

HIGH PERFORMANCE CONCRETE, LIGHTWEIGHT

**\*\*From Bridgewater BRS 0149(4)**

This provision was utilized in the Bridgewater BRS 0149(4) project as material for constructing half-filled grid decking, with payment made under the decking item. Method of Measurement and Basis of Payment are included here for paying self-consolidating concrete under its own pay item.

- 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. Materials shall meet the requirements Subsection 501.02 and the following:

Lightweight Coarse Aggregate for Structural Concrete.....704.14

- xx. CLASSIFICATION AND PROPORTIONING. Proportioning of High Performance Concrete, Lightweight shall meet the following requirements:

HPC Class	Req.** Cem. Mat. kg/m <sup>3</sup> (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)
LW	391 (660)	0.44	150 (6)	7.0 ± 1.5	704.02B	30 (4000)	N/A

\* The listed 28-day compressive strength will serve as the basis of designing or approving the concrete mix.  
 \*\* See tables located below for required cementitious materials.

Required Cementitious Materials

HPC Class	Cement kg/m <sup>3</sup> (lbs/cy)		Fly Ash kg/m <sup>3</sup> (lbs/cy)		Cementitious Materials kg/m <sup>3</sup> (lbs/cy)
LW	313 (528)	+	78 (132)	=	391 (660)

OR

HPC Class	Cement kg/m <sup>3</sup> (lbs/cy)		GGBFS kg/m <sup>3</sup> (lbs/cy)		Cementitious Materials kg/m <sup>3</sup> (lbs/cy)
LW	293 (495)	+	98 (165)	=	391 (660)

The maximum unit density of High Performance Concrete, Lightweight concrete shall be:

- (a) Plastic. 1922 kg/m<sup>3</sup> (120 lb/ft<sup>3</sup>).

(b) Dry. 1842 kg/m<sup>3</sup> (115 lb/ft<sup>3</sup>).

A water-reducing, retarding, or water-reducing-retarding admixture shall be used for High Performance Concrete, Lightweight unless otherwise authorized in writing by the Engineer.

The results of slump, air content, unit weight and strength tests, for a 2.3 m<sup>3</sup> (3 yd<sup>3</sup>) trial batch of High Performance Concrete, Lightweight shall be submitted with the mix design.

xx. BATCHING. Lightweight aggregate stockpiles shall be presoaked for a minimum period of 48 hours immediately prior to use. Soaking shall be accomplished by continuous sprinkling or other suitable means that will provide a uniform moisture content throughout the stockpile.

xx. FIELD TESTS. The following testing procedure shall be utilized for High Performance Concrete, Lightweight used on the project. After the first 2.3 m<sup>3</sup> (3 yd<sup>3</sup>) of concrete are placed from the first load of concrete, a sample of poured concrete shall be retrieved. The pour shall be stopped and the slump and air content tested.

If the concrete properties are outside of the specified ranges, the mix shall be corrected, and the same procedure shall be performed on all subsequent loads until 2 consecutive slump and air tests are found to be within acceptable ranges.

Any air entrainment dosage adjustments done at the plant shall be tested in the same manner when on project.

(a) Air Content Tests. A volumetric air meter shall be used for determining the air content of High Performance Concrete, Lightweight in accordance with AASHTO T 196M/T 196.

(b) Strength Tests. A test shall be the average of the strengths of at least three specimens from the same sample of concrete.

xx. CONCRETE FINISHING.

(a) General. A finishing machine shall be provided on all decks constructed with High Performance Concrete, Lightweight regardless of length.

(b) 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 with approximately 64,000 synthetic turf blades per square meter (6000 blades per square foot), each approximately 13 mm (1/2 inch) long.

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)(4) 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)(4) 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 (Self-Consolidating Concrete) 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 (1 1/2 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 (Self-Consolidating Concrete) 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 (Self-Consolidating Concrete).

The cost of furnishing testing facilities and supplies at the batch plant will not be paid for separately but will be considered incidental to Special Provision (Self-Consolidating Concrete).

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 (Self-Consolidating Concrete).

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
900.608 Special Provision (High Performance Concrete, Lightweight)	Cubic Meter (Cubic Yard)