

557.2101 16 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

Ultra High Performance Concrete (UHPC)

The material shall be Ultra High Performance Concrete consisting of the following components all supplied by one manufacturer:

Fine aggregate

Cementitious material

Super plasticizer

Accelerator

Steel Fibers, deformed, specifically made for steel reinforcement

14 mm x 0.185 mm, 2200 MPa yield minimum, deformed

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* ≥ 180 MPa

Not Heat-Treated ≥ 150 MPa

Not Heat-Treated 4 day ≥ 100 MPa

Prism Flexural Tensile toughness (ASTM C1018; 305 mm span) $I_{30} \geq 48$

Long-Term Shrinkage (ASTM C157; initial reading after set) ≤ 766 microstrain

Chloride Ion Penetrability (ASTM C1202) ≤ 250 coulombs

Chloride Ion Penetrability (AASHTO T259; 12.7 mm depth) < 0.07 kg/m³

Scaling Resistance (ASTM C672) $y < 3$

Abrasion Resistance (ASTM C944 2x weight; ground surface) < 0.73 grams lost

Freeze-Thaw Resistance (ASTM C666A; 600 cycles) RDM $> 96\%$

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

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.

* Heat-Treated - According to manufacturer's recommendation, temperature not to exceed 120°C.

CONSTRUCTION

Qualification Testing: Note: qualification testing will be waived if the same material from the same supplier has already been tested and accepted according to this standard. The Contractor shall complete the testing of the UHPC a minimum of three months before placement of the joint. The testing sequence will include the submission of a plan for casting and testing procedures to the DCES for review and approval followed by casting and testing according to the approved plan.

Casting and testing must include the following:

Contractor shall use the same mixing equipment intended to mix the UHPC for the joint.

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A minimum of 12 cylinders 75 mm x 150 mm 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 10°C of the low end of the proposed temperature range for curing in the field. 2 cylinders shall be tested each testing day. Testing days are at 4 days, 7 days, 14 days, and 28 days. The compressive strength shall be measured by ASTM C39 and shall meet 100 MPa minimum at 4 days and 150 MPa minimum at 28 days. Only a concrete mix design that passes these tests may be used to form the joint.

Cast 6 additional cylinders 305 mm diameter and 190 mm deep. Each cylinder shall have one 800 mm 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 #19 bars embedded 125 mm deep and 3 of the bars shall be #13 bars embedded 75 mm 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 100 MPa.

This test is a pullout test. The samples pass if the bars yield, then fail without the concrete failing and without the bars pulling out of the concrete. If the samples do not pass, consult the DCES for further action to be taken. The joint cannot be poured until the DCES addresses the failure. The DCES may order the pour to take place using the mix design without making changes, or may change the reinforcement pattern.

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.

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 or minus 2 mm.

The UHPC in the form shall be cured according to Manufacturer's recommendations to attain the required design strength. Accelerators may be added to the UHPC mix to speed strength gain. The UHPC shall be protected from freezing during curing. A continuous curing temperature of a minimum of 16°C is recommended.

557.2101 16 FIELD CAST JOINTS BETWEEN PRECAST CONCRETE UNITS

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 180 mm and 250 mm. 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 75 mm x 150 mm. All sets shall be moist cured for 4 days and shall be kept sheltered in open air after 4 days, and shall be placed within one meter of the material it represents.

The following tests shall be performed:

Concrete compressive strengths shall be according to ASTM C 39. The first set is to be tested at 4 days. The second set shall be tested at 28 days. The third set will be sent to the Materials Bureau between the 4th day and the 14th day. The fourth set shall be treated as a reserve set.

MEASUREMENT FOR PAYMENT

Measurement will be by length of UHPC joints placed in meters. The length of in-place UHPC shall be calculated to the nearest 0.1 m.

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.