength and Maturity Meter correlation testing. The compressive strength cylinder and maturity meter correlation testing will be performed for the first production day and at the discretion of the Engineer for each remaining placement week, or until terminated by the Engineer.

353-11 Method of Measurement.

The quantity to be paid for will be the volume, in cubic yards [cubic meters], of concrete placed and accepted. The quantity will be calculated on the basis of field-measured dimensions. The depth used in this calculation will be determined by averaging an appropriate number of measurements from the plane of the existing pavement surface to the surface of the subgrade, as it exists immediately prior to placing the concrete.

353-12 Basis of Payment.

Price and payment 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.

Payment will be made under:

- | | |
|--------------------|---|
| Item No. 353- 70- | Concrete Pavement Slab Replacement - per cubic yard. |
| Item No. 2353- 70- | Concrete Pavement Slab Replacement - per cubic meter. |