

HIGH PERFORMANCE CONCRETE, CLASS A LOW CEMENT

****As approved by Structures Section 01/22/10.**

The CONCRETE FINISHING Subsection of these provisions is specific to a bare deck application utilizing this material as the deck concrete.

****From Hartford BHF BPNT(12)**

- xx. DESCRIPTION. This work shall consist of furnishing and placing high performance portland cement concrete at the locations indicated in the Plans and as directed by the Engineer.

The work under this Section shall be performed in accordance with these provisions, the Plans, and Section 501 of the Standard Specifications.

- xx. MATERIALS. The coarse aggregate shall be conditioned so that 24 hours prior to the anticipated concrete placement time, the total moisture percentage is a minimum of 0.75% greater than the absorption percentage for that aggregate. The minimum moisture percentage shall be maintained throughout the 24 hour period.

- xx. CLASSIFICATION AND PROPORTIONING. Proportioning of High Performance Concrete, Class A Low Cement shall meet the following requirements:

HPC Class	Req.** Cem. Mat. kg/m ³ (lbs./cy)	Maximum Water- Cem. Mat. Ratio	Max. Slump mm (in.)	Air Content (%)	Coarse Aggregate Gradation Table	28-Day* Comp. Strength MPa (psi)	28-Day* Modulus of Rupture MPa (psi)
A Low Cement	362 (611)	0.44	150 (6)	7.0 ± 1.5	704.02B	30 (4000)	4.48 (650)
* The listed 28-day compressive strength or modulus of rupture will serve as the basis of designing or approving the concrete mix.							
** See tables located below for required cementitious materials.							

Required Cementitious Materials

Cement kg/m ³ (lbs/cy)		Fly Ash kg/m ³ (lbs/cy)		Silica Fume Admixture kg/m ³ (lbs/cy)		Cementitious Materials kg/m ³ (lbs/cy)
266 (449)	+	72 (122)	+	24 (40)	=	362 (611)

OR

Cement kg/m ³ (lbs/cy)		GGBFS kg/m ³ (lbs/cy)		Silica Fume Admixture kg/m ³ (lbs/cy)		Cementitious Materials kg/m ³ (lbs/cy)
248 (418)	+	90 (153)	+	24 (40)	=	362 (611)

OR

Blended Silica Fume Cement (8.0%) kg/m ³ (lbs/cy)		Fly Ash kg/m ³ (lbs/cy)		Cementitious Materials kg/m ³ (lbs/cy)
290 (489)	+	72 (122)	=	362 (611)

OR

Blended Silica Fume Cement (8.0%) kg/m ³ (lbs/cy)		GGBFS kg/m ³ (lbs/cy)		Cementitious Materials kg/m ³ (lbs/cy)
272 (458)	+	90 (153)	=	362 (611)

The Contractor will be responsible for providing a workable mix design.

xx. CONCRETE FINISHING.

(a) Finishing Bridge Decks with No Asphalt Wearing Surface.

- (1) Rail Support Requirements. Finishing machine rail supports shall be accurately set and of substantial construction so that the finished deck surface will conform to the profile and transverse sections shown in the Plans. Finishing machine rail supports shall be placed and adjusted to properly provide for the deflection of forms, falsework, and structural supporting members which will occur during the placement of the concrete. Finishing machine rail supports shall not be attached by welding to portions of the flanges. The finishing machine rail supports shall be spaced at a maximum of 600 mm (2 feet) on center and of sufficient design as to secure the rail to prevent it from falling off the support.
- (2) Straightness Check. Prior to texturing, the finished concrete surface shall be examined by the Contractor and the Engineer using a straightedge. The straightedge shall be not less than 3 m (10 feet) long. It shall be furnished by the Contractor and maintained in good, usable condition at the placement site at all times. While the concrete is still plastic, surface depressions shall be filled with concrete of the same Class as the placement in progress. The added concrete shall be worked sufficiently into the underlying concrete to ensure that it creates a single monolithic layer. Surface irregularities greater than 3 mm (1/8 inch) in 3 m (10 feet) in either the longitudinal or the transverse direction shall be corrected in a manner acceptable to the Engineer. Thin mortar or laitance, which may have accumulated ahead of the finishing machine screed, shall be removed from the work site. These materials shall not be used to fill depressions. All costs for providing a straightedge to test the trueness of the concrete finishing will be considered incidental to Contract item 631.16.

- (3) Turf Drag. After finishing, the surface shall be given a suitable texture with an artificial turf drag made of molded polyethylene. The selection of turf drag should be capable of producing a surface texture with a horizontal peak to peak distance ranging from 0.5 mm to \leq 6.35 mm (0.02 inch to \leq 0.25 inch) and having a peak to peak amplitude of 0.1 mm to 20 mm (0.005 inch to 0.8 inch). Select a turf drag material that will minimize tearing and rolling of coarse aggregate from the surface. Past experience has shown that a turf drag in which the majority of the blades are orientated in a common direction should reduce those occurrences.

The Contractor shall apply texture in a transverse direction by hand methods. Other directions may be allowed with the approval of the Engineer. All texturing shall be performed from a work bridge immediately following the finishing operations and prior to curing operations. A second work bridge will be required for curing purposes unless a method utilizing a single work bridge has been approved by the Engineer.

One pass of the turf drag over the finished area is desired. The drag shall leave a seamless strip between passes. Texture resulting from the drag shall stop within 300 mm (1 foot) of the gutter line. Any build up of concrete at the beginning or end of the pass shall be hand troweled to provide an even transition. An acceptable broom finish may be applied to small areas of deck surface where a turf drag cannot be operated.

The drag should produce a transverse, skid resistant micro-texture acceptable to the Engineer, but should not tear the surface. If the drag is not producing an acceptable micro-texture, the Contractor shall adjust the means and methods until an acceptable micro-texture is achieved.

The Contractor shall check the drag material before the deck pour and from time to time during finishing for tears, worn surface, or hardened concrete. The Contractor should clean or replace the drag as often as necessary to maintain a well-defined micro-texture.

The turf drag should not be applied when the surface is so wet or plastic that the ridges formed flow back into the valleys when the drag has passed, nor should dragging be delayed until the concrete is so hard that sharp ridges cannot be formed by the drag. Surface conditions may not be fully uniform, however, and dragging should be timed to maximize skid resistance.

If the 10 minute maximum, as specified in Subsection 501.17(c), for applying the wet cure cannot be met, then fogging of the area shall be performed. Fogging shall be performed in a manner that keeps the relative humidity above the evaporation rate of the concrete surface, but not so excessive that water begins to collect on the surface prior to texturing or other surface manipulating procedures.

- (4) Hand Finishing. In areas which are inaccessible to finishing machines, use of approved manual vibratory-equipped power screeds with approved grade control method may be used, with approval of the Engineer. Straightness shall be checked as specified in subpart (a)(2) of this Section and to ensure a smooth ride and seamless transition to the finishing machine's finished area. If manual vibratory-equipped power screeds are used, then initial vibration of the concrete for consolidation in those areas shall be of the minimal duration possible to avoid over vibration and loss of air entraining of the surface concrete in these areas.

Hand finishing shall be allowed only in areas inaccessible to finishing machines or manually driven vibratory-equipped power screeds. Hand screeds or bullfloats shall be magnesium and 250 mm (10 inches), or more, in width. Care shall be taken not to overwork the concrete surface during any finishing operation. Straightness shall be checked in any hand finished area as specified in subpart (a)(2) of this Section and to ensure a smooth ride and seamless transition to the finishing machine's finished area.

- xx. METHOD OF MEASUREMENT. The quantity of Special Provision (High Performance Concrete, Class A Low Cement) to be measured for payment will be the number of cubic meters (cubic yards) of concrete placed in the complete and accepted work, as determined by the prismatic method using dimensions shown on the Plans or as directed by the Engineer, including the volume of precast concrete stay-in-place forms, but excluding the volume of steel or other stay-in-place forms and form filling materials. No deductions will be made for the volume of concrete displaced by steel reinforcement, structural steel, expansion joint material, scuppers, weep holes, conduits, tops of piles, scoring, chamfers or corners, inset panels of 38 mm (1½ inches) or less in depth, or any pipe less than 200 mm (8 inches) in diameter.
- xx. BASIS OF PAYMENT. The accepted quantity of Special Provision (High Performance Concrete, Class A Low Cement) will be paid for at the Contract unit price per cubic meter (cubic yard). Payment will be full compensation for performing the work specified, including designing the mix, satisfactory finishing and curing, and for furnishing all forms, materials, including joint filler and bond breaker, labor, tools, admixtures, equipment, including automatic temperature recording units, trial batches, and incidentals necessary to complete the work.

The cost of heating materials and protecting the concrete against cold weather, and any additional cost for cement, will not be paid for separately but will be considered incidental to Special Provision (High Performance Concrete, Class A Low Cement).

The cost of furnishing testing facilities and supplies at the batch plant and the setting of inserts, bench marks, and bridge plaques furnished by the Agency will not be paid for separately but will be considered incidental to Special Provision (High Performance Concrete, Class A Low Cement).

Costs for all materials, labor, and incidentals for steel or other stay-in-place forms and form filling materials will not be paid for separately, but will be considered incidental to Special Provision (High Performance Concrete, Class A Low Cement).

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
900.608 Special Provision (High Performance Concrete, Class A Low Cement) (FPQ)	Cubic Meter (Cubic Yard)