SP- 150289
(New)

SPECIAL PROVISIONS
FOR
ULTRA HIGH PERFORMANCE CONCRETE

Jackson County
BRFN-052-1(97)--39-49

Effective Date
July 18, 2017

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.

150289.01 DESCRIPTION.

A. Furnish all materials, tools, and labor necessary for the performance of all work to form, prepare bonding surfaces, cast, finish, and cure Ultra High Performance Concrete (UHPC) where required per plan for Ultra High Performance Concrete Joints.

B. Submittals.
Provide submittals to the Engineer in electronic format, in accordance with Article 1105.03 of the Standard Specifications.

The submittals requiring written approval from the Engineer are as follows:

1. UHPC Placement Plan.
- **a.** Submit the UHPC Placement Plan for approval 28 days before placement of UHPC for longitudinal superstructure module connections.
- **b.** The UHPC Placement Plan shall include, but not necessarily be limited to, the following:
  - Proposed method(s) of joint surface preparation to achieve the required concrete surface profile texture, as required in the design plans.
  - Proposed forming method(s).
  - Proposed batching sequence. The batching sequence shall include the order and time of introduction of the materials and the mixing time.
  - Proposed sequence and schedule for UHPC placement operations.
  - Details of all equipment to be used to batch and place UHPC materials, including mixers, pumps, concrete buggies, etc.
  - Curing procedures, including minimum cure time and minimum strength requirements prior to loading.
  - Testing procedures.
  - Quality control / quality assurance procedures for verification of mix uniformity.

2. **UHPC Mix Design.**
   - **a.** Submit UHPC mix design and results of the following tests to the Engineer 60 days prior to first placement of UHPC. The Engineer may waive the tests of the UHPC mix if these tests have been previously performed for material supplied by the Manufacturer.
   - **b.** A minimum of eight cylinders 3 inches by 6 inches for compressive strength testing and three additional 12 inch diameter by 7 1/2 inch deep cylinders for pullout testing shall be cast for mix design testing.
   - **c.** All compressive test cylinders shall be cured using the same method of curing proposed to be used in the field. The temperature during curing shall be within 18°F of the low end of the proposed temperature range for curing in the field. Compressive testing times are at 4 days, 7 days, 21 days and 28 days and two cylinders shall be tested for each testing day. The compressive strength shall be measured by ASTM C39 and shall meet 12 ksi minimum at 4 days and 21 ksi minimum at 28 days. Only a UHPC mix design that passes these tests may be used to form the joints.
   - **d.** The additional three 12 inch diameter by 7 1/2 inch cylinders shall each have one 32 inch long epoxy-coated reinforcing bar cast in the center of the circular face for pullout testing. The axis of the bar shall be perpendicular to the formed surface. The bars shall be No. 4 bars embedded 3 inches deep. These cylinders shall be kept wet for four days prior to delivery to the testing lab. Pullout testing shall be in accordance with ASTM E488. The test shall be performed as soon as practical after corresponding compressive test samples reach 12 ksi compressive strength. Pullout test samples pass if the bars yield without the UHPC failing and without the bars pulling out of the UHPC.
   - **e.** Results of all compressive and pullout tests, conducted by an AASHTO accredited testing lab, shall be submitted to the Engineer for review and approval 60 days prior to use of the UHPC in the field.

3. **List of Similar Bridge Projects.**
   60 days prior to first placement of UHPC, provide to the Engineer a list of bridge projects in which the proposed UHPC material has been used as joint fill between precast concrete elements (within or outside the USA). The Engineer reserves the right to reject proposed UHPC material which lacks a proven track record for precast concrete joint filling in bridge applications.

150289.02 MATERIALS.

A. UHPC Material.

UHPC material shall meet the following requirements at 28 days, unless noted otherwise:

1.	Minimum compressive strength (ASTM C39)	
	Heat-treated*	≥ 25 ksi
	Not heat-treated**	≥ 21 ksi
	Not heat-treated 4 day**	≥ 12 ksi
2.	Prism flexural tensile toughness (ASTM C1018; 10 inch span)	$I_{30} \geq 48$
3.	Long-term shrinkage (ASTM C157; initial reading after set)	≤ 766 microstrain
4.	Chloride ion penetrability (ASTM C1202)	≤ 250 coulombs
5.	Chloride ion penetrability (AASHTO T259; 1/5 inch depth)	≤ 0.07 oz/ft^3
6.	Scaling resistance (ASTM C672)	y < 3
7.	Abrasion resistance (ASTM C944 2x weight; ground surf.)	< 0.025 oz. lost
8.	Freeze-thaw resistance (ASTM C666A; 600 cycles)	RDM > 96%
9.	Alkali-silica reaction (ASTM C1260; tested for 28 days)	Innocuous

*Heat treated according to Manufacturer's recommendation; temperature not to exceed 250°F.
**Not heat-treated-cured at a temperature of 60°F ± 3°F.

B. Water.

1. Free from foreign materials in amounts harmful to concrete and embedded steel and meeting the following requirements:

a.	Presence of oil	None
b.	pH (AASHTO T26)	5.0-8.5
c.	Organic solids (AASHTO T26, PPM)	200 max.
d.	Total inorganic solids (AASHTO T26, PPM)	2000 max.
e.	Chloride ion content (PPM)	500 max.
f.	Sulphate ion content (PPM)	1000 max.

2. Potable water obtained from a municipal supply, suitable for drinking, may be accepted without testing.

C. Fiber Reinforcement.
Steel fibers are required for the UHPC.

150289.03 CONSTRUCTION.

A. Quality Assurance.
Measure slump flow on each batch of UHPC. The slump flow will be conducted using a mini-slump cone. The flow for each batch shall be between 7 inches and 10 inches. Record the slump flow for each batch in the QA/QC log. Provide a copy of the log to the Engineer.

B. 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 UHPC supplier to be on site during the placement of all UHPC, inclusive of all longitudinal connections. The UHPC representative shall be knowledgeable in the supply, mixing, delivery, placement, and curing of the UHPC material.

C. Storage.
Assure the proper storage of UHPC premix fibers and additives as required by the UHPC supplier's specifications in order to protect materials against loss of physical and mechanical properties.

D. Forming, Batching, Placement, And Curing.

1. Work together with UHPC Manufacturer to ensure appropriate initial strength gains to meet the desired project schedule.

2. Grinding of the UHPC surface can be performed when strength of 10 ksi has been achieved, unless otherwise recommended by UHPC Manufacturer. If significant fiber pullout is observed during grinding operations, grinding shall be suspended and shall not resume until written approval is obtained from the Engineer.

3. The bridge can be opened to traffic when strength of 15 ksi has been achieved, unless otherwise recommended by the UHPC Manufacturer.

4. Construction loads applied to the bridge during UHPC placement and curing are the responsibility of the Contractor. Submit the weight and placement of concrete buggies, grinding equipment or other significant construction loads to the Engineer for review prior to the pre-pour meeting described above.

5. Forming, batching, placing, and curing shall be in accordance with the procedures as submitted to and accepted by the Engineer.

6. The design and fabrication of forms shall follow approved installation drawings and shall follow the recommendations of the UHPC Manufacturer. All the forms for UHPC shall be constructed from plywood. The forms shall be coated to prevent absorption of water.

7. Follow the batching sequence as specified by the UHPC Manufacturer and as approved by the Engineer.

8. Overfill the surface of the UHPC field joints by up to 1/8 inch above the top of the precast concrete panels.

9. Each UHPC joint shall be cast using one continuous placement. No cold joints shall be permitted between any individual lengths of UHPC joint.

10. The concrete in the form shall be cured according to Manufacturer's recommendations at minimum temperature of 60°F to attain the design strength.

E. Material Testing.

1. Cast four sets of compressive test cylinders for each day of UHPC placement. Each set shall consist of three 3 inch by 6 inch cylinders. All sets shall be cured in an environment similar to the material they represent.

2. Compressive tests shall be performed in accordance with ASTM C39. Three specimens shall be tested to validate achievement of the 10 ksi compressive strength required prior to grinding UHPC overfill. Three specimens shall be tested to validate achievement of 15 ksi compressive strength prior to opening the bridge to traffic. Three specimens shall be tested at 28 days to validate the required 21 ksi final strength. The remaining three specimens shall be treated as reserves.

150289.04 METHOD OF MEASUREMENT.

No separate measurement.

150289.05 BASIS OF PAYMENT.

No separate payment will be made for ultra high performance concrete joint. The cost is included in price bid for Full Depth Precast Deck Panels.