

## SECTION 523—ULTRA-THIN PORTLAND CEMENT CONCRETE OVERLAY

**523.1 DESCRIPTION**—This work is the construction of an accelerated strength ultra-thin Portland cement concrete overlay as indicated.

### 523.2 MATERIAL—

(a) **Accelerated Strength Portland Cement Concrete.** Section 704.1(b), modified as follows:

- Delete Table A.
- Use concrete reinforced with polypropylene fibers according to ASTM C 1116, Type III 4.13 and ASTM C 1116 (Ref: ASTM C 1018) Performance Level 1 outlined in Section 21, Note 17 and Residual Strength. Use 100% virgin polypropylene (PE) manufactured to an optimum gradation for use as concrete reinforcement.

(b) **Design Basis.** Section 704.1(c), modified as follows:

- Revise the first sentence of the first paragraph as follows:  
Make trial mixtures and computations for accelerated strength Portland cement concrete including the molding and curing of test specimens.
- Revise the first sentence of the second paragraph and add a second sentence as follows:  
Design a concrete mix for having a 28-day minimum compressive strength of 26 MPa (3,750 pounds per square inch) for acceptance when tested according to PTM 604 and a 24-hour minimum compressive strength of 21 MPa (3,000 pounds per square inch). Measure concrete consistency in millimeters (inches) of slump as specified in Section 523.3(v).
- Add the following sentence to the third paragraph:  
If the overlay depth is less than 75 mm (3 inches), use No. 8 coarse aggregate instead of No. 57 coarse aggregate.
- Revise the fifth paragraph as follows:  
Use a cement factor of 385 kg (650 pounds) minimum per cubic meter (cubic yard) and a water-cement ratio of 0.42 maximum.
- Revise the sixth paragraph as follows:  
The Contractor may substitute flyash for Portland cement at a maximum rate of 10% by mass (weight) for cement. Include flyash with cement when determining the water-cement ratio. Add PE fiber at the rate of 1.78 kg (3.0 pounds) minimum per cubic meter (cubic yard).

**1. Air Content.** Section 704.1(c)3. Revise the first sentence as follows:  
Design cement concrete with an air content of 7.0% in the plastic state.

**2. Class of Cement Concrete.** Section 704.1(c)2. Revise the heading and first sentence as follows:  
**Accelerated Strength Portland Cement Concrete.** The concrete design submitted for review is required to comply with the specified requirements, supported by air content and compressive strength test data according to Bulletin 5. Delete the last paragraph.

(c) **Concrete Admixtures.** Section 711.3 and as follows:

- If accelerating admixtures are used, provide accelerating admixtures that do not contain chlorides.

(d) **Concrete Curing Material.** Section 711.1 and Section 711.2(a), Type 2

**523.3 CONSTRUCTION**—Section 501.3, modified as follows:

(a) **General.** Section 501.3(a), with the following additions:

Prepare a QC Plan, as specified in Section 106, detailing the timing and sequence of the work, including timing of mixing, hauling, placing, curing, monitoring of concrete temperature, joint sawing, and sampling and testing for compressive strength for opening to traffic. Indicate variations on timing in response to anticipated variations in the air temperature for the time of placement. Submit the QC Plan for review before the start of the project. Do not start work until the QC Plan has been approved.

(e) **Preparation and Protection of Base Course.** Replace Section 501.3(e) with the following:

(e) **Bituminous Surface Preparation.** Completely clean milled pavement surface. Limit cleaning to area that will be overlaid the same day. Protect the cleaned and prepared surface from oil or grease drippings from compressors, concrete trucks, spreaders, pavers, etc. by using protective covers. Remove all deleterious materials before overlaying. Sprinkle to thoroughly dampen the bituminous surface immediately before placement of cement concrete without causing pooled or puddle water.

(h) **Handling and Placing Reinforcement.** Delete Section 501.3(h).

(i) **Transverse Joint.** Replace Section 501.3(i) with the following:

(i) **Joints.** Saw joints as soon as concrete has hardened sufficiently to permit sawing without excessive raveling resulting from the sawing operation. Space joints equidistant longitudinally and transversely. Determine spacing using formula of 300 mm (1 foot) of joint spacing per 25 mm (1-inch) of depth of cement concrete overlay. Saw joints with a green cut saw to a depth of D/3 and a minimum width of 3 mm (1/8 inch). Do not seal joints. Clean joints of all deleterious material after sawing.

Saw soon enough after placement to prevent random cracking. If necessary, conduct sawing operations continuously, both day and night, regardless of weather conditions. Omit sawing if a crack occurs at or within 450 mm (1.5 feet) of a joint location, before the time of the sawing or during sawing. If a crack occurs before acceptance of pavement, remove and replace one full panel width and length.

Other than white curing compound, remove curing materials from overlay, at the location where a joint is to be cut. Remove only sufficient covering to provide space necessary for sawing joints. As soon as the joint is made, replace the covering. The maximum time period allowed for pavement curing covers to be removed is 1/2 hour. If white membrane curing compound is used, cure the joint area, as specified in the first six paragraphs in Section 501.3(l)1.c.

Do not displace coarse aggregate from the joint location using a vibrating T-bar, or using a filler strip at the joint.

(j) **Longitudinal Joints.** Delete Section 501.3(j).

(l) **Curing Concrete.** Section 501.3(l), revised as follows:

1. **Normal Curing.** Revise the first sentence as follows:

Allow curing materials to remain in place and maintain as specified, for a period of 24 hours or until the concrete has reached 21 MPa (3,000 pounds per square inch) compressive strength.

Add the following paragraphs:

Provide adequate insulating blankets to prevent rapid heat loss if the air temperature is 18 °C (65F) or less. Remove any insulation when a minimum compressive strength of 21 MPa (3,000 pounds per square inch) has been attained. Remove insulation at such a rate that the temperature change in the concrete does not exceed 4 °C (40F) within any 1-hour period. If a temperature change in the concrete in excess of 4 °C (40F) occurs within any 1-hour period, whether insulation is used or not, consider the work defective.

The application or removal of insulation covers may be controlled by the use of maturity concepts, provided the minimum degree-hours of curing has been achieved at the top of the slab.

(n) **Sealing Joints and Cracks.** Delete Section 501.3(n).

(r) **Opening to Traffic.** Replace Section 501.3(q) with the following:

(r) **Opening to Traffic.** Sample plastic concrete, for compressive strength testing (PTM No. 604) before opening to traffic, according to the approved QC Plan. The Representative will select sample locations according to PTM No. 1. The Representative will determine when pavement will be opened to traffic, but no sooner than 24 hours or when the concrete attains the minimum required compressive strength. If concrete pavement has not attained a minimum 24-hour compressive strength of 21 MPa (3,000 pounds per square inch) at the time of opening to traffic, consider the work defective.

(t) **Tests for Depth.** Section 501.3(s), with the following exception:

- For projects at intersections and less than 3500 m<sup>2</sup> (3,000 square yards), drill two cores.

(u) **Defective Work.** Section 501.3(t), except revise the first paragraph as follows:

Unless otherwise directed in writing by the District Executive, remove and replace, at no expense to the Department, pavement that is; defective in surface tolerance, as specified in Section 501.3(o); defective in compressive strength as specified in Section 523.2(b); defective in depth, as specified in Section 523.3(t); defective in air content, as specified in Section 523.2(b)1; where the temperature change in concrete in excess of 4 °C (40F) occurs within a 1-hour period; or showing surface defects resulting from the effects of rain, hail, improper final finish, excessive raveling of joints during sawing, or honeycombing which, in the Representative's opinion, cannot be repaired.

(v) **Test Slab.** Construct an off-site slab 2 weeks before placement of accelerated concrete pavement on the project as follows:

Construct the test slab one lane width wide and 3.7 m (12 feet) long. Use the concrete mix design specified in Section 523.2(a) and (b) in the test slab. Establish a target value for the consistency during placement of the test slab. The slump for production shall be the consistency of the test slab  $\pm 25$  mm ( $\pm 1$  inch). Submit any adjustments for review.

If maturity concept is being used, correlate degree-hours of cure to compressive strength breaks at 8, 12, 16, and 24 hours following placement of the test slab. Establish the minimum number of degree-hours of cure by correlation with compressive strength tests. Verify maturity curves with first 2 days production work, regardless of quantity placed, by recording compressive strength breaks at 8, 12, 16, and 24 hours following placement.

Appropriately time joint saw cut operations as they are proposed for the actual work. The results of this test slab will be used to adjust the timing of joint sawing during construction of the actual project.

Cure the test slab as proposed for the actual work and demonstrate by compressive cylinder breaks, and maturity data if maturity concepts are used, that the mix conforms to the opening to traffic requirement within 24 hours of placement.

#### 523.4 MEASUREMENT AND PAYMENT—

(a) **Surface Preparation.** Square Meter (Square Yard)

(b) **Ultra-thin Portland Cement Concrete Overlay.** Square Meter (Square Yard)

This unit price includes saw cutting of transverse and longitudinal joints and construction of test slab.

(c) **Concrete Pavement Cores.** Each

The price includes the measuring apparatus, which remains the Contractor's property upon completion of the project. The Department will not pay for additional cores drilled if the depth is deficient by more than 6.5 mm (1/4 inch).