1. ULTRA HIGH-PERFORMANCE CONCRETE (UHPC)

A. Description. Furnish all materials, tools, and labor necessary for the performance of all work to form, cast, finish, and cure Ultra High-Performance Concrete (UHPC) in the bearing pedestals and expansion joint block outs as shown in the bridge plans.

B. Materials. Use Ductal JS1000, or equivalent as approved by the Project Manager and MDT Bridge Bureau. Material supplier for Ductal JS1000 UHPC concrete:

Lafarge North America, Inc.
Telephone: 773-372-1000
Email: ductal-na@lafargeholcim.com
8700 W Bryn Mawr Ave., Suite 300
Chicago, IL USA 60631

C. Submittals. Submit the following items for review and approval:

1) Proposed product information including material properties and certifications.

2) Quality control plan that includes the following as a minimum:

a) Mixing protocol as required by product supplier.

b) Casting procedure.

c) Sampling and testing procedures including the applicable ASTM standards.

d) Curing procedure.

e) Method of forming in accordance with the supplier's recommendations.

f) Pour sequence plan including staging areas for materials and equipment as well as the anticipated total time to complete the pour.

g) Grinding procedure.

h) Submit Domestic Material certifications per §106.09 of the Standard Specifications.

3) Quality Control Representative. Provide a resume that includes the credentials and past experience for a quality control representative from the supplier that is knowledgeable and experienced in the supply, mixing, delivery, placement, curing and finishing of UHPC.

4) Proposed equipment. Provide equipment in accordance with supplier requirements. Use high shear pan mixers, supplied by Lafarge, to produce UHPC. Include proposed mixing equipment, buggies, grinding equipment, and any other equipment that will be used to cast and cure the bearing pedestals.

5) Trial batch and trial placement. Perform at least one trial batch and placement a minimum of 14 days prior to placing the UHPC to verify the mix is in accordance with supplier's specifications. Perform the trial batch and trial placement with the Project Manager and supplier representative present. Perform the trial batch under the same ambient conditions (time of day, weather, temperature, etc.) as expected during construction. Construct a full scale trial placement near the project site to simulate not less than one bearing pedestal. Reinforce the pedestal using plain reinforcing steel at the same spacing as the actual substructure element detailed in the plans. Use the same equipment, forming, casting and curing procedures that will be used for construction. Place the trial batch of UHPC only after adjacent abutment concrete has reached the required 28-day compressive strength.

Provide the results of temperature, slump, and unit weight for a minimum of two independent samples. Provide 12-hour, and 36-hour compressive strengths for Ductal JS1000. Provide compressive strengths as specified by supplier and as approved by the Project Manager for other mix designs. Conduct the compressive strength test on 3-in by 6-in cylinders with three cylinders tested each testing day. Perform the tests in accordance with ASTM C39. Grind the loading surfaces to ensure end planeness within 1/10 of a degree. Cure all test samples using the same method of curing proposed during construction. Test all samples at Lafarge North America or by a testing lab approved by the Project Manager. The compressive strength must meet the minimum strengths specified for the approved mix design.

The trial batch and placement must meet all the requirements of this specification to be considered successful. The Project Manager will approve the trial batch. Repeat additional trial batches if necessary and as direction by the Project Manager. Do not proceed with construction of the pedestal without approval from the Project Manager.

6) Forms. Construct watertight forms that are coated to prevent absorption of water and in accordance with supplier's recommendations.

7) Quality control. Provide the approved Quality Control Representative on site during placement of the bearing pedestals. The Quality Control Representative will be responsible for quality control and will have the authority to direct the production and placement methods. The Quality Control Representative will have the authority to reject any UHPC material.

a) Sample and test each batch in accordance with the approved quality control plan.

b) Maintain a quality control log and submit a copy of the log to the Project Manager after all UHPC placements are completed.

c) Make five sets of 3-in x 6-in compressive strength test samples for each day of placement. Use cylinders provided by Lafarge. Cure all sets in an environment similar to the material they represent. With the exception of the curing requirements, perform the following tests in accordance with ASTM C39. Unless otherwise specified by supplier and as approved by the Project Manager:

(1) Test the first set for compressive strength at 12-hours. These cylinders will be field cured.

(2) Test the second set for compressive strength at 36-hours. These cylinders will be field cured.

(3) Test the third set at 28-days. These cylinders will be cured in accordance with supplier recommendations

(4) The fourth and fifth sets will be collected and cured by MDT.

8) Casting process. Comply with the recommendations and procedures provided by supplier and accepted by the Project Manager. Limit free fall height to prevent segregation of steel fibers. Fill the bearing pedestal at a speed comparable to the flow speed of the fresh mix and as directed by supplier. Place the UHPC pedestal in a continuous operation. Cold joints are not permitted. Unless otherwise approved by supplier and the Project Manager, fill the pedestal form 0.5-in higher than the top surface of the pedestal to allow entrapped air to rise in this zone during curing.

9) Curing. Cover the top surface of the UHPC with a layer of transparent or white polyethylene film at least 4-mils thick. Cure the UHPC in accordance with supplier's specifications. Do not place any loading on the UHPC pedestal until the UHPC has achieved a minimum of 12-ksi compressive strength.

10) Grinding. Once the UHPC has obtained 12-ksi compressive strength, or an alternative strength approved by the Project Manager, grind the UHPC surface to the truss seat elevation shown in the plans. Suspend grinding operations if significant steel fiber pullout is observed. Do not resume grinding until directed by the Project Manager.

D. Method of Measurement. Concrete – Class UHPC is measured in accordance with Standard Specification 552.04.

E. Basis of Payment. This item and all incidental items required to provide this item per contract documents including labor, materials, equipment, trial batches, and testing to be included in the unit price bid for Concrete – Class UHPC.