

## Attachment A

### ITEM 557.21010016 - FIELD CAST JOINTS BETWEEN PRECAST CONCRETE UNITS

#### **SCOPE**

This specification covers field casting of joints for precast concrete units, including batching, transportation, casting and curing.

#### **MATERIAL**

**High Weight Methyl Methacrylate** (used to prevent leaking joint)

The high molecular weight methacrylate (HMWM) resin shall be low viscosity and non-fuming. Acceptance is based on the manufacturer certifying that it conforms to the following, and the contractor forwarding the certification to the DCES:

Viscosity	Less than 25 cps when measured according to ASTM D2849
Density	Greater than 8.4 lb/gal. @ 77° F.
Flash Point	Greater than 200° F.
Vapor Pressure	Less than 1.0 mm Hg @ 77° F. (ASTM D 323)
TG (DSC)	Greater than 136° F (ASTM D3418)
Gel Time	Greater than 40 minutes for a 100 gram mass
Percent Solids	Greater than 90 % by weight
Bond Strength	Greater than 1522.3 psi (ASTM C882)

**Sand** The sand shall be commercial quality dry blast sand. 95% of the sand shall pass the #8 sieve, and 95% shall be retained on the #30 sieve.

The container shall include the following information: The name of the manufacturer, the brand name of the product, the date of manufacture.

#### **Ultra High Performance Concrete (UHPC)**

The material shall be Ultra High Performance Concrete, with all components supplied by one manufacturer. Materials commonly used in UHPC follow:

Fine aggregate  
Cementitious material  
Super plasticizer  
Accelerator  
Steel Fibers, deformed, specifically made for steel reinforcement

Water shall meet the requirements of §712-01.

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

Minimum Compressive Strength (ASTM C39)	
Heat-Treated*	≥ 25 ksi
Not Heat-Treated	≥ 21 ksi
Not Heat-Treated 4 day	≥ 12 ksi
Prism Flexural Tensile toughness (ASTM C1018**; 10 in. span)	I <sub>30</sub> ≥ 48
Long-Term Shrinkage (ASTM C157; initial reading after set)	≤ 800 microstrain
Chloride Ion Penetrability (ASTM C1202)	≤ 250 coulombs
Chloride Ion Penetrability (AASHTO T259; 1/5 in. depth)	< 0.07 oz/ft <sup>3</sup>
Scaling Resistance (ASTM C672)	y < 3
Abrasion Resistance (ASTM C944 2x weight; ground surface)	< 0.025 oz. lost
Freeze-Thaw Resistance (ASTM C666A; 600 cycles)	RDM > 96%

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Alkali-Silica Reaction (ASTM C1260; tested for 28 days)

Innocuous

\* Heat-Treated - According to manufacturer's recommendation, temperature not to exceed 250°F.

\*\* This ASTM test has been discontinued. The Department continues to require it while options are explored for its replacement.

Casting and testing must include the following:

A minimum of 12 cylinders 3 in. X 6 in. shall be cast.

All 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. 2 cylinders shall be tested each testing day. Testing times are at 4 days, 7 days, 14 days, and 28 days. 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 joint.

Cast 6 additional cylinders 12 in. diameter and 7 ½ in. deep. Each cylinder shall have one 32 in. long epoxy-coated reinforcing bar cast in the center of the circular face. The axis of the bar shall be perpendicular to the formed surface. 3 of the bars shall be #6 bars embedded 5 inches deep and 3 of the bars shall be #4 bars embedded 3 inches deep. These cylinders will be kept wet for four days then delivered to the Materials Bureau for testing according to Test Method No. NY 701-14 E. Contact the Materials Bureau prior to casting for specific instructions on preparing the test specimens. The test will be performed as soon as practical after the corresponding samples reach 12 ksi.

This test is a pullout test. The samples pass if the bars yield without the UHPC failing and without the bars pulling out of the UHPC.

Results of all the tests above, conducted by an AASHTO accredited testing lab shall be submitted to the DCES for review and approval a minimum of 60 days prior to the use of UHPC in the field. Provide to the DCES 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 DCES reserves the right to reject a proposed UHPC material which lacks a proven track record in precast concrete joint filling in bridge applications.

### **CONSTRUCTION**

**Pre-Pour Meeting:** Prior to the initial placement of the UHPC, the contractor shall arrange for an on site meeting with the UHPC representative. The contractor's staff and the NYSDOT Engineer and 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.

The contractor shall arrange for a representative of the UHPC supplier to be on site during the placement of the joints. The representative shall be knowledgeable in the supply, mixing, delivery, placement, and curing of the UHPC material.

**Storage:** The contractor shall assure the proper storage of premix, fibers and additives as required by the supplier's specifications in order to protect materials against loss of physical and mechanical properties.

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#### **Form Work, Batching and Curing**

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

The contractor shall follow the batching sequence as specified by the supplier and approved by the DCES. The surface of the UHPC field joints shall be filled flush with the precast panels to within a tolerance of plus 1/16 in. and minus 0 in.

The UHPC in the form shall be cured according to Manufacturer's recommendations to attain the required strength shown on the contract documents. A continuous curing temperature of a minimum of 60°F is recommended.

#### **Quality Control**

The contractor shall measure the 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 in. and 10in. The slump flow for each batch shall be recorded in the QA/QC log. A copy of the log shall be given to the Engineer.

The contractor shall take four sets of compressive strength test samples for each day of placement. Each set consists of 3 cylinders 3in. X 6in. All sets shall be cured in an environment similar to the material they represent.

The following tests shall be performed:

Compressive strengths shall be according to ASTM C 39. The timing of the testing shall be as required by the contract documents. The second set shall be tested at 28 days. The third set will be sent to the Materials Bureau between the 4<sup>th</sup> day and the 14<sup>th</sup> day. The fourth set shall be treated as a reserve set.

#### **Watertight Integrity Test**

After the joint has reached the required strength, a watertight integrity test may be performed in accordance with §567-3.01.H. If leakage does not occur the Contractor need not seal the joint.

#### **Sealing the Joint**

Abrasive blast clean the area to be treated, removing all contaminants from the surface. Clean adjacent surfaces of the leaking joints using compressed air which is free of oil and moisture.

Do not apply sealers if rain is expected within 12 hours of completion. Apply sealers to clean, dry surfaces when the surface temperature is at least 50° F, and if near 50° F, rising. The sealer shall be mixed and applied according to the manufacturer's instructions and no more than 5 gallons at a time. Pour the sealer over the joints.

When the methacrylate surface will be used as a driving surface, sand must be applied to provide friction. After the resin has been applied, at least 20 minutes shall elapse before applying the sand. The sand shall be broadcast at a rate of approximately two pounds per square yard, completely covering the sealer.

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The sealer must be tack-free before construction traffic is permitted to resume.

**MEASUREMENT FOR PAYMENT**

Measurement will be by length of UHPC joints placed in feet. The length of in-place UHPC shall be calculated to the nearest foot.

**BASIS OF PAYMENT**

Payment at the contract price for the above item shall be full compensation for all labor, equipment, and material to do the work.

Superseded  
For Informational  
Purposes Only

## Attachment B

### NYSDOT UHPC Implementation Notes:

NYSDOT is using a non-proprietary performance-based specification requiring qualification testing for the acceptance of Ultra High Performance Concrete (UHPC). Currently the use of UHPC is limited to joints between precast components mainly for accelerated construction.

#### Applications completed to date:

1. Precast Deck Systems
  - UHPC joints, exposed stud pockets, concrete overlay
  - UHPC joints, hidden haunches for studs, diamond ground deck surface
  - UHPC joints with accelerated cure, hidden haunches for studs, diamond ground deck surface
2. Prefabricated superstructure Systems
  - Deck Bulb Tees ,UHPC joints, membrane and asphalt overlay
  - Deck Bulb Tees ,UHPC joints, concrete overlay
  - NEXT beam, UHPC joints, concrete overlay
  - NEXT beam, UHPC joints, membrane and asphalt overlay
  - NEXT beam ,UHPC joints, thin overlay
  - Prefabricated Modular Deck beams UHPC joints, diamond ground deck surface

An exposed aggregate finish to the mating surface of the precast component to the UHPC is specified in order to eliminate leakage through interface. In addition sealing with High Molecular Weight Methacrylate (HMWM) or proving the joint water tightness with Watertight Integrity Testing is required in the specification. These measures are not needed for deck surfaces with membranes and overlays.

Where UHPC Joints are predefined in the contract, NYSDOT prefers to pay for the joints as a separate item as shown in the attached specification. When the contractor is allowed the freedom to locate the joints based on construction methods and means or when the contract allows either precast or cast in place deck options, cost of UHPC joints are included in the overall deck item.

The following practical considerations need attention:

- For non-overlay decks, overfilling of joints  $\frac{1}{4}$  inch is needed to deal with consolidation settlement of UHPC.
- Pre-wetting of precast surfaces to SSD before joint fill is critically important.
- Due to highly flow able nature of UHPC, leak proof formwork is essential.
- The maturity method for strength tests is recommended when accelerated curing is used.