## 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 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 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 the 24 hour acceptance strength. 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 from 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 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/yd$^3$ [15 L/m$^3$] 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. 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 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.

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 350-10, 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. 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:

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