(3) Supports shall be removed gradually so as to allow the concrete to support its own weight uniformly.

i. Falsework supports shall be released near the center of the span and progress toward the end supports.

ii. All falsework piles shall be removed in accordance with the requirements of Subsection 203.01, Paragraph 21.

Backfilling against Structures

Paragraph 3. a. (6) of Subsection 702.03 is void and superseded by the following:

(6) Backfilling shall not be started against any structure until the concrete develops a compressive strength of at least 70% of the design compressive strength.

PRECAST CONCRETE SUBSTRUCTURE ELEMENTS

Description of Work

This work shall consist of furnishing and installing precast concrete abutment caps, abutment wings, and grade beams as shown in the plans and in accordance with the Standard Specifications, the applicable sections of the Special Provision titled “Precast or Precast/Prestressed Concrete Structural Units” and this special provision. This work includes all necessary materials and equipment to complete the work as shown on the plans. The use of cast-in-place concrete will not be considered for substitution.

Material Requirements

1. The class of concrete and grade of reinforcing steel shall be as shown in the plans.

2. The corrugated metal pipe (CMP) shall be in accordance with Section 1035 – Corrugated Metal Pipe of the Standard Specifications.

3. A High Early Concrete or Self-Consolidating Concrete (SCC) shall be used to connect the precast substructure elements to the bearing piles. The High Early Concrete or SCC shall be as prescribed in the special provisions.

Construction Methods

1. Shop Drawings for Precast Elements

The Contractor shall submit shop drawings of the precast concrete elements for review.

The Contractor shall design the devices used to lift and handle the precast concrete elements. The shop drawing showing the details of the lifting device

system shall be prepared and sealed by a Professional Engineer licensed in the State of Nebraska and shall include the following:

- Show locations and details of the lifting devices and the type and amount of any additional reinforcing required for lifting.

- Show minimum compressive strength required prior to lifting and handling the precast concrete elements.

2. Assembly and Sequence of Construction Plan Requirements

As noted in the plans, the Contractor is required to submit an Assembly and Sequence of Construction Plan for review.

The assembly plan shall include, but not necessarily be limited to the following:

- Methods of providing temporary support of the precast substructure elements. Methods for adjusting the element to its required location and elevation shall be included.

3. Fabrication

- No concrete shall be placed in the forms until the Engineer has inspected the forms and has approved the materials and the placement of the materials in the forms.

4. Handling, Storage, and Transportation

- The Contractor shall be responsible for exercising extreme care in lifting, handling, storing and transporting the precast concrete elements to prevent cracking or damage.

- Storage areas shall be smooth and well compacted to prevent damage due to differential settlement

- The precast concrete elements shall be maintained in an upright position.

- Proper support bearings shall be used to avoid twisting of the precast concrete element.

- The precast concrete elements shall be transported in an upright position and the points of support and direction of the reactions with respect to the element shall be approximately the same during transportation and storage as when the element is in its final position.

- Adequate padding shall be provided between tie chains and cables to prevent chipping of the concrete.

- Precast elements shall not be placed into the bridge structure until the minimum 28 day compressive strength specified on the plans has been attained.

5. Suggested General Procedure for installation of Abutment Caps, Wings, and Grade Beams (supported on piles)

   - Provide any temporary supports and/or leveling devices as required in the assembly plan.
   - Lift abutment cap, wing, or grade beam precast element plan using lifting devices as shown in the shop drawings.
   - Set the precast element over the top of the driven piles. Check for proper horizontal/lateral alignment and adjust as required.
   - Adjust the elevation of each precast element to the required elevation by means of leveling devices or shims.
   - Place High Early Concrete or SCC in the CMP pockets as shown on the plans to connect precast concrete element to bearing piles.
   - Cure top surface of the High Early Concrete or SCC in accordance with the special provisions.

Method of Measurement

The quantity of concrete for which payment will be made shall be the plan quantity in cubic yards.

All reinforcing steel is measured in pounds (LB). Payments will be based on the plan quantities when the structure is built according to the plans.

Basis of Payment

Pay Item	**Pay Unit**
Class 47B-3000 Concrete for Precast Abutment Caps	Cubic Yards (CY)
Class 47B-3000 Concrete for Precast Abutment Wings	Cubic Yards (CY)
Class 47B-3000 Concrete for Precast Grade Beams	Cubic Yards (CY)
Epoxy Coated Reinforcing Steel for Precast Abutment Caps	Pounds (LB)
Epoxy Coated Reinforcing Steel for Precast Abutment Wings	Pounds (LB)
Epoxy Coated Reinforcing Steel for Precast Grade Beams	Pounds (LB)

The furnishing, placing, and curing of the High Early Concrete or SCC shall be subsidiary to the relevant precast concrete element pay item.

Payment is full compensation for all work prescribed in this section.

PRECAST CONCRETE APPROACH SLAB ELEMENTS

Description of Work

This work shall consist of furnishing and installing precast concrete approach slabs as shown in the plans and in accordance with the Standard Specifications , the applicable sections of the Special Provision titled “Precast or Precast/Prestressed Concrete Structural Units” and this special provision. This work includes all necessary materials and equipment to complete the work as shown on the plans. The use of cast-in-place concrete will not be considered for substitution.

Material Requirements

1. The class of concrete and grade of reinforcing steel shall be as shown in the plans.

Construction Methods

1. Shop Drawings for Precast Elements

   The Contractor shall submit shop drawings of the precast concrete elements for review.

   The Contractor shall design the devices used to lift and handle the precast concrete elements. The shop drawing(s) showing the details of the lifting device system shall be prepared and sealed by a Professional Engineer licensed in the State of Nebraska and shall include the following:

   - Show locations and details of the lifting devices and the type and amount of any additional reinforcing required for lifting.
   - Show minimum compressive strength required prior to lifting and handling the precast concrete elements.

2. Fabrication

   - No concrete shall be placed in the forms until the Engineer has inspected the forms and has approved the materials and the placement of the materials in the forms.
   - The top surface of the precast approach slab panels for the approach section and paving section shall be drag finished with wet burlap. The burlap finish shall create a uniform, fine-grained finish on the concrete surface.

3. Handling, Storage, and Transportation

   - The Contractor shall be responsible for exercising extreme care in lifting, handling, storing and transporting the precast concrete elements to prevent cracking or damage.

- Storage areas shall be smooth and well compacted to prevent damage due to differential settlement.

- Proper support bearings shall be used to avoid twisting of the precast concrete element.

- The precast concrete elements shall be transported in such manner that the points of support and direction of reactions with respect to the element shall be approximately the same during transportation and storage as when the element is in its final position.

- Adequate padding shall be provided between chains and cables to prevent chipping of the concrete.

- Precast elements shall not be placed into the bridge structure until the minimum 28 day compressive strength specified on the plans has been attained.

4. Installation of the Precast Approach Slab Panels

   - The precast approach slab panels for the approach sections and the paving sections shall be installed at the locations specified in the plans.

   - One end of the paving section panels will be supported by the grade beam. The other end of the paving section panels will be placed on grade. Upon attachment of the paving section panels to the grade beams and completion of the longitudinal joints between paving section panels, any voids under the paving section panels shall be filled with flowable fill to ensure that the paving section panels are completely supported.

Method of Measurement

The quantity of concrete for which payment will be made shall be the plan quantity in cubic yards.

All reinforcing steel is measured in pounds (LB). Payment will be based on the plan quantities when the structure is built according to the plans.

Basis of Payment

Pay Item	**Pay Unit**
Class 47BD-4000 Concrete for Precast Approach Section Panels	Cubic Yards (CY)
Class 47BD-4000 Concrete for Precast Paving Section Panels	Cubic Yards (CY)
Epoxy Coated Reinforcing Steel for Precast Approach Section Panels	Pounds LB)
Epoxy Coated Reinforcing Steel for Precast Paving Section Panels	Pounds (LB)

The furnishing and placing of the flowable fill shall be subsidiary to the pay item “Class 47BD-4000 Concrete for Precast Paving Section Panels”.

Payment is full compensation for all work prescribed in this section.

NU-DECK PANELS

Description of Work

This work shall consist of furnishing and installing the NU-Deck Panels as shown in the plans, as noted in the Special Provision titled “Precast or Precast/Prestressed Concrete Structural Units” and this special provision.

The NU-Deck Panels and the NU prestressed concrete girders shall be fabricated by the same precast/prestressed fabricator.

Material Requirements

1. The class of concrete and the grade of reinforcing steel and prestressing strands shall be as shown on the plans.

2. The deck panel support system shall be provided as shown on the plans.

3. The Self-Consolidating Concrete (SCC) used to connect the NU-Deck Panels to the girders shall be as prescribed in the special provisions.

Construction Methods

1. Shop Drawings

   The Contractor shall submit shop drawings of the precast deck panels for review.

   The Contractor shall design the devices used to lift and handle the deck panels. The shop drawing(s) showing the details of the lifting device system shall be prepared and sealed by a Professional Engineer licensed in the State of Nebraska and shall include the following:

   - Show locations and details of the lifting devices and the type and amount of any additional reinforcing steel required for lifting

   - Show minimum compressive strength required prior to lifting and handling the deck panels.

2. Fabrication

   - The top surface of the deck panels shall be drag finished with wet burlap. The burlap finish shall create a uniform, fine-grained finish on the concrete surface.

3. Handling, Storage, and Transportation

   - The precast deck panels shall not be placed into the bridge structure until the minimum 28 day compressive strength specified on the plans has been attained.

4. Installation of the NU-Deck Panels

    - The NU-Deck Panels shall be installed at the locations specified in the plans.

Method of Measurement

The NU-Deck Panels will be measured for payment by the lump sum.

Basis of Payment

Pay Item	Pay Unit
NU-Deck Panels	Lump Sum (LS)

Payment is full compensation for all work prescribed in this special provision, including the cost of the deck panel support system and the SCC connecting the NU-Deck Panels to the prestressed concrete girders.

SELF-CONSOLIDATING CONCRETE FOR GIRDER HAUNCH

Description

This work shall consist of furnishing and placing self-consolidating concrete (SCC) into the area between the bottom of the NU-Deck Panels and the top of the NU girders including the shear pockets of each girder line as described in the plans and as stated in this special provision.

Material Requirements

1. The self-consolidating concrete (SCC) for the haunch grouting shall be in accordance with the special provision “Self-Consolidating Concrete (SCC) Field Application.

2. The SCC mix design shall be a high early strength SCC meeting the following requirements:

    a. Attain a compressive strength of 3,500 psi before any construction loads are allowed on the bridge deck.

    b. Attain a compressive strength of 4,000 psi before the bridge is open to traffic.

    c. Attain a compressive strength of 6,000 psi at 28 days.

Construction Methods

1. Pre-pour Meeting

    a. Prior to the initial placement of the SCC grout, the Contractor shall arrange an on-site meeting with the Contractor’s staff, NDOR Project

Manager, inspectors, Material and Research Division personnel and Bridge Division personnel. The objective of the meeting will be to clearly outline the procedures for mixing, transporting, finishing and curing of the SCC grout.

2. Form Work

   a. Prior to placement of the SCC, the Contractor shall seal the joints between the NU-Deck Panels over the NU Girders as shown in the plans to prevent the SCC from flowing into the transverse deck joints.

3. Grouting Procedures

   a. Grouting shall be done at the 4 inch diameter pouring ports as shown on the plans starting from one end of the bridge and proceeding to the other end. Grouting from one pouring port shall not stop until concrete is overflowing from the 4 in. port (vents) between this pouring port and the adjacent ones.

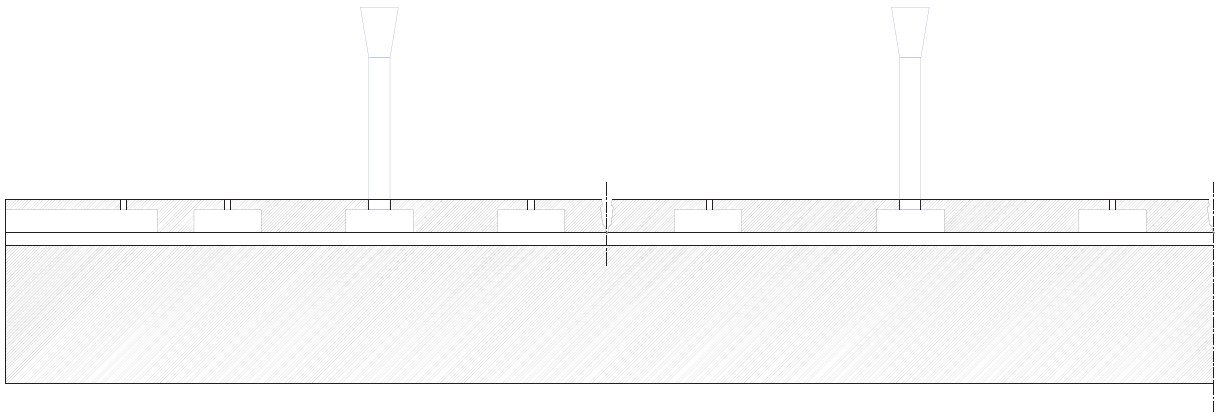
   b. Vents / pouring ports with overflowing concrete shall be covered or plugged to prevent continuous overflow.

   c. Avoid using pressurized concrete as that might cause panel uplifting and/or leakage of concrete.

   d. Using a concrete head of up to 4 feet, as shown below, is recommended to ensure adequate flow distance, complete filling of the pockets.

   e. Grouting the haunch and shear pockets of each girder line shall be conducted as one continuous pour to avoid having construction joints.

   f. A demonstration video is available upon request.



Payment

1. The furnishing and placing of the SCC grout shall be subsidiary to the pay item “NU-Deck Panels”.

HIGH EARLY CONCRETE FOR SUBSTRUCTURE CMP POCKETS, LONGITUDINAL DECK JOINT ABOVE GIRDER D, AND APPROACH SLAB JOINTS AND POCKETS

Description

This work shall consist of furnishing, placing, and curing High Early Concrete for the following applications shown in the design plans:

1. Placement of concrete into the CMP pockets in the abutment caps, wings, and grade beams.

2. Placement of concrete into the longitudinal bridge deck joint above Girder D.

3. Placement of concrete into the longitudinal joints between the approach slab panels and the pockets in the paving section panels.

Material Requirements

1. The High Early Concrete shall be in accordance with Section 1002 of the Standard Specifications. The Class of Concrete shall be 47B-HE.

2. The High Early Concrete placed in the substructure CMP pockets shall meet the following requirements:

    a. Attain a compressive strength of 2,500 psi before the holes are drilled for the swedge anchor bolts and the concrete girders are set on the abutment caps.

    b. Attain a compressive strength of 2,500 psi before the precast approach slab panels are placed on the grade beams.

    c. Attain a compressive strength of 3,500 psi before any construction equipment loads are placed on the bridge and approach slabs.

    d. Attain a compressive strength of 4,000 psi before the bridge is open to traffic.

    e. Attain a compressive strength of 4,000 psi at 28 days.

3. The High Early Concrete placed in the longitudinal bridge deck joint above Girder D shall meet the following requirements.

    a. Attain a compressive strength of 3,500 psi before any construction equipment loads are placed on the bridge.

    b. Attain a compressive strength of 4,000 psi before the bridge is open to traffic.

    c. Attain a compressive strength of 5,000 psi at 28 days.

4. The High Early Concrete placed in the longitudinal joints between the approach slab panels and the pockets in the paving section panels shall meet the following requirements:

    a. Attain a compressive strength of 3,500 psi before any construction equipment loads are placed on the approach slabs.

    b. Attain a compressive strength of 4,000 psi before the approach slabs are open to traffic.

    c. Attain a compressive strength of 4,000 psi at 28 days.

Construction Methods

1. The Contractor shall seal off the transverse joints at so that High Early Concrete placed in the longitudinal joints does not flow into the transverse joints.

2. The CMP's in the substructure elements and the longitudinal joints shall be overfilled with the High Early Concrete, the excess concrete screeded off, and the top surfaces finished to a uniform, even texture.

3. Following the placement of the High Early Concrete in the longitudinal joints in the bridge deck and approach slabs, the Contractor shall give the concrete surface a drag finish with wet burlap. The drag finish shall create a uniform, fine-grained finish on the concrete surface.

Payment

1. The furnishing, placing, and curing of the High Early Concrete in the substructure CMP pockets shall be subsidiary to the relevant pay item "Class 47B-3000 Concrete for Precast Abutment Caps", "Class 47B-3000 Concrete for Precast Wings" or "Class 47B-3000 Concrete for Precast Grade Beams".

2. The furnishing, placing, and curing of the High Early Concrete in the longitudinal deck joint above Girder D shall be subsidiary to the pay item "NU-Deck Panels".

3. The furnishing, placing, and curing of the High Early Concrete in the longitudinal joints between the approach slab panels and the pockets in the paving section shall be subsidiary to the pay items "Class 47BD-4000 Concrete for Precast Approach Section Panels" or "47BD-4000 Concrete for Precast Paving Section Panels".

SELF-CONSOLIDATING CONCRETE FOR SUBSTRUCTURE CMP POCKETS, ALTERNATE ABUTMENT BACKWALL POCKETS, LONGITUDINAL DECK JOINT ABOVE GIRDER D, AND APPROACH SLAB JOINTS AND POCKETS

Description

As an alternate, Self-Consolidating Concrete (SCC) may be used in lieu of High Early Concrete for the following applications shown in the design plans:

1. Placement of concrete into the CMP pockets in the abutment caps, wings, and grade beams.

2. Placement of concrete into the longitudinal bridge deck joint above Girder D.

3. Placement of concrete into the longitudinal joints between the approach slab panels and the pockets in the paving section panels.

If the Contractor elects to utilize the alternate abutment backwall details shown in the plans, the pockets in the backwalls shall be filled with SCC.

Material Requirements

1. The self-consolidating concrete (SCC) for the above applications shall be in accordance with the special provision “Self-Consolidating Concrete (SCC) Field Application with the following exception. The Slump Flow range shall be between 24 – 28 inches.

2. The SCC placed in the substructure CMP pockets shall meet the following requirements:

    a. Attain a compressive strength of 2,500 psi before the holes are drilled for the swedge anchor bolts and the concrete girders are set on the abutment caps.

    b. Attain a compressive strength of 2,500 psi before the precast approach slab panels are placed on the grade beams.

    c. Attain a compressive strength of 3,500 psi before any construction equipment loads are placed on the bridge and approach slabs.

    d. Attain a compressive strength of 4,000 psi before the bridge is open to traffic.

    e. Attain a compressive strength of 6,000 psi at 28 days.

3. The SCC placed in the longitudinal bridge deck joint above Girder D shall meet the following requirements.

    a. Attain a compressive strength of 3,500 psi before any construction equipment loads are placed on the bridge.

b. Attain a compressive strength of 4,000 psi before the bridge is open to traffic.

c. Attain a compressive strength of 6,000 psi at 28 days.

4. The SCC placed in the longitudinal joints between the approach slab panels and the pockets in the paving section panels shall meet the following requirements:

   a. Attain a compressive strength of 3,500 psi before any construction equipment loads are placed on the approach slabs.

   b. Attain a compressive strength of 4,000 psi before the approach slabs are open to traffic.

   c. Attain a compressive strength of 6,000 psi at 28 days.

5. The SCC placed in the pockets for the alternate abutment backwall shall meet the following requirements.

   a. Attain a compressive strength of 3,000 psi before any granular backfill is placed against the backwall and before the precast approach slab section panels are placed on the backwall.

   b. Attain a compressive strength of 6,000 psi at 28 days.

Construction Methods

1. The Contractor shall seal off the transverse joints at so that SCC placed in the longitudinal joints does not flow into the transverse joints.

2. The surface of the longitudinal joint shall be overfilled 1/4 inch above the top of the precast panels. Wood top forms shall be utilized for overfilling the joint.

3. The SCC placed in the longitudinal joints in the bridge deck and approach slabs shall be cured in accordance with Section 706.03 9. d (1) and (2) of the Standard Specifications.

4. The overfilled area of the longitudinal joints shall be ground to the surface elevation of the adjacent panels. Grinding of the SCC surface can be performed upon completion of the curing process and when compressive strength of 3,500 psi has been achieved.

5. The top surface of the SCC placed in the CMP pockets of the precast elements shall be wet-cured in accordance with Section 704.03.

Payment

1. The furnishing, placing, and curing of the SCC in the substructure CMP pockets shall be subsidiary to the relevant pay item “Class 47B-3000 Concrete for Precast Abutment Caps”, “Class 47B-3000 Concrete for Precast Wings” or “Class 47B-3000 Concrete for Precast Grade Beams”.

2. The furnishing, placing, and curing of the SCC in the longitudinal deck joint above Girder D shall be subsidiary to the pay item “NU-Deck Panels”.

3. The furnishing, placing, and curing of the SCC in the longitudinal joints between the approach slab panels and the pockets in the paving section shall be subsidiary to the pay items “Class 47BD-4000 Concrete for Precast Approach Section Panels” or “47BD-4000 Concrete for Precast Paving Section Panels”.

4. The furnishing, placing, and curing of the SCC in the pockets for the alternate abutment backwall shall be subsidiary to the pay item “Class 47B-3000 Concrete for Precast Abutment Caps”.

PRECAST CONCRETE JOINTS UTILIZING ULTRA HIGH PERFORMANCE CONCRETE

Description

This specification covers field casting of joints for precast concrete units using Ultra High Performance Concrete (UHPC). This work shall include forming, preparing bonding surfaces, casting, finishing, and curing UHPC at the locations specified in the plans.

Materials Requirements

1. The material used for casting the transverse joints indicated in the plans shall be Ultra High Performance Concrete with all components supplied by one manufacturer. The Contractor shall be responsible for the UHPC mix design. The UHPC shall be proportioned according to Manufacturer’s recommendation.

    a. The UHPC shall consist of cementitious materials, fine aggregate, super plasticizer and accelerator admixtures, water and steel fibers, deformed or non-deformed specifically made for steel reinforcement.

    b. No change shall be made in the approved UHPC during the progress of the work without the prior written permission of the Materials & Research Portland Cement Concrete (PCC) Engineer.

    c. The UHPC material shall meet the requirements in Table 1 at 28 days, unless otherwise noted.

Table 1.

Ultra High Performance Concrete (UHPC)	
Compressive Strength (ASTM C39) minimum 12 ksi at 4 days - minimum 21 ksi at 28 days	
*Flexural Toughness and First-Crack Strength-Fiber Reinforced Concrete (ASTM C1018), 10 inch span	$I_{30} \geq 48$
Long-Term Shrinkage (ASTM C157; initial reading after set)	≤ 800 microstrain
*Chloride Ion Permeability (AASTHO T259) ; $^1/_2$ inch depth	< 0.07 oz/ft^3
*Chloride Ion Permeability (ASTM C1202)	≤ 250 coulombs
*Scaling Resistance (ASTM C 672)	y < 3
Freeze-Thaw Resistance (ASTM C666-B; 600 cycles)	RDM > 95%
*Alkali-Silica Reaction (ASTM C 1567) at 28 days	<0.10%

*After thermo treatment

d. The tests in Table 1 shall be conducted by an AASHTO accredited testing lab.

e. Potable water obtained from a municipal supply, suitable for drinking, shall be used.

f. UHPC shall not be placed on the project until the required submittals and testing has been reviewed and approved by the Engineer.

Submittals

1. UHPC Placement Plan

a. The Contractor shall submit a UHPC placement plan for review 28 days before placement of the UHPC in the joints.

b. The UHPC placement plan shall include, but not necessarily be limited to, the following:

(1) Proposed method(s) of joint surface preparation for the NU-Deck panels and approach section panels.

(2) Proposed forming methods.

(3) Proposed bulkhead placement in joints

(4) Proposed batching sequence. The batching sequence shall include the order and time of introduction of the materials and the mixing time.

(5) Proposed sequence and schedule for UHPC placement operations.

(6) Details of all equipment to be used to batch and place UHPC materials.

(7) Curing procedures

(8) Testing procedures

(9) Quality Control/Quality Assurance procedures for verification of mix uniformity.

2. UHPC Mix Design

a. The Contractor shall submit the UHPC mix design and the results of the required tests in Table 1 to the PCC Engineer 60 days prior to the first placement of UHPC. The Engineer may waive the tests of the UHPC mix if these tests have been previously performed for the material supplied by the manufacturer.

b. The following cylinders shall be made and delivered to the AASHTO accredited testing lab for testing:

(1) Concrete Compressive Strength: A minimum of twelve 3x6 inch cylinders shall be cast in accordance with ASTM C39. Two cylinders shall be tested and averaged for each reported test. The cylinders shall be tested at 4, 7 and 28 days. The compressive strength shall be measured by ASTM C39 and shall meet a minimum of 12 ksi at 4 days and a minimum of 21 ksi at 28 days. Only a UHPC mix design that passes these tests may be used to form the joints. All compressive test cylinders shall be cured in accordance with the manufacturer's recommendations and using the same method of curing to be used in the field.

3. List of Similar Bridge Projects

a. The Contractor shall provide to the PCC 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 PCC Engineer reserves the right to reject a proposed UHPC material which lacks a proven track record in precast joint filling in bridge applications.

Construction Methods

1. Pre-Pour Meeting

a. Prior to the initial placement of the UHPC, the Contractor shall arrange for an on-site meeting with the UHPC manufacturer's representative, the Contractor's staff, NDOR Project Manager, inspectors, Materials and Research personnel and Bridge Division personnel. The objective of the meeting will be to clearly outline the procedures for mixing, transporting, finishing and curing of the UHPC.

2. Storage

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

3. Panel Preparation and Form Work

a. The Contractor shall expose the aggregate along the joint edge of the panels to create a better bond before placing UHPC.

i. The Contractor shall use a concrete surface retarder, abrasive blasting, or other method approved by the Engineer to expose the aggregate. This procedure shall be done to the deck panels and approach section panels before these elements are placed on the bridge.

ii. Care shall be exercised not to damage the epoxy coating of the exposed reinforcing steel while exposing the aggregate. Any damage that does occur to the epoxy coating shall be touched-up with epoxy coating.

iii. The surfaces of the joints shall be prepared to a saturated surface dry condition prior to placement of the UHPC.

b. Material properties of UHPC vary considerably from conventional concrete, both during the plastic state and at the hardened state. The Contractor shall note that additional forming effort will be required to ensure the forms are properly sealed and are capable of resisting the anticipated form pressures.

c. The Contractor shall note that the UHPC placement on grade typically requires top forms for containment of the material within the designated placement area. Top forms commonly require application of dead weight to resist pressures created by the fluid UHPC. Other means to resist the hydrostatic pressure are feasible and may be proposed by the Contractor. Mechanical inserts in the top of the deck panels are not allowed. If steel ties are used to tie the formwork to the inside surface of the joint, the ties shall be stainless steel.

d. Wood forms shall be used for top forms and for placing the UHPC in the joints in the bridge rail. All wood forms shall be constructed from plywood. The forms shall be coated to prevent absorption of water.

4. Mock-up Procedures

a. The Contractor shall arrange for the UHPC manufacturer's representative to be on site during the mock-up procedures. The representative shall be knowledgeable in the supply, mixing, delivery, placement, and curing of the UHPC.

b. Mockups of each UHPC pour shall be performed prior to actual UHPC construction and conducted per the requirements of this special provision. Mockups of horizontal closure pours shall be four feet in length with all other dimensions to match those required by the plans. Mockups of vertical closure pours shall be two feet in length with all other dimensions to match those required by the plans. The mockup process shall be observed by the manufacturer's representative. Two portable batching units shall be supplied by the manufacturer to the contractor for mixing of the UHPC.

5. UHPC Batching, Placement, and Curing

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

b. The contractor shall arrange for two UHPC manufacturer's representatives to be on site during the placement of the joints. The representatives shall be knowledgeable in the supply, mixing, delivery, placement, and curing of the UHPC.

c. The surface of the UHPC field joints shall be overfilled 1/4 inch above the top of the precast panels. Wood top forms shall be utilized for overfilling the joints.

d. 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 7-10 inches. The slump flow for each batch shall be recorded and reported to the Engineer.

e. Concrete shall be placed continuously in each joint. No cold joints will be permitted within individual lengths of the UHPC joint.

f. The UHPC in the form shall be cured according to manufacturer's recommendations to attain the required strength shown in the contract documents. A minimum curing temperature of 60ºF is recommended.

g. The Department shall sample and test a minimum of twelve 3x6 inch cylinders for compressive strength for each day's placement. All cylinders shall be cured in an environment similar to the material they represent. The cylinders shall be delivered to the Material and Research Central Laboratory for testing. Compressive tests shall be performed in accordance with ASTM C39.

    i. Three specimens shall be tested to validate achievement of the 12 ksi compressive strength required prior to grinding UHPC overfill.

    ii. Three specimens shall be tested to validate achievement of 15 ksi compressive strength prior to opening the bridge to traffic.

    iii. Three specimens shall be tested at 28 days to validate the required 21 ksi final compressive strength.

    iv. The remaining specimens shall be treated as reserves.

h. The UHPC quality control shall be responsibility of the Contractor. UHPC shall meet the required strength specified in the contract documents.

6. Diamond Grinding of Joints

a. Grinding of the UHPC surface can be performed when strength of 12 ksi has been achieved. Use equipment specifically designed for PCC pavement production grinding.

b. If significant fiber pullout is observed during grinding operations, grinding shall be suspended and shall not resume until approval is obtained from the Engineer.

7. Opening Bridge to Traffic

   a. The bridge may be opened to traffic when the compressive strength reaches 15 ksi.

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 linear foot.

Basis of Payment

Pay Item	Pay Unit
Ultra-High Performance Concrete for Bridge	Linear Foot (LF)

Payment is full compensation for all work prescribed in this special provision.

SELF-CONSOLIDATING CONCRETE (SCC) FIELD APPLICATION

Section 1002 in the Standard Specification is amended to include the following:

Description

Self-Consolidating Concrete (SCC) is defined as a highly workable concrete that can be placed under its own weight and adequately fill all voids without segregation. SCC is placed without the need for vibration or other mechanical consolidation.

Materials Requirements

a. The material shall be SCC and shall consist of the following:

   (1) Cementations materials shall meet requirements of Section 1004.

   (2) Fine Aggregate shall meet the specification AASHTO M 6.

   (3) Coarse Aggregate shall meet AASHTO M 43 Size (No. 3/8 to No. 8).

   (4) SCC shall consist of super plasticizer, accelerators and air admixtures and water. All admixtures shall meet the specifications in accordance with Section 1007 of the Specification.

b. No change shall be made to the approved SCC mix design during the progress of work without the prior written permission of the Portland Cement Concrete (PCC) Engineer.

c. The SCC fresh, mechanical and permeability properties shall conform to the requirement in Table 1. The Contractor shall provide from a NDR Approved

Independent Certified laboratory the testing data within the last 5 years and be submitted with tests as specified in Table 1.

Table 1.

Self-Consolidated Concrete (SCC)	
Slump Flow – ASTM C 1611	Range. 26 – 30 inches
Passing Ability by J-Ring Method – ASTM C 1621	Range. 0 – 2 inches
Visual Stability Index (VSI) – Appendix of ASTM C 1611 is required.	VSI. 0 – 1
Air Content (ASTM C 231)	6.0 – 8.5%
Compressive Strength (ASTM C39)	Min. 6 ksi at 28 days
Freeze-Thaw Resistance (ASTM C666-B; 600 cycles)	RDM > 70%

Mix Design Approval Requirements:

a. The Contractor shall submit a pre-test trial of SCC Mix Design consisting of a minimum 4 cubic yards.

b. The pre-test trial SCC Mix Design shall be submitted to the Engineer 5-6 weeks prior to any SCC being placed on the project.

c. The SCC pre-test trial shall not be paid for directly by the Department and shall be subsidiary to items which direct payment is made.

d. Concrete shall not be placed on the project before the SCC testing has been reviewed and approved by the Engineer.

e. Material shall be produced by a NDR's approved Ready Mix Plant for SCC.

f. A SCC pre-test trial shall be tested at the project site and delivered by a NDR's Approved ready mix plant. SCC shall be sampled and tested by Material and Research Central Laboratory.

(1) Air Content of Freshly Mixed Concrete by Pressure Method – ASTM C 231.

(2) Compression Strength – ASTM C 39.

(3) Slump Flow – ASTM C 1611.

(4) Passing Ability by J-Ring Method – ASTM C 1621.

(5) Visual Stability Index (VSI) – Appendix of ASTM C 1611 is required.

(6) Any changes to the mix design require the approval of the Concrete Engineer and a batch trial will be required.

(7) The contractor shall submit batching sequence as specified recommendation to the Engineer.

Project Requirements

a. Materials & Research personal will be on-sight to perform the quality assurance of SCC for the following tests.

(1) Air Content of Freshly Mixed Concrete by Pressure Method – ASTM C 231

(2) Compression Strength – ASTM C 39.

(3) Slump Flow – ASTM C 1611.

(4) Passing Ability by J-Ring Method – ASTM C 1621.

(5) Visual Stability Index (VSI) – Appendix of ASTM C 1611 is required.

b. Concrete quality control shall be the responsibility of the Contractor.

REMOVE STRUCTURE AT STATION 666+48.70

The item, "Remove Structure at Station 666+48.70" shall be in accordance with the pertinent provisions of Section 203 of the Standard Specifications.

If there are lead plates under the existing steel rail posts, the lead plates shall be recycled in accordance with Paragraph 3. Environmental Requirements in Subsection 203.01 of the Standard Specifications.

The paint on the existing structural steel has not been tested. The contractor shall conduct their own analysis of the paint for the presence of toxic metals at project start-up and adjust worker protection and work practices according to the results.

CONTRACTOR'S ACCESS CROSSING

It will be the Contractor's option to use an access crossing to construct the bridge on this project.

Bidders must submit a bid for the item "Access Crossing ___" in the schedule of items.

The item "Access Crossing ___" will be paid for as a lump sum. The bid price shall be considered full compensation for all work required for the Contractor to construct and remove the access crossing. The Contractor will only be paid for this item if they construct the access crossing. The Contractor will be paid 90% of the lump sum when the access crossing is installed. The remaining 10% of the lump sum will be paid when the access crossing is removed.

If the Contractor does not plan to utilize an access crossing, they shall bid the item "Access Crossing ___" at 0$. If the Contractor bids this item at 0$ and later decides to utilize an access crossing, it will be at the Contractor's expense.