

# Special Specification 4119

## Ultra-High Performance Concrete (UHPC)



### 1. DESCRIPTION

Furnish and place ultra high performance concrete (UHPC) where shown on the plans.

### 2. MATERIALS

- 2.1. **UHPC.** Provide a proprietary UHPC product with independent test data showing the proposed UHPC product meets the requirements of Table 1.

Table 1  
UHPC Requirements

Property	Test Method	Requirement
28-Day Compressive Strength <sup>1</sup> , Min (psi)	ASTM C 1856	21,000
4-Day Compressive Strength <sup>1</sup> , Min (psi)	ASTM C 1856	14,000
Flexural Tensile Toughness, (10 in span)	ASTM C 1018	$I_{30} \geq 48$
28-Day Shrinkage, microstrain	ASTM C 157	$\leq 800$
Permeability <sup>2</sup> , coulombs	ASTM C 1202	$\leq 250$
Scaling Resistance	ASTM C 672	$y < 3$
Freeze-Thaw Resistance, 300 cycles, % RDM	ASTM C 666A	$> 96$
Alkali Silica Reactivity, % Max expansion at 14 days	ASTM C 1260	$< 0.1$

1. Use 3"x6" cylindrical specimens
2. After 7 day of standard cure and 21 days of water curing at 100°F

- 2.2. **Water.** Furnish water meeting the requirements of Item 421.
- 2.3. **Chemical Admixtures.** Furnish chemical admixtures meeting the requirements of DMS-4640
- 2.4. **Steel Fibers.** Furnish steel fibers with a tensile strength greater than 300 ksi. Use 2% of fibers by weight of concrete.

### 3. EQUIPMENT

- 3.1. Provide equipment batch, mix, transport, and place UHPC as recommended by the UHPC manufacturer. Provide equipment necessary to test fresh and hardened UHPC properties.

### 4. CONSTRUCTION

- 4.1. **Pre-Pour Meeting.** Prior to the initial placement of the UHPC, arrange for an onsite pre-pour meeting with the UHPC material representative, and the Engineer. The objective of the meeting will be to clearly outline the procedures for mixing, transporting, finishing and curing of the UHPC material.
- 4.2. The representative of the UHPC material will be on site during the placement of the joints. The representative must be knowledgeable in the supply, mixing, delivery, placement, and curing of the UHPC material.

4.3. **Storage:** Properly store UHPC materials as required by the manufacturer in order to protect materials against loss of physical and mechanical properties.

4.4. **Trial Batch.** Perform trial batches, at least 2 months prior to joint construction, using proposed UHPC materials and equipment to demonstrate UHPC can be mixed and placed properly. Conduct the necessary testing to ensure the proposed UHPC meet the workability and compressive strength requirements.

During trial batching, cast an additional six 12-in. diameter x 8-in. deep cylinders. Embed a 32 in. long #5 reinforcing steel bar in the center of the each cylinder to a depth of 5 in. Ensure the axis of the bars is perpendicular to the formed surface. Cure cylinders covers for 4 days or until the concrete compressive strength reaches 14 ksi. Test the pullout strength once the cylinders have reached a compressive strength of 14 ksi Test the pullout strength in accordance to ASTM E488. A passing test is when the bar reached yield strength before pulling out of the concrete.

4.5. **Forms.** Provide non-absorbent formwork in contact with the UHPC. Retain UHPC for pours that are not flat by using top forms. Properly seal forms to contain the fluidity of UHPC. Construct forms to allow for a slight overfilling of the joint and to provide a slight pressure head after the UHPC is placed. Follow the manufacture's recommendations for the design and fabrication of forms. Do not remove forms until UHPC has reached a compressive strength of 14 ksi

4.6. **Mixing and Placing UHPC.** Mix and place UHPC in accordance to the manufacturer's recommendations. Use mixing equipment that is recommended by the UHPC manufacturer.

Place UHPC following the manufacturer's recommendations. Do not vibrate and do not finish UHPC. When pouring long or intersecting joints, ensure that the leading edge of the pour does not dry out and crack. Pour all succeeding UHPC placements into fluid UHPC.

When grinding is performed to meet final surface elevation, do not perform grinding until UHPC has reached a compressive strength of 14 ksi.

4.7. **Quality Control.** Perform the testing listed in Table 2. The Engineer will make and test the compressive strength cylinders

Table 2  
UHPC Testing Requirements

Property	Test Method	Frequency
Slump Flow	ASTM C 1856	Every Batch
Temperature	Tex-422-A	Every Batch
3 x 6 Cylinder for Compressive Strength	ASTM C 1856	3 sets per production day <sup>1,2</sup>

1. Each set consists of three cylinders.
2. Make sets of cylinders intermittently throughout the UHPC pour.

The flow for each batch must be between 7 in. and 10in.

The Engineer will test sets of cylinders from each production day at 4 days, 14 days, and at 28 days after casting.

**5. MEASUREMENT**

Measurement will be by the cubic yard of UHPC measured in place.

**6. PAYMENT**

The work performed, materials furnished, trial batches, equipment, labor, tools, and incidentals will not be paid for directly, but will be considered subsidiary to pertinent items.