

HIGH PERFORMANCE CONCRETE, RAPID SET

**\*\*From Woodstock BRF 0151(21)**

xx. DESCRIPTION. This work shall consist of designing, furnishing, and placing a high early strength, 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 of Subsection 501.02 and the following:

High Early Strength Portland Cement.....701.04

xx. MIX DESIGN SUBMISSION CRITERIA. Concrete shall meet the following requirements:

(a) The mix shall be classified as self-consolidating concrete (SCC) mix. If the project will only be using this mix in flat work application, then the mix will be classified and tested as a conventional concrete with a slump not to exceed 9 inches.

(b) Compressive Strength.

28 day compressive strength - 5000 psi

In addition to this requirement, the Contractor shall be aware that a minimum compressive strength of 4000 psi, as determined by field-cured test cylinders, shall be achieved prior to allowing traffic on the structure.

(c) Permeability. 56 Day Permeability - 2500 coulombs (The permeability may be tested prior to 56 days but results must still be 2500 coulombs or less). Test shall be performed in accordance with Subsection 510.04(b)(6)f.

(d) Air Content. 7 ± 1.5%.

(e) Slump/Spread. The mix shall not exhibit segregation at the slump /spread being used.

(1) For SCC mix the visual stability index (VSI) shall be equal to or less than 1.

(2) Spread range will be established for the initial submittal of mix for approval .The J-Ring Test will be conducted per ASTM C1621.The upper and the lower ranges of the spread shall not have a difference of greater than 2 inches between the J-Ring and spread test or VSI greater than 1. Spread test, ASTM C1611, will be done for the production mix only, unless the Engineer requests J-Ring testing be done.

- (f) Alkali-Silica Reactivity (ASR). Test shall be performed in accordance with Subsections 510.04(b)(6)g and 510.04(b)(7).
- (g) The mix may contain shrinkage-compensating admixture such that there will be no separation of concrete from adjacent precast units. The Contractor shall include results for the unrestrained shrinkage test method, ASTM C 157, procedure 11.1.2. Take readings for a minimum of 28 days after the curing period is complete. The maximum shrinkage allowed shall be 0.04%. Testing shall be performed by an independent lab that is CCRL accredited in AASHTO T 30 or ASTM C 1260.
- (h) A proprietary concrete mix design meeting the same performance requirements may also be considered for use.

xx. SUBMITTALS. A minimum of fourteen (14) calendar days prior to placement (or prior to the pre-placement meeting, if one is required), the Contractor shall submit the mix design for approval. The mix design shall be submitted to the Agency's Materials Laboratory, attention Composite Materials Engineer. Concrete under this provision shall not be placed until the mix design has been approved.

- (a) Trial Batch. Twenty-one (21) to seven (7) days prior to the first placement, the Contractor shall produce and place a 2 cubic yard trial batch, as an SCC, at a location agreed upon by the Contractor and the Engineer. The purpose of this trial batch is to demonstrate that the mix is capable of producing the wet test results within the specified ranges. The Engineer shall be given a minimum notice of seven (7) days prior to the trial batch pour. The trial batch shall be poured in the presence of the Engineer and the Composite Materials Engineer. The trial batch shall be produced and poured in the same manner, estimated concrete temperature, and time frames that will occur during construction. The Contractor shall provide qualified personnel to test spread, air content, and temperature of the trial batch.

The slump/spread shall be within +/-2 inches for conventional mix or +/-3 inches for SCC, but still be within the established range limits for conventional or SCC. J-Ring test will be done for SCC mix with the difference between the J-Ring and spread test not greater than 2 inches.

If this mix will be used in flat work application, a second trial batch will be required at the anticipated slump the Contractor will need; this trial batch will be tested for the same properties, except for the spread, where it will be for slump. If the mix will only be used in flat work application for the project, the requirement for testing the mix as an SCC will be disregarded. If the trial mix falls outside of any of the listed ranges for the testing criteria, the trial batch shall be subject to rejection.

- (b) Mix Acceptance Criteria. The placed concrete will be tested for all mix design criteria as specified herein, with the exception of permeability, shrinkage, and ASR. The Contractor may test the load in accordance with 501.06(a)(2) for initial QC in order to make any needed adjustments. The sample shall be taken in

accordance with AASHTO R-60 or ASTM C172. If the test results fall outside of the specified ranges for the tested criteria, the mix shall be subject to rejection.

- xx. CURING CONCRETE. The method of wet curing used shall meet the requirements of Subsection 501.17. Concrete shall be wet cured until it has reached the minimum design strength as specified herein, verified by testing of field cylinders.
43. LOADING OF CONCRETE. After the concrete has been placed and the finishing operations concluded, it shall not be walked on or disturbed in any manner, including the removal of forms, until curing is complete as specified herein.

The concrete shall obtain the specified minimum design strength prior to any vehicular loading.

A portable compression testing machine calibrated in accordance with Section 5 of ASTM C 39 shall be provided by the Contractor and available on-site for cylinder testing of field-cured cylinders for construction progress. There shall also be a hand held grinding stone included with the compression testing machine. The hand held grinding stone will be used to grind the top of the cylinders to relieve any sharp projections on the cylinder surface. All testing and equipment shall conform to ASTM C 39. Testing shall be performed, and equipment operated by, an Agency project individual(s). The individual(s) shall be trained in the operation of the machine by the owner or representative of the machine who is proficient in the operations and functions of the machine.

If an independent lab is proposed to be used to test the field-cured cylinders, the Contractor shall submit documentation providing verification for the following:

- (a) Calibration of the compression machine in accordance with Section 5 of ASTM C 39.
- (b) Compression machine meets the requirements of ASTM C 39.
- (c) Proficiency of the technician who will be performing the test methods.

The Engineer may approve barring any other unforeseen requirements. The State at any time reserves the right to perform an independent proficiency of the technician for the test methods used and review of the testing facility.

- xx. METHOD OF MEASUREMENT. The quantity of Special Provision (High Performance Concrete, Rapid Set) 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 ½ 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, Rapid Set) 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, Rapid Set).

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, Rapid Set).

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, Rapid Set).

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
900.608 Special Provision (High Performance Concrete, Rapid Set)(FPQ)	Cubic Yard