SP-150886
(New)

SPECIAL PROVISIONS
FOR
ULTRA HIGH PERFORMANCE CONCRETE OVERLAY

Cass County
BRF-092-2(44)--38-15

Effective Date
September 20, 2022

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

150886.01 DESCRIPTION.

Supply, mix, transport, place, finish, and cure Ultra High Performance Concrete (UHPC) for use as an overlay and riding surface in accordance with the Contract Documents.

150886.02 MATERIALS.

A. Material Properties.
Provide materials as follows. All materials in Items 1 and 2 below must be premixed and proportioned in bags or supersacks and come from the same batch or lot. Assure proper storage of all materials including but not limited to cement, aggregate, steel fibers and additives, as required by the manufacturer's recommendations to protect the integrity of the materials against the loss of physical and mechanical properties.

1. Fine Aggregate - Crushed Quartz with 100% passing the No. 30 sieve and a maximum of 3% passing the No. 200 sieve.

2. Cementitious Material - Meet all applicable ASTM specifications.

3. Steel Fibers - ASTM A 820, Type 1, cold drawn high-carbon steel with a minimum tensile strength of 300 ksi, length of 12 mm to 13 mm, and diameter of 0.220 mm to 0.225 mm. Minimum steel fiber content will be 3.25% of the mix's dry volume.

4. Water - Water for mixing Portland cement per Standard Specifications and as specified by the manufacturer for use in the UHPC mix.

5. Admixtures - Only as specified by the UHPC manufacturer.

B. UHPC Mix Design.

Submit UHPC mix design to the Engineer 30 days prior to first placement of UHPC. For constituent ingredients or admixtures which may be subject to field adjustment by the UHPC manufacturer, indicate criteria for determining final proportion rates along with minimum and maximum proportion limits. The mix design submittal shall be accompanied by the certified material test results specified in SP-150886.02, C.

C. Material Performance Requirements.

The UHPC mix shall meet the material properties listed in Table SP-15XXXX.02-1: Required UHPC Material Properties after 28 days. Material testing shall be conducted by an independent, AASHTO accredited testing laboratory. The test report shall identify the specific mix being tested and shall be representative of the mix design submitted for production work. The test report must be accompanied by a statement from the UHPC manufacturer certifying the material properties are compliant with specification requirements.

Table SP-150886.02-1: Required UHPC Material Properties after 28 days

Description	Test Method	Acceptance Criteria
Compressive Strength	ASTM C 39, modified per ASTM C 1856 (average of three, 3"x6" cylinder specimens)	≥14 ksi at 28 days
Long-Term Shrinkage	AASHTO T 160 (64 weeks)	≤ 800 micro-strain
Chloride Ion Penetrability	AASHTO T 259 (1/2" depth)	< 0.1183 lbs/yd^3
Scaling Resistance	ASTM C 672	Y < 3
Freeze-Thaw Resistance	AASHTO T 161 / ASTM C 666A (300 cycles)	Relative Dynamic Modulus of Elasticity > 95%
Alkali-Silica Reaction	ASTM C 1260	Innocuous

150886.03 CONSTRUCTION.

A. Surface Preparation

1. Prior to placement of UHPC overlay, texture the bridge deck base course by means of hydrodemolition. Refer to Special Provisions for Surface Texturing of Existing Bridge Deck using Hydrodemolition. Construct barrier rails on the bridge deck prior to the UHPC overlay being installed.

2. Following hydrodemolition and within 24 hours of UHPC overlay placement, the prepared bridge deck base course shall receive thorough final cleaning to remove all debris, contaminants, and residue. Final cleaning shall include sandblasting or high-pressure water blasting (7500 psi minimum).

3. The hydrodeomolition cleanup described in the Special Provisions for Surface Texturing of Existing Bridge Deck using Hydrodemolition may be acceptable in lieu of separate sandblasting or high-pressure water blasting provided all debris, contaminants, and residue are removed to the Engineer's satisfaction, such cleaning is completed within 24 hours of UHPC overlay placement and there are no subsequent construction activities planned or

permitted prior to overlay placement which could cause contamination of the prepared bridge deck surface.

4. Follow final washing and/or sandblasting by air blasting with oil-free compressed air.

5. Shortly before overlay placement, bring the bridge deck surface to saturated-surface-dry (SSD) condition. Accomplish this by thorough saturation of the bridge deck surface and removal of any excess water with oil-free compressed air. At the Contractor's option, SSD condition may be established and maintained at the time of final bridge deck cleaning or may be established by separate operation immediately prior to overlay placement.

6. Maintain the cleaned and SSD condition by covering with clean polyethylene sheeting or by other means approved by the Engineer, until such time the overlay is placed.

B. Placement Plan.

1. Submit a placement plan with a detailed construction work schedule to the Engineer for review and approval at least 30 days prior to the scheduled UHPC placement pour. The following list is intended as a guide and may not address all the means and methods chosen to use.
   - Responsible personnel and hierarchy.
   - Equipment – including but not limited to mixers, holding tanks, generators, wheelbarrows, scales, meters, thermometers, floats, screeds, burlap, plastic, heaters, blankets, etc.
   - Quality Control of batch proportions - including dry ingredients, steel fibers, water, and admixtures.
   - Quality Control of mixing time and batch times.
   - Batch procedure sequence.
   - Form work – including materials and removal.
   - Placement procedure – including but not limited to surface preparation of existing concrete surfaces and pre-wetting of the existing concrete interface to SSD condition before the placement of UHPC, spreading, finishing, and curing protection. Include provisions for acceptable ambient conditions and batch temperatures and corrective measures as appropriate.
   - Threshold limits for ambient temperature, ambient relative humidity, batch consistency, batch proportions, batch temperature, batch times and related corrective actions.

2. Pumping of UHPC is not allowed.

3. Addition of mix water or surface water to improve workability or aid in placement is not allowed. The prepared deck surface must be free of all excess water at the time of overlay placement.

C. Pre-Pour Meeting.

Prior to the initial placement of UHPC, arrange for an onsite meeting with the UHPC representative and the Engineer. The Contractor's staff and the Contracting Authority's inspectors shall attend the site meeting. The objective of the meeting will be to clearly outline the procedures for mixing, transporting, finishing, and curing of the UHPC material. Arrange for a representative of the UHPC supplier to be on site during the placement of all UHPC. The UHPC representative shall be knowledgeable in the supply, mixing, delivery, placement, and curing of the UHPC material.

D. Forming, Mixing, Transporting, Placing and Curing.

1. Placement and final finishing of the UHPC shall be performed expeditiously, and an approved curing compound shall be applied to the UHPC overlay surface immediately after final

finishing. Apply plastic sheeting to the surface following placement of curing compound for the duration of the manufacturer's recommended minimum curing period.

2. Forming, batching, placing, and curing will be in accordance with the UHPC manufacturer's recommendations, the Contractor's procedure submittals, and as accepted by the Engineer.

3. Representatives of the UHPC manufacturer knowledgeable in supplying, mixing, transporting, placing, finishing, and curing of the UHPC material must be present during mixing, transporting, and placing of the UHPC. The Contractor shall arrange for two manufacturer's representatives to be on site for the duration of the UHPC construction; one representative shall remain with the mixing operations and the second representative shall remain with the placement operations. Do not start mixing or placing UHPC until the manufacturer's representatives are on-site. Place UHPC in accordance with the approved Placement Plan using one continuous pour. The use of bulkheads will not be permitted. Keep UHPC from freezing until it has achieved a minimum compressive strength of 11.0 ksi minimum.

4. Provide a minimum of three portable batching units for mixing of the UHPC. Mixing equipment which is not supplied by the UHPC manufacturer must be reviewed by the UHPC manufacturer for adequacy. During batching keep the temperature of the UHPC below 80°F; ice may be added to the mix as recommended by the UHPC manufacturer's representative.

E. Acceptance Testing.

1. Acceptance of UHPC material as batched for production work shall be based on compliance with submitted and approved batching proportions, and field verification testing in accordance with Table SP-150886.03-1.

2. The District Materials Engineer and Construction and Materials Bureau Structures Field Engineer shall be notified a minimum of 2 working days prior to the anticipated UHPC placement.

3. Compressive strength, slump flow and visual stability testing shall be performed by an independent, AASHTO accredited materials testing laboratory hired by the Contractor. Test results shall be submitted to the Engineer for approval. Testing frequencies of each test listed in Table SP-150886.03-1 represent the minimum frequencies for acceptance. Additional testing frequency may be required, at the discretion of the Engineer.

4. Provide an adequate location to place compressive strength specimens for initial curing prior to transport to the lab. Curing boxes shall be equipped with supplemental heat or cooling as necessary to cure specimens in accordance with ASTM C31.

5. At the Contractor's option, Maturity Method for estimating the in-place strength of UHPC may be used in lieu of destructive testing of compressive strength specimens for purposes of confirming the minimum compressive strength for roadway loading/opening (11 ksi). Use of this method requires the development of the strength-maturity relationship according to Materials I.M. 383. If the minimum compressive strength for roadway loading/opening is not confirmed by compressive strength testing or Maturity Method, the hardened UHPC must achieve a minimum age of 10 days prior to roadway loading/opening.

6. Acceptance testing for 28-day compressive strength (14 ksi) will be based on the average strength of 3, 3 inch by 6 inch cylinder specimens. Maturity Method will not be permitted as a substitute for destructive testing of compressive strength specimens for purposes of confirming the specified 28-day compressive strength. Field coring of UHPC and/or strength testing of field cores shall not be accepted.

7. When test data indicates slump flow or visual stability are not achieved, immediately notify the Engineer. Adjustments to pre-approved batching proportions must be approved by the Engineer.

Table SP-150886.03-1: UHPC Acceptance Testing

Description	Test Method	Acceptance Criteria	Frequency
Minimum Compressive Strength for Roadway Loading/Opening	ASTM C 39, modified per ASTM C 1856	≥ *11 ksi (ave. of three 3"x6" cylinder specimens)	**One set (minimum) of three cylinders per day of placement, tested at date determined by Contractor to confirm 11ksi compressive strength achieved.
28 Day Compressive Strength	ASTM C 39, modified per ASTM C 1856	≥ 14 ksi (ave. of three 3"x6" cylinder specimens)	One set of thee cylinders per day of placement, tested at 28 days.
Slump Flow and Visual Stability	ASTM C 1856	8 inches (Min.) 10 inches (Max.) No bleed water Consistent fiber distribution	One per batch

* Minimum age of 5 days for hardened UHPC will be acceptable for roadway loading/opening in lieu of test results confirming 11 ksi compressive strength.
**Determine the quantity of compressive strength test sets to cast and the date of testing. Maturity Method for estimating in-place strength, in accordance with Materials I.M. 383, is acceptable in lieu of compressive strength testing for roadway loading/opening.

150886.04 METHOD OF MEASUREMENT.

The quantity of Ultra High Performance Concrete will be measured as the number of square yards of UHPC placed and accepted. The volume will be computed using the dimensions shown on the plans. The quantity of corrective grinding, if required, will not be measured.

150886.05 BASIS OF PAYMENT.

A. The quantity of UHPC overlay will be paid at the Contract unit price per square yards. Price and payment will constitute full compensation for final cleaning and surface preparation, supplying, mixing, transporting, placing, finishing, curing, and for furnishing all equipment, tools, labor, and incidentals required to complete the work. No additional payment will be made for surface preparation of the bridge deck base course, or for surface correction of the bridge deck overlay.

B. No additional payment will be made for additional quantity of material used to compensate for inaccuracies in the placement of the bridge deck base course, or for areas where the removals associated with base course surface texturing exceed the planned depth.

C. Additional quantity of material used in the determination of material properties and for acceptance testing as described herein will be furnished at no additional cost to the Contracting Authority.

D. If the UHPC does not meet the minimum acceptance criteria as described herein, the UHPC will be removed and replaced or remediated to the satisfaction of the Engineer at the Contractor's expense. No additional payment will be made for remedial solutions to deck delamination between the UHPC and underlying bridge elements.